A. Key Legislation and Service Policies

Administrative Procedure Act (1966; 5 U.S.C. 551-559, 701-706 and 801-808, as amended): Contains procedures that Federal agencies must follow, including public information, open meetings, and privacy of information requirements, and provisions for hearings, adjudications, rule making, and judicial and congressional review of Federal agency actions.

Agricultural Credit Act of 1987 (7 U.S.C. 5104; P.L. 100-233): Authorizes the Farmer's Home Administration (FmHA) to transfer land to any Federal or State agency for conservation purposes (e.g., the FmHA can transfer fee-title or assign interests in real estate to the U.S. Fish and Wildlife Service for the protection of floodplains, wetlands, and surrounding uplands).

American Indian Religious Freedom Act (1978): Directs agencies to consult with native traditional religious leaders to determine appropriate policy changes necessary to protect and preserve Native American religious cultural rights and practices.

Americans with Disabilities Act (1992): The Americans with Disabilities Act is the most comprehensive Federal civil-rights statute that prohibits discrimination on the basis of disability in employment, State and local government, public accommodations, commercial facilities, transportation, and telecommunications.

Antiquities Act of 1906 (16 U.S.C. 431-433): First United States law to provide general protection of cultural or natural resources. This act authorizes the scientific investigation of antiquities on Federal land and provides penalties for unauthorized removal of objects taken or collected without a permit.

Archaeological and Historic Preservation Act (1974): Requires that Federal agencies provide for *"...the preservation of historical and archeological data (including relics and specimens) 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 of Federally-licensed activity or program."*

Archaeological Resources Protection Act of 1979, as amended (16 U.S.C. 470aa-470mm): The Archaeological Resources Protection Act (ARPA) was enacted *"...to secure, for the present and future benefit of the American people, the protection of archaeological resources and sites which are on public lands and Indian lands, and to foster increased cooperation and exchange of information between governmental authorities, the professional archaeological community, and private individuals."* The main focus of ARPA is on regulation of legitimate archeological investigation on public lands and the enforcement of penalties against looting or vandalism of these resources. Protects materials of archaeological interest from unauthorized removal or destruction and requires Federal managers to develop plans and schedules to locate archaeological resources.

Appropriate Uses Policy (2006) 603 FW1: Describes procedures for refuge managers to follow when deciding if uses are appropriate on a refuge. Appropriate uses are either proposed or existing uses on a refuge that meet at least one of the following four conditions: 1) the use is a wildlife-dependent recreational use as identified in the 1997 Improvement Act; 2) the use contributes to fulfilling the refuge purpose(s), the Refuge System mission, or goals or objectives described in a refuge management plan approved after October 9, 1997, the date the Improvement Act was signed into law; 3) the use involves the take of fish and wildlife under State regulations; or 4) the use has been found to be appropriate as described further in the Appropriate Refuge Uses policy. This policy applies to all proposed and existing uses in the Refuge System only where the Service has jurisdiction over the use. The policy does not apply in: 1) situations where reserved rights or legal mandates provide that the Service must allow the use, and 2) refuge management activities (e.g., fish and wildlife population or habitat management actions including, but not limited to: prescribed burns, water level management, invasive species control, routine scientific monitoring, law enforcement activities, and maintenance of existing refuge facilities).

Architectural Barriers Act (1968): Requires Federally-owned, leased, or funded buildings and facilities to be accessible to persons with disabilities.

Bald and Golden Eagles Protection of 1940 (16 U.S.C. 668-668d; 54 Statute 250), as amended: Provides for the protection of the bald eagle (the national emblem) and the golden eagle by prohibiting, except under certain specified conditions, the taking, possession and commerce of such birds.

Biological Integrity, Diversity, and Environmental Health (2001) 601 FW 3: As part of the comprehensive conservation planning process, this policy provides for the consideration and protection of the broad spectrum of fish, wildlife, and habitat resources found on refuges and associated ecosystems. It provides refuge managers with an evaluation process to analyze their refuge and recommend the best management direction to prevent further degradation of environmental conditions; and where appropriate and in concert with refuge purposes and Refuge System mission, restore lost or severely degraded components.

Clean Air Act (1970; 42 U.S.C. 7401 et seq.), as amended: A comprehensive Federal law that regulates air emissions from area, stationary, and mobile sources. This law authorizes the U.S. Environmental Protection Agency to establish National Ambient Air Quality Standards to protect public health and the environment.

Clean Water Act (1977); Federal Water Pollution Control Act: This is the principal law that governs pollution of the Nation's surface waters. The Clean Water Act employs several regulatory and non-regulatory tools to sharply reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff. Section 404 of the Clean Water Act requires permits (issued by the U.S. Army Corps of Engineers) for the discharge of dredged or fill material into waters of the United States, including wetlands.

Coastal Barrier Resources Act (1982; 16 U.S.C. 3501 et seq.), as amended: This Act (CBRA) designated various undeveloped coastal barrier islands, depicted by specific maps, for inclusion in the Coastal Barrier Resources System. Areas so designated were made ineligible for direct or indirect Federal financial assistance that might support development, including flood insurance, except for emergency life-saving activities. Exceptions for certain activities, such as fish and wildlife research, are provided, and National Wildlife Refuges and other, otherwise protected areas are excluded from the System.

Compatibility Policy (2000) 603 FW 2: Incorporates the compatibility provisions of the National Wildlife Refuge System Improvement Act of 1997, that amends the National Wildlife Refuge System Administration Act of 1966. The Compatibility Policy is for determining whether proposed and existing uses, which the Service has jurisdiction over and are occurring on national wildlife refuges, are compatible (i.e., will not detract from or materially interfere) with the purpose(s) of the refuge or with the Refuge System's mission. The policy is to ensure that we (the Service) administer proposed and existing national wildlife refuge uses according to laws, regulations, and policies concerning compatibility, and provides procedures for documentation and periodic review of existing refuge uses.

Comprehensive Conservation Plans (2000) 602 FW 3: As required by the National Wildlife Refuge System Improvement Act of 1997, Comprehensive Conservation Plans (CCPs) describe the desired future conditions of a refuge and provide long-range guidance and management direction to achieve refuge purposes; help fulfill the Refuge System mission; maintain and, where appropriate, restore the ecological integrity; as well as to meet other mandates. The purpose of developing the CCP is to provide the refuge manager with a 15-year management plan for the conservation of fish, wildlife, and plant resources and their related habitats, while providing opportunities for compatible wildlife-dependent recreational uses.

Convention Between the United States of America and the Mexican States for the Protection of Migratory Birds and Game Mammals, 1936 (50 Statute 1311).

Convention of Nature Protection and Wildlife Preservation in the Western Hemisphere, 1940 (56 Statute 1354).

Convention Between the United States and Great Britain (for Canada for the Protection of Migratory Birds). (39 Statute 1702; TS 628), as amended.

Convention on Wetlands of International Importance, Especially as Waterfowl Habitats (I.L.M. 11:963-976, September 1972, Ramsar Convention).

Cooperative Research and Training Units Act (1960; 16 U.S.C. 753a-753b), as amended: Authorizes the Secretary of the Interior to enter into cooperative agreements with colleges and universities, State fish and game agencies, and nonprofit organizations for the purpose of developing adequate, coordinated, cooperative research and training programs for fish and wildlife resources.

Criminal Code Provisions of 1940 (18 U.S.C. 41), as amended: Provides for fines and penalties for the unlawful taking, disturbing, hunting, trapping, capturing of *"...any bird, fish, or wild animal of any kind whatever, or takes or destroys the eggs or nest of any such bird or fish, on any lands or waters which are set apart or reserved as sanctuaries, refuges or breeding grounds for such birds, fish, or animals under any law of the United States or willfully injures, molests, or destroys any property of the United States on any such lands or waters..."*

Disaster Relief Act of 1974 (42 U.S.C. 5121 et seq.), as amended: Provides authority for Federal agencies to assist State and local governments during Presidentially-declared emergencies.

Economy Act (1932; 31 U.S.C. 1535): Provides authority for Federal agencies to order goods and services from other Federal agencies and to pay the actual costs of those goods and services. The Act was passed to obtain economies of scale and eliminate overlapping activities of the Federal government.

Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901-3932, as amended): The purpose of this act is to promote wetlands conservation for the public benefit and to help fulfill international obligations in various migratory bird treaties and conventions. The Act authorizes the purchase of wetlands from Land and Water Conservation Fund monies. The Act also requires the Secretary of the Interior to establish a National Wetlands Priority Conservation Plan, requires the States to include wetlands in their Comprehensive Outdoor Recreation Plans, and transfers funds from import duties on arms and ammunition to the Migratory Bird Conservation Fund.

Endangered Species Act of 1973, as amended: The main purposes of the Endangered Species Act are to: 1) provide a means whereby ecosystems of threatened and endangered species may be conserved; and 2) provide a program for the conservation of threatened and endangered species. The provisions of the Endangered Species Act include, but are limited to, land acquisition, cooperative programs with the States, and interagency cooperation (Section 7). Section 7(a)(1) directs Federal agencies to carry out programs for the conservation of threatened and endangered species.

Environmental Education Act of 1990 (20 U.S.C. 5501-5510): Established the Office of Environmental Education within the Environmental Protection Agency, to develop and administer a Federal environmental education program. The Office is required to develop and support environmental programs in consultation with other Federal natural resource management agencies, including the Fish and Wildlife Service.

Environmental Education Policy (2006) 605 FW 6: Provides the Service's policy governing the management of environmental education programs on units of the Refuge System. Environmental education is a priority, appropriate use of the Refuge System when compatible. The policy encourages refuge managers to provide quality environmental education programs that can promote understanding and appreciation of natural and cultural resources and their management on all lands and waters in the Refuge System. The policy

also emphasizes that refuge staff develop and take full advantage of opportunities to work with volunteers and partners who have an interest in conducting quality environmental education programs on refuges.

Executive Order 11514; Protection and Enhancement of Environmental Quality (1970): This directs that the *"...Federal Government shall provide leadership in protecting and enhancing the quality of the Nation's environment to sustain and enrich human life. Federal agencies shall initiate measures needed to direct their policies, plans, and programs so as to meet national environmental goals..."*

Executive Order 11644; Use of off-road vehicles on the public lands (1972): Requires that the Service designate areas as open or closed to off-highway vehicles in order to protect refuge resources, promote safety, and minimize conflict among the various refuge users; monitor the effects of these uses once they are allowed; and amend or rescind any area designation as necessary based on the information gathered.

Executive Order 11987; Exotic organisms (1977): Executive agencies shall, to the extent permitted by law, restrict the introduction of exotic species into the natural ecosystems on lands and waters which they own, lease, or hold for purposes of administration; and, shall encourage the States, local governments, and private citizens to prevent the introduction of exotic species into natural ecosystems of the United States.

Executive Order 11988; Floodplain Management (1977): This directs that each Federal agency *"...shall provide leadership and take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains...,"* in carrying out its responsibilities.

Executive Order 11989; Off-Road Vehicles on Public Lands (1977): Requires the Service to close areas to off-highway vehicles when we determine that the use cause or will cause considerable adverse effects on the soil, vegetation, wildlife, habitat, or cultural or historic resources.

Executive Order 11990; Protection of Wetlands (1977): This directs that each Federal agency *"...shall provide leadership and shall take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities..."*

Executive Order 12996; Management and General Public Use of the National Wildlife Refuge System (1996): This spells out the mission of the Refuge System along with establishing guiding principles to help insure the long-term enjoyment of the Refuge System for present and future generations. The order directs the Secretary of the Interior to recognize compatible wildlife-dependent recreational activities involving hunting, fishing, wildlife observation and photography, and environmental education and interpretation as priority general public uses on the Refuge System (i.e., the big six).

Executive Order 13007; Indian Sacred Sites (1996): Directs Federal land management agencies to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners, avoid adversely affecting the physical integrity of such sacred sites and where appropriate, maintain the confidentiality of sacred sites.

Executive Order 13112; Invasive Species (1999): This order was established to address the growing ecological and economic damage caused by invasive species. Executive Order 13112 requires Federal agencies to: 1) identify actions that might impact the status of invasive species and prevent introductions of invasive species; 2) not authorize, fund, or carry out actions likely to cause the introduction or spread of invasive species; 3) detect and respond rapidly to control invasive species populations; 4) monitor and conduct research on invasive species; 5) restore native species and habitat conditions in ecosystems that have been invaded; and 6) promote public education on invasive species.

Executive Order 13158; Marine Protected Areas (2000): directs protection of the significant natural and cultural resources within the marine environment for the benefit of present and future generations by strengthening and expanding the Nation's system of marine protected areas (MPAs). An MPA is any area of the marine environment that has been reserved by Federal, State, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein. The EO directs Federal agencies to work together with states, territories, tribes and non-governmental partners to develop and maintain an effective national system of MPAs in the United States and to accomplish a variety of related tasks working with public and private partners. The "marine environment" is defined as those areas of ocean and coastal waters, the Great Lakes and their connecting waters, and submerged lands thereunder, over which the United States exercises jurisdiction, consistent with international law.

Executive Order 13186; Responsibilities of Federal agencies to protect migratory birds (2001): Provides guidance for Service programs relative to the management and conservation of migratory birds. Its purpose is to minimize the potential adverse effects of migratory bird take, with the goal of striving to eliminate take, while implementing our mission. This guidance includes, but is not limited to: 1) integrating migratory bird conservation measures into our activities; 2) restoring and enhancing the habitat of migratory birds; 3) ensuring our actions/plans promote migratory bird conservation; 4) promoting inventory, monitoring, research, management studies and information exchange related to migratory birds; 5) promoting education and outreach related to migratory birds; 6) identifying special migratory bird habitats; and 7) strengthening non-Federal partnerships to further bird conservation.

Executive Order 13443; Facilitation of Hunting Heritage and Wildlife Conservation (2007): Directs Federal agencies that have programs and activities that have a measurable effect on public land management, outdoor recreation, and wildlife management, including the Department of the Interior and the Department of Agriculture, to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat.

Farmland Protection Policy Act (7 U.S.C. 4201 et seq.): Requires Federal agencies to identify and take into account the adverse effects of their programs on the preservation of farmlands.

Federal Aid in Sport Fish Restoration Act (1950; 16 U.S.C. 777-777k), as amended: Commonly called the Dingell-Johnson Act or Wallop-Breaux Act, this provides Federal aid to the States for management and restoration of fish having *"...material value in connection with sport or recreation in the marine and/or fresh waters of the United States."* In addition, amendments to the Act provide funds to the States for aquatic education, wetlands restoration, boat safety, and clean vessel sanitation devices (pumpouts), and a non-trailerable boat program. Funds are derived from a 10-percent excise tax on certain items of sport fishing tackle, a 3-percent excise tax on fish finders and electric trolling motors, import duties on fishing tackle, yachts and pleasure craft, interest on the account, and a portion of motorboat fuel tax revenues and small engine fuel taxes. To participate in the Federal Aid in Sport Fish Restoration program, States are required to agree to this law and pass laws for the conservation of fish, which include a prohibition against the diversion of license fees for any other purpose than the administration of the State fish department.

Federal Aid in Wildlife Restoration Act (1937; 16 U.S.C. 669-669i), as amended: Commonly called the "Pittman-Robertson Act," this provides Federal aid to States for management and restoration of wildlife. Funds from an 11-percent excise tax on sporting arms and ammunition are appropriated to the Secretary of the Interior and apportioned to States on a formula basis for paying up to 75 percent of the cost-approved projects. Project activities include acquisition and improvement of wildlife habitat, introduction of wildlife into suitable habitat, research into wildlife problems, surveys and inventories of wildlife problems, acquisition and development of access facilities for public use, and hunter education programs, including construction and operation of public target ranges.

Federal Environmental Pesticide Control Act of 1972 (7 USC 136-136y), as amended: This established, under the Administrator of the EPA, a program for controlling the sale, distribution, and application of pesticides through an administrative registration process. The amendments provided for classifying pesticides for "general" or "restricted" use. "Restricted" pesticides may only be applied by or under the direct supervision of a certified applicator. Amendments to this Act also authorized experimental use permits and provided for administrative review of registered pesticides and for penalties for violations of the statute. States were authorized to regulate the sale or use of any pesticide within a State, provided that such regulation does not permit any sale or use prohibited by the Act. The Federal Environmental Pesticide Control Act of 1972 amended the **1947 Federal Insecticide, Fungicide, and Rodenticide Act** (FIFRA). The 1947 statute (FIFRA), prohibited the sale or distribution of "*economic poisons*," provided for the registration of such materials, and authorized penalties for violation of the Act. The Endangered Species Act later amended FIFRA to define imminent hazard to include situations involving *unreasonable hazard to the survival of a species declared by the Secretary of the Interior to be endangered or threatened*.

Federal Fire Prevention and Control Act of 1974 (15 U.S.C. 2201 et seq.), as amended: This authorizes reimbursement to State and local fire services for costs incurred in firefighting on Federal property.

Federal Noxious Weed Act (1990): Requires the use of integrated management systems to control or contain undesirable plant species, and an interdisciplinary approach with the cooperation of other Federal and State agencies.

Federal Property and Administrative Services Act of 1949 (40 U.S.C. 471-535), as amended: Sets forth requirements for the management and disposal of government property, including excess property (property under the control of any Federal agency, but which it no longer needs) and surplus property (excess property not required for the needs of any Federal agency).

Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j, not including 742 d-l), as amended: This established a comprehensive national fish and wildlife policy and broadened the authority for acquisition and development of refuges. The policy emphasizes the commercial fishing industry but also with a direction to administer the Act with regard to the inherent right of every citizen and resident to fish for pleasure, enjoyment, and betterment, and to maintain and increase public opportunities for recreational use of fish and wildlife resources. Among other things, the Act directs a program of continuing research, extension, and information services on fish and wildlife matters, both domestically and internationally. A 1974 amendment to the Fish and Wildlife Act of 1956 abolished the "Bureau of Sport Fisheries and Wildlife" and re-designated it as the "United States Fish and Wildlife Service"(Public Law 93-271). In 1978, the Fish and Wildlife Act was amended to allow the Service to accept donations of both real and personal property. In 1998, the Fish and Wildlife Act of 1956 was further amended to promote volunteer programs and community partnerships for the benefit of national wildlife refuges. This also required the Secretary of the Interior to develop refuge education programs to provide outdoor classroom opportunities for students to promote understanding of the Refuge System and to improve scientific literacy in conjunction with both formal and informal education programs.

Fish and Wildlife Conservation Act of 1980 ("Nongame Act")(16 U.S.C. 2901-2911), as amended: Authorizes financial and technical assistance to the States for the development, revision, and implementation of conservation plans and programs for nongame fish and wildlife. A 1988 amendment requires the Service to monitor and assess migratory nongame birds, determine the effects of environmental changes and human activities, identify those likely to be candidates for endangered species listing, identify appropriate actions, and report to Congress one year from enactment. It also requires the Service to report at 5 year intervals on actions taken.

Fish and Wildlife Coordination Act (1934), as amended: Authorizes the Secretary of the Interior to assist Federal, State, and other agencies in development, protection, rearing and stocking fish and wildlife on Federal lands and to study effects of pollution on fish and wildlife. The Act also requires consultation with the U.S. Fish and Wildlife Service and the wildlife agency of any State wherein the waters of any stream or other water body are

proposed to be impounded, diverted, channelized or otherwise controlled or modified by any Federal agency, or any private agency under Federal permit or license; with a view to preventing loss of, or damage to, wildlife resources in connection with such water resource projects. The Act further authorizes Federal water resource agencies to acquire lands or interests in connection with water use projects specifically for mitigation and enhancement of fish and wildlife.

Fish and Wildlife Improvement Act of 1978 (16 U.S.C. 7421; 92 Stat. 3110), as amended: Authorizes the Secretaries of the Interior and Commerce to establish, conduct, and assist with National training programs for State fish and wildlife law enforcement personnel. It also authorized funding for research and development of new or improved methods to support fish and wildlife law enforcement. The law provides authority to the Secretaries to enter into law enforcement cooperative agreements with State or other Federal agencies, and authorizes the disposal of abandoned or forfeited items under the fish, wildlife, and plant jurisdictions of these Secretaries. It strengthens the law enforcement operational capability of the Service by authorizing the disbursement and use of funds to facilitate various types of investigative efforts.

Flood Control Act of 1944, as amended: This act, supplemented by other flood control acts and river and harbor acts, authorizes various Corps of Engineers water development projects. The Flood Control Act expressed Congressional intent to limit the authorization and construction of navigation, flood control, and other water projects to those having significant benefits for navigation and which could be operated consistent with other river uses. This authorized the construction of numerous dams and modifications to previously existing dams. Several provisions of this act impact the responsibilities of the Service under the **Fish and Wildlife Coordination Act**.

Food Security Act of 1985 "Farm Bill" (99 Stat. 1354), as amended by the Food, Agriculture, Conservation, and Trade Act of 1990: This contains several provisions that contribute to wetland conservation. The "Swampbuster" provisions stated that farmers who produce an agricultural commodity on wetlands converted after enactment are ineligible for most farmer program subsidies. Administration of the program in the Department of Agriculture (USDA), which is required to consult with the U.S. Fish and Wildlife Service on matters relating to wetland identification, determination of exemptions to the wetland conservation provisions, issuance of implementing regulations, mitigation, and restoration of values and functions on converted wetlands. This Act also authorized the Secretary of Agriculture to grant or sell conservation easements, which may include wetlands, to State or local governments or private non-profit organizations for conservation purposes. In addition, the 1985 Act also established a Conservation Reserve program, providing incentives to private landowners (e.g., farmers) to return farmland to permanent vegetative cover and for applying soil conservation prescriptions such as wildlife habitat development. The program was expanded in 1988 by regulation to make cropped wetlands eligible for the program, with the intended result of wetland restoration (i.e., The Wetland Reserve Program).

Freedom of Information Act (1966; 5 U.S.C. 552): Requires all Federal agencies to make available to the public for inspection and copying administrative staff manuals and staff

instructions, official, published and unpublished policy statements, final orders deciding case adjudication, and other documents. Special exemptions have been reserved for nine categories of privileged material, including but not limited to confidential matters relating to National defense or foreign policy, law enforcement records, and trade or commercial secrets. The Act requires the party seeking the information to pay reasonable search and duplication costs.

Historic Sites, Buildings and Antiquities Act (16 U.S.C. 461-462, 464-467), as amended. Also known as the Historic Sites Act, this declared it a national policy to preserve historic sites and objects of national significance, including those located on refuges. It provided procedures for designation, acquisition, administration, and protection of such sites. Among other things, National Historic and Natural Landmarks are designated under authority of this Act. As of January, 1989, 31 national wildlife refuges contained such sites.

Lacey Act of 1900 (16 U.S.C. 701), as amended: Makes it unlawful to import, export, sell, acquire, or purchase fish, wildlife or plants taken, possessed, transported, or sold: 1) in violation of U.S. or Indian law, or 2) in interstate or foreign commerce involving any fish, wildlife, or plants taken possessed or sold in violation of State or foreign law. The Lacey Act covers all fish and wildlife and their parts or products, and plants protected by the Convention on International Trade in Endangered Species and those protected by State law. Commercial guiding and outfitting are considered to be a sale under the provisions of the Act. The Act also includes prohibitions on the importation of wild vertebrates and other animals listed in the Act or declared by the Secretary of the Interior to be injurious to man or agriculture, wildlife resources, or otherwise, except under certain circumstances and pursuant to regulations. The Lacey Act includes penalties and fines for violations involving imports or exports or violations of a commercial nature.

Land and Water Conservation Fund Act (1965): Authorizes the use of the receipts from the sale of surplus Federal land, outer continental shelf oil and gas sales, and other sources for land acquisition. Section 7(a)(l) of this Act provides authority to use Land and Water Conservation Fund money for acquisition of refuge areas under paragraph (5) of section 7(a) of the Fish and Wildlife Act of 1956.

Marine Mammal Protection Act (1972): The Marine Mammal Protection Act (MMPA) was enacted on October 21, 1972. All marine mammals are protected under the MMPA. The MMPA prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S.

Migratory Bird Conservation Act (1929; 16 U.S.C. 715-715d, 715e, 715f-715r), as amended: This established a Migratory Bird Conservation Commission to approve areas recommended by the Secretary of the Interior for acquisition with Migratory Bird Conservation Funds.

Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-712), as amended: The Migratory Bird Treaty Act (MBTA) is one of the earliest Federal wildlife management laws enacted to

protect migratory birds, which were rapidly declining from unregulated sport and commercial hunting. Specific provisions in the MBTA include the establishment of a Federal prohibition, unless permitted by regulations, to *"...pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention ...for the protection of migratory birds...or any part, nest, or egg of any such bird."*

Migratory Bird Hunting and Conservation Stamp Act (1934; 16 U.S.C. 718-718j), as amended: Known as the "Duck Stamp Act," this requires each waterfowl hunter 16 years of age or older to possess a valid Federal hunting stamp. Receipts from the sale of the stamp are deposited in a special Treasury account known as the Migratory Bird Conservation Fund and are not subject to appropriations. Funds appropriated under the Wetlands Loan Act (16 U.S.C. 715k-3 - 715k-5), as amended, are merged with duck stamp receipts and provided to the Secretary of the Interior for the acquisition of migratory bird refuges under provisions of the Migratory Bird Conservation Act (16 U.S.C. 715 et seq), as amended, and since August 1, 1958, for acquisition of "Waterfowl Production Areas."

National Environmental Policy Act of 1969 (42 U.S.C. 4321-4347), as amended: The National Environmental Policy Act (NEPA) requires that all Federal agencies prepare detailed environmental impact statements for "every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment. NEPA stipulates factors to be considered in environmental impact statements, and requires that Federal agencies employ an interdisciplinary approach in related decision-making and develop means to ensure that un-quantified environmental values are given appropriate consideration, along with economic and technical considerations.

National Historic Preservation Act of 1966 (16 U.S.C. 470-470b, 470c-470n), as amended: Provides for preservation of significant historical features (buildings, objects, and sites) through a grant-in-aid program to the States. It established a National Register of Historic Places and a program of matching grants under the existing National Trust for Historic Preservation (16 U.S.C. 468-468d). The Act established an Advisory Council on Historic Preservation, which was made a permanent independent agency in 1976. That Act also created the Historic Preservation Fund. Federal agencies are directed to take into account the effects of their actions on items or sites listed or eligible for listing in the National Register. As of January, 1989, 91 historic sites on national wildlife refuges have been placed on the National Register, including Aransas NWR (Matagorda Island Lighthouse).

National Wilderness Preservation System (1964): Also known as the "Wilderness Act of 1964"; the purpose was to preserve and protect wild lands in their natural condition *"...to secure for the American people of present and future generations the benefits of an enduring resource of wilderness.*" This act directed Federal agencies such as the U.S. Fish and Wildlife Service to survey their roadless lands for possible wilderness designation. Wilderness areas are protected from development and the operation of motorized equipment.

A Wilderness Area is defined as an area with at least 5,000 acres of undisturbed, undeveloped land affected by the forces of nature and may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

National Wildlife Refuge System Administration Act of 1966 as amended by the National Wildlife Refuge System Improvement Act of 1997, 16 U.S.C. 668dd-668ee. (Refuge Administration Act): Defines the National Wildlife Refuge System and authorizes the Secretary to permit any use of a refuge provided such use is compatible with the purposes for which the refuge was established. The Refuge Improvement Act clearly defines a unifying mission for the Refuge System; establishes the legitimacy and appropriateness of the six priority public uses (hunting, fishing, wildlife observation and photography, and environmental education and interpretation); establishes a formal process for determining compatibility; established the responsibilities of the Secretary of Interior for managing and protecting the System; and requires a comprehensive conservation plan for each refuge by 2012. This Act amended portions of the Refuge Recreation Act and National Wildlife Refuge System Administration Act of 1966.

National Wildlife Refuge System Improvement Act (1997): Sets the mission and administrative policy for all refuges in the National Wildlife Refuge System. Clearly defines a unifying mission for the Refuge System; establishes the legitimacy and appropriateness of the six priority public uses (hunting, fishing, wildlife observation and photography, and environmental education and interpretation); establishes the responsibilities of the Secretary of the Interior for managing and protecting the system; and requires a comprehensive conservation plan for each refuge by the year 2012. This Act amended portions of the Refuge Recreation Act and National Wildlife Refuge System Administration Act of 1966.

Native American Graves Protection and Repatriation Act (1990): Requires Federal agencies and museums to inventory, determine ownership of, and repatriate cultural items under their control or possession.

North American Wetlands Conservation Act (1989; 16 U.S.C. 4401-4412), as amended: Provides funding and administrative direction for implementation of the North American Waterfowl Management Plan and the Tripartite Agreement on wetlands between Canada, U.S. and Mexico.

Protection Act (1922; 16 U.S.C. 594): Provides for the Secretary of the Interior to protect and preserve, from fire, disease, or the ravages of beetles or other insects, timber on the public lands owned by the United States.

Reciprocal Fire Protection Act of 1955 (42 U.S.C. 1856), as amended by the Wildfire Suppression Assistance Act of 1989 (102 Stat. 1615): Provides authority for Federal agencies to enter into mutual assistance agreements with foreign, State, and local governments for combating wildfires, and to provide emergency assistance when no agreement exists.

Refuge Recreation Act of 1962 (16 U.S.C. 460k-460k-4), as amended: Authorizes the Secretary of the Interior to administer refuges, hatcheries, and other conservation areas for recreational use, when such uses do not interfere with the area's primary purposes. The Act provides for public use fees and permits, and penalties for violation of regulations. It also authorizes the acceptance of donations of funds and real and personal property to assist in carrying out its purposes. Amendments to the Act authorize acquisition of lands and interests suitable for: 1) fish and wildlife-oriented recreation, 2) protection of natural resources, 3) conservation of endangered or threatened species, or 4) carrying out two or more of the above. Such lands were required to be adjacent to or within an existing conservation area. Acquisition was not permitted with "duck stamp" receipts for these purposes.

Refuge Revenue Sharing Act of 1935 (16 U.S.C. 715s), as amended: Provides for payments to county governments in lieu of taxes, using revenues derived from the sale of products from refuges. Revenues received from refuge products, such as animals, timber and minerals, or from leases or other privileges, are required to be deposited in a special Treasury account and net receipts distributed to counties. Remaining monies are required to be transferred to the Migratory Bird Conservation Fund for land acquisition under provisions of the Migratory Bird Conservation Act. The Act was later amended to expand the revenue sharing system to include National Fish Hatcheries and Service research stations. It also included in the Refuge Revenue Sharing Fund receipts from the sale of salmonid carcasses. Payments to counties were established as: 1) on acquired land, the greatest amount calculated on the basis of 75 cents per acre, three-fourths of one percent of the appraised value, or 25 percent of the net receipts produced from the land, and 2) on land withdrawn from the public domain, 25 percent of net receipts and basic payment, in lieu of taxes on public lands. Amendments to the Act authorized appropriations to make up any difference between the amount in the Revenue Sharing Fund and the amount scheduled for payment in any year. Counties are also required to pass payments along to other units of local government within the county which suffer losses in revenues due to the establishment of Service areas.

Refuge Trespass Act of 1948 (18 U.S.C. 41): This consolidated penalty provisions of various acts from 1905 through 1934, establishing and protecting fish and wildlife areas, and restated the intent of Congress to protect all wildlife within Federal sanctuaries, refuges, fish hatcheries and breeding grounds.

Rehabilitation Act (1973): Requires programmatic accessibility in addition to physical accessibility for all facilities and programs funded by the Federal government to ensure that anybody can participate in any program.

Rivers and Harbors Act (1899; 33 U.S.C. 403): Section 10 of this Act requires the authorization by the U.S. Army Corps of Engineers prior to any work in, on, over, or under a navigable water of the United States.

Secretarial Order No. 3226; Evaluating Climate Change Impacts in Management Planning (2001): The Department of the Interior Secretarial Order 3226 states that “there is a consensus in the international community that global climate change is occurring and that it should be addressed in governmental decision making…This Order ensures that climate

change impacts are taken into account in connection with Departmental planning and decision making." Additionally, it calls for the incorporation of climate change into long-term planning documents such as the CCP.

Transfer of Certain Real Property for Wildlife Conservation Purposes Act of 1948 (16 U.S.C. 667b-d), as amended: This Act provides that, upon a determination by the Administrator of the General Services Administration, real property no longer needed by a Federal agency can be transferred without reimbursement to the Secretary of the Interior if the land has particular value for migratory birds, or to a State agency for other wildlife conservation purposes.

Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 U.S.C. 4601 et seq.), as amended: Establishes uniform land acquisition policies for all Federal agencies, and establishes requirements for the uniform and equitable treatment of persons displaced from their homes, businesses or farms by Federal or Federally-assisted programs, including land acquisition.

Volunteer and Partnership Enhancement Act (1998): This amended the Fish and Wildlife Act of 1956 to promote volunteer programs and community partnerships for the benefit of national wildlife refuges, and for other purposes.

Waterfowl Depredations Prevention Act (1956; 7 U.S.C. 442-445), as amended: This Act authorizes the Secretary of the Interior to use surplus grain owned by Commodity Credit Corporation in feeding waterfowl to prevent crop damage. Findings regarding possible crop damage are to be made by the Secretary of the Interior and grain is to be used to lure waterfowl away from crops while not exposing them to shooting over areas to which they have been lured. Such grain may be made available to Federal, State or local governments or private organizations or individuals. Appropriations are authorized to reimburse the Corporation for packaging and transporting such grain.

Water Resources Planning Act (1965), as amended: This established a Water Resources Council to be composed of Cabinet representatives, including the Secretary of the Interior. The Council was empowered to maintain a continuing assessment of the adequacy of water supplies in each region of the U.S. In addition, the Council was mandated to establish principles and standards for Federal participants in the preparation of river basin plans and in evaluating Federal water projects. Upon receipt of a river basin plan, the Council was required to review the plan with respect to agricultural, urban, energy, industrial, recreational, and fish and wildlife needs. This also established a grant program to assist States in participating in the development of related comprehensive water and land use plans.

Wetlands Reserve Program: The Wetlands Reserve Program (WRP) is a voluntary program. It provides technical and financial assistance to eligible landowners to address wetland, wildlife habitat, soil, water, and related natural resource concerns on private lands in an environmentally beneficial and cost-effective manner. The program provides an opportunity for landowners to receive financial incentives to restore, protect, and enhance wetlands in exchange for retiring marginal land from agriculture. There are three enrollment

options for landowners: 1) permanent easement, 2) 30-year easement, and 3) a restoration cost-share agreement. The WRP was re-authorized in the Farm Security and Rural Investment Act of 2002 (Farm Bill). The Natural Resources Conservation Service administers the program (*See Also: Food Security Act of 1985*).

Wilderness Act of 1964 (16 U.S.C. 1131): This Act directed the Secretary of the Interior to review every roadless area of 5,000 or more acres and every roadless island (regardless of size) within National Wildlife Refuge and National Park Systems and to recommend to the President the suitability of each such area or island for inclusion in the National Wilderness Preservation System, with final decisions made by Congress. The Act provides criteria for determining suitability and establishes restrictions on activities that can be undertaken on a designated area. It authorizes the acceptance of gifts, bequests, and contributions in furtherance of the purposes of the Act and requires an annual report at the opening of each session of Congress on the status of the wilderness system.

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Appendix B. Environmental Assessment and Finding of No Significant Impact (FONSI)

1.0 PURPOSE OF AND NEED FOR PROPOSED ACTION

1.1 Introduction

The United States Fish and Wildlife Service (Service) proposes to implement a Comprehensive Conservation Plan (CCP) for the Texas Mid-coast National Wildlife Refuge Complex (Complex), which would guide management on the Brazoria, San Bernard and Big Boggy National Wildlife Refuges for the next 15 years. This Environmental Assessment (EA) is being prepared to evaluate the effects associated with this proposal and it complies with the National Environmental Policy Act (NEPA) in accordance with Council on Environmental Quality regulations (40 CFR 1500-1509) and Department of the Interior (516 DM 8) and Service (550 FW 3) policies (see Section 1.7 for a list of additional regulations with which this EA complies). NEPA requires examination of the effects of proposed actions on the natural and human environment. In the following chapters, we describe three alternatives for future refuge management, the environmental consequences of each alternative, and our preferred management direction. Each alternative includes a reasonable mix of fish and wildlife habitat prescriptions and wildlife-dependent recreational opportunities consistent with the Refuge System Improvement Act and specific refuge purposes.

The environmental consequences of each alternative are described and form the basis for selection of the proposed action. This EA covers the environmental consequences for future management actions and current facilities on the Complex. However, some future actions such as the construction of major facilities will require further environmental documentation.

1.2 Location

The Complex is located in Brazoria, Fort Bend, Matagorda, and Wharton Counties, Texas. The Refuge is approximately 45 miles south of Houston, and approximately 45 miles southwest of Galveston, Texas (See Figure EA 1-1 or Map 3-3. Texas Mid-coast National Wildlife Refuge Complex Location in the CCP).

1.3 Background

The Complex includes the Brazoria, San Bernard, and Big Boggy National Wildlife Refuges (NWR), comprising a total of 105,000 acres along the Texas Gulf Coast. Brazoria NWR and most of the San Bernard NWR occur in Brazoria County with satellite units of San Bernard NWR in Matagorda, Fort Bend and Wharton Counties. Big Boggy NWR is entirely in Matagorda County. Figure 1 shows the location of the core refuges. Brazoria NWR is the oldest refuge of the Complex (1966) followed by San Bernard (1969) and Big Boggy (1983). The Service established the refuges to provide quality habitat for wintering migratory waterfowl and other wildlife.

The Complex supports a myriad of plant communities, co-evolving with biotic and abiotic systems, soil and flat to low topography (0 - 50 ft. elevation) to form an ecosystem of marshes, prairies and bottomland hardwood forests that are increasingly disappearing from the coastal landscape. Further influencing the preponderance of plant communities is the varied marine type

climatic conditions that result from the flow of warm gulf air modified by surges of continental air, resulting in a humid subtropical climate with hot summers and mild winters (Hatch et al. 1999).

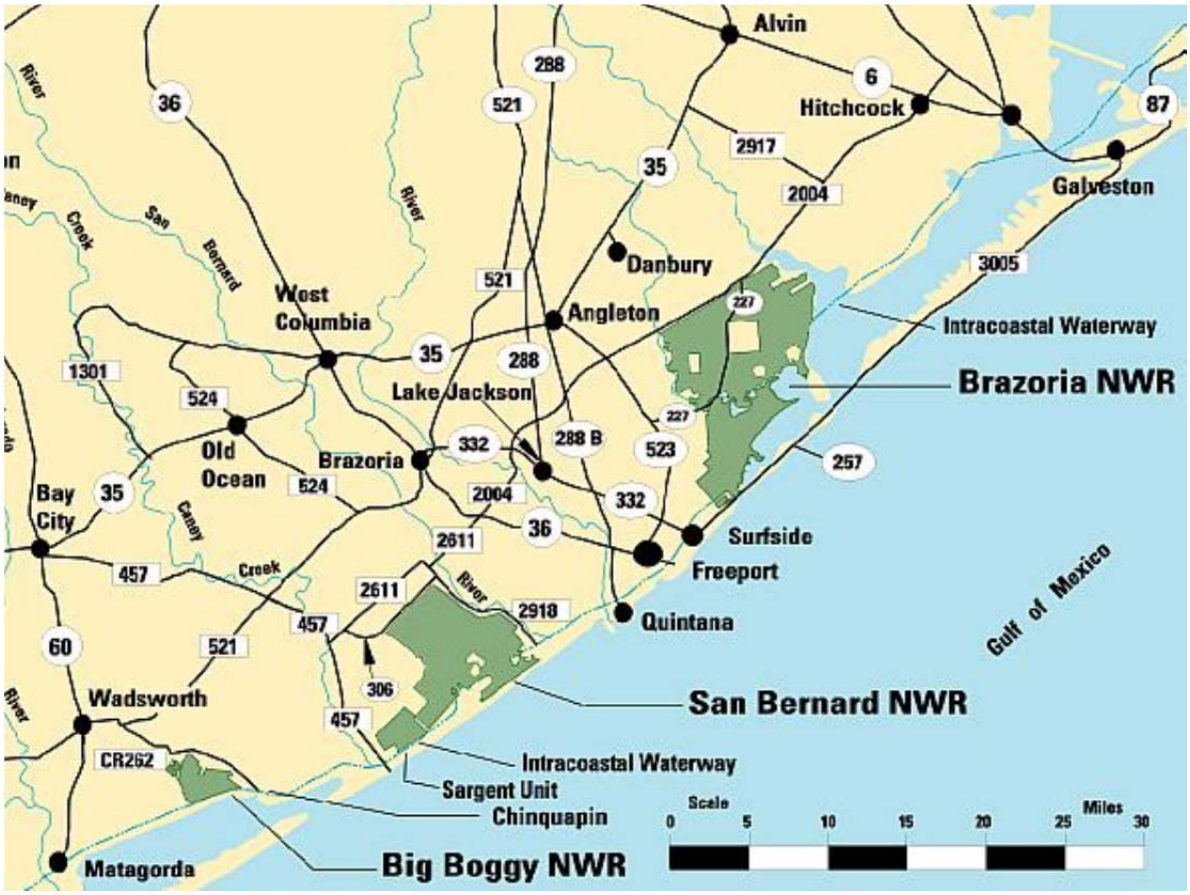

Figure EA 1-1. Refuges of the Texas Mid-coast National Wildlife Refuge Complex (U.S. Government Printing Office. 2003).

The Complex is home to thousands of wintering snow geese and recognized as an internationally significant shorebird site. Scattered woodlots in the refuges, as well as the remaining portions of the Columbia Bottomlands forest in the San Bernard NWR, are vital stopover points for neotropical migrants.

The wide variety of habitats include saline and non-saline prairie, mudflats, fresh and salt marsh, fresh and saltwater lakes, bottomland hardwood forest, and two intermittent freshwater streams. A 5,000-acre tract of native bluestem prairie on Brazoria NWR represents one of the last coastal prairies in Texas.

The Complex is one of the principal wintering areas in North America for snow geese as well as hundreds of thousands of shorebirds that use the mudflats during spring and fall migration. Over 230 species of neo-tropical passerine migrants have been recorded in the Complex.

Ongoing management is necessary to maintain these important and varied habitats. Water management projects help to maintain the shallow, freshwater ponds used by many birds, especially during times of drought. Controlled burning of grasslands recycles nutrients and helps control the spread of invasive species. A multitude of coordinated efforts related to preservation of the remaining Columbia Bottomland forests continue throughout the Complex to benefit the wildlife and habitat encompassing the entire Complex.

1.4 Purpose

The purpose of the proposed action is to specify a management direction for the Complex over the next 15 years. The selected management direction for the Complex achieves each Refuge's purposes, vision and goals; contributes to the mission of the National Wildlife Refuge System (NWRS or Refuge System); is consistent with principles of sound fish and wildlife management; and address relevant mandates and major issues during scoping. The proposed management direction is described in detail through a set of goals, objectives, and strategies in the CCP. The purpose of this EA is to assess the impacts of proposed management actions.

1.5 Need for Action

The action is needed because a long-term management plan does not currently exist for the Complex. Management is guided by various general policies and short-term plans that do not reflect current conditions or recent scientific knowledge. The action is also needed to address current management issues and to satisfy the legislative mandates of the National Wildlife Refuge System Improvement Act of 1997, which requires the preparation of a CCP for all national wildlife refuges in the United States.

1.6 Decision to be Made

The Regional Director for the Southwest Region (Region 2 of the Service) will make two decisions based on this EA: (1) select which alternative the Refuge will implement, and (2) determine if the selected alternative is a major federal action significantly affecting the quality of the human environment, thus requiring preparation of an Environmental Impact Statement (EIS), or whether the Proposed Action alternative can proceed.

The Complex's proposed action is Alternative B. Assuming no significant impact is found, the final CCP will include a Finding of No Significant Impact (FONSI), a statement explaining why the selected alternative will not have a significant effect on the quality of the human environment. This determination takes into consideration the Service and Refuge System mission, the purpose(s) for which the refuges were established, and other legal mandates. Once the FONSI is signed, the CCP will be implemented, monitored annually, and revised when necessary.

1.7 Regulatory Compliance

National Wildlife Refuges are guided by the mission and goals of the National Wildlife Refuge System (NWRS), the purpose(s) of an individual refuge, Service policy, and laws and international treaties. Relevant guidance includes the National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act) , Refuge Recreation Act of 1962, and selected portions of the Code of Federal Regulations and Fish and Wildlife Service Manual.

The CCP's overriding consideration is to carry out the purposes for which the refuges were established. The laws used to establish the refuges and provide the funds for acquisition, state the refuge purposes. Fish and wildlife management is the first priority in refuge management, and the Service allows and encourages public use (wildlife-dependent recreation) as long as it is compatible with, or does not detract from, refuge purposes.

The Service prepared this EA and represents compliance with applicable federal statutes, regulations, Executive Orders, and other compliance documents. Appendix A contains a list of the key laws, orders, and regulations that provide a framework for the proposed action. Further, this EA reflects compliance with applicable State of Texas and local regulations, statutes, policies, and standards for conserving the environment and environmental resources such as water and air quality, endangered plants and animals, and cultural resources. The Complexe will complete an Endangered Species Act Section 7 Consultation for inclusion in the CCP (Appendix G).

Comprehensive Conservation Plans include a review of the appropriateness and compatibility of existing Refuge uses and of any planned future public uses. If a use is determined to be an 'Appropriate Refuge Use' by a refuge manager, it then goes through the 'Compatibility Determination' process. For more information on Appropriate Refuge Uses and Compatibility Determinations, including a list of currently approved CDs, see Chapter 5, Section 2 of the CCP.

1.8 Scoping/Public Involvement and Issues Identified

Formal scoping began with publication of a notice of intent to prepare a CCP and EA in the *Federal Register* on June 23, 2009. Planning Update #1 was released to the public in August of 2009, announcing the beginning of the planning process and asking the public for help identifying the issues that need to be addressed in the CCP.

The Complex held three public open house meetings during the June 23rd to September 21st, 2009 comment period. The Complex held all three meetings the week of September 14, 2009. The first meeting was held at the Lake Jackson Library in Lake Jackson, Texas from 6–8 p.m. with 18 in attendance, the second at Demi-John Fire Hall in Freeport, Texas from 6–8 p.m. 9 in attendance, and the last at the Complex Headquarters in Brazoria, Texas from 10 a.m.–3 p.m. with 14 people attending.

The Planning Team held an ecoregional coordination meeting at Brazoria NWR on December 9, 2009, to coordinate with other conservation agencies and organizations in an attempt to gain a

greater understanding of issues occurring at the landscape-scale, and what management actions are taking place to address those issues. This joint effort helped gain a better understanding of the management actions occurring within the Gulf Coast Prairies and Marshes Ecoregion and attempted to highlight areas that each agency, including the Texas Mid-coast NWR Complex, can focus management efforts in addressing issues impacting fish, wildlife, and their habitats within the larger landscape. Table EA 1-1 lists agencies and organizations that attended the ecoregion coordination meeting.

Table EA 1-1 Agencies and Organizations attending Ecoregional Coordination Meeting

Texas Parks Wildlife Department	Attwater Prairie Chicken NWR
Texas Chenier Plains NWR	The Nature Conservancy
Gulf Coast Joint Venture	Trinity River NWR
FWS Ecological Services	Texas Mid-coast NWR Complex

In addition to three open house public meetings and the ecoregional coordination meeting, the Complex hosted a government-to-government meeting and invited Texas Parks and Wildlife Department (TPWD) on February 9, 2010. The Complex held the meeting at its Headquarters and provided a forum for sharing ideas, concerns, and issues regarding management and outcomes on the Complex to benefit the development of the CCP. This interagency meeting proved to be a great asset with the State of Texas and helped the Complex form many of its wildlife related alternatives and management consideration of multiple species such as quail, turkey, and deer.

The Complex released Planning Update # 2 in March of 2010, to offer an opportunity to the public to review and comment on the issues identified during the public scoping process and announced the draft goal statements as well as the preliminary range of management alternatives developed by the planning team.

Additional public scoping for the Land Protection Plan (LPP) planning process was conducted in January, 2012, with a comment period open from January 15, 2012 until February 5, 2012. Three public (open house) meetings were held to provide information on the proposed expansion and respond to questions and concerns; January 20, 2012, at the Discovery Center on Brazoria NWR near Freeport, Texas; January 24, 2012, at the Complex Office near Brazoria, Texas; and February 2, 2012 at the Hudson Woods Unit of San Bernard NWR near Angleton, Texas. A total of 30 people attended the public meeting, with attendance of 15, 7, and 8 respectively, at each public meeting. A response card indicating support or non-support of the proposal was handed out at each meeting, enabling participants to provide a quick response. In addition, The Facts newspaper printed articles twice during the open comment period, which generated 8 email responses. Of the 27 total responses, 22 supported the project expansion and five did not.

The feedback received at the conclusion of the public scoping period and throughout the planning process identified concerns from a variety of stakeholders. The issues and concerns provided the basis for developing the Complex's management direction and played a role in determining desired conditions for each refuge. The issues are divided into five categories: ecoregion-related management, habitat management, wildlife management, public use

opportunities, and facilities/infrastructure management as described below. All the following issues are Refuge management concerns unless otherwise specified.

The planning team identified the following issues after reviewing The Nature Conservancy's Gulf Coast Prairies and Marshes Ecoregional Assessment, Texas Comprehensive Wildlife Conservation Strategy, and other supporting documents to identify threats and issues for the Gulf Coast Prairies and Marshes Ecoregion. In addition to these documents, conservation and research organizations; local, state, and federal government agencies; and the public also identified issues during our scoping process and open house meetings. These issues helped us further our outreach efforts, gain a better understanding of what is occurring on the landscape surrounding the Complex, and determine the role of the refuges in conserving wildlife and their habitats within the larger landscape. Although these issues are outside the scope of the CCP they were used when considering development of management direction.

1.8.1 Ecoregion Issues

The Complex is taking a landscape-scale approach to management over the life of the CCP. Comments and concerns from our partners, the general public, and our ecoregional meeting were addressed according to; but not limited to, major issues/threats such as the effects of climate change, erosion/saltwater intrusion, wildland fire use, petroleum development, and land conservation and are described in detail below.

Fragmentation

Remaining tracts of wetland, marsh, and prairie habitats are being broken up, divided, and impacted from development of roads for commerce, development for housing, and businesses, and for agricultural purposes throughout the ecoregion. Fragmentation of the landscape has also been identified as having a highly detrimental impact on species that are less mobile (Fahrig 2003).

Commercialization

Commercialization activities are having negative impacts on both wildlife and habitat within the ecoregion, which is encompassing expanding human encroachment from the Houston Metropolitan approximately 45 miles north of the Complex. One of the biggest challenges is the sale of sand deposits developed throughout the ecoregion for commercial resale out of wetland and riparian areas that affect water quality downstream as well as in the bays.

Petroleum development, timber cutting, commercial crabbing and oyster harvest, livestock grazing and haying, turf farms, pollution from fertilizer and pesticides, and illegal dumping have all been identified as major impacts of commercialization affecting the entire ecoregion.

Urbanization

Changing from vegetative environments to those of asphalt and concrete reduces wildlife species, produces monocultures of grass that do not benefit wildlife, and creates barriers for many less mobile species. Urbanization is fragmenting native plant communities and resulting in a direct loss of plant diversity. Increasing pesticide and herbicide use around managed lands and an increase in fertilizer use are some of the many contributing factors of urbanization with negative impacts on prairie habitat. Urbanization also adds additional stressors on a limited

amount of public lands in Texas with an increased amount of natural resource users such as boaters, anglers, hunters, and outdoor enthusiasts. Urbanization is a serious issue since the Complex is just about 45 miles of the 3.9 million people living in and around Houston.

Disturbance

The effects of disturbance in some coastal habitats to a number of coastal wildlife species, particularly certain groups of birds, (waterfowl, colonial waterbirds, shorebirds) is largely unquantified and merits investigation. The Complex identified increased boat use and increased air traffic as well as oil and gas exploration as disturbances that could affect wildlife in the ecoregion.

Prairie Conversion, Habitat Conversion

Habitats are being converted into monocultures and are changing to urban environments through development and draining of wetlands. These projects are directly contributing to a net loss of prairie habitat affecting both flora and fauna prairie-dependent species. This direct loss of habitat is a major concern for the ecoregion.

Climate Change

As habitats change, the wildlife species that utilize those habitats will also change. Although the Complex can do little to resolve this issue, it can realize that such change is occurring, document these changes through data collection, and adapt management to reflect/address changes in hydrology and plant communities. Sea-level rise will have a direct impact on all three of the coastal refuges. Various models are being used to evaluate the loss of coastal marshes. Estimates from some models are showing that nearly 90 percent of the marshes on the Complex today may be converted to open water by 2100. Water, or lack of water, is expected to become a major environmental crisis throughout the state in the near future if conservation measures are not taken seriously. Combined with climate change, this issue has the potential to impact many refuge management activities such as wetland management, farming, habitat restoration, grazing, and fire management. Although climate change and other factors have the potential to alter the distribution of habitat types in this area, the effects of this change on resources across the landscape, including wildlife species, are still unknown.

Erosion/Saltwater Intrusion

Concerns on the impacts of navigation traffic that introduces saltwater into freshwater marshes and causes drastic changes in native local plant communities and a loss of habitat for many other species was expressed by the planning team as well as in the ecoregional meeting. Natural processes such as storms, hurricanes, and SLR all contribute to saltwater intrusion that affects prairie habitat.

Wildland Fire Use

The suppression of wildfire has changed local prairie communities and this suppression supports the growth of invasive and exotic species, which compound prairie restoration efforts. The planning team expressed concerns on the use of wildland fire from suppression tactics to the negative impacts of smoke in local communities surrounding the Complex.

Petroleum Development
The public had concerns of petroleum development and the potential impacts it can have on both Complex habitats and wildlife species. Many members of the public would like to see no petroleum development on refuges and many would like to see special mitigations incorporated to minimize negative impacts to wildlife.

Land Conservation
The expected effects of climate change, urban encroachment, development of small ranchettes with a few livestock and horses, as well as fragmentation, continue to expand near the Complex highlighting the importance of land conservation and continued expansion of Refuge-managed lands. Stakeholders expressed a desire to continue the acquisition process and promoted the management activities occurring throughout the Complex promoting land conservation.

The San Bernard NWR is approaching the 28,000-acre cap originally set by the Service in 1997 in decision documents with the Austin's Woods Conservation Plan Land Protection and Compliance Document. The Plan outlines the need to counter the rapid development and expansion of urban areas within the Columbia Bottomlands and protect a unique ecosystem essential for maintaining populations of migratory birds and resident species. The concerns identified in 1997 are still relevant and to date less than 5 percent of the historic habitat has been conserved. Recent research has continued to support the importance of these habitats for migratory songbirds, while nation-wide populations of songbirds continue to decline. Millions of Nearctic-Neotropical migrants make landfall in the bottomlands during spring and fall migration to rest and feed after and before crossing the Gulf of Mexico, respectively.

Acquisition efforts are a watershed-scale ecosystem type approach; focusing on the conservation of ecosystem integrity, function, heterogeneity, and biologic diversity addressed as a "bioreserve" network. The bottomlands are home to rare plants and several species that are at the edge of their range as well as newly defined species. Where the landscape is flat and unencumbered, the native forests are unique and add to the natural beauty of the area. An updated Land Protection Plan (LPP) (Appendix I) includes a proposal to allow the Service to continue conservation efforts within the Columbia Bottomlands, including raising the 28,000-acre cap to 70,000 acres. During the separate scoping meetings held for the LPP, concerns from the public regarding this expansion included feral hogs, the "thicket" appearance, removing lands from the tax base, acquisition funding, and additional public use opportunities. These issues are addressed in this document, the EA and the LPP.

1.8.2 Habitat Management Issues

Gulf Coast Prairies and Marshes
The Gulf Coast prairies and marshes were once part of an immense ecosystem covering nine million acres, in the states of Texas and Louisiana. Many of the tall grasses typically found in the Midwest prairie region occur on the coastal prairie as well, where bluestems are intermixed with species native to the coastal wetlands. The coastal prairie underwent intensive man-made development starting in the mid-20th century (Allain et al. 1999) and now totals less than 250,000 acres in Texas. Many native plant and animal components have

already been lost, but the Service along with partners recognize the need to maintain existing remnants and restore native coastal prairie habitats.

Members of the public, TPWD, other federal agencies, and the planning team expressed concern on how the Complex will manage to ensure the conservation, diversity, and enhancement of the Gulf Coast prairies and marshes. Comments and concerns from our partners and the general public on issues related to the conservation, diversity, and enhancement of Gulf Coast prairies and marshes were addressed consistent with, but not limited to, major issues such as development, erosion, fragmentation, invasive species, land management and other land use practices, natural occurrence, and pollution and are described in detail below.

Development **-** The effects of development include construction activity (i.e. building roads, structures, hardscape, oil and gas exploration), urbanization, urban sprawl, utility lines, and right of ways, as well as creation and modification of reservoirs. Direct effects of development in the Gulf Coast prairies and marshes are loss and habitat, and direct mortality of wildlife. Associated affects to development include impacts on water quality due to fertilizers, pesticides, herbicides and sanitary waste systems.

Erosion – Erosion may occur on beaches, along rivers, streams, creeks, shipping channels, jetties, ditches and other locations. Sea level rise, siltation, beach erosion, and subsidence are also major contributors to erosion.

Fragmentation – Habitat fragmentation results from changes in land use for purposes such as agriculture, land transportation (roads and highways), water transportation (shipping channels), housing, and commercial and industrial development. Ecoregional partners have linked fragmentation to inhibited wildlife dispersal, lack of available habitat and reduced gene flow. Fencing and saltwater intrusion have been linked to fragmentation as well.

Invasive Species (Flora) – Invasive species are a sub-set of non-native species that can aggressively alter an ecosystem. Several invasive species, including Chinese tallow, Macartney rose, deep-rooted sedge, and salt cedar are common on the Complex and are reducing the quality and potential of native prairie and marsh habitats. Invasive species out-compete native vegetation, reduce plant diversity, alter hydrology, change soil characteristics and nutrient cycling and can impact the effectiveness of prescribed fire. Fire is the predominant management tool in the coastal prairies and salt marsh to control brush and invasive species encroachment. The use of herbicides may be employed during habitat restoration to remove invasive species and improve overall habitat conditions to support native wildlife.

Land Management and Other Land Use Practices **-** Land management practices including, prescribed fire, farming, moist soil management, grazing and haying have avariety of impacts on the Gulf Coast prairies and marshes. Effects of management practices vary but the intent is to provide quality habitat for native wildlife, including non-natural management areas. Water management is the one tool that the refuges do not have control over. Although the refuges do have some water rights, they are not sufficient for even current management needs. In addition, the ability to purchase water in support of farming programs and wildlife wetlands is solely determined by the Water Development Boards.

Natural Occurrences **-** Natural occurrences such as drought, floods, and stochastic events such as hurricanes and wildfire have both positive and negative impacts on Gulf Coast prairies and marshes. Although unpredictable, these events are regularly occurring and impact management decisions.

Pollution **-** Pollution outside the Complex, but within the Gulf Coast prairies and marshes—such as petroleum/chemical spills, non-point and point source pollutants, contaminated water discharge, airborne sulfates, nitrates, heavy metals, and pesticide use—have lasting negative impacts on both wildlife and habitat.

Bottomland Hardwood Forest

Comments and concerns from our ecoregional meeting, as well as concerns from partners and the general public, were expressed according to, but not limited to, major issues such as residential development, incompatible forestry and livestock production practices, and stream channelization, and are each described in detail below.

Residential Development **-** Residential development in the bottomland hardwood forests and floodplain is affected by habitat being converted for residential use and the associated effects of development such as the impacts on water quality with septic systems outside city limits, use of fertilizers, as well as pesticide and herbicide run-off into river systems. The development of subdivisions usually alters the entire hydrological system of a given area.

Incompatible Forestry and Livestock Production Practice **-** Forestry and livestock production also affects the productivity and function of bottomland hardwood forests through efforts such as clear cutting of trees to convert forests to grasslands as well as an increased number of "hobby ranchers." These types of incompatible practices can eliminate or alter a system drastically enough to change the entire production of flora and provide ideal conditions for exotic flora to become established, decrease soil stability, and change the hydrology of the entire system.

Stream Channelization **-** As residential areas continue to expand as well as increased livestock production and forestry practices the natural hydrology of a system becomes difficult to maintain and manage, especially in the constantly flooded hardwood forest. Large developers as well as municipalities, typically alter hydrological activities on a large scale in an attempt to minimize flooding damage to newly developed areas.

Forest Restoration **-** The Complex allows some areas in the bottomland hardwood forests to grow and regenerate and in some areas, supplemental plantings are necessary to provide an additional seed source to help areas develop into mature stands.

Water Management **-** Alterations to associated wetlands in bottomland hardwood forests are to the extent that management efforts need to be initiated to restore wetlands. The Complex will continue to collaborate with natural resource partners to maximize wetlands for the benefit of waterfowl and all other wildlife dependent on bottomland hardwood forests.

Dune and Beach
San Bernard NWR has approximately four miles of beach habitat between the mouth of the San Bernard River and Cedar Lakes Cut. Due to re-dredging of the San Bernard River in January 2010, the Cedar Lakes Cut has since silted in enabling vehicle access to the San Bernard Beach from the Sargent Beach during lower tides. To access the Cedar Lakes cut, vehicles need to traverse above the vegetation line due to the erosion of the Sargent Beach. Prior to the silting in of the Cedar Lakes Cut the San Bernard Beach has been accessible only by boat for the past 12 years. The Refuge is extremely concerned about the beach resources, where unlimited access is contrary to the Refuges purposes.

1.8.3 Wildlife Management

Threatened and Endangered Species
Three listed bird species (piping plover, northern aplomado falcon, and interior least tern) have been documented on the Complex. The piping plover is listed as endangered in Brazoria and Matagorda Counties and can be found on refuge beaches and mud flats from late July to May annually. The northern aplomado falcon is listed as endangered in Matagorda County. Irregular sitings of a transient bird have occurred on the San Bernard NWR. The interior least tern is listed as endangered in Wharton and Fort Bend Counties. These birds are migratory through the area and are usually associated with mudflats along river banks. In addition, the Sprague's pipit, which is a candidate species, has been documented in all four counties, but its current status on the Complex is unknown. It is a migrant species found during migration and winter, generally tied to upland native grasslands and can be found in large numbers in coastal grasslands. The red know is also a candidate species utilizing beach and tidal flats at San Bernard NWR. All five listed sea-turtles are found in the Gulf or Bays near the refuges. The Kemp's ridley sea turtle will nest on the San Bernard NWR beach. The refuge supports the Kemp's ridley Sea Turtle Recovery Plan by patrolling and responding to turtle stranding and nesting reports.

Two additional species, the Attwater's prairie chicken and the whooping crane, which do not currently occur on the Complex, may have potential recovery habitat on the Complex. In the future, the Service may consider reintroducing the Attwater's prairie-chicken onto refuge prairies and the expansion of whooping crane populations up the coast.

Migratory Bird Species and Species of Special Management Concern
Loss of prairie habitat has affected many grassland dependent bird species and is experiencing an alarming rate of decline. Waterfowl wintering throughout the Complex are dependent upon the wetlands provided by the Complex and are faced with additional challenges during periods of drought. Shorebirds and waterbirds are also dependent on moist soil management to get them through extended drought periods.

Monitoring the effects of management actions includes monitoring species of special management concern and focal species. These species are good representatives for a host of other species, with similar habitat requirements. The management staff selects focal species to monitor the effects of landscape scale characteristics that if properly managed will have beneficial effects on species sharing similar conservation needs.

Management of Invasive Species (Fauna)
Invasive fauna pose a biological threat to the entire Complex with their ability to displace native plant species, degrade wetlands and other natural communities, alter fire regimes, reduce natural diversity and habitat values. Once established, eliminating these plants is very expensive and labor intensive and continue to cause major economic and biological impacts throughout the entire ecoregion.

1.8.4 Visitor Services

Public Use Opportunities
The public has expressed concerns in growing each of the big six wildlife dependent recreational opportunities provided throughout the Complex including hunting, fishing, wildlife observation, wildlife photography, interpretation, and environmental education. Some members of the public felt that the Complex needs to expand public outreach as well as expand opportunities for the public to volunteer on the refuges.

Preservation of Historical Sites
The Complex is situated in an area recognized within a rich archeological and historical setting. The Complex will continue to incorporate historical interpretation into the public use areas.

Entrance Fees
Members of the public split, with some opposed and some in favor of implementing an entrance fee throughout the Complex.

1.8.5 Facilities/Infrastructure Management

The Complex identified the need to improve and expand upon visitor use and administrative infrastructure.

Visitor Use Infrastructure
Members of the public would like to see additional hiking and paddling trails, non-motorized boat launches, and signs and exhibits throughout the Complex.

Roadways - The public use roads are generally maintained gravel roads in good condition. The Complex paved the 3-mile entrance road to the Discovery Center over the past 7 years. Temporary road closures may occur during and after storm events. Large amounts of rainfall will result in tour road closures at San Bernard NWR as surface run-off may flood the road in several locations. Cedar Lake Creek periodically floods following heavy rainfall. The end of the tour loop at San Bernard may close until floodwaters recede and the turn-around is dry. Storm tides occurring at Brazoria often push debris and water across the public use area. The refuge may close the Big Slough Tour Road until floodwaters recede, debris is removed from the roadway, and washouts repaired. The Complex identified the need to maintain vehicular access on existing roads with some opportunities to provide additional pullouts in strategic locations to provide additional wildlife observation opportunities.

Administrative Infrastructure - The Brazoria NWR identified the need for additions and improvements in volunteer facilities, and relocating facilities to higher grounds.

1.8.6 Addressing Issues in the CCP and EA

While the Complex is influenced by all of the landscape-level issues discussed above, development outside Complex boundaries is beyond the control of the Service. These stressors on wildlife and habitat help focus the importance of the Complex. These issue help the Complex to further its outreach efforts, gain a better understanding of what is occurring on the landscape surrounding refuge lands, and determine the role of the Complex in conserving wildlife and their habitats within the larger landscape.

- Fragmentation
- Commercialization
- Urbanization
- Disturbance
- Prairie / Habitat Conversion
- Residential Development
- Incompatible Forestry and Livestock Production Practices
- Stream Channelization

These issues, which impact resources outside refuge boundaries, are considered outside the scope of the CCP: however, they were considered while developing the refuge management direction. These stressor can also occur within refuge lands and are addresses with the remaining issues (in sections 1.8.1 through 1.8.5) in the CCP (Chapter 4: Management Direct) and EA (as shown in Table EA 2-3.

2.0 ALTERNATIVES

2.1 Formulation of Alternative

Alternatives are different approaches or combinations of management actions designed to achieve a refuge's purposes and vision, the goals identified in the CCP, the goals of the Refuge System, and the mission of the Service. Based on the issues, concerns, and opportunities heard during the scoping process, the Planning Team developed three alternative management scenarios that represent a reasonable range of alternatives, which Complex may use.

The EA considered three alternatives. In addition, the planning team considered two other alternatives but eliminated them from detailed analysis for the reasons listed below (see section 2.2). These alternatives represent different approaches or management scenarios for the future protection, restoration, and management of the refuge fish, wildlife, plants, habitats, and other resources, as well as compatible wildlife-dependent recreation. Refuge staff assessed the biological conditions of refuge habitats and analyzed the external relationships affecting each refuge unit. This information contributed to the development of refuge goals and, in turn, helped formulate the alternatives, summarized in Table 2-4. The Complex will examine alternatives in five broad issue categories:

Ecoregion Management: How will the Complex contribute to addressing Gulf Coast Prairies and Marshes ecoregion conservation related issues?

Habitat Management: How will the Complex manage habitats to ensure the conservation, diversity, and enhancement of the Gulf Coast Prairies and Marshes? How will the Complex manage habitats to ensure the conservation, diversity, and enhancement of bottomland hardwood forests?

Wildlife Management: How will the Complex manage wildlife to ensure the protection of trust resources?

Visitor Services: How will the Complex manage public use opportunities while ensuring the protection of fish, wildlife, and their habitats?

Facilities/Infrastructure Management: How will the Complex provide for infrastructure and related developments while ensuring the protection of trust resources?

2.2 Alternatives Considered but Dismissed from Detailed Analysis:

NEPA and the Improvement Act designed the alternatives development process to allow the planning team to consider the widest possible range of issues and develop feasible management solutions that respond to these issues. The Refuge then incorporates these management solutions into one or more alternatives evaluated in the EA process and considered for inclusion in the CCP.

The Complex does not usually consider actions and alternatives that are not feasible or may cause substantial harm to the environment in an EA. Similarly, an action (and therefore, an alternative containing that action) should generally not receive further consideration if:

- It is illegal (unless it is the No Action Alternative, which must be considered to provide a baseline for evaluation of other alternatives, even though it may not be capable of legal implementation).
- It does not fulfill the mission of the Refuge System.
- It does not relate to or help achieve one of the goals of the refuge.
- Its environmental impacts have already been evaluated in a previously approved NEPA document.

However, if such actions or alternatives address a controversial issue or an issue on which the Planning Team received many public comments, they may consider these in detail in a NEPA document to demonstrate clearly, why they are not feasible or would cause substantial harm to the environment.

During the alternatives development process, the planning team considered a wide variety of potential actions on the Complex. The planning team ultimately rejected and excluded the

following actions from the alternatives proposed here because they did not achieve refuge purposes or were incompatible with one or more goals.

The Complex considered eliminating the farming program at Brazoria NWR. They considered this alternative infeasible because it does not contribute to the objectives and goals outlined in the plan. The farm fields/wetlands provide valuable habitats as both wetlands and farm fields for large population of wintering waterfowl. Without active management of these areas, the refuge could not support the waterfowl, shorebird and sandhill crane population it currently supports. Abandoning this program will involve habitat restoration to combat invasive species encroachment. Areas currently farmed were previously disturbed before establishment of the Refuge. Farming is limited in scope and provides both "hot foods," natural foods, as well as freshwater and cover for migratory birds and resident wildlife in both the fields and secondary water catchment basins. The Complex uses farming as a wildlife management tool, where wildlife directly benefit from crops left in the field, but equally benefit from the presence of fresh water associated with rice farming.

The public made a request to concentrate efforts on buying existing mineral rights on the refuge so that no more drilling will occur, initiating in sensitive areas of the Refuge and slowly expanding until the refuge owns all the mineral rights. The Complex considers this infeasible because, oftentimes, mineral rights have been withheld prior to the current landowner's title policy and, therefore, do not transfer to the refuge upon acquisition. Acquiring mineral rights is unfeasible with current staff and budget.

2.3 Features and Management Common to All Alternatives

Although the alternatives differ in many ways, there are similarities among them; several elements of refuge management are common to all alternatives. We list these common management activities below to reduce the length and redundancy of the individual alternative descriptions.

2.3.1 Ecoregion Management

Climate Change

The Complex would continue to monitor prairie habitat and condition to determine the effects of climate change on refuge resources by conducting groundwater modeling, water quality/water quantity analyses to fully understand the refuge's water resources, and use the best available science to minimize the impacts associated with climate change. The refuges would use green infrastructure and related technologies when opportunities and funding permit to reduce its carbon footprint and contribution to climate change.

Wildland Fire Use

The Complex will suppress all wildland fires. Suppression strategies range from monitoring the fire while allowing it to burn itself out (as in the case where no life, property, or resources are threatened and/or smoke management is not an issue of concern), to full suppression (if life, property, and resources are threatened and/or smoke management is an issue of concern).

The Complex will use a decision support process to guide and document wildfire management decisions. The process will provide situational assessment, analyze hazards and risk, define implementation actions, and document decisions and rationale for all decisions. The Complex will continue to manage wildland fires for multiple objectives, acknowledging that objectives can change as the fire progresses across the landscape.

Petroleum Development

Oil and gas exploration is occurring on four locations on the Complex (see Map 3-13. Brazoria National Wildlife Refuge Oil and Gas Exploration and 3-14. San Bernard National Wildlife Refuge Oil and Gas Operations in the CCP). Service policy 612 FW 2 states: "the objectives of oil and gas management on Service lands are to protect wildlife populations, habitats and other resources; and provide for the exercise of non-federal oil and gas rights while protecting Service resources to the maximum extent possible." In accordance with 50 CFR 29.32, persons holding mineral rights shall to the greatest extent practicable, conduct all exploration, development, and production operations in such a manner as to prevent the damage, erosion, pollution, or contamination to the lands, waters, facilities, and vegetation of the area. They must also conduct such operations without interference with the operation of the Refuge or disturbance to wildlife, and would be subject to prior approval by the Service. All operations would be required to operate under current local, state, and federal regulations and policies. Each operator is required to provide the Refuge Manager with an annual Development and Operations Plan for review and approval.

Operators would be required to prevent, to the maximum extent possible, releases of hazardous materials and substances, crude oil, and produced water. Each operator and/or facility operator would have a current Oil Discharge Prevention and Contingency Plan outlining procedures for accidental releases. Sampling, remediation, and restoration of contaminated sites would be the responsibility of the operator and/or facility operator and would occur in consultation with the Service and the appropriate state agency. All sites no longer being used by industry would be sampled for contaminants at the operator's expense to ensure proper disposal of material and that refuge staff and/or the visiting public are not exposed to contaminants.

Based on Service policy, the Complex requires that wells, roads, pipelines, and associated infrastructure and facilities not needed to support ongoing operations be removed and the sites restored to the satisfaction of the Refuge Manager.

Reasonable restrictions include restriction on time of year (October 15–March 15) for operations designed to minimize wildlife disturbance during the winter months; restriction on equipment to include low-pressure terra-tired vehicles or tracked equipment in the marshes and small "Bumble Bee" drillers in the bottomlands; and restrict ATV use in marsh habitats. The Refuge Manager will negotiate seismograph operations, pad placement, pipeline right-of-way, access roads, and all associated activities to reduce impacts on Refuge resources and management programs. The Refuge Manager will negotiate locations of production lines prior to drilling. Operators will generally place such lines along roadways and are directionally drill under wetlands or other sensitive environments. The refuge only permits closed-loop drilling operations. All seismic operations must hire an environmental monitor, selected by the Refuge Manager, who reports to the Refuge Manager, to monitor all seismic operations and ensure minimal habitat damage. In

Texas, the refuges may accept payment for restoration work required after the seismic operations. The refuges will then conduct restoration and monitoring efforts using those funds.

2.3.2 Habitat Management

Gulf Cost Prairies and Marshes

Prescribed Fire

The Complex would continue to use prescribed fire as a management tool used for restoration and maintenance of fire-adapted ecosystems and integrate the natural fire regime into bottomland hardwood forests, marsh, and prairie habitats. Restoration of coastal prairie may require treatment with prescribed fire annually or once every two years depending on the response of the vegetation and the ability to carry fire.

Maintenance of coastal prairie habitats generally requires the application of fire to the unit on a three to four year cycle. The Complex would continue to treat 25 to 35 percent of the coastal prairie and salty prairie habitats annually. The Complex uses a helicopter on prescribed fire ignitions on larger burns and as funding permits, and ground ignition when feasible. The Complex uses backing fires (against the wind) and flanking fires (parallel with the wind) and limited head fires, with flanking fire preferred due to longer combustion rates. The Complex uses backing fires to reinforce the firebreak.

Prescribed fire will be used on a two to six year rotation on 25 to 35 percent of burnable acres within the Complex's coastal marshes (as environmental conditions allow) to mimic the historic fire regime of this ecosystem.

Regularly scheduled prescribed burning best mimics the historic natural fire regimes within the Gulf Coast Prairie Ecoregion. Table EA 2-1 identifies burnable acres that the Complex can best manage by applying fire along with acreages and desired management rotation and season. (See Map EA 2-1. Big Boggy National Wildlife Refuge Fire Management, Map EA 2-2. Brazoria National Wildlife Refuge Fire Management and Map EA 2-3. San Bernard National Wildlife Refuge Fire Management).

Table EA 2-1. Prescribed Fire Schedule for Texas Mid-coast NWR Complex

Big Slough Units (5,725 acres)	Cox Lake Cross Trail Pond North Ridge Olney Pond Salt Lake Teal Pond Wolf Lake	1834 85 1002 134 1576 147 947	3 - 4 years	L. Summer – Winter
Marsh Unit (14,593 acres)	Alligator Marsh Middle Bayou	3857 1457	4 - 5 years	L. Summer – Fall

	Shrimp Farm Wharton Bayou	4828 4451		
ICWW (Salt Marsh) Units (8,253 acres)	Christmas Ridge Freshwater Lake Slop Bowl	5808 3421 946	4 - 5 years 5 - 6 years 5 - 6 years	L. Summer – Fall
Island Units (841 acres)	Island 1 Island 2 Island 3 Island 4 Island 5	26 420 88 38 269	3 – 4 years	L. Summer – Winter
Prairie Units (13,338 acres)	Austin Bayou Bermuda Triangle Bluestem Butterfly Chocolate Bayou Ditch 6 to 7 Canvasback Firehall Otter Slough Walker Ditch 2004 Crossroads	1524 1129 2441 755 3831 578 937 183 555 861 544	3 – 4 years	L. Summer – Winter
Sargent Units (4 subunits) (5620 acres)	Pentagon Marsh Sargent Check Station Sargent Pasture Smith Marsh	618 1719 835 2448	4 years	Summer L. Summer L. Summer Summer – Fall
Upland Units (7 subunits) (8,201 acres)	Cedar Lake Creek Storm Pasture Crawfish Ducroz Entrance Road Rail Pond Road Road Pasture	739 599 2092 1551 1096 1011 1113	3- 4 years 3- 4 years 3- 4 years 3- 4 years 3- 4 years 3 years 3 years	Summer – Fall Fall – Winter Fall – Winter Summer – Fall L. Summer Fall – Winter L. Summer – Fall
Tidal Units—2 subunits (15,611)	Cedar Lakes Cowtrap Marsh	4475 11,136	4 – 5 years	L. Summer – Fall L. Summer – Winter
Moist Soil Units- 2 subunits (1767)	Moccasin Pond Wolfweed Wetlands	368 1399	2 – 3 years	L. Summer – Fall
Bottomland Units—3 subunits (1123)	Big Tree Pasture Buffalo Creek Halls Bayou	205 850 68	4 - 5 years 3 - 4 years 4 - 5 years	L. Summer – Fall L. Summer – Winter L. Summer – Winter
Freshwater Wetlands	Mallard and Julia's Pond	675	3-4 years	Summer – Fall

(742 acres)	McCoach	67		
Uplands and Salty Prairie (2195 acres)	North Marsh Hunter	1209 986	3 years	L. Summer – Winter
Salt Marsh	Kilbride	1107	5 years	L. Summer

Bottomland Hardwood Forests

Forest Restoration
Although the focus of the Austin's Woods Conservation Plan is acquiring old growth hardwood forest, some tracts acquired have a combination of old growth and restoring forests. Often, the Refuge allows natural regeneration to occur and supplemental planting are not required to achieve the desired conditions. However if immediate seed sources are not available, the Refuge will complete supplemental plantings, generally with slower growing species (live oaks). These plantings are necessary to provide an additional plant resource to help areas develop into diverse mature stands. In addition, direct planting has occurred following illegal clearing, at the expense of the culprit.

Water Management
The San Bernard NWR, where appropriate, would restore historic hydrology by filling ditches, installing water control structures, or constructing levees in areas that have been hydraulically altered with drainage ditches prior to acquisition. The Complex acquired Hudson Woods (and possibly future tracts) and restored natural hydrology, in partnership with the Natural Resource Conservation Service (NRCS). NRCS purchased a conservation easement from the landowner with Wetland Reserve Program funds prior to the Service acquiring the remaining land (fee title) from the landowner. In collaborating with NRCS, the Service must adhere to any stipulations identified in the conservation agreement. The NRCS designed and paid for the water control structure installed at Hudson Woods to restore Willow Oxbow.

2.3.3 Wildlife Management

Migratory Bird Species and Species of Special Concern
Over 320 bird species use Complex habitats during parts of their lifecycles and the Texas Gulf Coast is the primary wintering area for most of the Central Flyway waterfowl. Additionally, these coastal salt marshes are the ancestral wintering grounds of the lesser snow goose, which are highly dependent upon native marsh plants produced on the Complex. The Complex is one of the few areas on the Texas coast where large numbers of snow geese still feed on the native salt marsh grasses rather than on agricultural crops. In addition, rookeries at the Complex provide nesting habitat for a large population of colonial water birds, while thousands of shorebirds use the tidal mud flats on the Complex.

Neotropical migratory birds nest in the understory and mid-story layers of un-grazed bottomland hardwood forests. Newly acquired, under-brushed tracts are allowed to naturally re-vegetate, which supports species of concern such as acadian flycatcher, prothonotary warbler, and yellow-

billed cuckoo. During migration, a large variety of warblers, vireos, thrushes, tanagers, buntings, and goatsuckers take cover and refuel on insects and soft berries in these lush, multi-layered forests.

Coastal prairies and marshes provide nesting habitat for a variety of songbirds including Henslow's sparrow, LeConte's sparrow, sedge wren, and other species of concern overwinter in our coastal prairies. These wintering sparrows and wrens vary in cover requirements, so the wide range of species benefit greatly from the prescribed burn program's mosaic of different-aged prairie units. Painted bunting and dickcissel nest in these grasslands during the summer, using the cover for nest site concealment and feeding on seeds and insects provided by the variety of prairie plants that exist in non-grazed grasslands. Species benefit from our burn timing; which targets woody species and allows nesting birds' time to complete nesting attempts.

Yellow rails, black rails, and mottled ducks all use the heavy salty prairie grasses present in our 3–6 year burn rotations. Mottled ducks need these places to conceal their nests, and further benefit from their presence near brood water. However, they need these tracts in large acreages, as mammalian predators like raccoons search areas adjacent to water bodies. The larger grassland offers better concealment for this duck. Overlapping in nesting requirements is the black rail, a highly secretive species of concern. Present year-round, the Complex overlooks this bird due to its highly secretive nature and its unwillingness to emerge from beneath its canopy of grass cover. Similar to the black rails is the wintering yellow rails. Some estimates place the number of remaining North American yellow rails at less than 20,000. Both species of rails have very little "vertical lift," making it possible to enclose them when using ring fire ignition patterns. Our current practice of using low-mortality ignition tactics benefits both rails and more vulnerable herptiles, such as the Gulf Salt Marsh Snake, another high-level species of concern. All refuges on the Complex will provide habitat for mottled ducks. Mottled ducks are a priority species for management and the Complex will continue to provide nesting habitat in conjunction with freshwater wetlands that provide habitat for rearing young and cover for molting birds. Flooding impoundments will coincide with the nesting season. The Complex will also manage prairie for grassland wintering birds through three-year rotational burning. We will manage upper marsh habitat for black and yellow rails.

A variety of research and monitoring surveys in conjunction with these species and their habitat is occurring on a seasonal (winter) basis. Coordination with other agencies and other academic institutions would continue. Monitoring and banding will continue to monitor changes in vegetation, population trends and species diversity in response to habitat changes. Annual surveys would continue including the Christmas Bird Count, Mottled Duck Surveys (aerial), and Colonial Waterbird Counts. The Complex would continue to conduct diamondback terrapin surveys, annual breeding songbird census, feeding behavior study at Dance Bayou Unit, black and yellow rail banding, summer mottled duck banding, winter and migratory bottomland songbird banding, and grassland songbird banding. Special use permits would be issued to researchers and other cooperators for banding raptors, shrikes, bottomland migratory songbirds at the Brazos River Unit, bottomland wintering songbirds at Big Pond Unit, grassland songbirds, and diamond-back terrapins.

Rare and Protected Species (Flora)
Four plant species listed as both federal and state Species of Concern are Texas windmill grass, Coastal Gay-feather, three-flower broomweed, and Texas yucca. The Complex's prairie restoration efforts would benefit these and future rare and protected species should they become present on any of the refuges. The Complex would continue to collect data on species present on its land and monitor any occurrence of rare or protected species.

Feral Hog Management
The Complex would continue to manage feral hog populations in accordance with the current Feral Hog Management Plan (2004), which identifies multiple options including; issuing Special Use Permits for trapping and use of hounds, public hunts and aerial shooting to control populations. All of these actions are needed to manage refuge habitats for native wildlife. It is estimated that only 20 percent of the population of feral hogs in Texas are removed annually. This is far below the recommended rate of 50 – 60 percent removal needed to maintain current numbers. Without control, feral hog populations will continue to grow, increasing impacts on soil, water, vegetation, habitat diversity and wildlife populations both on and off refuge lands.

Currently, Special Use Permits (SUPs) are issued so that hogs can be trapped or hunted with the aid of hounds. SUPs are issued on a 6-month or 1-year basis, for a specific area of the refuge. This is the principle method for feral hog management within the bottomland units. Hunters and trappers must provide harvest reports on a monthly basis to the appropriate refuge manager. These SUPs require that hogs be killed quickly and removed from the refuge. Approximately 120 hogs are removed from Brazoria NWR and 450 hogs removed from San Bernard NWR annually thru the issuance of Special Use Permits.

The Service would contract with U.S. Department of Agriculture Wildlife Services or a private contractor to aerial hunt and control feral hog populations within marsh and prairie habitats (excluding bottomland units of San Bernard NWR) at Brazoria, San Bernard and Big Boggy NWRs. For aerial control, a professional sharpshooter would conduct shooting from a helicopter. Hogs would be humanely killed by accurate shots taken from the lowest safe altitude at which the helicopter can operate. Eighteen hours of flight time in December 2011 removed nearly 400 hogs across the Complex.

Brazoria NWR and San Bernard NWR collaborate with the Texas Youth Hunting Association and hold a youth feral hog hunt on two weekends per year. The Refuges hold the hunt in February at San Bernard NWR and in March at Brazoria NWR. Approximately 20 hogs at Brazoria NWR and 30 hogs at San Bernard NWR are removed annually by youth hunts. Other than the special youth hunts, public hunting is not currently allowed; however, the Complex intends to complete a Hunt Plan and Hunt Open Package for white-tailed deer and feral hogs in selected units in the future. Additional NEPA assessment will be conducted at that time.

2.3.4 Visitor Services

Fishing
The Complex provides four public fishing areas, offering a variety of saltwater fishing and crabbing opportunities. Fishing occurs on all navigable waters throughout the Complex from

designated locations and the Gulf Intracoastal Waterway (GIWW). State regulations determine all fishing restrictions with specific restrictions listed in 50 CFR. Navigable waters open to fishing are by boat access only and users must remain within the tidal margins.

The Complex allows fishing year-round in the designated areas in accordance with applicable state and federal regulations. All public fishing areas are available for use during daylight hours only, with the exception of Bastrop Bayou Public Fishing Area. This particular area is open 24 hours a day, but permits no overnight camping. All fishing must occur in accordance with state fishing regulations, and fishermen are required to have appropriate state fishing licenses. *Brazoria NWR* has three public fishing areas that allow land access to saltwater fishing: Bastrop Bayou, Clay Banks, and Salt Lake Public Fishing Areas. Bastrop Bayou Public Fishing Area is universally accessible and offers a 200-foot pier with fish attracting lights, five paved bank fishing pull-offs, a universally accessible toilet, paved parking, and night-lights. The Clay Banks Public Fishing Area offers bank fishing along a one-mile segment of Bastrop Bayou. The Salt Lake Fishing Area offers 1.4 mile of bank fishing and a non-motorized boat ramp.

Navigable waters within the boundaries of the refuge open to fishing are Salt Lake, Nicks Lake, and Lost Lake. State waters including Cox Lake, Alligator Lake, Bastrop Bayou, and bays adjacent to the Brazoria NWR are open to fishing as well.

San Bernard NWR has one public fishing area that allows land access to Cedar Lake Creek. The Cedar Lake Public Fishing Area offers an accessible 20 foot by 10 foot fishing pier, a fishing trail that offers .4 miles of bank fishing, and a small public boat ramp that gives visitors access to Cedar Lake Creek. Fishing is permitted in navigable waters including Cedar Lake Creek, Cedar Lakes, and Cow Trap Lakes within and adjacent to the boundary of the refuge. The refuge permits fishing from the San Bernard Beach also.

Big Boggy NWR allows public fishing on the navigable waters of Boggy Creek and adjacent state waters.

Fishing is a traditional use of the area's saltwater bays and lakes that adjoin and are within the refuges. With the expected continued growth in the Houston Metropolitan Area, the number of fishing visits is likely to increase. The Complex is currently providing fishing opportunities for up to 30,000 fishing visits, and with the anticipated increase of 55 percent over the life of the CCP, the Complex can still provide quality experience while minimizing conflicts with other Complex users.

Preservation of Historic Sites

The Complex would continue to identify, protect, and manage all significant cultural resources in a spirit of stewardship for the benefit of future generations. The Refuge would administer, preserve, and protect these resources in such a manner that sites, buildings, structures, and other objects of cultural value are preserved and maintained for scientific study and public appreciation and use. The Complex would ensure that during the appropriate stages of decision-making affecting these resources such as construction, land use or resource planning, and land acquisition or disposal, it will give full consideration to cultural resources and remains in compliance with the state historic preservation act.

A monument and a historical interpretation panel identify the former Maddox home site on Brazoria NWR. The area is open to the public and a short trail enables visitors to access the former home site along the tour loop.

There are no historic sites preserved or interpreted on San Bernard NWR and Big Boggy NWR.

2.3.5 Facilities/Infrastructure Management

Visitor Use Infrastructure

Roadways
Vehicle access is allowed on designated refuge roads. Section 3.4.5.1 of the CCP provides a list of public use roads. Other roads throughout the Complex are for Service personnel only. Maintenance of these roads is highly dependent on weather, but generally graded two to three times a year. Major storm events may require additional maintenance.

2.3.6 Coordination between Government Agencies and Private Interests

Coordination with governmental agencies and private interests is essential in carrying out the objectives of the Complex. The Complex would continue to work with state and federal agencies, academia, conservation organizations, interested entities, and private landowners to provide positive results in areas of conservation of lands, habitat management, science, and public outreach. The Complex will continue cooperation with Padre Island National Seashore and U.S. Geological Survey (USGS) sea turtle lab regarding the sea turtle stranding and nest collection from area beaches.

2.4 Alternatives Analyzed in Detail

The Complex developed the following alternatives to comply with NEPA and to provide ways to represent a number of issues, concerns, and opportunities identified during the public and internal scoping process. Though the alternatives may have different emphases, habitat maintenance, restoration, and preservation are common elements of each alternative. The Complex intends for the alternatives to provide a range of public uses and access and respond to issues or concerns identified during the planning process as discussed below.

2.4.1 Alternative A—No Action Alternative (Current Management):

2.4.1.1 Ecoregion Management

Climate Change
San Bernard NWR would continue to implement limited carbon sequestration projects. These projects include natural forest restoration and supplemental planting totaling approximately 36 acres. The Refuge would continue to market the opportunity for carbon sequestration projects.

Brazoria NWR and San Bernard NWR would continue to incorporate climate change into their environmental education programs. Photovoltaic technology powers the Discovery Center located on Brazoria NWR and it uses green building products when feasible.

Big Boggy NWR would not conduct any climate change projects.

Erosion/ Saltwater Intrusion

The Complex will continue to engage in management activities and maintain facilities that reduce erosion and prevent saltwater intrusion on all three refuges.

At Brazoria NWR, projects include: bank armoring by use of concrete block/mats from Bastrop Bayou to Alligator Lake (approximately 2 miles) along the GIWW and shoreline rip-rap along 2,000 feet of Cox Lake and 100 feet at Salt Lake.

At San Bernard NWR projects include: large concrete slabs placed as rip-rap along the south end to protect 1500 feet of levee from wind driven wave action; as funds and time allow, the refuge plants smooth cordgrass in "goose eat-outs" (barren mudflats) to encourage sedimentation of the marsh and plugging small tidal channels.

Big Boggy NWR would continue to implement projects to slow down erosion including rip-rap projects that occur on Dressing Point Island. The rip-rap does not prevent erosion but significantly reduces the rate.

Land Conservation

Under Alternative A the San Bernard NWR would complete the existing Austin's Woods Conservation Plan. The expected effects of climate change, urban encroachment, development of small ranchettes, as well as habitat fragmentation near the Complex highlight the importance of land conservation and expansion of refuge managed lands. Acquisition efforts are a watershed scale ecosystem type approach; focusing on the conservation of ecosystem integrity, function, heterogeneity, and biological diversity addressed as a "bioreserve" network.

Conservation with this approach requires a conservation design establishing an integrated network of individual tracts that provide representative samples of the regional landscape, or what is referred to as a "bioreserve" network. Reflecting the concept of a bioreserve network, the Columbia Bottomlands Conservation Partnership will have conserved 33,000 acres with its governmental and non-governmental partners by the end of fiscal year 2012, with 28,000 acres protected as refuge lands.

Currently, the emphasis of land acquisition focuses on bottomland hardwood forest and associated wetlands and prairie habitats. The bottomland forests of the ecosystem have high wildlife and wetland values. This ecosystem is the only expanse of forested wetlands adjacent to the Gulf of Mexico in Texas and originally covered 700,000 acres. In 1995, a Columbia Bottomlands Task Force (Task Force) estimated that only 177,000 acres of forest remained. This ecosystem is especially important for Nearctic-Neotropical migratory birds because of its proximity to the Gulf of Mexico. Millions of Nearctic-Neotropical migrants make landfall in the bottomlands during spring migration and use the area during fall migration. Migrating birds

depend on the remaining forest tracts for rest and feeding both before and after crossing the Gulf. The Task Force found that 237 species of birds, totaling at least 29 million individuals, migrate through the forest every year. Dr. Sidney Gauthreaux, Jr., (2002) using Doppler radar, documented that the Columbia Bottomlands is a major stopover area for these migrants. The area is located within the Texas Mid-coast Initiative Area of the Gulf Coast Joint Venture of the North American Waterfowl Management Plan.

Since 1997, the Complex has been working with partners conserving forested habitat, with the Service acquiring fee title and conservation easements to approximately 24,500 acres from willing sellers and donors. Under the approved Austin's Woods Conservation Plan the Service can only acquire 28,000 acres. With this cap reached in 2012, the Service would stop acquiring bottomland forest tracts.

2.4.1.2 Habitat Management

Gulf Coast Prairies and Marshes

Prairie/Grassland Restoration

Because much of the Complex was working livestock ranch or farm prior to refuge establishment, there infrastructure remains in place that interfere with native prairie restoration and management including roads, levees, ditches, and water control structures that all affect the natural hydrology of the prairie.

With disturbances initiated through farming, grazing, and development, prairies and grasslands are often the first areas encroached by exotic species such as Chinese tallow and restoration efforts have proved to be a challenge on budget and resources. Exotic and invasive species have complicated restoration efforts in prairie habitats since they can quickly become established prior to implementing restoration plans. The Complex initially treats many tallow-infested tracts with herbicides as well as mechanical manipulation in an attempt to convert it back to a functional prairie habitat.

Many of the species of special management concern have life history requirements (i.e., nesting, wintering habitat, etc.) directly tied to grasslands. The coastal prairies of Texas are important wintering grounds for sparrows and wrens. With nationwide habitat loss of prairies and grasslands, there are fewer places migrating birds can feed, rest, and winter. Direct habitat loss is the biggest concern for prairie-dependent species.

As a management tool, the Refuge Complex is actively collecting native seed for restoration efforts from native prairie grasslands within its boundaries. However, this is challenging because production and access to seed harvested is highly dependent on weather conditions. To help overcome this challenge, the Complex has purchased native prairie hay and distributed that hay using a bale spreader to restore native prairie. The Refuge will use areas restored as healthy functioning prairie habitat to collect seed to aid in the restoration of other prairie habitats.

Cooperative Haying
Brazoria NWR is the only refuge in the Complex that administers a cooperative haying program. Cooperative haying of 35 to 50 acres annually would continue to maintain wildfire buffer areas for Wildland Urban Interface (WUI) areas at Brazoria NWR. The cooperative haying program reduces fuel buildup in salty and coastal prairie habitats where prescribed fire cannot be implemented due to an expansion of WUI areas closing in on the Refuge boundary. The Complex generally conducts cooperative haying in late summer.

Restoration
Active restoration activities would occur on Brazoria and San Bernard NWRs. These refuges would actively restore old fields and coastal prairie through a combination of chemical, mechanical, fire, and planting of native prairie seed. Once restored, the refuges will use fire to maintain the habitat mimicking historic fire regimes.

Management of Invasive Species (Flora)
The Complex would continue not consider grazing as a management tool on all three refuges.

The Complex would continue to use mechanical, chemical, and prescribed fire treatments to control salt cedar, Chinese tallow, deep-rooted sedge, trifoliate orange and Japanese honeysuckle, and any additional species on an as-needed basis. Table EA 2-2 describes the chemicals used to target high profile invasive species throughout the Complex.

Table EA 2-2 Chemical Treatments on the TMC NWR Complex

Rodeo	Cattails & Phragmites	Boom sprayer & aerial	Create open water for wildlife
Clearcast	Chinese tallow	Aerial	Eradicate invasive flora in bottomland forest
Glyphosate	Various grasses and Deep-rooted sedge	Hand & Backpack sprayer	Manage various grasses in & around facilities for safety & esthetics
Garlon 4	Chinese tallow & Macartney rose	Hand & Backpack sprayer	Coastal Prairie restoration
Roundup & Arsenal	Various grasses	Hand & Backpack sprayer	Manage various grasses in & around facilities for safety & esthetics
Grazon P+D & Remedy	Chinese tallow & Macartney rose	Aerial	Coastal Prairie restoration
Grazon Next	Chinese tallow & Macartney rose	Aerial	Coastal Prairie restoration
Habitat	Cattails & Phragmites	Boom sprayer & aerial	Create open water for wildlife
Pasture Guard	Yaupon	Aerial	Coastal Prairie restoration

Brazoria NWR would continue to use mechanical treatment on up to 100 acres of invasive species, including salt cedar and Chinese tallow. Mechanical treatment is the direct removal of trees using a tub grinder on an excavator or grinding using a gyrotrac or hydroax. Mechanical removal of Chinese tallow trees along drainage ditches would continue to be done in partnership with the drainage district. Approximately 1,600- 2,500 acres of Chinese tallow will be treated with chemical application as part of an annual on-going prairie restoration initiative. The chemicals generally used are Grazon P+D ® and Grazon Next® through aerial application. The Complex utilizes drift retardant to minimize drift; spraying is only conducted in areas where there are no sensitive resources (i.e,. species that could be adversely impacted) and where private lands would not be impacted. Ground application would continue to be used for road maintenance and in small problem areas of deep-rooted sedge using a backpack pump or an ATV. The use of herbicides will continue to decline as the refuge transitions from a restoration to a maintenance management approach in prairie habitats. All herbicide application are evaluated through the Pesticide Use Permit (PUP) process (see section 4.2 for further detail). Prescribed fire would be used as a management tool on approximately 2,500 - 3,000 acres of prairie annually. Prescribed fire techniques and schedule are discussed above in the Features and Management Common across Alternatives section under Fire Management.

San Bernard NWR would continue to treat up to 50 acres annually by the same mechanical means as Brazoria NWR designed to remove Chinese tallow. Chemical application (same chemicals as Brazoria NWR) would be applied to approximately 100 acres annually and the Refuge would burn approximately 600 acres of coastal and salty prairie habitats to control Chinese tallow. Because of the presence of native hardwood trees in the bottomland forests of San Bernard NWR, mechanical and ground applied chemical treatments would be used to control invasive species, including Chinese tallow. On average, the refuge would annually treat up to 100 acres of bottomlands for invasive species.

At Big Boggy NWR, the refuge would primarily utilize prescribed fire to control invasive species among the coastal and salty prairie habitats. However, mechanical and herbicide application will be utilized when species and density warrant their use. The refuge generally treats less than 100 acres of invasive species annually.

Farming Program

Brazoria NWR would continue to use cooperative farming on 10 farm fields that fall in a three-year rotation and range from 50 to 120 acres for a total of 1,000 acres. Out of these 1,000 acres, approximately 220-350 acres are farmed on a given year. Three out of ten units (approximately 220-350 acres) are put into production each year with the remaining seven left fallow. The fallow fields are generally manipulated through discing and flooding during the off cycles of the rotation. The units essentially become a moist soil unit and may be flooded to provide wildlife habitat during non-production years. Rice is the main crop in production with the occasional grain sorghum. The purpose of the cooperative farming program on Brazoria NWR is for habitat benefits from the farming operations. A Cooperative Farming Agreement is prepared annually and identifies field and crops planted as well as compensation to the government, which could include direct payment, crops left in field, or rent equivalents. Rent equivalents may include discing in non-farmed marshes; purchase of herbicide used to spray invasive trees and brush on

irrigation laterals and/or track-hoe or excavator work on irrigation laterals. Additional rent equivalents include maintenance of feeder ditches, pipes, and water control structures and water credits purchased by farmer to be used by the refuge as duck or shorebird water following harvest. The farmer ensures that after final harvest, all cropped fields will be prepared for re-watering. Levees would be made water tight next to control structures. Discing immediately after harvest is not allowed unless unusual conditions warrant ground disturbance because of excess rutting of fields and breaching levees. In the event that a second cutting of rice crop occurs, the farmer is required to leave 25 percent of second harvest uncut to provide forage for waterfowl.

San Bernard NWR would continue to farm a 10-acre plot located in the headquarters area. This field is planted with rye grass during the winter as a source of winter browse and to attract wildlife with emphasis on white-fronted geese to the area for winter wildlife viewing. At other times, the field is used for administrative purposes such as testing plastic sphere ignition devices, testing and demonstrating rocket nets or other activities requiring a minimally vegetated area.

At Big Boggy NWR**,** a total of 90 acres would be farmed through force account at Mathis Field. The entire 90 acres would continue to be planted with rye grass to provide winter browse for waterfowl.

Water Management
Whenever possible, the Complex would continue to restore drained wetlands through plugging ditches or installing water control structures.

Brazoria NWR would continue to restore the wetland component of wet prairie mostly by reshaping and building up ditch borrows material. Water control structures are installed to manipulate water levels in the prairie. In addition, water delivery canals, and levees around farm field/moist soil units are rebuilt to improve water management and movement capability across the units.

Water Delivery Canals
Brazoria NWR and Big Boggy NWR would continue to maintain irrigation canals on the refuges for water delivery and movement. The drainage district general maintains ditches 1-14 on the Brazoria NWR, which includes Chinese tallow control, mowing and digging out ditches. Several of the ditches are utilized for water delivery as well.

San Bernard NWR - There are no irrigation canals on the refuge.

Water Purchases
Brazoria NWR and Big Boggy NWR have the ability to purchase and receive water. Brazoria NWR may purchase water from the Gulf Coast Water Authority and Big Boggy NWR from Lower Colorado River Authority. Water purchase is dependent on rainy seasons and may not be an option in extreme drought years. During droughts, water is extremely limited and may not be purchased for agricultural use. Water purchases will be determined on an annual basis and highly dependent on funding and availability. Freshwater from rice fields is captured and can provide wetland habitat below the rice fields. Brazoria NWR purchased approximately $15,000

and $18,000 worth of water in 2008 and 2009 respectively. Big Boggy purchased approximately $5,000 worth of water for the 2008 and 2009 fall/winters. At San Bernard NWR, no purchases are made because there is no infrastructure in place to support this operation.

Irrigation Wells

Brazoria NWR will continue to manage three irrigation wells but regularly uses only the 4-inch well at Teal Pond. During drought situations, this small pump may provide the only freshwater in the Big Slough area. Water from this pump can be diverted to Teal, Olney, or Crosstrails Ponds. San Bernard NWR will continue to utilize two large irrigation wells. The 8-inch well at Wolfweed is a backup to the Cedar Lake Creek diversion pump and is used when Cedar Lake Creek is salty. A 10-inch pump at Sargent is utilized to provide fresh water in the moist-soil units in the Pentagon Marsh. This pump is essential to providing freshwater in this salt marsh habitat.

Big Boggy NWR has no wells.

Ponds, Reservoirs, and Moist Soil Units

All refuges on the Complex would continue to manage moist soil units and fields with a combination of draining and summer discing, utilizing a stubble roller while flooded, and where opportunity exists, flood units with saltwater to control vegetation. The reservoirs are generally self-sustaining but may be drained and refilled with saltwater to control encroaching vegetation.

Brazoria NWR would continue to manage 23 fields/ponds for freshwater habitats (See Map EA 2-4. Brazoria National Wildlife Refuge Moist Soil Units – Big Slough and Map EA 2-5. Brazoria National Wildlife Refuge Moist Soil Units – North Refuge).

San Bernard NWR would continue to maintain two reservoirs, eight moist soil units, and two ponds (See Map EA 2-6. San Bernard National Wildlife Refuge Moist Soil Units).
Big Boggy NWR will continue to manage four moist soil units (See Map EA 2-7. Brazoria National Wildlife Refuge Moist Soil Units).

<u>Bottomland Hardwood Forest</u>

The bottomland hardwood forests are both a mix of old growth, sustainable habitats and newly regenerative habitats. The old growth forest habitat of the San Bernard NWR (parts of Dance Bayou, Bird Pond, Big Pond, McNeil, Wilson, and other units) largely require no direct management to maintain dynamic ecological processes. Many units previously cleared for tree harvesting and cattle grazing are susceptible to non-native species invasion. Invasive species control coupled with a propensity for regeneration has allowed many units to overcome extensive habitat damage. Herbicide applications are generally by hand due to the need to limit drift.

Today, the San Bernard NWR has over 24,500 acres of bottomland hardwoods with continuing accrual of additional habitats under the auspices of the Austin's Woods Conservation Plan. Its objective is to conserve and restore these mature forests and protect this dynamic climax ecosystem and all the wildlife it harbors.

Across the Texas Gulf Coast marshes, prairies, and bottomland hardwood forests, the focus of restoration efforts is on converting previously disturbed areas back to native habitat to be fully utilized by native wildlife species.

Dune and Beach

San Bernard NWR has approximately four miles of beach habitat between the mouth of the San Bernard River and Cedar Lakes Cut. Due to re-dredging of the San Bernard River in January 2010, the Cedar Lakes Cut has since silted in enabling vehicle access to the San Bernard Beach from the Sargent Beach during lower tides. To access the Cedar Lakes cut, vehicles need to traverse above the vegetation line due to the erosion of the Sargent Beach. Prior to the silting in of the Cedar Lakes Cut, the San Bernard Beach has been accessible only by boat for the past 12 years. The refuge is extremely concerned about the beach resources, where unlimited access is contrary to the refuges purposes.

2.4.1.3 Wildlife Management

Threatened and Endangered Species

A total of five bird species (piping plover, northern aplomado falcon, interior least tern, Attwater's prairie-chicken, and whoopingt), one fish, (the smalltooth sawfish); and five reptiles (the Atlantic hawksbill, green, Kemp's ridley, leatherback, and the loggerhead sea turtles) are all protected under the Endangered Species Act and have potential habitat in or adjacent to the Complex. The piping plover is listed as endangered in Brazoria and Matagorda Counties and can be found on refuge beaches and mud flats from late July to May annually. The Service identifies portions of the Complex as critical habitat for the piping plover. The northern aplomado falcon is listed as endangered in Matagorda County. Irregular sittings of a transient bird have occurred on the San Bernard NWR. The interior least tern is listed as endangered in Wharton and Fort Bend Counties. These birds are migratory through the area and are usually associated with mudflats along river banks. The Attwater's prairie chicken and the whooping crane do not currently occur on the Complex; however, the Service identifies the Complex as potential re-introduction areas for both of these species with potential reintroduction of Attwater's prairie chickens onto refuge prairies and the expansion of whooping crane populations up the coast. Management staff will conduct coordination and studies to determine best potential management direction to maximize success if reintroductions occur on the Complex. With current and proposed management actions, habitat restoration efforts are providing larger tracts of functional native habitat that have the potential to eventually provide suitable habitat for other listed species that have been historically documented in the vicinity of the Complex.

In addition, the Sprague's pipit, which is a candidate species, has been documented in all four counties, but its current status on the Complex is unknown. It is a migrant species found during migration and winter, generally tied to upland native grasslands and can be found in large numbers in coastal grasslands. All five listed sea-turtles are found in the Gulf or Bays near the refuges. The Kemp's ridley sea turtle will nest on the San Bernard NWR beach. The refuge supports the Kemp's ridley Sea Turtle Recovery Plan by patrolling and responding to turtle stranding and nesting reports.

The Complex supports and assists with the implementation of the Kemp's Ridley Sea Turtle Recovery Plan. This includes beach sea turtle surveys during nesting season (May–July), flipper tagging, excavating sea turtle nests and transporting them to the incubation facility at Padre Island National Seashore. The Refuge monitors and responds to calls regarding sea turtles on Gulf coast beaches between the mouth of the Colorado River and Quintana Beach.

Management of Invasive Species (Fauna)

Invasive species such as feral hog, nutria, red imported fire ants, and Rasberry crazy ants have negative effects to both wildlife and wildlife habitat. In addition, areas disturbed by feral hogs become prone to the establishment of exotic plant species. Feral Hog Management is discussed in section 2.3.3 of this document. Nutria are rare but are present in Complex water impoundments. Alligators generally hold their population in check. Red imported fire ants throughout the southeastern United States have seriously impacted numerous ground-dwelling species such as Northern bobwhite quail. Researchers in the academia and land management arenas are evaluating their impact on mottled ducks and black rails. Populations of Rasberry crazy ants have not been located on the Complex yet. However, impacts to tree and ground nesting birds, and reptile nests could be devastating if they move into the Complex.

Red Imported Fire Ants and Rasberry Crazy Ants

Throughout the Complex, staff would treat rookery areas for red imported fire ants using methoprene (insect growth regulator) bait like Extinguish®. Treatments will occur before nesting season in October-November when moisture starts and ants began surfacing.

At Brazoria NWR, staff would treat Wolf Lake Skimmer Lot rookery with the same chemicals. At San Bernard NWR, staff would treat Cedar Lakes rookery.

The Complex is monitoring the Rasberry Crazy Ant, a recently discovered invasive species, for presence and wildlife impacts on the Brazos River Unit of San Bernard NWR. The ants are in a nearby hayfield, but have not been located on the Complex. Currently, no field treatment has been developed for Rasberry Crazy Ants. As research and treatments become available, the Complex will use the best available science to control Rasberry crazy ants.

At Big Boggy NWR, staff would treat Dressing Point Island rookery.

2.4.1.4 Visitor Services

Approximately 35,000 visitors visit Brazoria NWR and 35,000 visitors come to San Bernard NWRannually. About a quarter of the visitors come during the spring season (March–April) to view birds and enjoy the coastal prairie habitat when a variety of flowering plants are blooming. Approximately 5,000 visitors come to Big Boggy NWR for hunting and fishing opportunities. The Brazoria Discovery Center is approximately 1,500 square feet and includes a visitor contact center, lab, and office, and can host up to 50 students at a time. It also contains a large screen television and projection screen for interpretive programs and contains a pavilion overlooking Big Slough in the back of the Discovery Center. The Discovery Environmental Education Program (DEEP) has been functioning at Brazoria NWR since 1994. DEEP currently serves

approximately 3,000 students and in future years may expand to 6,000 students as the population of the area increases.

The Complex continues to serve as an outdoor education center where graduate students conduct research projects involving waterfowl and other migratory birds, agriculture and moist soil unit production, fish and wildlife, as well as forestry studies. Brazoria NWR and San Bernard NWR are open to the public throughout the year during daylight hours. Big Boggy NWR is closed with the exception of limited hunting and fishing opportunities.

San Bernard NWR maintains six areas that provide wildlife observation, interpretation, and photography opportunities. Cocklebur Slough Public Use Area provides an auto tour while the Hudson Woods, Dow Woods, Betty Brown, San Bernard Oak, and Little Slough are walking trails. Visitors can find interpretation of Refuge resources along all trails and the auto tour. Expansion of the environmental education programs at Brazoria NWR occurs at San Bernard NWR proper, as well as at the bottomland units.

Boating is allowed in all navigable waters throughout the Complex in support of hunting, fishing, and wildlife observation.

Hunting

The Complex will continue to provide the current level of hunting opportunities. All three refuges in the Complex allow waterfowl hunting. In addition to waterfowl hunting opportunities, the Service cooperates with TPWD and the Stringfellow Wildlife Management Area (WMA) and Texas Youth Hunting Program (TYHP) to provide white-tailed deer/feral hog youth hunts on San Bernard NWR and feral hog hunts on San Bernard and Brazoria NWR's respectively.

Brazoria NWR has two public waterfowl hunting areas: Christmas Point and Middle Bayou Public Waterfowl Hunt Areas (see Brazoria NWR Hunt Area Map 3-30 and 3-31). The Christmas Point Public Waterfowl Hunt Area lies southeast of the GIWW and encompasses approximately 4,000 acres. Access is by boat only. The Middle Bayou Public Waterfowl Hunt Area encompasses approximately 1,500 acres and access to this site is by boat or by walk-in from CR227. On these units, the Refuge permits hunting of ducks, geese, and coots. It prohibits pits and permanent blinds.

During the youth feral hog hunts, in partnership with TYHP, youth hunt from temporary blinds located off FM2004, in the Otter Slough Area.

San Bernard NWR has three designated public hunting areas (Cedar Lakes, Smith Marsh, and Salt Bayou Public Waterfowl Hunt Areas) and one permit hunting area (Sargent Permit Waterfowl Hunt Area), illustrated on the San Bernard NWR Hunt Area Map 3-32 of the CCP. All of these public hunting areas are accessible by boat only, and are open for the pursuit of ducks, geese, and coots. The Cedar Lakes Public Waterfowl Hunt Area (2,400 acres) lies south of the GIWW, and the Smith Marsh Public Waterfowl Hunt Area (1,400 acres) is on the west side of Cedar Lakes Creek. Salt Bayou Public Waterfowl Hunt Area encompasses 3,600 acres accessible from Cedar Lakes Creek, the Gulf Intracoastal Waterway, or through the shallow

Cowtrap Lakes system. The Sargent Permit Waterfowl Hunt offers a limited hunting opportunity on 4,000 acres with walk-in or boat access.

For the TPWD youth deer/feral hog hunts and the TYHP feral hog hunts, all hunting opportunities are limited to stationary blinds. There are a total of nine stationary blinds in the McNiel/Ducroz/Stringfellow Unit. This bottomland unit is contiguous with the Nannie M. Stringfellow WMA.

Big Boggy NWR has two public hunting areas: the Pelton Lake Public Waterfowl Hunt Area and Matthes Field Public Waterfowl Hunt Area. Pelton Lake encompasses 1,100 acres on the east end of the refuge, whereas the Matthes Field Public Waterfowl Hunt Area is located at the north end of the refuge along Chinquapin Road (see Big Boggy NWR Hunt Area Map 3-33). The Complex primarily maintains this 200-acre area for goose hunting, but both areas are open for the hunting of ducks, geese, and coots.

On the Complex, the Public Waterfowl Hunt Areas are open during the State Waterfowl seasons. Teal season is generally scheduled for 9 to 16 days beginning mid-September. Regular season generally begins late October through mid-January with one two-week mid-season closure. In addition, the Public Waterfowl Hunt Areas across the Complex are open during the Conservation Order Light Goose Season, following regular waterfowl season. The Complex holds youth hunts on the McNiel/Ducroz/Stringfellow Unit of San Bernard NWR three weekends per year; two in October and one in December. Youth hunts led by the Texas Youth Hunting Program (TYHP) occur at San Bernard and Brazoria NWRs two weekends per year (February/March) at each location.

All refuges on the Complex provide hunting opportunities. Issue 1, Management of Invasive Species (Fauna) discusses feral hog hunting opportunities. Public Waterfowl Hunting Areas are open access on a first come, first serve basis. Waterfowl hunting areas are open during the teal and general waterfowl seasons in accordance with state seasons. The Complex allows hunting from a half hour before sunrise to sunset.

Wildlife Observation

Existing Wildlife observation opportunities would continue to be available at San Bernard and Brazoria NWRs. The Complex estimates annual visitation at 70,000 with approximately 32,000 visitors coming to the refuges for wildlife observation opportunities. General public access to observe wildlife and refuge habitats including the means of access such as automobile, hiking, bicycling, boating, canoeing and kayaking. Bird watching continues to be the most popular form of wildlife observation on the refuge, where visitors can see large concentrations of waterfowl, wading birds, and neo-tropical songbirds. Big Boggy NWR would remain closed to public use other than special tours.

San Bernard NWR offers wildlife observation and hiking at several locations. The San Bernard auto tour and Moccasin Pond loop provide 9.4 miles of gravel roads with observation platforms, vehicle pullouts, trails, boardwalks, and a butterfly garden. The Cocklebur Slough Road provides opportunities to see wading birds, raptors, and passerines as well as resident wildlife in light forest and grassland habitats. Moccasin Pond loop is at the edge where the salty prairie

meets the high marsh. From the loop road a variety of fresh and saltwater, open water, marsh, and grassland habitats support an array of migratory and resident wildlife. Bicyclists are welcome on all Refuge roads that are open to public vehicles. The San Bernard Oak trail, which is located .5 mile north of the Refuge entrance, along CR 306, provides a .6 mile trail through a mature bottomland forest to the largest live oak in Texas. The trail crosses a slough before reaching the tree, which provides excellent opportunity for viewing bottomland wildlife including wood ducks, reptiles, and songbirds.

Hudson Woods, located five miles west of Angleton, Texas, on SH 521 provides 5.9 miles of walking trails through early and mid-succession stage bottomland forest. Walking the trails provides excellent opportunities for viewing winter and migratory songbirds. Two oxbow lakes provide opportunities for viewing waterbirds including anhinga, waterfowl, and wading birds. An observation deck at Scoby Lake, the deck on the front of the Discovery Outpost and the photo blind provide excellent opportunities to view wetland wildlife.

Dow Woods is the most recent bottomland forest unit opened to provide wildlife observation opportunities. The unit is located on the north side of the City of Lake Jackson. Currently 2.7 miles of trail are available for wildlife observation through a restoring forest and along the shore of Bastrop Bayou. Visitors commonly see native wildlife including deer, armadillos, and raccoons along with migratory songbirds, woodpeckers, and owls.

Betty Brown, the smallest unit on San Bernard NWR, has a 3/8 mile loop trail that takes visitors to the shore of the San Bernard River. This mature growth forest provides excellent opportunities to see migratory songbirds as they move inland from the Gulf of Mexico.

Brazoria NWR will continue to emphasize wildlife observation and highlight these opportunities in a variety of strategic locations including: the Big Slough Public Use Area, Otter Slough, Bastrop Bayou, and Middle Bayou Trail. On Brazoria NWR, the 7.5-mile gravel auto tour route meanders through the Big Slough Public Use Area, wrapping around Olney and Teal Ponds and accessing Big Slough and Rogers Pond. The tour loop, accessible by foot, bicycle, or automobile, includes boardwalks, observation platforms, vehicle pull-offs, trails, and butterfly gardens, each of which is associated with offering opportunities for wildlife observation. In addition, a remote bird-viewing camera is set up at Gator Nest Pond to broadcast video of wildlife to the Discovery Center. The 3-mile paved entrance road from County Road 227 also provides wildlife observation opportunities.

Brazoria NWR also has viewing areas outside the Big Slough Public Use Area. Mottled Duck Marsh, off County Road 208 on the refuge's northern edge, rewards visitors on the lookout for views of waterfowl, wading birds, and shorebirds. The farm fields along County Road 227 and FM 2004 also offer wildlife-viewing opportunities from the public roadway. The Refuge is proposing to work with Brazoria County and develop pull-offs along the county roads for visitors to safely view wildlife without hampering traffic flow.

Wildlife Photography
In addition to the opportunities provided above for wildlife observation, San Bernard NWR would continue to provide a photo blind at Hudson Woods, which presents opportunity for photographing wildlife.

Brazoria and Big Boggy NWRs would provide no additional facilities for wildlife photography.

Environmental Education
The Complex would continue to provide environmental education through their Discovery Environmental Education Program (DEEP).

The Discovery Center at Brazoria NWR would continue to host the majority of the DEEP programs. However, the Discovery Outpost at Hudson Woods and the Wolfweed Wetlands at San Bernard NWR may continue to host field trips as well. The Discovery Center would continue to offer environmental education year round. Activities would include staff-led field trips and issuance of Special Use Permit for after hours or closed area access.

Picnicking may occur as an incidental use supportive of the environmental education program. Picnic tables are located outside of the Discovery Center and visitors may use them in conjunction with environmental education activities.

Interpretation
The Complex would continue to coordinate with the Friends of Brazoria Wildlife Refuges to host the annual Migration Celebration at San Bernard NWR, a weekend event held in April. The event hosted at the refuge features van and marsh buggy tours, numerous children hands-on learning activities, and presentations, including Birds of Prey and Reptiles. Over 1,800 visitors and volunteers attended the 2012 event.

Opportunities for interpretation occur throughout the Complex. People may encounter interpretive opportunities within any public use areas and administrative offices throughout the Complex.

Entrance Fee
Currently, there is no entrance fee required.

2.4.1.5 Facilities/Infrastructure Management

The Complex has three administrative sites. The Complex Office is located on San Bernard at the intersection of FM2611 and CR316. The facility provides office space for Complex management, administrative, biological, law enforcement, and fire program management. The field office for San Bernard NWR is located along CR306 and includes office facilities for refuge management, maintenance, and fire crew as well as maintenance and equipment storage facilities. The Brazoria NWR field office is located off FM2004 and south of CR208. The facility provides office space for refuge management, maintenance, law enforcement, and fire crew as well as maintenance and equipment storage facilities.

The Otter Slough headquarters of Brazoria NWR consists of the Refuge's field headquarters that is located off FM 2004. The office has eight individual offices and supports field operations including management, maintenance, fire, and law enforcement.

The field headquarters of San Bernard NWR is located on CR 306. The field headquarters include the Refuge's office and fire office, maintenance and storage buildings and storage sheds, quarters, two volunteer pads and a communications tower (repeater).

The primary facility resources on Big Boggy NWR are habitat management and resource protection related. No developed infrastructure occurs on this refuge.

Visitor Use Infrastructure

Visitor Orientation Facilities
The Discovery Center at Brazoria NWR is the only facility constructed specifically for visitor orientation in the Complex. However, visitors will continue to find printed information, interpretive map panels, and a helpful staff member at the Complex Headquarters and Refuge Field Offices.

Trails
Both San Bernard NWR and Brazoria NWR would continue to provide trails for Refuge visitors. Big Boggy NWR does not have any trails. Please refer to Section 3.4.5.2 of the CCP for a full list of trails provided at each Refuge.

San Bernard NWR offers 12 miles of walking/hiking trails at four different locations; Hudson Woods, Betty Brown Unit, San Bernard Oak, and the Cocklebur Slough public use area.

Brazoria NWR offers 5 miles of walking/hiking trails at two different locations; Middle Bayou and Big Slough Public Use Area.

Non-motorized Boat Launches
The Complex would continue to provide four access points to use for launching canoes and kayaks at Brazoria and San Bernard NWRs. There are no access points on Big Boggy NWR.

Brazoria NWR has two non-motorized boat launches at Salt Lake and Bastrop Bayou.
San Bernard NWR has a boat ramp on Cedar Lake Creek that visitors could use for canoes and kayaks.

Signs/Exhibits
Exhibit and information panels at observation decks, kiosks, and trailheads would consist of photo panels.

Administrative Infrastructure

Volunteer Facilities
The Complex would continue to provide recreational vehicle pads at Brazoria NWR and San Bernard NWR. There would not be any volunteer facilities provided at Big Boggy NWR. The RV village at Brazoria NWR supports eight RV pads. San Bernard NWR has RV facilities to support two volunteer RVs.

Administrative Facilities
The Complex would continue to maintain a variety of facilities to support Refuge operations and programs including administrative, maintenance, and fire facilities. Find a full list of facilities and their descriptions in Section 3.4.6.2 of the CCP.

2.4.2 Alternative B—(Proposed Action):

2.4.2.1 Ecoregion Management

Climate Change
Management would be the same as Alternative A; however, the Complex would also consider monitoring prairies and marshes carbon sequestration. The Complex would implement a baseline monitoring program for all species that occur on the Complex and would monitor population shifts. The visitor services program would consider expanding the climate change curriculum provided by their DEEP program as new information on climate change becomes available. The Complex would expand its use of green products where feasible. The Complex would add photovoltaics to old offices and new facilities and expand existing systems when opportunities arise.

San Bernard NWR would restore 10 percent of bottomland forests requiring restoration through native planting of oak using carbon sequestration funding. San Bernard NWR may also use exchange of carbon credits for restoration and would implement a habitat-modeling program to predict shifts in bottomland composition. San Bernard NWR would incorporate climate change into their Refuge displays and replace existing refuge displays with recycled products.

Erosion/Saltwater Intrusion
Management to address erosion and saltwater intrusion would be the same as Alternative A; however, there would be an increase in the types and amounts of structural and restoration techniques used and discussed below.

Brazoria NWR would rehab the Salt Lake weir, and increase cooperation with the Army Corps of Engineers (ACOE) to establish up to seven additional beneficial dredge projects, shoreline protection projects and approximately 10 miles of bank armoring along the GIWW. Reef domes will be installed along the bank of Oyster Lake and West Bay to prevent the breaching of Oyster Lake due to ongoing erosion. Brazoria NWR would also explore the option of planting smooth cordgrass to reduce erosion.

San Bernard NWR will also increase cooperation with the ACOE to identify and implement two beneficial dredge sites and approximately 6 miles of bank armoring or installation of break waters along the GIWW with breakwaters preferred.

Big Boggy NWR would install reef domes and/or geotubes to stabilize erosion of Dressing Point Island.

Land Conservation

Under Alternative B, the Service proposes to increase the 28,000 acre cap by an additional 42,000 acres (to a total of 70,000 acres); continuing conservation efforts in the Columbia Bottomlands and associated habitats, as described in the Land Protection Plan provide CCP Appendix I. This expansion would remain within the approved project geographical boundary in Brazoria, Matagorda, Fort Bend, and Wharton counties in Texas and would continue the conservation efforts within the Austin's Woods Conservation Project. The original Conservation Plan, approved in 1997, was intended to counter the rapid destruction of prime old growth bottomland hardwood forests in the Columbia Bottomlands ecosystem. That plan responded to concerns shared by the Service, the Texas Parks and Wildlife Department, local government agencies, conservation organizations and landowners over preserving a sustainable portion of this internationally significant ecosystem. The original overall goal shared by all of the project partners was to protect approximately 10 percent of the estimated original 700,000-acre ecosystem to sustain plant and animal populations and maintain the ecosystem's diversity. The Service would continue to utilize a variety of funding mechanisms for purchasing fee title or conservation easements within the Columbia Bottomland Ecosystem; work with partners finding conservation solutions; and take a lead role in the conservation of additional forested habitats, identifying federal and non-federal funding sources in cooperation with private landowners, federal, state and local governments and non-profit organizations.

2.4.2.2 Habitat Management

Gulf Coast Prairies and Marshes

Cooperative Haying

Brazoria NWR would increase the cooperative haying program up to 75 total acres to increase the wildland urban interface (WUI) buffer area where it cannot implement prescribed fire due to the presence of houses adjacent to the Refuge boundary.

Restoration

Management would be the same as Alternative A; however, Brazoria NWR would establish partnerships for native prairie seed harvest. It would collect seed from refuge prairies and use it to restore other coastal prairie habitats on the refuge. The refuge would restore approximately 600–800 acres annually.

Management of Invasive Species (Flora)

The Complex would continue to use mechanical, chemical, and prescribed fire treatments as described in Alternative A, with the additional treatments as described below. This management alternative would incorporate limited livestock grazing throughout the Complex as a

management tool for specific issues like invasive species management, pond management, or to control aggressive native plants. Livestock grazing would be seasonal with AUM (animal unit month) and acreage to be grazed determined annually. It would be a winter grazing program, short duration incorporating a rotation system in this time frame. Although the Refuge would maintain existing fences, the use of electric wires would be the primary method of keeping the livestock within the specific unit. An example may be to use grazing to control phragmites re-growth following a fall burn.

Brazoria NWR would increase the number of acres treated mechanically every year to approximately 200 acres. The Refuge would reduce chemical application to approximately 800–1200 acres annually as it restores areas. The Refuge would increase prescribed fire to approximately 5,000 acres annually. Brazoria NWR would also implement monitoring and control of phragmites stands and they would implement an early detection program to identify new invasive species.

San Bernard NWR (prairie and marsh habitats) would increase mechanical treatment to approximately 100 acres annually and increase use of prescribed fire to approximately 1,000 acres per year. Chemical application would continue to be the same as Alternative A.

San Bernard NWR (bottomland forest) would implement the same management as Alternative A, plus they would contract approximately 50 acres per year for mechanical and chemical treatments. The refuge would increase mapping of invasive and prevent the spread of invasive species along right-of-ways through monitoring and education.

Big Boggy NWR would implement the same management as Alternative A; however, it would treat Chinese tallow along fence lines, roads, and water delivery canals (approximately 20 acres) through chemical application.

Farming Program

Management would be the same as Alternative A; however, Brazoria NWR would increase farming acres to approximately 1,200–1,500 to include additional moist soil units into the crop rotation. The cooperative farmer would still only plant 350–400 acres annually. The acreage that would be included is already in moist soil production.

San Bernard NWR would explore potential for habitat restoration and protection partnerships with Texas RICE, Ducks Unlimited, and the Coastal Program. San Bernard NWR would also implement monitoring on prairie restoration areas listed in Alternative A.

Water Management

Management would be the same as Alternative A; however, there would be drilling of additional wells and development of new/rehabilitation of existing water control structures as outlined below.

Water Delivery Canals

Brazoria NWR would construct water diversions along ditches and canals to capture more runoff water. Lift pumps and check dams would be installed in drainage ditches.

Big Boggy NWR would clean out existing water delivery canals and drainage ditches to increase freshwater availability.

Water Purchases
Water will continued to be purchased, on an as needed basis, as described in Alternative A.

Irrigation Wells
Brazoria NWR would drill an additional well in farm fields.

San Bernard NWR would rehabilitate two existing irrigation wells. Rehabilitation of these wells would involve clearing out well and determining the reason for low water flow. The refuge would add one additional well for Moccasin and Rail Pond.

Big Boggy NWR would add an irrigation well at McCoach Unit.
Ponds, Reservoirs, Moist Soil Units
Big Boggy NWR would rehabilitate levee and water control structures at Matthes Pond and Mallard Pond.

San Bernard NWR would rehabilitate levees and level the west and middle units of Wolfweed Wetlands to improve management capability. The refuge would explore expansion of Wolfweed Wetlands and increase management capabilities at Sargent Pentagon Marsh by establishing two additional moist-soil units totally 120 acres and water canals.

Bottomland Hardwood Forest
Management would be the same as Alternative A.

Dune and Beach Management
San Bernard NWR would protect the San Bernard beach habitat and wildlife through limiting vehicle access above the tidal zone. Beach resources, including the debris that help to stabilize the dunes, are extremely critical to maintaining this habitat for a variety of native wildlife and protection of the adjacent marsh. Unintentional fires could have detrimental effects on marsh and dune habitats. The Service will restrict campfires and fireworks on the beach habitat.

2.4.2.3 Wildlife Management

Threatened and Endangered Species
In addition to the Alternative A, the Complex would begin monitoring for the potential reintroduction of APC and whooping crane. The Service lists the refuge as a potential reintroduction site for whooping crane, but given the fact that the refuge is outside of the whooping crane flyaway means the refuge will play a much smaller role in this recovery effort. Monitoring would include baseline data on freshwater availability and blue crab populations.

In preparation for a potential APC reintroduction, the refuge would monitor habitat conditions; conduct research on burning regimes, grazing, and cooperative haying; and collect baseline data

on insect populations. If the Complex reintroduced APC, it would implement the APC Recovery Plan.

Management of Invasive Species (Fauna)

Feral Hog
Management of feral hogs would be the same as Alternative A.

Red Imported Fire Ants and Rasberry Crazy Ants
Management of invasive ants would be the same as Alternative A; however, the Complex would enable the release of Phorid flies as a natural predator to control red imported fire ants.

2.4.2.4 Visitor Services

Hunting
The Complex will continue to manage hunting as it is under Alternative A, but Brazoria NWR would provide a youth waterfowl hunting permit area, which would increase youth hunting opportunities by 20 percent over the life of the CCP. San Bernard and Big Boggy NWRs would provide hunting only until 1 p.m. Additional areas will be open to waterfowl hunting in Eagles Nest Lake after completion of a hunt plan and associated environmental compliance. The Complex may consider future deer hunts if populations and/or habitat conditions would benefit from enacting a white-tailed deer hunt program following environmental compliance.

Wildlife Observation
Wildlife observation would continue to be managed as it is under Alternative A; however, the Complex would increase opportunities by constructing new wildlife observation facilities. Brazoria NWR would provide a viewing area on Otter Slough (possibly a boardwalk across the slough) and establish pull-off points along FM2004, at the farm fields, and on CR 227.

Wildlife Photography
The Complex would continue to manage wildlife photography as it is under Alternative A, plus San Bernard NWR would add photo blinds at Dow Woods area. Brazoria NWR would add photo blinds to the Big Slough area.

Environmental Education
Environmental education would continue as it is under Alternative A and the Complex would increase the education program. Brazoria NWR and San Bernard NWR would expand outreach by contacting local media outlets, radio, and Web sites to provide information on the DEEP program, events, and refuge purposes. Provide a one-weekday camp focused on the “at-risk” group of youth (Boys and Girls Club, etc.).

The DEEP program at Brazoria NWR would expand to include an additional school district. The DEEP program at San Bernard NWR would expand to include seven additional school districts including: West Columbia, Sweeny, Bay City, Van Vleck, Angleton, Pearland, and Alvin schools. San Bernard NWR would also like to develop a partnership with Brazosport College at the Dow Woods Unit, enabling them to use the Unit as an outdoor classroom.

Interpretation
Management of interpretation would continue as in Alternative A, but organized interpretative programs would be expanded to include a variety of venues on a monthly basis. Interpretive activities would include day and night naturalist walks and audio/visual presentations conducted by staff and volunteers. Brazoria NWR would also construct an information kiosk along FM2004.

Entrance Fee
In this management alternative, the Complex would make the current voluntary moneybox visible and more secure. Brazoria NWR would add a donation box at the fishing pier and San Bernard NWR would add donation boxes to public use areas.

2.4.2.5 Facilities/Infrastructure Management

Visitor Services Facilities

Visitor Orientation Facilities
Management of these facilities would be the same as Alternative A; however, San Bernard NWR would develop a stand-alone, unmanned visitor orientation facility for after-hour and weekend visitors.

Trails
Management would be the same as Alternative A, except Brazoria NWR would remove the Middle Bayou Trail at Brazoria NWR and a provide new trail at Otter Slough. San Bernard NWR would provide bicycle opportunities in the bottomland forest public use area at Dow Woods and Hudson Woods.

Non-motorized Boat Launches
Management would be the same as Alternative A; however, San Bernard NWR would provide a second launch and pullout location at the end of CR 318 that provides access to Cedar Lake Creek to provide additional opportunities for canoes and kayaks and establish a paddling trail.

Signs/Exhibits
Management would be the same as Alternative A, but this alternative would require construction of eight new exhibits and signs replacing signs in existing kiosks. The Complex will place new information signs at Cedar Lake Creek's kayak access and Dow Woods Unit. The refuge will also replace existing signs to improve the quality and content.

Administrative Facilities

Volunteer Facilities
Under this alternative, Brazoria NWR would develop a new RV facility near the new field headquarters at Otter Slough. This facility would replace the existing facility and would move it out of the immediate storm surge zone where it currently occurs. San Bernard NWR would

expand volunteer facilities to five total volunteer pads and would construct a laundry/community building.

Administrative Facilities
San Bernard NWR would construct an equipment storage facility to use for staging equipment and supplies prior to landfall of a hurricane at Buffalo Creek Unit.

2.4.3 Alternative C

2.4.3.1 Ecoregion Management

Climate Change
Management would be the same as Alternative B; however, San Bernard NWR would increase restoration efforts to 25 percent.

Erosion/Saltwater Intrusion
Management would be the same as Alternative B; however, additional shoreline protection projects would occur.

Brazoria NWR would construct breakwater structures (rip-rap, reef domes, or geotubes) to Lost Lake to increase sedimentation behind the structure and prevent further erosion. The refuge would do these projects in partnership with the ACOE and through grants and other funds available.

San Bernard NWR would increase bank armoring or installation of breakwaters along the Intracoastal Waterway to 10 miles of shoreline protected.

Big Boggy NWR would expand Dressing Point Island using geotubes, beneficial dredges, and breakwaters, and also work with ACOE to implement two beneficial dredge sites off-refuge on the opposite side of the GIWW and install approximately two miles of bank armoring or installation of breakwater with breakwaters being preferred.

Land Conservation
Land Conservation within the Columbia Bottomlands will be the same as Alternative B.

2.4.3.2 Habitat Management

Gulf Coast Prairies and Marshes

Cooperative Haying
Management would be the same as Alternative B.

Restoration
Management would be the same as Alternative B; however, Brazoria NWR would develop a seed bank on 500 acres of native prairie to collect and distribute native prairie seed to increase restoration efforts across the ecosystem to include off-refuge locations.

Management of Invasive Species (Flora)
This management alternative would be the same as Alternative B, but Brazoria NWR would allow limited bison grazing instead of livestock as a management tool for specific issues such as invasive species control or reducing the progression of aggressive natives. Grazing with bison would be managed on a year-round basis across the larger coastal prairies rather than seasonal like livestock. Bison may be moved into a small part of a larger pasture using an electric fence to obtain the desired habitat outcome, for instance in moist soil unit to control phragmites. Brazoria NWR would decrease the number of acres treated mechanically every year to approximately 100. Chemical application would be reduced to approximately 200 acres annually and only occur where the refuge cannot use fire as the primary management tool (i.e. levees). The refuge would continue to increase its use of prescribed fire to burn approximately 8,000 acres annually. Reduction in mechanical and chemical treatments is due to conversion from active restoration to maintenance.

San Bernard NWR (prairie and marshes) would decrease both mechanical and chemical treatments to approximately 50 acres annually where it cannot employ fire as the primary management tool. There would be an increase in prescribed fire to burn approximately 4,200 acres annually.

Farming
Under Alternative C, the Refuge would reduce the cooperative farming program at Brazoria NWR to 500 acres, and only farm 150–200 annually. The Complex would eliminate farming at San Bernard and Big Boggy NWRs.

Water Management
Water management would be the same as Alternative B.

Water Delivery Canals
Management would be the same as Alternative B.

Water Purchases
Management would be the same as alternative B; however, Brazoria NWR would explore the options to purchase water rights so that we would not have to rely heavily on purchases and decrease water purchase from Gulf Coast Water Authority to approximately $10,000 annually. Brazoria NWR would also increase partnerships with Ducks Unlimited and Velasco Drainage District to increase freshwater availability.

Irrigation Wells
Management would be the same as Alternative B.

Ponds, Reservoirs, Moist Soil Units
Management would be the same as Alternative B.

Bottomland Hardwood Forest
Management would be the same as Alternative A.

Dune and Beach
Management would be the same as Alternative B.

2.4.3.3 Wildlife Management

Threatened and Endangered Species
Management would be the same as Alternative B.

Management of Invasive Species (Fauna)

Feral Hog
Management would be the same as Alternative A; however, the Brazoria and San Bernard NWRs would open refuges to general feral hog hunt. Portions of both refuges (including bottomland units) would be open on three weekends during the late winter/early spring. An estimated 210 hunter days would occur annually.

Red Imported Fire Ants and Rasberry Crazy Ants
Under this alternative, the Complex would implement broad scale treatment using methoprene (insect growth regulator) bait like Extinguish®.

2.4.3.4 Visitor Services

Hunting
Management of hunting would be the same as Alternative B; however, San Bernard NWR would offer a deer hunt to reduce populations once population data is available.

Wildlife Observation
Management of these activities would be the same as Alternative B.

Wildlife Photography
Management of these activities would be the same as Alternative B.

Environmental Education
Management of these activities would be the same as Alternative B.

Interpretation
Management of these activities would be the same as Alternative B.

Entrance Fee
Management of these activities would be the same as Alternative B.

2.4.3.5 Facilities/Infrastructure Management

Visitor Use Infrastructure

Visitor Orientation Facilities
Management under this alternative would establish a standalone and manned visitor contact station at San Bernard NWR Headquarters.

Trails
Management of trails would be the same as Alternative B.

Non-motorized Boat Launches
Management of these launches would be the same as Alternative B; however, San Bernard NWR would work with partners to establish additional launch sites, one on Brazos River, one on Oyster Creek, and one on the San Bernard River.

Signs/Exhibits
Management of signs and exhibits would be the same as Alternative B.

Administrative Infrastructure

Volunteer Facilities
Under this alternative Brazoria NWR would keep the same facilities outlined in Alternative A, but the refuge would construct a larger laundry/community building to support volunteers. Management of these facilities for San Bernard NWR would be the same as Alternative B.

Administrative Facilities
Management of these facilities would be the same as Alternative B.

2.5 Comparison of Alternatives

Table EA 2-3. Comparison of Alternatives

Issue	Alternative A: Current Management (No Action)	Alternative B	Alternative C
Ecoregion Management			
Climate Change	Supplement natural forest regeneration with restoration efforts; monitor carbon sequestration; conduct education programs; and use “green” technologies and building products on all new construction	Same as Alternative A plus increase restoration efforts; utilize exchange of carbon credits; gather baseline data on habitat composition/wildlife diversity; update refuge displays; and	Same as Alternative B plus increase restoration efforts above described levels

		increase use of "green" technologies	
Erosion / Saltwater Intrusion	Construct/Use a variety of structural and some restoration techniques at various locations	Same as Alternative A plus increase the types and amounts of structural and restoration techniques used	Same as Alternative B but diversify the types of structural and restorative techniques used
Wildland Fire Use	Follow direction of current FMP	Same as Alternative A	Same as Alternative A
Petroleum Development	Work cooperatively with companies to minimize impacts to refuge resources	Same as Alternative A	Same as Alternative A
Land Conservation	The Complex will continue to acquire lands under the 1997 Austin's Woods Conservation Plan until the 28,000 cap is reached	The Complex will acquire lands under the new (see Appendix) Land Protection Plan up to 70,000 acres	Same as Alternative B
Habitat Management			
Gulf Coast Prairies and Marshes			
Prairie/Grassland Restoration and Management	Cooperative haying conducted; wetland and farmland rehabilitation. Native prairie restoration	Same as Alternative A, plus increase acreage of haying, and increase number of rehabilitation projects. Increase prairie restoration	Same as Alternative B plus develop seed bank on prairie restoration areas.
Management of Invasive Species (Flora)	Mechanical, chemical, and prescribed fire use allowed; grazing not allowed	Same as Alternative A plus increase the types and amounts of management prescriptions used including limited livestock grazing	Same as Alternative B but diversity the types of management prescriptions used including bison grazing
Prescribed Fire Use	Allowed Complex-wide to improve habitats and reduce hazardous fuels	Same as Alternative A	Same as Alternative A
Farming Program	Cooperative farming and force account farming occur on all three refuges	Same as A, plus incorporate additional moist soil units into farming rotation at Brazoria NWR	Reduce cooperative farming acres at Brazoria NWR and eliminate farming at Big Boggy and San

			Bernard NWRs
Water Management	Restore prairie pothole hydrology as opportunity arises; use established wells to provide freshwater to moist soil units during drought periods; and purchase water from various water authorities annually	Same as Alternative A plus drill additional wells, and develop new / rehabilitate existing water control structures	Same as Alternative B plus increase water availability through the development of partnerships and purchase of water rights; expand wetlands; and rehabilitate marshes
Bottomland Hardwood Forest			
Forest Restoration	Allow natural regeneration, where appropriate add supplemental planting of hardwood species; treat invasive species	Same as Alternative A	Same as Alternative A
Water Management	Restore previously drained wetlands	Same as Alternative A	Same as Alternative A
Dune and Beach			
	Management of beach resources have not been clearly defined due to recent silting in of Cedar Lakes Cut and trespass across upland vegetation on private land to access the Cut.	Cooperatively work with County and General Land Office (GLO) to provide additional protection on San Bernard Beach restricting type of access and activities by visitors that would be compatible with Refuge Purpose.	Same as Alternative B
Wildlife Management			
Threatened and Endangered Species	Implement the Sea Turtle Recovery Plan	Same as A, plus if reintroduction of APC and whooping crane occur, implement APC and whooping crane recovery plans	Same as Alternative B
Migratory Bird Species and Species of Special Management Concern	Manage a variety of habitats for resting, feeding, and reproductive purposes	Same as Alternative A	Same as Alternative A
Management of Invasive Species	Baiting and broad scale treatments to control	Same as Alternative A plus release natural	Same as Alternative A but diversify the

(Fauna)	ants	predators to control ants	types of management prescriptions used for each invasive
Visitor Services			
Hunting	Allowed in designated areas for waterfowl, youth deer/feral hog hunt on San Bernard NWR, and a youth feral hog hunt One permit area and ATV use allowed in designated area for disable hunters	Same as Alternative A plus provide a youth waterfowl hunt; and revise the hunting schedule at two locations	Same as Alternative B plus provide a population reduction deer hunt
Fishing	Allowed on all navigable waters and from designated locations	Same as Alternative A	Same as Alternative A
Wildlife Observation	Brazoria and San Bernard NWRs open to wildlife observation; visitors directed to designated public use areas	Same as Alternative A plus construct additional photo blinds, new trails, a boardwalk, and road pull-offs to provide for additional opportunity	Same as Alternative B
Wildlife Photography	Photo blind at Hudson Woods	Same as Alternative A plus develop additional photography opportunities	Same as Alternative B
Environmental Education	Various programs and events conducted	Same as Alternative A plus increase number of programs conducted and expand programs into additional school districts at San Bernard NWR	Same as Alternative B
Interpretation	One annual 3-day event	Same as Alternative A plus expand organized interpretive programs at a variety of Refuge venues on a monthly basis.	Same as Alternative B

Preservation of Historic Sites	Historical sites are identified and interpreted in public use areas when appropriate	Same as Alternative A	Same as Alternative A
Entrance Fee	No entrance fee required	Provide donation boxes at various public use areas	Same as Alternative B
Facilities/ Infrastructure Management			
Visitor Use Infrastructure:			
Visitor Orientation Facilities	Visitor contact station located at Brazoria NWR Discovery Center	Same as Alternative A plus additional Visitor Contact Station at San Bernard NWR	Same as Alternative A plus construct stand-alone Visitor Center at San Bernard NWR Field Office.
Trails	Hiking trail provided at Brazoria and San Bernard NWRs	Same as Alternative A plus construct a new trail at Brazoria NWR Field Office; provide bicycle access at Dow Woods Unit.	Same as Alternative B
Non-Motorized Boat Launches	Canoe / Kayak launches provided at San Bernard and Brazoria NWRs	Same as Alternative A plus construct one additional launch	Same as Alternative B plus construct two additional launches
Signs/Exhibits	Signs and exhibits at Brazoria and San Bernard NWRs	Construct new exhibits and signs and improve quality and content of existing exhibits and signs	Same as Alternative B
Roadways	Vehicular access allowed on designated refuge roads	Same as Alternative A	Same as Alternative A
Administrative Infrastructure:			
Volunteer Facilities	Recreation vehicle pads provided at Brazoria and San Bernard NWRs	Construct new recreation vehicle site at Brazoria NWR, and expand recreation vehicle sites at San Bernard NWR; include additional facilities at both locations	Same as A, plus construct additional facilities at Brazoria NWR
Administrative Facilities	A variety of administrative /	Construct new administrative /	Same as Alternative B

	maintenance facilities available at various Refuges	maintenance facilities at various refuges	
Budget	Base Funding: $2.9M Fire Funding: $788,000 Other: $ 410,000 (Project Specific Funding)	In addition to Alt. A: $1.7M Project Funding: $213,000 Staff Salaries: $200,000	Addition to Alt. A: $1.7M Project Funding: $220,000. Staff Salaries: $200,000.
Staff	26 FTEs	In addition to Alt A: 7 FTEs	In addition to Alt. A: 7 FTEs

Table EA 2-4. Mitigation Measures and Monitoring

Mitigation Measure and Monitoring Description	Alternatives
General	
Gather updated resource baseline data to form a current analytical base from which to judge future management impacts and effects.	A, B, & C
Develop and implement an extensive and ongoing monitoring program to judge management action effectiveness and provide alternative solutions that would decrease any short-term or long-term negative impacts on fish and wildlife resources and other environmental elements.	A, B, & C
Regulate management actions to address any potential impacts. For example, activities would be conducted during times of the year and in areas where breeding and nesting activities are at a minimum.	A, B, & C
Prohibit or restrict activities in areas where listed species occur. The potential effects of CCP implementation on federally-listed species has been reviewed per an Intra-Service Section 7 Consultation (See Appendix F).	A, B, & C
Seek public input in future planning for any management actions that are considered major federal actions, as per NEPA requirements.	A, B, & C
Air Quality	
For prescribed burning the following precautions would be in place: habitat management involving prescribed burning will occur only under ideal weather conditions and smoke management practices will be implemented during all burning events; an approved Prescribed Burn Plan, favorable weather conditions, and adequate firefighting resources all work together to prevent pervasive air pollution or from affecting air quality.	A, B, & C
Water Management and Quality	
Avoids spraying during or immediately before a rainfall event to reduce the chances of run-off and herbicide delivery to water resources.	A, B, & C
Agency-approved application practices and guidelines will be implemented during all prescription events and under an approved plan to prevent or minimize effects to water quality.	A, B, & C
Conduct water sampling on all potable waters on the Complex. Multiple water quality sampling and analysis occurs in the surface waters on and around the Complex.	A, B, & C

Mitigation Measure and Monitoring Description	Alternatives
Soils	
Erosion fences will be established on construction sites when erosion is a concern. If heavy sediment deposits occur in water, maintenance workers will use excavators to pull sediment and move it back into place.	A, B, & C
Habitats	
Take a proactive approach to working with information provided through biological surveys, inventories, and monitoring including monitoring of invasive species and prescribed burning to determine changing conditions and vegetation associated with climate change or other potential impacts.	A, B, & C
Wildlife	
The Complex will coordinate with Coastal Prairie Conservation Initiative and others to maximize outcomes and success of prairie restoration efforts.	A,B, & C
The Complex will continue to monitor area beaches for nesting sea turtles in coordination with Padre Island National Seashore.	A, B, &C
The refuge management methods would not result in direct take of any species of conservation concern and vegetation clearing activities would not occur during general bird nesting season, March through August.	A, B, & C
Oil and Gas Activities	
Each refuge will work with oil and gas companies to ensure that to the greatest extent practicable, all exploration, development, and production operations are conducted in such a manner as to prevent the damage, erosion, pollution, or contamination to the lands, waters, facilities, and vegetation of the area.	A, B, & C
The Complex will continue restoring marshland by planting smooth cordgrass in areas impacted by oil and gas activities.	A, B, & C

3.0 AFFECTED ENVIRONMENT

Refer to Chapter 3 of the Comprehensive Conservation Plan.

4.0 ENVIRONMENTAL CONSEQUENCES

This section analyzes and discusses the potential environmental effects or consequences reasonably expected by the implementation of each of the three alternatives described in Chapter 2 of this EA. The 15-year life of the CCP will portray each alternative and the expected outcomes.

This chapter identifies, describes, and compares the impacts of implementing the three alternatives proposed in this EA on the Complex's physical, biological, and socio-economic environment. Current management (Alternative A, the No Action Alternative) provides the basis for comparing the effects of the action alternatives (Alternatives B and C). This chapter analyzes the direct, indirect, and cumulative effects of each alternative as defined below in section 4.1.

The Complex conducted an analysis of the effects of management actions on the physical environment for air quality, water quality/quantity, and soils. It also conducted an analysis of the

effects of management actions on the biological environment for vegetation/habitat, wildlife, and species of special concern (e.g., threatened and endangered species). Although all plant, animal, and fish species on the Complex are important, many species are not expected to experience any change—or at most, a negligible one—as a result of implementing any of the alternatives. For that reason, this chapter does not discuss all Refuge species.

An analysis of the effects of management actions on the socio-economic environment has been conducted for local populations and economy, recreational uses and facilities, scenery, oil and gas activities, natural and cultural prehistoric and historic resources, and land acquisition. This chapter describes potential impacts in terms of type, duration, intensity, and context (scale). General definitions are as follows:

4.1 Definition of Terms

Effects

Direct effects are the impacts that would be caused by the alternative at the same time and place as the action.

Indirect effects are impacts that occur later in time or distance from the triggering action.

Cumulative effects are incremental impacts resulting from other past, present, and reasonably foreseeable future actions, including those taken by federal and non-federal agencies, as well as undertaken by private individuals. Cumulative impacts may result from singularly minor but collectively significant actions taking place over a period of time.

Impact Type

Beneficial impacts are those resulting from management actions that maintain or enhance the quality and/or quality of identified refuge resources or recreational opportunities.

Adverse impacts are those resulting from management actions that degrade the quality and/or quantity of identified refuge resources or recreational opportunities.

Duration of Impacts

Short-term impacts affect identified refuge resources or recreational opportunities; they occur during implementation of the management action but last no longer.

Medium-term impacts affect identified refuge resources or recreational opportunities that occur during implementation of the management action; they are expected to persist for some time into the future though not throughout the life of the CCP.

Long-term impacts affect identified refuge resources or recreation opportunities; they occur during implementation of the management action and are expected to persist throughout the life of the CCP and possibly longer.

Intensity of Impact

Negligible impacts result from management actions that cannot be reasonably expected to alter identified refuge resources or recreational opportunities at the identified scale; impacts are so small that they would not be measurable.

Minor impacts result from a specified management action that can be reasonably expected to have detectable though limited effect on identified refuge resources or recreation opportunities at the identified scale; impacts are detectable but would affect a small area.

Moderate impacts result from a specified management action that can be reasonably expected to have apparent and detectable effects on identified refuge resources or recreation opportunities at the identified scale; effects would be readily apparent and would occur over a relatively large area but are not extreme or excessive.

Major impacts result from a specified management action that can be reasonably expected to have readily apparent and substantial effects on identified refuge resources and recreation opportunities at the identified scale; effects would be readily apparent and would substantially change the characteristics of the resource.

Scale of Impact

Site-specific effects are those impacts that occur solely within the project area (i.e., construction site or treatment area).

Localized impacts are those that would occur within and immediately surrounding the project area.

Refuge/Complex-wide impacts are those that would occur across the entire Refuge/Complex landscape.

Widespread impacts are those that would occur beyond the Complex landscape.

4.2 Effects Common to all Alternatives

Several potential effects will be very similar under each alternative, and they are summarized in this section.

Climate Change

The Complex considers carbon sequestration, a climate-related phenomenon, in planning. Vegetated land is a tremendous factor in carbon sequestration. Terrestrial biomes of all sorts—grasslands, forests, wetlands, tundra, and desert—are effective in both preventing carbon emission and acting as biological “scrubber” of atmospheric CO2.

In terms of climate change, conserving natural habitat for the Complex is the primary management focus for the CCP. The actions proposed in this CCP would conserve or restore land and habitat, and would thus retain existing carbon sequestration on the Complex. Additional conserved lands would ensure that development and loss of current carbon sequestration ability does not occur in the future. This in turn contributes positively to efforts to mitigate human-induced global climate change.

One Complex activity in particular, prescribed burning, releases CO_2 directly into the atmosphere from the biomass consumed during combustion. However, there is actually no net loss of carbon, since new vegetation quickly germinates and sprouts to replace the burned-up biomass and over time sequesters or assimilates an approximately equal amount of carbon as was lost to the air (Dai et al. 2006). The use of green technology and products as specified in the CCP would reduce the Complex's carbon footprint. The differences in the amount of carbon sequestration expected from each alternative is further discussed in section 4.3.1.

Regional modeling of how long-term global warming patterns might emerge in the U.S. suggests that future climates along the Texas Gulf Coast could be very different from those of the past. Climate researchers used unique state-of-the art high resolution nested climate simulation models to explore the importance of fine scale processes in determining climate change hotspots in the continental U.S. and Mexico (Texas Climate Initiative).

The occurrence of climate change hotspots in the U.S. was generally persistent in the southwestern U.S., including Texas. Northern Mexico was also a region of persistent, intense climate changes. Interestingly, the observed pattern of responsiveness was largely consistent between low and high-end emissions scenarios and throughout the 21st century. The persistence of the hotspot patterns observed in these regional climate modeling experiments suggest that the broad patterns of responsiveness observed may be robust to climate system variability. Changes in inter-annual variability, particularly of precipitation, were the primary drivers of peak climate changes in these modeling studies (Texas Climate Initiative).

The Service undertook an investigation of wetland trends and future conditions in response to a changing climate across three coastal units of the Complex.

The Complex assessed future wetland conditions spatially by modeling sea level inundation rates resulting from predicted sSLR from 2010 to 2100. Researchers derived low and high estimates of SLR used in the inundation model by combining two SLR prediction models for the region. Results of the sea level inundation model were stored in a GIS database and used to quantify potential impacts to existing wetlands at decadal intervals from 2010 to 2100. Results of the 1938/44–2008 trends analysis showed a significant increase of in-flow through (tidally influenced) wetland acres across the Complex. Results of the future conditions analysis predict that sea level rise will significantly alter or displace the majority of wetlands across the Complex between 2020 (71.03 percent of current wetland acres) and 2050 (87.10 percent of current wetland acres) (USFWS 2009). This will occur equally under all three proposed management alternatives evaluated in this EA.

Results of the 1938/44 to 2008 wetlands trends analysis tends to indicate subsidence and/or SLR

had been occurring across the Complex prior to the significant impacts of climate change predicted today. The increase in the area of flow through wetland basins from 2872.79 (1938/44) acres to 4593.34 (2008) acres is an indication that the coastal wetlands of TMC have already been impacted by SLR to some degree. In addition to SLR, many climate change studies predict changes to tropical storm events, precipitation rates, and temperature levels at rates that can affect habitat conditions and distributions along the Gulf Coast. Combined with SLR, it is likely that tropical storm events will accelerate wetland impacts across the Complex by increasing wave action and erosion rates that will compound the conversion of coastal salt marsh to open bays. Changes in precipitation amounts and runoff may also impact wetlands. A decrease in freshwater inputs to coastal wetland systems resulting from reduced rainfall and increased upstream water usage from agriculture, urban, and industrial use may increase salinity rates and reduce sediment inputs to coastal wetland systems. Compounding this likelihood is a predicted temperature increase of >3˚F (HadCM2) to >7˚F (CGCM2), which could increase the annual surface water evaporation rates by more than a foot (Fang and Stefan 1999), further decreasing freshwater inputs and increasing salinity rates.

In response to past episodes of SLR, coastal wetlands have responded by migrating to adjacent uplands or building additional substrate to account for changes in water depth. Were this to happen, it is unlikely that impacts to coastal wetland systems would be significant in a period of accelerated climate change. However, where migration of wetlands to higher ground is not possible because of existing human developments and land uses, coastal wetlands are likely to be diminished in extent or eliminated (Cahoon et al.1998). Using the results of the high inundation model, the Complex is predicted to lose 37,926 acres (36 percent of its total area) to open bay (seawater) conversion by 2100. This will eliminate 90 percent of the current wetlands on the Complex. While San Bernard and Brazoria NWRs will still contain a substantial portion of the upland land mass, it is not known if these areas are suitable for future wetland migration and formation or if the wetlands formed there would function at a level 24 of long-term productivity to offset predicted losses. The Complex may need to purchase additional lands suitable for inland wetland development to offset predicted wetland loss.

Again, these predicted long-term, climate-change-related impacts would occur regardless of which of the management alternatives under consideration here the Service ultimately selects. Over the 15-year life of the CCP, impacts associated with climate change are likely to be adverse, minor to moderate, and widespread.

Herbicide Application

Chemical herbicides are one of the methods the Service uses to control invasive plants on national wildlife refuges. Herbicides can efficiently and effectively suppress or kill unwanted plants and the Service uses them in such a manner as to minimize adverse effects on non-target resources. An herbicide suppresses or kills plants by decreasing their growth, seed production, and competitiveness (USFWS 2009b).

The Complex must weigh the benefits of herbicides in controlling invasive plants against the potential for exposure and impacts to human health, non-target organisms, and the environment. The federal and state governments regulate herbicides to ensure that they do not pose unreasonable risks. The EPA requires extensive test data from herbicide producers prior to

licensing and determining restriction on use. EPA scientists and analysts carefully review these data to determine whether to register (license) an herbicide and whether certain restrictions on use are needed (USFWS 2009b).

EPA evaluates both exposure and toxicity to determine the risk associated with use of a given herbicide. Applications and subsequent movement may expose people, non-target flora and fauna, water, and soil directly or indirectly to herbicides; the refuge can minimize or avoid this exposure by following proper instructions and labels. For wildlife and humans, herbicides may enter the body through the skin, by swallowing, and by breathing. Once the refuge applies herbicides, the many biotic (living) and abiotic (non-living) processes that affect the fate of herbicides in the environment further influence the potential for exposure.

Herbicide use on national wildlife refuges must comply with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and other federal laws and authorities. The use of herbicides and other pesticides on refuges is governed by the U.S. Department of Interior Integrated Pest Management Policy (517 DM 1), the Service Pest Management Policy and Responsibilities (30 AM 12), and the Service Refuge Manual (7 RM 14).

The Service policies and Refuge Manual state that we will use herbicides only after full consideration of management alternatives including chemical, biological, physical, and no action. If after considering all of these factors managers determine that we must use herbicides to meet invasive plant management objectives, then we will use the least hazardous, most effective herbicides to meet those objectives (USFWS 2009b).

Refuge staff must complete a Pesticide Use Proposal (PUP) whenever we use a pesticide or herbicide on a refuge, including applications by staff, volunteers, contractors, or in association with a right-of-way easement or Special Use Permit. Individuals with duties related to plant management and knowledge and experience with herbicides typically complete and submit the PUP. An online PUPs database enables staff to complete and submit PUPs electronically at https://systems.fws.gov/PUPS/. Depending on the pesticide and other conditions listed in the PUP, the PUP may need Regional Office review and approval, and under some circumstances, the Regional Office may need to submit the PUP for Washington Office review and approval. PUPS that are part of an approved integrated pest management plan may receive five-year approvals. The Director periodically issues specific guidance that includes details about PUP approval authority and which herbicides and application scenarios require review beyond the field station.

Refuge managers or the project leader ensures that:

- Pest management decisions are consistent with all applicable policies, laws, and regulations.
- Anyone applying pesticides, releasing biological control agents, and conducting other Integrated Pest Management activities has the appropriate training and equipment necessary to protect their safety and health.
- We apply pesticides only after the appropriate reviewer approves the PUP.
- We establish threshold levels of damage or pest populations according to Service or refuge goals and objectives and applicable laws.

- Staff store, handle, and dispose of pesticides and pesticide containers in accordance with the label and in a manner that safeguards human, fish, and wildlife health and prevents soil and water contamination.
- Submit annual reports documenting pesticide use and efficacy into the online PUPs database (USFWS 2009b).

Each of the alternatives would follow the above procedures and each would use the same herbicides and have approximately similar rates of application. Environmental impact associated with herbicide use on the Complex would be both adverse and beneficial. Adverse impacts may occur from localized toxicity of non-target organisms (plant and animal), and would be short-term to long-term (short-term for any given application, but long-term if the applications are repeated regularly). Herbicides would also have negligible, short-term adverse impacts on water quality. They may potentially leach into and pollute groundwater and may flush into surface water if improperly applied. However, proper application under conditions specified on product labels and the use of best management practices minimizes movement of herbicides from their intended targets.

Beneficial impacts from herbicide application would also occur under each alternative. Benefits would result from control of invasive plants that threaten to infest large areas, displacing native species of flora and fauna; these beneficial effects would be long-term, Complex-wide, and of moderate intensity.

Petroleum Development Impacts

As noted in Section 2.3 of this EA, oil and gas exploration is occurring on four locations on the Complex. Operators are required to prevent, to the maximum extent possible, releases of hazardous materials and substances, crude oil, and produced water. All oil and gas facilities are required to have berms or secondary containment systems to prevent contamination of land and water resources. Each operator and/or facility operator must have a current Oil Discharge Prevention and Contingency Plan outlining procedures for accidental releases. Sampling, remediation, and restoration of contaminated sites would be the responsibility of the operator and/or facility operator and would occur in consultation with the Service and the appropriate state agency. All sites no longer in use must be sampled for contaminants at the operator's expense to ensure proper disposal of material and that refuge staff and/or the visiting public are not exposed to contaminants. The Service may request that wells, roads, pipelines, and associated infrastructure and facilities not needed to support ongoing operations be removed and the sites restored to the satisfaction of the Refuge Manager.

Reasonable restrictions include restriction on time of year (October 15–March 15) for operations designed to minimize wildlife disturbance during the winter months; restriction on equipment to include low-pressure terra-tired vehicles or tracked equipment in the marshes and small "Bumble Bee" drillers in the bottomlands; and restriction of ATV use in marsh habitats. The Refuge Manager will negotiate the locations of production lines prior to drilling. Operators will generally place such lines along roadways, and directionally drill under wetlands or other sensitive environments. The Complex only permits closed loop drilling operations. All seismic operations must hire an environmental monitor, who is selected by the Refuge Manager and who reports to the Refuge Manager, to monitor all seismic operations and ensure minimal habitat

damage. In Texas, the refuges may accept payment for restoration work required after the seismic operations. The refuges will then conduct restoration and monitoring efforts using those funds.

Petroleum exploration and extraction activities and facilities would impact each alternative equally. In summary, these impacts would be adverse, long-term, site-specific, and of negligible to minor intensity.

Cultural Resources

The Service is responsible for managing archeological and historic sites found on national wildlife refuges. Undertakings accomplished on the Complex have the potential to impact cultural resources. The consequences for cultural resources would be the same under each management alternative.

Although the presence of cultural resources, including historic properties, cannot stop a federal undertaking, the undertakings are subject to Section 106 of the National Historic Preservation Act. Thus, Refuge Managers and the Project Leader, during early planning, provide the Regional Historic Preservation Officer (RHPO) with: 1) a description and location of all projects, activities, routine maintenance and operations that affect ground and structures; 2) requests for permitted uses; and 3) alternatives being considered. The RHPO analyzes these undertakings for potential to affect historic properties and enters into consultation with the State Historic Preservation Officer (SHPO) and other parties as appropriate. The Refuge Manager and/or Project Leader ask the public and local government officials to identify concerns about impacts caused by the undertaking in a notification that is at least equal to, and preferably with, the public notification carried out for NEPA and compatibility.

Impacts on cultural resources associated with each alternative would at most be negligible to minor, site-specific, and long-term.

Environmental Justice

Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations” was signed by President Clinton on February 11, 1994, to focus federal attention on the environmental and human health conditions of minority and low-income populations, with the goal of achieving environmental protection for all communities. The Order directs federal agencies to develop environmental justice strategies to aid in identifying and addressing disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations. Another intent of the Order is to promote nondiscrimination in federal programs substantially affecting human health and the environment, and to provide minority and low-income communities with access to public information and opportunities for participation in matters relating to human health or the environment.

None of the three management alternatives described in this EA would disproportionately place any adverse environmental, economic, social, or health impacts on minority and low-income populations. The Complex anticipates that implementation of any alternative that includes

public use and environmental education will provide a benefit to the residents residing in the surrounding communities.

Feral Hog Management

The detrimental impacts of feral hogs are well documented (West et. al. 2009). They damage native habitat by rooting and trampling. These activities result in compaction of soils, which influence plant regeneration, community structure, soil properties, nutrient cycling, and water infiltration. Feral hogs induce the spread of invasive plant species because invasive exotics typically favor disturbed areas and colonize more quickly than many native plants. Feral hogs compete with native wildlife for resources and cause direct wildlife mortality through nest predation and opportunistic consumption of birds, reptiles and amphibians. Feral hogs also vector many diseases that can be contracted by other animal species. Any increase in population would lead to adverse impacts on other wildlife species. Feral hogs increase the overall harvest yield losses incurred by farmers both on and off the refuges. Additionally, feral hogs cause damage to roads, levees, and public use areas by means of rooting, thus leading to equipment and vehicle damage used to maintain and travel these areas. They also pose health and safety risks due to disease and potential for vehicle accidents.

The management activities conducted on the Complex, (as described in the Feral Hog Management Plan), are necessary to reduce the impacts mentioned above. Activities that require use of vehicles or equipment may increase impacts to air quality due to emission. Impacts to soils and vegetation would be expected from foot and vehicular traffic. However, these direct impacts to air, soil and vegetation would be negligible and short-term impacts. No impacts to water quality or quantity are expected from the proposed management activities. There would likely be some short-term impacts to non-target wildlife species (short-term disturbance and displacement) as a result of the activities involving vehicles, foot traffic and aerial shooting. These impacts, however, would be short-term, only lasting through the duration of the management activity.

Hogs that are killed by staff (i.e., law enforcement officers or professional sharpshooters) are quickly and humanely killed by an accurate shot to the neck/shoulder area. Special Use Permits and staff removal are outside of public view. Coyotes, vultures, and other wildlife, normally consume carcasses that are left where shot in remote areas, within one to two days. Carcasses near public use facilities are removed from public view.

The indirectly long-term impacts of feral hog management are expected to be beneficial to soil, water, vegetation, and wildlife as feral hog numbers are reduced. In addition, many predators and scavengers would benefit from the carcasses left in the field.

Fishing

Forty percent of the visitation on the Refuge Complex is for saltwater fishing. Visiting anglers enjoy some of the best fishing for redfish, spotted sea trout, black drum, sheepshead, and flounder in Texas. Brazoria NWR has three public fishing areas that allow land access to saltwater fishing. One boat ramp is located on the west bank of Bastrop Bayou, off CR 227, and another ramp is located off CR 257 on the refuge's southwestern boundary. San Bernard NWR has one fishing area—Cedar Lake Public Fishing Area offers an accessible fishing pier, a fishing

trail that offers bank fishing and a public boat ramp that gives visitors access to Cedar Lake Creek. The Refuge allows saltwater fishing and crabbing in designated areas in accordance with applicable state and federal regulations. At Big Boggy NWR, public fishing is limited to the navigable waters of Boggy Creek and Lake and the portion of the Refuge bordering the GIWW.

Under each of the alternatives, the refuge would continue to allow fishing on all navigable waters from designated locations. The effects of each alternative would be identical. The effects of fishing and associated boating activities on migratory and shore birds include noise, harassment, and displacement. Compaction of vegetation may occur along the shores and along creeks from fisherman accessing fishing points. With the stipulations outlined below disturbances caused by fishing, including associated boating activities is not having an adverse impact on wildlife resources. Refuge staff monitor shorelines for erosion. Trash is the single greatest impact on the refuges associated with this use. Trash left from fishing activities can be harmful to wildlife. Monofilament line can entangle wildlife or be ingested. Ingested lead sinkers can cause lead poisoning and food scraps are not healthy for wildlife. In an effort to control trash, the refuge has installed monofilament recycling containers at fishing areas. Trash is removed from fishing areas on a weekly basis. Fishing areas are shut down if trash gets out of hand.

Under each, the impacts on Complex fishing opportunities would be beneficial, long-term, widespread, and of moderate intensity.

Refuge Revenue Sharing

Annual Refuge revenue-sharing payments to Brazoria, Matagorda, and Fort Bend counties, Texas, would continue at similar rates under each alternative. If the Complex acquires and adds lands to the refuges, the payments would increase accordingly.

Indian Trust Assets

The Complex has identified no Indian Trust Assets on its lands. There are no reservations or ceded lands present. Because the Complex does not believe resources are present, it does not anticipate impacts to result from implementation of either alternative described in the EA.

Other Common Effects

None of the alternatives would have more than negligible or at most minor effects on geology, topography, noise levels, transportation, waste management, or human health and safety.

4.3 Physical Environment

4.3.1 Impacts on Air Quality

Each of the alternatives would implement the following mitigation measure to protect air quality: For prescribed burning, the following precautions would be in place: habitat management involving prescribed burning will occur only under ideal weather conditions and smoke management practices will be implemented during all burning events; an approved prescribed burn plan, favorable weather conditions, and adequate firefighting resources all work together to prevent pervasive air pollution or unnecessary effects on air quality.

The analysis below assumes implementation of this mitigation measure to protect air quality.

Alternative A—No Action Alternative (Current Management)

Existing conserved lands provide important beneficial impacts on regional air quality by providing open space and vegetated habitats. The forests, wetlands and prairies serve as air filters, filtering out particulates, aerosols, and other pollutants, thus improving air quality in the region. Mature bottomland forests sequester carbon in the leaves, stems, trunks and roots of woody plants. It has been estimated that an acre of maturing Columbia Bottomland forest will sequester 131 tons of carbon (Delaney etal. 2002). So, within the current boundaries of the refuge (which has included acquisition of 28,000 of bottomland hardwood habitat to date) up to 3,668,000 tons of carbon could potential be sequested.. Conservation of existing refuge units is beneficial, long-term, minor to moderate, and widespread.

Management actions and activities associated with Alternative A that could potentially affect air quality include prescribed fire, farming operations, equipment and vehicle operation, and landscape conservation.

Refuge staff would use prescribed fire Complex-wide to manage, enhance, or restore habitats and reduce hazardous fuels. Table 2-1 shows the prescribed fire schedule for the Complex. Annually, Brazoria NWR would burn on average about 10,600 acres, San Bernard NWR about 8,200 acres, and Big Boggy NWR about 1,900 acres. Prescribed fire would have generally minor, sometimes moderate, adverse impacts that are short-term in duration at the local to widespread scales due to smoke emitted from burning vegetation. Smoke consists of particulate matter, aerosols, soot, and a variety of gases, all of which degrade air quality when they are present. In brush and grass vegetation types, smoke would dissipate rapidly and smoke should disappear shortly after the fire burns down; long-lasting smoldering would not be a problem. Generally, whenever weather conditions allow for prescribed burns, air masses are not stagnant, and smoke will rise and disperse, minimizing impacts on ground level air quality, visibility, and human health.

Brazoria NWR would continue to use cooperative farming on 10 farm fields comprising 1,000 acres; of these 1,000 acres, the Refuge farms three fields of approximately 220–350 acres in a given year with the remaining seven units left fallow. San Bernard NWR would continue to farm a single 10-acre plot. Big Boggy NWR would farm a total of 90 acres of rye grass for winter browse for waterfowl through force account at Mathis Field. Exhaust from farm equipment and fugitive dust produced by the use of agricultural machinery (e.g., tractors and plows) during discing and harvest may both produce negative short-term direct effects to air quality. These farming operations would continue to result in some negligible short-term negative impacts on air quality at the local scale since the refuge only farms up to 350 acres and the total Complex is approximately 44,044 acres. In preparation and harvest of all farming operations, the use of two tractors for less than two months out of the year will have negligible impact on air quality within the Complex.

Dust and emissions produced by equipment and vehicle operation associated with construction such as road maintenance would be minor and localized. Performing work during times of low to no wind would abate blowing dust. Furthermore, most construction occurs as maintenance to already existing facilities or infrastructure that is small scale and localized. During extremely

dry periods, the Complex would water down heavily used unpaved roads to reduce fugitive dust emissions.

Herbicides are an important management tool used to gain an upper hand on the war against the many aggressive non-native flora. Table 2-2 identifies chemicals and target species. Brazoria NWR would continue to treat 1,600–2,500 acres with Grazon P+D and Grazon Next Generation through aerial application. San Bernard NWR would use the same chemicals as Brazoria NWR and treat approximately 100 acres annually. The Complex conducted no chemical treatments on Big Boggy NWR, but the option to use them if deemed necessary would still be available in the event of a Chinese tallow outbreak. The majority of these treatments would be aerial application, but the Complex may use hand, backpack, and boom sprayers on a variety of target species. Performing work during times of low wind would abate non-target species and maximize chemical efficiency. Spraying chemicals to treat target fauna may produce negative short-term direct effects to air quality.

The Complex does not anticipate any other Refuge management activities or public uses to adversely affect air quality to any appreciable degree.

Important beneficial impacts from Alternative A on regional air quality would accrue from the Complex's continuing management of tens of thousands of acres of open space and vegetated habitats. The forests, fields, and marshes on these conservation lands serve as air filters, filtering out particulates, aerosols, and other pollutants, thus improving air quality in the region.
In summary, Alternative A would entail both adverse and beneficial impacts on air quality on the Complex. Impacts from prescribed fire would be adverse, short-term, minor to moderate, and localized to widespread. Impacts from farming and vehicular operation would be adverse, short-term, negligible to minor, and localized. Overall impacts from habitat conservation and management would be beneficial, long-term, minor to moderate, and widespread.

Alternative B—Proposed Action

Alternative B would conserve and restore additional habitat acreage, with a focus on bottomland hardwood forests and prairies. By conserving additional habitat and filtering foliage, this alternative would be more beneficial for air quality than Alternative A. Carbon sequestration in the bottomland hardwood habitats would be expected to be up to ___ with potential acquisition of 42,000 additional acres. These benefits would be long-term, moderate, and widespread.

Alternative B would have the same amount of prescribed fire but would have a slightly higher (from 1,000 acres to 1,200 acres) use of herbicides that would have short-term, localized air quality impacts. Although these adverse impacts would be slightly greater (from 1,000 acres to 1,200 acres) than Alternative A, they would still be considered adverse, short-term, minor to moderate, and localized to widespread.

Alternative B would conserve and restore additional habitat acreage, with a focus on bottomland hardwood forests and prairies. By conserving more habitats and filtering foliage, this alternative would be slightly more beneficial for air quality than Alternative A.

Alternative C
This alternative would keep prescribed fire use the same and reduce farming, leading to lower air emissions from exhaust and fugitive dust. Overall, adverse impacts of Alternative C on air quality from the same actions and activities would still be approximately the same as Alternative B.

The beneficial impacts on air quality from habitat conservation (including carbon sequestration), management, and restoration would be the same as Alternative B. These benefits would be long-term, moderate, and widespread.

4.3.2 Impacts on Water Resources

Each of the alternatives benefits water resources, both in terms of quality and quantity, simply by maintaining and conserving large areas of healthy, vegetated habitats that protect soils and waters. These vegetated habitats filter out contaminants, minimize erosion, turbidity, and sedimentation, and regulate water flows by serving as "sponges" that soak up rainfall and slowly release moisture over the following days and weeks.

Each of the alternatives would implement the following mitigation measures to protect water quality:

- Avoid spraying during or immediately before a rainfall event to reduce the chances of run-off and herbicide delivery to water resources.
- Implement agency-approved application practices and guidelines during all prescription events and under an approved plan to prevent or minimize effects to water quality.
- Conduct water sampling on all potable waters on the Complex. Multiple water quality sampling and analysis occurs in the surface waters on and around the Complex.

The analysis below assumes implementation of these mitigation measures to protect water quality.

Alternative A—No Action Alternative
The following activities would continue under Alternative A and could potentially have impacts on water quality: erosion prevention measures, farming, invasive species control, herbicide use, and oil and gas operations. Section 4.2 discussed herbicide use and oil and gas operations above in "Effects Common to All Alternatives."

The Complex would continue to engage in management activities and maintain facilities that reduce erosion and prevent saltwater intrusion on all three refuges. Such facilities would include bank armoring by use of concrete block/mats and large concrete slabs used as riprap.
The Complex would construct and use a variety of structural and some restoration techniques at various locations. Brazoria NWR projects include two miles of bank armoring by use of concrete block/mats along the GIWW and shoreline riprap along 2,000 feet of Cox Lake and 100 feet at Salt Lake. San Bernard NWR projects include large concrete slabs serving as riprap along the south end to protect 1,500 feet of levee from wind-driven wave action and to encourage sedimentation of the marsh and plugging small tidal channels. Big Boggy NWR would continue to install riprap to slow down erosion at Dressing Point Island. These activities would result in

increased sedimentation and turbidity during construction, but these impacts would be minor and short-term; long-term benefits would outweigh these short-term adverse impacts. These efforts would help protect freshwater quality, present saltwater intrusion, and reduce erosion and sedimentation, and would thus represent a long-term, localized beneficial effect on the Complex's hydrology.

The cooperative farming operation and moist soil units on Brazoria NWR would continue to maintain 1,000 acres of farmland, of which only 220 to 350 acres would be farmed annually. This operation has the potential to cause short-term, negligible to minor, localized (only within and around specific farm units) to widespread adverse impacts to water quality. Ground-disturbing farming operations such as crop planting and discing using tractors may churn and expose bare soils to direct rainfall; they have the potential to increase erosion, thereby resulting in higher levels of sediments reaching area water bodies. This siltation could adversely affect water quality of these water bodies locally and downstream during and after storm events; however, the area's virtually flat topography reduces erosive potential, and the amount of soil matter reaching watercourses as suspended sediments is likely to be relatively small.

Overall, these adverse impacts on water quality from Alternative A are likely to be negligible to minor, localized, and short-term. The Complex's habitat conservation efforts and erosion control measures would have beneficial, moderate, long-term, and widespread effects on water quality (extending beyond the boundaries of individual refuges).

Alternative B—Proposed Action

Under Alternative B, there would be greater efforts to address erosion and saltwater intrusion than with Alternative A. Brazoria NWR would rehabilitate the Salt Lake weir and increase cooperation with ACOE to establish up to seven additional beneficial dredge projects and approximately 10 miles of bank armoring along the GIWW. This refuge would also explore the option of planting smooth cordgrass to reduce erosion. San Bernard NWR would also increase cooperation with ACOE to identify and implement two beneficial dredge sites and approximately six miles of bank armoring or installation of break waters along the GIWW with breakwaters preferred. Big Boggy NWR would install reef domes and/or geotubes to stabilize erosion of Dressing Point Island. There would be minor short-term adverse impacts (increased sedimentation and turbidity) during project construction; however, these actions would expand water resource benefits provided by Alternative A.

Increasing cooperative farming and moist soil acreage at Brazoria NWR to 350-400 acres annually has the potential to increase short-term, localized to widespread adverse impacts to water quality from increased erosion, turbidity (suspended sediments), and sedimentation. However, as noted above, the area is flat topography tends to minimize erosion and sedimentation; therefore, the intensity of these impacts would still be negligible to minor. Since Alternative B would eventually protect more riparian lands and conserve their bottomland hardwood forests which filter surface and ground water, than Alternative A, its long-term beneficial impacts on water quality and resources would be greater than Alternative A's.

Overall, Alternative B, like Alternative A, would cause both adverse and beneficial impacts. Its adverse impacts would be greater than Alternative A's. Its beneficial impacts would be greater than Alternative A's.

Alternative C

Alternative C would maintain and develop structures like Alternative B, but would diversify the types of structural and restorative techniques used. Brazoria NWR would construct a breakwater structure made of riprap, reef domes, or geotubes) to Lost Lake to increase sedimentation behind the structure and prevent further erosion. San Bernard NWR would increase bank armoring or installation of breakwaters along the GIWW to 10 miles of shoreline protected.

Big Boggy NWR would expand Dressing Point Island using geotubes, beneficial dredges, and breakwaters, as well as working with ACOE to implement two beneficial dredge sites off-refuge on the opposite side of the GIWW and install approximately two miles of bank armoring or breakwater. There would be adverse, short-term direct impacts during construction. However, the long-term effects would be beneficial for water resources and quality, as engineers design these structures to restore and protect areas from further erosion.

Under Alternative C, Brazoria NWR would reduce the cooperative farming program to 500 acres, and only farm 150–200 acres annually, restoring the remaining acres to coastal prairie. San Bernard and Big Boggy NWRs would eliminate agricultural activities altogether. These actions could potentially further reduce the erosion and localized water pollution from siltation and turbidity associated with agriculture in this flat area.

Overall, Alternative C would have fewer adverse impacts on water quality than Alternative B due to reduced farming. Adverse impacts would be negligible to minor, localized, and short-term. Alternative C's beneficial impacts on water quality would be greater than Alternative A and B's due to the increased land conservation (Alt. B & C) and a greater level of effort to reduce erosion and saltwater intrusion.

4.3.3 Impacts on Soils

Each of the alternatives would implement the following mitigation measure to protect soils:

- Establish erosion fences on construction sites when erosion is a concern. If heavy sediment deposits occur during construction in water, maintenance workers will use excavators to pull sediment and move it back into place.

The analysis below assumes implementation of this mitigation measure to protect soils.

Alternative A—No Action Alternative

Habitat conservation (of bottomland hardwood forest and other habitat) has beneficial effect on soils. Vegetation catches rainfall before it strikes the ground and roots hold the soils in place. Impacts from conserving natural habitats, which protect the soil surface and prevents erosion, would be largely beneficial, long-term, minor to moderate, and widespread. Over considerable time, conserving the protective cover provided by vegetation gives soils a chance to develop, improving both fertility and depth.

The following management activities, which would continue under Alternative A, could potentially have impacts on the Complex's soils: construction activities, road maintenance, prescribed fire and fire suppression, farming, public use facilities, wildlife foraging such as geese eat-outs and feral hog foraging, and habitat conservation. All but the last of these activities would have adverse effects on soils; the final (habitat conservation) would have a beneficial effect.

Construction activities (including excavation), road maintenance, farming, as well as some fire suppression and prescribed fire activities all have the potential to disturb, compact, or disrupt and move soils. This can happen by means of bulldozer blades, front-end loader buckets, tractor discs, or by means of treads or tires. These activities expose soils to potential wind and water erosion; however, the flat topography of the three refuges minimizes the risk of erosion and soil loss.

Geese eat-outs and feral hog foraging can disturb soils as well. Geese eat-outs happen when a large flock of wintering geese eats most or all of the vegetation in a confined area, exposing the soils beneath. A secondary factor is that their fecal matter would fertilize these same soils, and if not over-fertilized or "burned," this could assist in the recovery of vegetation on the site. The high feral hog population foraging across the refuges in many habitats causes widespread soil disturbance due to their particular feeding habits, namely their aggressive rooting behavior, which rips up extensive areas. While this is certainly damaging to vegetation and native plants, the amount of damage it causes to soils proper is unclear, because once more, the area's flat topography does not facilitate soils erosion and transport offsite. The Complex's ongoing efforts to control feral hog populations helps keep this potential damage in check.

Impacts from conserving Complex habitats and ground cover, which protects the soil surface and prevents erosion, would be largely beneficial, long-term, minor to moderate, and widespread. Over considerable time, conserving the protective cover provided by vegetation gives soils a chance to develop, improving in both fertility and depth.

Overall, Alternative A would lead to both adverse and beneficial effects on the Refuges' soils. Adverse effects would tend to be negligible to minor, localized to Complex-wide, and mostly short-term. Beneficial effects would be minor to moderate, Complexe-wide, and long-term.

Alternative B—Proposed Action

Under this alternative, a larger amount of land would be conserved, which would result in beneficial impacts to soils over a larger area.

Impacts that result from implementing refuge management activities would be similar those discussed under Alternative A; the type of impacts would be the same with varying degrees of soil disturbance depending on the amount and location of management actions. Overall, the impacts would be adverse and beneficial, negligible to minor, localized, and short term.

Alternative C

Impacts from implementing Alternative C would be similar but not identical to Alternatives A and B. The reduction in farming acreage at Brazoria NWR and elimination of farming at San

Bernard and Big Boggy NWRs would reduce the amount of soils subjected to the repeated stresses of discing, disturbance, exposure, fertilizers, and herbicide. Over time, subjecting soils to intensive agriculture tends to degrade them by reducing fertility, nutrient availability, and depth, and increasing compaction and possible contamination. The farming acreage is a small fraction of the total acreage of soils on the three refuges, but this would still constitute a reduced adverse impact on soils from the other two alternatives.

In general, under Alternative C, adverse effects (from reducing in farming acreage) would be less than Alternatives A and B, and beneficial effects (from habitat conservation) would be about the same. In summary, Alternative C is more beneficial than Alternatives A and B.

4.4 Biological Environment:

4.4.1 Impacts on Prairie Habitats

Alternative A—No Action Alternative

Under Alternative A, impacts on prairie habitats would result from the use of habitat management and restoration techniques (including prescribed fire and cooperative haying), mechanical and chemical treatments of invasive species, feral hog control, visitor and facilities use and management, and oil and gas development. Section 4.2 above describes impacts of oil and gas development.

The Complex would continue to prohibit grazing on all three refuges. The Complex would also continue to use mechanical, chemical, and prescribed fire treatments to control salt cedar, Chinese tallow, deep-rooted sedge, trifoliate orange and Japanese honeysuckle, and any additional invasive species on an as-needed basis. The Complex would conduct cooperative haying. Native prairie restoration activities would occur on Brazoria and San Bernard NWRs. These refuges would actively restore old fields and coastal prairie through a combination of chemical, mechanical, fire, and planting of native prairie seed. Once restored, they would use fire to maintain the habitat, mimicking natural fire regimes. Regular fires every few years can prevent the encroachment of woody plants that could eventually take over a prairie and replace it with scrub or woodland. The Complex would continue to control feral hogs through a variety of means including issue special use permits for feral hog hunting with the aid of hounds or trapping, collaborative youth hunts and aerial shooting . While this would not be enough to eradicate feral hogs from the Complex, it would help control their numbers and thus adverse impacts to native prairie habitats from the hogs' rooting behavior, which damages and destroys native prairie fauna.

Existing visitor use facilities and management/administrative infrastructure, including buildings, parking lots, trails, and over 50 miles of roads occupy land surface area. These developed lands represent a small fraction of the total area of the three refuges. Fragmentation and loss of coastal prairie habitat due to development is an issue in and around the refuges. The Complex addresses this issue through its acquisition and restoration programs, which provides unfragmented habitat for wildlife.

Overall effects from Alternative A on prairie habitats at the Complex would be both adverse and beneficial. However, the beneficial effects greatly exceed the adverse effects. Adverse effects would be minor, long-term, and localized to refuge-wide. Beneficial effects would be moderate, long-term, and refuge-wide.

Alternative B—Proposed Action

Under Alternative B, impacts on prairie habitat would result from the same actions and activities listed under Alternative A. However, Alternative B would be more beneficial than Alternative A as described below.

This management alternative would incorporate limited livestock grazing throughout the Complex as a management tool for specific issues, such as invasive species management (of both exotic species and aggressive native plants). San Bernard NWR would increase mechanical treatment to approximately 100 acres annually and increase use of prescribed fire to approximately 1,000 acres per year. Chemical application would continue to be the same as Alternative A. Feral hog management would continue as described in Alternative A. Brazoria NWR would increase the cooperative haying program up to 75 total acres to increase the wildland urban interface buffer area where it cannot implement prescribed fire due to the presence of houses adjacent to the refuge boundary.

The Complex would establish a one-mile long trail across from the Brazoria NWR Field Office to support other wildlife dependent recreational activities and would result in direct loss of less than an acre of prairie habitat. Other prairie restoration activities would be the same as Alternative A; however, Brazoria NWR would establish partnerships for native prairie seed harvest. Seeds would be collected from refuge prairies and used to restore other coastal prairie habitats on the refuge; approximately 600–800 acres of prairie annually.

San Bernard NWR would also implement monitoring on prairie restoration areas listed in Alternative A.

Overall, Alternative B would be more beneficial for prairie habitat than Alternative A.

Alternative C

Under Alternative C, impacts on prairie habitat would result from the same actions and activities listed under Alternatives A and B. However, Alternative C would be more beneficial for native prairies than either Alternative A or Alternative B, as described below.

The refuge would manage invasive species under Alternative C the same as Alternative B, but Brazoria NWR would allow limited bison grazing under Alternative C instead of livestock as a management tool for specific issues, such as invasive species or controlling aggressive natives. The refuge would manage grazing with bison on a year-round basis across the larger coastal prairies rather than seasonally as with livestock. Bison may be moved into a small part of a larger pasture using an electric fence to obtain the desired habitat outcome, for instance in a moist soil unit to control phragmites. Management of feral hogs would be the same as Alternative A; however, Brazoria and San Bernard NWRs would open refuges to a general feral hog hunt. Cooperative haying and prairie restoration would be the same as Alternative B.

However, Brazoria NWR would develop a seed bank on 500 acres of native prairie to collect and distribute native prairie seed to increase restoration efforts across the ecosystem to include off-refuge locations.

Overall, Alternative C would be more beneficial for prairie habitat than either Alternative A or Alternative B.

4.4.2 Impacts on Wetland and Aquatic Habitats

Alternative A—No Action Alternative

Many ongoing refuge management activities that would continue under Alternative A—including prescribed fire, restoration, management of invasive species, and provision of additional water—have beneficial and adverse impacts on wetland and aquatic habitats as described below.

The Complex would continue to use mechanical, chemical, and prescribed fire treatments to control salt cedar, Chinese tallow, deep-rooted sedge, and any additional species on an as needed basis. The Complex would continue to control feral hogs with various means, particularly aerial shooting in marsh and prairie habitats in and around wetlands. Brazoria NWR would continue to restore the wetland component of wet prairie mostly by reshaping and building up ditch borrows material. The refuge would install water control structures to manipulate water levels in the prairie. In addition, it would rebuild water delivery canals and levees around farm field/moist soil units to improve water management and movement capability across the units.

Brazoria and Big Boggy NWRs would continue to maintain irrigation canals on the refuges for water delivery and movement. They would capture freshwater from rice fields and provide wetland habitat below the rice fields. Brazoria NWR would continue to manage three irrigation wells. During drought situations, the small 4-inch pump at Teal Pond may provide the only freshwater in the Big Slough area. The Complex can also divert water from this pump to Teal, Olney, or Crosstrails Ponds. San Bernard NWR would continue to use two large irrigation wells regularly. The 8-inch well at Wolfweed is a backup to the Cedar Lake Creek diversion pump and the Refuge would use it when Cedar Lake Creek is salty. The refuge would use a 10-inch pump at Sargent to provide fresh water in the moist-soil units in the Pentagon Marsh, which is essential to providing freshwater in this salt marsh habitat.

All refuges on the Complex would continue to manage moist soil units and fields with a combination of draining and summer discing, using a stubble roller while flooded. The reservoirs are generally self-sustaining but may be drained and refilled with saltwater to control encroaching vegetation. Brazoria NWR would continue to manage 23 fields/ponds for freshwater habitats. San Bernard NWR would continue to maintain two reservoirs, eight moist soil units, and two ponds. Big Boggy NWR would continue to manage four moist soil units.

Existing administrative and public use roads and trails occupy a small fraction of the total area of wetlands across the three refuges. The Complex conserves additional wetlands and aquatic habitats through the acquisition program in addition to forested habitat.

Overall, Alternative A would result in both adverse and beneficial impacts on wetland and aquatic habitats. Adverse effects would be minor, long-term, and localized to refuge-wide. Beneficial effects from the actions described above would be moderate, long-term, and refuge-wide to widespread.

Alternative B—Proposed Action

Under Alternative B, both adverse and beneficial impacts on wetland and aquatic habitats would occur from the same actions and activities as under Alternative A. However, Alternative B would be more beneficial for wetlands and aquatic habitats than Alternative A due to the additional actions described below.

San Bernard NWR would increase mechanical treatment in salty prairie from 50 to approximately 100 acres annually and increase use of prescribed fire from 400 acres to approximately 1,000 acres per year. Chemical application would continue to be the same as Alternative A, which is less than 200 acres annually. Feral hog management would be the same as Alternative A. Water management would be the same as Alternative A; however, there would be drilling of additional wells and development of new/rehabilitated existing water control structures. The Complex would continue to purchase water on an as-needed basis, as described in Alternative A. Brazoria NWR would drill an additional well in Farm Fields. San Bernard NWR would rehabilitate two existing irrigation wells. Rehabilitation of these wells would involve clearing out the well and determining the reason for low water flow. The refuge would add one additional well for Mocassin and Rail Pond while Big Boggy NWR would add an irrigation well at McCoach Unit.

Big Boggy NWR would rehabilitate levee and water control structures at Matthes Pond and Mallard Pond. San Bernard NWR would rehabilitate levees and level the west and middle units of Wolfweed Wetlands to improve management capability. San Bernard NWR would explore expansion of Wolfweed Wetlands and increase management capabilities at Sargent Pentagon Marsh by establishing two additional moist-soil units totaling 120 acres and water canals. Brazoria NWR would construct water diversions along ditches and canals to capture more runoff water. The refuge would install lift pumps and check dams in drainage ditches. Big Boggy NWR would clean out existing water delivery canals and drainage ditches to increase freshwater availability.

Land conservation would benefit wetland and aquatic habitats. Many conserved tracts include conservation of waterways, and seasonally flooded swales. Bottomland forests filter surface and ground water, which improves water quality in waterways and basins, including the Bays and estuaries.

Impacts to wetlands and aquatic habitats would also include construction of a 600-foot boardwalk across from Brazoria NWR Field Office. Overall, Alternative B would be more beneficial for wetlands and aquatic habitats than Alternative A.

Alternative C

Alternative C includes the same management actions and activities that may affect wetlands and aquatic habitats both adversely and beneficially as Alternatives A and B.

Under Alternative C, management of water purchases, irrigation wells, ponds, reservoirs, moist soil units, and water delivery canals would be the same as Alternative B; however, Brazoria NWR would explore the option of purchasing water rights so that we would not have to rely heavily on annual water purchases from the water authority to flood seasonal wetlands. Brazoria NWR would also increase partnerships with Ducks Unlimited and Velasco Drainage District to increase freshwater availability through canal improvements. This will improve the Refuge's ability to manage wetlands for the benefits of waterfowl.

Overall, Alternative C would be more beneficial for wetlands and aquatic habitats than Alternatives A and B.

4.4.3 Impacts on Bottomland Hardwood Forests

Alternative A—No Action Alternative

Under Alternative A, the current levels and type of management activities for bottomland hardwood forests would continue. Current management includes restoring hydrology, planting of native hardwood species, allowing natural regeneration, and controlling invasive species. Restoring hydrology would ensure that bottomland hardwood forests have the levels of standing, flowing, and groundwater they need, and during the right seasons. Planting of native hardwood species would emphasize native species that offer benefits to wildlife, such as oaks. The Complex would continue to allow natural regeneration in those instances where staff judge that native species will predominate. Staff would also control invasive species to prevent them from displacing and outcompeting natives. Trail maintenance supporting public use (hunting, wildlife observation, wildlife photography, hiking) through bottomland hardwood forests result in minor, site-specific impacts.

The Complex maintains thousands of acres of bottomland hardwood forests, a disappearing habitat on the Texas Gulf Coast due to extensive urban, suburban, industrial, and agricultural development. Existing visitor use facilities and management/administrative infrastructure, including buildings, parking lots, and trails occupy land surface area. These developed lands represent a small fraction of the total area of bottomland forest.

Currently, emphasis in land acquisition focuses on bottomland hardwood forest and associated wetlands and prairie habitats. The Complex is currently working on updating the LPP to expand the acreage within the acquisition boundary from 28,000 to 70,000 acres. These additional acres would have a long-term beneficial impact to the bottomland hardwood ecosystem.

Overall, Alternative A's effects on bottomland hardwood forests would include both adverse and beneficial impacts, though the latter would far outweigh the former. Adverse impacts would be minor, long-term, and localized to refuge-wide. Beneficial impacts would be moderate, long-term, and widespread.

Alternative B—Proposed Action

Under Alternative B, the acreage of conserved bottomland forest would increase and therefore ensure that natural diversity is sustained across the ecoregion. The overall benefit of conserving additional bottomland habitat will ensure its preservation into the future. The hydrology is

preserved to the extent possible insuring future diversity of plants and animals. Overall, Alternative B's effects on bottomland hardwood forests would include both adverse and beneficial impacts, though again the latter would far outweigh the former. Overall, the net benefits for migratory birds associated with Alternative B would greatly exceed those of Alternative A.

The same management actions and activities that occur on existing bottomland hardwood forests under Alternative A would likely occur under Alternative B. Due to the costs and personnel required to maintain public use programs, these programs are limited to only a few tracts, where the use is at such a level that the benefit to the public to have trails, and other opportunities. Invasive species management is required to some level on all bottomland tracts. Nearly all tracts are intersected by pipeline, road, electrical line and other right-of-way easements. These are all conduits for invasive species and non-native species that threaten natural bottomland diversity.

Overall, Alternative B would be more beneficial, moderate, long-term and widespread than Alternative A.

Alternative C
Same as Alternative B.

4.4.4 Impacts on Migratory Birds

Alternative A—No Action Alternative
Alternative A would manage a variety of habitats for resting, feeding, and reproductive purposes for the benefit of migratory birds. Tools and techniques used on behalf of migratory birds would include prescribed fire, moist soil management, farming, research (primarily on mottled ducks, yellow and black rails, wintering and migratory songbirds), water management, and rookery management. These habitat management activities result in short-term adverse impacts (temporary disturbance and displacement) to resident wildlife; however, these impacts would be of short duration and the benefits of the resulting habitat improvements would outweigh these adverse impacts. Each of these management tools/techniques would be used explicitly to maintain and restore habitats that would benefit migratory waterfowl, neotropical migrants, and other migratory birds. Prescribed fire would maintain open habitats and encourage vigorous growth that foraging birds use. The Complex manages moist soil management and farming specifically to provide carbohydrate and protein-rich foods for wild birds, which are important in helping them gain weight and strength while they are wintering on the Complex. Water management provides water to habitats and makes them more beneficial to migratory birds, both as sources of food and places to loaf, rest, and breed. Research helps generate knowledge and information that would lead to better resource management and decision-making on behalf of migratory birds. Rookery management protects known and active rookery sites for colonial nesting water birds from disturbance during the nesting season.

Under this alternative, there would also be certain adverse impacts from disturbance associated with public use programs, including hunting. The presence of hunters and other humans may agitate and disturb flocks of birds, placing them under energetic and psychological stress. Hunting will remove waterfowl from the population both directly through take and indirectly

through wounding. Even wildlife watchers may inadvertently scare off large flocks of wintering geese, ducks, and other water-associated birds, causing them to use energy unnecessarily when they need to be feeding, resting, adding weight, and strengthening themselves for their long journeys northward to breeding grounds. These adverse impacts would be short-term to long-term, negligible to minor, localized but also potentially widespread throughout the central flyway.

Overall, Alternative A would have both beneficial and adverse effects. The beneficial effects from many different management efforts and actions would be moderate, long-term, and widespread. The adverse effects would be short-term to long-term, negligible to minor, localized but also potentially widespread.

Alternative B—Proposed Action

Like Alternative A, Alternative B would also manage a variety of habitats for resting, feeding, and reproductive purposes for the benefit of migratory birds, using the same tools and techniques discussed above.

Alternative B would also carry out additional actions that would affect migratory birds beneficially including the conservation of additional lands. To reduce erosion and saltwater intrusion, Alternative B would increase the types and amounts of structural and restoration techniques used. This alternative would increase the acreage of haying, increase the number of rehabilitation projects, and increase prairie restoration. It would incorporate additional moist soil units into the farming rotation at Brazoria NWR. Alternative B would drill additional wells on the Complex; these would provide additional water for irrigation and increase water management capacity on moist units and wetlands. This alternative would also develop new and rehabilitate existing water control structures. In order to manage invasive flora, it would increase the types and amounts of management prescriptions used, including limited and targeted livestock grazing. These combined habitat conservation, management, and restoration actions would have short-term adverse impacts (disturbance and displacement) during project implementation, but would generally benefit a wide variety of migratory birds, from waterfowl to shorebirds and wading birds in the long-term.

Adverse impacts from hunting and other public uses would be the same as Alternative A: short-term to long-term, negligible to minor, localized but also potentially widespread.

Overall, the net benefits for migratory birds associated with Alternative B would exceed those of Alternative A.

Alternative C

As Alternatives A and B, Alternative C would also manage a variety of habitats for resting, feeding, and reproductive purposes, are benefiting migratory birds. Alternative C would use the same tools and techniques as the other two alternatives. However, it reduces the acreage dedicated to farming from 1,000 to 500 acres. Alternative C converts the reduction of 500 acres in farming back to prairie habitat, which would in turn reduce the amount of food and forage production for migratory and wintering waterfowl, and thus, the ability of the Complex to

support the same large waterfowl numbers for extended periods. This would represent a minor to moderate, long-term, widespread adverse impact for migratory birds.

Overall, Alternative C would generate both adverse and beneficial impacts on migratory birds. Adverse impacts would result from both public use disturbance as well as a reduction in farming acreage and would be minor to moderate, long-term, and widespread. Beneficial impacts would result from prescribed fire, moist soil management, some farming, research, water management, and rookery management. These benefits, like those of Alternatives A and B, would be moderate, long-term, and widespread.

4.4.4 Impacts on Resident, Native Wildlife

Alternative A—No Action Alternative

Existing habitat management practices that support current populations and diversity of resident native wildlife would continue under Alternative A. These management practices include: constructing and using a variety of structural and some restoration techniques at various locations to decrease erosion and saltwater intrusion; controlling invasive plant species with mechanical, chemical, and prescribed fire treatments; hunting and trapping to control feral hogs; baiting and broad scale treatments to control non-native fire ants; rehabilitating wetlands and farm lands; restoring native prairie habitat; haying and farming (both cooperative and force account); restoring prairie pothole hydrology as opportunity arises; using established wells to provide freshwater to moist soil units during drought periods; purchasing water from various water authorities annually; and restoring previously drained wetlands. Since all of these actions would continue under this alternative, current levels of wildlife diversity and abundance should also continue through the life of the CCP.

Implementation of these management actions can result in minor short-term adverse impacts such as temporary disturbance and displacement of native wildlife; however, management specifically designed these actions to improve habitat conditions for the benefit of wildlife. Reducing erosion and saltwater intrusion would protect freshwater areas and marshes from conversion to brackish and salt marshes. A variety of vertebrates and invertebrates depend on the maintenance of fresh water areas. Controlling invasive flora and fauna precludes or minimizes the displacement of native species. Cooperative haying helps maintain grasslands and stimulates growth of edible, nutritious shoots. Many native species forage on the Complex's farmlands. Restoring pothole hydrology would provide water and valuable edge habitat for a number of prairie and wetlands species. Irrigating moist soil units during drought periods would maintain their usefulness as important foraging grounds for many species of waterfowl, wading birds, marsh birds, and shorebirds.

Under Alternative A, no appreciable changes in populations or species diversity are expected. Wildlife population and habitat management on the Complex already renders considerable benefits for resident, indigenous wildlife, and these benefits would continue under this alternative. The adverse impacts from disturbance associated with public use programs such as wildlife observation, wildlife photography, and hunting (including direct mortality of white-tailed deer), all of which bring people into relatively close proximity to wildlife, which would be negligible to minor, short-term to long-term, localized to widespread.

Overall net impacts on resident, native wildlife from Complex management under Alternative A would continue to be moderate beneficial, long-term, and widespread.

Alternative B—Proposed Action
Under Alternative B, the Complex would implement the same management activities as those described under Alternative A, except at different levels and intensities. Additional conservation of lands, increased habitat management and restoration efforts would result in greater short-term adverse impacts (disturbance and displacement during project implementation). However, by increasing invasive species control, reducing erosion, restoring habitat, and improving hydrology on the Complex, it would tend to provide for greater benefits to resident, native wildlife than those of Alternative A. Adverse impacts from public use-related disturbance would be negligible to minor, short-term to long-term, localized to widespread, as they are with Alternative A.

Overall, Alternative B's net impacts on resident, native wildlife would be more beneficial than Alternative A's.

Alternative C
Under Alternative C, management of invasive species would use more diverse strategies and perhaps be more effective, to the benefit of native wildlife. In this alternative, increasing water availability through the development of partnerships and purchase of water rights, expanding wetlands, restoration of 500 acres of fields to native prairies, and rehabilitating marshes would all tend to benefit wildlife more than in Alternative B. Adverse impacts from disturbance associated with public use would be negligible to minor, short-term to long-term, localized to widespread, as they are with Alternative A.

Overall, Alternative C's net effects on resident, native wildlife would be more beneficial than Alternative B. These impacts would be moderate, beneficial, long-term, and widespread.

4.4.5 Impacts on Threatened and Endangered Species

Alternative A—No Action Alternative
Table 3-8 in Chapter 3 of the CCP is a list of federal and state threatened and endangered species, as well as species of concern, that are expected to occur within Brazoria, Matagorda, Fort Bend, and Wharton Counties. Within the Complex, the only federally listed species known to occur are the piping plovers, green sea turtle, and Kemps ridley sea turtle. In addition, the Complex has found loggerhead, hawksbill, and leatherback-stranded sea turtles on area beaches. The Complex would continue to implement the Sea Turtle Recovery Plan and would support all sea turtle recovery efforts by patrolling area beaches for stranding and nests. The Complex would continue to restrict refuge beaches from vehicular traffic to protect these species. The Complex will continue to excavate all nests and transfer them to the incubation site at Padre Island National Seashore, and live turtles would be transferred to the NOAA recovery facility in Galveston.

The San Bernard beach is designated critical habitat for piping plovers. The Complex will continue to conduct plover surveys on area beaches and protect designated critical habitat.

The Complex provides potential habitat for Attwater's prairie chicken and the whooping crane, but do not currently occur in the Complex. All the federally listed species would continue to be protected under the Endangered Species Act and any projects that could potentially impact listed species would undergo Section 7 Consultation prior to any ground disturbing activities. Overall, the effects of Alternative A on federally threatened and endangered species would be beneficial, moderate to major, long-term, and widespread.

Alternative B—Proposed Action

Each of the actions and impacts for listed species anticipated for Alternative A would also occur with Alternative B. In addition, under Alternative B, there would be potential benefits to the federally endangered whooping crane and the APC, if these species re-establish populations on the Complex. Both of these species occur on refuges nearby and are the focus of major sustained federal recovery programs. If these reintroductions occur, the Complex would then implement APC and whooping crane recovery plans.

The Complex would begin monitoring for the potential reintroduction of APC and whooping crane. In preparation for a potential APC reintroduction, the Complex would monitor habitat conditions; conduct research on burning regimes, grazing, and cooperative haying; and collect baseline data on insect populations. The Complex is listed a potential reintroduction site for whooping crane, but since the Complex is outside of the whooping crane flyway, the Complex would play only a small role in this recovery effort. Monitoring would include baseline data on freshwater availability and blue crab populations.

Overall, the effects of Alternative B on federally threatened and endangered species would also be beneficial, moderate to major, long-term, and widespread. With additional efforts on behalf of two other endangered species—the APC and the whooping crane—this alternative would be more beneficial than Alternative A.

Alternative C

Alternative C's actions and effects on threatened and endangered species would be the slightly more than Alternative B: beneficial, moderate to major, long-term, and widespread.

4.5 Human Environment

4.5.1 Impacts on Local Population and/or Economy

Alternative A—No Action Alternative

The Complex would continue to implement current management programs and no change in refuge staff would be required. The economic and social condition of the area would remain the same. The presence and operation of the refuges provides economic benefits to the surrounding communities within a 30-mile radius in several ways. The Complex attracts local, national, and some international visitors and by attracting visitors to the area, the refuges generates revenue for the local economy. Much of the Complex's annual budget is recycled into local businesses through Complex staff salaries and purchases of equipment and supplies, as well as contracts for local labor to accomplish refuge projects. The annual Complex budget is roughly 2.8 million dollars. The Complex provides full-time employment for 28 individuals and up to 12 temporary

or part-time staff (primarily high school and college students), that live in nearby communities. Special project funds for restoration through grants, private and corporate donations add an additional $500,000 to the economy annually as projects to restore and enhance refuge habitats are implemented by the refuge and partners on refuge lands.

Although the refuge does not pay taxes to the counties, Revenue Sharing does provide some off-set for the loss of taxes. These represent important contributions to the coffers of local governments. As such, expenditures and profits associated with these programs are important inputs to the economy of the local community.

Spending by approximately 75,000 annual visitors to the Complex generates economic activity throughout the local economy in terms of income, jobs, and tax revenue (Carver and Caudill, 2007). Extrapolating from economic studies conducted for other Region 2 national wildlife refuges, total expenditures related to Complex visitation could reach some two million dollars annually, with up to several dozen jobs generated by and dependent on these expenditures. This is a positive and important contribution to the local economy, but it is quite small in comparison with the total annual income, employment, and tax bases of Brazoria, Matagorda, and Fort Bend counties, in which the three refuges of the Complex are located.

Under Alternative A, the economic benefits would continue at current levels. The impact of Complex operation and visitation on the local economy would be beneficial, minor, long-term, and widespread.

Alternative B—Proposed Action

Economic impacts of Alternative B would be greater than Alternative A, commensurate with the proposed increase in Complex programs, actions, staffing, budget, and spending under this alternative. In addition, the populations of the Texas Gulf Coast and Houston metro areas are projected to continue growing for the near future. This would likely result in an increase in visitation to the Complex and associated visitor spending, which is a stimulus for the local economy, contributing jobs, income, and tax revenues. Relative to the enormous local economy, these socioeconomic benefits would be small, but still tangible and appreciated.

The loss in tax revenue to the counties would occur with additional land acquisition. Prior to 2010, the counties on average received 43 percent of what the maximum payment could be through the Refuge Revenue Sharing Program. This percentage decreased significantly in 2010 due to the decision not to supplement revenue funds with general tax revenue funds by Congress, through their efforts to reduce the Federal Budget. The Service's land acquisition benefits the economy by sustaining land values at current and rising levels. In addition, funds generated from land sales are available for other economic benefits to the landowner.

Under Alternative B, the impact of Complex operations and visitation on the local economy would be beneficial, minor, long-term, and widespread.

Alternative C

Economic impacts of Alternative C would also be beneficial, and exceed those of Alternative A, due to the increased staffing, budget, and visitation at the Complex. The elimination of

cooperative farming would reduce economic benefits to one individual farmer but impacts to the local economy from this reduction would be negligible. The Complex expects the proposed addition of grazing to offset this effect. In addition, under this alternative the Complex would have greater short-term expenditures on larger projects to reduce erosion and saltwater intrusion. Like Alternative A and B, the net effect of Alternative C on the local economy would be would be beneficial, minor, long-term, and widespread under this alternative as well.

4.5.2 Impacts on Aesthetic and Visual Resources

Alternative A—No Action Alternative

Habitat management actions that remove vegetation, disturb soils, and use heavy equipment (prescribed burning, invasive species control, habitat restoration, etc.) can be visually unattractive in the short-term (during project implementation); however, in the long-term these actions restore and improve habitat quality and should result in a more aesthetically pleasing landscape. Existing erosion control structures, including revetment geotubes and oyster domes, can detract from aesthetics.

Under Alternative A, the Complex would continue to protect tens of thousands of acres of open space, including scenic habitats such as bottomland hardwood forests, coastal marshes, prairies, and farmland. In an area of the state and the Gulf Coast that is developing rapidly and that already has substantial industrial, commercial, and residential footprints, the maintenance of this aesthetically pleasing open space is a great benefit of the Complex.

Proposed maintenance (no new construction planned) of infrastructure under Alternative A is on a small scale and would not have more than negligible, short-term, localized adverse effects on visual resources within the Complex. Long-term impacts will depend on the design, location, and context of the new facilities. Overall, the Complex expects the impacts of its facilities, operations, and visitation on aesthetic and visual resources to be beneficial, moderate, long-term, and widespread.

Alternative B—Proposed Action

Under Alternative B, the same actions that take place under Alternative A would also occur, but to different extents. There would be an increase in prairie restoration and management activities such as mechanical treatments and prescribed fire, as well as construction of one new trail, a new office at San Bernard NWR, and construction of new maintenance and storage buildings at Brazoria and San Bernard NWRs. Increased erosion control would further detract from aesthetics along the GIWW. Short-term impacts would be the same as Alternative A, but overall long-term impacts would be more beneficial than Alternative A due to increased restoration and management and the augmented effort to acquire and protect more riparian corridors and bottomland hardwood forest.

Alternative C

Under Alternative C, the San Bernard will construct an office and visitor center instead of the office/visitor contact station proposed under Alternative B on San Bernard NWR. The impacts will be the same (same location and project footprint) as described under Alternative B.

4.5.3 Impacts on Public Use Opportunities

Alternative A—No Action Alternative

Under Alternative A, current opportunities for hunting, fishing, wildlife observation and photography, environmental education and interpretation on the Complex would all remain the same. The Complex identified these six wildlife-dependent activities as priority public uses of national wildlife refuge in accordance with the Improvement Act.

Section 4.2 discusses fishing; each of the alternatives would have the same effect on fishing opportunities on the Complex.

Alternative A would maintain existing hunting opportunities, including waterfowl and feral hog and white-tailed deer. The Complex would allow waterfowl hunting in designated areas of all three refuges. One permit area and ATV use is allowed for disabled hunters at the Sargent Unit of San Bernard NWR. There would also be a youth-only hunt allowed for feral hogs on Brazoria and San Bernard NWRs in cooperation with TYHP. Feral hogs/white-tailed deer hunting opportunities for youth will continue at San Bernard NWR in cooperation with TPWD-Stringfellow WMA. Maintaining existing public hunting opportunities on the Complex would continue to be a benefit to the public. The impact of Alternative A on hunting opportunities would be beneficial, moderate, long-term, and localized.

Alternative A would maintain current wildlife observation and photography opportunities and facilities. Brazoria and San Bernard NWRs would remain open to wildlife observation; visitors would be directed to designated public use areas. Bird watching is the most popular form of wildlife observation and would likely remain so in the future. Most birders visit during the cooler months of November through March when large concentrations of waterfowl are present and readily observable. The spring and fall bird migrations are also popular for viewing neo-tropical songbirds. Brazoria NWR would maintain its auto-tour route through the Big Slough Recreation Area, which contains a number of wildlife viewing areas and stations as well as a couple of nature trails. San Bernard NWR would also maintain its wildlife drive, trails, and observation platforms, which offer outstanding views of geese, ducks, shorebirds, marsh birds, and wading birds. San Bernard NWR would also maintain a photo blind at Hudson Woods. Wildlife observation and photography are two of the big six wildlife-dependent public uses identified in the Improvement Act as being generally compatible with the purposes of national wildlife refuges. Alternative A would maintain existing wildlife observation and photography opportunities on the Complex, which would be a benefit. Thus, impacts of Alternative A on wildlife observation and photography would be beneficial, moderate, long-term, and widespread.

Under Alternative A, the environmental program on the Complex would continue to provide opportunities for both children and adults to learn about the Complex and natural habitats of the Texas Gulf Coast. The education programs improve the quality of the visitor's experience and provide them with a better understanding of the benefits, issues, and challenges of natural resource conservation in the coastal ecosystem. The program meets local and State of Texas education standards, allows professional development for teachers, provides community-based service organization programs, meets youth group merit badge requirements, and instills a sense of stewardship and understanding of conservation issues.

The Discovery Center at Brazoria NWR is the focus of the Complex's active environmental education program. Its classroom/lab, outfitted with stereomicroscopes and a video microscope projector, is a highlight for visiting students and adults. The DEEP currently serves approximately 3,000 students annually. A partnership exists between the Friends of Brazoria NWR and area school districts to help with the financial impacts of the program expansion. The Complex has an MOU with the Brazosport Independent School District for this program. To help accommodate increases in demand for the program, workshops would be available to train teachers to lead their students through a high quality outdoor experience.

At San Bernard NWR, DEEP currently serves approximately 500 students, and this alternative would maintain this level. Activities would continue to occur primarily at the Hudson Woods Unit, making use of a small building (Discovery Outpost), the entrance road, and various trails. Habitats studied are bottomland hardwood forest and freshwater marsh.

Alternative A would maintain existing opportunities for interpretation on the Complex. The Complex would continue to hold one annual 3-day event (Migration Celebration). Other interpretive opportunities are present and would continue along wildlife drives, at observation points, and at the Brazoria NWR visitor contact station.

The Complex would continue to tailor messages and delivery methods to specific audiences and present them at the Discovery Center and other locations. Interpretation enhances opportunities for a quality visitor experience on the refuges and promotes visitor understanding for America's natural resources. Visitors would continue to make their own connection with natural resources through talks, publications, brochures, fact sheets, species lists, signs, interpretive panels, and exhibits. Exhibits would continue to be easy to read, understand, and accessible.

Current levels of wildlife observation, photography, environmental education, and interpretation would continue and the Complex would maintain facilities that support these activities. The impacts of continuing these activities throughout the Complex would be beneficial, moderate, long-term, and widespread.

Alternative B—Proposed Action

In general, under Alternative B, the Complex would augment wildlife-dependent recreation opportunities.

Alternative B would provide a new youth waterfowl hunt and revise the schedule at two locations. Potentially opening Eagle Nest Lake on San Bernard NWR to waterfowl hunting would be an additional benefit. Alternative B would offer more hunting opportunities than Alternative A. Overall benefits of Alternative B for hunting would be moderate, long-term, and localized.

Under this alternative, the Complex would increase wildlife observation opportunities by constructing new wildlife observation facilities. Brazoria NWR would provide a viewing area on Otter Slough (possibly a boardwalk across the slough) and establish pull off points along FM2004, at the Farm Fields, and on CR 227. San Bernard NWR would add photo blinds at the Dow Woods Unit and Brazoria NWR would add photo blinds to the Big Slough area. Because

of these new facilities for both wildlife observation and photography, Alternative B would be more beneficial than Alternative A, but overall impacts would be basically the same (moderate, long-term, and widespread).

Alternative B would allow bicycles on the trails a Hudson Woods. This would increase opportunities for visitors to access remote areas along Oyster Creek. Based on current levels of bicycle use on other areas of the refuge conflicts between users are not anticipated.

Alternative B would expand the environmental education program into additional school districts. Brazoria NWR and San Bernard NWR would expand outreach by contacting local media outlets, radio, and Web sites to provide information on the DEEP program, events, and refuge purposes. We would provide a one week day camp focused on the "at-risk" group of kids (Boys and Girls Club, etc.). The DEEP program at Brazoria NWR would expand to include one additional school district (Angleton/Danbury school district).

The DEEP program at San Bernard NWR would expand to include two additional school districts (Van Vleck/Bay City and Columbia). San Bernard NWR would also like to develop a partnership with Brazosport College at the Dow Woods Unit, enabling them to use the area as an outdoor classroom. Overall then, with respect to environmental education, Alternative B would be more beneficial than Alternative A, but overall impacts would be basically the same (moderate, long-term, and widespread).

Alternative B would expand the interpretive program at a variety of refuge venues on a monthly basis. Across the Complex, interpretive activities would include day and night naturalist walks and audio/visual presentations conducted by staff and volunteers. Brazoria NWR would also construct an information kiosk along FM2004. Due to this expanded program, Alternative B would be more beneficial than Alternative A, but overall impacts on interpretation would be the same (moderate, long-term, and widespread).

Alternative C

In general, public uses under Alternative C tend to be similar to or more expansive than those of Alternative B.

Alternative C proposes a new hunt for white-tailed deer on bottomland units (San Bernard NWR). This alternative would also change the Sargent Unit waterfowl lottery hunt to an open, walk-in hunt and modify the timing of the hunt by decreasing the hours of allowed hunting (morning hunt instead of all-day hunt). Overall effects of Alternative C with respect to hunting opportunities on the Complex would be more beneficial than those of Alternative B. Alternative C would be beneficial, moderate, long-term, and localized.

Proposed facilities and opportunities for wildlife observation and photography, as well as expansion of environmental education, under Alternative C would be the same as Alternative B. Therefore, the effects on these activities would be the same as well (beneficial, moderate, long-term, and widespread).

Under Alternative C, interpretation would be the same as in Alternative B. The effects would also be very similar: beneficial, moderate, long-term, and widespread.

4.5.4 Impacts on Visitor Use Facilities:

Alternative A—No Action Alternative
All visitor use facilities and related infrastructure, including roads, kiosks, trails, boardwalks, observation decks, and visitor centers/contact stations would be maintained. The impact of Alternative A on visitor use facilities would be moderate, beneficial, long-term, and widespread.
Alternative B—Proposed Action
There would be additional benefits under Alternative B from expanded visitor use facilities such as signs, trails, a visitor contact station, and a new kayak and canoe launch on Cedar Lake Creek at San Bernard NWR, additional photo blinds, trails, and a boardwalk on Brazoria NWR. Allowing bicycle use of the dirt trails at Hudson Woods may cause rutting which could require additional maintenance to make the trail safe and accessible to all visitors.

Alternative C
There would be even more additional benefits from those of Alternative B due to a new visitor center at San Bernard NWR and a new kayak and canoe launch.

4.6 Assessment of Cumulative Impacts:

A cumulative impact is defined as an impact on the environment that results from the incremental impact of the [proposed] action when added to other past, present, and reasonably foreseeable future action regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

Cumulative impacts are the overall, net effects on a resource that arise from multiple actions. Impacts can “accumulate” spatially, when different actions affect different areas of the same resource. They can also accumulate over the course of time, from actions in the past, the present, and the future. Occasionally, different actions counterbalance one another, partially cancelling out each other’s effects on a resource. But more typically, multiple effects add up, with each additional action contributing an incremental impact on the resource. Accurately summarizing cumulative effects is difficult in that while one action increases or improves a resource in an area, other unrelated actions may decrease or degrade that resource in another area.

As stated in the Service Manual (550 FW 1 and 2), in an EA, a cumulative impact assessment should be conducted if it is determined necessary through scoping to make a determination of significance of the proposed action. When a cumulative effects analysis is included in an EA, the analysis need only be sufficient for the decision maker to reach a conclusion on the significance of the impact in order to determine if the preparation of an EIS is required.

This section addresses the potential cumulative effects for all the alternatives and is intended to consider the activities on the Complex in the context of other actions on a larger spatial and temporal scale. The current resource conditions (Affected Environment) reflect the impacts of

past and present actions that have taken place on the Complex as described in Chapter 3 of the CCP. Earlier parts of this EA discuss the impacts of proposed future actions (for all alternatives). The adverse direct and indirect effects of current refuge management and the proposed actions (all alternatives) on air, water, soil, habitat, wildlife, the local economy and population, and aesthetic/visual resources are expected to be mostly negligible to moderate and short-term to long-term. The benefits to habitat, wildlife, and public use that the proposed action would achieve greatly outweigh any of the adverse impacts discussed in this document. The Service also considered past, present, and future planned actions on other state, federal, and private lands surrounding the Complex. The section below provides an analysis area for potential cumulative effects on each resource and a summary of those potential impacts.

Cumulative Impacts on Physical Resources

Air Quality

A substantial amount of heavy industrial activity is present within the multi-county region south of Houston. Both permitted and unpermitted releases of a wide variety of pollutants and contaminants have a substantial impact on air quality in the region. These organic and inorganic chemicals would have an adverse impact on air quality and ecosystems within the Complex, but these precise effects have not been extensively studied or documented. Barge and boat traffic along the GIWW, pipelines, Houston airports, and the traffic of millions of residents in the metropolitan area all have substantial negative impacts on air quality. While the Complex's implementation of periodic prescribed fires during times when this is permitted would temporarily add smoke to the regional air shed; overall, the presence of the Complex's nearly 100,000 acres of natural habitat would help serve to ameliorate adverse effects on air quality of hundreds of other human activities and processes in the region.

Air quality is always a concern on the Complex, which is located within 60 miles of one of the most industrialized and populated areas in the United States. Hundreds of refineries and chemical plants occur in surrounding counties as well as the Freeport/Clute industrial center. Approximately 60 natural gas and coal power plants, some of the nation's largest shipping ports, two major airports several regional airports, and one military base also surround the Complex. The Houston area has nearly 5 million inhabitants as well as a sprawling urban commuter population in one of the largest industrial complexes in the country.

Projects on the refuge that affect air quality would be consistent with the minimal effects produced in the past (as described in section 4.3.1 of this EA). When compared to the magnitude of industrialization occurring in areas surrounding the Complex, the effects of refuge management actions are negligible. In all alternatives, the prescribed burning program, construction, and maintenance activities and increased visitor use would essentially have the same adverse effects to refuge air quality, while the preservation of native bottomland hardwood habitat would have long-term benefits to air quality by limiting local development and increasing carbon sequestration. These adverse and beneficial impacts, however, would not be cumulatively significant.

Water Management and Quality

Increasing population in the region, along with greater urban, commercial, and industrial development would all tend to increase the extent of adverse effects on water quality in and

around the Complex by increasing discharges from point and non-point sources of water pollutants and contaminants.

As the area has grown and developed, the increasing diversion and drainage of water from shallow channels and bayous upstream of the Complex have occurred as flood control measures. This has cumulatively reduced the amount of water flowing into the Complex refuges and is a long-term threat to both aquatic and wetland habitats.

The GIWW is a major source of erosion, leading to saltwater intrusion and the subsequent degradation of freshwater marshes. This project affects all three refuges in the Complex.

E. coli (fecal coliform bacteria) from untreated wastewater, whether from an increase in ranching activity or improperly controlled septic system releases, affects both primary (contact) and secondary recreational activities involving contact with the water. This affects both the Brazoria and San Bernard NWRs. It has led to periodic closures of both boating and fishing activities along the San Bernard River.

All of the above activities, actions, and trends have had adverse implications for water quality and quantity in the area. These large detrimental influences work against and offset the refuges' largely beneficial impacts on water quality and quantity, from conserving more than 100,000 acres of marsh, prairie, riparian, and bottomland hardwood forest. In view of these increasing adverse pressures on water quality and quantity, which are likely to continue to increase in the near future, the Complex's positive effects on water resources become even more important. However, the net cumulative effect on water resources in the coming decades would probably be more negative than positive. At the end of the 15-year planning period, the overall condition of water resources on the Complex as a result of cumulative effects is likely to be less than at present, with less water and lower water quality. These impacts, however, would not be cumulatively significant.

Soils

Rapid population growth and associated development in the multi-county region cause the development and covering of soils in the greater Houston area and Texas Gulf Coast at a rapid rate. As the population of an area grows, it converts soils that formerly supported agriculture and natural habitats to roads and streets, residential, commercial, institutional, and industrial areas. Instead of supporting biologically productive ecosystems, the soils beneath all these developments support buildings and structures. In this regional context, the soils of the Complex have an even greater importance.

Past, present, and reasonably foreseeable future impacts to soils on the Complex would stem mostly from activities on the Complex itself, rather than from activities occurring outside of the three refuges. Refuge management activities would result in effects on soils as discussed in earlier parts of this EA, including ground disturbance from crop cultivation, prescribed fires and wildlife suppression, and construction, which can result in erosion and sedimentation. Over years of farming a site, its soils are also subject to nutrient loss and declining soil fertility, which the Complex can compensate for to some extent by extensive application of nitrogen and phosphate fertilizers (See Table 3-7, Applications for Invasive Target Species Applications).

While there would be some application of herbicides, both to agricultural soils and other sites, currently, herbicides tend not to be persistent or accumulate in the environment. However, continuous use of these chemical compounds would mean that residues of a number of herbicides would continue to occur in soils throughout the lifetime of the CCP.

Effects from other ground disturbance activities off-refuge are likely to remain at roughly the same level as they are currently. The Complex implements farming under organic practices, which allow for maintaining soil nutrients without the use of fertilizers, pesticides, herbicides, and constant crop propagation and harvesting. Alternatives A, B, and C, which propose similar amounts of construction and other management activities, would have similar effects to soils. Oil and gas operations vary seasonally depending on the industry. The refuge has some facilities on the south unit and there are a number of facilities and pipelines outside the refuge boundaries. The refuge does not own the mineral rights; therefore, the potential for additional oil and gas operations is always possible. There could be potential cumulative impacts on soil quality if oil and gas operations increase in the future.

Overall, cumulative effects on soils (from all alternatives) would be a mix of minor adverse and minor to moderate, beneficial. Adverse cumulative effects would probably occur to those soils that are regularly or continually subjected to some form of disturbance. The Complex does not anticipate these adverse effects to be major. Minor to moderate, beneficial effects on soils would be expected to occur at those sites constituting the great majority of the area of the refuges, whereupon undisturbed soils would continue to develop (slowly increasing in depth as well as fertility) as a result of nearly continuous vegetative cover. These adverse and beneficial impacts, however, would not be cumulatively significant.

Cumulative Impacts on Biological Resources

In general, the area considered for the cumulative impacts on biological resources is the Gulf Coast Prairies and Marshes Ecoregion, unless otherwise specified below. Chapter one of this EA discussed ecoregion issues such as fragmentation, commercialization, urbanization, disturbance, and habitat conversion, which influence, impact, and threaten biological resources on the Complex.

Prairie Habitats

Impacts on prairie habitats from the management actions under all three alternatives would be generally beneficial, long-term, moderate, and widespread. There would also be some adverse impacts from implementation of refuge management activities, construction and maintenance of refuge infrastructure, and visitor use, but these adverse impacts would be minor in comparison to the beneficial effects.

Other private and public prairie conservation and restoration efforts in the region contribute to long-term beneficial cumulative impacts on prairie habitats. The Katy Prairie Conservancy (KPC) was established in 1992 to conserve Katy Prairie west of Houston. This prairie encompasses more than 1,000 square miles and is bordered by the Brazos River on the southwest, pine-hardwood forest on the north, and Houston on the east. Historically, Katy Prairie was a poorly drained tall-grass prairie subject to periodic fires; it also included a substantial area

of wetlands. The aim of the KPC is to protect between 30,000–60,000 acres of Katy Prairie both in its current agricultural state, with portions enhanced as wetlands and restored prairie habitat.

The Nature Conservancy owns Nash Prairie, north of West Columbia; this will be the Complex's biggest partner in prairie conservation and restoration. Nash Prairie is a 300-acre parcel of native Texas Coastal Prairie. Nash Prairie has never been grazed or farmed. Except for the encroachment of invasive species (notably Chinese tallow), it represents the Texas Coastal Prairie as it existed centuries ago at the time of European contact. To date, the Service has identified almost 300 plant species at Nash Prairie, with 14 considered rare.

There is also the Pierce Ranch west of Wharton, partnering with Texas RICE, restoring and constructing wetlands and prairies. TPWD has a prairie initiative as well; its action plan calls for identifying critical habitats of Texas Coastal Prairie.

In combination, these and other initiatives will have a generally beneficial, cumulative effect on restoration of prairie habitats in the wider region. The Complex would be contributing to these positive impacts. When compared to the magnitude of impacts on prairie habitats occurring outside of the Complex, these beneficial impacts would not be cumulatively significant.

Wetland and Aquatic Habitats

Continuing development in and around the refuges will continue to adversely affect the Complex's wetland and aquatic habitats through alteration of the hydrologic regime. In general, there will be less water flow to the refuges in the future, which could subject wetland and aquatic habitats to moisture stress.

Long-term cumulative impacts from the Complex's proposed management actions on wetlands and aquatic habitats would be moderate, beneficial, and widespread across the Complex. Adverse cumulative impacts from habitat fragmentation due to visitor use and management infrastructure would be minor and localized to widespread. When compared to the magnitude of impacts on wetland and aquatic habitats occurring outside of the Complex, the impacts from proposed management activities (all alternatives) would not be cumulatively significant.

Bottomland Hardwood Forests

The Complex partners with the NRCS on conservation easements that include management, conservation, and restoration of bottomland hardwood forests, as part of the Wetlands Reserve Program. The TPWD is acquiring bottomland hardwood forest in these counties as well. In addition, there are two WMAs and one state park in Complex counties and one state park, Columbia Bottomlands. In combination, all of these joint efforts will increase the acreage and quality of protected bottomland forests along the Texas mid-coast. Against these positive conservation trends is the general population growth and residential, commercial, and industrial development occurring in the wider region between the Gulf Coast and Houston.

The Complex maintains thousands of acres of bottomland hardwood forests, which is disappearing due to extensive urban, suburban, industrial, and agricultural development. The impacts from management of bottomland hardwood forests (under all alternatives) would be both beneficial (due to land acquisition and protection) and adverse (due to development, use, and

maintenance of visitor use and administrative infrastructure) as described in section 4.4.3. These impacts, however, when compared to impacts on bottomland hardwood forest outside of the Complex, would not be cumulatively significant.

Migratory Birds

Under each of the alternatives, effects on migratory birds from proposed management actions would be beneficial, long-term, moderate to major, and widespread. Under this alternative, there would also be certain adverse impacts from disturbance associated with public use programs, including hunting. Adverse impacts from the disturbance of visitor use activities would be short-term to long-term, negligible to minor, localized but also potentially widespread. None of these impacts would be cumulatively significant.

These actions on the Complex are a small part of a number of integrated efforts to manage migratory birds on the flyway, continental, and hemispheric scales, as described in Chapter 1 of the CCP. The Complex contributes to and collaborates with waterfowl management efforts by the Service and a number of states and Canadian provinces in the Central Flyway. The North American Waterfowl Management Plan (NAWMP) seeks to restore waterfowl populations in Canada, the United States, and Mexico to levels recorded in the 1970s. This international partnership has worked to identify priority habitats for waterfowl and has established goals and objectives for waterfowl populations and habitats. Regional partnerships, called joint ventures, are the implementing mechanisms of the NAWMP. The Texas Mid-coast Complex is situated within the Gulf Coast Joint Venture.

The North American Bird Conservation Initiative (NABCI) seeks to ensure the long-term health of North America's native bird populations by increasing the effectiveness of existing and new bird conservation initiatives, enhancing coordination among the initiatives, and fostering greater cooperation among the continent's three national governments and their people. In 1999, the U.S. NABCI approved a framework for delineating ecologically-based planning, implementation, and evaluation units for cooperative bird conservation in the U.S. and Canada known as Bird Conservation Regions (BCRs). BCRs are ecologically distinct regions in North America with similar bird communities, habitats, and resource management issues.

Partners in Flight (PIF) is a cooperative effort involving partnerships among numerous governments and NGOs concerned about neotropical migrants and other birds. Partners in Flight was created in 1990 in response to growing concerns about declining populations of many land bird species and to emphasize the conservation of birds not covered by existing conservation initiatives. Bird conservation plans, are developed in each region to identify species and habitats most in need of conservation, to establish objectives and strategies to provide needed conservation, to establish objectives and strategies to provide needed conservation activities, and to implement and monitor progress on the plans. This North American Landbird Conservation Plan summarizes the conservation status of landbirds across North America, illustrating broad patterns based on a comprehensive, biologically-based species assessment. The Texas Mid-coast NWR is within PIF Physiographic Area #6, the Coastal Prairies.

PIF Landbird Conservation Plan-Gulf Coastal Prairie (2008) covers the BCR #37, the Gulf Coastal Prairie. This plan selected and developed conservation recommendations for four

species of concern, and one suite of species, with expectations that actions proposed would benefit a number of species with similar habitat requirements. The selected species are seaside sparrow, northern bobwhite, loggerhead shrike, Le Conte's sparrow, and a suite of warblers (Cerulean, Swainson's, and goldenwinged) which represent neotropical migrants that use Gulf Coast stopover habitat.

The U. S. Shorebird Conservation Plan, adopted in 2001, seeks to stabilize populations of all shorebirds that are in decline because of factors affecting habitat in the United States. At a regional level, the plan's goal is to ensure that shorebird habitat is available in adequate quantity and quality to support shorebird populations in each region. This plan considers 53 species of shorebirds. Twenty of these species at risk listed in this plan occur on the Complex.
In addition to these continent-wide and international plans, Texas has a number of initiatives. At the state level, there are a number of initiatives in Texas that have positive cumulative consequences for migratory birds, including the Texas Comprehensive Wildlife Conservation Strategy (2005), Land and Water Resources Conservation and Recreation Plan (2005), Texas Wetlands Conservation Plan (1997), Austin's Woods Conservation Plan (1997), and Seagrass Conservation Plan for Texas (1999). While these do not focus primarily on migratory birds, their implementation would still provide long-term, cumulative benefits for them.

Finally, the Complex is located within the Service-designated Gulf Coast Prairies and Marshes Ecoregion, which is the subject of intra-Service collaborative conservation efforts.
In combination, all of the foregoing efforts should improve the prospects for many migratory birds species at all scales, from local to hemispheric. However, these efforts confront a wide variety of threats to migratory birds at all scales. Most of these are threats to habitats where the birds breed in the spring and summer months (in more northerly areas) and where they winter (in more southerly areas), as well as crucial stopover habitats that migratory birds need when they are in transit between summer and winter ranges. Habitat conversion, degradation, and fragmentation from diverse human activities, including urbanization, agriculture, logging and forestry, mining, and hydroelectric development, all on a vast scale, threaten populations of migratory birds species. Whether long-term cumulative impacts trend negative or positive varies by species, and there are hundreds of migratory bird species in question.

Resident, Native Wildlife

Regionally, the Complex anticipates increased habitat loss and fragmentation to occur in the coming 15 years from the general, long-term increase in population and development within the central Gulf Coast region of Texas. In general, such habitat loss and fragmentation would be detrimental to populations of most, but not all, species of resident, native wildlife. Reduced populations of wildlife outside of the Complex may or may not affect the size and viability of populations on the Complex.

Under all alternatives, there would be long-term benefits to resident native wildlife due to the habitat protection provided by the Complex. Overall, cumulative impacts on resident, native wildlife from Complex management under the three alternatives would be moderate, beneficial, long-term, and widespread. There would also be adverse impacts from disturbance associated with public use programs, but these impacts would be negligible to minor, short-term to long-

term, localized to widespread. None of these impacts, however, would be cumulatively significant.

Threatened and Endangered Species

The protection of habitat provided by the Complex would result in a benefit to long-term conservation of threatened and endangered species. All alternatives would beneficially impact federally threatened and endangered species known to occur on Complex (piping plovers, green sea turtle, and Kemps ridley sea turtle) due to habitat protection, species surveys, and monitoring. These beneficial impacts would be moderate to major, long-term, and widespread. Alternatives B and C would provide greater benefits to additional species than Alternative A, with the potential reintroduction of the whooping crane and the APC. These impacts, however, would not be cumulatively significant.

Recent years have witnessed a slow trend toward the overall recovery of populations of both piping plovers and sea turtles. The Complex expects this cumulative trend to continue over the coming 15 years, and the Complex will continue contributing to the recovery of these species. Neither the APC nor the whooping crane now occur on the Complex, but if generally positive trends continue with regard to their recovery, they may possibly occur, or relocation efforts may be focused inside the boundaries of the Complex, within the timeframe of this CCP. With regard to the whooping crane, the Complex would therefore participate in continuing efforts to re-establish other flocks, migratory and non-migratory, of this highly endangered bird.

Cumulative Impacts on the Human Environment

Based on the analysis presented earlier in this chapter, the Service has concluded that there would be no significant cumulative impacts on the human environment from proposed refuge management actions, when considered in context with other state, federal, and private actions (as summarized below), all management alternatives have similar impacts and conclusions.

Local Population and/or Economy

As a result of projected population and economic growth in the region over the coming 15 years, overall cumulative economic impacts would continue to be beneficial. The Complex would continue to contribute positive, if relatively minor, economic effects on the region.

Aesthetic and Visual Resources

Aesthetic and visual resources in the region surrounding the Complex are rapidly diminishing due to residential development, urbanization, and other ecoregional issues. The Complex has an overall beneficial effect on aesthetic and visual resource in this area where open space and natural beauty are diminishing.

Hunting

As in most states, there is a long-term, generalized decline in hunting participation in Texas, even as the state's population (and thus the number of potential hunters) continues to grow very rapidly. While a number of factors undoubtedly contribute to this, the rising cost of hunting on private land may be growing prohibitively expensive for much of the public, decreasing its ability to actually participate in hunting, if not the desire or demand to hunt. Under these circumstances, the importance of public lands and wildlife habitat to hunters, such as those available on the Complex, cannot be understated. However, if hunting demand or participation

on the Complex were to increase greatly, as a result of declining opportunities elsewhere, this excessive competition could eventually decrease the quality of the hunting experience available on the Complex.

Wildlife Observation and Wildlife Photography

There are a growing number of other formal and informal opportunities for wildlife observation in the region. The City of Freeport is developing wildlife observation areas in marsh habitats alongside Hwy 36. Two county parks offer additional opportunities for both observation and photography. The Gulf Coast Bird Observatory, outside of Lake Jackson and Quintana, encourages wildlife observation. TPWD has established the Coastal Birding Trail. Brazos Bend State Park, west of Rosharon, covers roughly 5,000 acres, with an eastern boundary fronting on the Brazos River. Visitors may view and photograph wildlife from a nature trail and hike bike/foot trails. The City of Lake Jackson has a wilderness park. The Complex will contribute to these long-term, cumulatively beneficial effects related to wildlife observation opportunities in the region. However, even as these formal facilities and opportunities increase, an expected decrease in the amount of overall wildlife habitat present due to the area's continuing growth and development (and associated habitat conversion) may reduce the amount of wildlife actually available for viewing and photography.

Environmental Education

Environmental Education (EE) is also taking place at other sites in the region, so that the Complex contributes to a beneficial cumulative effect from all of these combined efforts. The Texas Master Naturalists Chapter does EE programs out of the INEOS facility, east of Brazoria NWR; it focuses on marsh ecology. The Chevron/Phillips plant provides EE opportunities at Flag Pond, north of Sweeney. TPWD does EE focused on fisheries at Sea Center Texas, located in Lake Jackson.

Interpretation

Within the larger region, each of the sites mentioned above under "Wildlife Observation and Wildlife Photography" also offers interpretive opportunities. Thus, the Complex would be playing an integral role in growing opportunities for nature and wildlife interpretation around the region.

Visitor Use Facilities

No outside forces or factors would cause or contribute to cumulative effects on these facilities.

4.7 Short-Term Uses versus Long-Term Productivity

The Complex dedicates the habitat protection and management actions under the proposed alternative to maintaining the long-term productivity of refuge habitats. The benefits of this plan for long-term productivity far outweigh any impacts from short-term actions, such as the construction of observation towers and a visitor center, or creation of new trails. While these activities would cause short-term negative impacts, the educational values and associated public support gained from the improved visitor experience would produce long-term benefits for the ecosystem.

Inventory and monitoring refuge resources is an essential part of ensuring long-term productivity. Resources are impacted by a variety of natural influences, including climate and storm events. Adding additional stressors through public use opportunities, oil and gas development, and short-term construction activities can have detrimental effects if coupled with other stressors. The Refuges ability to manage habitats, control short-term disturbance and buffer uncontrollable events will enable population sustainability. Within the limited public use areas at each refuge, it is expected that repetitive disturbance and infrastructure does impact populations. However, by limiting the area of impact, the refuge hopes to obtain a balance between providing opportunities for visitors and meeting the needs of wildlife.
Therefore, implementing the proposed alternative would lead to long-term benefits for wildlife protection and land conservation that far outweigh any short-term impacts.

4.8 Unavoidable Adverse Effects and Mitigation Measures

All action alternatives may have some unavoidable adverse impacts. The Complex expects the impacts described below to be minor and/or short-term in duration. The Complex would attempt to minimize these impacts wherever possible. The following sections describe the measures the Complex would employ to mitigate and minimize the potential impacts that could result from implementation of the proposed action.

Water Quality from Soil Disturbance and Use of Herbicides
The Complex expects foot traffic on new foot trails to have a negligible impact on soil erosion. To minimize the impacts from public use, the Complex would include informational signs that request trail users to remain on the trails, in order to avoid causing potential erosion problems.

Long-term herbicide use for exotic plant control could result in a slight decrease in water quality in areas prone to exotic plant infestation. Through the proper application of herbicides, however, the Complex expects this to have a minor impact on the environment, with the benefit of reducing or eliminating exotic plant infestations.

Wildlife Disturbance
Disturbance to wildlife is an unavoidable consequence of any public use program, regardless of the activity involved. The Complex would design all of the public use activities proposed under the proposed alternative to minimize levels of impact.

Vegetation Disturbance
Negative impacts could result from the creation and maintenance of trails that require the clearing of non-sensitive vegetation along their length. The Complex expects this to be a minor short-term impact. The Complex would minimize this impact by installing informational signs that request users to stay on the trails.

Other Unavoidable and Adverse Impacts
Potential development of the Complex's buildings, trails, and other improvements could lead to minor short-term negative impacts on vegetation, soils, and some wildlife species. When building the administrative facilities, the Complex would make efforts to use recycled products

and environmentally sensitive products and would build the facility in the same footprint as the current administrative offices. Projects to remove man-made impoundments and other infrastructure would be done using best management practices and areas would be restored through planting of native prairie grasses. All construction activities would comply with the requirements of Section 404 of the Clean Water Act; the National Historic Preservation Act; Executive Order 11988, Floodplain Management; and other applicable regulatory requirements.

4.9 Irreversible and Irretrievable Commitment of Resources:

Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that this use could have on future generations. Irreversible effects primarily result from the use or destruction of specific resources that cannot be replaced within a reasonable period, such as energy or minerals. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action, such as extinction of a threatened or endangered species or the disturbance of a cultural resource. None of the alternatives would result in a large commitment of nonrenewable resources. Project implementation would require the irretrievable commitment of fossil fuels (diesel and gasoline), oils, and lubricants used by heavy equipment and vehicles. In addition, management actions in this document will require a commitment of funds that would then be unavailable for use on any other Service projects. At some point, commitment of funds to these projects would be irreversible, and once used, these funds would be irretrievable. The Service would implement best management practices to minimize potential impacts.

Table EA 4-2. Summary of Environmental Effects by Alternative

Environmental Resource	Alternative A: Current Management/ No Action Alternative	Alternative B: Proposed Action Alternative	Alternative C
Impacts on Air Quality	• Impacts from prescribed fire would be adverse, short-term, minor to moderate, and localized to widespread • Impacts from farming and vehicular operation would be adverse, short-term, negligible to minor, and localized • Impacts from habitat conservation and management would be beneficial, long-term, minor to moderate, and widespread.	• Adverse impacts greater than Alternative A, but still considered adverse, short-term, minor to moderate, and localized to widespread. • Impacts from additional habitat conservation and management would be more beneficial than Alternative A, long-term, moderate, and widespread.	• Adverse impacts from the same actions are approximately the same as Alternative B. • Impacts from additional habitat conservation and management would be greater than Alternative A & B, long term, moderate, and widespread

Impacts on Water Resources	• Adverse impacts on water quality from farming and invasive control using herbicides are likely to be negligible to minor, localized, and short-term. • Habitat conservation efforts and erosion control measures would be beneficial, moderate, long-term, and widespread.	• Adverse impacts greater than Alternative A's, negligible to minor, localized and short-term. • Beneficial impacts would greater than Alternative A's, due to increased habitat conservation.	• Fewer adverse impacts on water quality than Alternative B due to reduced farming. • Overall adverse impacts would be negligible to minor, localized, and short-term. • Beneficial impacts would be greater than Alternative A's due to the habitat conservation and a greater level of effort to reduce erosion and saltwater intrusion.
Impacts on Soils	• Both adverse and beneficial effects. • Adverse effects would tend to be negligible to minor, localized to Refuge-wide, and mostly short-term. • Beneficial effects would be minor to moderate, Refuge-wide, and long-term.	• Same as Alternative A.	• Better than Alternatives A and B due to reduced impacts on soils from farming.
Impacts on Prairie Habitats	• Both adverse and beneficial effects but beneficial effects exceed adverse. • Adverse effects would be minor, long-term, and localized to Refuge-wide. • Beneficial effects would be moderate, long-term, and Refuge-wide.	• More beneficial than Alternative A.	• More beneficial than Alternatives A and B.
Impacts on Wetland and Aquatic Habitats	• Both adverse and beneficial impacts on wetland and aquatic habitats. • Adverse effects would be minor, long-term, and localized to Refuge-wide. • Beneficial effects from the actions described	• More beneficial than Alternative A.	• More beneficial than Alternative A and probably more beneficial than Alternative B.

	above would be moderate, long-term, and Refuge-wide to widespread.		
Impacts on Bottomland Hardwood Forests	• Effects would be both adverse and beneficial with beneficial impacts outweigh the adverse impacts. • Adverse impacts would be minor, long-term and localized to Refuge-wide. • Beneficial impacts would be moderate, long-term, and widespread.	• Same as Alternative A.	• Same as Alternative A.
Impacts on Migratory Birds	• Both beneficial and adverse effects. • Beneficial effects from many different management efforts and actions would be moderate, long-term, and widespread. • Adverse effects would be short-term to long-term, negligible to minor, localized but also potentially widespread.	• More beneficial than Alternative A.	• Both adverse and beneficial impacts. • Adverse impacts would result both from public use disturbance as well as a reduction in farming acreage and would be minor to moderate, long-term, and widespread. • Beneficial impacts would result from prescribed fire, moist soil management, some farming, research, water management, and rookery management and would be moderate, long-term, an widespread.
Impacts on Resident, Native Wildlife	• Net impacts would be beneficial, moderate, long-term, and widespread.	• Net impacts would be more beneficial than Alternative A's.	• Net effects would be more beneficial than Alternative B. • These impacts would be moderate, beneficial, long-term, and widespread.
Impacts on Threatened and Endangered Species	• Net impacts would be beneficial, moderate to major, long-term, and widespread.	• More beneficial than Alternative A.	• Same as Alternative B.

Impacts on Cultural Resources	• Continue to protect cultural resources under NHPA and Section 106 consultations with TX SHPO. • Impacts would be beneficial, minor to moderate, long-term and localized to widespread.	• Same as Alternative A.	• Same as Alternative A.
Socioeconomic Impacts	• Impact of Complex operations and visitation on the local economy would be beneficial, negligible to minor, long-term, and widespread.	• Likely greater than Alternative A.	• Likely greater than Alternative B.
Impacts on Aesthetic and Visual Resources	• Impacts would be moderate, beneficial, long-term, and widespread.	• Short-term impacts would be the same as Alternative A • Long-term impacts would be more beneficial than Alternative A due to stepped-up restoration and management and the augmented effort to acquire and protect more riparian corridors and bottomland hardwood forest.	• The impacts will the same (same location and project footprint) as described under Alternative B.
Impacts on Hunting	• Impact would be beneficial, moderate, long-term, and localized.	• More beneficial than Alternative A.	• Overall benefits same as Alternative B. • New hunt for white-tailed deer on bottomland units (San Bernard NWR) would increase public benefits of this alternative. • Change Sargent Unit waterfowl lottery hunt to open, walk-in hunt and modify timing.
Impacts on Fishing	• Impact would be moderate, beneficial, long-term, and widespread.	• Same as Alternative A.	• Same as Alternative A.
Impacts on Wildlife	• Impact would be	• Slightly more beneficial	• Same as Alternative B.

Observation	beneficial, moderate, long-term, and widespread	than Alternative A because of new facilities development.	
Impacts on Wildlife Photography	• Impact would be moderate, beneficial, long-term, and widespread.	• Slightly more beneficial than Alternative A because of new photography opportunities (e.g., photo blinds).	• Same as Alternative B.
Impacts on Environmental Education	• Impact would be moderate, beneficial, long-term, and widespread.	• More beneficial than Alternative A due to expansion into additional school districts.	• Same as Alternative B.
Impacts on Interpretation	• Impact would be moderate, beneficial, long-term, and widespread.	• More beneficial than Alternative A due to expanded program.	• Same as Alternative B.
Impacts on Visitor Use Facilities	• Impact would be moderate, beneficial, long-term, and widespread.	• Additional benefits from expanded visitor use facilities such as signs, trails, visitor contact station, and boat launches.	• Additional benefits from those of Alternative B from new visitor center at San Bernard NWR and boat launches.

5.0 CONSULTATION, COORDINATION, AND DOCUMENT PREPARATION

5.1 Document prepared by:

Please refer to Appendix I in the Plan

5.2 References

Allain L., Malcolm V, Johnston S, Patton D, Stewart Sr. RE, Milam N. Brochure. 1999. Paradise Lost? The Coastal Prairie of Louisiana and Texas. U.S. Government Printing Office. Plamplet. 732 North Capitol St. NW • Washington, DC. 2003. 39 pp

Cahoon, D.R., J. W. Day and D. J. Reed. 1999. The influence of surface and shallow subsurface soil processes on wetland elevation, a synthesis. Current Topics in Wetland Biogeochemistry 3: 72-88.

Carver, Erin and James Caudill 2007. Banking on Nature 2006: The Economic Benefits to Local Communities of National Wildlife Refuge Visitation. Division of Economics, U.S. Fish and Wildlife Service, Washington, DC. September.

Collins, S., Collins S.L. 1990. Fire in North American Tallgrass Prairies. University of Oklahoma Press. 82-98 pp.

Cowardin, L. M., V. Carter, F. C. Golet, E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. Jamestown, ND: Northern Prairie Wildlife Research Center Online. http://www.npwrc.usgs.gov/resource/1998/classwet/classwet.htm (Version 04DEC98).

Dai, X.; Boutton, T.W.; Hailemichael, M. 2006. Soil carbon and nitrogen storage in response to fire in a temperate mixed-grass savanna. Journal of Environmental Quality 35: 1620-8pp.

Fang, X., and H.G. Stefan. 1998. "Temperature Variability in the Lake Sediments ." Water Resources Research, 34(4), 717-729.

Fahrig, L. 2003 Effects of habitat fragmentation on biodiversity. Annu. Rev. Ecol. Evol. Stsm. 34:487-515.

Gauthreaux, Dr. S.A. 2002. Radar Ornithology and the Conservation of Migratory Birds. Clemson University. 6pp.

Hatch SL, Schuster JL, and Drawe DL. 1999. Grasses of the Texas Gulf Prairies and Marshes. 1st ed. College Station (TX). Texas A&M University Press. 1999. 355 pp.

Schuman, G.E., J. D. Reeder, J. T. Manley, R. H. Hart and W. A. Manley. 1999. Impact of Grazing Management on the Carbon and Nitrogen Balance of a Mixed-grass Rangeland. Ecological Applications 9 (1)- 65-71 pp.

Texas Climate Initiative. 2011. http://texasclimate.org/. Accessed February 14, 2011.

U.S. Fish and Wildlife Service. 2009. Texas Mid-coast Refuge Complex: Trends and Predicted Sea Level Rise Impacts to Coastal Wetlands. Southwest Region, Albuquerque, NM. 37 pp.

U.S. Fish and Wildlife Service. 2009 b. U.S. Fish and Wildlife Service, National Wildlife Refuge System. Managing Invasive Plants: Concepts, Principles and Practices. Available online at: http://www.fws.gov/invasives/staffTrainingModule/methods/chemical/practice.html.

West, B. C., A. L. Cooper, and J. B. Armstrong. 2009. Managing wild pigs: A technical guide. Human-Wildlife Interactions Monograph 1:1–55.

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United States Fish and Wildlife Service
Environmental Action Statement

Within the spirit and intent of the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (NEPA), and other statutes, orders, and policies that protect fish and wildlife resources, I have established the following administrative record and determined that the action of implementing the Texas Mid-coast National Wildlife Refuge Complex Comprehensive Conservation Plan is found not to have significant environmental effects as determined by the attached *Finding of No Significant Impact* (following) and the *Comprehensive Conservation Plan and Environmental Assessment*.

for Joy E Nicholopoulos

Dr. Benjamin N. Tuggle, Regional Director
U.S. Fish and Wildlife Service, Region 2

9/12/13
Date

Jennifer Sanchez, Project Leader
Texas Mid-coast National Wildlife Refuge Complex

4-12-2013
Date

Aaron Archibeque, Regional Chief
NWR System, Region 2

9/11/13
Date

Carol A. Torrez

Carol Torrez, NEPA Coordinator
Division of Planning, Region 2

9/10/13
Date

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FINDING OF NO SIGNIFICANT IMPACT

ENVIRONMENTAL ASSESSMENT FOR THE TEXAS MID-COAST NATIONAL WILDLIFE REFUGE COMPLEX COMPREHENSIVE CONSERVATION PLAN U.S. FISH AND WILDLIFE SERVICE

The U.S. Fish and Wildlife Service (Service) has developed a Comprehensive Conservation Plan (CCP) and Environmental Assessment (EA) for the Texas Mid-coast National Wildlife Refuge Complex (Complex) located in Brazoria, Matagorda, Fort Bend and Wharton Counties, Texas. The CCP provides management direction for present and future refuge managers of the Brazoria, Big Boggy and San Bernard National Wildlife Refuges (NWRs) for the next 15 years. The Complex took a landscape-scale approach in preparing the CCP, identifying issues and threats to the ecosystem including climate change, erosion/saltwater intrusion, fragmentation, urbanization and development, and loss of natural processes such as fire in maintaining natural habitats. The CCP describes management activities that occur on the refuges and provides management goals, measurable objectives, and strategies designed to enhance and protect existing habitats for the benefit of wildlife. The goals and objectives shall guide management toward the Complex's vision or the ecologically desirable outcome across the refuges. The CCP also identifies wildlife observation, interpretation, photography, and other wildlife-dependent recreation opportunities; development of compatible facilities; habitat and wildlife management; and implementation of related programs.

An EA was completed to fulfill the requirements of the National Environmental Policy Act (NEPA) of 1969 and to inform the public of the possible environmental consequences of implementing the CCP for the Complex. Three alternatives were evaluated and analyzed for potential impacts on the natural and human environment. The EA was prepared to provide decision-making framework that 1) explores a reasonable range of alternatives to meet project objectives, 2) evaluates potential issues and impacts to the refuge, resources and values, and 3) identifies mitigation measures to minimize the degree or extent of these impacts.

ALTERNATIVES CONSIDERED AND ANALYZED

Alternative A: Current Management (No Action Alternative)

This alternative is the baseline for comparison with the action alternatives because it does not involve change from current management programs and emphases. It represents biological management, land conservation and public use activities presently occurring and those that have occurred on the Brazoria, Big Boggy and San Bernard NWR during the last 10 or so years. Activities such as prescribed fire, wildlife management, cooperative farming, wetland management, photography, interpretation, environmental education, hunting, and fishing would continue without any major changes.

Under Alternative A, the Complex would continue land conservation only under the existing Austin's Woods Conservation Plan, which limits acquisition to 28,000 acres. The Service currently has one pending acquisition which when acquired will complete the authorization limit. No further acquisition would occur within the scope of the Austin's Woods Conservation Plan.

The coastal prairie and salty prairie habitats across the Complex will be managed with prescribed burning and haying on a limited scale. The Brazoria NWR would continue Cooperative Farming on about 1,000 acres and moist-soil management on nearly 1800 acres. The San Bernard NWR would continue to provide a 10 acre rye field near the headquarters and moist-soil management on about 1,200 acres including the Pentagon Marsh and Wolfweed Wetlands. Big Boggy NWR would continue to manage about 300 acres of moist-soil managed wetlands and maintain the 90 acre rye field. Native prairies would be restored across the Complex, treating invasive species with herbicide, burning, and dispersing seed.

Forests would be allowed to restore naturally and could be supplemented with seedling planting. Drained wetlands within the bottomlands would be restored. Forested habitats on the refuge will be protected from additional fragmentation.

Dune and beaches will be managed within the Open beaches act, limiting vehicle access above the high-tide line.

Wildlife management activities; including the implementation of the Sea Turtle Recovery Plan will continue. The Complex will manage all habitats to benefit a diversity of native and migratory wildlife providing for resting feeding, and reproductive needs. Feral hog control will continue as outlined in the 2004 Plan allowing issuance of Special Use Permits, aerial shooting and public hunts to control local populations. Treatment of local populations of red-imported fire ants will occur within the rookeries. Treatment of mosquito populations on the refuges are prohibited.

Recreational opportunities would continue with the six wildlife-dependent recreation uses that include hunting, fishing, wildlife observation, photography, interpretation, and environmental education throughout its Public Use Areas. The refuge would also continue to provide opportunities for some recreational uses that are supportive of the six uses mentioned above. These uses include hiking, bicycling, and boating. No entrance fee is currently charged.

Alternative B: Proposed Action

This alternative would provide for a proactive approach to making concerted strategic decisions, through the consideration and analysis of the best available science, based on the goals for management of the Complex. This alternative was developed based on input received from the public, Texas Parks and Wildlife Department (TPWD), ecoregion partners, Service staff, Service biological and visitor services reviews, and the professional judgment of the planning team. This alternative is based on successful pre-existing management strategies and has incorporated ecological principles that apply to the Coastal Prairie and Marshes Ecoregion.

This is the alternative that would best achieve refuge purposes, vision, and goals and would best contribute to the National Wildlife Refuge System mission. Alternative B, with associated goals, objectives, and strategies, comprises the CCP for the Texas Mid-coast National Wildlife Refuge Complex. This alternative would also stress the use of adaptive resource management based on observation and the most current scientific research.

Under Alternative B the San Bernard NWR would acquire and conserve lands in accordance with the 2012 Land Protection Plan (Appendix I in CCP) of up to 70,000 acres within the Columbia Bottomland Ecosystem. Conserved lands may include bottomland forest, riparian, open water and coastal prairie habitats within the original Austin's Woods Conservation Project Area Boundary. The Service will continue to work with conservation partners, working toward maintaining the integrity of this isolated and threatened ecosystem.

The Service will include grazing by domestic cattle as a management tool to promote the fire-grazing interaction that historically occurred and increase diversity and health in the prairie environment. Additional acreage would be incorporated under the haying program. The cooperative farm fields/moist soil units would be increase 200 acres for a total of 1200, of which 400 acres would be planted annually. Water wells would be drilled to provide ground water to supplement rainfall, and purchased water and provide freshwater wetlands.

Forests will be managed as in Alternative A but the Service would work cooperatively with the Texas General Land Office to provide additional protection on the San Bernard Beach.

The Complex would implement inventory and monitoring programs to evaluate habitat for the potential reintroduction of both the Attwater's Prairie Chicken and the Whooping Crane. Phorid flies which are a natural predator of the red-imported fire ant could be released on the Complex.

Recreational opportunities would improve its six priority public uses through increased information, signage, and facilitation by refuge staff. The Complex would also improve the uses that are supportive of the six priority public uses in a similar manner. Consideration of charging an entrance fee was withdrawn from this alternative; no entrance fee will be charged.

Alternative C

Alternative C is based on input received from the public, TPWD, ecoregion partners, Service staff, and biological and visitor services reviews. This alternative responds to the issues of habitat management for greater public access throughout the refuge. Alternative C is generally a "more of" alternative than Alternative B. Alternative C departs from Alternative B by allowing for bison grazing rather than domestic cattle grazing in the management of the prairie grasslands.

In addition Alternative C would reduce the cooperative farming acreage from 1000 to 500 acres, allowing 500 of former field to be restored to native coastal prairie. Alternative C would allow for the Service to manage a portion of the prairie as a seed bank for prairie restoration projects off the refuge.

DECISION: THE SELECTED ALTERNATIVE

Alternative B was selected over the other alternatives because it best meets the Complex's vision for the future, the purposes for which the refuge was established, and the habitat, wildlife, and visitor services goals identified in the CCP. This alternative is the basis for the Comprehensive Conservation Plan and describes how habitat objectives will be accomplished through a combination of management activities to encourage ecological integrity, improve or maintain habitats for native and migratory wildlife and provide for recreational opportunities. Future

management actions will have a neutral or positive impact on the local economy and the recommendations in the CCP will ensure that refuge management is consistent with the mission of the National Wildlife Refuge System and U.S. Fish and Wildlife Service.

SUMMARY OF EFFECTS

Implementation of the Service's decision would be expected to result in environmental, social and economic effects as outlined in the CCP/EA and summarized here. The CCP describes habitat management, wildlife management, and land conservation objectives that would result in improved habitat conditions. The proposed recreational opportunities would result in enhanced experiences for refuge visitors.

The San Bernard NWR would continue to expand in accordance with the 2012 Land Protection Plan. Lands may be acquired if a willing seller or donor becomes available and acquired through fee title acquisition or conservation easement. Conservation would allow beneficial minor to moderate and long-term effects to air, water, soil and habitats and wildlife.

Refuge management activities (prescribed burning, farming, moist-soil management, invasive species control, new construction, etc.) would result in short- and long-term negligible to moderate, both adverse and beneficial impacts to soils, air, water, habitat, and wildlife as described in the EA; however, the long-term impacts are expected to be beneficial. These habitat management activities would mimic heterogeneous conditions created by the historic fire-grazing interaction and healthy landscape conditions. Alternative B would benefit and improve habitat quality on the refuge's prairie grasslands.

The refuge would increase some public uses and facilities in this alternative. However, any additions to public use opportunities would be small and produce only a minor effect on habitats. New facilities would remain within the already developed footprint so as to prevent habitat loss. Short-term wildlife and habitat disturbance may occur during construction of additional facilities. The public use management actions and associated facilities improvements might have a negative though minor negative impact on habitat at the local scale but would also have a beneficial effect to public use opportunities on the widespread scale. All public use actions help the Complex and the National Wildlife Refuge System meet habitat and wildlife related outreach and education goals at a local to widespread scale. Public use improvements will allow for increased public use due to the growing metropolitan area and improve the quality and management of those opportunities. The increased opportunities for wildlife-related recreational opportunities on the refuge would also have beneficial impacts on the local economy through increased visitation and revenue.

Disturbance to wildlife at some level is an unavoidable consequence of any public use program, regardless of the activity involved. Obviously, some activities innately have the potential to be more disturbing than others. The management actions to be implemented have been carefully planned to avoid high levels of impact. As currently proposed, the known and anticipated levels of disturbance associated with management actions are considered minimal and well within the tolerance levels of know wildlife species and populations present in the area.

Implementing the Service's management action is not expected to have any significant adverse effects on wetlands and floodplains, pursuant to Executive Order 11990 and 11988, because there would be no development of refuge facilities within wetland or floodplain areas. There would be no adverse effect on threatened, endangered, proposed or candidate species and/or critical habitat, as documented in the intra-service Section 7 (Endangered Species) Consultation completed with the Clear Lake Ecological Services Field Office and signed on September 21, 2012. In addition, archeological and/or historical resources would not be impacted.

The Complex considered other past, present, or reasonably foreseeable future planned actions and no significant cumulative impacts would result from the addition of the proposed refuge management actions, as outlined in Alternative B.

PUBLIC OUTREACH, REVIEW AND COMMENT

Development of the Texas Mid-coast NWR Complex CCP has been coordinated with all interested and/or affected parties.

Formal scoping began with publication of a Notice of Intent to prepare a CCP and EA, which was published in the *Federal Register* on June 23, 2009 (Volume 74, Number 119, pp. 29714-29715). When the Notice of Intent was published, the team distributed a Planning Update requesting public feedback and informing community members of upcoming public scoping meetings. The planning team solicited public comments on rRefuge issues to aid in CCP development through three open house meetings held the week of September 14, 2009. Forty-one participants attended these meetings.

The Planning Team held an ecoregion-wide coordination meeting at the Brazoria NWR Discovery Center December 2, 2009, to gain a better understanding of the issues within the Gulf Coast Prairie and Marshes Ecoregion, where the Complex is located, and to determine the Complex's role in addressing issues impacting fish, wildlife, and their habitats within the larger landscape. Seventeen participants attended this meeting.

The Complex also met with the State (TPWD) on February 9, 2010 to solicit feedback on past, present and future management concerns across the Complex.

In preparation for developing a Land Protection Plan for the Austin's Woods Conservation Project, three public meetings were held in January and February, 2012. A total of 30 people attended the public meeting. In addition the local newspaper published two articles about the meetings and comment period. A total of 27 comments were received, 22 supporting the project expansion and five did not.

Comments were solicited on the draft CCP and the EA for the Complex from August 15, 2012 to September 20, 2012. The public was notified of the release of the draft CCP and the EA through the Notice of Availability on August 15, 2012 (77 FR 158, pp. 49011-49015) and again on August 21, 2012 (77, FR 162, pp. 50523-50524), through local media outlets, and public notices were posted at all refuge offices. The draft CCP and EA were made available online, at the Regional Office in Albuquerque, at the Complex headquarters, and at three public libraries in surrounding communities. An open house public meeting was held on August 29, 2012.

Approximately 10 participants attended that meeting. The Service received four comments (three via emails and one letter). All comments were considered and addressed in Appendix L (Response to Comments) of the CCP.

FINDINGS

Based on the analysis documented in the environmental assessment and with due consideration given to comments from the public and through consultation with the State of Texas, it is my determination that the proposed action does not constitute a major Federal action that will have a significant effect on the quality of the human environment under the meaning of Section 102 (2) (C) of the National Environmental Policy Act of 1969 (as amended). As such, it is my conclusion that an environmental impact statement is not required for this plan and the selected alternative may be implemented as soon as practicable. This determination is based on the following factors (40 C.F.R. 1508.27), as addressed in the attached Environmental Assessment, which is attached.

1. Both beneficial and adverse effects have been considered and this action will not have a significant effect on the environment (Environmental Assessment, pages B-53 – B-98).

2. The actions will not have a significant effect on public health and safety (Environmental Assessment, pages B-78 – B-98).

3. The project will not significantly affect any unique characteristics of the geographic area such as proximity to historical or cultural resources, wild and scenic rivers, or ecologically critical areas (Environmental Assessment, pages B-93 – B-98).

4. The effects on the quality of the human environment are not likely to be highly controversial (Environmental Assessment, pages B-78 – B-98).

5. The actions do not involve highly uncertain, unique, or unknown environmental risks to the human environment (Environmental Assessment, pages B-78 – B-98).

6. The actions do not establish a precedent for future actions with significant effects nor do they represent a decision in principle about a future consideration (Appendix B, Environmental Assessment).

7. There will be no cumulatively significant impacts on the environment. Cumulative impacts have been analyzed with consideration of other similar activities on adjacent lands, in past action, and in foreseeable future actions (Environmental Assessment, pages B-84 – B-92).

8. The actions will not significantly affect any site listed in, or eligible for listing in, the National Register of Historic Places, nor will they cause loss or destruction of significant scientific, cultural, or historic resources (Environmental Assessment, pages B-97).

9. The actions are not likely to adversely affect threatened or endangered species, or their habitats (Environmental Assessment, pages B76 – B-97); Appendix G: Intra-Service Section 7 Consultation).

10. The actions will not lead to a violation of federal, state, or local laws imposed for the protection of the environment (Environmental Assessment, pages B-4 – B-5).

Recommended: _____ 4-12-2013
Jennifer L. Sanchez, Project Leader — Date
Texas Mid-coast NWR Complex

Approved: for _____ 9/12/13
Dr. Benjamin N. Tuggle, Regional Director — Date
U.S. Fish and Wildlife Service, Region 2

SUPPORTING REFERENCES

Fish and Wildlife Service, 2012. Draft Comprehensive Conservation Plan and Environmental Assessment for the Texas Mid-coast National Wildlife Refuge Complex, Brazoria, Fort Bend, Matagorda and Wharton Counties, Texas. U.S. Department of the Interior, Fish and Wildlife Service, Southwest Region.

Fish and Wildlife Service, 2013. Draft Comprehensive Conservation Plan and Environmental Assessment for the Texas Mid-coast National Wildlife Refuge Complex, Brazoria, Fort Bend, Matagorda and Wharton Counties, Texas. U.S. Department of the Interior, Fish and Wildlife Service, Southwest Region.

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Appendix C. Compatibility Determinations

Compatibility determinations are included in this appendix. The following uses were found to be appropriate and evaluated to determine their compatibility with the mission of the Refuge System and the purposes of refuges within the Complex:

- Hunting
- Fishing
- Wildlife Observation
- Wildlife Photograph
- Environmental Education
- Interpretation
- Boating
- Bicycling
- Hiking
- Cooperative Farming
- Cooperative Grazing
- Pesticide Application to Control Mosquito Populations

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COMPATIBILITY DETERMINATION

USE: Hunting

REFUGE NAME: Texas Mid-coast National Wildlife Refuge Complex

ESTABLISHING AND ACQUISITION AUTHORITIES:
Texas Mid-coast National Wildlife Refuge Complex (Complex) is comprised of Brazoria, San Bernard, and Big Boggy National Wildlife Refuges (NWRs). Brazoria NWR was established on October 20, 1966, San Bernard NWR was established next on November 7, 1968, and Big Boggy NWR was established on July 8, 1983. All three refuges were created and managed under provisions of the Migratory Bird Conservation Act (16 U.S.C. 712d) and the Refuge Recreation Act (16 U.S.C. 460k-1 and 16 U.S.C. 460k-2). Brazoria and San Bernard NWRs were also established under the Fish and Wildlife Act of 1956 (16 U.S.C. 742(a)(4) and 16 U.S.C. 742(b)(1)).

REFUGE PURPOSE(S):

1. "…for use as an inviolate sanctuary,… for any other management purposes,… for migratory birds." (Migratory Bird Conservation Act [16 U.S.C. 712d])
2. "…for the development, advancement, management, conservation, and protection of fish and wildlife resources…" [16 U.S.C. 742f(a)(4)] and "…for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude…" [16 U.S.C. 742f(b)(1)] (Fish and Wildlife Act of 1956)
3. "…suitable for-(1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species…" [16 U.S.C. 460k-1]; "…the Secretary… may accept and use… real… property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donor…" [16 U.S.C. 460k-2] (Refuge Recreation Act, as amended [16 U.S.C. 460k – 460k-4]).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:
The mission of the National Wildlife Refuge System (Refuge System) is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

Description of Use:

(a) What is the use?
Currently, waterfowl hunting is allowed on all three refuges in the Complex. In addition to waterfowl hunting opportunities, the Service cooperates with Texas Parks and Wildlife Department (TPWD) and the Nannie M. Stringfellow Wildlife Management Area (WMA) to provide white-tailed deer/feral hog youth hunts on San Bernard NWR. For these youth hunts, TPWD issues youth hunting permits through a

lottery system, and assigns hunt blinds on the day of the hunt. Permitted hunters and standby hunters are given the opportunity to utilize up to 9 blinds (one youth hunter per blind with one adult) on the refuge, adjacent to the WMA, so that all standby hunters are accommodated and a youth has the opportunity to hunt. TPWD administers the hunt almost completely, with the exception of the Service providing the land base and providing a higher level of regulations regarding hunting methods (e.g., baiting is not allowed). The Service also partners with Texas Youth Hunting Program (TYHP) to provide feral hog hunting opportunities at San Bernard and Brazoria NWRs. Feral Hog hunts normally provide opportunities for 10 youth hunters a weekend, on 4 weekend hunts (2 weekends at each refuge).

(b) Where is the use conducted?

Brazoria NWR has two public waterfowl hunting areas: Christmas Point and Middle Bayou Public Waterfowl Hunt Areas - see Brazoria NWR Hunt Area Map 3-30 of the Comprehensive Conservation Plan (CCP). The Christmas Point Public Waterfowl Hunt Area lies southeast of the Gulf Intracoastal Waterway and encompasses approximately 4,000 acres. Access is by boat only. The Middle Bayou Public Waterfowl Hunt Area encompasses approximately 1,500 acres and access to this site is also by boat or by walk-in from CR227. On these units, hunting of ducks, geese and coots is permitted. Pits and permanent blinds are prohibited.

During the youth feral hog hunts, in partnership with TYHP, youth hunt from temporary blinds located off FM2004, in the Otter Slough Area.

San Bernard NWR has three designated public hunting areas (Cedar Lakes, Smith Marsh, and Salt Bayou Public Waterfowl Hunt Areas) and one permit hunting area (Sargent Permit Waterfowl Hunt Area), illustrated on the San Bernard NWR Hunt Area Map 3-32 of the CCP. All of these public hunting areas are accessible by boat only, and are open for the pursuit of ducks, geese and coots. The Cedar Lakes Public Waterfowl Hunt Area (2,400 acres) lies south of the Gulf Intracoastal Waterway, and the Smith Marsh Public Waterfowl Hunt Area (1,400 acres) is on the west side of Cedar Lakes Creek. Salt Bayou Public Waterfowl Hunt Area encompasses 3,600 acres accessible from Cedar Lakes Creek, the Gulf Intracoastal Waterway, or through the shallow Cowtrap Lakes system. The Sargent Permit Waterfowl Hunt offers a limited hunting opportunity on 4,000 acres with walk-in or boat access.

For the TPWD youth deer/feral hog hunts and the TYHP feral hog hunts, all hunting opportunities are limited to stationary blinds. There are a total of nine stationary blinds in the McNiel/Ducroz/Stringfellow Unit. This bottomland unit is contiguous with the Nannie M. Stringfellow WMA.

Big Boggy NWR has two public hunting areas: the Pelton Lake Public Waterfowl Hunt Area and Matthes Field Public Waterfowl Hunt Area. Pelton Lake encompasses 1,100 acres on the east end of the refuge, whereas the Matthes Field Public Waterfowl Hunt Area is located at the north end of the refuge along Chinquapin Road (see Big

Boggy NWR Hunt Area Map 3-33 of the CCP). This 200-acre area is primarily maintained for goose hunting, but both areas are open for the hunting of ducks, geese, and coots.

(c) When is the use conducted?

On the Complex, the Public Waterfowl Hunt Areas are open during the State Waterfowl seasons. Teal Season is generally scheduled for 9 to 16 days beginning mid September. Regular season generally begins late October through mid-January with one two-week mid-season closure. In addition the Public Waterfowl Hunt Areas across the Complex are open during the Conservation Order Light Goose Season, following regular waterfowl season. Youth hunts on the McNiel/Ducroz/Stringfellow Unit of San Bernard NWR are held three weekends per year; two in October and one in December. Youth hunts led by the TYHP occur at San Bernard and Brazoria NWRs two weekends per year (February/March) at each location.

(d) How is the use conducted?

Hunting on these Public Waterfowl Hunt Areas is managed in accordance with regulation set forth by the State of Texas. Hunters are required to use non-toxic shot. As stated in Goal 4, Strategy 5 under Objective 5 of the CCP, the refuge will promote hunter compliance with Federal and State regulations and encourage good sportsmanship, ethical hunting behavior, and understanding of the refuge and its purposes through law enforcement visibility and effective wording within informational brochures with high-quality maps, signs, and website updates. The refuge will continue to encourage hunting participation of under-represented segments of the public such as disadvantaged youth, persons with disabilities, and women, through various organizations.

In addition, San Bernard NWR permits TPWD to utilize the McNiel/Ducroz/Stringfellow Unit during their youth deer/feral hog hunts three weekends per year. The refuge provides this opportunity to youth hunters enabling standby hunters an additional area to hunt if needed due to standby hunters in excess of permits available on the Stringfellow WMA. No baiting is allowed in association with the hunt on refuge lands. The Service maintains nine hunt blinds on Service property for this cooperative hunt.

As stated above, the Service also partners with TYHP to provide feral hog hunting opportunities at San Bernard and Brazoria NWRs. At San Bernard NWR, TYHP utilizes the same blinds as utilized by TPWD during their youth hunts. A special use permit is issued to TYHP to enable them access to the blinds and for baiting prior to the hunt and during the hunt. At Brazoria NWR, TYHP erects portable blinds within Otter Slough and along ditches on the north side of the refuge. The hunt has been successful over the past three years in removing an average of 35 feral hogs per year from the refuges.

(e) Why is this use being proposed?

Hunting is an existing wildlife-dependent public use occurring on all three refuges within the Complex. Hunting, one of the six priority public uses of national wildlife refuges, is an important wildlife management tool used to control populations of some species that might otherwise exceed the carrying capacity of their habitat and threaten the well-being of other wildlife species or, in some instances, human health and safety. The objective for hunting is to provide safe and high quality hunting opportunities on the Complex. Waterfowl hunting is a traditional use and still very popular outdoor recreational pursuit in the region. Refuges and other public lands along the Texas Gulf Coast play a key role in providing hunting opportunities to the public.

Big game hunting is one management tool used to enhance healthier populations of deer, and decrease feral hog populations, however, throughout the Complex; impacts to the overall populations of these species are minimal.

The guiding principles that the Refuge System uses to manage quality hunting on refuges are: 1) to manage wildlife populations consistent with approved management plans; 2) to promote visitor understanding of and increase visitor appreciation for America's natural resources; 3) to provide opportunities for quality recreational and education experiences; and, 4) to minimize conflicts with visitors participating in other compatible wildlife-dependent recreational activities.

AVAILABILITY OF RESOURCES:

With the exception of the Sargent Permit Hunt, waterfowl hunting is open in accordance with state seasons. The Complex has two full-time Refuge Officers and one dual function officer, who monitor the use for adherence to regulations. Permits for the Sargent Permit Hunt are issued out of the Complex office in October each year. These permits require about 40 hours to process. Although blinds have been maintained in the past, the refuge changed the permit hunt to allow hunters to set up temporary blinds within the hunt zone. The estimated cost for managing waterfowl hunts is $22,000.

In preparation for the TPWD deer/feral hog hunts, the refuge maintains the access to the nine blinds. During the TPWD deer/feral hog hunts and the TYHP feral hog hunts, the Service provides one individual during orientation to provide information on the refuge and Refuge System. One staff will also be available during the hunt for any issues that arise. Both of these hunts are managed by the partner agency/organization. In addition to the hunting opportunity, youth receive a variety of other opportunities tied to hunting such as learning how to follow a blood trail, making hog sausage, and learning about the refuge and its purpose. The San Bernard NWR provides nine hunt blinds for both of these hunts. Temporary blinds and feeders are provided by the TYHP. The estimated cost for partnering with these organizations and providing youth hunting opportunities is $3,800.

ANTICIPATED IMPACTS OF THE USE:
Short-term impacts: Providing carefully planned and managed hunting opportunities with restrictions that limit access to specific refuge locations will generally minimize disturbance to wildlife populations, the environment, and non-consumptive users. Direct mortality to hunted species (deer, feral hogs,) would, of course, occur. Some wounding of animals may occur as well. The presence and activity of hunters may cause temporary disturbance to other wildlife in the area, but there are no foreseeable detrimental impacts to these species. Concerns are primarily centered on the possibility of impacting non-target species that are sensitive to disturbance. Visitor and hunter safety and law enforcement issues are the priority when designing and planning all hunting activities on refuges. Vehicle traffic will increase slightly during the hunting events, and the sound of gun shots will temporarily reduce the serenity for the non-hunting public. Loss of plants from foot traffic is minor, or temporary. Soil and plant disturbance may occur in ingress and egress routes, but will be minor and temporary because of the limited and controlled use associated with the managed hunts.

Long-term impacts: No detrimental long-term impacts from hunting are anticipated as long as wildlife populations are monitored through the refuge biological program or by state officials. When deer populations become over-abundant they can have profound negative impacts on their environment through herbivory thereby directly and indirectly affecting other native plants and wildlife species.

Cumulative Impacts:
There are no anticipated cumulative impacts. Harvest on the refuge would be limited and would fall within the state's population management goals, which are based on the best available science.

All hunts would follow all applicable laws, regulations and policies; including title 50 of the Code of Federal Regulations, the Refuge System Manual, the mission and goals of the Refuge System, and the purposes, goals, and objectives of the Complex. Operating this activity does not hinder the refuge's ability to meet habitat goals, provides for the safety of the area's citizens, and supports several of the primary objectives of the refuge. The EA for the Draft CCP contains a more detailed discussion of the anticipated impacts of hunting on the Complex.

PUBLIC REVIEW AND COMMENT:
This compatibility determination was published and available for public review and comment concurrent with the Draft CCP and EA; the comment period opened August 15 and closed on September 20, 2012. Public notification included a notice in the Federal Register, media announcements, public notices posted throughout the local communities, and a public meeting. One comment specific to hunting was received. The comment suggested that displacement of users by hunting is a long-term and cumulative impact that should be stated and discussed. Displacement of users is not discussed as a long-term or cumulative impact because hunting areas on the Complex are separate from other public use areas. Under the existing hunt program, there is no user conflict. See CCP Appendix L for more information on the Complex's Response to Comments.

DETERMINATION (CHECK ONE BELOW):
___ Use is Not Compatible
_X_ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:
In order to ensure that hunting remains a compatible use on the Complex, the following stipulations are necessary:

1. Big Boggy NWR, Sargent Permit Public Waterfowl Hunt Area on San Bernard NWR, and Middle Bayou Public Waterfowl Hunting Area on Brazoria NWR prohibit the shooting or hunting of all animals except ducks, geese, and coots.
2. Hunters are prohibited from the use of or possession of lead shot, target shooting, target practice, dog training (with or without the use of firearms), and hunting within 500 feet of houses.
3. Hunters utilizing temporary blinds are required to remove decoys and portable blinds daily upon cessation of hunting.
4. Shotguns must be unloaded and cased or broken down when transported in vehicles.
5. Hunters must use nontoxic shot and maintain a safe and courteous distance from other parties.
6. Hunters must carry out their empty shells and trash.
7. The Complex prohibits the use or possession of alcoholic beverages while on refuge lands or waters.
8. In order to protect fragile habitats and wildlife, the Complex prohibits off-road vehicle travel and ATV use on refuge lands.

JUSTIFICATION:
As defined by the National Wildlife Refuge System Improvement Act of 1997, wildlife-dependent recreational uses may be authorized on a refuge when they are compatible and not inconsistent with public safety. Hunting is included as one of these six wildlife-dependent recreational opportunities, which are to receive enhanced and priority consideration in refuge planning and management. Continued hunting opportunities on the Complex will not conflict with any of the other priority public uses, adversely impact biological resources, or detract from refuge goals, objectives, and management activities described in the CCP. Through the compatibility determination process, the Complex has determined that hunting, in accordance with the stipulations provided above, will not materially interfere with or detract from the fulfillment of the Refuge System mission or the purposes of each refuge.

SIGNATURE: Refuge Manager _____ 4-12-2013
(Signature and Date)

CONCURRENCE: Regional Chief _____ 9/4/13
(Signature and Date)

MANDATORY 15-YEAR RE-EVALUATION DATE: 2028

COMPATIBILITY DETERMINATION

USE: Fishing

REFUGE NAME: Texas Mid-coast National Wildlife Refuge Complex

ESTABLISHING AND ACQUISITION AUTHORITIES:
Texas Mid-coast National Wildlife Refuge Complex (Complex) is comprised of Brazoria, San Bernard, and Big Boggy National Wildlife Refuges (NWRs). Brazoria NWR was established on October 20, 1966, San Bernard NWR was established next on November 7, 1968, and Big Boggy NWR was established on July 8, 1983. All three refuges were created and managed under provisions of the Migratory Bird Conservation Act (16 U.S.C. 712d) and the Refuge Recreation Act (16 U.S.C. 460k-1 and 16 U.S.C. 460k-2). Brazoria and San Bernard NWRs were also established under the Fish and Wildlife Act of 1956 (16 U.S.C. 742(a)(4) and 16 U.S.C. 742(b)(1)).

REFUGE PURPPOSE(S):

1. "…for use as an inviolate sanctuary,… for any other management purposes,… for migratory birds." (Migratory Bird Conservation Act [16 U.S.C. 712d])
2. "…for the development, advancement, management, conservation, and protection of fish and wildlife resources…" [16 U.S.C. 742f(a)(4)] and "…for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude…" [16 U.S.C. 742f(b)(1)] (Fish and Wildlife Act of 1956)
3. "…suitable for- (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species…" [16 U.S.C. 460k-1]; "…the Secretary… may accept and use… real… property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donor…" [16 U.S.C. 460k-2] (Refuge Recreation Act, as amended [16 U.S.C. 460k – 460k-4]).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:
The mission of the National Wildlife Refuge System (Refuge System) is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

DESCRIPTION OF USE:

(a) What is the use?
Fishing is an existing wildlife-dependent public use occurring on all three refuges within the Complex. Fishing is one of the six priority public uses of national wildlife refuges, as specified in the National Wildlife Refuge Improvement Act of 1997. Approximately 35,000 of the 78,000 annual visitors come to the Complex to fish allowing the Complex to provide traditional outdoor activities for families to participate in wildlife recreational opportunities. Anglers are treated to some of the best fishing for redfish, spotted sea

trout, black drum, sheepshead, and flounder in the state of Texas. No commercial fishing or crabbing is allowed on the Complex.

(b) Where is the use conducted?

The Complex provides four public fishing areas, offering a variety of saltwater fishing and crabbing opportunities. All shoreline areas open to fishing are designated by "Public Fishing Area" signs and are shown on public use maps of the Comprehensive Conservation Plan (CCP). Navigable waters open to fishing are by boat access only and users must remain within the tidal margins.

Bastrop Bayou Public Fishing Area and Pier	Cedar Lake Creek Public Fishing Area and Pier	Navigable waters within refuge boundaries
Clay Banks Public Fishing Area	Navigable waters within refuge boundaries	
Salt Lake Public Fishing Area		
Navigable waters within Refuge Boundaries		

Brazoria NWR has three public fishing areas that allow land access to salt water fishing: Bastrop Bayou, Clay Banks, and Salt Lake Public Fishing Areas. Bastrop Bayou Public Fishing Area is universally accessible and offers a 200-foot pier with fish attracting lights, five paved bank fishing pull-offs, a universally accessible toilet, paved parking, and night-lights. The Clay Banks Public Fishing Area offers bank fishing along a one-mile segment of Bastrop Bayou. The Salt Lake Fishing Area offers 1.4 mile of bank fishing and a non-motorized boat ramp.

Navigable waters within the boundaries of the refuge open to fishing are Salt Lake, Nicks Lake, and Lost Lake. State waters including Cox Lake, Alligator Lake, Bastrop Bayou, and bays, adjacent to the Brazoria NWR are open to fishing as well.

San Bernard NWR has one public fishing area that allows land access to Cedar Lake Creek. The Cedar Lake Public Fishing Area offers an accessible 20 foot by 10 foot fishing pier, a fishing trail that offers .4 miles of bank fishing, and a small public boat ramp that gives visitors access to Cedar Lake Creek. Fishing is permitted in navigable waters including Cedar Lake Creek, Cedar Lakes and Cow Trap Lakes within and adjacent to the boundary of the refuge.

On Big Boggy NWR**,** public fishing is allowed on the navigable waters of Boggy Creek and adjacent State waters.

(c) When is the use conducted?

Fishing is allowed year-round in the designated areas in accordance with applicable State and federal regulations. All public fishing areas are available for use during daylight hours only, with the exception of Bastrop Bayou Public Fishing Area. This particular area is open 24 hours a day, but no overnight camping is permitted.

(d) How is the use conducted?

All fishing must occur in accordance with state fishing regulations, and fishermen are required to have appropriate State fishing licenses. Refuge law enforcement officers patrol Public Fishing Areas to prevent littering and illegal take of fish, while educational efforts have been increased to encourage anglers to collect and discard excess and old fishing line, hooks, and sinkers, since wildlife are known to die after ingesting this debris. The refuge allows the use of cast nets for collecting bait for personal use at public fishing areas. The Brazoria NWR also has picnic tables at the Bastrop Bayou Fishing Area and Salt Lake Fishing Area. Refuge visitors are welcome to use these tables for picnicking, which typically occurs in conjunction with the primary use of fishing.

(e) Why is this use being proposed?

The objective for the fishing program is to provide safe and high-quality fishing opportunities on the Complex, which offers exceptional recreational fishing and crabbing opportunities in a saltwater environment.

Fishing programs promote understanding and appreciation of natural resources and their management on all lands and waters in the Refuge System.

AVAILABILITY OF RESOURCES:

The public fishing areas require routine maintenance in terms of mowing, maintenance or repairs to piers, and replacement of lights at Bastrop Bayou. At Brazoria NWR, trash is collected from trash receptacles on a weekly basis. Port-a can service is required at the Bastrop Bayou Fishing Pier and Salt Lake Public Fishing Area. The majority of routine maintenance is performed by volunteers and youth program hires in the summer. The estimated cost of maintaining these areas is $5,000. Two full-time and one dual function law enforcement officers patrol the public fishing areas and assist TPWD Game Wardens patrolling navigable waters, ensuring that regulations are being followed and resources protected. Checking fishing areas and users is the single greatest LE activity occurring on the refuges. Approximately, $55,000 is needed for law enforcement associated with this use. The Complex can sustain the current fishing program at current funding levels.

ANTICIPATED IMPACTS OF THE USED:

Short and Long-term Impacts:

Fishing is consistent with the refuge purpose and mission by providing traditional outdoor pastime that is deeply rooted in America's natural heritage. Fishing on the refuge will have a beneficial effect on goals and objectives identified in the Complex's CCP by providing opportunities for families to participate in a wildlife dependent recreational use.

The affects of fishing and associated boating activities on migratory and shore birds include noise, harassment and displacement. Compaction of vegetation may occur along the shores and along creeks from fisherman accessing fishing points. With the existing mitigation measures disturbances caused by fishing, including associated boating activities is not having an adverse impact on wildlife resources. Shorelines are monitored for erosion. Trash is the single greatest impact on the refuges associated with this use.

Cumulative Impacts:
Fishing on the Complex is not anticipated to have any cumulative negative impacts that will affect life history requirements of any wildlife species. Fish and crab harvest on the refuges would be limited and would fall within the state's population management goals which are based on the best available science. Shoreline fishing is permitted at only four locations (identified above) which limits conflict with other users, habitat degradation and wildlife disturbance. Fish gear, including lead sinkers and monofilament line discarded by fishermen creates trash and can injure or kill wildlife. Law enforcement patrol of fishing area would help to minimize this effect.

All fishing is within all applicable laws, regulations and policies; including title 50 of the Code of Federal Regulations, the Refuge System Manual, the mission and goals of the Refuge System, and the purposes, goals, and objectives of the Complex. Operating this activity does not hinder the refuge's ability to meet habitat goals, provides for the safety of the area's citizens, and supports several of the primary objectives of the refuges.

PUBLIC REVIEW AND COMMENT:
This compatibility determination was published and available for public review and comment concurrent with the Draft CCP and EA; the comment period opened August 15 and closed on September 20, 2012. Public notification included a notice in the Federal Register, media announcements, public notices posted throughout the local communities, and a public meeting. One comment specific to fishing was received. The comment states there are no long-term and cumulative impacts but lead sinkers and monofilament line discarded by fishing creates trash and kills wildlife and are long-term and cumulative impacts that should be stated and discussed. The CD was edited for clarification. See CCP Appendix L for more information on the Complex's Response to Comments.

DETERMINATION (CHECK ONE BELOW):
___ Use is Not Compatible
_X_ Use is Compatible with Following Stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:
The following stipulations are required to ensure that fishing remains a compatible use on the Complex:

1. Vehicles may be parked only in designated areas.
2. Access to the three designated Public Fishing Areas where bank fishing is allowed is by foot only.
3. The Complex prohibits off-road vehicle travel and parking.
4. Mud boats use on refuge waters is prohibited to protect fragile habitats and wildlife.

5. The Complex prohibits commercial crab traps on refuge waters.
6. Campfires and camping is prohibited.
7. Boat launching is allowed in designated areas only.
8. The use of trot lines, sail lines, set lines, jugs, gigs, spears, bush hooks, snatch hooks, crossbows, or bows and arrows of any type is not allowed on the Complex.

JUSTIFICATION:
As defined by the National Wildlife Refuge System Improvement Act of 1997, wildlife-dependent recreational uses may be authorized on a refuge when they are compatible and not inconsistent with public safety. Fishing is included as one of these six wildlife-dependent recreational opportunities, which are to receive enhanced and priority consideration in refuge planning and management. The continued fishing program on the Complex will not conflict with any of the other priority public uses, adversely impact biological resources, or detract from refuge goals, objectives, and management activities described in the National Wildlife Refuge System Improvement Act of 1997.

Through the compatibility determination process, The Complex has determined that fishing, in accordance with the stipulations provided above, will not materially interfere with or detract from the fulfillment of the Refuge System mission or the purposes of the refuges.

SIGNATURE: Refuge Manager _____ 4-12-2013
(Signature and Date)

CONCURRENCE: Regional Chief _____ 9/4/13
(Signature and Date)

MANDATORY 15-YEAR RE-EVALUATION DATE: 2028

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COMPATIBILITY DETERMINATION

USE: Wildlife Observation

REFUGE NAME: Brazoria National Wildlife Refuge

ESTABLISHING AND ACQUISITION AUTHORITIES:
Brazoria NWR was established next on October 20, 1966, under provisions of the Migratory Bird Conservation Act (16 U.S.C. 712d), the R Recreation Act (16 U.S.C. 460k-1 and 16 U.S.C. 460k-2), and the Fish and Wildlife Act of 1956 (16 U.S.C. 742(a)(4) and 16 U.S.C. 742(b)(1)).

REFUGE PURPOSE(S):

1. "…for use as an inviolate sanctuary,… for any other management purposes,… for migratory birds." (Migratory Bird Conservation Act [16 U.S.C. 712d])
2. "…for the development, advancement, management, conservation, and protection of fish and wildlife resources…" [16 U.S.C. 742f(a)(4)] and "…for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude…" [16 U.S.C. 742f(b)(1)] (Fish and Wildlife Act of 1956)
3. "…suitable for- (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species…" [16 U.S.C. 460k-1]; "…the Secretary… may accept and use… real… property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donor…" [16 U.S.C. 460k-2] (Refuge Recreation Act, as amended [16 U.S.C. 460k – 460k-4]).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:
The mission of the National Wildlife Refuge System (Refuge System) is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

DESCRIPTION OF USE:

(a) What is the use?
Wildlife observation is an existing wildlife-dependent recreational use available on Brazoria NWR. The refuge estimates annual visitation at 35,000 with approximately 16,000 visitors coming to the refuge for wildlife observation opportunities. General public access to observe wildlife and refuge habitats including the means of access such as automobile, hiking, bicycling, boating, canoeing and kayaking. Bird watching continues to be the most popular form of wildlife observation on the refuge, where visitors can see large concentrations of waterfowl, wading birds and neo-tropical songbirds. Other wildlife observation opportunities allow the public to view alligators, raccoons, armadillos, coyotes, bobcats, butterflies, and dragonflies, as well as wildflowers.

(b) Where is the use conducted?

The refuge will continue to emphasize wildlife observation and highlight these opportunities in a variety of strategic locations including: the Big Slough Public Use Area, Otter Slough, Bastrop Bayou and Middle Bayou Trail. On Brazoria NWR, the 7.5-mile gravel auto tour route meanders through the Big Slough Public Use Area, wrapping around Olney and Teal Ponds and accessing Big Slough and Rogers Pond. The tour loop, accessible by foot, bicycle, or automobile, includes boardwalks, observation platforms, vehicle pull-offs, trails, and butterfly gardens, each of which is associated with offering opportunities for wildlife observation. In addition, a remote bird viewing camera is set up at Gator Nest Pond to broadcast video of wildlife to the Discovery Center. The 3-mile paved entrance road from County Road 227 also provides wildlife observation opportunities.

Brazoria NWR also has viewing areas outside the Big Slough Public Use Area. Mottled Duck Marsh, off County Road 208 on the refuge's northern edge, rewards visitors on the lookout for views of waterfowl, wading birds, and shorebirds. The farm fields along County Road 227 and FM 2004 also offer wildlife viewing opportunities from the public roadway. The refuge is proposing to work with Brazoria County and develop pull-offs along the County Roads for visitors to safely view wildlife safely without hampering traffic flow.

(c) When is the use conducted?

Visitors can observe wildlife on Brazoria NWR year-round during daylight hours. As bird watching is the most popular form of wildlife observation across the refuge, most people prefer to visit during the cooler months of November through March when large concentrations of migratory waterfowl are present. The spring and fall bird migrations are also popular for viewing neo-tropical songbirds and shorebirds. The refuge is also known for its easily observed population of alligators, which brings visitors to the refuge throughout the year.

(d) How is the use conducted?

Wildlife observation is conducted with the Service's mission and the refuge's purposes, goals, and objectives as the guiding principles. Visitors are allowed to utilize any of the public use areas for wildlife observation purposes. Occasionally, refuge visitors observing wildlife utilize picnic tables scattered across the refuge. Picnicking, therefore, is an incidental use that supports wildlife observation. Wildlife observation may occur through a variety of modes, including from vehicles and bicycles on refuge public access roads as well as on foot along designated trails and boardwalks.

(e) Why is this use being proposed?

Wildlife observation is an existing priority public use of the Refuge System as identified in the Refuge System Improvement Act of 1997, and receives enhanced consideration over non-priority uses. Wildlife observation activities on Brazoria NWR are designed to promote the purpose of the refuge and support the mission, promote understanding and appreciation of natural and cultural resources, and their management on all lands and waters in the Refuge System.

The objective for wildlife observation is to provide safe, enjoyable, high quality, and accessible opportunities to view wildlife on the refuge. In addition, the program aims to promote visitor understanding for America's natural resources while minimizing conflicts with visitors participating in other compatible wildlife-dependent activities. Almost half of all visitors to the refuges hike a trail, drive the auto tour, or spend a few moments at a wildlife overlook. The refuge provides local, regional, national and international visitors with a wide range of wildlife observation opportunities, supporting a rapidly growing nature tourism industry in coastal Texas.

AVAILABILITY OF RESOURCES:

The refuge only has one full-time public-use staff (Outdoor Recreation Planner). The majority of maintenance in public use areas is completed by volunteers, youth program hires and maintenance staff. Roadways, trails and the yard around the Discovery Center require mowing and weed-eating throughout the growing season. Gravel roads require grading and all observation decks, platforms and shelters require annual maintenance and repairs. Much of the public use area is below 8 feet in elevation and even tropical storms may wash debris up on to the roads, scour gravel, damage piers and platforms and blow down signs. The estimated cost for providing facilities for wildlife observation at Brazoria NWR is $22,000 annually. To date, annual requirements in time, materials, and supplies needed to manage and ensure the success of this area have been within existing refuge resources.

Public use areas are patrolled regularly by law enforcement staff (2 –FTEs) ensuring protection of refuge resources and public safety.

ANTICIPATED IMPACTS OF THE USE:

Short and Long-term Impacts:

Wildlife observation of one of several wildlife oriented public use opportunities being provided primarily within the Big Slough Public Use Area. Although there is some temporary disturbance to wildlife due to human activity on the land, these short-term impacts are minimal. The most likely impacts will be during migration when wildlife may be easily disturbed because they have not become accustomed to recurring traffic. Visitor access is typically by individuals or small groups for short durations. Destruction or negative impacts to habitat and associated vegetation are minimal because public use is confined to trails, and to state, county, and refuge roads.

These short-term, temporary effects are countered by the opportunity to connect with nature while observing wildlife, which results in stronger environmental stewardship. This is a long-term benefit that impacts the landscape as a whole. The long-term impacts of the public use facilities are minimal, because the facilities are confined to county roads and the Public Use Areas which are utilized for biological monitoring and habitat management as well.
The activities follow all applicable laws, regulations and policies, including: Migratory Bird Conservation Act, Title 50 Code of Federal Regulations, Refuge System Manual, Refuge System goals and objectives, and refuge goals and objectives.

These activities are compliant with the purpose of the refuge and the Refuge System mission. Wildlife observation has a beneficial effect on refuge goals and objectives by striving to enhance

opportunities and quality of visitor experiences on the refuge while instilling an appreciation for the value of and the need for fish and wildlife habitat conservation. Crucial

Cumulative Impacts:
Providing an opportunity for people to observe wildlife and nature is a beneficial long-term environmental impact. Because of the limited opportunity beyond the refuges that provide wildlife observation in a natural setting, cumulative impacts are considered beneficial. Because facilities are utilized by visitors conducting multiple priority recreation uses, the cumulative impacts are minimal. Since impacts are anticipated to be minimal, there will be no negative impacts to the extent that will affect life history requirements of any wildlife species. Wildlife impacts will be carefully monitored in an attempt to identify changes in wildlife behavior and habitat response near observation areas. If impacts are detected, adaptive strategies will be developed to reduce or eliminate impacts to wildlife.

PUBLIC REVIEW AND COMMENT:
This compatibility determination was published and available for public review and comment concurrent with the Draft CCP and EA; the comment period opened August 15 and closed on September 20, 2012. Public notification included a notice in the Federal Register, media announcements, public notices posted throughout the local communities, and a public meeting. No comments specific to this determination were received.

DETERMINATION (CHECK ONE BELOW):
___ Use is Not Compatible
__X_ Use is Compatible with Following Stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:
To ensure compatibility with Refuge System and Brazoria NWR goals and objectives the activity can only occur under the following stipulations:

1. Use is confined to daylight hours.
2. Camping and campfires are prohibited.
3. To protect fragile habitat and wildlife, the refuge prohibits off-road vehicle travel and parking is not permitted. Wandering off-trail is also prohibited.
4. Harassment of wildlife or excessive damage to vegetation is prohibited.

JUSTIFICATION:
As defined by the National Wildlife Refuge System Improvement Act of 1997, wildlife-dependent recreational uses may be authorized on a refuge when they are compatible and not inconsistent with public safety. Wildlife observation is included as one of these six wildlife-dependent recreational opportunities, which are to receive enhanced and priority consideration in refuge planning and management. Continued wildlife observation on the refuge will not conflict with any of the other priority public uses, adversely impact biological resources, or detract from refuge goals, objectives, and management activities described in the CCP. Through the compatibility determination process, Brazoria NWR has determined that wildlife observation, in accordance with the stipulations provided above, will not materially interfere with or detract from the fulfillment of the Refuge System mission or the purposes of the refuge.

SIGNATURE: Refuge Manager _____ 4-12-2013
(Signature and Date)

CONCURRENCE: Regional Chief _____ 9/4/13
(Signature and Date)

MANDATORY 15-YEAR RE-EVALUATION DATE: 2028

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COMPATIBILITY DETERMINATION

USE: Wildlife Observation

REFUGE NAME: San Bernard National Wildlife Refuge

ESTABLISHING AND ACQUISITION AUTHORITIES:
San Bernard NWR was established next on November 7, 1968, under provisions of the Migratory Bird Conservation Act (16 U.S.C. 712d), the Refuge Recreation Act (16 U.S.C. 460k-1 and 16 U.S.C. 460k-2), and the Fish and Wildlife Act of 1956 (16 U.S.C. 742(a)(4) and 16 U.S.C. 742(b)(1)).

REFUGE PURPOSE(S):

1. "…for use as an inviolate sanctuary,… for any other management purposes,… for migratory birds." (Migratory Bird Conservation Act [16 U.S.C. 712d])
2. "…for the development, advancement, management, conservation, and protection of fish and wildlife resources…" [16 U.S.C. 742f(a)(4)] and "…for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude…" [16 U.S.C. 742f(b)(1)] (Fish and Wildlife Act of 1956)
3. "…suitable for- (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species…" [16 U.S.C. 460k-1]; "…the Secretary… may accept and use… real… property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donor…" [16 U.S.C. 460k-2] (Refuge Recreation Act, as amended [16 U.S.C. 460k – 460k-4]).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:
The mission of the National Wildlife Refuge System (Refuge System) is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

DESCRIPTION OF USE:

(a) What is the use?
Wildlife observation is an existing wildlife-dependent recreational use available on San Bernard NWR. The refuge estimates annual visitation at 35,000 with approximately 16,000 visitors coming to the refuge for wildlife observation opportunities. General public access to observe wildlife and refuge habitats including the means of access such as automobile, hiking, bicycling, boating, canoeing and kayaking. Bird watching continues to be the most popular form of wildlife observation on the refuge, where visitors can see large concentrations of waterfowl and neo-tropical songbirds. Other wildlife observation opportunities allow the public to view alligators, raccoons, armadillos, coyotes, bobcats, butterflies, and dragonflies, as well as wildflowers.

(b) Where is the use conducted?

San Bernard NWR offers wildlife observation and hiking at several locations. The San Bernard auto tour and Moccasin Pond loop provide 9.4 miles of gravel roads with observation platforms, vehicle pullouts, trails, boardwalks, and a butterfly garden. The Cocklebur Slough Road provides opportunities to see wading birds, raptors and passerines as well as resident wildlife in light forest and grassland habitats. Moccasin Pond loop is at the edge where the salty prairie meets the high marsh. From the loop road a variety of fresh and saltwater, open water, marsh and grassland habitats support an array of migratory and resident wildlife. Bicyclists are welcome on all refuge roads that are open to public vehicles. The San Bernard Oak trail which is located .5 mile north of the refuge entrance, along CR 306, provides a .6 mile trail through a mature bottomland forest to the largest live oak in Texas. The trail crosses a slough before reaching the tree which provides excellent opportunity for viewing bottomland wildlife including wood ducks, reptiles and songbirds.

Hudson Woods, located 5 miles west of Angleton, Texas on SH 521 provides 5.9 miles of walking trails through early and mid-succession stage bottomland forest. Walking the trails provides excellent opportunities for viewing winter and migratory songbirds. Two oxbow lakes provide opportunities for viewing waterbirds including anhinga, waterfowl and wading birds. An observation deck at Scoby Lake, the deck on the front of the Discovery Outpost and the photo blind provide excellent opportunities to view wetland wildlife.

Dow Woods is the most recent bottomland forest unit opened to provide wildlife observation opportunities. The unit is located on the north side of the City of Lake Jackson. Currently 2.7 miles of trail are available for wildlife observation through a restoring forest and along the shore of Bastrop Bayou. Native wildlife including deer, armadillo's and raccoons are commonly seen along with migratory songbirds, woodpeckers and owls.

Betty Brown, the smallest unit on San Bernard NWR, has a 3/8 mile loop trail which takes visitors to the shore of the San Bernard River. This mature growth forest provides excellent opportunities to see migratory songbirds as they move inland from the Gulf of Mexico.

(c) When is the use conducted?

Visitors can observe wildlife on San Bernard NWR year-round during daylight hours. As bird watching is the most popular form of wildlife observation across the Complex, most people prefer to visit during the cooler months of November through March when large concentrations of waterfowl are present. The spring and fall bird migrations are also popular for viewing neo-tropical songbirds. The refuge is also known for their easily observed population of alligators.

(d) How is the use conducted?

Wildlife observation is conducted with the Service's mission and the refuges' purposes, goals, and objectives as the guiding principles. Visitors are allowed to utilize any of the

public use areas for wildlife observation purposes. Occasionally, refuge visitors observing wildlife utilize picnic tables at the headquarters, Bobcat Woods or at Hudson Woods. Picnicking, therefore, is an incidental use that supports wildlife observation. Wildlife observation may occur through a variety of modes, including vehicles and bicycles on refuge public access roads as well as on foot at designated trails and boardwalks.

(e) Why is this use being proposed?

Wildlife observation is an existing priority public use of the Refuge System as identified in the Refuge System Improvement Act of 1997, and receives enhanced consideration over non-priority uses. Wildlife observation activities on San Bernard NWR are designed to promote the purpose of the refuge and support the mission, promote understanding and appreciation of natural and cultural resources, and their management on all lands and waters in the Refuge System.

The objective for wildlife observation is to provide safe, enjoyable, high quality, and accessible opportunities on the refuge. In addition, the program aims to promote visitor understanding for America's natural resources while minimizing conflicts with visitors participating in other compatible wildlife-dependent activities. Almost half of all visitors to the refuges hike a trail, drive the auto tour, or spend a few moments at a wildlife overlook. The refuge provides local, regional, national and international visitors with a wide range of wildlife observation opportunities, supporting a rapidly growing nature tourism industry in Texas.

AVAILABILITY OF RESOURCES:

The Complex only has one full-time public-use staff (Outdoor Recreation Planner). The majority of the maintenance of the public use areas is completed by volunteers, youth program hires and maintenance staff. Facilities at Hudson Woods are maintained via a contract. Roadways, trails and the yard around the Discovery Outpost at Hudson Woods all require mowing and weed-eating throughout the growing season. Gravel roads require grading and all observation decks, platforms and shelters require annual maintenance and repairs. Current staff is stretched with trying to maintain all trails and parking areas. For this reason, a contract is issued for work at Hudson Woods, which is 23 miles away from the field headquarters. A contract may be added for maintaining Dow Woods in the future. The estimated cost for providing facilities for wildlife observation at San Bernard NWR is $35,000 annually. To date, annual requirements in time, materials, and supplies needed to manage and ensure the success of this area have been within existing refuge resources. Trail counters are being installed on trails to better evaluate the use of trails. A sign-in record is being maintained at Hudson Woods.

Public use areas are patrolled regularly by law enforcement staff (2 –FTEs) ensuring protection of refuge resources and public safety.

ANTICIPATED IMPACTS OF THE USE:

Short and Long-term Impacts:

Wildlife observation of one of several wildlife oriented public use opportunities being provided at several public use locations on San Bernard NWR. Although there is some temporary disturbance to wildlife due to human activity on the land, these short-term impacts are minimal. The most likely impacts will be during migration when wildlife may be easily disturbed because they have not become accustomed to repetitive traffic. Visitor access is typically by individuals or small groups for short durations. Destruction or negative impacts to habitat and associated vegetation are minimal because public use is confined to trails, and to state, county, and refuge roads.

These short-term, temporary effects are countered by the opportunity to connect with nature while observing wildlife, which results in stronger environmental stewardship. This is a long-term benefit that impacts the landscape as a whole. The long-term impacts of the public use facilities are minimal, because the facilities are confined to county roads and the Public Use Area which are utilized for biological monitoring and habitat management as well.

The activities follow all applicable laws, regulations and policies, including: Migratory Bird Conservation Act, Title 50 Code of Federal Regulations, Refuge System Manual, Refuge System goals and objectives, and refuge goals and objectives.

These activities are compliant with the purpose of the refuge and the National Wildlife Refuge System Mission. Wildlife observation has a beneficial effect on refuge goals and objectives by striving to enhance opportunities and quality of visitor experiences on the refuge while instilling an appreciation for the value of and the need for fish and wildlife habitat conservation.

Cumulative Impacts:

Providing an opportunity for people to observe wildlife and nature is a beneficial long-term environmental impact. Because of the limited opportunity beyond the refuges that provide wildlife observation in a natural setting, cumulative impacts are considered beneficial. Because facilities are utilized by visitors conducting multiple priority recreation uses, the cumulative impacts are minimal. Since impacts are anticipated to be minimal, there will be no negative impacts to the extent that will affect life history requirements of any wildlife species. Wildlife impacts will be carefully monitored in an attempt to identify changes in wildlife behavior and habitat response near observation areas. If impacts are detected, adaptive strategies will be developed to reduce or eliminate impacts to wildlife.

PUBLIC REVIEW AND COMMENT:

This compatibility determination was published and available for public review and comment concurrent with the Draft CCP and EA; the comment period opened August 15 and closed on September 20, 2012. Public notification included a notice in the Federal Register, media announcements, public notices posted throughout the local communities, and a public meeting. No comments specific to this determination were received.

DETERMINATION (CHECK ONE BELOW):
___ Use is Not Compatible
_X__ Use is Compatible with Following Stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:
To ensure compatibility with National Wildlife Refuge System and San Bernard NWR goals and objectives the activity can only occur under the following stipulations:

1. Use is confined to daylight hours.
2. Camping and campfires are prohibited.
3. To protect fragile habitat and wildlife, the refuge prohibits off-road vehicle travel and parking is not permitted. Wandering off-trail is also prohibited.
4. Harassment of wildlife or excessive damage to vegetation is prohibited.

JUSTIFICATION:
As defined by the National Wildlife Refuge System Improvement Act of 1997, wildlife-dependent recreational uses may be authorized on a refuge when they are compatible and not inconsistent with public safety. Wildlife observation is included as one of these six wildlife-dependent recreational opportunities, which are to receive enhanced and priority consideration in refuge planning and management. Continued wildlife observation on the refuge will not conflict with any of the other priority public uses, adversely impact biological resources, or detract from refuge goals, objectives, and management activities described in the CCP. Through the compatibility determination process, San Bernard NWR has determined that wildlife observation, in accordance with the stipulations provided above, will not materially interfere with or detract from the fulfillment of the Refuge System mission or the purposes of the refuge.

SIGNATURE: Refuge Manager _____ 4-12-2013
(Signature and Date)

CONCURRENCE: Regional Chief _____ 9/4/13
(Signature and Date)

MANDATORY 15-YEAR RE-EVALUATION DATE: ____2028____

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COMPATIBILITY DETERMINATION

USE: Wildlife Photography

REFUGE NAME: Texas Mid-coast National Wildlife Refuge Complex

ESTABLISHING AND ACQUISITION AUTHORITIES:
Texas Mid-coast National Wildlife Refuge Complex (Complex) is comprised of Brazoria, San Bernard, and Big Boggy National Wildlife Refuges (NWRs). Brazoria NWR was established on October 20, 1966, San Bernard NWR was established next on November 7, 1968, and Big Boggy NWR was established on July 8, 1983. All three refuges were created and managed under provisions of the Migratory Bird Conservation Act (16 U.S.C. 712d) and the Refuge Recreation Act (16 U.S.C. 460k-1 and 16 U.S.C. 460k-2). Brazoria and San Bernard NWRs were also established under the Fish and Wildlife Act of 1956 (16 U.S.C. 742(a)(4) and 16 U.S.C. 742(b)(1)).

REFUGE PURPOSE(S):

1. "…for use as an inviolate sanctuary,… for any other management purposes,… for migratory birds." (Migratory Bird Conservation Act [16 U.S.C. 712d])
2. "…for the development, advancement, management, conservation, and protection of fish and wildlife resources…" [16 U.S.C. 742f(a)(4)] and "…for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude…" [16 U.S.C. 742f(b)(1)] (Fish and Wildlife Act of 1956)
3. "…suitable for- (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species…" [16 U.S.C. 460k-1]; "…the Secretary… may accept and use… real… property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donor…" [16 U.S.C. 460k-2] (Refuge Recreation Act, as amended [16 U.S.C. 460k – 460k-4]).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:
The mission of the National Wildlife Refuge System (Refuge System) is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

DESCRIPTION OF USE:

(a) What is the use?
Wildlife photography is one of the six existing wildlife-dependent recreational uses occurring on Brazoria and San Bernard NWR. Many visitors come to the Complex to observe a variety of wildlife and landscapes that they would not be able to observe without the Complex's presence. Photography is closely linked to wildlife observation as the refuge offers visitors a chance to photograph wildlife in their native habitat. The

Complex estimates annual visitation at 78,000 with approximately 30,000 visitors coming to the Complex for wildlife observation and photography opportunities.

(b) Where is the use conducted?

All Complex public roads will be open to the public for wildlife photography unless specifically closed by the refuge manager. Wildlife photography is primarily facilitated by wildlife observation points across the general public use areas throughout the Complex. These include auto-tour routes, boardwalks, observation platforms, vehicle pullouts, trails, butterfly gardens, access roads, and farm fields. In addition, San Bernard NWR has constructed a photo blind at the Hudson Woods Unit that has enhanced the visitor's opportunity for a quality wildlife experience while limiting wildlife disturbance with a protected walkway and blind. An additional photo blind is planned for Dow Woods and at Brazoria NWR.

The Complex will continue to emphasize wildlife photography and highlight these opportunities in a variety of locations including:

Brazoria Auto Tour	Middle Bayou Trail
Field Headquarters Entrance Road /Otter Slough	Bastrop Bayou Fishing Areas
Farm Fields	Mottled Duck Marsh
San Bernard Auto Tour and Moccasin Pond	
San Bernard Oak Trail	Hudson Woods Unit
Little Slough Trail (across from Complex Office)	Dow Woods Unit
Betty Brown Unit	

(c) When is the use conducted?

Visitors are welcome to participate in photography opportunities during daylight hours year-round.

(d) How is the use conducted?

The Complex provides local, regional, national, and international visitors with a wide range of photography opportunities, supporting a rapidly growing nature-tourism industry in Texas. Photography of birds, wildlife, wildflowers, and scenery are each very popular. Most of the photography takes place from the window of the visitor's vehicle, trails, and observation platforms at the Brazoria and San Bernard NWR. A photo contest in conjunction with the Migration Celebration has attracted many new photographers to the refuge Complex.

In addition, Brazoria NWR has added a nature photography activity to the Discovery Environmental Education Program (DEEP). The Friends group funded eleven cameras to

be used for structured and unstructured exploration of nature occurring there. These cameras will also be used for interpretive programs at Migration Celebration.

Through the strategies listed under Objective 3 of the Comprehensive Conservation Plan, the refuge has establish a bird feeding station at Discovery Center and manage this station as dynamic exhibits that promote photography among other public uses. In addition, the Complex plans to host children refuge photography contests and display the winning photos in the Complex office or Brazos Mall. Lastly, the Complex will continue to facilitate photography by making cameras and portable photo blinds available for loan to the visiting public.

(e) Why is this use being proposed?

The objective for this use is to provide safe and high quality opportunities for photography on the Complex. Visitors of all ages and abilities have an opportunity to photograph wildlife and habitat resources on the refuges. Photographing wildlife in natural or managed environments fosters a connection between visitors and natural resources. Wildlife photography on the Complex provides opportunities for wildlife enjoyment not commonly available on adjacent private land.

AVAILABILITY OF RESOURCES:

Because photography utilizes the same facilities as wildlife observation, there is no identified additional cost of maintaining these facilities for photography beyond that described under the wildlife observation compatibility determination. Photography was added to the mini-course schedule for DEEP in 2010. Although the majority of the costs of starting the program were handled by the Friends Group, an estimated $1,000 is required annually for maintaining the program; replacing cameras, flash drives and portable blinds. Costs generally come out of the Public Use Operational budget for the Complex. Expansion of photography opportunities through providing cameras and blinds on loan through special interpretation programs will require additional staff or volunteers to manage this use. The estimated cost for this expansion is $2500.00 annually. The photography contest, held in association with Migration Celebration, is managed by a Friends Group Member and self sustaining through the entry fees required for the contest. Costs associated with matting and the display of the photographs in the Complex office is paid by the refuge. An estimated $500.00 is required annually to mount and display quality photographs. To date, the photography mini-course has been well received by students and teachers. The Complex will continue to monitor the success of this and other DEEP courses through teacher feedback. No formal monitoring of photography users is planned.

ANTICIPATED IMPACTS OF THE USE:

Short and Long-term Impacts:

The measurable environmental impacts for photography are expected to be short-term. There is some temporary disturbance to wildlife due to human activity on the land. The most likely impacts will be during spring and early summer when many animals are nesting and brood rearing, and during spring and fall migration. Visitor access is typically by individuals or small groups for short durations. Destruction or negative impacts to habitat and associated vegetation are minimal because public use is confined to trails, and to state, county, and refuge roads.

Reducing the size of the impacted area, combined with sporadic, limited use by the public should prevent unacceptable impacts. Winter activities pose little to no impact on vegetation, and winter disturbance to resident wildlife is temporary and minor.

These short-term, temporary effects are countered by the opportunity photography allows, which results in stronger environmental stewardship long-term which benefits the landscape as a whole.

The activities follow all applicable laws, regulations and policies, including: Migratory Bird Conservation Act, Title 50 Code of Federal Regulations, Refuge System Manual, Refuge System goals and objectives, and refuge goals and objectives.

These activities are compliant with the purposes of the refuges and the Refuge System Mission. Operating this activity does not alter the refuges' ability to meet habitat goals and it helps support several of the primary objectives of the refuges.

Cumulative Impacts:
Wildlife photography opportunities are not anticipated to have any cumulative negative impacts to the extent that will affect life history requirements of any wildlife species. Other public uses such as wildlife observation occur at the same sites used for wildlife photography. Wildlife photography opportunities may increase over time, but it is not anticipated to be significant enough to cause any cumulative impacts. Wildlife impacts will be carefully monitored in an attempt to identify changes in wildlife behavior and habitat response near photography areas. If impacts are detected, adaptive strategies will be developed to reduce or eliminate the impacts on wildlife.

Providing an opportunity for people to photograph wildlife and nature is a beneficial long-term environmental impact. Because of the limited opportunity beyond the refuges that provide photography in a natural setting, cumulative impacts are considered beneficial. Because photographers also participate in other approved recreation uses, the cumulative impacts will be minimal.

PUBLIC REVIEW AND COMMENT:
This compatibility determination was published and available for public review and comment concurrent with the Draft CCP and EA; the comment period opened August 15 and closed on September 20, 2012. Public notification included a notice in the Federal Register, media announcements, public notices posted throughout the local communities, and a public meeting. No comments specific to this determination were received.

DETERMINATION (CHECK ONE BELOW):
___ Use is Not Compatible
_X_ Use is Compatible with Following Stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:
To ensure compatibility with the Refuge System and Complex goals and objectives, photography can only occur under the following stipulations:

1. Use is confined to daylight hours only.

2. Camping and fires are prohibited.
3. No temporary photo blinds may be left on the overnight.
4. Harassment of wildlife or excessive damage to vegetation is prohibited.
5. Photography is restricted to designated public access points and established blinds. To protect fragile habitats and wildlife, off-road vehicle travel and parking is not permitted.
6. Wildlife impacts will be carefully monitored. If impacts are detected, adaptive strategies will be developed, such as temporary closures and limit number o photographers in a given area to reduce wildlife disturbance.

JUSTIFICATION:
As defined by the National Wildlife Refuge System Improvement Act of 1997, wildlife-dependent recreational uses may be authorized on a refuge when they are compatible and not inconsistent with public safety. Photography is included as one of these six wildlife-dependent recreational opportunities, which are to receive enhanced and priority consideration in refuge planning and management. Continued photography opportunities on the Complex will not conflict with any of the other priority public uses, adversely impact biological resources, or detract from refuge goals, objectives, and management activities described in the National Wildlife Refuge System Improvement Act of 1997. Through the compatibility determination process, the Complex has determined that photography, in accordance with the stipulations provided above, will not materially interfere with or detract from the fulfillment of the Refuge System mission or the purposes of the refuges.

SIGNATURE: Refuge Manager _____ 4-12-2013
(Signature and Date)

CONCURRENCE: Regional Chief _____ 9/4/13
(Signature and Date)

MANDATORY 15-YEAR RE-EVALUATION DATE: 2028

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COMPATIBILITY DETERMINATION

USE: Environmental Education

REFUGE NAME: Texas Mid-coast National Wildlife Refuge Complex

ESTABLISHING AND ACQUISITION AUTHORITIES:
Texas Mid-coast National Wildlife Refuge Complex (Complex) is comprised of Brazoria, San Bernard, and Big Boggy National Wildlife Refuges (NWRs). Brazoria NWR was established on October 20, 1966, San Bernard NWR was established next on November 7, 1968, and Big Boggy NWR was established on July 8, 1983. All three refuges were created and managed under provisions of the Migratory Bird Conservation Act (16 U.S.C. 712d) and the Refuge Recreation Act (16 U.S.C. 460k-1 and 16 U.S.C. 460k-2). Brazoria and San Bernard NWRs were also established under the Fish and Wildlife Act of 1956 (16 U.S.C. 742(a)(4) and 16 U.S.C. 742(b)(1)).

REFUGE PURPOSE(S):

1. "…for use as an inviolate sanctuary,… for any other management purposes,… for migratory birds." (Migratory Bird Conservation Act [16 U.S.C. 712d])
2. "…for the development, advancement, management, conservation, and protection of fish and wildlife resources…" [16 U.S.C. 742f(a)(4)] and "…for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude…" [16 U.S.C. 742f(b)(1)] (Fish and Wildlife Act of 1956)
3. "…suitable for- (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species…" [16 U.S.C. 460k-1]; "…the Secretary… may accept and use… real… property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donor…" [16 U.S.C. 460k-2] (Refuge Recreation Act, as amended [16 U.S.C. 460k – 460k-4]).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:
The mission of the National Wildlife Refuge System (Refuge System) is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

DESCRIPTION OF USE:

(a) What is the use?
Environmental education is an existing wildlife-dependent recreational use occurring on Brazoria and San Bernard NWRs. The environmental education (EE) program provides safe, accessible, and high quality opportunities for children and adults to learn about the refuge and habitats of the Texas Gulf Coast.

Environmental education at the Complex incorporates on-site, hands-on activities and programs that address the audience's course of study, refuge purpose(s), physical attributes, ecosystem dynamics, conservation strategies, and the Refuge System mission. These programs are conducted on refuge lands by Service staff, volunteers and partner organizations.

The Complex currently provides on-site environmental education programs for local schools ranging from elementary to high school in the surrounding areas and activities for approximately 41 groups per year with a total yearly visitation of approximately 3,200 students to these programs.

On Brazoria NWR, the refuge has been conducting the Discovery Environmental Education Program (DEEP) since 1994. The program there currently serves approximately 3,000 students but the refuge would like to increase the program's capabilities in other school districts.

DEEP has also been functioning at the San Bernard NWR since 2003, serving approximately 500 students with expectations to expand service to 1,000 students.

(b) Where is the use conducted?

On Brazoria NWR, the Discovery Center has been the center of the Complex's active environmental education program since 2005, serving also as a meeting site for refuge staff and the Friends of the Brazoria NWR and a visitor contact station. The building has received high praise from visitors and the classroom/lab, outfitted with stereomicroscopes and a video microscope projector, has become a highlight for visiting students and adults. In addition to the Discovery Center Environmental education programs are conducted at the following refuge trails and facilities:

- Big SloughTrail
- Big Slough Auto Tour
- Crosstrails Kiosk

The San Bernard NWR activities occur primarily at the Hudson Woods Unit, making use of a small cabin (Discovery Outpost), the entrance road, and various trails including:

- Scoby Lake
- Live Oak Trail

At Hudson Woods environmental education focuses primarily on freshwater wetlands and bottomland forest ecosystems and wildlife. On average, a single field trip is hosted at the San Bernard Wolfweed Wetland Complex annually. This trip focuses on freshwater marsh, riparian habitat and blue crab ecology. The Comprehensive Conservation Plan includes opportunities to expand the program at San Bernard NWR's Wolfweed Wetlands area and at Dow Woods.

(c) When is the use conducted?

The use is conducted during the school year with on-site activities occurring primarily throughout the spring and fall. The refuge provides winter and summer programs as needed.

(d) How is the use conducted?

Structured, curriculum-based environmental education activities comply with Service policy (605 FW 6), which are aligned with State and national environmental education criteria. Environmental education programs typically involve groups of students of varying ages participating in on-site activities led by staff or docents about the geological, biological, or ecological topics regarding the site. A variety of mini-courses are available that are generally taught outside of the classroom. Standard mini-courses include:

- Bug sweeping in a freshwater wetland
- Microscope lab in the classroom
- Fishing basics
- Reptiles and amphibians
- Wildlife track casting
- Trail Walks
- Refuge tours
- Water and it's characteristics
- Seining in brackish wetlands
- Bats: facts and superstitions
- Wings: how birds fly
- Terrestrial insect sweeping and ID
- blue crab ecology
- nature photography and
- tree identification and growth.

At some sites, students have even been involved with habitat restoration activities.

A partnership exists between the Friends of Brazoria NWR and area school districts to help with the financial impacts of the program expansion. The Complex has a Memorandum of Understanding (MOU) with the Brazosport Independent School District for this program and additional MOUs are expected with other school districts. To help accommodate increases in demand for the program, workshops will be available to train teachers to lead their students through a high quality outdoor experience.

Both refuges also participate in the Wilderness Passport program, and each child receives a passport sticker for two of the eight area ecosystems, included in the passport, they visit on the Complex. This program was developed by Houston Wilderness, a community conservation and outdoor education organization.

Picnicking may occur as an incidental use supportive of the environmental education program. Picnic tables are located outside of the Discovery Center and may be utilized in conjunction with environmental education activities.

(e) Why is this use being proposed?

Environmental education provides a way for people to connect with nature through a hands-on approach and provides educational experiences that are not easily gained in a classroom setting. Texas mandates that a significant percentage of science education be in the form of lab and field investigations, and the refuge program is a perfect fit for these types of field-based experiences. The program meets local and State of Texas education standards, allows professional development for teachers, provides community-based service organization programs, meets youth group merit badge requirements, and instills a sense of stewardship and understanding of conservation issues. The EE program also improves the quality of the visitor's experience and provides them with a better understanding of the benefits, issues, and challenges of natural resource conservation in the coastal ecosystem. The program expansion is proposed to serve additional students, though the expansion is limited by the number of available docents as well as the carrying capacity of the environment. The experiences provided at the Discovery Complex influence the lives of the children and help them to fully appreciate the gift of living on the Texas Coast.

AVAILABILITY OF RESOURCES:

The Complex currently has one part-time employee (1/2 FTE) to manage the environmental education program. The program relies heavily on volunteers, many of which are trained Texas Master Naturalists, for docents and to conduct the actual classes. Other Complex staff assists throughout the year during various field trips when volunteers are not available or providing specialty topics such as fire management. Operation of DEEP requires replacement of EE supplies, including; petri dishes, sweep nets, cameras, flash drives, food for live reptiles, etc. and operation of the Discovery Center. Being off the electrical grid, operations costs are generally associated with replacement of batteries, propane fuel for the back-up generator and facility cleaning and maintenance (including staff salary). Annual expenditures to maintain the current DEEP are estimated at $65,000. Based on a review of the refuge budget allocated for these activities, there is currently sufficient funding to ensure compatibility and to administer and manage the existing use. Strategies to expand DEEP have been identified and would require hiring a full-time FTE to replace the current part-time position. Expansion of DEEP to additional School Districts including the use of additional venues and full-time FTE will increase the annual costs to $110,000.

The Complex has an MOU with the Brazosport Independent School District for this program and additional MOUs are expected with other school districts.

The activities follow all applicable laws, regulations and policies, including: Migratory Bird Conservation Act, Title 50 Code of Federal Regulations, Refuge System Manual, Refuge System goals and objectives, and refuge goals and objectives.

These activities are compliant with the purpose of the refuge and the Refuge System Mission. Operating this activity does not alter the refuge's ability to meet habitat goals and it helps support several of the primary objectives of the refuge.

ANTICIPATED IMPACTS OF THE USE:

Short and Long-term Impacts:

Environmental education has a beneficial effect on refuge purposes as well as the mission of the NWRS by developing a refuge based curriculum to meet national and/or State educational standards for 4th and 7th grades. The Complex serves as an information resource and outdoor classroom for post secondary schools throughout the area.

Environmental education has a beneficial effect on refuge goals and objectives by striving to enhance opportunities and the quality of the visitor's experience, allowing program participants to demonstrate learning through refuge-specific stewardship tasks and projects. Environmental education activities strive to promote understanding and appreciation of natural and cultural resource management throughout the Complex.

Most interpretation activities will occur at, or be directed to, existing and future facilities in strategic locations, providing quality opportunities while limiting wildlife and habitat disturbance. These activities are usually predictable in timing (such as daylight hours) and in a given geographical location (such as on a trail). School buses and personal vehicles would utilize developed roads and parking areas to access trails which are already in place. Self-guided interpretation would be sporadic, by small groups of people, and at established trails and kiosks. This may cause short term disturbance as well, but would have minimal impact. In addition, the refuge teaches students the prohibitions on picking wildflowers and removing bird feathers. Students are taught the importance of good wildlife observation techniques, including moving slowly and quietly to produce the least possible disruption to the environment

Potential impacts to wildlife and the environment include short-term disturbance, minor soil compaction on existing trails and vegetative impacts in the immediate vicinity of the activity. During on-site activities, a small number of organisms, like aquatic insects, may be temporarily removed from their habitat for observation, but these organisms are returned and the students are taught the ethic of leaving the refuge in an undisturbed state. Disturbance is typically short-term and will only temporarily displace wildlife. Adequate habitat is usually available for wildlife nearby. Anticipated long-term impacts are beneficial to the refuge, as these activities promote a conservation ethic in the local community. This use would increase in the future the DEEP program expanded to additional school districts with a full-time position with visitor services responsibilities added as proposed in the CCP.

Cumulative Impacts:

Environmental education on the Complex is not anticipated to have any cumulative negative impacts to the extent that will affect life history requirements of any wildlife species. Other public uses such as wildlife observation and photography at the same sites used for environmental education and interpretation may increase over time, but it is not anticipated to be significant enough to cause cumulative impacts. The cumulative impacts of educating the public about conservation issues would be beneficial to meeting the Service mission and refuges purposes. Wildlife impacts will be carefully monitored in an attempt to identify changes in

behavior and habit response near congregation areas. If impacts are detected, adaptive strategies will be developed to reduce or eliminate the impacts to wildlife.

PUBLICE REVIEW AND COMMENT:
This compatibility determination was published and available for public review and comment concurrent with the Draft CCP and EA; the comment period opened August 15 and closed on September 20, 2012. Public notification included a notice in the Federal Register, media announcements, public notices posted throughout the local communities, and a public meeting. No comments specific to this determination were received.

DETERMINATION (CHECK ONE BELOW):
___ Use is Not Compatible
_X_ Use is Compatible with Following Stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:
The refuges are always involved in facilitating environmental education programs on the Complex in order to ensure compatibility. Special requests for environmental education use of the Complex after-hours must be reviewed by the Refuge Manager.

1. Other than Service programs, any other environmental education activity or program conducted on Service lands will be required to obtain a Special Use Permit. These permits will contain conditions to ensure that impacts are minimized to ensure compatibility. As part of the special use permit application and renewal process, annual evaluations will be conducted to assess if objectives are being met and that the natural resources are not being adversely affected. The refuge will modify or eliminate any use that results in unacceptable impacts to wildlife or any other resources.
2. Environmental education programs will avoid sensitive sites and vulnerable wildlife populations and will be held at or near established facilities so that impacts may be minimized.
3. Evaluations of sites and programs will be conducted periodically to assess if objectives are being met and that natural resources are not being adversely impacted.
4. Wildlife impacts will be carefully monitored. If impacts are detected, adaptive strategies will be developed, such as the creation of approach-zones, or moving program locations and times to reduce wildlife disturbance.

JUSTIFICATION:
Environmental education is an existing priority public use of the Refuge System as identified in the Refuge System Improvement Act of 1997, and receives enhanced consideration over non-priority uses. Environmental education activities on the Complex are designed to promote the purpose of the Refuge and support its mission, promoting understanding and appreciation of natural and cultural resources and their management on all lands and water in the Refuge System. Environmental education programs conducted on the Complex are in accordance with the stipulations above, will not "materially detract from or interfere with" the purposes for which the refuges were established or conflict with any of the other priority public uses. The program also will not adversely impact other biological resources or detract from refuge goals, objectives, and management activities.

SIGNATURE: Refuge Manager _____ 4-12-2013
(Signature and Date)

CONCURRENCE: Regional Chief _____ 9/4/13
(Signature and Date)

MANDATORY 15-YEAR RE-EVALUATION DATE: 2028

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COMPATIBILITY DETERMINATION

USE: Interpretation

REFUGE NAME: Texas Mid-coast National Wildlife Refuge Complex

ESTABLISHING AND ACQUISITION AUTHORITIES:
Texas Mid-coast National Wildlife Refuge Complex (Complex) is comprised of Brazoria, San Bernard, and Big Boggy National Wildlife Refuges (NWRs). Brazoria NWR was established on October 20, 1966, San Bernard NWR was established next on November 7, 1968, and Big Boggy NWR was established on July 8, 1983. All three refuges were created and managed under provisions of the Migratory Bird Conservation Act (16 U.S.C. 712d) and the Refuge Recreation Act (16 U.S.C. 460k-1 and 16 U.S.C. 460k-2). Brazoria and San Bernard NWRs were also established under the Fish and Wildlife Act of 1956 (16 U.S.C. 742(a)(4) and 16 U.S.C. 742(b)(1)).

REFUGE PURPOSE(S):

1. "…for use as an inviolate sanctuary,… for any other management purposes,… for migratory birds." (Migratory Bird Conservation Act [16 U.S.C. 712d])
2. "…for the development, advancement, management, conservation, and protection of fish and wildlife resources…" [16 U.S.C. 742f(a)(4)] and "…for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude…" [16 U.S.C. 742f(b)(1)] (Fish and Wildlife Act of 1956)
3. "…suitable for- (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species…" [16 U.S.C. 460k-1]; "…the Secretary… may accept and use… real… property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donor…" [16 U.S.C. 460k-2] (Refuge Recreation Act, as amended [16 U.S.C. 460k – 460k-4]).

NATIONAL AND WILDLIFE REFUGE SYSTEM MISSION:
The mission of the National Wildlife Refuge System (Refuge System) is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

DESCRIPTION OF USE:

(a) What is the use?
Interpretation is an existing wildlife-dependent recreational opportunity occurring on Brazoria and San Bernard NWRs. The refuge communicates the most important fish, wildlife, habitat, and resource issues to visitors of all ages and abilities through effective interpretation. In accordance with Objective 4 of the Comprehensive Conservation Plan, the Complex is proposing to increase the overall effectiveness of the interpretive program

above current levels to ensure that all visitors gain a better understanding of three primary concepts:

1. The value of protecting natural landscapes and the unique purposes of the Complex;
2. The Complex as a component of a national network of refuges, protecting wildlife and habitat resources; and
3. The significance and mission of the Refuge System.

(b) Where is the use conducted?

Opportunities for interpretation occur throughout the Complex. People may encounter interpretive opportunities within any public use areas provided on the Complex including but not limited to the following areas:

On Brazoria NWR, interpretation is conducted at the following locations: the self-guided auto tour route, Discovery Center and associated information pavilion, Bastrop Bayou Fishing Area, Big Slough Trail, and the Teal Pond observation platform. Personal interpretive services include the Discovery Center programs, group presentations, guided talks and tours, and special events. The refuge utilizes open houses to provide unique interpretative opportunities to groups, families, and individuals, through live reptile displays, animal track casting, seining for aquatic insects, and viewing the microscopic world. Hunting and fishing information kiosks are located at the Bastrop Bayou Fishing Area. The Big Slough Trail has a corresponding interpretive trail guide. Teal Pond observation platform has three interpretive panels providing information on migratory waterfowl. The Discovery Center has static and interactive interpretive displays and dioramas. The information pavilion near the Discovery Center has four interpretive panels on recreational opportunities and wildlife specific information and identification. The Brazoria Field Office, located off FM 2004 near Otter Slough, provides a brief welcome and introduction to the refuge via interpretive panels in the lobby.

San Bernard NWR has five interpretive kiosks located at Bobcat Woods, Auto Loop entrance, San Bernard Oak Trail, Hudson Woods, and Dow Woods. Hunting and fishing information kiosks are located at Cedar Lake Creek, Sargent, and Big Boggy NWR. San Bernard NWR Oak Trail and the Tveten Trail at Dow Woods has a corresponding interpretive guide and trail brochure. Bobcat Woods, Hudson Woods, and Dow Woods have interpretive panels along each trail. Cedar lake Creek Paddling Trail also has an interpretive trail guide. San Bernard NWR Office and Screened Shelter both contain interpretive panels to welcome and orient visitors and introduce them to refuge resources.

(c) When is the use conducted?

Visitors are welcome to participate in interpretive programs during daylight hours throughout the year. Interpretive opportunities are available in the form of self-guided tours and interpretive signs along historical structures and trails. Interpretive guided programs are also available throughout the year or as requested by organized groups such as school groups, Boy Scouts, Girl Scouts, etc.

(d) How is the use conducted?

The Complex contains multiple means for refuge visitors to experience the interpretative program through publications, including: brochures, fact sheets, and species lists; signs, interpretive panels, exhibits, guided walks and presentations. Exhibits are accessible and easy to read and understand. They contain audio and tactile elements that can benefit everyone through appealing to multiple paths of learning. The Complex plans to enhance the interpretation program through partnerships with the Texas Master Naturalists and the Friends Group providing additional lectures and guided walks at both Brazoria and San Bernard NWRs.

(e) Why is this use being proposed?

Interpretation enhances opportunities for a high quality visitor experience on each of the three refuges. It also promotes visitor understanding for America's natural resources by providing safe, enjoyable, and accessible interpretive opportunities, products, and facilities. Many visitors do not realize the distinction between national wildlife refuges and a park or Federal or State agency lands that are managed for different purposes. Increased efforts are needed to help people better understand the role of national wildlife refuges, the Service mission, and to have a heightened awareness of conservation and stewardship concepts. Interpretation at the Complex provides opportunities for visitors to make their own connection with refuge resources through talks, publications, brochures, fact sheets, species lists, signs, interpretive panels, and exhibits.

AVAILABILITY OF RESOURCES:

Currently, the primary interpretation is primarily through panels and publications. Over the past three years, many of the brochures and panels were updated and replaced through the efforts of a seasonal intern (.25 FTE) and the outdoor recreation specialist. Approximately 0.5 FTE is required to administer and manage these activities adequately. In addition, maintenance and improvement of refuge interpretive signs, trails, and visitor center displays will periodically be required. The total estimated cost per year is estimated at $65,000. Based on a review of the refuge budget allocated for these activities, there is currently sufficient funding to ensure compatibility and to administer and manage the existing use. Strategies to expand the interpretive program with additional interpretive activities will require hiring another FTE to capture the potential for this area.

The CCP recommends additional staffing and facilities to expand interpretation. Greater numbers of people would learn about, and benefit from, the refuge with additional staff and interpretative materials. Additional staff would be able to provide additional interpretation programs and develop new or replace existing panels and literature.

ANTICIPATED IMPACTS OF THE USE:

Short and Long-term Impacts:
The overall impacts to the refuges and their associated wildlife populations from interpretation would be minimal. Most interpretive activities will occur at, or be directed to, existing and future facilities in strategic locations, providing quality opportunities while limiting wildlife and habit disturbance. These activities are usually predictable in timing (such as daylight hours) and in a given geographical location (such as on a trail). Potential impacts to wildlife and the environment include short-term disturbance, minor soil compaction on existing trails and vegetative impacts in the immediate vicinity of the activity. Disturbance is typically short-term and should only temporarily displace wildlife. Adequate habitat is usually available for wildlife nearby. Personal vehicles would utilize developed roads and parking areas to access trails that are already in place. Self-guided interpretation would be sporadic, by small groups of people, and at established trails and kiosks. This may cause short-term disturbance as well, but would have minimal impact.

Cumulative Impacts: No cumulative or indirect effects are anticipated to occur as a result of the refuge interpretation program. Evaluations of sites and programs will be conducted periodically to assess if objectives are being met and that natural resources are not being adversely impacted.

Interpretation occurs in conjunction with other wildlife-dependent activities including; wildlife observation, environmental education and photography. Providing an opportunity for people to learn among natural habitats and view native wildlife provides wide-scale beneficial environmental impacts. Although interpretation and associated wildlife-dependent uses may increase over time, it is not anticipated to be significant enough to cause cumulative impacts. The cumulative impacts of educating the public about conservation issues would be beneficial to meeting the Service mission and the refuges purposes.

As the demand for interpretation changes, refuge management will adjust the frequency, time and locations of the programs to minimize impact on wildlife and other resources affected by these programs. Interpretive programs will avoid sensitive sites and vulnerable wildlife populations and will be held at or near established facilities so that impacts may be minimized. Potential wildlife impacts will be carefully monitored. If impacts are detected, adaptive strategies will be developed, such as the creation of approach-zones, or moving program locations and times to reduce wildlife disturbance.

PUBLIC REVIEW AND COMMENT:
This compatibility determination was published and available for public review and comment concurrent with the Draft CCP and EA; the comment period opened August 15 and closed on September 20, 2012. Public notification included a notice in the Federal Register, media announcements, public notices posted throughout the local communities, and a public meeting. No comments specific to this determination were received.

DETERMINATION (CHECK ONE BELOW):

___ Use is Not Compatible
_X_ Use is Compatible with Following Stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:
To ensure compatibility with the Refuge System and Complex goals and objectives, photography can only occur under the following stipulations:

1. Use is confined to daylight hours only.
2. Camping and campfires are prohibited.
3. To protect fragile habitat and wildlife, the refuge prohibits off-road vehicle travel and parking is not permitted.
4. Harassment of wildlife or excessive damage to vegetation is prohibited.

JUSTIFICATION:
As defined by the National Wildlife Refuge System Improvement Act of 1997, wildlife-dependent recreational uses may be authorized on a refuge when they are compatible and not inconsistent with public safety. Interpretation is included as one of these six wildlife-dependent recreational opportunities, which are to receive enhanced and priority consideration in refuge planning and management. The continued interpretation program on the Complex will not conflict with any of the other priority public uses, adversely impact biological resources, or detract from goals, objectives, and management activities described in the National Wildlife Refuge System Improvement Act of 1997. In fact, this wildlife-dependent recreational use will serve to enhance visitors' understanding of refuge resources and the role the refuges serve within the Refuge System. Through the compatibility determination process, the Complex has determined that interpretation, in accordance with the stipulations provided above, will not materially interfere with or detract from the fulfillment of the Refuge System mission or the purposes of the refuges.

SIGNATURE: Refuge Manager _____ 4-12-2013
(Signature and Date)

CONCURRENCE: Regional Chief _____ 9/4/13
(Signature and Date)

MANDATORY 15-YEAR RE-EVALUATION DATE: 2028

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COMPATIBILITY DETERMINATION

USE: Boating (Use of small motor boats, canoes, kayaks, and air boats)

REFUGE NAME: Texas Mid-coast National Wildlife Refuge Complex

ESTABLISHING AND ACQUISITION AUTHORITIES:
Texas Mid-coast National Wildlife Refuge Complex (Complex) is comprised of Brazoria, San Bernard, and Big Boggy National Wildlife Refuges (NWRs). Brazoria NWR was established on October 20, 1966, San Bernard NWR was established next on November 7, 1968, and Big Boggy NWR was established on July 8, 1983. All three refuges were created and managed under provisions of the Migratory Bird Conservation Act (16 U.S.C. 712d) and the Refuge Recreation Act (16 U.S.C. 460k-1 and 16 U.S.C. 460k-2). Brazoria and San Bernard NWRs were also established under the Fish and Wildlife Act of 1956 (16 U.S.C. 742(a)(4) and 16 U.S.C. 742(b)(1)).

REFUGE PURPOSE(S):

1. "…for use as an inviolate sanctuary,… for any other management purposes,… for migratory birds." (Migratory Bird Conservation Act [16 U.S.C. 712d])
2. "…for the development, advancement, management, conservation, and protection of fish and wildlife resources…" [16 U.S.C. 742f(a)(4)] and "…for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude…" [16 U.S.C. 742f(b)(1)] (Fish and Wildlife Act of 1956)
3. "…suitable for- (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species…" [16 U.S.C. 460k-1]; "…the Secretary… may accept and use… real… property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donor…" [16 U.S.C. 460k-2] (Refuge Recreation Act, as amended [16 U.S.C. 460k – 460k-4]).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:
The mission of the National Wildlife Refuge System (Refuge System) is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

DESCRIPTION OF USE:

(a) What is the use?
Boating is an existing recreational use occurring on Brazoria, San Bernard, and Big Boggy NWRs. Boating opportunities on the Complex include use of canoes, kayaks, small motor boats, and airboats. Although boating is not identified as one of the six wildlife-dependent recreational uses in the National Wildlife Refuge System Improvement Act of 1997, this activity is directly tied to fishing and hunting and supports wildlife observation, photography, and interpretation. The Complex is proposing to

continue to provide boating opportunities specifically in support of fishing, hunting and wildlife observation. The Complex estimates annual visitation at 78,000 with approximately 32,000 visitors assessing the Complex through boats for wildlife observation, hunting and fishing.

(b) Where is the use conducted?

On Brazoria NWR, boats are permitted on Nicks, Salt, and Lost Lakes by way of the Gulf Intracoastal Waterway (GIWW) or Bastrop Bayou. Brazoria NWR has one non-motorized boat launch for canoes and kayaks at Salt Lake and one at Clay Banks for access into Bastrop Bayou. Other boat launches are located off-refuge, and individuals may access refuge waters through the adjacent bayous, bays, and the Intracoastal Waterway.

At San Bernard NWR, a boat ramp is located on Cedar Lake Creek to provide access for canoes, kayaks, and small motor boats. A second non-motorized boat launch is available further up Cedar Lake Creek, just off CR 318 to encourage wildlife observation from non-motorized boats on Cedar Lake Creek. Navigable waters of Cedar Lakes, Cow Traps, and Salt Bayou are open to boat access. Again, boats may gain access to refuge waters from adjacent bayous, bays, and the GIWW. Boats are allowed on all navigable waters across the Complex.

Navigable waters of Boggy Creek are open for boating on Big Boggy NWR. Access is gained via the Intracoastal Waterway.

(c) When is the use conducted?

Boat launches on Brazoria and San Bernard NWRs are open to the public each day from dawn to dusk. Boating may occur year-round within that time range. As the majority of this use occurs in association with fishing and hunting, boating use is heaviest in the spring and fall during prime fishing seasons.

(d) How is the use conducted?

Refuge visitors are allowed to access waters via refuge boat ramps and by access from adjacent bays, bayous, and the GIWW. The refuges boating opportunities is designed as a means of enabling additional opportunities for wildlife dependent priority public uses such as hunting and fishing (in accordance with state regulations) and wildlife observation and photography. These opportunities enable visitors to fish and observe wildlife, which can instill an appreciation for the value of and need for fish and wildlife habitat conservation.

(e) Why is this use being proposed?

Boating on Brazoria and San Bernard NWRs facilitates fishing, hunting, wildlife observation, photography, and interpretation, each of which is one of the six wildlife-dependent recreational uses described in the National Wildlife Refuge System Improvement Act of 1997. This supportive recreational opportunity will help to establish an enhanced appreciation of the outdoor experience and encourage families and future generations to continue to pursue outdoor recreation

AVAILABILITY OF RESOURCES:
Boating serves primarily as a mode of transportation for Complex visitors to experience hunting, fishing and wildlife observation opportunities. Existing refuge visitor services and law enforcement staff and budget are adequate to administer this use. The Service will not have to provide special equipment or require a significant increase in staff expenditure to continue this use but will need to maintain the current staffing levels. The needed staff, time, and equipment is already largely committed. Approximately $10,000 is required annually to maintain this use.

ANTICIPATED IMPACTS OF THE USE:
Short and Long-term Impacts:
Boating supports the fishing, hunting and wildlife observation which are all consistent with the refuges' purposes and the mission of the Service, by providing traditional outdoor pastime that is deeply rooted in America's natural heritage. Boating on the refuge will have a beneficial effect on Refuge goals and objectives identified in the Complex's Comprehensive Conservation Plan by providing opportunities for families to participate in the wildlife dependent recreational uses.

The affects of boating activities on migratory and shore birds include noise, harassment and displacement. Within current regulations including the restrictions to navigable waters and closed marsh, boating activities are not anticipated to have an adverse impact on wildlife resources.

Cumulative Impacts:
There are no anticipated cumulative impacts anticipated from the use of boats for fishing, hunting and wildlife observation to the extent that will affect life history requirements of any wildlife species. Any potential wildlife impacts will be carefully monitored in an attempt to reduce or eliminate these impacts on all wildlife.

All wildlife-dependant uses and boating are within all applicable laws, regulations and policies; including title 50 of the Code of Federal Regulations, the Refuge System Manual, the mission and goals of the Refuge System, and the purposes, goals, and objectives of the Complex. Operating this activity does not hinder the refuges' ability to meet habitat goals, provides for the safety of the area's citizens, and supports several of the primary objectives of the refuges.

PUBLIC REVIEW AND COMMENT:
This compatibility determination was published and available for public review and comment concurrent with the Draft CCP and EA; the comment period opened August 15 and closed on September 20, 2012. Public notification included a notice in the Federal Register, media announcements, public notices posted throughout the local communities, and a public meeting. One comment specific to boating was received. The comment states there are no cumulative impacts but noise and visual presence by boating creates disturbance and is a long-term and cumulative impact that should be stated and discussed. FWS lumps airboats with other craft that are much less intrusive and cause less disturbance. Airboats have much greater impacts and should be analyzed separately than small motor boats (which are not defined but should be defined), canoes, and kayaks. Known impacts were discussed and future monitoring will be conducted. The CD was not changed as result of the comment. See CCP

Appendix L for more information on the Complex's Response to Comments.

DETERMINATION (CHECK ONE BELOW):
___ Use is Not Compatible
_X__ Use is Compatible with Following Stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:
To ensure that boating remains a compatible use, the Complex has developed the following stipulations:

1. Use is confined to daylight hours only.
2. Camping and campfires are prohibited.
3. Boat launching is permitted at designated areas only.
4. The use of mud boats outside of navigable waters is prohibited to protect fragile habitat and wildlife.

JUSTIFICATION:
As defined by the National Wildlife Refuge System Improvement Act of 1997, wildlife-dependent recreational uses are to receive enhanced and priority consideration in refuge planning and management. Boating is consistent with the refuges purposes and the mission of the Refuge System by providing alternative means of transportation to allow the public to enjoy wildlife dependent recreational opportunities such as hunting, fishing, wildlife observation, wildlife photography and interpretation.

Boating will not conflict with any of the other priority public uses, adversely impact biological resources, or detract from refuge goals, objectives, and management activities described in the CCP. Boating in accordance with the above stipulations will enhance the Complex's ability to attract refuge visitors and teach them about the purposes of the refuges and their role in the Refuge System. Through the compatibility determination process, the Complex has determined that boating, as described above, will not materially interfere with or detract from the fulfillment of the Refuge System mission or the purposes of the refuges.

SIGNATURE: Refuge Manager _____ 4-12-2013
(Signature and Date)

CONCURRENCE: Regional Chief _____ 9/4/13
(Signature and Date)

MANDATORY 10-YEAR RE-EVALUATION DATE: ____2023_____

COMPATIBILITY DETERMINATION

USE: Bicycling

REFUGE NAME: Texas Mid-coast National Wildlife Refuge Complex

ESTABLISHING AND ACQUISITION AUTHORITIES:
Texas Mid-coast National Wildlife Refuge Complex (Complex) is comprised of Brazoria, San Bernard, and Big Boggy National Wildlife Refuges (NWRs). Brazoria NWR was established on October 20, 1966, San Bernard NWR was established next on November 7, 1968, and Big Boggy NWR was established on July 8, 1983. All three refuges were created and managed under provisions of the Migratory Bird Conservation Act (16 U.S.C. 712d) and the Refuge Recreation Act (16 U.S.C. 460k-1 and 16 U.S.C. 460k-2). Brazoria and San Bernard NWRs were also established under the Fish and Wildlife Act of 1956 (16 U.S.C. 742(a)(4) and 16 U.S.C. 742(b)(1)).

REFUGE PURPOSE(S):

1. "…for use as an inviolate sanctuary,… for any other management purposes,… for migratory birds." (Migratory Bird Conservation Act [16 U.S.C. 712d])
2. "…for the development, advancement, management, conservation, and protection of fish and wildlife resources…" [16 U.S.C. 742f(a)(4)] and "…for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude…" [16 U.S.C. 742f(b)(1)] (Fish and Wildlife Act of 1956)
3. "…suitable for- (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species…" [16 U.S.C. 460k-1]; "…the Secretary… may accept and use… real… property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donor…" [16 U.S.C. 460k-2] (Refuge Recreation Act, as amended [16 U.S.C. 460k – 460k-4]).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:
The mission of the National Wildlife Refuge System (Refuge System) is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

DESCRIPTION OF USE:

(a) What is the use?
Bicycling is an existing recreational use occurring on all established gravel tour roads, Middle Bayou Trail on Brazoria NWR and trails at the Dow Woods Unit of San Bernard NWR. Although bicycling is not identified as one of the six wildlife-dependent recreational uses in the National Wildlife Refuge System Improvement Act of 1997, this activity serves as a supplemental recreational opportunity that enhances the Complex's offerings for wildlife observation, photography, and interpretation.

(b) Where is the use conducted?

On San Bernard NWR, bicyclists are welcome on the Auto Tour Loop, along with vehicles, within the Public Use Area.

On Dow Woods, a unit of San Bernard NWR, bicycling is permitted on both the Tveten Trail and the Bayou Loop.

On Brazoria NWR, bicycling is permitted on gravel roads, open to vehicles, within the Big Slough Auto Tour. In addition, bicycling is allowed on the Middle Bayou Trail, located near the Fishing Pier on Bastrop Bayou.

(c) When is the use conducted?

Both Brazoria and San Bernard NWRs are open to the public each day from sunrise to sunset. Bicycling may occur during those daytime hours.

(d) How is the use conducted?

Bicyclists are allowed to ride solely along designated refuge trails and public access roads. This use primarily facilitates other wildlife-dependent recreational uses such as wildlife observation, photography and interpretation.

(e) Why is this use being proposed?

Bicycling on Brazoria and San Bernard NWRs facilitates/or generates additional opportunities for wildlife observation, photography, and interpretation, each of which is one of the six wildlife-dependent recreational uses described in the National Wildlife Refuge System Improvement Act of 1997. This supportive recreational opportunity helps to establish an enhanced appreciation of the outdoor experience and encourage families and future generations to continue to pursue outdoor recreation and appreciate the value of wildlife and habitat conservation.

AVAILABILITY OF RESOURCES:

For the management and maintenance of this use in association with the public use roads at San Bernard and Brazoria NWRs, there is no additional cost. Roads are graded and roadways are mowed for all traffic. No additional mowing or maintenance is required for the Middle Bayou Trail at Brazoria NWR. The trail is mowed two to three times annually for all users. The costs associated with bicycling on the Dow Woods Trails, has not been determined. This is a new use on a new type of trail base (recycled granite over crushed concrete laid between garden edging). Additional maintenance may be required on the Bayou Loop, for the first couple of years as the concrete and granite compact. The estimated cost of maintaining the Dow Woods Trails is $1,200 annually for the first several years and less than $500 after that.

Additional law enforcement is required at Dow Woods to monitor all public uses, including bicycling to ensure that use is in accordance to published regulations and habitat and wildlife disturbance is minimized. Based on a review of the refuge budget allocated for these activities, there is currently sufficient funding to ensure compatibility and to administer and manage the existing use.

ANTICIPATED IMPACTS OF THE USE:

Short and Long-term Impacts:

Short-term negative impacts from bicycling are similar to those associated with vehicular traffic on roads and hiking along trails, namely associated with disturbance of wildlife. Wildlife disturbances may include flushing, as well as altering wildlife behavior to avoid human presence. The most likely impacts will be during spring and early summer when public use is greatest. Visitor access is typically by individuals or small groups for short durations. The use of the trails and roadways are generally irregular; minimizing impacts to temporarily displaced wildlife.

The long-term negative impacts are the modification of natural habitat to provide public use opportunities. This loss of natural habitat may be minimal, for dirt paths or mowed vegetation paths to moderate; for boardwalks or concrete trails and gravel roads.

Bicycling also has a beneficial effect on refuge goals and objectives by striving to enhance and diversify opportunities and quality of visitor experiences on the refuge. Bicycling can also promote visitor understanding of, and increase appreciation for, America's natural and cultural resources and conservation history. Bicycling provides an opportunity for people to bicycle among natural habitats and view native wildlife, which is a beneficial long-term environmental impact as people are able to connect with nature. This connection fosters environmental stewardship.

The activity follows all applicable laws, regulations and policies, including: Migratory Bird Conservation Act, Title 50 Code of Federal Regulations, National Wildlife Refuge System Manual, National Wildlife Refuge System goals and objectives, and Refuge goals and objectives.

This activity is compliant with the purposes of the refuges and the Refuge System mission. Operating this activity does not alter the refuges' ability to meet habitat goals and it helps support several of the primary objectives of the refuges.

Cumulative Impacts: Bicycling on the Complex is not anticipated to have any cumulative negative impacts to the extent that will affect life history requirements of any wildlife species. Bicycling is a mode for visitors to obtain access to the refuges while participating in other wildlife-dependent activities including; wildlife observation, interpretation, environmental education and photography. Providing an opportunity for people to bicycle among natural habitats and view native wildlife provides wide-scale beneficial environmental impacts as well. Although bicycling and associated wildlife-dependent uses may increase over time, it is not anticipated to be significant enough to cause cumulative impacts. The Complex will regularly evaluate bicycling to assess if objectives are being met and that natural resources are not being adversely impacted by these opportunities. If negative impacts are determined, mitigation measures may include seasonal or short term closures to protect both wildlife and trails.

PUBLIC REVIEW AND COMMENT:

This compatibility determination was published and available for public review and comment concurrent with the Draft CCP and EA; the comment period opened August 15 and closed on September 20, 2012. Public notification included a notice in the Federal Register, media announcements, public notices posted throughout the local communities, and a public meeting.

One comment specific to bicycling was received. The comment states there are no cumulative impacts but rutting, safety, illegal trails, and wildlife disturbance by mountain bikes are long-term and cumulative impacts that should be stated and discussed. Based on the historical light use these potential impacts are not expected to be a concern. This activity could result in some deterioration of the trails from rutting, but regular maintenance will be conducted to ensure that needed repairs are made and the trails are safe for all visitors. As stated above, the Complex will regularly evaluate bicycling to assess if objectives are being met and that natural resources are not being adversely impacted by these opportunities. As stated above, if negative impacts are determined, mitigation measures may include seasonal or short-term closures to protect both wildlife and trails. See CCP Appendix L for more information on the Complex's Response to Comments.

DETERMINATION (CHECK ONE BELOW):
___ Use is Not Compatible
_X_ Use is Compatible with Following Stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:
To protect fragile habitats and wildlife, off-road vehicle travel and parking is not permitted. For the same reason, bicycles are allowed only on public access roads and designated trails.

JUSTIFICATION:
As defined by the National Wildlife Refuge System Improvement Act of 1997, wildlife-dependent recreational uses are to receive enhanced and priority consideration in refuge planning and management. The continuation of bicycling at the Complex supports these priority public uses offered on the refuges as this activity supports wildlife observation, photography, and interpretation. This use will not conflict with any of the other priority public uses, adversely impact biological resources, or detract from refuge goals, objectives, and management activities described in the CCP. In fact, bicycling in accordance with the above stipulations will enhance the Complex's ability to attract refuge visitors and teach them about the purpose of the Complex and its role in the National Wildlife Refuge System. Through the compatibility determination process, the Complex has determined that bicycling, as described above, will not materially interfere with or detract from the fulfillment of the Refuge System mission or the purposes of the refuges.

SIGNATURE: Refuge Manager _____ 4-12-2013
(Signature and Date)

CONCURRENCE: Regional Chief _____ 9/4/13
(Signature and Date)

MANDATORY 10-YEAR RE-EVALUATION DATE: ____2023____

COMPATIBILITY DETERMINATION

USE: Hiking

REFUGE NAME: Texas Mid-coast National Wildlife Refuge Complex

ESTABLISHING AND ACQUISITION AUTHORITIES:
Texas Mid-coast National Wildlife Refuge Complex (Complex) is comprised of Brazoria, San Bernard, and Big Boggy National Wildlife Refuges (NWRs). Brazoria NWR was established on October 20, 1966, San Bernard NWR was established next on November 7, 1968, and Big Boggy NWR was established on July 8, 1983. All three refuges were created and managed under provisions of the Migratory Bird Conservation Act (16 U.S.C. 712d) and the Refuge Recreation Act (16 U.S.C. 460k-1 and 16 U.S.C. 460k-2). Brazoria and San Bernard NWRs were also established under the Fish and Wildlife Act of 1956 (16 U.S.C. 742(a)(4) and 16 U.S.C. 742(b)(1)).

REFUGE PURPOSE(S):

1. "…for use as an inviolate sanctuary,… for any other management purposes,… for migratory birds." (Migratory Bird Conservation Act [16 U.S.C. 712d])
2. "…for the development, advancement, management, conservation, and protection of fish and wildlife resources…" [16 U.S.C. 742f(a)(4)] and "…for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude…" [16 U.S.C. 742f(b)(1)] (Fish and Wildlife Act of 1956)
3. "…suitable for- (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species…" [16 U.S.C. 460k-1]; "…the Secretary… may accept and use… real… property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donor…" [16 U.S.C. 460k-2] (Refuge Recreation Act, as amended [16 U.S.C. 460k – 460k-4]).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:
The mission of the National Wildlife Refuge System (Refuge System) is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

DESCRIPTION OF USE:

(a) What is the use?
Hiking is an existing recreational use occurring at Brazoria and San Bernard NWRs. Hiking serves as a supportive recreational use that enhances the Complex's wildlife-dependent recreation offerings, especially wildlife observation, photography, and interpretation. The refuge estimates annual visitation at 78,000 with approximately 30,000 visitors coming to the refuge for wildlife observation and photography

opportunities with an additional 3,500 attending interpretational and environmental educational opportunities; with many of these activities accessed through hiking.

(b) Where is the use conducted?

Brazoria NWR provides three trails for hikers to use in a variety of settings, leading to a wide variety of habitat experiences. The Big Slough Boardwalk and Trail (0.6 miles) over the slough that provides a close encounter with a marsh crowned with spiky cattail and bulrush. The Big Slough Trail winds through low forests of yaupon and small clearings to an observation platform. The Cox Lake Trail is a short (.5 miles) is located within the Big Slough Public Use Area and takes visitors to the Maddox homesite and the shore of Cox Lake. The Middle Bayou Trail (2 miles) is located along the old abandoned Union Pacific Railroad. The trail traverses salty and coastal prairie habitats.

San Bernard NWR has a total of twelve hiking trails. Cow Trap Marsh Trail (1.2 miles) is a levee trail that traverses high, intermediate, and low marsh zones. Bobcat Woods Trails (1.5 miles) provides an accessible boardwalk and trail that provides exciting wildlife observation opportunities. At the trailhead are restrooms, interpretive displays, tables, and demonstration native garden for hummingbirds and butterflies. The San Bernard Oak Trail (0.7 miles) allows refuge visitors to wander through an old growth stand of live oak, pecan, hackberry, and ash. The Scissortail Trail (0.8 miles) is a loop following forested and brushy habitat along Cocklebur Slough. Cedar Lake Creek Trail is a .20 mile trail following the creek for fishing or hiking opportunities. Little Slough Trail (1.2 miles) located across from the Complex Office offers an opportunity for visitors to walk along a seasonally flooded slough.

Three bottomland units provide hiking opportunities away from the core refuges. Betty Brown Unit, located just north of FM 2611 offers a 3/8th mile loop trail that takes visitors to the shore of the San Bernard River. Hudson Woods Unit, located 5 miles west of Angleton, Texas, on State Highway 521, has three additional hiking trails in early and mid-succession stage bottomland forest. These include the Scoby Lake Trail (1.4 mile loop along Scoby Lake), the Live Oak Trail (1.8 miles that circles the north end of the property), and the Oyster Creek Trail (2.7 mile trail following the Oyster Creek). Dow Woods Unit, located just north of Lake Jackson, Texas, includes the accessible Tveten Trail (0.9 concrete loop) and Bayou Loop (2.3 mile gravel trail).

(c) When is the use conducted?

Public use areas, including the trails on Brazoria and San Bernard NWRs, are open each day from dawn to dusk. Hiking may occur during daytime hours with no seasonal closures, though this use occurs primarily in the spring with some use in the fall and winter.

(d) How is the use conducted?

All manner of pathways are available, from a concrete trail to boardwalks to woodland and bayou mowed trails. None of the trails are especially long, and all are on relatively flat terrain. Wandering off-trail is prohibited, due to habitat disturbance and dangerous wildlife such as alligators and venomous snakes reside in thicker vegetation.

(e) Why is this use being proposed?

Hiking on Brazoria and San Bernard NWRs facilitates fishing, wildlife observation, photography, and interpretation, each of which is one of the six wildlife-dependent recreational uses described in the National Wildlife Refuge System Improvement Act of 1997. The trails provide excellent opportunities for visitors to view waterfowl, wading birds, migratory songbirds, deer, alligators, and other resident and migratory wildlife, while also experiencing the unique coastal ecosystems across the Complex. This supportive recreational opportunity will help to establish an enhanced appreciation of the outdoor experience and encourage families and future generations to continue to pursue outdoor recreation. Additional self-guided brochures or interpretive trails will be developed to expand hiking opportunities as they support wildlife dependent recreational activities. Hiking is usually the preferred method of wildlife observation and increases the potential of observing more elusive bird species not commonly observed on roads.

AVAILABILITY OF RESOURCES:

Trails, including the bottomland trails, require monthly mowing during the growing season. In addition, trimming limbs and picking up fallen limbs is required twice a year. The trails are maintained through a variety of means; contract, volunteers, summer youth programs and maintenance staff. Approximately $6,000 for San Bernard NWR and $1,200 for Brazoria NWR are required for annual maintenance of trails and associated parking areas. An estimated 1400 hours, by staff, contractor and volunteers, are spent on trail maintenance across the Complex.

ANTICIPATED IMPACTS OF THE USE:

Short and Long-term Impacts:

Potential impacts to hiking activities include short-term disturbance to wildlife, minor soil compaction on existing trails and vegetative impacts in the immediate vicinity of the activity. Most hiking activities will occur at, or be directed to, existing and future trails and roads in strategic locations, providing quality opportunities while limiting wildlife and habit disturbance. Disturbance is typically short-term and should only temporarily displace wildlife. Adequate habitat and escape cover is usually available for wildlife nearby.

Impacts will be greatest during spring and early summer when use of the trails is greatest. Visitor access is typically by individuals or small groups for short durations. The use of the trails is generally irregular; minimizing impacts to temporarily displaced wildlife.

The long-term negative impacts are the modification of natural habitat to provide public use opportunities. This loss of natural habitat may be minimal, for dirt paths or mowed vegetation paths to moderate; for boardwalks or concrete trails. Hiking has a beneficial effect on refuge goals and objectives by striving to enhance and diversify opportunities and quality of visitor experiences on the refuge, promoting visitor understanding of, and increase appreciation for, America's natural and cultural resources and conservation history by providing safe, informative, enjoyable, and accessible areas of the refuge that would not otherwise be observed or appreciated. Providing an opportunity for people to hike among natural habitats and view native wildlife connects people with nature and fosters environmental stewardship.

The activities follow all applicable laws, regulations and policies, including: Migratory Bird Conservation Act, Title 50 Code of Federal Regulations, Refuge System Manual, National Wildlife Refuge System goals and objectives, and Refuge goals and objectives.

These activities are compliant with the purposes of the refuges and the National Wildlife Refuge System mission. Operating this activity does not alter the refuge's ability to meet habitat goals and it helps support several of the primary objectives of the refuges.

Cumulative Impacts:
There are no anticipated cumulative impacts. Hiking is a mode for visitors to obtain access to the refuges while participating in other wildlife-dependent activities including; wildlife observation, interpretation, environmental education and photography. Providing an opportunity for people to hike among natural habitats and view native wildlife provides wide-scale beneficial environmental impacts as well. Because of the limited opportunity beyond the refuges that provide hiking in a natural setting, the cumulative impacts of the hiking program are beneficial. Although hiking and associated wildlife-dependent uses may increase over time, it is not anticipated to be significant enough to cause cumulative impacts. Evaluations of sites and programs will be conducted periodically to assess if objectives are being met and that natural resources are not being adversely impacted by hiking. The cumulative impacts of educating the public about conservation issues would be beneficial to meeting the Service mission and the refuges purposes.

PUBLIC REVIEW AND COMMENT:
This compatibility determination was published and available for public review and comment concurrent with the Draft CCP and EA; the comment period opened August 15 and closed on September 20, 2012. Public notification included a notice in the Federal Register, media announcements, public notices posted throughout the local communities, and a public meeting. No comments specific to this determination were received.

DETERMINATION (CHECK ONE BELOW):
___ Use is Not Compatible
_X__ Use is Compatible with Following Stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:
To ensure that hiking remains a compatible use, the Complex has developed the following stipulations:

1. Camping is prohibited.
2. To protect fragile habitats and wildlife, off-road vehicle travel and parking is not permitted. No motorized vehicles are allowed on trails.
3. Wandering off trails is prohibited.
4. Littering is prohibited; hiking is allowed on a "pack it in, pack it out" basis.

JUSTIFICATION:
As defined by the National Wildlife Refuge System Improvement Act of 1997, wildlife-dependent recreational uses are to receive enhanced and priority consideration in refuge planning and management. The continuation of hiking at the Complex supports these priority public uses offered on the refuges as this activity supports wildlife observation, photography, fishing, and interpretation. This use will not conflict with any of the other priority public uses, adversely impact biological resources, or detract from refuge goals, objectives, and management activities described in the Refuge System Improvement Act of 1997. In fact, hiking in accordance with the above stipulations will enhance the Complex's ability to attract refuge visitors and teach them about the purpose of the Complex and its role in the Refuge System. Through the compatibility determination process, the Complex has determined that hiking, as described above, will not materially interfere with or detract from the fulfillment of the Refuge System mission or the purposes of the refuges.

SIGNATURE: Refuge Manager _____ 4-12-2013
(Signature and Date)

CONCURRENCE: Regional Chief _____ 9/4/13
(Signature and Date)

MANDATORY 10-YEAR RE-EVALUATION DATE: 2023

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COMPATIBILITY DETERMINATION

USE: Cooperative Farming

REFUGE NAME: Brazoria National Wildlife Refuge

ESTABLISHING AND ACQUISITION AUTHORITIES:
Brazoria NWR was established next on October 20, 1966, under provisions of the Migratory Bird Conservation Act (16 U.S.C. 712d), the Refuge Recreation Act (16 U.S.C. 460k-1 and 16 U.S.C. 460k-2), and the Fish and Wildlife Act of 1956 (16 U.S.C. 742(a)(4) and 16 U.S.C. 742(b)(1)).

REFUGE PURPOSE(S):

1. "…for use as an inviolate sanctuary,… for any other management purposes,… for migratory birds." (Migratory Bird Conservation Act [16 U.S.C. 712d])
2. "…for the development, advancement, management, conservation, and protection of fish and wildlife resources…" [16 U.S.C. 742f(a)(4)] and "…for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude…" [16 U.S.C. 742f(b)(1)] (Fish and Wildlife Act of 1956)
3. "…suitable for- (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species…" [16 U.S.C. 460k-1]; "…the Secretary… may accept and use… real… property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donor…" [16 U.S.C. 460k-2] (Refuge Recreation Act, as amended [16 U.S.C. 460k – 460k-4]).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:
The mission of the National Wildlife Refuge System (Refuge System) is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

DESCRIPTION OF USE:

(a) What is the use?
Cooperative farming is an economic use on the Brazoria NWR which is utilized as a management tool to provide habitat for resident and migratory wildlife. The cooperative farming, primarily rice farming occurs on a 3-year rotational basis across up to 1200 acres. Only approximately 1/3 of the total acreage is in production each year, enabling the other acreage to be flooded for moist soil management purposes. Payments by the cooperator may be in the form of water purchase for moist soil units, in-kind services such as mowing or disking fields, or direct payment in addition to a portion of the crop is left in the field for wildlife use.

(b) Where is the use conducted?

The farming acreage is located on the north side of the refuge between Ditch 6 and CR 208, just south of FM2004. The acreage is former coastal prairie that has been in crop production for many years prior to becoming part of the refuge. The area is traversed by several drainage ditches managed by the Brazoria County Drainage District #8. These ditches, along with FM2004, have altered the hydrology throughout this area. Where historically there was sheet surface flow, excess rainfall has been channelized. Although the ditches have altered the natural habitat, the refuge can take advantage of the same ditches by flooding croplands and moist-soil units. Surrounding acreage is managed as coastal prairie where prescribed fire is utilized. Water holding capability has been enhanced where ditch run-off water and excess water from farming is captured creating wet prairies.

(c) When is the use conducted?

Initial entry into the farm units occurs late winter to begin draining flooded units, followed by disking and ground preparation, with planting in March. The units are flooded throughout the growing season (April – June) and drained for harvest in July. Following harvest, the units are re-flooded for a second crop which is harvested in late September/early October. The Service's portion of the crop, generally comes from this second harvest which can be flooded for a third time, allowing winter waterfowl and waterbirds to utilize the field for food and cover.

(d) How is the use conducted?

A cooperative farming agreement is prepared annually. The agreement identifies which units are to be planted in a given year. Total acreage planted annually is 350 – 400 acres, with fields rotated every three years. In addition, payment including in-lieu services is identified and scheduled.

(e) Why is this use being proposed?

As it has been implemented, cooperative farming is a management tool utilized to provide high energy food for wildlife during the late fall and early winter months. In addition through rotation, fallow units are flooded, providing freshwater wetland habitats during the winter or during periods of severe drought when freshwater resources are critical. One additional benefit of the farming program is the capture of excess water onto the prairies below the farm fields.

AVAILABILITY OF RESOURCES:

Adequate funding and staff are available to manage the cooperative farming program. The cooperative farming program is overseen by the assistant refuge manager. Following preparation of the annual agreement, the assistant manager must stay in contact with the farmer throughout the year ensuring that the agreement is adhered to. On average, less than 2 percent of their time is required to manage the cooperative farming program. Estimated cost for managing the program is $3500 annually.

ANTICIPATED IMPACTS OF THE USE:

Short and Long-term Impacts:

Farming and associate moist-soil management activities on the refuge are directly related to and support the purposes for which the refuge was established. Cooperative farming results in short-term disturbances and long-term benefits to both resident and migratory wildlife using the refuge. Short-term impacts will include disturbance and displacement of wildlife that is typical of any heavy equipment operation. Positive long-term benefits result in providing food/habitat for migratory and resident wildlife. In 2010, the crops grown on the refuge provide food for a peak population of 800+ mottled ducks, 3,000 snow geese, 10,000+ winter waterfowl, 3000 sandhill cranes, 4000+ shorebirds and 1,000 wading birds.

The activities follow all applicable laws, regulations and policies, including: Migratory Bird Conservation Act, Title 50 Code of Federal Regulations, National Wildlife Refuge System Manual, National Wildlife Refuge System goals and objectives, and Refuge goals and objectives.

These activities are compliant with the purpose of the refuge and the Refuge System mission. Operating this activity does not alter the refuge's ability to meet habitat goals and it helps support several of the primary objectives of the refuge.

Cumulative Impacts:

Farming only occurs on lands that have been previously farmed. The impacts described above are minimal and short-term. The proposed action is not expected to incrementally add to any other state, private, or federal actions that are proposed or currently occurring in the area. The proposal benefits numerous wildlife species and supports hunting, wildlife observation, wildlife photography, environmental education, and interpretation. This activity does not significantly impact other refuge activities or wildlife populations locally or nationwide.

PUBLIC REVIEW AND COMMENT:

This compatibility determination was published and available for public review and comment concurrent with the Draft CCP and EA; the comment period opened August 15 and closed on September 20, 2012. Public notification included a notice in the Federal Register, media announcements, public notices posted throughout the local communities, and a public meeting. One comment specific to farming was received. The comment states that cumulative impacts of farming should be stated and discussed; by farming it not only keeps hundreds of acres from being restored to natural ecosystems but also creates a water pollution problem with fertilizer and pesticide use and costs money which could be used elsewhere to manage natural ecosystems. As stated above, we maintain that there are no cumulative impacts from our small farming program, which only utilized previously farmed areas. The determination was edited to address potential pollution from fertilizer application. See CCP Appendix L for more information on the Complex's Response to Comments.

DETERMINATION (CHECK ONE BELOW):

___ Use is Not Compatible

_X_ Use is Compatible with Following Stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:
Brazoria NWR management will continue periodic monitoring of the vegetative conditions and wildlife populations within the farm field/moist soil units and be aware of changing climatic (e.g. drought, flood) or other conditions which might necessitate changes to the number of farmed acres. If changes should occur, the permittee will be contacted and adjustments to the permit will be made, pursuant to the terms and conditions of the Special Use Permit.

JUSTIFICATION:
The farming program supports the refuge purposes by providing forage and cover for wildlife and by contributing to a diversity of habitat types. The acreage farmed by cooperators greatly reduces the budgetary and manpower requirements that would be needed if the refuge staff farmed all of the cropland independently. Farming, as a management tool to achieve certain vegetative and water level conditions, is recognized in the Service Manual as approved management practices so long as the refuge has control over season and area of use, and the location and extent of farming operations. Cooperative farming on the refuge is consistent with local practices and is accomplished only on land suitable for such management. Refuge croplands supplement natural food sources on the refuge and provide undisturbed areas where wintering waterfowl can forage. The refuge farming program minimizes crop depredation on area lands, thus preventing economic loss to private landowners. Additionally, wildlife viewing opportunities are enhanced through concentrating birds.

SIGNATURE: Refuge Manager _____ 4-12-2013
(Signature and Date)

CONCURRENCE: Regional Chief _____ 9/4/13
(Signature and Date)

MANDATORY 10-YEAR RE-EVALUATION DATE: 2023

COMPATIBILITY DETERMINATION

USE: Cooperative Grazing Program

REFUGE NAME: Texas Mid-coast National Wildlife Refuge Complex

ESTABLISHING AND ACQUISITION AUTHORITIES:
Texas Mid-coast National Wildlife Refuge Complex (Complex) is comprised of Brazoria, San Bernard, and Big Boggy National Wildlife Refuges (NWRs). Brazoria NWR was established on October 20, 1966, San Bernard NWR was established next on November 7, 1968, and Big Boggy NWR was established on July 8, 1983. All three refuges were created and managed under provisions of the Migratory Bird Conservation Act (16 U.S.C. 712d) and the Refuge Recreation Act (16 U.S.C. 460k-1 and 16 U.S.C. 460k-2). Brazoria and San Bernard NWRs were also established under the Fish and Wildlife Act of 1956 (16 U.S.C. 742(a)(4) and 16 U.S.C. 742(b)(1)).

REFUGE PURPOSE(S):

1. "…for use as an inviolate sanctuary,… for any other management purposes,… for migratory birds." (Migratory Bird Conservation Act [16 U.S.C. 712d])
2. "…for the development, advancement, management, conservation, and protection of fish and wildlife resources…" [16 U.S.C. 742f(a)(4)] and "…for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude…" [16 U.S.C. 742f(b)(1)] (Fish and Wildlife Act of 1956)
3. "…suitable for- (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species…" [16 U.S.C. 460k-1]; "…the Secretary… may accept and use… real… property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donor…" [16 U.S.C. 460k-2] (Refuge Recreation Act, as amended [16 U.S.C. 460k – 460k-4]).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:
The mission of the National Wildlife Refuge System (Refuge System) is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

DESCRIPTION OF USE:

(a) What is the use?
This Compatibility Determination evaluates the use of domestic livestock grazing on selected units of Brazoria and San Bernard NWR as a management tool in order to maintain vital components of waterfowl, endangered species, and other wildlife habitat. Livestock grazing is proposed by the Service under Alternative B (proposed action) of the Draft Comprehensive Conservation Plan (CCP) as an additional management tool that, in conjunction with fire, herbicide and mechanical manipulation, would be utilized

to achieve desired coastal prairie and freshwater management unit conditions to benefit grassland-dependant wildlife.

(b) Where is the use conducted?

A comprehensive livestock management plan will be developed to determine strategic locations to graze livestock, however, grazing may be employed as a management tool in coastal prairie habitats and fresh-water impoundments which would benefit native wildlife including: 1) maintaining of mottled duck nesting habitat; 2) control of invasive species; and 3) manage prairie habitats for Attwater's prairie chicken. Potential locations for implementation include; on Brazoria NWR moist-soil units, farm fields and restored prairie units between Austin Bayou and Ditch 6 and north of Walker Ditch and Haskins Mound, on San Bernard NWR restored prairie units associated with the historic Damon Prairie (Buffalo Creek and Eagle Nest Lake Units).

(c) When is the use conducted?

Timing of grazing will be determined on the development of the livestock management plan that will address season, timing, intensity and duration of each grazing season to meet the management needs of grassland dependent wildlife species throughout the Complex.

(d) How is the use conducted?

Livestock grazing will be conducted based seasonal rotation systems that best meet the habitat management considerations for endangered species, grassland dependent wildlife species, and waterfowl. Stocking rates, season, timing, intensity and duration of all livestock grazing occurring on the Complex will be designed to meet the needs of wildlife. The refuge would administer livestock grazing through issuance of a Special Use Permit (SUP) to a cooperative livestock permitee(s). The SUP would specify the details of the use, including any restrictions.

(e) Why is this use being proposed?

The objective of the livestock grazing program is to provide a management tool to help meet the desirable habitat characteristics (reduce vegetative cover, encourage forbs) that benefit grassland dependent wildlife species that prefer early seral stages. This type of management could make certain areas more attractive to waterfowl, shorebirds, other migratory birds and resident species, including the Attwater's prairie chicken, for which the Complex has been identified as a potential re-introduction site. Grazing on the Complex will be strictly incorporated as a wildlife management tool and no consideration will be given on the basis of economic significance to the Complex or surrounding communities.

Light to moderate grazing, often in combination with prescribed fire, is a generally accepted tool in prairie chicken management for preventing creation of an overly-dense, matted grassland cover situation (Lehmann 1941; Hamerstrom et al. 1957; Chamrad and Dodd 1972; Cogar et al. 1977; Kessler 1978a,b; Jurries 1979; U.S. Fish and Wildlife Service 2010).

AVAILABILITY OF RESOURCES:
Through the issuance of refuge SUPs, this use is a cooperative, commercial program whereby the permittee is leased the grazing rights and the refuge dictates the number of cattle to meet objectives. Direct annual costs to administer this program and facilities are primarily in the form of staff time. It is anticipated that refuge staff will collectively spend approximately 0.25 FTE's (divided between botanist, biologist and manager) and $25,000 in salary, materials and supplies annually to administer a grazing program. Regular communication with the permittees, rotation and rest planning, boundary and interior fence inspection, vegetation monitoring and wildlife use monitoring are all necessary to gather information and make informed decisions to use this tool.

ANTICIPATED IMPACTS OF THE USE:
Short and Long-Term Impacts:
The refuge does not anticipate short-term or long-term adverse impacts to wildlife species or other resources from the grazing operations as this activity is a management tool which will specifically benefit early succession dependent species. In general, light to moderate grazing results in an increased species richness of both plants and animals (Kantrud and Kologiski 1982, Archer and Smeins 1991). It must be noted however, that while grazing is a viable tool for managing wildlife habitat (Lehmann 1941; Kessler 1978a,b; Ryder 1980; Bryant et al. 1982; Kantrud and Kologiski 1982), not all wildlife species have the same habitat requirements. Therefore, not all species respond similarly to grazing (Phillips 1936, Ryder 1980, Kantrud and Kologiski 1982, Hanley and Page 1982, Clark et al. 1989). Grazing will implemented in accordance with an approved management plan which will strive to balance the needs of wildlife dependent on more mature prairie grasslands with the needs of early successional grasslands. Grazing, along with fire, will be utilized to proportionally manage for the latter.

Grazing has the potential of producing negative impacts on watershed hydrologic parameters including infiltration, run-off, temperature increase and sedimentation. With light stocking rates and short-term grazing cycles, these potential negative impacts will be minimized through appropriate planning and monitoring.

No adverse socioeconomic impacts are anticipated.

Cumulative Impacts:
There are no anticipated cumulative impacts. Grazing, when implemented would occur in conjunction with other prairie management and restoration techniques. Managing prairie grasslands to provide a diversity species and prairie conditions will benefit a wider array of wildlife and plants. Should grazing be implemented on the Complex as a management tool, the cumulative impacts will be beneficial based on improving habitat characteristics for selective species of wildlife.

PUBLIC REVIEW AND COMMENT:
This compatibility determination was published and available for public review and comment concurrent with the Draft CCP and EA; the comment period opened August 15 and closed on September 20, 2012. Public notification included a notice in the Federal Register, media announcements, public notices posted throughout the local communities, and a public meeting. One comment specific to farming was received. The comment states that cumulative impacts of

grazing should be stated and discussed; livestock grazing results in trampling of vegetation, rutting of soil, and uses up important food sources that could instead be used by wildlife. In addition, the huge amount of organic manure causes water pollution problems. In addition, cattle like to rest in wet or riparian areas, which causes wildlife habitat problems and the potential spread of non-native invasive plant species. The Sierra Club opposes the reintroduction of livestock cattle into the Complex because it is not needed and has not been justified. The Service maintains that sufficient analysis and justification was provided to determine compatibility. Under careful implementation that will include an annual inventory and monitoring of prairie conditions, grazing can be beneficial, increasing diversity, and providing habitat for some species that cannot be sustained in a fire alone management approach. Prior to implementing a grazing program that would utilize only cool season pasture grazing and/or high intensity – short duration grazing to target invasive species, a grazing management plan will be prepared. This plan will identify the goals and objectives for grazing as well as implementation strategies and the specific impacts of this implementation as well as a monitoring program to ensure habitat and wildlife benefits are occurring from this management activity. See CCP Appendix L for more information on the Complex's Response to Comments.

DETERMINATION (CHECK ONE BELOW):
___ Use is Not Compatible
_X__ Use is Compatible with Following Stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:
The following stipulations are required to ensure that grazing remains a compatible use on the Complex:

1. A step down Livestock Management Plan will be developed to determine how grazing will accomplish management objectives on the Complex
2. Grazing activities are strictly used as a management tool to benefit grassland dependent wildlife species, threatened and endangered species and grassland dependent species.
3. The refuges will conduct annual utilization and monitoring techniques to determine if wildlife objectives are being met by the livestock management plan.
4. The Refuge Manager reserves the right to modify all aspects of the livestock management plan to insure wildlife objectives are being met by grazing livestock on the refuge.

JUSTIFICATION:
With the potential of reintroduction of Attwater's prairie chickens to the mid-coast prairies, grazing should be considered at a viable management tool. Numerous research studies have documented the beneficial impacts of carefully managed grazing on prairie chicken habitat. The approved Attwater's Prairie Chicken Recovery Plan also reflects the importance of grazing as a tool for management of Attwater's prairie chicken habitat. Properly managed, grazing provides and alternative prairie management tool that can be beneficial to early seral grassland depend wildlife species, including mottled ducks, bobwhite quail and some grassland songbirds by prolonging early seral conditions either after habitat manipulating activities or just through active grazing.

The Complex has determined that grazing, in accordance with the stipulations provided above, will not materially interfere with or detract from the fulfillment of the Refuge System mission or the purposes of the refuge. The refuge will continue to monitor this use and adjust the program as necessary to protect and enhance refuge resources. The benefits of the grazing program are expected to outweigh associated impacts.

SIGNATURE: Refuge Manager _____ 4-12-2013
(Signature and Date)

CONCURRENCE: Regional Chief _____ 9/4/13
(Signature and Date)

MANDATORY 10-YEAR RE-EVALUATION DATE: 2023

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COMPATIBILITY DETERMINATION

USE: Pesticide application to control mosquito populations

REFUGE NAME: Texas Mid-coast National Wildlife Refuge Complex

ESTABLISHING AND ACQUISITION AUTHORITIES:
Texas Mid-coast National Wildlife Refuge Complex (Complex) is comprised of Brazoria, San Bernard, and Big Boggy National Wildlife Refuges (NWRs). Brazoria NWR was established on October 20, 1966, San Bernard NWR was established next on November 7, 1968, and Big Boggy NWR was established on July 8, 1983. All three refuges were created and managed under provisions of the Migratory Bird Conservation Act (16 U.S.C. 712d) and the Refuge Recreation Act (16 U.S.C. 460k-1 and 16 U.S.C. 460k-2). Brazoria and San Bernard NWRs were also established under the Fish and Wildlife Act of 1956 (16 U.S.C. 742(a)(4) and 16 U.S.C. 742(b)(1)).

REFUGE PURPOSE(S):

1. "…for use as an inviolate sanctuary,… for any other management purposes,… for migratory birds." (Migratory Bird Conservation Act [16 U.S.C. 712d])
2. "…for the development, advancement, management, conservation, and protection of fish and wildlife resources…" [16 U.S.C. 742f(a)(4)] and "…for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude…" [16 U.S.C. 742f(b)(1)] (Fish and Wildlife Act of 1956)
3. "…suitable for- (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species…" [16 U.S.C. 460k-1]; "…the Secretary… may accept and use… real… property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donor…" [16 U.S.C. 460k-2] (Refuge Recreation Act, as amended [16 U.S.C. 460k – 460k-4].

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:
The mission of the National Wildlife Refuge System (Refuge System) is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

DESCRIPTION OF USE:

(a) What is the use?
In accordance with Service policy, enable Mosquito Control District(s) to apply pesticides for the control of adult mosquitoes over specified areas of the refuges that are adjacent to human populations. Mosquitoes breed in the high salt marsh and migrate inland to brush or forest cover. Spraying is in the public interest, mostly to alleviate severe nuisance to the citizens of Brazoria County but these have the potential of caring diseases which can infect both human and wildlife populations.

The following mosquito species can be found breeding in the saltmarsh environment on the refuges; the first two of which are the main pests:

Aedes sollicitans – a vector of eastern equine encephalitis and the primary pest, receiving more than half of the control effort. (Note: western equine encephalitis occurs in Texas in western protions)
A. taeniorhynchus – primarily a pest to people.
A. albopictus – a vector of dengue fever (relatively new in the United States)
Psorophora columbiae – primarily a pest to people

West Nile Virus was confirmed in Texas in July 2002. That year, Harris County had several hundred confirmed cases of West Nile in humans. In 2010, although Brazoria County did not have any documented cases of West Nile Virus, Houston and surrounding counties documented 28 cases among the human population and 269 infected mosquitoes (diseasemaps.USGS.gov/wnv). The primary carrier of West Nile has been identified as *Culex spp*. These species breed in fresh water ponds and potholes which can be found on in the wet prairie during periods of high rainfall. These mosquitos are single egg layers, found in generally low numbers and should not be a driving force in implementing a mosquito control program on the refuges.

In Texas, cases of Saint Louis encephalitis (SLE) have averaged about 17 per year, and statewide, SLE caused 27 deaths in 1964, two in 1980 and six in 1986. The local history in State Health Department records indicated four past human cases of SLE from Brazoria County: in 1980, one case each in Freeport and Brazoria; in 1982 one in Freeport. No cases were reported in 2010.

In 2010, six out of 19 documented cases of imported dengue fever in Texas occurred in the Greater Houston area.

Species *A. sollicitans* and *A. taeniorynchus* are the primary nuisance mosquitos. They lay their eggs in large groups and their eggs may lay in the salt marsh for months without hatching until conditions are right.

(b) Where is the use conducted?

Specific locations would be identified in the Mosquito Control Plan. Locations would generally be areas of the refuge in proximity of human populations including the DemiJohn area, lower San Bernard River (River's End). In the past, the spray areas totaled 996 acres, which comprises only a relatively small portion of the refuges – about two percent. About four percent of the uplands are sprayed: on Brazoria NWR 593 acres are sprayed out of 14,051 acres of upland and on San Bernard NWR 403 acres are sprayed out of 2,220 acres of upland. Malathion nor Dibrom may not be sprayed over water.

The Complex will coordinate with the Mosquito Control district to ensure they are aware of Service lands (bottomlands) near inland communities and restrain from spraying these area unless a serious health concern is identified.

(c) When is the use conducted?

The need for daily spraying is determined through the use of "Landing Rate Counts" by the District; an observer counts the number of mosquitoes landing per minute on the observer's thigh and on those sites which had a "threshold" count of 5 or more spraying is then completed. Although spraying could occur at any time during the year, it is most likely to occur during late spring and fall when high tides have brought water up and into the upper salt marshes. Spraying is generally conducting during morning hours when the winds are light.

(d) How is the use conducted?

Spraying would be conducted the Mosquito Control District through aerial application. This compatibility review is on ultra-low volume (ULV) aerially-applied Malathion or Dibrom for use on selected small upland portions of the refuges for control of adult mosquitoes.

(e) Why is this use being proposed?

The Service allows pesticide treatments for mosquito population control on Refuge System lands when local, current mosquito population monitoring data have been collected and indicate that refuge-based mosquito populations are contributing to a human or wildlife health threat. The data from New Jersey Traps at locations near DemiJohn and the San Bernard NWR headquarters show periods of time where within 24 hours, collections in excess of 500 occurred regularly throughout the year.

AVAILABILITY OF RESOURCES:

Adequate staff and funding are available to manage this program, which involves issuance of a Special Use Permit (SUP) to the Mosquito District for mosquito control. The cost is minimal. Primary cost associated with this permit will be annual review of permitted and conditions which warrant control, preparation and reporting on Pesticide Use Proposal and field monitoring. Direct annual costs to administer this program, including staff time is less than $5,000 annually.

ANTICIPATED IMPACTS OF THE USE:

Short and Long-Term Impacts:

An Environmental Assessment completed in 1994 on this proposed activity discusses the effects of spraying Malathion on refuge lands. In addition the Services' Report, Environmental Effects of Mosquito Control, discusses the ecological role of mosquitoes and the effects of various control agents of mosquitoes and non-target species.

Malathion and Dibrom are organophosphate adulticides. Several pyrethroids including, permethrin, resmethrin and sumithrin. The pyrethroids are usually combined with the synergist piperonyl butoxide, which interferes with an insect's detoxifying mechanisms. None of these pesticides is persistent in the environment. Currently, Dibrom is being used to spray over communities and lands surrounding the refuges by the Mosquito Control District.

All adulticides are very highly toxic to aquatic invertebrates in concentration < 1 ppb (Milam al. 2000). However unlike other adulticides, Malathion and Dibrom application over water is restricted by the label and is not proposed by the refuges.

Like other aquatic insects with terrestrial adult stages, mosquitoes provide a link between aquatic and terrestrial ecosystems as they convert detritus and aquatic microbial biomass into flying insect biomass. Most adult mosquitoes are relatively short-lived. The probability of daily survival for adult mosquitoes, an important factor in disease transmission varies among species and habitats. Daily survival probabilities usually range from 0.6-0.9, with much of the mortality coming from predation (USFWS 1993). Mosquitoes are fed upon by a variety of invertebrates predators, including spiders (Strickman et al. 1997; Fox 1998) and odonates (Sukhachevea 1996), although there are no known specialist predators that prey exclusively on mosquitoes. Vertebrate predators include insectivorous birds and bats (Zinn and Humphrey 1981), although mosquitoes often account for only a small percentage of the total biomass consumed. Consumption of mosquitoes by the Indiana bat (*Myotis sodalist*), for example, accounted for up to 6.6 percent of the total diet (Kurta and Whitaker 1998). The apparent absence of any specialized predator-prey relationships among adult mosquitoes and predators however, does not necessarily discount the contribution of mosquitoes to the diet of a wide variety of generalized predators.

The impact of reducing the density of mosquitoes in aquatic and terrestrial systems has not been studied. General predators probably switch to alternate prey, which in turn may be impacted by the increased predation. The few specialist predators of mosquito larvae may be impacted the greatest due to the lack of alternate prey and/or the inability of such predators to uncouple from a closely evolved predator-prey relationship.

None of the adulticides identified above are known to directly impact birds. Nesting birds are not expected to be impacted. The black-shouldered and swallow-tailed kites, white-tailed hawk and northern harrier infrequently nest on the refuges. The American kestrel occurs in migration. Although some insect prey of some bird species will be affected, only a small percentage of the habitat will be impacted and alternate feeding sites are available. No significant impacts are expected

Threatened and endangered species that occur on the refuge (piping plover) and Category 2 species including black rail, Henslow's sparrow, and southeastern snowy plover), and State-listed species (wood stork, swallow-tailed kite, reddish egret and white-tailed hawk) that occur, are not expected to be within spray areas. A Section 7 consultation, dated 1994, has been completed.

Most passerine birds such as warblers are insectivorous. Nesting occurs from March to August. Found nesting in the salty prairie grassland community are eastern meadowlarks, red-winged blackbirds, boat-tailed grackles and sea-side sparrows. The coastal prairie is used during the winter by migrant mourning doves, painted buntings, dickcissels, eastern meadowlarks eastern kingbirds and scissor-tailed flycatchers. Bobwhite quail and great-tailed grackles are nesters.

No significant impacts are expected on these species because alternate sites to the small portions of sprayed habitat are available.

The Service places special emphasis on protection of neo-tropical migratory bird species such as the orioles, tanagers, hummingbirds, wood warblers, vireos, flycatchers, etc., several of which are insectivorous. These birds "fall out" of northward migration during passage of cold fronts along the Gulf coast in May, using coastal woodlands. These sites are not sprayed.

The principle purpose for the refuges is waterfowl maintenance. Common waterfowl species on the refuges include the snow goose, American wigeon, green-winged and blue-winged teal, gadwall, northern pintail and northern shoveler. The mottled duck is a year round resident and a nesting species. With their increased nutritional requirements, breeding female ducks and mottled duck broods are extremely dependent on invertebrate foods. Since wetlands should not receive spray, the waterfowl invertebrate foods, broods and breeding pairs should not be impacted.

Impacts on fish are not expected since spraying over water is not permitted. Maintaining buffer zones should help avoid water. Strict control will be needed on the part of the pilot to avoid drift over tidal water. Impacts on amphibians and reptiles have been poorly studied. One study found no observable response. No significant impacts should occur.

Mammalian toxicity is relatively low for all adulticides.

Cumulative Impacts:
No adverse cumulative impacts are anticipated by the proposed mosquito control techniques. This use will be closely monitored for any adverse impacts throughout the year.

PUBLIC REVIEW AND COMMENT:
This compatibility determination was published and available for public review and comment concurrent with the Draft CCP and EA; the comment period opened August 15 and closed on September 20, 2012. Public notification included a notice in the Federal Register, media announcements, public notices posted throughout the local communities, and a public meeting. One comment specific to this determination (pesticide application to control mosquito populations) was received. The comment states that cumulative impacts of pesticide application for mosquito control should be stated and discussed; mosquito control causes pesticide drift, kills wildlife, kills wildlife foods, and poisons ecosystems. The Sierra Club opposes mosquito control which is not compatible as wildlife management on the Complex and has not been justified. The Service maintains that sufficient analysis and justification were provided to determine compatibility, given the scope of the proposed activity. This determination does not provide for unlimited use of pesticides across the refuges. The scope of this activity is very limited and only conducted when mosquito populations are at levels that jeopardize human and wildlife health. See CCP Appendix L for more information on the Complex's Response to Comments.

DETERMINATION (CHECK ONE BELOW):
___ Use is Not Compatible
_X__ Use is Compatible with Following Stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:
The following stipulations are required to ensure that fishing remains a compatible use on the Complex:

1. A step-down Mosquito Management Plan will be developed to determine how pesticide applications will accomplish management and human health objectives on the Complex.

JUSTIFICATION:
The Complex has a large number of communities near refuge lands. Arthropods such as mosquitoes pose an annoyance to humans and worldwide can have consequences such as mosquito-borne infections. Service Policy allows mosquito control on refuge lands when it is necessary to protect the health and safety of the public or a wildlife or domestic animal population. We will allow management of mosquito populations on refuge lands using effective means that pose the lowest risk to wildlife and habitats.

SIGNATURE: Refuge Manager _____ 4-12-2013
(Signature and Date)

CONCURRENCE: Regional Chief _____ 9/4/13
(Signature and Date)

MANDATORY 10-YEAR RE-EVALUATION DATE: ___2023_____

Davis Pond Freshwater Diversion Project	Army Corps of Engineers	30.3
Coushatta Reservation	Bureau of Indian Affairs	559.6
Lake Texana	Bureau of Reclamation	13738.1
Mission-Aransas National Estuarine Research Reserve	National Oceanic and Atmospheric Administration	5182.1
Big Thicket National Preserve*	National Park Service	1351.4
Jean Lafitte National Historical Park and Preserve	National Park Service	17010.7
Padre Island National Seashore	National Park Service	55307.8
Anahuac National Wildlife Refuge	US Fish and Wildlife Service	34392.7
Aransas National Wildlife Refuge	US Fish and Wildlife Service	114657.1
Attwater Prairie Chicken National Wildlife Refuge	US Fish and Wildlife Service	10538.0
Bayou Sauvage National Wildlife Refuge	US Fish and Wildlife Service	24292.9
Bayou Teche National Wildlife Refuge*	US Fish and Wildlife Service	4865.5
Big Branch Marsh National Wildlife Refuge	US Fish and Wildlife Service	17584.8
Cameron Prairie National Wildlife Refuge	US Fish and Wildlife Service	9613.4
Delta National Wildlife Refuge	US Fish and Wildlife Service	48799.1
Lacassine National Wildlife Refuge	US Fish and Wildlife Service	34366.3
Laguna Atascosa National Wildlife Refuge	US Fish and Wildlife Service	89398.1
Lower Rio Grande Valley National Wildlife Refuge*	US Fish and Wildlife Service	26799.3
Mandalay National Wildlife Refuge	US Fish and Wildlife Service	3303.0
McFaddin National Wildlife Refuge	US Fish and Wildlife Service	58861.4
Moody National Wildlife Refuge	US Fish and Wildlife Service	3516.9
Sabine National Wildlife Refuge	US Fish and Wildlife Service	125790.1
Texas Point National Wildlife Refuge	US Fish and Wildlife Service	8952.0
Trinity River National Wildlife Refuge*	US Fish and Wildlife Service	9133.8

Gulf Coast Prairies and Marshes Ecoregion Federally, State, and Privately Managed Lands		
Atkinson Island Wildlife Management Area	Texas Parks and Wildlife Department	179.4
Battleship Texas (BB-35) State Historic Site	Texas Parks and Wildlife Department	1.0
Boca Chica State Park	Texas Parks and Wildlife Department	1686.8
Brazos Bend State Park	Texas Parks and Wildlife Department	4980.6
Candy Cain Abshier Wildlife Management Area	Texas Parks and Wildlife Department	223.0
CCA/CPL Marine Development Center State Fish Hatchery	Texas Parks and Wildlife Department	115.5
Christmas Bay	Texas Parks and Wildlife Department	218.3
D.R. Wintermann Wildlife Management Area	Texas Parks and Wildlife Department	249.8
Fannin Battleground State Historic Site	Texas Parks and Wildlife Department	13.6
Fulton Mansion State Historic Site	Texas Parks and Wildlife Department	3.6
Galveston Island State Park	Texas Parks and Wildlife Department	2004.5
Goose Island State Park	Texas Parks and Wildlife Department	265.9
Guadalupe Delta Wildlife Management Area	Texas Parks and Wildlife Department	7239.0
J.D. Murphree Wildlife Management Area	Texas Parks and Wildlife Department	24949.9
Justin Hurst Wildlife Management Area	Texas Parks and Wildlife Department	15627.2
Lake Texana State Park	Texas Parks and Wildlife Department	648.9
Levi Jordan Plantation State Historic Site	Texas Parks and Wildlife Department	97.0
Lipantitlan State Historic Site	Texas Parks and Wildlife Department	6.6
Lower Neches Wildlife Management Area	Texas Parks and Wildlife Department	7677.0
Mad Island Wildlife Management Area	Texas Parks and Wildlife Department	7280.9
Mustang Island State Park	Texas Parks and Wildlife Department	4528.8
Nannie M. Stringfellow Wildlife Management Area	Texas Parks and Wildlife Department	4905.6
Perry R. Bass Marine Fisheries Research Center	Texas Parks and Wildlife Department	31.2
Port Isabel Lighthouse State Historic Site	Texas Parks and Wildlife Department	1.6
Redhead Pond Wildlife Management Area	Texas Parks and Wildlife Department	44.7
San Jacinto Battleground State Historic Site	Texas Parks and Wildlife Department	1243.6
San Jacinto Monument	Texas Parks and Wildlife Department	10.4

Gulf Coast Prairies and Marshes Ecoregion Federally, State, and Privately Managed Lands		
Sea Center Texas Fish Hatchery	Texas Parks and Wildlife Department	78.2
Sea Rim State Park	Texas Parks and Wildlife Department	4034.8
Sheldon Lake State Park	Texas Parks and Wildlife Department	2655.4
Stephen F. Austin State Park	Texas Parks and Wildlife Department	503.2
Welder Flats Wildlife Management Area	Texas Parks and Wildlife Department	1488.5
Sabine Pass Battleground State Park and Historic Site	Texas Historical Commission	61.5
Varner-Hogg Plantation State Historic Site	Texas Historical Commission	69.8
Bayou Segnette State Park	Louisiana Department of Culture, Recreation and Tourism	86.9
Fairview-Riverside State Park	Louisiana Department of Culture, Recreation and Tourism	96.2
Fontainebleau State Park	Louisiana Department of Culture, Recreation and Tourism	2583.3
Fort Pike State Historic Site	Louisiana Department of Culture, Recreation and Tourism	95.3
Grand Isle State Park	Louisiana Department of Culture, Recreation and Tourism	38.7
Palmetto Island State Park	Louisiana Department of Culture, Recreation and Tourism	1290.0
Saint Bernard State Park	Louisiana Department of Culture, Recreation and Tourism	2.5
Sam Houston Jones State Park*	Louisiana Department of Culture, Recreation and Tourism	1816.7
West Belle Pass	Louisiana Department of Natural Resources	1695.7
Atchafalaya Delta Wildlife Management Area	Louisiana Department of Wildlife and Fisheries	141000.0
Bashman Bayou Natural and Scenic River	Louisiana Department of Wildlife and Fisheries	19.4
Bayou Bienvenue Natural and Scenic River	Louisiana Department of Wildlife and Fisheries	1.1
Bayou Cane Natural and Scenic River	Louisiana Department of Wildlife and Fisheries	3.4
Bayou Chinchuba Natural and Scenic River	Louisiana Department of Wildlife and Fisheries	3.7
Bayou Des Allemands Natural and Scenic River	Louisiana Department of Wildlife and Fisheries	2590.7

Gulf Coast Prairies and Marshes Ecoregion Federally, State, and Privately Managed Lands		
Bayou Dupre Natural and Scenic River	Louisiana Department of Wildlife and Fisheries	16.2
Bayou LaCombe Natural and Scenic River	Louisiana Department of Wildlife and Fisheries	222.5
Bayou Saint John Natural and Scenic River	Louisiana Department of Wildlife and Fisheries	118.7
Biloxi Wildlife Management Area	Louisiana Department of Wildlife and Fisheries	40752.5
Huey P Long Fish Hatchery	Louisiana Department of Wildlife and Fisheries	10.5
Isles Dernieres Barrier Islands Refuge	Louisiana Department of Wildlife and Fisheries	17.0
Lake Boeuf Wildlife Management Area	Louisiana Department of Wildlife and Fisheries	780.2
Lake Borgne Canal Natural and Scenic River	Louisiana Department of Wildlife and Fisheries	3.9
Marsh Island Wildlife Refuge	Louisiana Department of Wildlife and Fisheries	70772.7
Pass A Loutre Wildlife Management Area	Louisiana Department of Wildlife and Fisheries	111534.8
Pearl River Wildlife Management Area	Louisiana Department of Wildlife and Fisheries	11776.1
Pirogue Bayou Natural and Scenic River	Louisiana Department of Wildlife and Fisheries	20.5
Pointe Aux Chenes Wildlife Management Area	Louisiana Department of Wildlife and Fisheries	35200.9
Rockefeller Wildlife Refuge	Louisiana Department of Wildlife and Fisheries	85812.7
Salvador Wildlife Management Area	Louisiana Department of Wildlife and Fisheries	30143.1
Sister Lake Camp	Louisiana Department of Wildlife and Fisheries	156.4
St Tammany Wildlife Refuge	Louisiana Department of Wildlife and Fisheries	19.9
State Wildlife Refuge	Louisiana Department of Wildlife and Fisheries	14813.9
Tangipahoa River Natural and Scenic River	Louisiana Department of Wildlife and Fisheries	24.9
Tchefuncte River And Its Tributaries Natural and Scenic River	Louisiana Department of Wildlife and Fisheries	629.6
Terre Beau Bayou Natural and Scenic River	Louisiana Department of Wildlife and Fisheries	17.3
Timken Wildlife Management Area	Louisiana Department of Wildlife and Fisheries	2864.6
West Pearl River Natural and Scenic River	Louisiana Department of Wildlife and Fisheries	268.9
White Lake Wetlands Conservation Area	Louisiana Department of Wildlife and Fisheries	71602.4
LSU Research Station	Louisiana State University	1056.4

Gulf Coast Prairies and Marshes Ecoregion Federally, State, and Privately Managed Lands		
Armand Bayou Coastal Preserve & Nature Center	Armand Bayou Nature Center and Texas Parks and Wildlife Department	319.3
Bolivar Flats	Audubon Society	491.3
Deadman Island	Audubon Society	9.6
Dunham Point	Audubon Society	175.6
Green Island	Audubon Society	68.8
Little Pelican Island	Audubon Society	91.1
Lydia Ann Island	Audubon Society	146.2
North Deer Island	Audubon Society	163.3
Pelican Island	Audubon Society	275.8
Rattlesnake Island, Ayres Island, And Roddy Island	Audubon Society	355.0
Sabal Palm Grove Sanctuary	Audubon Society	101.4
Second Chain Of Islands	Audubon Society	9.9
Smith Point Spoil	Audubon Society	10.0
Snake Island	Audubon Society	21.7
Sundown Island	Audubon Society	28.9
Sydney Island	Audubon Society	42.4
Three Islands	Audubon Society	228.7
Vingt-et-un Islands	Audubon Society	12.0
West Bay Bird Island	Audubon Society	121.3
Wisner Wildlife Management Area	Edward Wisner Donation Advisory Committee	16817.9
Houston Audubon Sanctuaries	Houston Audubon	3362.0
Katy Prairie	Katy Prairie Conservancy	13000.0
Pass Manchac Lighthouse	Lake Maurepas Society	8.0
Beason's Park	Lower Colorado River Authority	23.9
FM 521 Park	Lower Colorado River Authority	13.4
Hollywood Bottom	Lower Colorado River Authority	36.1
Matagorda Bay Nature Park	Lower Colorado River Authority	1761.3
Hancock County Marsh Coastal Reserve	Mississippi Department of Marine Resources	7641.4

Gulf Coast Prairies and Marshes Ecoregion Federally, State, and Privately Managed Lands		
Clive Runnells Family Mad Island Marsh Preserve	The Nature Conservancy	7063.3
Francine Cohn Preserve	The Nature Conservancy	300.0
Nash Prairie	The Nature Conservancy	403.0
Pierce Marsh Preserve	The Nature Conservancy	1361.0
Shamrock Island Preserve	The Nature Conservancy	110.0
Texas City Prairie Preserve	The Nature Conservancy	2300.0

Data from: U.S. Fish and Wildlife Service (2009), USGS Gap Analysis Program (2010), ESRI (2009), Texas Parks and Wildlife Department (2004), and U.S. National Atlas et al. (2006)

Note: Not all of Lower Rio Grande Valley NWR, Trinity River NWR, Bayou Teche NWR, Sam Houston Jones State Park, and Big Thicket National Preserve fall in Gulf Coast Prairies and Marshes Ecoregion

E. Species List

This appendix contains a list of over 1,600 species identified on Texas Mid-coast National Wildlife Refuge Complex.

E.1. Mammals

ORDER DIDELPHIMORPHA — Marsupials

FAMILY DIDELPHIDAE
Virginia Oppossum *(Didelphis virginiana)*

ORDER XENARTHRA — Edentates

FAMILY DASYPODIDAE
Nine-banded Armadillo *(Dasypus novemcinctus)*

ORDER INSECTIVORA — Insectivores

FAMILY SORICIDAE
Short-tailed Shrew *(Blarina brevidcauda)*
Least Shrew *(Cryptotis parva)*

FAMILY TALPIDAE
Eastern Mole *(Scalopus aquaticus)*

ORDER CHIROPTERA — Bats

FAMILY VESPERTILIONIDAE
Big Brown Bat *(Estesicus fuscus)*
Eastern Pipestrelle *(Pipistrellus subflavus)*
Eastern Red Bat *(Lasiurus borealis)*
Evening Bat *(Nycticeius humeralis)*
Hoary Bat *(Lasiurus cinereus)*
Brazilian Free-tailed Bat *(Tadarida brasiliensis)*
Northern Yellow Bat *(Lasiurus intermedius)*
Refinesque's Big-eared Bat *(Plecotus rafinesquii)*
Seminole Bat *(Lasiurus seminolus)*
Silver-haired Bat *(Lasionycteris noctivagans)*

ORDER CARNIVORA — Carnivores

FAMILY CANIDAE
Coyote *(Canis latrans)*
Gray Fox *(Urocyon cinereoargenteus)*
Red Fox *(Vulpes vulpes)*

FAMILY PROCYONIDAE
Raccoon *(Procyon lotor)*
Ringtail *(Bassariscus astutus)*

FAMILY MUSTELIDAE

Long-tailed Weasel *(Mustela frenata)*
American Mink *(Mustela vison)*
Northern River Otter *(Lutra canadensis)*
Spotted Skunk *(Spilagale putorius)*
Striped Skunk *(Mephitis mephitis*

FAMILY FELIDAE

Bobcat *(Felis rufus)*
Cougar *(Felis concolor)*

ORDER ARTIODACTYLA — Ungulates

FAMILY SUIDAE

Pig (*Sus scrofa)*

FAMILY CERVIDAE

White-tailed Deer *(Odocoileus virginianus)*

ORDER RODENTIA — Rodents

FAMILY SCIURIDAE

Eastern Gray Squirrel *(Sciurus carolinensis)*
Southern Flying Squirrel *(Glaucomys volans)*
Eastern Fox Squirrel *(Sciurus niger)*

FAMILY GEOMYIDAE

Attwater's Packet Gopher (*Geomys attwateri)*
Baird's Pocket Gopher *(Geomys breviceps)*

FAMILY CASTORIDAE

American Beaver *(Castor canadensis)*

FAMILY MURIDAE

Deer Mouse *(Peromyscus leucopus)*
Eastern Woodrat *(Neotoma floridana)*
Eastern Harvest Mouse *(Reithrodontomys humulis)*
Fulvous Harvest Mouse (*Reithrodontomys fulvescens)*
Hispid Pocket Mouse *(Chaetodipus hispidus)*
House Mouse *(Mus musculus)*
Roof Rat *(Rattus rattus)*
Hispid Cotton Rat *(Sigmodon hispidus)*
Marsh Rice Rat *(Oryzomys palustris)*
Northern Pygmy Mouse *(Baiomys taylori)*
Norway Rat *(Rattus norvegicus)*
White-footed Mouse *(Peromyscus leucopus)*

FAMILY CRICETIDAE

Muskrat *(Ondatra zibethicus)*

FAMILY MYOCASTORIDAE

Nutria *(Myocastor coypus)*

ORDER LAGOMORPHA — Lagomorphs

FAMILY LEPORIDAE
Eastern Cottontail (*Sylvilagus floridanus)*
Swamp Rabbit (*Sylvilagus aquaticus)*
California Jackrabbit *(Lepus califorinicus)*

E.2. Birds

ORDER PODICIPEDIFORMES

FAMILY GAVIIDAE - Loons
Common Loon *(Gavia immer)*

FAMILY PODICIPEDIDAE – Grebes
Eared Grebe (*Podiceps nigricollis)*
Horned Grebe (*Podiceps auritus)*
Least Grebe *(Tachybaptus dominicus)*
Pied-billed Grebe *(Podilymbus podiceps)*
Western Grebe *(Aechomorphus occidentalis)*

ORDER PELECANIFORMES

FAMILY PELECANIDAE – Pelicans
American White Pelican *(Pelecanus erythrorhynchos)*
Brown Pelican (*Pelecanus occidentalis*)

FAMILY PHALACROCORACIDAE – Cormorants
Neotropic Cormorant *(Phalacrocorax brasilianis)*
Double-crested Cormorant *(Phalacrocorax auritus)*

FAMILY ANHINGIDAE – Anhingas
Anhinga *(Anhinga anhinga)*

FAMILY FREGATIDAE - Frigatebirds
Magnificent Frigatebird (*Fregata magnificens*)

ORDER CICONIFORMES

FAMILY ARDEIDAE – Bitterns, Herons, Egrets
American Bittern *(Botaurus lentiginosus)*
Least Bittern (*Ixobrychus exilis)*
Great Blue Heron (*Ardea herodias)*
Great Egret *(Ardea alba)*
Snowy Egret *(Egretta thula)*
Little Blue Heron *(Egretta caerulea)*
Tri-colored Heron (*Egretta tricolor*)
Reddish Egret (*Egretta rufescens*)
Cattle Egret *(Bubulcus ibis)*
Green Heron (*Butorides virescens)*
Black-crowned Night Heron (*Nycticorax nycticorax*)
Yellow-crowned Night-Heron *(Nyctanassa violacea)*

FAMILY THRESKIORNITHIDAE – Ibises and Spoonbills

White Ibis (*Eudocimus albus*)
Glossy Ibis (*Plegadis falcinus*)
White-faced Ibis *(Plegadis chihi)*
Roseate Spoonbill (*Platalea ajaja*)

FAMILY CICONIIDAE - Storks

Wood Stork (*Mycteria americana*)

ORDER ANSERIFORMES

FAMILY ANATIDAE – Waterfowl

Black-bellied Whistling Duck *(Dendrocygna autumnalis)*
Fulvous Whistling Duck *(Dendrocygna bicolor)*
Greater White-fronted Goose *(Anser albifrons)*
Snow Goose *(Chen caerulescens)*
Ross' Goose (*Chen rossii*)
Canada Goose (*Branta canadensis*)
Wood Duck *(Aix sponsa)*
Green-winged Teal *(Anas crecca)*
Mallard *(Anas platyrhynchos)*
Mottled Duck (*Anas fulvigula*)
Blue-winged Teal *(Anas discors)*
Cinnamon Teal (*Anas cyanoptera*)
Green-winged Teal (*Anas crecca*)
Northern Shoveler *(Anas clypeata)*
Northern Pintail *(Anas acuta)*
Gadwall *(Anas strepera)*
American Wigeon *(Anas americana)*
Canvasback (*Aythya valisineria*)
Redhead (*Aythya americana*)
Ring-necked Duck *(Aythya collaris)*
Lesser Scaup *(Aythya affinis)*
Greater Scaup (*Aythya marila*)
Surf Scoter (*Melanitta perspicillata*)
White-winged Scoter (*Melanitta fusca*)
Common Goldeneye *(Bucephala clangula)*
Bufflehead *(Bucephala albeola)*
Hooded Merganser *(Lophodytes cucullatus)*
Common Merganser (*Mergus merganser*)
Red-breasted Merganser (*Mergus serrator*)
Masked Duck (*Nomonyx dominicus*)
Ruddy Duck *(Oxyura jamaicensisz)*

ORDER FALCONIFORMES

FAMILY CATHARTIDAE – Vultures

Black Vulture *(Coragyps atratus)*
Turkey Vulture *(Cathartes aura)*

FAMILY ACCIPITRIDAE – Hawks

Osprey *(Pandion haliaetus)*
Swallow-tailed Kite (*Elanoides forficatus*)
White-tailed Kite (*Elanus leucurus*)
Mississippi Kite (*Ictinia mississippiensis*)
Bald Eagle *(Haliaeetus leucocephalus)*
Northern Harrier *(Circus cyaneus)*
Sharp-shinned Hawk *(Accipiter striatus)*
Cooper's Hawk *(Accipiter cooperii)*
Red-shouldered Hawk *(Buteo lineatus)*
Broad-winged Hawk *(Buteo platypterus)*
Red-tailed Hawk *(Buteo jamaicensis)*
Swainson's Hawk *(Buteo swainsoni)*

FAMILY FALCONIDAE – Falcons

Crested Caracara (*Caracara cheriway*)
American Kestrel *(Falco sparverius)*
Merlin *(Falco columbarius)*
Peregrine Falcon *(Falco peregrinus)*

FAMILY PHASIANIDAE & ODONTOPHORIDAE – Turkey & Quail

Wild Turkey *(Meleagris gallopavo)*
Northern Bobwhite *(Colinus virginianus)*
Attwater's Greater Prairie Chicken *(Tympanuchus cupido attwateri) (extirpated)*

ORDER GRUIFORMES

FAMILY RALLIDAE – Rails

Yellow Rail *(Coturnicops noveboracensis)*
Black Rail *(Laterallus jamaicensis)*
Clapper Rail *(Rallus longirostris)*
King Rail *(Rallus elegans)*
Virginia Rail *(Rallus limicola)*
Sora *(Porzana carolina)*
Purple Gallinule (*Porphrio porphyrio*)
Common Moorhen (*Gallinula chloropus*)
American Coot *(Fulica americana)*

ORDER CHARADRIIFORMES

FAMILY CHARADRIIDAE – Plovers

Black-bellied Plover (*Pluvialis squatarola*)
American Golden Plover (*Pluvialis dominica*)
Snowy Plover (*Charadrius alexandrinus*)
Wilson's Plover (*Charadrius wilsonia*)
Semipalmated Plover (*Charadrius semipalmatus*)
Piping Plover (*Charadrius melodus*)
Killdeer *(Charadrius vociferous)*

FAMILY HAEMATOPODIDAE - Oystercatchers

American Oystercatcher (*Haematopus palliatus*)

FAMILY RECURVIROSTRIDAE - Stilts and Avocets

Black-necked Stilt (*Himantopus mexicanus*)
American Avocet (*Recurvirostra americana*)

FAMILY SCOLOPACIDAE – Sandpipers

Greater Yellowlegs *(Tringa melanoleuca)*
Lesser Yellowlegs *(Tringa flavipes)*
Solitary Sandpiper *(Tringa solitaria))*
Spotted Sandpiper *(Actitis macularia)*
Willet *(Catoptrophorus semipalmatus)*
Hudsonian Godwit *(Limosa haemastica)*
Marbled Godwit *(Limosa fedoa)*
Whimbrel *(Numenius phaeopus)*
Long-billed Curlew *(Numenius americanus)*
Upland sandpiper *(Bartramia longicauda)*
Ruddy Turnstone *(Arenaria interpres)*
Red Knot *(Calidris canutus)*
Sanderling *(Calidris alba)*
Dunlin *(Calidris alpina)*
Semipalmated Sandpiper (*Calidris pusilla*)
Western Sandpiper (*Calidris mauri*)
Least Sandpiper *(Calidris minutilla)*
Pectoral Sandpiper *(Calidris melanotos)*
White-rumped Sandpiper *(Calidris fuscicollis)*
Baird's Sandpiper *(Calidris bairdii)*
Stilt Sandpiper *(Calidris himantopus)*
Buff-breasted Sandpiper *(Tryngites subruficollis)*
Short-billed Dowitcher *(Limnodromus griseus)*

Long-billed Dowitcher *(Limnodromus scolopaceus)*
Wilson's Snipe *(Gallinago delicata)*
American Woodcock *(Scolopax minor)*
Wilson's Phalarope *(Phalaropus tricolor)*

FAMILY LARIDAE – Gulls, Terns and Skimmers

Laughing Gull (*Larus atricilla*)
Ring-billed Gull *(Larus delawarensis)*
Franklin's Gull *(Larus pipixcan)*
Bonaparte's Gull *(Larus philadelphia)*
Herring Gull *(Larus argentatus)*
Lesser Black-backed Gull *(Larus fuscus)*
Greater Black-backed Gull *(Larus marinus)*
Gull-billed Tern (*Sterna nilotica*)
Caspian Tern (*Sterna caspia*)
Royal Tern (*Sterna maxima*)
Sandwich Tern (*Sterna sandvicensis*)
Common Tern (*Sterna hirundo*)
Forster's Tern (*Sterna forsteri*)
Least Tern (*Sterna antillarum*)
Black Tern (*Chlidonias niger*)
Black Skimmer (*Rhynchops niger*)

ORDER COLUMBIFORMES

FAMILY COLUMBIDAE – Pigeons

White-winged Dove (*Zenaida asiatica*)
Mourning Dove *(Zenaida macroura)*
Inca Dove *(Columbina inca)*
Common Ground Dove *(Columbina passerina)*

ORDER CUCULIFORMES

FAMILY CUCULIDAE – Cuckoos

Black-billed Cuckoo *(Coccyzus erythropthalmus)*
Yellow-billed Cuckoo *(Coccyzus americanus)*
Groove-billed Ani *(Crotophaga sulcirostris)*

ORDER STRIGIFORMES

FAMILY TYTONIDAE - Barn Owls

Barn Owl (*Tyto alba*)

FAMILY STRIGIDAE – Typical Owls

Eastern Screech-Owl *(Otus asio)*
Great Horned Owl *(Bubo virginianus)*
Barred Owl *(Strix varia)*
Burrowing Owl *(Athene cunicularia)*
Short-eared Owl *(Asio flammeus)*

ORDER CAPRIMULGIFORMES

FAMILY CAPRIMULGIDAE – Goatsuckers

Common Nighthawk *(Chordeiles minor)*
Chuck-will's-widow *(Caprimulgus carolinensis)*
Whip-poor-will *(Caprimulgus vociferous)*

ORDER APODIFORMES

FAMILY APODIDAE – Swifts
Chimney Swift *(Chaetura pelagica)*

FAMILY TROCHILIDAE – Hummingbirds
Ruby-throated Hummingbird *(Archilochus colubris)*

ORDER CORACIIFORMES

FAMILY ALCEDINIDAE – Kingfishers
Belted Kingfisher *(Ceryle alcyon)*

ORDER PICIFORMES

FAMILY PICIDAE – Woodpeckers
Red-headed Woodpecker *(Melanerpes erythrocephalus)*
Red-bellied Woodpecker *(Melanerpes carolinus)*
Yellow-bellied Sapsucker *(Sphyrapicus varius)*
Downy Woodpecker (P*icoides pubescens)*
Northern Flicker *(Colaptes auratus)*
Pileated Woodpecker *(Dryocopus pileatus)*

ORDER PASSERIFORMES

FAMILY TYRANNIDAE - Flycatchers
Olive-sided Flycatcher *(Contopus cooperi)*
Eastern Wood-pewee *(Contopus virens)*
Yellow-bellied Flycatcher (*Empidonax flaviventris*)
Acadian Flycatcher *(Empidonax virescens)*
Willow Flycatcher *(Empidonax trailli)*
Alder Flycatcher *(Empidonax alnorum)*
Least Flycatcher *(Empidonax minimus)*
Eastern Phoebe *(Sayornis phoebe)*
Say's Phoebe (*Sayornis saya*)
Vermilion Flycatcher (*Pyrocephalus rubinus*)
Ash-throated Flycatcher (*Myiarchus cinerascens*)
Great Crested Flycatcher (*Myiarchus crinitus*)
Brown-crested Flycatcher (*Myiarchus tyrannulus*)
Western Kingbird (*Tyrnannus verticalis*)
Eastern Kingbird *(Tyrannus tyrannus)*
Couch's Kingbird (*Tyrannus couchii*)
Tropical Kingbird (*Tyrannus melancholicus*)
Scissor-tailed Flycatcher *(Tyrannus forficatus)*

FAMILY HIRUNDINIDAE – Swallows
Purple Martin *(Progne subis)*
Tree Swallow *(Tachycineta bicolor)*
Northern Rough-winged Swallow *(Stelgidopteryx serripennis)*

Bank Swallow *(Riparia riparia)*
Cliff Swallow *(Petrochelidon pyrrhonota)*
Cave Swallow (*Petrochilidon fulva*)
Barn Swallow *(Hirundo rustica)*

FAMILY CORVIDAE – Jays/Crows
Blue Jay *(Cyanocitta cristata)*
American Crow *(Corvus brachyrhynchos)*

FAMILY PARIDAE – Chickadees/Titmice
Carolina Chickadee *(Poecile carolinensis)*
Tufted Titmouse *(Baeolophus bicolor)*

FAMILY CERTHIIDAE – Creepers
Brown Creeper *(Certhia americana)*

FAMILY TROGLODYTIDAE – Wrens
Carolina Wren *(Thryothorus ludovicianus)*
Bewick's Wren *(Thryomanes bewickii)*
House Wren *(Troglodytes aedon)*
Winter Wren *(Troglodytes troglodytes)*
Sedge Wren *(Cistothorus platensis)*
Marsh Wren *(Cistothorus palustris)*

FAMILY MUSCICAPIDAE – Kinglets/Gnatcatchers/Thrushes
Golden-crowned Kinglet *(Regulus satrapa)*
Ruby-crowned Kinglet *(Regulus calendula)*
Blue-gray Gnatcatcher *(Polioptila caerulea)*
Eastern Bluebird *(Sialia sialis)*
Veery *(Catharus fuscescens)*
Gray-cheeked Thrush *(Catharus minimus)*
Swainson's Thrush *(Catharus ustulatus)*
Hermit Thrush *(Catharus guttatus)*
Wood Thrush *(Catharus mustelinus)*
American Robin *(Turdus migratorius)*

FAMILY MIMIDAE – Mockingbirds/Thrashers
Gray Catbird *(Dumetella carolinensis)*
Northern Mockingbird *(Mimus polyglottos)*
Brown Thrasher *(Toxostoma rufum)*

FAMILY BOMBYCILLIDAE – Waxwings
Cedar Waxwing *(Bombycilla cedrorum)*

FAMILY LANIIDAE – SHRIKES
Loggerhead Shrike *(Lanius ludovicianus)*

FAMILY STURNIDAE – Starlings
European Starling *(Sturnus vulgaris)*

FAMILY VIREONIDAE - Vireos
White-eyed Vireo *(Vireo griseus)*
Bell's Vireo *(Vireo bellii)*
Yellow-throated Vireo *(Vireo flavifrons)*
Warbling Vireo *(Vireo gilvus)*
Philadelphia Vireo *(Vireo philadelphicus)*
Blue-headed Vireo *(Vireo solitarius)*
Red-eyed Vireo *(Vireo olivaceus)*

FAMILY EMBERIZIDAE – Warblers, etc

Tennessee Warbler *(Vermivora peregrina)*
Golden-winged Warbler (*Vermivora chrysoptera*)
Blue-winged Warbler *(Vermivora pinus)*
Orange-crowned Warbler *(Vermivora celata)*
Nashville Warbler *(Vermivora ruficapilla)*
Northern Parula *(Parula americana)*
Yellow Warbler *(Dendroica petechia)*
Chestnut-sided Warbler *(Dendroica pensylvanica)*
Magnolia Warbler *(Dendroica magnolia)*
Yellow-rumped Warbler *(Dendroica coronata)*
Black-throated Blue Warbler *(Dendroica caerulescens)*
Black-throated Green Warbler *(Dendroica virens)*
Cerulean Warbler *(Dendroica cerulea)*
Blackburnian Warbler *(Dendroica fusca)*
Yellow-throated Warbler *(Dendroica dominica)*
Pine Warbler *(Dendroica pinus)*
Prairie Warbler *(Dendroica discolor)*
Palm Warbler (*Dendroica palmarum*)
Bay-breasted Warbler (*Dendroica castanea*)
Blackpoll Warbler *(Dendroica striata)*
Black-and-white Warbler *(Mniotilta varia)*
American Redstart *(Setophaga ruticilla)*
Prothonotary Warbler *(Protonotaria citrea)*
Worm-eating Warbler *(Helmitheros vermivorus)*
Swainson's Warbler *(Limnothlypis swainsonii)*
Ovenbird *(Seiurus aurocapillus)*
Northern Waterthrush *(Seiurus noveboracensis)*
Louisiana Waterthrush *(Seiurus motacilla)*
Kentucky Warble *(Oporornis formosus)*
Mourning Warbler *(Oporornis philadelphia)*
Common Yellowthroat *(Geothlypis trichas)*
Hooded Warbler *(Wilsonia citrina)*
Wilson's Warbler *(Wilsonia pusilla)*
Yellow-breasted Chat *(Icteria virens)*

TANAGERS

Summer Tanager *(Piranga rubra)*
Scarlet Tanager *(Piranga olivacea)*
Western Tanager *(Piranga ludoviciana)*

CARDINALS, GROSBEAKS & BUNTINGS

Northern Cardinal *(Cardinalis cardinalis)*
Rose-breasted Grosbeak *(Pheucticus ludovicianus)*
Blue Grosbeak *(Guiraca caerulea)*
Indigo Bunting *(Passerina cyanea)*
Painted Bunting *(Passerina ciris)*
Dickcissel *(Spiza americana)*

SPARROWS, TOWHEES & ALLIES

Green-tailed Towhee (*Pipilo chrorurus*)
Spotted Towhee *(Pipilo maculates)*
Chipping Sparrow *(Spizella passerina)*
Clay-colored Sparrow (*Spizella pallida*)
Field Sparrow *(Spizella pusilla)*
Lark Sparrow *(Chondestes grammacus)*
Savannah Sparrow *(Passerculus sandwichensis)*
Grasshopper Sparrow *(Ammodramus savannarum)*
Henslow’s Sparrow *(Ammodramus henslowii)*
Le Conte's Sparrow *(Ammodramus leconteii)*
Nelson’s Sharp-tailed Sparrow (*Ammodramus nelsonii*)

Seaside Sparrow (*Ammodramus maritimus*)
Fox Sparrow *(Passerella iliaca)*
Song Sparrow *(Melospiza melodia)*
Lincoln's Sparrow *(Melospiza lincolnii)*
Swamp Sparrow *(Melospiza georgiana)*
White-throated Sparrow *(Zonotrichia albicollis)*
White-crowned Sparrow (*Zonotrichia leucophrys)*
Dark-eyed Junco *(Junco hyemalis)*

BLACKBIRDS & ORIOLES

Red-winged Blackbird (*Agelaius phoeniceus)*
Eastern Meadowlark *(Sturnella magna)*
Western Meadowlark (*Sturnella neglecta*)
Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*)
Rusty Blackbird *(Euphagus carolinus)*
Brewer's Blackbird (*Euphagus carolinus*)
Great-tailed Grackle *(Quiscalus mexicanus)*
Boat-tailed Grackle (*Quiscalus major*)
Common Grackle *(Quiscalus quiscula)*
Brown-headed Cowbird *(Molothrus ater)*
Bronzed Cowbird (*Molothrus aeneus*)
Orchard Oriole *(Icterus spurius)*
Bullock's Oriole *(Icterus bullockii)*
Baltimore Oriole *(Icterus galbula)*

FAMILY FRINGILLIDAE – Finches

Pine Siskin *(Carduelis pinus)*
American Goldfinch *(Carduelis tristis)*

E.3. Amphibians

ORDER CAUDATA – Salamanders

FAMILY SIRENIDAE

Western Lesser Siren (*Siren intermedia nettingi*)

FAMILY SALAMANDRIDAE

Central Newt (*Notophthalmus viridescens louisianensis*)

FAMILY PROTEIDAE

Red River Mudpuppy (*Necturus maculosus louisianensis*)

FAMILY AMBYSTOMATIDAE

Marbled Salamander *(Ambystoma opacum*)
Small-mouthed Salamander (*Ambystoma texanum*)

ORDER ANURA – Frogs & Toads

FAMILY SCAPHIOPODIDAE

Hurters Spadefoot (*Scaphiopus holbrookii hurteri*)

FAMILY BUFONIDAE

Dwarf American Toad (*Bufo americanus charlesmith*)
Woodhouse's Toad (*Bufo w. woodhousii*)
Gulf Coast Toad *(Bufo valliceps)*

FAMILY HYLIDAE

Blanchard's Cricket Frog *(Acris crepitans blanchardi)*
Cope's Gray Treefrog *(Hyla chrysoscelis)*
Green Treefrog *(Hyla cinerea)*
Northern Spring Peeper *(Psuedacris c. crucifer)*
Eastern Gray Treefrog *(Hyla versicolor)*
Squirrel Treefrog *(Hyla squirella)*
Spotted Chorus Frog *(Psuedacris clarki)*
Strecker's Chorus Frog *(Psuedacris streckeri)*
Upland Chorus Frog *(Pseudacris triseriata feriarum)*

FAMILY MICROHYLIDAE

E. Narrow-mouthed Toad *(Gastrophryne carolinensis)*
Great Plains Narrow-mouth Toad *(Gastrohpryne olivacea)*

FAMILY RANIDAE

S. Crawfish Frog *(Rana a. areolata)*
Bullfrog *(Rana catesbeiana)*
Bronze Frog *(Rana clamitans clamitans)*
Southern Leopard Frog *(Rana sphenocephala)*

E.4. Reptiles

ORDER TESTUDINES – Tortoises and turtles

FAMILY KINOSTERNIDAE

Mississippi Mud Turtle *(Kinosternon subrubrum hippocrepis)*
Yellow Mud Turtle *(Kinosternon flavivens flavivens)*
Common Musk Turtle *(Sternotherus odoratus)*

FAMILY CHELYDRIDAE

Snapping Turtle *(Chelydra serpentine)*

FAMILY EMYDIDAE

Mississippi Map Turtle (*Graptemys kohnii*)
Ornate Box Turtle (*Terrapene ornate ornate)*
Red-eared Slider (*Trachemys scripta elegans*)
Texas Diamondback Terrapin *(Malaclemys terrapin littoralis)*
Texas River Cooter *(Pseudemys texana)*
Three-toed Box Turtle (*Terrapene carolina triunguis*)
Western Chicken Turtle (*Deirochelys reticularia miaria*)

FAMILY TESTUDINIDAE

Texas Tortoise *(Gopherus berlandieri)*

FAMILY TRIONYCHIDAE

Midland Smooth Softshell *(Apalone m. muticus*)
Pallid Spiny Softshell *(Apalone spiniferus pallidus)*

FAMILY CHELONIIDAE – Sea turtles

Loggerhead *(Caretta caretta)*
Green Turtle *(Chelonia mydas)*
Atlantic Hawksbill *(Eretmochelys imbricata)*
Atlantic Ridley *(Lepidochelys kempi)*

FAMILY DERMOCHELIDAE - Leatherbacks

Leatherback *(Dermochelys coriacea)*

ORDER SQUAMATA –Snakes and Lizards

FAMILY IGUANIDAE – American arboreal lizards

Green Anole *(Anolis carolinensis)*

FAMILY PHRYNOSOMATIDAE – North American spiny lizards and allies

Northern Fence Lizard *(Sceloporus undulates hyacinthinus)*
Texas Horned Lizard *(Phrynosoma cornutum)*
Texas Spiny Lizard (*Sceloporus olivaceus)*

FAMILY TEIIDAE - Tegus

Six-lined Racerunner *(Cnemidophorus sexlineatus*)
Texas Spotted Whiptail *(Cnemidophorus sixleneatus sixlineatus)*

FAMILY SCINCIDAE - Skinks

Southern Prairie Skink *(Eumeces septentrionalis oitusirastrus)*
Five-lined Skink *(Eumeces fasciatus)*
Broadhead Skink *(Eumeces laticeps)*
Ground Skink *(Scincella lateralis)*

FAMILY ANGUIDAE – Lateral Fold Lizards

W. Slender Glass Lizard (*Ophisaurus attenuates atenuates*)

FAMILY COLUBRIDAE – Colubrid Snakes - Advanced

Mississippi Ring-necked Snake (*Diadophis punctatus strictogenys*)
Texas Rat Snake (*Elaphe obsolete lindheimeri*)
Southwestern Rat Snake (*Elaphe guttata meahllmorum)*
Western Mud Snake (*Farancia abacura reinwardtii*
Eastern Hog-nosed Snake (*Heterodon p. platirhinos*)
Dusty Hog-nosed Snake *(Heterodon nasicus gloydi)*
Speckled Kingsnake (*Lampropeltis getulua holbrooki*)
Prairie Kingsnake (*Lampropeltis callisgaster callisgaster)*
Louisiana Milk Snake (*Lampropeltis triangulum amaura)*
Western Coachwhip (*Masticophis flagellum testaceus)*
Rough Green Snake (*Opheodrys aestivus*)
Marsh Brown Snake (*Storeria dekayi limnetes*)
Blotched Water Snake (*Nerodia erythrogaster transversa)*
Broad-banded Water Snake (*Nerodia fasciata confluens*)
Gulf Salt Marsh Snake (*Nerodia clarki clarki)*

Diamond-backed Water Snake (*Nerodia rhombifer)*
Graham's Crayfish Snake (*Regina grahamii*)
Gulf Crawfish Snake (*Regina rigida sinicola*)
Flat-headed Snake (*Tantilla gracilis*)
Gulf Coast Ribbon Snake (*Thamnophis proximus orarlus*)
Checkered Garter Snake (*Thamnophis m. marcianus)*
Rough Earth Snake (*Virginia striatula*)
Eastern Garter Snake (*Thamnophis s. sirtalis*)
Plains Blind Snake *(Leptotyphlops dulcis dulcis)*
Texas Night Snake *(Hypsiglena torquatajani)*
Western Smooth Green Snake *(Liochlorophis vernalis blanchardi)*
Eastern Yellow-bellied Racer *(Coluber constrictor flaviventris)*
Texas Glossy Snake *(Arizona elegans arenicola)*
Texas Scarlet Snake *(Cemophora coccinea lineri)*

FAMILY ELAPIDAE – Cobras, Kraits, Mambas and Coral Snakes
Texas Coral Snake *(Micrurus fulvius tenere)*

FAMILY VIPERIDAE – Pitviper Snakes
Southern Copperhead (*Agkistrodon c. contortrix*)
Western Cottonmouth (*Agkistrodon piscivorus leucostoma*)
Canebrake Rattlesnake (*Crotalus horridus atricaudatus*)
Western Pigmy Rattlesnake (*Sistrurus miliarius streckeri*)
Western Massasauga (*Sistrurus catenatus tergeminus)*
Western Diamondback (*Crotalus atrox)*

ORDER CROCODYLIDAE – True Crocodiles

FAMILY CROCODYLIDAE
American Alligator (*Alligator mississippiensis*)

E.5. Fish

ORDER LEPISOSTEIFORMES - Gars

FAMILY LEPISOSTEIDAE
Spotted Gar (*Lepisosteus oculatus*)
Longnose Gar (*Lepisosteus osseus*)
Alligator Gar (*Atractosteus spatula*)

ORDER ANGUILLIFORMES - True Eels

FAMILY ANGUILLIDAE
American Eel (*Anguilla rostrata*)

ORDER AULOPIFORMES – Grinners and Lizardfish

FAMILY SYNODONTINAE
Inshore Lizard Fish *(Synodus foetens)*

ORDER TETRAODONTIFORMES – Triggerfish, Pufferfish and Boxfish

FAMILY TETRAODONTIDAE
Least Puffer *(Sphoeroides parvus)*

ORDER AMIIFORMES - Bowfins

FAMILY AMIIDAE
Bowfin *(Amia calva*)

ORDER CLUPEIFORMES – Ray-finned fish

FAMILY CLUPEIDAE - Herrings & Shads
Skipjack Herring (*Alosa chrysochloris*)
Gizzard Shad (*Dorosoma cepedianum*)
Gulf Menhaden (Brevoortia patronus)
Threadfin Shad (Dorosoma petense)

FAMILY ENGRAULIDAE - Anchovies
Bay Anchovy (Anchoa mitchilli)

ORDER OSTEOGLOSSIFORMES

FAMILY HIODONTIDAE - Mooneyes
Goldeye (*Hiodon alosoides*)

ORDER SALMONIFORMES

FAMILY ESOCIDAE - Pikes
Grass Pickerel (*Esox americanus*)

ORDER CYPRINIDAE

FAMILY CYPRINIDAE- Minnows or carps
Central Stoneroller (*Campostoma anomalum*)
Grass Carp (*Ctenopharyngodon idella*)
Goldfish *(Carassius auritus)*
Red Shiner (*Cyprinella lutrensis*)
Blacktail Shiner (*Cyprinella venusta*)
Common Carp (*Cyprinus carpio*)
Mississippi Silvery Minnow (*Hybognathus nuchalis*)
Plains Minnow (*Hybognathus placitus*)
Ribbon Shiner (*Lythrurus fumeus*)
Shoal Chub *(Macrohybopsis hyostoma)*
Silver Chub *(Macrohybopsis storeriana)*
Golden Shiner (*Notemigonus crysoleucas*)

Blackspot Shiner (*Notropis atrocaudalis*)
Smalleye Shiner *(Notropis buccula)*
Ghost Shiner (*Notropis buchanani*)
Sharpnose Shiner *(Notropis oxyrhyncus)*
Chub Shiner *(Notropis potteri)*
Silverband Shiner *(Notropis shumardi)*
Sand Shiner *(Notropis stramineus)*
Mimic Shiner (*Notropis volucellus*)
Pugnose Minnow (*Opsopoeodus emiliae*)
Suckermouth Minnow (*Phenacobius mirabilis*)
Fathead Minnow *(Pimephales promelas)*
Bullhead Minnow (*Pimephales vigilax*)
Creek Chub (*Semotilus atromaculatus*)

FAMILY CATOSTOMIDAE- Suckers

River Carpsucker (*Carpiodes carpio*)
Blue Sucker *(Cycleptus elongates)*
Lake Chubsucker (*Erimyzon sucetta*)
Smallmouth Buffalo (*Ictiobus bubalus*)
Black Buffalo (*Ictiobus niger*)
Spotted Sucker (*Minytrema melanops*)
Gray Redhorse (*Moxostoma congestum*)

FAMILY MUGILIDAE - Mullet

Striped Mullet *(Mugil cephalus)*
White Mullet *(Mugil curema)*

ORDER ELOPIFORMES

FAMILY ELOPIDAE - Ladyfish

Lady Fish *(Elops saurus)*

ORDER GASTEROSTEIFORMES

FAMILY SYNGNATHIDAE - Pipefishes

Gulf Pipefish *(Syngnathus scovelli)*
Chain Pipefish (*Syngnthus louisianae)*

ORDER SILURIFORMES

FAMILY ICTALURIDAE - Bullhead Catfishes

Black Bullhead (*Ameiurus melas*)
Yellow Bullhead (*Ameiurus natalis*)
Blue Catfish (*Ictalurus furcatus*)
Channel Catfish (*Ictalurus punctatus*)
Tadpole Madtom (*Noturus gyrinus*)
Freckled Madtom (*Noturus nocturnus*)
Flathead Catfish (*Pylodictis olivaris*)

FAMILY ARIIDAE - Sea catfishes

Hardhead Catfish *(Arius felis)*
Gafftopsail Catfish (*Bagre marinus)*

ORDER BATRACHOIDIFORMES

FAMILY BATRACHOIDIDAE - Toadfishes

Gulf Toadfish *(Opsanus beta)*
Atlantic Midshipman (*Porichthys porosissimus)*

ORDER PERCOPSIFORMES

FAMILY APHREDODERIDAE - Pirate Perches
Pirate Perch (*Aphredoderus sayanus*)

ORDER ATHERINIFORMES

FAMILY ATHERINIDAE - Silversides
Brook Silverside (*Labidesthes sicculus*)
Inland Silverside (*Menidia beryllina*)

FAMILY BELONIDAE - Needlefish
Atlantic Needlefish (*Strongylura marina*)

FAMILY POECILIIDAE - Livebearers
Western Mosquitofish (*Gambusia affinis*)
Sailfin Molly (*Poecilia latipenna*)

FAMILY FUNDULIDAE - Topminnows
Western Starhead Topminnow (*Fundulus blairae*)
Golden Topminnow (*Fundulus chrysotus*)
Gulf Killifish (*Fundulus grandis*)
Diamond Killifish *Adinia xenica*
Blackstripe Topminnow (*Fundulus notatus*)
Bayou Topminnow (*Fundulus pulverous*)
Longnose Killifish (*Fundulus similis*)
Plains Killifish (*Fundulus zebrinus*)
Rainwater Killifish (*Lucania parva*)
Sheepshead Minnow (*Cyprinodon variegatta*)

ORDER PERCIFORMES

FAMILY MORONIDAE - Temperate Basses
White Bass (*Morone chyrsops*)

FAMILY CARANGIDAE - Jacks
Crevalle Jack *(Caranx hippos)*

FAMILY CENTRARCHIDAE - Sunfish
Flier (*Centrarchus macropterus*)
Redbreast Sunfish *(Lepomis auritus)*
Green Sunfish *(Lepomis cyanellus*)
Warmouth (*Lepomis gulosus*)
Orangespotted Sunfish (*Lepomis humilis*)
Bluegill (*Lepomis macrochirus*)
Dollar Sunfish (*Lepomis marginatus*)
Longear Sunfish (*Lepomis megalotis*)
Redear Sunfish (*Lepomis microlophus*)
Spotted Sunfish (*Lepomis punctatus*)
Bantam Sunfish (*Lepomis symmetricus*)
Spotted Bass (*Micropterus punctulatus*)
Largemouth Bass (*Micropterus salmoides*)
White Crappie (*Pomoxis annularis*)

Black Crappie (*Pomoxis nigromaculatus*)

FAMILY ELASSOMATIDAE
Banded Pygmy Sunfish (*Elassoma zonatum*)

FAMILY PERCIDAE - Perches
Western Sand Darter (*Ammocrypta clara*)
Scaly Sand Darter (*Ammocrypta vivax*)
Slough Darter (*Etheostoma gracile*)
Dusky Darter (*Percina sciera*)

FAMILY GERREIDAE - Mojarras
Spotfin Mojarra (*Eucinostomus argenteus)*
Silver Jenny (*Eucinostomus gula)*
Tidewater Mojarra *(Eucinostomus harengulus)*
Flagfin Mojara (*Eucinostomus currani)*

FAMILY HAEMULIDAE
Pigfish (*Orthopristis chrysoptera)*

FAMILY SCIAENIDAE - Drums
Freshwater Drum (*Aplodinotus grunniens*)
Black Drum (*Pogonias cromas*)
Red Drum (*Sciaenops ocellata*)
Gulf Kingfish (*Menticirrhus littoralis*)
Sand Seatrout (*Cynoscion arenarius*)
Silver Seatrout (*Cynoscion nothus*)
Spotted Seatrout (*Cynoscion nebulosa*)
Spot (*Leiostomus xanthurus*)
Atlantic Croaker (*Micropogon undulates)*
Silver Perch (*Bairdiella chrysura)*

FAMILY SPARIDAE - Porgies
Sheepshead *(Archosargus probatocephalus)*
Pinfish (*Lagodon rhomboids)*

ORDER PLEURONECTIFORMES – Flounders and Soles

FAMILY PARALICHTHYIDAE - Flounders
Southern Flounder (Paralycthyes lethostigma)
Fringed Flounder (Etropus crossotus)
Bay Whiff (*Citharichthys spilopterus)*

FAMILY SOLEIDAE - Soles
Hogchoker *(Trinectes maculates)*
Lined Sole (*Achirus lineatus)*

FAMILY CYNOGLOSSIDAE - Tonguefishes
Blackcheek Tonguefish (*Symphurus plagiusa)*

ORDER RAJIFORMES

FAMILY DASYATIDAE - Stingrays

Southern Stingray *(Dasyatis americana)*
Atlantic Stingray *(Dasyatis Sabina)*

FAMILY GOBIIDAE - Gobies
Naked Goby *(Gobiosoma bosci)*
Darter Goby *(Gobionellus boleosoma)*
Clown Goby *(Microgobius golosus)*

E.6. Butterflies

ORDER LEPIDOPTERA

FAMILY PAPILIONIDAE - Swallowtails
Pipe-Vine Swallowtail *(Battus philenor)*
Black Swallowtail *(Papilio polyxenes)*
Giant Swallowtail *(Heraclides cresphontes)*
Tiger Swallowtail *(Papilio glaucus)*
Spicebush Swallowtail *(Papilio troilus)*
Palamedes Swallowtail *(Papilio palamedes)*

FAMILY PIERIDAE - Whites and Sulphurs
Checkered White *(Pontia protodice)*
Cabbage White *(Pieris rapae)*
Great Southern White *(Ascia monuste)*
Falcate Orangetip *(Paramidea midea)*
Orange Sulphur *(Colias eurytheme)*
White Angled Sulphur *(Anteos clorinde)*
Yellow Angled Sulphur *(Anteos maerula)*
Dog Face *(Colias cesonia)*
Cloudless Sulphur *(Phoebis sennae)*
Orange-Barred Sulphur *(Phoebis philea)*
Large Orange Sulphur *(Phoebis agarithe)*
Little Yellow *(Eurema lisa)*
Mexican Yellow *(Eurema mexicannum)*
Sleepy Orange *(Eurema nicippe)*
Dainty Sulphur *(Nathalis iole)*

FAMILY LYCAENIDAE - Gossamer-winged
Harvester *(Feniseca tarquinius)*
Soapberry Hairstreak *(Phaeostrymon alcestis)*
Banded Hairstreak *(Satyrium calanus)*
Striped Hairstreak *(Satyrium liparops)*
Northern Hairstreak *(Fixsenia ontario)*
Red Banded Hairstreak *(Calycopis cecrops)*
Dusky-blue Hairstreak *(Calycopis isobeon)*
Olive Hairstreak *(Mitoura gyrnea)*
Henry's Elfin *(Incisalia henrici)*
Great Purple Hairstreak *(Atlides halesus)*
Eastern Pine Elfin *(Incisalia niphon)*
White-M Hairstreak *(Parrhasius m-album)*
Gray Hairstreak *(Strymon melinus)*
Western Pigmy Blue *(Brephidium exile)*
Cassius Blue *(Leptotes cassius)*
Marine Blue *(Leptotes marina)*
Ceraunus Blue *(Hemiargus ceraunus)*
Reakit's Blue *(Hemiargus isola)*
Eastern Tailed Blue *(Everes comyntas)*
Spring Azure *(Celastrina argiolus)*

FAMILY LIBYTHEIDAE - Snout Butterflies
Snout Butterfly *(Libytheana bachmanii)*

FAMILY HELICONIIDAE - Longwings
Gulf Fritillary *(Agraulis vanilla)*
Julia *(Dryas iulia)*

Zebra *(Heliconius charitonius)*

FAMILY NYMPHALIDAE - Nymphalids

Variegated Fritillary *(Euptoieta claudia)*
Bordered Patch *(Chlosyne lacinia)*
Silvery Checkerspot *(Charidryas nycetis)*
Texan Crescent *(Anthanassa texana)*
Phaon Crescent *(Phyciodes phaon)*
Pearl Crescent *(Phyciodes tharos)*
Question Mark *(Polygonia interrogationis)*
Mourning Cloak *(Nymphalis antiopa)*
Red Admiral *(Vanessa atalanta)*
American Painted Lady *(Vanessa virginiensis)*
Painted Lady *(Vanessa cardui)*
Buckeye *(Junonia coenia)*
Red-Spotted Purple *(Limenitis arthemis astyanax)*
Viceroy *(Limenitis archippus)*
Common Mestra *(Mestra amymone)*
Goatweed Leafwing *(Anaea andria)*
Hackberry Emperor *(Asterocampa celtis)*
Tawny Emperor *(Asterocampa clyton)*

FAMILY SATYRIDAE – Satyrs and Wood Nymphs

Southern Pearly Eye *(Enodia portlandia)*
Gemmed Satyr *(Cyllopsis gemma)*
Carolina Satyr *(Hermeuptychia sosybius)*
Little Wood Satyr *(Megisto cymela)*
Common Wood Nymph *(Cercyonis pegala)*

FAMILY DANAIDAE - Milkweed Butterflies

Monarch *(Danaus plexippus)*
Queen *(Danaus gilippus)*

FAMILY HESPERIIDAE - Skippers

Silver-spotted Skipper *(Epargyreus clarus)*
White-striped Longtail *(Chioides catillus)*
Long-tailed Skipper *(Urbanus proteus)*
Dorantes Longtail *(Urbanus dorantes)*
Northern Cloudywing *(Thorybes pylades)*
Southern Cloudywing *(Thorybes bathyllus)*
Confused Cloudywing *(Thorybes confuses)*
Southern Scalloped Sootywing *(Staphylus mazans)*
Sickle-winged Skipper *(Achlyodes mithridates)*
Sleepy Duskywing *(Erynnis brizo)*
Juvenal's Duskywing *(Erynnis juvenalis)*
Horace's Duskywing *(Erynnis horatius)*
Funereal Duskywing *(Erynnis funeralis)*
Wild Indigo Duskywing *(Erynnis baptisiae)*
Common Checkered Skipper *(Pyrgus communis)*
Tropical Checkered Skipper *(Pyrgus oileus)*
Turk's Cap Skipper *(Heliopetes macaira)*
Hayhurst's Scallopwing *(Staphylus hayhurstii)*
Mazans Scallopwing *(Staphylus mazans)*
Common Sootywing *(Pholisora catullus)*
Swarthy Skipper *(Nastra lherminier)*
Neamathla Skipper *(Nastra neamathla)*
Julia's Skipper *(Nastra julia)*
Clouded Skipper *(Lerema accius)*
Least Skipper *(Ancyloxypha numitor)*
Orange Skipperling *(Copaeodes aurantiacus)*
Southern Skipperling *(Copaeodes minimus)*
Fiery Skipper *(Hylephila phyleus)*
Meske's Skipper *(Hesperia meskei)*
Whirlabout *(Polites vibex)*
Southern Broken Dash *(Wallengrenia otho)*

Northern Broken Dash *(Wallengrenia egeremet)*
Little Glassywing *(Pompeius verna)*
Sachem *(Atalopedes campestris)*
Broad-winged Skipper *(Poanes viator)*
Yehl Skipper *(Poanes yehl)*
Dun Skipper *(Euphyes vestries)*
Lace-winged Roadside Skipper *(Amblyscirtes aesculapius)*
Celia's Roadside Skipper *(Amblyscirtes celia)*
Common Roadside Skipper *(Amblyscirtes vialis)*
Eufala Skipper *(Lerodea eufala)*
Twin-spot Skipper *(Oligoria maculate)*
Brazilian Skipper *(Calpodes ethlius)*
Salt Marsh Skipper *(Panoquina panoquin)*
Obscure Skipper *(Panoquina panoquinoides)*
Ocola Skipper *(Panoquina ocola)*
Polydamas Swallowtail *(Battus polydamas)*
Mexican Silverspot *(Dione moneta)*
White Peacock *(Anaea andria)*

E.7. Dragonflies

ORDER ODONATA

FAMILY AESHNIDAE - Darner
Common Green Darner *(Anax junius)*
Comet Darner *(Anax longipes)*
Regal Darner *(Coryphaeschna ingens)*
Swamp Darner *(Epiaeschna heros)*

FAMILY GOMPHIDAE - Clubtails
Clubtail spp. *(Gomphidae spp.)*

FAMILY MACROMIIDAE - Cruisers
Royal River Cruiser *(Macromiidae taeniolata)*

FAMILY CORDULIIDAE - Emeralds
Common Baskettail *(Epitheca cynosure)*
Prince Baskettail *(Epitheca princeps)*

FAMILY LIBELLUIDAE - Skimmers
Four-spotted Pennant *(Brachymesia gravida)*
Halloween Pennant *(Celithemis eponina)*
Banded Pennant *(Celithemis fasciata)*
Calico Pennant *(Celithemis elisa)*
Eastern Pondhawk *(Erythemis simpliciollis)*
Great Pondhawk *(Erythemis vesiculosa*
Band-winged Dragonlet *(Erythrodiplax umbrata)*
Seaside Dragonlet *(Erythrodiplax bertenice)*
Slaty Skimmer *(Libellula incesta)*
Common Whitetail *(Libellula lydia)*
Needham's Skimmer *(Libellula needhami)*
Great Blue Skimmer *(Libellula vibrans)*
Window Skimmer *(Libellula luctuosa)*
Greater Hyacinth Glider *(Miathyria marcella)*
Roseate Skimmer *(Orthemis ferruginea)*
Blue Dasher *(Pachydiplax longipennis)*
Wandering Glider *(Pantala flavescens)*
Spot-winged Glider *(Pantala hymenaea)*
Eastern Amberwing *(Perithemis tenera)*
Carolina Saddle Bags *(Tramea Carolina)*
Black-mantled Glider *(Tramea lacerata)*
Red-mantled Glider *(Tramea onusta)*

E.8. Vascular Plants

CLASS POLYPODIOPSIDA - Ferns and Fern Allies

FAMILY ASPLENIACEAE
Ebony Spleenwort *(Asplenium platyneuron)*

FAMILY AZOLLACEAD
Mosquite Fern *(Azolla caroliniana)*

FAMILY OPHIOGLOSSACEAE
Southern Grape Fern *(Botrychium biternatum)*

FAMILY POLYPODIACEAE
Resurrection Fern *(Polypodium polypodioides var. Michauxianum)*

FAMILY RICCIACEA
Riccia Liverwort (*Riccia fluitans*)
Ricciacarpus (*Ricciacarpus natans)*

FAMILY SALVINIACEAE
Mosquito Fern *(Azolla caroliniana)*

FAMILY THELYPTERIDACEAE
Wide-spread Maiden Fern *(Thelypteris kunthii)*

CLASS PINOPSIDA - Gymnosperms

FAMILY CUPRESSACEAE
Eastern Red Cedar *(Juniperus virginiana* var. *silicicola)*

FAMILY PINACEAE
Loblolly Pine *(Pinus taeda)*

CLASS LILIOPSIDA - Monocots

FAMILY AGAVACEAE
Datil Yucca *(Yucca baccata)*
Yucca *(Yucca freemanii)*
LouisianaYucca *(Yucca louisianensis)*
Spanish Dagger Yucca *(Yucca treculeana)*

FAMILY ALISMATACEAE
Beaked Burhead *(Echinodorus beteroi)*
Burhead *(Echinodorus cordifolius)*
Burhead *(Echinodorus rostratus)*
Burhead *(Echinodorus tenellus)*
Grassy Arrowhead *(Sagittaria graminea)*

Longlobe Arrowhead *(Sagittaria longiloba)*
Nipplebract Arrowhead *(Safittaria papillosa)*
Delta Arrowhead *(Sagittaria platyphylla)*

FAMILY ALLIACEAE
Canada Meadow Onion *(Allium canadense)*
Meadow garlic *(Allium canadense* var. *mobiliense)*
Crow-poison *(Nothoscordum bivalve)*

FAMILY ARACEAE
Green Dragon *(Arisaema dracontium)*
Water Lettuce (*Pistia Stratiotes)*

FAMILY ARECACEAE
Dwarf Palmetto (*Sabal minor)*

FAMILY BROMELIACEAE
Small Ball Moss *(Tillandsia recurvata)*
Spanish Moss *(Tillandsia usneoides)*

FAMILY CANNACEAE
Bannana of the Everglades *(Canna flacida)*
Indian-shot *(Canna glauca)*

FAMILY COMMELINACEAE
Erect Dayflower *(Commelina erecta)*
Narrow-leaf Dayflower *(Commelina erecta* var. *angustifolia)*
Ohio Spiderwort *(Tradescantia ohioensis)*
Spreading Day-flower *(Commelina diffusa)*

FAMILY CYPERACEAE
Broadwing Sedge (Carex alata)
Greenish-White Sedge *(Carex albolutescens)*
Amphibious Sedge *(Carex amphibola)*
Bicknell's Sedge *(carex bicknellii)*
Carolina Sedge *(Carex caroliniana)*
Woodbank Sedge *(Carex cephalophora*)
Cherokee Caris-sedge *(Carex cherokeenses)*
Basal-fruit Caric-sedge *(Carex basiantha)*
Charming Caric-sedge *(Carex blanda)*
Crowfoot Caric-sedge *(Carex crus-corvi)*
Flaccid-fruit Caric-sedge *(Carex flaccosperma)*
Frank's Caric-sedge *(Carex frankii)*
Hyaline-scale Caric-sedge *(Carex hyalinolepis)*
Leavenworth's Caric-sedge *(Carex leavenworthii)*
Long's Sedge *(Carex longii)*
Louisiana Caric-sedge *(Carex louisianica)*
Hop-like Caric-sedge *(Carex lupuliformis)*
Hop caric-sedge *(Carex lupulina)*
Mead's Sedge *(Carex meadii)*
Sharp-scale Caric-sedge *(Carex oxylepis)*
Reflexed fruit Caric-sedge *(Carex retroflexa)*
Four-angled Caric-sedge *(Carex tetrastachya)*
Eastern Foxsedge *(Carex triangularis)*
Sangamon Caltrop Caric-sedge *(Carex tribuloides)*
Fox Sedge *(Carex vulpinoidea)*

Taperleaf Flat-sedge *(Cyperus acuminatus)*
Jointed Flat-sedge *(Cyperus articulatus)*
Slender Flatsedge *(Cyperus bipartitus)*
Buttonbush Flatsedge *(Cyperus cephalanthus)*
Poorland Flatsedge *(Cyperus compressus)*
Baldwin's Flat-sedge *(Cyperus croceus)*
Globe Flatsedge *(Cyperus echinatus)*
Yellow Nutgrass *(Cyperus esculentus)*
Sheathed Flatsedge *(Cyperus haspan)*
Ricefield flat-sedge *(Cyperus iria)*
Pond Flat-sedge *(Cyperus ochraceus)*
Sharp-scale Flatsedge *(Cyperus oxylepis)*
Marsh Flat-sedge *(Cyperus pseudovegetus)*
Purple Nutsedge *Cyperus rotundus)*
False-nutgrass *(Cyperus strigosus)*
Coastal Plain Flat-sedge *(Cyperus thyrsiflorus)*
Oneflower Flatsedge *(Cyperus uniflorus)*
Green Flatsedge *(Cyperus virens)*
Deeprooted Sedge *(Cyperus entrerianus)**
Needle Spikesedge *(Eleocharis acicularis)*
White Spikerush *(Eleocharis albida)*
Gulfcoast Spikesedge *(Eleocharis cellulosa)*
Small Spikerush *(Eleocharis minima)*
Sand Spikesedge *(Eleocharis montevidensis)*
Dwarf Spikesedge *(Eleocharis pavrula)*
Sparestem Spikesedge *(Eleocharis quadrangulata)*
Fimbry *(Fimbristylis castanea)*
Fimbry *(Fimbristylis thermalis)*
Grasslike Fimbry *(Fimbristylis miliacea)*
Vahl's Hairy Fimbry *(Fimbristylis puberula)*
Fimbry (*Fimbristylis spadicea)*
Wooly Fimbry *(Fimbristylis tomentosa)*
Vahl fimbry *(Fimbristylis vahlii)*
Keeled Bulrus *(Isolepis carinata)*
Short-leaf Spike-sedge *(Kyllinga brevifolia)*
American Snoutbean *(Rhynchosia americana)*
Snoutbean *(Rhynchosia minima)*
Texas Snoutbean *(Rhynchosia senna)*
Anglestem Beakrush *(Rhynchospora caduca)*
Whitetop Starrush (Rhynchospora colorata)
Soft-bristle Horned Beakrush *(Rhynchospora corniculata)*
Elliot's Beakrush *(Rhynchospora elliottii)*
Globe Beakrush *(Rhynchospora globularis)*
Clustered Beakrush *(Rhynchospora glomerata)*
Shortbeak Beaksedge *(Rhynchospora nitens)*
Olney Bulrush (*Schoenoplectus americanus)*
California Bulrush *(Schoenoplectus californicus)*
Threesquare Blurush (*Schoenoplectus pungens)*
Salt-Marsh Bulrush (*Schoenoplectus robustus)*
Softstem Bulrush (*Schoenoplectus tabernaemontani)*
Baldwin's Nutrush (*Scleria baldwinii)*
Fringed Nutrush (*Scleria ciliate)*
Slenderfruit Nutrush (*Scleria georgiana)*
Small-head nutrush *(Scleria oligantha)*
Carolina Whipgrass (*Scleria pauciflora)*

FAMILY HYDROCHARITACEAE
Common Frogbit *(Limnobium spongia)*

FAMILY IRIDACEAE
Purple Pleat-leaf *(Eustylis pupurea) or (Alophia drummondii)*
South Texas Herbertia *(Herbertia lahue)*
Prairienymph *(Herbertia lahue* ssp. *caerula)*
Southern Blue-flag *(Iris virginica)*

Narrowleaf Blue-eyed Grass *(Sisyrinchium angustifolium)*
Yellow Blue-eyed Grass *(Sisyrinchium exile)*
Dotted (Roadside) blue-eyed grass *(Sisyrinchium langloisii)*
Least Blue-eyed Grass *(Sisyrinchium minus)*

FAMILY JUNCACEAE

Taper-tip (knotleaf) Rush *(Juncus acuminatus)*
White-Root Rush *(Juncus brachycarpus)*
Toad Rush *(Juncus bufonius)*
Forked Rush *(Juncus dichotomus)*
Soft Rush *(Juncus effuses)*
Common Rush *(Juncus effuses* var. *solutes)*
Bog Rush (*Juncus elliotti)*
Inland rush *(Juncus interior)*
Grass-leaf Rush *(Juncus marginatus)*
Many-Head Rush *(Juncus polycephalus*)
Needlegrass (black) Rush, (*Juncus roemerianus)*
Slender Rush *(Juncus tenuis)*
Roundhead Rush *(Juncus validus)*

FAMILY LEMNACEAE

Duckweed *(Lemna aequininoctialis)*
Swollen Duckweed *(Lemna gibba)*
Little Duckweed *(Lemna obscura)*
Duckweed (*Lemna trinervis)*
Duckmeat *(Spirodela polyrhiza)*
Brazillian Water-meal *(Wolffia brasiliensis*)
Columbia Wolffia *(Wolffia columbiana)*
Water-meal *(Wolffia papulifera)*
Bogmat *(Wolffiella gladiate)*
Mid-midget (Bogmat) *(Woffiella lingulata)*

FAMILY LILIACEAE

Yellow Colic-root *(Alteris aurea)*
Drummond Rain Lily *(Cooperia drummondii)*
Rain-lily *(Cooperia traubii)*
Spider Lily *(Hymenocallis liriosme)*

FAMILY MARANTACEAE

Powdered Thalia *(Thalia dealbata)*

FAMILY NAJADACEAE

Southern Naiad *(Najas guadalupensis)*
Spiny Naiad *(Najas marina)*

FAMILY ORCHIDACEAE

Water Spider Orchid *(Habenaria repens)*
Nodding Ladies' tresses *(Spiranthes cernua)*
Texas Ladies' tresses *(Spiranthes gracilis* var. *brevilabris)*
Oval Ladies' tresses *(Spiranthes cernua)*
Spring Ladies' tresses *(Spiranthes vernalis)*

FAMILY POACEAE

Winter Bentgrass *(Agrostis hyemalis)*
Upland Bentgrass *(Agrostis perennans)*
Rough Bentgrass *(Agrostis scabra)*
Carolinia Foxtail *(Alopecurus carolineanus)*

Bushy Beardgrass *(Andropogon glomeratus)*
Spritbeard Bluestem *(Andropogon ternaries)*
Broom-sedge Bluestem *(Andropogon virginicus)*
Purple Silky-Scale *(Anthaenantia rufa)*
Slimspike (Prairie) Three-awn *(Aristida longespica)*
Oldfield Three-awn *(Aristida oligantha)*
Giant Cane *(Arundinaria gigantea)*
Giant Reed *(Arundo donax)*
Southern Carpet Grass *(Axonopus fissifolius)*
Awnless Bluestem *(Bothriochloa exaristata)*
King Ranch Bluestem (*Bothriochloa ischaemum* var. *ischaemum)**
Long-spike Silver Bluestem *(Bothriochloa longipaniculata)*
Silver Bluestem *(Bothriochloa laguroides ssp. torreyana)*
Little Quaking Grass *(Briza minor)**
Rescuegrass *(Bromus catharticus)*
Buffalo Grass *(Buchloe dactyloides)*
Southern Sandbur *(Cenchrus echinatus)*
Coastal Sandbur *(Cenchrus spinifex) **
Broad-leaf Woodoats *(Chasmanthium latifolium)*
Hairy-collar Woodoats *(Chasmanthium laxum)*
Paraguay Windmill Grass *(Chloris canterae)**
Texas Windmill Grass *(Chloris texensis)*
Tumble Windmill Grass (Chloris verticillata)
Pitted Jointgrass *(Coelorachis cylindrical)*
Bermuda grass *(Cyndon dactylon)**
Egyptian Crow's-foot *(Dactyloctenium aegyptium)**
Tapered Rosette-Grass *(Dichanthelium acuminatum* var. *acuminatum)*
Cypress Panic Grass *(Dichanthelium dichotomum* var. *dichotomum)*
Heller's Panic Grass *(Dichanthelium oligosanthes* var. *oligosanthes*)
Scribner's Rosette-Grass *(Dichanthelium oligosanthes* var. *scribnerianum)*
Wooly Panicum *(Dichanthelium scabriusculum)*
Velvet-Panic-Grass *(Dichanthelium scoparium)*
Roundseed Panicum *(Dichanthelium sphaerocarpon)*
Roundseed Panicum (*Dichanthelium sphaerocarpon* var. *isophyullum*)
Roundseed Panicum *(Dichanthelium sphaerocarpon* var. *sphaerocarpon*)
Angleton Bluestem *(Dichanthium aristatum)*
Needleleaf Rosette-Grass *(Dichanthelium aciculare)*
Western Panicgrass *(Dichanthelium acuminatum* var. *fasciculatum)*
Southern Crab-grass *(Digitaria ciliaris)*
Fall Witch-Grass *(Digitaria cognate)*
Fall Witchgrass *(Digitaria cognatum* var. *cognatum)*
Smooth Crabgrass *(Digitaria ischaemum)*
Hairy Crabgrass *(Digitaria sanguinalis)*
Dune Crabgrass *(Digitaria texana)*
Seashore Saltgrass *(Distichlis spicata)*
Jungle Rice *(Echinochloa colona) **
Barnyard Grass *(Echinochloa crus-galli)*
Gulf Cockspur Grass *(Echiochloa crus-pavonis)*
Barnyard Grass *(Echiochloa crus-pavonis* var. *macera)*
Goosefoot-grass *(Eleusine indica)*
Canada Wildrye *(Elymus canadensis)*
Quackgrass (*Elymus repens)*
Virginia Wildrye *(Elymus virginicus)*
Lacegrass *(Eragrostis capillaries)*
Bigtop Lovegrass *(Eragrostis hirsuta)*
Mourning Lovegrass *(Eragrostis lugens)*
Field lovegrass *(Eragrostis refracta)*
Red Lovegrass *(Eragrostis secundiflora)*
Purple Lovegrass *(Eragrostis spectabilis)*
Wichita Lovegrass (Lacegrass) *(Eragrostis secundiflora* ssp. *oxylepis)*
Prairie Cupgrass *(Eriochloa contracta)*
Louisiana cupgrass *(Eriochloa puctata)*

Stiff-leaf Windmill Grass (*Eustachys petraea)*
Stiffleaf Choloris *(Eustachys petraea)*
Little Barley *(Hordeum pusillum)*
Junegrass *(Rostraria cristata)*
Catchfly grass *(Leersia lenticularis)*
Bunch cut-grass *(Leersia monandra)*
Virginia Cut-grass *(Leersia virginica)*
Nealley Sprangletop *(Leptochloa nealleyi)*
Branching Spangletop (*Leptochloa panacea)*
Mexican Sprangletop *(Leptochloa fusca* ssp. *uninervia)*
Ozarkgrass *(Limnodea arkansana)*
Cane-like Rye-grass (Reed fescue) *(Lolium arundinaceum)**
Perennial Rye-grass *(Lolium perenne)**
Two-flower Melic *(Melica mutica)*
Shoregrass *(Monanthochloe littoralis*)
Gulf Muhly *(Muhlenbergia capillaries)*
Nimbleweed *(Muhlenbergia schreberi)*
Texas Winter Grass *(Nassella leucotricha)*
Creeping Lovegrass *(Neeragrostis reptans)*
Basket-grass *(Oplismenus hirtellus)**
Bitter Panicum *(Panicum amarum)*
Beaked Panicum *(Panicum anceps)*
Witchgrass *(Panicum capillare)*
Fall Spreading Witchgrass *(Panicum dichotomiflorum)*
Filly Panicum *(Panicum halli* var. *filipes)*
Wooly Panicum *(Panicum lanuginosum)*
Vine-mesquite *(Panicum obtusum)*
Red-top panic-grass *(Panicum rigidulum)*
Switchgrass *(Panicum virgatum)*
Egyptian Panicgrass (*Paspalidium germinatum var. germinatum)*
Water Panicum (*Paspalidium germinatum var. paludivagum)*
Pitchfork Paspalum *(Paspalum bifidum)*
Sour Paspalum *(Paspalum conjugatum)*
Dallis grass *(Paspalum dilatatum)**
Knotgrass *(Paspalum distichum)*
Florida Paspalum *(Paspalum floridanum)*
Creeping Water Paspalum *(Paspalum fluitans)*
Woodland Paspalum *(Paspalum langei)*
Longtom *(Paspalum lividum)*
Mat Paspalum *(Paspalum minus)*
Bahia grass *(Paspalum notatum)**
Brownseed Paspalum *(Paspalum plicatulum)*
Hairyseed Paspalum *(Paspalum pubiflorum)*
Thin Paspalum *(Paspalum setaceum)*
Vasey-grass *(paspalum urvillei)*
Seashore paspalum *(Paspalum vaginatum)*
Yellow Bristlegrass *(Pennisetum glaucum)*
Timothy Canary-grass *(Phalaris angusta)*
Carolina Canary grass *(Phalaris caroliniana)*
Savannah Panicum *(Phanopyrum gymnocarpon)*
Common Reed *(Phragmites australis)*
Annual Bluegrass *(Poa annua)*
Autumn Bluegrass *(Poa autumnalis)*
Rabbit-foot Grass *(Polypogon monspeliensis)*
Junegrass *(Rostraria cristata)*
Tumblegrass *(Schedonnardus paniculatus)*
Little Bluestem *(Schizachyrium scoparium)*
Slender Bluestem *(Schizachyrium tenerum)*
Yellow Foxtail *(Setaria glauca)*
Giant Bristlegrass *(Setaria magna)*
Knotroot Bristlegrass *(Setaria parviflora)*
Bristlegrass *(Setaria pumila)**
Indian grass *(Sorghastrum avenaceum)*
Yellow Indiangrass *(Sorghastrum nutans)*
Johnson grass *(Sorghum halepense)*
Smooth Cordgrass *(Spartina alterniflora)*
Marshhay Cordgrass *(Spartina patens)*
Prairie Cordgrass *(Spartina pectinata)*
Gulf Cordgrass *(Spartina spartinae)*
Slender Wedgescale *(Sphenopholis intermedia)*
Prairie Wedgegrass *(Sphenopholis obtusata)*
Tall Dropseed *(sporobolus asper)*
Dropseed *(Sporobolus composites* var. *composites)*

Whorled Dropseed *(Sporobolus coromandelianus)*
Rattail Smutgrass *(Sporobolus indicus)*
Padre Island Dropseed *(Sporobolus Tharpii)*
Seashore Dropseed *(Sporobolus virginicus)*
Gaping Panicum *(Steinchisma hians)*
St. Augustine grass *(Stenotaphrum secundatum)**
Texas Wintergrass *(Stipa leucotricha)*
Purple-top Tridens *(Tridens flavus)*
Longspike Tridens *(Tridens strictus)*
Eastern Gamagrass *(Tripsacum dactyloides)*
Prairie Trisetum *(Trisetum interruptum)*
Sea-oats *(Uniola paniculata)*
Broad-leaf Liver-seed grass (signalgrass) *(Urochloa platyphylla)*
Creeping Liver-seed grass (Sprawling signal grass) *(Urochloa reptans)* *
Six-weeks Fescue (Common sixweeksgrass) *(Vulpia octoflora)*
Texas Willkommia *(Willkommia texana)*
Marsh Millet *(Zizaniopsis miliacea)*

FAMILY PONTEDERIACEAE
Blue Mudplantain *(Heteranthera limosa)*
Mudplantain *(Heteranthera reniformis)*

FAMILY POTAMOGETONACEAE
Waterthread Pondweed *(Potamogeton diversifolius)*
Longleaf Pondweed *(Potamogeton nodosus)*
Widgeon-grass *(Ruppia maritime)*

FAMILY SMILACEACEAE
Saw Greenbrier *(Smilax bona-nox)*
Common Greenbrier *(Smilax rotundifolia)*
Small's Greengrier *(Smilax smallii)*

FAMILY TYPHACIAE
Narrow-leaved Cattail *(Typha angustifolia)*
Gulf Coast Cattail *(Typha domingensis)*
Common Cattail *(Typha latifolia)*

CLASS MAGNOLIOPSIDA - Dicots

FAMILY ACANTHACEAE
Branched Fold-wing *(Dicliptera brachiata)*
Gulf Swampweed *(Hygrophila lacustris)*
Lance-leaf Water-willow *(Justicia ovata* var. *lanceolata)*
Water-willow *(Justicia runyonii)*
Low Ruellia (Prairie petunia) *(Ruellia humilis)*
Western Wild Petunia (*Ruellia nudiflora* var. *occidentalis)*
Runyon's Wild Petunia (*Ruellia nudiflora* var.*runyonii)*
Smooth Wild Petunia (*Ruellia strepens)*

FAMILY ACERACEAE
Box-elder *(Acer negundo)*

FAMILY AIZOACEAE
Coast Sea Purslane (Sesuvium maritimum)
Sea Purslane *(Sesuvium portulacastrum)*

Desert Horse Purslane (Trianthema portulacastrum)

FAMILY AMARANTHACEAE

Alligator Weed (*Alternanthera philoxeroides)*
Sessile Joyweed *(Alternanthera sessilis)*
Berlandier Amaranth *(Amaranthus berlandieri)*
Gregg Amaranth *(Amaranthus greggii)*
Water Hemp *(Amaranthus tamariscinus)*
Tropical Green Pigweed (Green amaranth) *(Amaranthus viridis)*
Water Hemp *(Amaranthus rudis)*
Lanceleaf Cottonflower *(Builleminea lanuginose var. tenuiflora)*
Common Cottonweed *(Froelichia gracilis)*
Lanceleaf Cottonflower (Gossypianthus lanuginosus)
Woolly Tidestromia *(Tidestromia laniginosa)*

FAMILY ANACARDIACEAE

Winged Sumac *(Rhus copallina)*
Poison Ivy (*Toxicodendron radicans)*

FAMILY APIACEAE

Butler Sand-parsley *(Ammoselinum butleri)*
Sea Rocket *(Cakile geniculata)*
Spade Leaf *(Centella erecta)*
Hairy-fruit Chervil (*Chaerophyllum tainturieri)**
Water Hemlock *(Cicuta maculate)*
Slim-lobe Celery *(Cyclospermum leptophyllum)*
Finger Dogshade *(Cynosciadium digitatum)*
Hooker's Eryngo *(Eryngium hookeri)*
Blue-flower Coyote-thistle *(Eryngium integrifolium)*
Rattlesnake-master *(Eryngium yuccifolium)*
Pennywort *(Hydrocotyle bonariensis)*
Marsh Pennywort *(Hydrocotyle umbellate)*
Water-pennywort *(Hydrocotyle verticillata)*
Texas Parsley *(Polytaenia texana)*
Mock Bishop-Weed *(Ptilimnium capillaceum)*
Canadian Sanicle *(Sanicula candensis)*
Black Snakeroot *(Sanicula odorata)*
Bristly Scaleseed *(Spermolepis echinata)*
Knotted Hedge-parsley *(Torilis nodosa)**
Texas Tauschia *(Tauschia texana)*
White Nimph *(Trepocarpus aethusae)*

FAMILY APOCYNACEAE

Blue-Star *(Amsonia illustris)*
Eastern Blue-Star *(Amsonia tabernaemontana)*

FAMILY AQUIFOLIACEAE

Possumhaw *(Ilex dicidua)*
American Holly *(Ilex opaca)*
Yaupon Holly *(Ilex vomitoria)*

FAMILY ASCLEPIADACEAE

Fewflower Milkweed (Asclepias lanceolata)
Slim Milkweed *(Asclepias linearis)*
Shore Milkweed *(Asclepias perennis)*
Red Milkweed *(Asclepias rubra)*

Antelope-horn (Green) Milkweed *(Asclepias viridis)*
Gulf Coast Swallowwort (C*ynanchum angustifolium)*
Five –angle Shiney-pod Milkvine *(Matelea gonocarpos)*

FAMILY ASTERACEAE

Creeping Spotflower *(Acmella opposifolia* var. *repens)*
Common Ragweed *(Ambrosia artemisiifolia)*
Western Ragweed *(Ambrosia psilostachya)*
Giant Ragweed *(Ambrosia trifida)*
Blood Ragweed *(Ambrosia trifida var. texana)*
Lazy Daisy *(Aphanostephus skirrhobasis)*
Coast Dozedaisy *(Aphanostephus skirrhobasis var. thalassius)*
Common Broomweed *(Amphiachris dracunculoides)*
Indian Plantain *(Arnoglossum ovatum)*
Easter Baccharis *(Baccharis halimifolia)*
Six Spanish Needles *(Bidens bipinnata)*
Smallhead Doll's Daisy *(Boltonia diffusa)*
Sea Ox-eye Daisy *(Borrichia frutescens)*
Straggler Daisy *(Calyptocarpus vialis)*
American Basketflower *(Centaurea americana)*
Common Least Daisy *(Chaetopappa aseroides)*
Spiny Aster (Wolfweed) *(Chlorantha spinosa)*
Hairy Goldenaster *(Chrysopsis pilosa)*
Mauchia *(Chrysopsis texana)*
Yellow Thistle *(Cirsium horridulum)*
Teaxas Thistle *(Cirsium texanum)*
Blue Mistflower *(Conoclinium coelestinum)*
Canadian Horseweed *(Conyza canadensis)*
Goldmane Coreopsis *(Coreopsis basalis)*
Lance-leaf Tickseed *(Coreopsis lanceolata)*
Plains Coreopsis (Tickseed) *(Coreopsis tinctoria)*
Cardamine Coreopsis *(Coreopsis tinctoria* var. *tinctoria)*
Yerba de Tajo *(Eclipta alba)*
Yerba de Tajo *(Eclipta prostrata)*
Elephant's-foot *(Elephantopus carolinianus)*
Geiser's (Basin) Fleabane *(Erigeron geiseri)*
Fireweed *(Erechtites hieracifolia)*
Canadian Horseweed *(Erigeron canadensis)*
Philadelphia Fleabane *(Erigeron philadelphicus)*
Corpus Christi Fleabane *(Erigeron procumbens)*
Prairie Fleabane *(Erigeron strigosus)*
Dog Fennel (Eupatorium capillifolium)
Mist-flower *(Eupatorium coelestinum)*
Yankee Weed *(Eupatorium compositifolium)*
Narrowleaf Boneset *(Eupatorium hyssolifolium)*
Small-flower Boneset *(Eupatorium lancifolium)*
Saw-leaf Throughwort (Fall boneset) *(Eupatorium serotinum)*
Texas Goldentop *(Euthamia gymnospermoides)*
Bushy (Flat-topped) Goldentop *(Euthamia leptocephala)*
Flat-topped Goldentop *(Euthamia tenuifolia)*
Fleischmann's Thrououghwort *(Fleischmannia incarnata)*
Yellow Indian-blanket *(Gaillardia aestivalis)*
Indian Blanket *(Gaillardia pulchella)*
Purple Cudweed *(Gamochaeta americana)*
Sneezeweeed *(Helenium amarum)*
Swamp (Narrow-leaf) Sunflower *(Helianthus angustifolius)*
Annual Sunflower *(Helianthus annuus)*

Maximillian Sunflower *(Helianthus maximiliarii)*
White-flowered Cat's-ear *(Hypochaeris microcephala)**
Narrowleaf Sumpweed *(Iva angustifolia)*
Annual Seacoast Sumpweed *(Iva annua)*
Bigleaf Sumpweed *(Iva frutescens)*
Weedy Dwarf Dandelion *(Krigia caespitosa)*
Tall Yellow Lettuce *(Lactuca canadensis)*
Woodland Lettuce *(Lactuca floridana)*
Slender Gayfeather *(Liatris acidota*)
Bracted Gayfeather *(Liatris bracteata)*
Kansas Gayfeather *(Liatris pycnostachya)*
Malva de Caballo *(Malachra capitata)*
Climbing Hempweed *(Mikania scandens)*
Yellowtop *(Packera glabella)*
Thread-leaf Groundsel *(Packera tampicana)*
Rosy Palafoxia *(Palafoxia rosea)*
Texas Palafoxia *(Palafoxia texana)*
False Ragweed *(Parthenium hysterophorus)*
Salt-marsh Camphorweed *(Pluchea camphorata)*
Marsh Fleabane *(Pluchea foetidaa)*
Sweetscent *(Pluchea carolinensis)*
Rosy Camphor-weed *(Pluchea rosea)*
Purple Pluchea *(Pluchea odorata* var *odorata)*
Fragrant Cudweed *(Pseudognaphalium helleri)*
Frangrant Cudweed *(Pseudognaphalium obtusilolium* ssp. *obtusifolium)*
Wand Black Root *(Pterocaulon virgatum)*
Carolina False Dandelion *(Pyrrhopappus carolinianus)*
Small-flowered False Dandelion *(Pyrrhopappus pauciflorus)*
Mexican Hat *(Ratibia columnifera)*
Naked Prairie Coneflower *(Ratibida peduncularis var. peduncularis)*
Pinnate Prairie Coneflower *(Ratibida pinnata)*
Camphor Daisy *(Rayjacksonia phyllocephala)*
Brown-eyed Susan *(Rudbeckia hirta)*
Texas Brown-Eyed Susan (*Rudbeckia texana)*
Slender Rosinweed *(Silphium gracile)*
Bears-foot Leafcup *(Smallanthus unvedalia)*
Canada Goldenrod *(Solidago canadense* var. *scabra)*
Dyersweed Goldenrod *(Solidago nemarolis)*
Seaside Goldenrod *(Solidago sempervirens)*
Twistedleaf Goldenrod *(Solidago tortifolia)*
Lawn Burweed *(Soliva sessilis)*
Prickly Sow-thistle *(Sonchus asper)*
Common Sow-thistle *(Sonchus oleraceus)**
Bushy Aster *(Symphyotrichum dumosum)*
Calico Aster *(Symphyotrichum lateriflorum)*
Heath Aster (*Symphyotrichum ericoides*)
Meadow Aster *(Symphyotrichum pratense)*
Southeastern Annual Salt Marsh Aster *(Symphyotrichum squamatum)*
Eastern Annual Salt Marsh Aster *(Symphyotrichum subulatum)*
Saline Aster *((Symphyotrichum tenuifolium)*
Bush Raceme Aster *(Symphyotrichum racemosum)*
Dandelion *(Taraxacum officinale)*
Green-thread *(Thelesperma filifolium)*
Three-flower Snakeweed *(Thurovia triflora)*
Virginia Frostweed *(Verbesin virginica)*
Wooly Ironweed *(Vernonia lindheimeri)*
Missouri Ironweed (*Vernonia missurica)*
Japanese Hawkweed *(Youngia japonica)**
Cocklebur *(Xanthium strumarium)*

FAMILY BATACEAE
Maritime Saltwort (Batis maritima)

FAMILY BIGNONIACEAE
Common Trumpet Creeper *(Campsis radicans)*

FAMILY BORAGINACEAE
Seaside Heliotrope *(Heliotropium curassavicum)*
Indian Heliotrope *(Heliotropium indicum)*
Four-spike Heliotrope *(Heliotropium procumbens)*
Carolina Puccoon *(Lithospermum caroliniense)*
Narrowleaf Groomwell *(Lithospermum incisum)*
Spring forget-me-not *(Myosotis macrosperma)*

FAMILY BRASSICACEAE
Sea Rocket *(Cakile geniculata)*
Shepard's Purse *(Capsella bursa-pastoris)*
Weak Bittercress *(Cardamine debilis)**
Bitterweed, Sneezeweed *(Helenium amarum)*
Fringed Sneezeweed *(Helenium drummondii)*
Purple-head Sneezeweed *(Helenium flexuosum)*
Virgina Pepperwort *(Lepidium virginicum)*
Bog Marsh-cress *(Rorippa barbareifolia)*
Yellowcress *(Rorippa palustris)*
Tansyleaf Yellowcress *(Rorippa teres)*
Virginia Sibara *(Sibara virginica)*

FAMILY BUDDLEJACEAE
Juniper-leaf (Polypremum procumbens)

FAMILY CACTACEAE
Texas Prickly Pear *(Opuntia engelmannii* var. *lindheimeri)*
Plains Prickly Pear *(Opuntia macrorhiza)*

FAMILY CALLITRICHACEAE
Larger Waterwort *(Callitriche heterophylla)*
Water-starwort *(Callitriche terrestris)*

FAMILY CAMPANULACEAE
Cardinal Flower *(Lobelia cardinalis)*
Foldear Lobelia *(Lobelia flaccidifolia)*
Downy Lobelia *(Lobelia puberula)*
Chicken Spike *(Sphenoclea zeylanica)*
Small Venus Looking-glass *(Triodanis biflora)*
Prairie Venus looking-glass *(Triodanis lamprosperma)*
Venus' Looking glass *(Triodanis perfoliata)*

FAMILY CAPPARIDACEAE
Roughseed Clammy-weed *(Polanisia dodecandra)*

FAMILY CAPRIFOLIACEAE

Japanese Honeysuckle *(Lonicera japonica)**
Trumpet Honeysuckle *(Lonicera sempervirens)*
Common Elderberry *(Sambucus niger var. canadensis)*
Coralberry (Indian-current) *(Symphoricarpos orbiculatus)*
Arrow-wood *(Viburnum dentatum)*
Rusty Blackhaw *(Viburnum rufidulum)*

FAMILY CARYOPHYLLACEAE

Sticky Mouse-ear Chickweed *(Cerastium glomeratum)*
Sleepy Catchfly *(Silene antirrhina)*
Bristleseed Sand-spurry *(Spergularia echinosperma)*
Marsh Sand-spurry *(Spergularia salina)*
Common Chickweed *(Stellaria media)*
Prostrate Starwort *(Stellaria prostrate)*

FAMILY CHENOPODIACEAE

Crested Saltbush *(Atriplex cristata)*
Matamoros Saltbush *(Atriplex matamorensis)*
Lamb's-quarter *(Chenopodium album)*
Wormseed Goosefoot *(Chenopodium amrosioides)*
Berlandier's Goosefoot *(Chenopodium berlandieri)**
Bigalow Glasswort *(Salicornia bigelovii)*
Virginia Glasswort *(Salicornia virginica)*
Annual Seepweed (Sea blite) *(Suaeda linearis)*
Sea-blight *(Suadeda maritime)*

FAMILY CISTACEAE

Rosemary Sunrose *(Helianthemum rosmarinifolium)*
Hairy Pinweed *(Lechea mucronata)*
San Saba Pinweed *(Lechea san-sabeana)*

FAMILY CONVOLVULACEAE

Silky Cressa *(Cressa truxillensis)*
Cusp Dodder *(Cuscuta cuspidate)*
Carolina Ponyfoot *(Dichondra carolinensis)*
Silky Evolvulus *(Evolvulus sericeus)*
Sharppod Morning Glory (Tie-vine) *(Ipomoea cordatotriloba)*
White-star Morning Glory *(Ipomoea lacunose)*
Soilbind Morning Glory *(Ipomoea pes-caprae)*
Saltmarsh Morning Glory *(Ipomoea sagittata)*
Sharppod Morning Glory *(Ipomoea cordatotriloba* var. *cordatotriloba)*

FAMILY CORNACEAE

Rough-leaf Dogwood *(Cornus drummondii)*

FAMILY CRASSULACEAE

Drummond Crassula *(Crassula drummondii)*
Ditch Stonecrop *(Penthorum sedoides)*

FAMILY CUCURBITACEAE

Smell Melon *(Cucumis melo)*
Deerapple (Balsam gourd) *(Ibervillea lindheimeri)*
Drooping Melonette (Guadeloupe cucumber) *(Melothria pendula)*

FAMILY CUSCUTACEAE

Cusp Dodder *(Cuscuta cuspidata)*
Dodder *(Cuscuta pentagona)*
Scaleflower Dodder *(Cuscuta squamata)*

FAMILY DROSERACEAE

Annual Dundew *(Drosera annua)*

FAMILY EBENACEAE

Common Persimmon *(Diospyros virginiana)*

FAMILY ELAEAGNACEAE

Cardinal Autumn Olive *(Elaeagnus umbellate)*

FAMILY EUPHORBIACEAE

Slender Three-seeded Mercury *(Acalypha gracilens)*
Rhombic-leaf Three-seed Mercury *(Acalypha rhomboidea)*
Virginia Three-seeded Mercury *(Acalypha virginica)*
Low Wild Murcury *(Argythamnia humilis)*
Marsh False-croton *(Caperonia palustris)*
Spotted Sand-mat *(Chamaesyce maculata)*
Eyebane Sand-mat *(Chamaesyce nutans)*
Matted Sand-mat *(Chamaesyce serpens)*
Jamaica Sawgrass *(Cladium jamaicense)*
Lindheimer's Hogwort Croton *(Croton capitatus var. lindheimeri)*
Wooly Croton *(Croton capitatus)*
Tropic Croton *(Croton glandulosus)*
One-seed Croton (Prairie tea) *(Croton monanthogynus)*
Gulf Croton *(Croton punctatus)*
Snow-on-the-prairie *(Euphorbia bicolor)*
Wild Poinsettia *(Euphorbia cyanthophora)*
Tramp's Spurge *(Euphorbia corollata)*
Toothed Spurge *(Euphorbia dentate)*
Warty Spurge *(euphorbia spathulata)*
Bird-seed Leafflower *(Phyllanthus pudens)*
Chinese Tallow Tree *(Triadica sebifera)**
Nettle-leaf Noseburn *(Tragia urticifolia)*

FAMILY FABACEAE

Huisache *(Acacia farnesiana)*
Indian Joint Vetch *(Aeschynomene indica)*
Mimosa *(Albizia julibrissin)**
False Indigobush *(Amorpha fruticosa)*
American Hogpeanut *(Amphicarpaea bracteata)*
Nodding Wild Indigo *(Baptisia bracteata (leucophea))*
Yellow Wild Indigo *(Baptisia sphaerocarpa)*
Green Wild Indigo *(Baptisia viridis)*
Prairie Senna *(Cassia fasciculate* var. *faciculata)*
Butterfly Pea *(Centrosema virginianum)*
Partridge Pea *(Chamaecrista fasciculata)*
White Prairie-clover *(Dalea candida)*
Oklahoma Prairie Clover *(Dalea compacta* var. *compacta)*
Bigtop Dalea *(Dalea enneandra)*

Swarf Bundleflower *(Desmanthus brevipes)*
Hoary Ticktrefoil *(Desmodium canescens)*
Illinois Bundleflower *(Desmanthus illinoensis)*
Sharoppod Bundleflower *(Desmanthus virgatus* var. *acuminatus)*
Bundleflower *(Demanthus virgatus* var. *depressus)*
Ticktrefoil *(Desmodium glabellum)*
Coralbean *(Erythrina herbacea)*
Downey Milkpea *(Galactia volubilis)*
Bagbod (*Glottidium vesicarium)*
Coast Indigo *(Indigofera miniata)*
Anil Indigo *(Indigofera suffruticosa)*
Low Pea-vine *(Lathyrus pusillus)*
Arabian Medick *(Medicago arabica)**
Black Medick *(Medicago lupulina)**
Burclover *(*Medicago *polymorpha)**
Indian Sweetclover *(Melilotus indicus)**
Yellow Sweetclover (*Melilotus officinalis)**
Sensitive Brier; Mimosa *(Mimosa microphlla)*
Pink Sensitivebrier *(Mimosa strigillosa)*
Yellow-puff (*Neptunia lutea)*
Tropical Puff (Prairie neptunia) *(Neptunia pubescens)*
Retama *(Parkinsonia aculeata)*
Honey Mesquite *(Prosopis glandulosa)*
Least Snoutbean *(Rhynchosia minima)*
Texas Snoutbean *(Rhynchosia senna* var. *texana)*
Littleleaf Sensitive Briar *(Schrankia microphylla)*
Sickle-pod *(Senna obtusifolia)*
Western Senna *(Senna occidentalis)**
Drummond's Rattlebush *(Sesbania drummondii)*
Coffee Bean *(Sesbania herbacae)*
Sidbeak Pencil-flower *(Stylosanthes biflora)*
Carolina Clover *(Trifolium carolinianum)*
Hop Clover *(Trifolium campestre)*
Peanut Clover *(Trifolium polymorphum)*
White Clover *(Trifolium repens)*
Persian Clover *(Trifolium resupinatum)*
Deer-pea Vetch *(Vicia ludoviciana)*
Cowpea *(Vigna luteola)*

FAMILY FAGACEAE

White Oak *(Quercus alba)*
Bur Oak *(Quercus macrocarpa)*
Drummond's Oak *(Quercus margarettiae)*
Swamp chestnut Oak *(Quercus michauxii)*
Water Oak *(Quercus nigra)*
Shumard Oak *(Quercus shumardii)*
Bastard Oak *(Quercus sunuata var. sinuata)*
Texas Oak *(Quercus buckleyi)*
Live Oak *(Quercus viriniana)*

FAMILY GENTIANACEAE

Coastal Century *(Centaurium breviflorum)*
Texas Centaury *(Centaurium claycosum)*
Muhlenberg's Centaury *(Centaurium muhlenbergii)*
Branching Centaury *(Centaurium pulchellum)*
Tall Prairie Gentian *(Eustoma exaltatum)*
Rosepink *(Sabtia angularis)*
Prairie Rose-gentian *(Sabtia campestris)*

FAMILY GERANIACEAE

Carolina Crane's-bill *(Geranium carolinanum)*

FAMILY HALORAGACEAE

Green Oarrot's Feather *(Myriophyllum pinnatum)*
Marsh Mermaid-weed *(Proserpinaca palustris)*

FAMILY HYDROPHYLLACEAE
Blue Waterleaf *(Hydrolea ovata)*

FAMILY JUGLANDACEAE
Water Hickory *(Carya aquatica)*
Sweet Pecan *(Carya illinoinensis)*
Eastern Black Walnut *(Juglans nigra)*

FAMILY KRAMERIACEAE
Range Ratany *(Krameria lanceolata)*

FAMILY LAMIACEAE
Browne's Safory *(Clinopodium brownie)*
Rough Hedeoma *(Hedeoma hispidum)*
Virginia Water Horehound *(Lycopus virginicus)*
Lemon Beebalm *(Monarda citriodora)*
Spotted Beebalm *(Monarda punctata)*
Lionsheart *(Physostegia angustifolia)*
Slender False Dragonhead *(Physostegia intermedia)*
Showy False Dragonhead *(Physostegia pulchella)*
Selfheal *(Prunella vulgaris)*
Blue Sage *(Salvia azurea* var. *grandiflora)*
Tropical Sage *(Salvia coccinea)*
Lyre-leaf Sage *(Salvia lyrata)*
Drummond Skullcap *(Scutellaria drummondii)*
Egg-leaf Skullcap *(Scutellaria ovate)*
Mouse-ear Betony *(Stachys crenata)*
Pink Mint *(Stachys drummondii)*
Canadian Germander *(Teucrium canadense)*
Costal Germander *(Teucrium cubense)*
Prairie Germander *(Teucrium lancinatum)*

FAMILY LENTIBULARIACEAE
Conespur *(Utricularia gibba)*
Purple Bladderwort *(Utricularia purpurea)*

FAMILY LINACEAE
Winged Flax *(Linum alatum)*
Stiff Yellow Flax *(Linum medium* var. *texanum)*
Berlandier's Flax *(Linum rigidum* var. *berlandieri)*

FAMILY LOGANIACEAE
Lax Hornpod *(Mitreola petiolata)*
Juniperleaf *(Polypremum procumbens)*
Texas Pinkroot *(Spigelia loganioides)*

FAMILY LYTHRACEAE
Purple Ammannia (Toothcup) *(Ammannia coccinea)*
Sticky Waxweed *(Cuphea glutinosa)*
Lance-leaf Loosestrife *(Lythrum alatum var. lanceolatum)*
California Lythrum *(Lythrum californicum)*
Rotala Tooth-cup *(Rotala ramosior)*

FAMILY MALVACEAE

Tall Poppy-mallow *(Callirhoe leiocarpa)*
Woods Wine Cups *(Callirhoe papaver)*
Scarlet Hibiscus *(Hibiscus coccineus)*
Halberdleaf Rosemallow *(Hibiscus laevis)*
Wooly Crimson-eyed rosemallow *(Hibiscus moscheutos subsp. Lasiocarpos)*
Virginia Salt-marsh-mallow *(Kosteletzkya virginica)*
Malva de Caballo *(Malachra capitata)*
Three-lobe False-mallow *(Malvastrum coromandelianum)*
Turks Cap Hibiscus *(Malvaviscus arboreus)*
Turk's Cap *(Malvastrum arboreus* var. *drummondii)*
Carolina Bristlymallow *(Modiola caroliniana)*
Showy Sida *(Sida Lindheimeri)*
Arrow-leaf Fanpetals *(Sida rhombifolia)*
Prickly Sida *(Sida spinosa)*

FAMILY MARANTACEAE
Powdered Thalia *(Thalia dealbata)*

FAMILY MELASTOMATACEAE
Maryland Meadow Beauty *(Rhexia mariana)*

FAMILY MELIACEAE
Chinaberry (China-ball) *(Melia acedarach)*

FAMILY MENISPERMACEAE
Carolina Smailseed *(Cocculus carolinus)*
Orientvine *(Cocculus diversifolius)*

FAMILY MOLLUGINACEAE
Spreading Sweetjuice *(Glinus radiates)*
Green Carpet-Weed *(Mollugo verticillata)*

FAMILY MORACEAE
Osage-orange *(Maclura pomifera)*
Red Mulberry *(Morus rubra)*

FAMILY MYRICACEAE
Southern Wax-myrtle *(Morella cerifera)*

FAMILY NYMPHAECEAE
Senorita (Blue) Waterlily (*Nymphaea elegans)*

FAMILY OLEACEAE
Eastern Swamp-privet *(Forestiera acuminate)*
Upland Forestiera *(Forestiera ligustrina)*
Green Ash *(Fraxinus pennsylvanica)*
Japanese Privet *(Ligustrum japonica)*
Wax leaf Privet *(Ligustrum lucidum)*
Chinese Privet *(Ligustrum sinense)*

FAMILY ONAGRACEAE

Plains Gaura *(Gaura brachycarpa)*
Lindheimer's Beeblossom *(Gaura lindheimeri)*
Large Flowered Beeblossom *(Gaura longiflora)*
Small Flowered Beeblossom *(Gaura mollis)*
Cylindric-fruit Seedbox *(Ludwigia glandulosa)*
Narrow-leaf Seedbox *(Ludwigia linearis)*
Water-primrose *(Ludwigia octovalis)*
Marsh Seedbox *(Ludwigia palustris)*
Verdolaga de Agua *(Ludwigia peploides)*
Creeping Primrose-willow *(Ludwigia repens)*
Uruguay Water Primrose *(Ludwigia* uruguayensis)*
Beach Evening-primrose *(Oenothera laciniata)*
Cutleaf Evening-primrose *(Oenothera laciniata)*
Pink (Showey) Evening-primrose *(Oenothera speciosa)*

FAMILY OXALIDACEAE

Pink Woodsorrel *(Oxalis debilis)**
Yellow Wood-sorrel *(Oxalis stricta)*
Violet woodsorrel *(Oxalis violacea)*

FAMILY PASSIFLORACEAE

Purple Passion Flower (Maypop) *(Passiflora incarnata)*
Yellow Passion Flower *(Passiflora lutea)*

FAMILY PHYTOLACCACEAE

Pokeweed *(Phytolacca americana)*
Bloodberry Pigeonberry *(Rivina humilis)*

FAMILY PLANTAGINACEAE

Slender Plantain *(Plantago elongate)*
Hybrid Plantain *(Plantago heterophylla)*
Red-seed Plantain *(Plantago rhodosperma)*
Pale-seed Plantain *(Plantago virginica)*

FAMILY PLUMBAGINACEAE

Carolina Sea-lavender *(Limonium nashii)*

FAMILY POLYGALACEAE

Pink Milkwort *(Polygala incarnata)*
Whorled Milkwort *(Polygala verticillata)*

FAMILY POLYGONACEAE

American Buckwheat-vine *(Brunnichia ovata)*
Smartweed *(Polygonum amphibium)*
Smartweed *(Polygonum amphibium var. emersum)*
Prostrate Knotweed *(Polygonum aviculare)*
Swamp Smartweed *(Polygonum hydropiperoides)*
Pennsylvania Smartweed *(Polygonun punctatum)*
Bushy Smartweed *(Polygonum ramosissimum)*
Bristly Smartweed *(Polygonum setaceum)*

Virginia Jumpseed *(Polygonum viginianum)*
Golden Fruited-dock *(Rumex chrysocarpus)*
Curley Dock *(Rumex crispus)*
Fiddle Dock *(Rumex pulcher)**
Swamp Dock *(Rumex verticillatus)*

FAMILY PONTEDERIACEAE
Blue Mudplantain *(Heteranthera limosa)*
Mudplantain *(Heteranthera reniformis)*

FAMILY PORTULACACEAE
Common Purslane *(Portulaca oleracea)*
Shaggy Portulaca *(Portulac pilosa)*
Wingpod Purslane *(Portulaca umbraticola)*

FAMILY PRIMULACEAE
Scarlet Pempernel *(Anagallis arvensis)*
Small Pimpernel *(Anagallis minima)*
Chaffweed *(Centunculus minimus)*
Bractless (Coast) Brookweed *(Samolus ebracteatus)*
Limewater Brookweed *(Samolus ebracteatus* var. *alyssoides)*
Valerand's Small-flowered Brookweed *(Samolus valerandi subp. parviflorus)*

FAMILY RANUNCULACEAE
Ten-petal Anemone (Windflower) *(Anemone berlandieri)*
Tuber Anemone *(Anemone heterophylla)*
Swamp Clematis (Blue jasmine) *(Clematis crispa)*
Texas virgin's Bower *(Clematis drummondii)*
Pitchers Virgin's Bower *(Clematis pitcherii)*
Blue Larkspur *(Delphinium carolinianum)*
Tiny Mousetail *(Myosurus minimus)*
Glowing Bristly Buttercup *(Ranunculus hispidus)*
Spiny-seed (fruit) Buttercup *(Ranunculus muricatus)*
Prairie Buttercup *(Ranunculus platensis)*
Low Buttercup *(Ranunculus pusillus)*
Creeping Buttercup *(Ranunculus repens)*
Hairy Buttercup *(Ranunculus sardous)*

FAMILY RHAMNACEAE
Rattan Vine (Alabama supplejack) *(Berchemia scandens)*
Carolina Buckthorn *(Frangula caroliniana)*

FAMILY ROSACEAE
Reverchon Hawthorne *(Crataegus reverchonii)*
Little-hip Hawthorn *(Crataegus spathulata)*
Hawthorn *(Crataegus viridis* var. *viridis)*
Green Hawthorn *(Crataegus viridis)*
White Avens *(Guem canadense)*
Carolina Cherry-laurel *(Prunus caroliniana)*
Macartney Rose *(Rosa bracteata)*
Highbush Blackberry *(Rubus argutus)*
Southern Dewberry *(Rubus trivialis)*

FAMILY RUBIACEAE
Buttonbush *(Cephalanthus occidentalis)*

Rough Buttonweed (Poorjoe) *(Diodia teres)*
Virginia Buttonweed *(Diodia virginiana)*
Catchweed Bedstraw *(Galium aparine)*
Stiff Marsh Bedstraw *(Galium labradoricum)*
Dry Bedstraw *(Galium tinctorium)**
Bedstraw *(Galium uniflorum)*
Rough Falsepennyroyal *(Hedeoma hispida)*
Prairie Bluetets *(Hedyotis nigricans)*
Bluets (*Oldenlandia boscii)*
Clustered Mille Graines (*Oldenlandia uniflora)*
Pink Spurwort *(Sherardia arvensis)**
Smooth False Buttonweed *(spermacoce glabra)*

FAMILY RUTACEAE
Chapatillo *(Amyris texana)*
Water Ash *(Ptelea trifoliate)*
Hercules' Club *(Zanthoxylum clava-herculis)*

FAMILY SALICACEAE
Black Willow *(Salix nigra)*

FAMILY SAPINDACEAE
Balloon-vine *(Cardiospermum halicacabum)*
Heartseed *(Cardiospermum microcarpum)*
Drummond's Western Soapberry *(Sapindus saponaria var. drummondii)*

FAMILY SAPOTACEA
Gum Bumelia *(Sideroxylon lanuginosum* ssp. *lanuginosum)*

FAMILY SAXIGRAGACEAE
Petiteplant *(Lepuropetalon spathulatum)*

FAMILY SCROPHULARIACEAE
Beach False-foxglove (*Agalinis fasciculate)*
Prairied False-foxglove *(Agalinis hterophylla)*
Seaside Gerardia *(Agalinis maritima)*
Ridge Stem False-foxglove *(Agalinis oligophylla)*
Saltmarsh Gerardia *(Agalininis purpurea)*
Water-hyssop *(Bacopa monnieri)*
Texas Paintbrush *(Castilleja indivisa)*
Browne's Savory *(Clinopodium brownie)*
Virginia Hedge-hyssop *(Gratiola virginiana)*
Texas Toad-flax *(Linaria texana)*
False Pimpernel *(Lindernia dubia)*
Axilflower *(Mecardonia acuminata)*
Yellow Flowered Mecardonia (Pagesia) *(Mecardonia procumbens)*
Pagesia *(Mecardonia vandellioides)*
Texas Toadflax *(Nuttallanthus texanus)*
Nodding Beardtounge *(Pentstemon laxiflorus)*
Gulf Coast penstemon *(Penstemon tenuis)*
Purslane speedwell *(Veronica peregrine)*
Wayside Speedwell *(Veronica polita)*

FAMILY SOLANACEAE
Seaside Petunia *(Calibrachoa parviflora)*
Carolina Worfberry *(Lycium carolinianum var. guadrifidum)*
Cut-leaf Groundcherry *(Physalis angulata var. lanceifolia)*

Downy Groundcherry *(Physalis pubescens)*
Texas Groundcherry *(Physalis virginiana var. texana)*
American Black Nightshade *(Solanum amercanum)*
Carolina Nightshade *(Solanum carolinense)*
Siverleaf Nightshade *(Solanum elaeagnifolium)*
Nightshade *(Solanum nodiflorum)*
Buffalo Bur *(Solanum rostratum)*
Texas Nightshade (Tomatillo) *(Solanum triquetrum)*

FAMILY SPHENOCLEACEAE
Chicken Spike *(Sphenoclea zeylanica)*

FAMILY STERCULIACEAE
Broom-weed (Chocolate weed) *(Melochia corchorifolia)*
Angle-pod Broomweed *(Melochia pyramidata)*

FAMILY TAMERACEAE
Saltcedar Tamarisk *(Tamarix gallica)*

FAMILY TILIACEAE
Smooth Orinoco Jute *(Corchorus hirtus var. glabellus)*

FAMILY ULMACEAE
Sugar Hackberry *(Ceeltis laevigata var. laevigata)*
American Elm *(Ulmus americana)*
Cedar Elm *(Ulmus crassifolia)*
Slippery Elm *(Ulmus rubra)*

FAMILY URTICACEAE
False-nettle *(Boehmeria cylindrical)*
Florida Pellitory *(Parietaria floridana)*
Brush Noseburn *(Tragia glanduligera)*
Pennsylvania Pellitory *(Parietaria pensylvanica)*
Heart-leaf Stinging-nettle *(Urtica chamaedryoides)*
Dog Nettle *(Utica urens)*

FAMILY VALERIANACEAE
Woods' Cornsalad *(Valerianella woodsiana)*

FAMILY VERBENACEAE
American Beautyberry *(Callicarpa americana)*
West Indies Lantana *(Lantana camara)*
Common Lantana *(Lantana horrida)*
Texas Lantana *(Lantana utricoides)*
Lance-leaf Frogfruit *(Phyla lanceolata)*
Turkey-tangle *(Phyla nodiflora)*
Diamond-leaf Frogfruit *(Phyla strigulosa)*
Brazilian Vervain *(Verbena brasiliensis)*
South American Vervain *(Verbena bonariensis)**
Texas Vervain *(Verbena halei)*
Brazilian Vervain *(Verbena litoralis)**
Nettle-leaf Vervain *(Verbena urticifolia)*
Virginia Frostweed *(Verbena xutha)*
Chastetree *(Vitex agnus-castu)*

FAMILY VIOLACEAE
Missouri Bayou Violet *(Viola sororia)*

FAMILY VISCACEAE
Christmas Mistletoe (*Phoradendron tomentosum)*

FAMILY VITACEAE
Pepper-vine *(Ampelopsis arborea)*
Raccoon Grape *(Ampelopsis cordata)*
Ivy Treebine *(Cissus trifoliate)*
Virginia Creeper *(Parthenocissus quinquefolia)*
Summer Grape *(Vitis aestivalis)*
Sweet Winter Grape *(Vitis cinerea)*
Mustang Grape *(Vitis mustangensis)*
Catbird Grape *(Vitis palmate)*

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F. Vegetative Alliances of the Texas Mid-coast National Wildlife Refuge Complex

I. BOTTOMLAND HARDWOOD FOREST

I.A.1 CARYA ILLINOINENSIS - CELTIS LAEVIGATA TEMPORARILY FLOODED FOREST ALLIANCE

Pecan – Sugarberry Temporarily Flooded Forest Alliance

I.A.2 CELTIS LAEVIGATA – ULMUS CRASSIFOLIA TEMPORARILY FLOODED FOREST ALLIANCE

Sugarberry – Cedar Elm Temporarily Flooded Forest Alliance

a. Cedar Elm – Pecan – Sugarberry/Longleaf Spikegrass – Cherokee Sedge Forest (Ulmus crassifolia - Carya illinoinensis - Celtis laevigata / Chasmanthium sessiliflorum - Carex cherokeensis)Ulmus crassifolia - Carya illinoinensis - Celtis laevigata / Chasmanthium sessiliflorum - Carex cherokeensis Forest

   Cedar Elm - Pecan - Sugarberry / Longleaf Spikegrass - Cherokee Sedge Forest Association

I.A.3 FRAXINUS PENNSYLVANICA - ULMUS AMERICANA - CELTIS LAEVIGATA TEMPORARILY FLOODED FOREST ALLIANCE
Green Ash - American Elm - Sugarberry Temporarily Flooded Forest Alliance

a. Fraxinus pennsylvanica - Ulmus americana - Celtis laevigata / Ilex decidua Forest Green Ash - American Elm - Sugarberry / Possum-haw Forest

I.A.4 QUERCUS VIRGINIANA TEMPORARILY FLOODED FOREST ALLIANCE
Live Oak Temporarily Flooded Forest Alliance

a. Live Oak / Yaupon - Dwarf Palmetto / Cherokee Sedge - Texas Mallow Forest (Quercus virginiana / Ilex vomitoria - Sabal minor / Carex cherokeensis - Malvaviscus arboreus var. drummondii)

I.A.5 QUERCUS VIRGINIANA - CARYA ILLINOINENSIS ALLIANCE

Live Oak – Pecan Alliance

I.A.6 QUERCUS VIRGINIANA - CELTIS LAEVIGATA FOREST ALLIANCE

Live Oak – Sugarberry Forest Alliance
a. Live Oak - Sugarberry / Dwarf Palmetto Forest (Quercus virginiana - Celtis laevigata / Sabal minor)

I.A.7 TRIADICA SEBIFERA FOREST ALLIANCE
Chinese Tallow Tree Forest Alliance

I.A.8 QUERCUS NIGRA FOREST ALLIANCE

Water Oak Forest Alliance

a. Water Oak / Yaupon / Longleaf Spikegrass Forest (Quercus nigra / Ilex vomitoria / Chasmanthium sessiliflorum)

II. OPEN WATER

II.A.1 HALODULE WRIGHTII PERMANENTLY FLOODED - TIDAL HERBACEOUS ALLIANCE

Shoal-grass Permanently Flooded - Tidal Herbaceous Alliance

III. DISTURBED

Disturbed areas can be categorized as 1) continuously disturbed (e.g., roads, spoil sites, moist soil units, etc), 2) static successional disturbed (e.g., unclassified static successional communities, mud flats, salt pans, etc), and 3) successional disturbed (e.g. old fields). Disturbed areas undergo environmental stresses either naturally or culturally and result in a static vegetation or landscape succession. Therefore they have vegetative or non-vegetative characteristics. If naturally disturbed, as in the case of old fields, the shift in succession to another population may take several years to a decade or more. Salt pans or mud flats for example are frequently disturbed by tidal action to the point where the soil is hypersaline and pioneering seeds are washed away before they germinate. Moist soil units are mechanically manipulated to disrupt invasion by plants such as cattails to keep the area open for waterfowl activity. Other natural conditions may for a time inhibit or promote the occurrence of one dominant species year after year such as those found occupied by wolfweed (*Chloracantha spinosus*).

IV. SALINE MARSH

A. UPPER SALINE MARSH

BACCHARIS HALIMIFOLIA - IVA FRUTESCENS TIDAL SHRUBLAND ALLIANCE

Groundsel-tree - Maritime Marsh-elder Tidal Shrubland Alliance

a. Baccharis halimifolia - Iva frutescens - Morella cerifera - (Ilex vomitoria) Shrubland Groundsel-tree - Maritime Marsh-elder - Wax-myrtle - (Yaupon) Shrubland

b. Iva frutescens ssp. frutescens / Spartina spartinae Shrubland

Southern Maritime Marsh-elder / Gulf Cordgrass Shrubland

BORRICHIA FRUTESCENS TIDAL SHRUBLAND ALLIANCE

Seaside Oxeye Tidal Shrubland Alliance

a. Seaside Oxeye / Saltmeadow Cordgrass - (Black Needlerush) Shrubland Association
   Borrichia frutescens / Spartina patens - (Juncus roemerianus) Shrubland
   Upper marsh edges and flats strongly dominated by Borrichia frutescens, ranging in size from narrow bands to flats in excess of 500 ha, often just below Iva frutescens or Baccharis halimifolia, often just above marshes dominated by Juncus roemerianus or Spartina alterniflora. Other characteristic species include Spartina patens, Iva frutescens, and Limonium carolinianum.
b. Seaside Oxeye / Gulf Cordgrass Shrubland Borrichia frutescens / Spartina spartinae)Irregularly tidally flooded shrubland. Other species can include Sarcocornia perennis, Lycium carolinianum, and Batis maritima.

DISTICHLIS SPICATA TIDAL HERBACEOUS ALLIANCE
Saltgrass Tidal Herbaceous Alliance

a. Saltgrass – (Saltmarsh Dropseed) Herbaceous Vegetation (Distichlis spicata - (Sporobolus virginicus)

   This association occurs in upper tidal areas (coastal prairies) and is dominated by Distichlis spicata, often mixed with other halophytic grasses and succulents such as Sporobolus virginicus, Sarcocornia perennis, Batis maritima, Lycium carolinianum, Heliotropium curassavicum, and others.

SPARTINA PATENS - (DISTICHLIS SPICATA) TIDAL HERBACEOUS ALLIANCE

Saltmeadow Cordgrass - (Saltgrass) Tidal Herbaceous Alliance

a. Saltmarsh cordgrass – Saltgrass – Saltmeadow Cordgrass Mesohaline Tidal Herbaceous Vegetation (Spartina alterniflora - Distichlis spicata - Spartina patens)
b. Gulf Cordgrass - Saltmarsh Dropseed Tidal Herbaceous Vegetation Association (Spartina spartinae – Sporobolus virginicus)
c. Paspalum vaginatum - Spartina patens Oligohaline Herbaceous VegetationSeashore Crowngrass - Saltmeadow Cordgrass Oligohaline Herbaceous Vegetation
d. Spartina alterniflora - Distichlis spicata - Spartina patens Mesohaline Tidal Herbaceous Vegetation
   Saltmarsh Cordgrass - Saltgrass - Saltmeadow Cordgrass Mesohaline Tidal HerbaceousVegetation

e. Spartina patens - Schoenoplectus (americanus, pungens) - (Distichlis spicata) Herbaceous Vegetation

Saltmeadow Cordgrass - (Chairmaker's Bulrush, Threesquare) - (Saltgrass) Herbaceous Vegetation

F.1.1. PHRAGMITES AUSTRALIS TEMPORARILY FLOODED HERBACEOUS ALLIANCE

Common Reed Temporarily Flooded Herbaceous Alliance

RUPPIA MARITIMA PERMANENTLY FLOODED - TIDAL TEMPERATE HERBACEOUS ALLIANCE

Beaked Ditch-grass Permanently Flooded - Tidal Temperate Herbaceous Alliance

SPARTINA PATENS - (DISTICHLIS SPICATA) TIDAL HERBACEOUS ALLIANCE
Saltmeadow Cordgrass - (Saltgrass) Tidal Herbaceous Alliance

SPARTINA PATENS - (SCHOENOPLECTUS PUNGENS) HERBACEOUS ALLIANCE
Saltmeadow Cordgrass - (Threesquare) Herbaceous Alliance

B. LOWER SALINE MARSH

BACCHARIS HALIMIFOLIA - IVA FRUTESCENS TIDAL SHRUBLAND ALLIANCE

Groundsel-tree - Maritime Marsh-elder Tidal Shrubland Alliance

a. Baccharis halimifolia - Iva frutescens - Morella cerifera - (Ilex vomitoria) Shrubland Groundsel-tree - Maritime Marsh-elder - Wax-myrtle - (Yaupon) Shrubland

This community is usually best developed at the upper limit of non-storm tidal inundation, on natural levees deposited by above-normal tides. The most common species are typically Baccharis halimifolia, Morella cerifera, Iva frutescens ssp. frutescens, Lycium carolinianum, Baccharis angustifolia, and Ilex vomitoria. Other species which may be present include Borrichia frutescens, Fimbristylis castanea, Limonium carolinianum, and Solidago sempervirens.
Iva frutescens ssp. frutescens / Spartina spartinae Shrubland

b. Iva frutescens ssp. frutescens / Spartina spartinae ShrublandSouthern Maritime Marsh-elder / Gulf Cordgrass Shrubland

SARCOCORNIA PERENNIS - (DISTICHLIS SPICATA, SPARTINA ALTERNIFLORA) TIDAL DWARF-SHRUBLAND ALLIANCE

Woody Glasswort - (Saltgrass, Saltmarsh Cordgrass) Tidal Dwarf-shrubland Alliance

a. Sarcocornia perennis - Batis maritima - Distichlis spicata Dwarf-shrubland Woody Glasswort - Saltwort - Saltgrass Dwarf-shrubland

BORRICHIA FRUTESCENS TIDAL SHRUBLAND ALLIANCE

Seaside Oxeye Tidal Shrubland Alliance

a. Seaside Oxeye / Saltmeadow Cordgrass - (Black Needlerush) Shrubland
b. Borrichia frutescens / Spartina patens - (Juncus roemerianus) Shrubland
c. Seaside Oxeye/Gulf Cordgrass Shrubland
d. Borrichia frutescens / Spartina spartinae Shrubland

BATIS MARITIMA TIDAL DWARF-SHRUBLAND ALLIANCE
Saltwort Tidal Dwarf-shrubland Alliance; Planta de Sal Dwarf-shrubland Alliance

a. Saltwort – Woody Glasswort Dwarf-shrubland Association (Batis maritima - Sarcocornia perennis, S. virginica)

JUNCUS ROEMERIANUS TIDAL HERBACEOUS ALLIANCE
Black Needlerush Tidal Herbaceous Alliance

a. Juncus roemerianus Herbaceous VegetationBlack Needlerush Herbaceous Vegetation

SCHIZACHYRIUM LITTORALE SHRUB HERBACEOUS ALLIANCE
Seaside Little Bluestem Shrub Herbaceous Alliance

SPARTINA ALTERNIFLORA TIDAL HERBACEOUS ALLIANCE
Saltmarsh Cordgrass Tidal Herbaceous Alliance

a. Spartina alterniflora - Juncus roemerianus - Distichlis spicata Herbaceous Vegetation
b. Saltmarsh Cordgrass - Black Needlerush - Saltgrass Herbaceous Vegetation

V. SALINE PRAIRIE

BACCHARIS HALIMIFOLIA SATURATED SHRUBLAND ALLIANCE
Groundsel-tree Saturated Shrubland Alliance

BACCHARIS HALIMIFOLIA - IVA FRUTESCENS TIDAL SHRUBLAND ALLIANCE

Groundsel-tree - Maritime Marsh-elder Tidal Shrubland Alliance

a. Iva frutescens ssp. frutescens / Spartina spartinae Shrubland
Southern Maritime Marsh-elder / Gulf Cordgrass Shrubland

BORRICHIA FRUTESCENS TIDAL SHRUBLAND ALLIANCE
Seaside Oxeye Tidal Shrubland Alliance

a. Borrichia frutescens / Spartina patens - (Juncus roemerianus) ShrublandSeaside Oxeye / Saltmeadow Cordgrass - (Black Needlerush) Shrubland

b. Borrichia frutescens / Spartina spartinae ShrublandSeaside Oxeye / Gulf Cordgrass Shrubland
   Irregularly tidally flooded shrubland. Other species can include Sarcocornia perennis, Lycium carolinianum var. quadrifidum, and Batis maritima.

MONANTHOCHLOE LITTORALIS TIDAL HERBACEOUS ALLIANCE

Shoregrass Tidal Herbaceous Alliance

PROSOPIS GLANDULOSA SHRUBLAND ALLIANCE
Honey Mesquite Shrubland Alliance

On the complex it is considered to be the northernmost occurrence of its historic range on the Texas Gulf Coast.

a. Prosopis glandulosa var. glandulosa - Opuntia engelmannii var. lindheimeri - Borrichia frutescens ShrublandHoney Mesquite - Texas Prickly-pear - Seaside Oxeye Shrubland

SPARTINA PATENS - (DISTICHLIS SPICATA) TIDAL HERBACEOUS ALLIANCE
Saltmeadow Cordgrass - (Saltgrass) Tidal Herbaceous Alliance

a. Saltmeadow Cordgrass - (Chairmaker's Bulrush, Threesquare) - (Saltgrass) Herbaceous Vegetation Association (Spartina patens – Schoenoplectus (Americanus, Pungens) – (Distichlis spicata)
b.
SPARTINA SPARTINAE SATURATED HERBACEOUS ALLIANCE

Gulf Cordgrass Saturated Herbaceous Alliance

a. Gulf Cordgrass – Little Bluestem Herbaceous Vegetation
   Spartina spartinae - Schizachyrium scoparium Vegetation

VI. UPLAND PRAIRIE/FRESHWATER WETLANDS

ANDROPOGON GLOMERATUS TEMPORARILY FLOODED HERBACEOUS ALLIANCE
Bushy Broomsedge Temporarily Flooded Herbaceous Alliance

SAGITTARIA LATIFOLIA SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE
Broadleaf Arrowhead Semipermanently Flooded Herbaceous Alliance

TRIADICA SEBIFERA FOREST ALLIANCE
Chinese Tallow-tree Forest Alliance

SCHOENOPLECTUS AMERICANUS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE

Chairmaker's Bulrush Semipermanently Flooded Herbaceous Alliance

SCHOENOPLECTUS CALIFORNICUS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE

Giant Bulrush Semipermanently Flooded Herbaceous Alliance

a. Schoenoplectus californicus Herbaceous VegetationGiant Bulrush Herbaceous Vegetation

PHRAGMITES AUSTRALIS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE

Common Reed Semipermanently Flooded Herbaceous Alliance

LUDWIGIA PEPLOIDES SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE

Floating Water-primrose Semipermanently Flooded Herbaceous Alliance

BACCHARIS HALIMIFOLIA SATURATED SHRUBLAND ALLIANC
Groundsel-tree Saturated Shrubland Alliance

SAGITTARIA LANCIFOLIA SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE

Lanceleaf Arrowhead Semipermanently Flooded Herbaceous Alliance

SCHIZACHYRIUM SCOPARIUM - PASPALUM PLICATULUM HERBACEOUS ALLIANCE
Little Bluestem - Brownseed Crowngrass Herbaceous Alliance

a. Little Bluestem - Brownseed Crowngrass - Yellow Indiangrass - Few-flower Witchgrass - Slender Crowngrass - Western Silvery Aster Alfisol Herbaceous Vegetation Associatin (Schizachyrium scoparium - Paspalum plicatulum - Sorghastrum nutans - Dichanthelium oligosanthes - Paspalum setaceum - Symphyotrichum pratense)
b. Schizachyrium scoparium - Paspalum plicatulum - Sorghastrum nutans - Dichanthelium oligosanthes - Paspalum setaceum - Symphyotrichum pratense Alfisol Herbaceous Vegetation
   Little Bluestem - Brownseed Crowngrass - Yellow Indiangrass - Few-flower Witchgrass - Slender Crowngrass - Western Silvery Aster Alfisol Herbaceous Vegetation.
c. Schizachyrium scoparium - Sorghastrum nutans - Paspalum plicatulum - Carex microdonta - Neptunia lutea Herbaceous Vegetation
   Little Bluestem - Yellow Indiangrass - Brownseed Crowngrass - Little-tooth Sedge - Yellow-puff Herbaceous Vegetation

TYPHA (ANGUSTIFOLIA, LATIFOLIA) - (SCHOENOPLECTUS SPP.) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE

(Narrowleaf Cattail, Broadleaf Cattail) - (Bulrush species) Semipermanently Flooded Herbaceous Alliance

a. Typha (angustifolia, domingensis, latifolia) - Schoenoplectus americanus Herbaceous Vegetation
   (Narrowleaf Cattail, Southern Cattail, Broadleaf Cattail) - Chairmaker's Bulrush Herbaceous Vegetation

POTAMOGETON SPP. - CERATOPHYLLUM SPP. - ELODEA SPP. PERMANENTLY FLOODED HERBACEOUS ALLIANCE

Pondweed species - Coontail species - Waterweed species Permanently Flooded Herbaceous Alliance

SPARTINA PATENS SEASONALLY FLOODED HERBACEOUS ALLIANCE

Saltmeadow Cordgrass Seasonally Flooded Herbaceous Alliance

a. Bushy Goldentop - Swamp Sunflower - White Doll's Daisy - Saltmeadow Cordgrass Herbaceous Vegetation
   Euthamia leptocephala - Helianthus angustifolius - Boltonia asteroides - Spartina patens Vegetation
b. Saltmeadow Cordgrass - (Tufted Fimbry, Chestnut Fimbry) - (Gulfdune Crowngrass) Herbaceous Vegetation
   Spartina patens - Fimbristylis (caroliniana, castanea) - (Paspalum monostachyum) Herbaceous Vegetation

PANICUM VIRGATUM - TRIPSACUM DACTYLOIDES HERBACEOUS ALLIANCE

Switchgrass - Eastern Gammagrass Herbaceous Alliance

NELUMBO LUTEA PERMANENTLY FLOODED TEMPERATE HERBACEOUS ALLIANCE

American Lotus Permanently Flooded Temperate Herbaceous Alliance

PASPALUM VAGINATUM TEMPORARILY FLOODED HERBACEOUS ALLIANCE

Seashore Crowngrass Temporarily Flooded Herbaceous Alliance

POLYGONUM SPP. SEASONALLY FLOODED HERBACEOUS ALLIANCE

Smartweed species Seasonally Flooded Herbaceous Alliance

Pennsylvania Smartweed - Pale Smartweed Herbaceous Vegetation Association (Polygonum pensylvanicum – Polygonum lapathipolium)

ELEOCHARIS QUADRANGULATA - SAGITTARIA SPP. SEASONALLY FLOODED HERBACEOUS ALLIANCE

Squarestem Spikerush - Arrowhead species Seasonally Flooded Herbaceous Alliance

PANICUM VIRGATUM - TRIPSACUM DACTYLOIDES HERBACEOUS ALLIANCE

Switchgrass - Eastern Gammagrass Herbaceous Alliance

a. Switchgrass - Eastern Gammagrass - (Maidencane) Herbaceous Vegetation (Panicum virgatum - Tripsacum dactyloides - (Panicum hemitomon)

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United States Department of the Interior

FISH AND WILDLIFE SERVICE

Texas Mid-coast National Wildlife Refuge Complex

RECEIVED
AUG 14 2012
CLEAR LAKE ES
HOUSTON, TEXAS

In Reply Refer To:
R2/NWRS-PLN

Memorandum

To: Field Supervisor, Clear Lake Ecological Services Field Office, Region 2, Houston, TX

From: Project Leader, Texas Mid-coast NWR Complex, Region 2

Subject: Review Copy, Draft Comprehensive Conservation Plan and Environmental Assessment (CCP/EA) for Texas Mid-coast NWR Complex and Intra-Service Section 7 Consultation

Please review the attached copy of the Intra-Service Section 7 Consultation and draft CCP/EA for the Texas Mid-coast NWR Complex. We have determined that implementation of the proposed CCP may affect, but is not likely to adversely affect the Attwater's prairie chicken, whooping crane, piping plover or its designated critical habitat, Atlantic hawksbill sea turtle, green sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, loggerhead sea turtle; will have no effect on northern aplomado falcon, interior least tern, smalltooth sawfish; and is not likely to jeopardize Sprague's pipit and Red Knot. Your comments on the draft CCP/EA and concurrence with our findings would be greatly appreciated.

If you have any questions, please contact me at (979) 964-4011. Thank you for your timely review of this CCP/EA and Intra-Service Section 7 Consultation.

Attachment

cc: Chief, Division of Planning, NWRS, Region 2

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G. INTRA-SERVICE SECTION 7 BIOLOGICAL EVALUATION FORM

Originating Person: Jennifer Sanchez
Telephone Number: (979) 964-4011
Date: June 15, 2012

I. Region: Southwest

II. Service Activity (Program):
Refuges: Texas Mid-coast National Wildlife Refuge Complex (TMCNWR)

III. Pertinent Species and Habitat:

A. Listed species and/or their critical habitat within the action area:

Attwater's prairie-chicken (*Tympanuchus cupido attwateri*) (APC)
Whooping crane (*Grus americana)*
Northern aplomado falcon (*Falco femoralis septentrionalis)*
Interior Least Tern (*Sterna antillarum athalassos)*
Piping plover (*Charadrius melodus)*
Smalltooth sawfish (*Pristis pectinata)*
Atlantic hawksbill sea turtle *(Eretmochelys imbricate)*
Green sea turtle *(Chelonia mydas*)
Kemp's Ridley sea turtle *(Lepidochelys kempii)*
Leatherback sea turtle *(Dermochelys coriacea)*
Loggerhead sea turtle *(Caretta caretta)*

Critical Habitat:

Piping Plover, *Charadrius melodus*

B. Proposed species and/or proposed critical habitat within the action area:
None

C. Candidate species within the action area:

Sprague's pipit *(Anthus spragueii)*
Red Knot *(Calidris canutus)*

IV. Geographic area or station name and action:
The proposed action is to implement a Comprehensive Conservation Plan for Texas Mid-coast NWR Complex located in Brazoria, Matagorda and Ft. Bend and Wharton Counties.

V. Location:

A. Ecoregion Number and Name:
Gulf Coast Prairies and Marshes Ecoregion

B. County and State:
Brazoria, Matagorda, Fort Bend, and Wharton Counties, Texas

C. Section, township, and range (or latitude and longitude):
31° 42' N 96°14'W

D. Distance (miles) and direction to nearest town:
Primary parcels approximately 10 miles east and 10 miles west of Freeport, TX

E. Species/habitat occurrence:

- *Attwater priaire Chicken*- The Complex has no Attwater prairie chickens at this time but has been identified as a potential future re-introduction site.
- *Whooping crane* - Whooping Cranes do not regularly occur on the Complex but for the cranes to reach recovery status, the Aransas/Wood Buffalo population will need to expand. Mid-coast Refuges (with Big Boggy first) will probably be required for the cranes to reach recovery status, due to the territorial nature of the birds. Plans to expand the range outside the current migration corridor are not established and the Mid-coast refuges do not have plans specific to providing whooping crane habitat at this time.
- *Northern aplomado falcon* - From 1996 to 1999, Northern aplomodo falcons were hacked on Matagorda Island and are continuing to nest and inhabit the Island's prairie habitat. Since then, two documented sightings of aplomado falcons have occurred on San Bernard NWR; the most recent in December 2011. Both sightings appear to be single transient birds. If the population were to increase the refuges may provide future nesting habitats. No directed management actions for this species are planned at this time.
- *Interior least tern* - The interior subspecies of least tern is a listed species for Fort Bend and **Wharton** Counties. This subspecies is distinguished from the coastal subspecies in its location of nesting, along rivers and mudflats on the interior middle N. America. For this reason nesting birds identified more than 50 miles from the coast are considered interior subspecies. These birds cannot be easily distinguished from coastal least terns and overlap migration and wintering areas. No documented nesting occurs in either Fort Bend or Wharton County and birds found are wintering or transient. No directed management actions for this species are planned at this time.

- *Piping plover*- The Texas Gulf Coast provides valuable wintering habitat for the piping plover. A portion of the Complex has been designated as critical habitat for the piping plover. The tidal mudflats on our refuges, especially in the Cedar Lakes area of San Bernard NWR, are extremely valuable to this and other plovers. These mudflats are not clearly identified in the critical habitat designation, but they are at times more valuable to this species than the nearby beaches.
- *Sprague's pipit* - Sprague's pipet is known to occur in Brazoria, Fort Bend, Matagorda, and Wharton counties, but its current status on the Complex is unknown. It is a migrant species found during migration and winter, generally tied to upland native grasslands and can be found in large numbers in coastal grasslands. It is associated with native coastal prairie and salty prairie habitats on the Complex similar to the American pipit. It prefers shorter prairie or prairie patches among denser or more mature prairie stands. It does not tolerate brush encroachment in prairie habitats (Robbins et.al. 1999). It can be found in post-burn areas. The species is a wintering migrant, feeding on insects spiders and some seeds, and may be found on the refuges October through March.
- *Red Knot* – Populations of red knots occur in Brazoria and Matagorda counties mainly September through April. Small numbers oversummer (Eubanks et al. 2006). It mainly rests and forages along beaches, where it is seen eating *Donax* during both spring and fall migration. However, on one occasion during fall migration a small group was observed on tidal mud flats at Cedar Lakes, on the bay side of the dune lines. San Bernard and Sargent Beaches and Cedar Lakes Pass ("the cut") harbor knots during migration and for the winter.
- *Smalltooth sawfish*- The U.S. population of smalltooth sawfish is found only in the Atlantic Ocean and Gulf of Mexico. Historically, the U.S. population was common throughout the Gulf of Mexico from Texas to Florida, and along the east coast from Florida to Cape Hatteras. This species generally requires marine habitats which are outside of the refuge boundaries, (primarily the Everglades region).
- Sea Turtles- Five sea turtles; *Kemp's ridley, loggerhead, green, leatherback and hawksbill,* occur in the Gulf and bay waters near the refuges. San Bernard, which has a small segment of Gulf beach has had two documented Kemp's ridley nest in 2009 and 2012. The refuge needs to continue to protect refuge beaches, including restricted vehicular traffic to protect this and other species. The Complex supports all sea turtle recovery efforts by patrolling area beaches for stranding and nests. All nests are excavated and transferred to the incubation site at Padre Island National Seashore. Live turtles are transferred to the NOAA recovery facility in Galveston.

VI. Description of proposed action (attach additional pages as needed):

The proposed action is to implement the Comprehensive Conservation Plan for the Texas Mid-coast NWR Complex over the next 15 years.

The Plan is divided into a series of goals, objectives, and strategies that will be implemented throughout the 15-year term of this Plan. Specific goals associated with the CCP are:

1. To contribute to conservation efforts and to foster the ecological integrity of the Gulf Coast Prairies and Marshes Ecoregion through proven and innovative management practices across the Complex.
2. To conserve and restore, enhance, and protect refuge habitats by implementing appropriate management programs to benefit native flora and fauna, including threatened and endangered species and other species of concern.
3. To protect, maintain, and enhance populations of migratory birds and resident fish and wildlife, including federal and state threatened and endangered species.
4. To develop and implement quality wildlife-dependent recreation programs, which are compatible with refuge purposes, and foster enjoyment and understanding of the Refuge's unique wildlife and plant communities.
5. To provide administrative and public use facilities needed to carry out the refuge's purposes and meet management objectives.

The overall management of the Complex will focus on protecting and restoring native habitats to promote wildlife, while enhancing opportunities for public use, such as hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation as well as to increase understanding and support for the Complex and the Refuge system. For detailed descriptions of goals, objectives, and strategies for the Plan, please refer to Chapter 4 of the attached Draft Plan.

VII. Determination of effects:

A. Explanation of effects of the action on species and critical habitats in items III. A, B, and C:

Habitat and Wildlife Management
Restoration and maintenance of bottomland hardwood forests and prairie habitat using management tools such as prescribed fire, invasive species management, planting and harvesting native prairie seed will not have any negative impacts on any of the listed species in and around the Complex boundaries

Public Use
The proposed increase in public use opportunities such as additional hunting opportunities, new trails, boardwalks and photo blinds promoting wildlife observation and wildlife photography as well as additional programs to increase environmental education and interpretation will not have any negative impacts on any listed species. Increased opportunities in all public use programs will be designed to avoid any potential impacts to any listed species.

Facilities/Infrastructure
The proposed increase in infrastructure such as new trails, additional bicycle access, new signs and exhibits, and additional canoe and kayak launches as well as new recreational vehicle sites, new administrative and maintenance facilities and a new visitor contact station will not have any negative impacts on any listed species. Additional opportunities in facilities and infrastructure will be designed to avoid any potential impacts to any listed species.

Overall, no significant adverse impacts to Federally-listed T&E species are expected to occur due to the management direction proposed in the Comprehensive Conservation Plan. Species-specific effects are further discussed below:

Attwater's prairie-chicken
The Attwater's prairie chicken are found only on the coastal prairies of Texas. Although not currently occurring on the Complex, several areas have been identified as potential future reintroduction sites.

Management staff will conduct coordination and studies to determine best potential management direction to maximize success if reintroductions occur on the Complex. Should APC be reintroduced on the Complex, restoration and maintenance of prairie habitat using management tools such as invasive species control, prescribed fire, and grazing should have beneficial impacts on APC recovery efforts.

Whooping Crane
Whooping Cranes do not regularly occur on Mid-coast Refuges. However, for the cranes to reach recovery status, the Aransas/Wood Buffalo population will need to expand. Mid-coast Refuges (with Big Boggy first) will probably be required for the cranes to reach recovery status. Implementing management actions identified in the CCP will not impact whooping cranes at this time.

Northern aplomado falcon
The northern aplomado falcons that have been documented on the Complex are transient visitors and the management direction proposed in the CCP is expected to have no effect on this species.

Interior least tern
While this subspecies of least tern may occur on the Complex, ongoing and proposed management actions are not expected to have any impact on it.

Piping Plover

The Complex serves as wintering habitat and the Service has designated portion of the Complex has been designated as critical habitat for the piping plover. Most of the management action that occur on the Complex will have no effect on the piping plover. The Complex will continue to conduct plover surveys on area beaches and protect designated critical habitat. Efforts to protect San Bernard beach through

limiting vehicle access above the tidal zone, should be beneficial to wintering piping plovers.

Sprague's Pipit
Management of prairie habitats (including prescribed burning, brush control, invasive species control, and grazing) as described in the CCP, can be beneficial to Sprague's pipit conservation.

Red Knot
The habitat types in which this species occurs receive little management. It would benefit from policies that limit vehicle disturbance on beaches and intertidal locations in Cedar Lakes. When its potential habitat is included, it should be considered in reviews of any activities that could impact potential habitat, such as oil and gas operations.

Smalltooth Sawfish
Because the species generally requires marine habitats, which are outside of the Complex boundaries, the refuges cannot play a direct role in the species recovery. However, the Complex can assist with outreach and partnering with state and federal entities to encourage habitat protection. Management actions proposed in the CCP will have no effect on this species.

Sea turtles
Five sea turtles; Kemp's ridley, loggerhead, green, leatherback and hawksbill, occur in the Gulf and bay waters near the refuges. San Bernard, which has a small segment of Gulf beach has had one documented Kemp's ridley nest in 2009. The refuge needs to continue to restrict refuge beaches from vehicular traffic to protect this and other species. The Complex supports and assist with all sea turtle recovery efforts. This includes beach sea turtle surveys during nesting season (May–July), flipper tagging, excavating sea turtle nests and transporting them to the incubation facility at Padre Island National Seashore. The Refuge monitors and responds to calls regarding sea turtles on Gulf coast beaches between the mouth of the Colorado River and Quintana Beach. Live turtles are transferred to the NOAA recovery facility in Galveston.

B. Explanation of actions to be implemented to reduce adverse effects:
The Complex will prohibit or restrict activities in areas where listed species occur. If additional listed species are found, the Complex will change/alter management actions so as not to disturb or impact the species, or consult with the Clear Lake Ecological Services Field Office prior (ESFO) to undertaking such actions to determine the appropriate course of action in order to adequately address any listed species concerns. With respect to public use activities, such as hunting, fishing and wildlife observation, these activities will only be allowed in established pre-designated area, seasons, and times.

As a working document, modification to the objectives and strategies are anticipated. If modifications result in changes to the effects analysis, or include actions that are

not considered in this document, the Complex will re-initiate consultation or consult with the Clear Lake ESFO over a particular action that may affect Federally-listed species or designated critical habitat.

VIII. Effect determination and response requested: [* = optional]

A. Listed species/designated critical habitat:

Determination	Response requested
no effect to species/critical habitat (species/unit): Northern aplomado falcon Interior least tern Smalltooth Sawfish	__X__ ***Concurrence**
may affect, but is not likely to adversely affect species/critical habitat (species/unit:) Attwater's prairie-chicken (APC) Whooping crane, Piping plover, Atlantic hawksbill sea turtle, Green sea turtle, Kemp's Ridley sea turtle, Leatherback sea turtle, Loggerhead sea turtle, Critical Habitat for the Piping Plover	__X__ **Concurrence**
may affect, and is likely to adversely affect species/critical habitat (species/unit: none)	____ **Formal Consultation**

B. Proposed species/proposed critical habitat:

Determination	Response requested
no effect on proposed species/proposed critical habitat (species/unit: n/a)	____ ***Concurrence**
is not likely to jeopardize proposed species/ adversely modify proposed critical habitat (species/unit: n/a)	____ **Concurrence**
is likely to jeopardize proposed species/	____ **Conference**

adversely modify proposed critical habitat
(species/unit: n/a)

C. Candidate species:

Determination	**Response requested**
no effect **(species: none)**	____***Concurrence**
is not likely to jeopardize candidate species/ **(species:** Sprague's pipit Red Knot)	_X_ **Concurrence**
is likely to jeopardize candidate species **(species:** none)	____**Conference**

_____ _____
Signature **date**
Complex Manager, TMC NWR Complex

IX. Reviewing ESO Evaluation:

A. Concurrence ✓ **Nonconcurrence** _____

B. Formal consultation required _____

C. Conference required _____

D. Informal conference required _____

F. Remarks (attach additional pages as needed):

Edith Griffing 9/21/2012
Signature **Date**
Title:

H. Wilderness Review Texas Mid-coast NWR Complex

H.1. Introduction

Wilderness Reviews (Reviews) are a required element of CCPs, and each refuge must follow the Review process outlined in 602 FW 1-3 and 610 FW 1-4. The process includes interagency and tribal coordination, public involvement, and NEPA compliance (610 FW 4.4 A). The purpose of the Review is to identify lands and waters that merit inclusion in the National Wilderness Preservation System (NWPS) and recommend suitable lands for Congressional designation (610 FW 4.4 A).

There are three phases to the Review process: (1) inventory; (2) study; and (3) recommendation. During the inventory phase, we identify lands and waters that meet the minimum criteria for wilderness designation (610 FW 4.4 B). Lands and waters that meet the minimum criteria for designation are called Wilderness Study Areas (WSAs). In the study phase, we assess a range of management alternatives to determine if a WSA is suitable for wilderness designation and corresponding management or if management under an alternate set of goals and objectives is more appropriate (610 FW 4.12 A). The findings of the study phase determine whether we will recommend a WSA for designation in the Final CCP. If we determine that the Complex contains lands and/or waters that are suitable for wilderness designation, we report the recommendation from the Director through the Secretary and the President to Congress in a subsequent Wilderness Study Report (610 FW 4.4). The following team performed the Wilderness Review for the Complex.

Table H-1. Wilderness Review Team

Jennifer Sanchez	Complex Manager	Jennifer_sanchez@fws.gov
Shane Kasson	Refuge Manager	Shane_kasson@fws.gov
Cody Dingee	Refuge Manager	James_dingee@fws.gov
Joseph Lujan	Biologist/Natural Resource Planner	Joseph_lujan@fws.gov

H.2. Wilderness Inventory

Section 2 (c) of the Wilderness Act of 1964 states that wilderness is an area that is "untrammeled by man, where man himself is a visitor who does not remain." The Act identifies the minimum criteria that an area must meet to be eligible for wilderness. Service policy states that we use the Act's minimum criteria to identify potential wilderness areas. These criteria include size, apparent naturalness, and outstanding opportunities for solitude or primitive recreation. Supplemental values are evaluated and documented but are not required for a WSA. The Complex Wilderness Review Team (team) met on January 12, 2011 to perform the inventory phase of the review.

Identification of Lands that Meet the Size Criteria

First, the team reviewed each refuge for any lands that meet the size criteria outlined by 610 FW 4.8 and described below:

- An area with more than 5,000 contiguous acres. State and private lands are not included in making this acreage determination.
- A roadless island of any size. A roadless island is defined as an area surrounded by permanent waters or that is markedly distinguished from the surrounding lands by topographical or ecological features (610 FW 1.5 Z).
- An area of less than 5,000 contiguous acres that is of sufficient size as to make practicable its preservation and use in an unimpaired condition, and of a size suitable for wilderness management.
- An area of less than 5,000 contiguous Federal acres that is contiguous with a designated wilderness, recommended wilderness, or area under wilderness review by another Federal agency that manages wilderness, such as the Forest Service, National Park Service, or Bureau of Land Management.

Lands that meet any of these four size criteria are identified as inventory units during the review process. Brazoria NWR contains four and San Bernard NWR contains three inventory units that meet the criteria listed above. These areas are identified in the following map (Figure H-1), and unit is evaluated for wilderness criteria in Table H-2. On Brazoria NWR, these were large areas (>5,000 acres) with minimal roads and are minimally managed. On San Bernard NWR, four bottomland areas that are either near the 5,000 acres or considered to be intact old-growth forest with significant acreage (>1,000) were proposed for evaluation. Two marsh units similar to the criteria for selecting areas on Brazoria NWR were also selected on San Bernard NWR for consideration. Big Boggy NWR was not selected for further evaluation because the total acreage is less than 5,000 acres and this further gets reduced as we remove managed areas, conservation easement areas and buffer areas with regular disturbance. The area for consideration becomes quite small and does not provide an area suitable for wilderness management.

Evaluation of the Naturalness Criteria

Section 2 (c) of the Wilderness Act defines wilderness as an area that "…generally appears to have been affected primarily by the forces of nature with the imprint of man's work substantially unnoticeable." In addition to the size criteria, Service policy states that an inventory unit must meet the naturalness criteria to qualify as a WSA. Although the area must appear natural to the average visitor, policy does not require that the land is in a pristine historic state (610 FW 4.9 A).

During the inventory phase, the team evaluated each inventory unit for the naturalness criteria. The following things were taken into consideration when determining naturalness: roads, navigable waters, the GIWW, oil and gas developments, aggressive fire program, and the fact that the area is within one of the most industrialized areas of the Nation. Findings for each inventory unit are noted in Table H-2.

Evaluation of Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation

In addition to meeting the size and naturalness criteria, an inventory unit must provide outstanding opportunities for solitude or primitive recreation to qualify as a WSA. The Wilderness Act does not define what was intended by solitude or a primitive and unconfined type of recreation. The Service, however, defines solitude as "a state of mind, a mental freedom that emerges from settings where visitors experience nature essentially free of the reminds of society, its inventions, and conventions; privacy and isolation are important components, but solitude is enhanced by the absence of distractions, such as large groups, mechanization, unnatural noise and light, unnecessary managerial presence (such as signs), and other modern artifacts (610 FW 1.5 AA)." The Service defines primitive and unconfined recreation as "activities that provide dispersed, undeveloped recreation and do not generally require permanent facilities (610 FW 1.5 R)." According to 610 FW 4.10, an area does not need to have outstanding opportunities for both solitude and primitive recreation nor does the area need to have outstanding opportunities on every acre.

During the inventory process, the team found that none of the units within the Complex qualified for opportunities for solitude or primitive and unconfined recreation. The results of the inventory are also displayed in Table H-2.

Supplemental Values

Although the presence of supplemental values is not required for an inventory unit to qualify as a WSA, 610 FW 4.11 recommends that the team document their presence if they exist. Supplemental values may include any ecological, geological, or other features of scientific, educational, scenic, or historic value. Since there were not any inventory units that met the "has an outstanding opportunity for solitude or primitive and unconfined recreation" criteria, supplemental values within each inventory unit were not documented.

H.3. Wilderness Inventory Summary

After completing the inventory phase of the Wilderness Review, the team did not find any lands that meet the minimum criteria for a Wilderness Study Area. Therefore, the team does not recommend that the Wilderness Study portion of the Review be performed. This concludes the Wilderness Review process at this time. The process will be replicated in accordance with policy at the time of the next CCP revision.

Table H-2. Minimum Criteria Inventory

Inventory Unit		Minimum Criteria for Wilderness				
Name	**Size**	**(1) has at least 5,000 acres of land or is of sufficient size to make practicable its preservation and use in an unconfined condition or is a roadless island;**	**(2) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable;**	**(3) has outstanding opportunities for solitude or primitive and unconfined recreation;**	**(4) contains ecological, geological, or other features of scientific, educational, scenic, or historical value;**	**Parcel qualifies as a Wilderness Study Area (Meets criteria 1, 2, and 3)**
Brazoria Wharton/Shrimp Farm/Chocolate Bayou	12,000 acres.	Yes. It is greater than 5,000 acres.	Yes.	No. Primarily marsh habitat bounded by state waters on the north and east. Although remote, impact from motorboats on these adjacent waters would preclude its sense of solitude.	N/A	No.

Brazoria Slop Bowl	Approximately 5,000 acres.	Yes. It is greater than 5,000 acres.	No. Oil and gas development has lead to facilities and created subsidence. This will require significant restoration over the next several years.	N/A	N/A	No.
Brazoria Alligator Marsh/Middle Bayou	7,200 acres.	Yes. It is greater than 5,000 acres.	No. Previous oil and gas activities may have created subsidence and abandoned roads impact water movement. The area requires repetitive treatment of invasive species.	N/A	N/A	No.
Brazoria Austin/Walker	10,000 acres	Yes. It is greater than 5,000 acres.	No. Although parts (2,000 plus acres) are natural. These parts are fragmented by man-made ditches, levees and roads. The area requires repetitive treatments of invasive species.	N/A	N/A	No

San Bernard Cow Trap Marsh/Cedar Lakes	9,500 acres	Yes. It is greater than 5,000 acres.	Yes. Unbroken saline marsh includes saline lakes and appears natural except for the GIWW.	No. Navigable waters are nearby and within the unit including the GIWW.	N/A	No
San Bernard Smith Marsh/Cedar Lake Creek	6,200 acres	Yes. It is greater than 5,000 acres.	Yes. Unbroken saline marsh includes saline lakes and appears natural.	No. Navigable waters are nearby and within the unit including the GIWW, which would preclude a sense of solitude.	N/A	No
San Bernard Austin's Woods Unit: Big Pond Unit	Unit is composed of three contiguous parcels, which total nearly 5,000 acres.	No. Contiguous acres are less than 5,000 acres. However the unit has unique habitat characteristics which is worthy for consideration.	Yes. The Big Pond Unit tracts of forested habitat are part of the largest remaining forested area within the Columbia Bottomlands.	No. The unit is traversed by six primary pipeline corridors that are maintained as open per Texas Railroad Commission requirements. Pipelines are continuous conduits of invasive species invasion, requiring repetitive control.	N/A	No.

San Bernard Austin's Woods Unit: Dance Bayou Unit	Two tracts totaling 1,300 contiguous acres.	No. Contiguous acres are less than 5,000 acres, however the unique bottomland habitat characteristics' are worthy for consideration.	Yes. This unit is recognized for its old growth bottomland forest and utilized extensively for research.	No. The unit is traversed by five primary pipeline corridors that are maintained as open per Texas Railroad Commission Requirements. Pipelines are continuous conduits of invasive species invasion, requiring repetitive control.	N/A	No.
San Bernard Austin's Woods Unit: Linville Bayou Unit	Three contiguous tracts totaling 1,700 acres.	No. Contiguous acres are less than 5,000 acres, however the unique mature bottomland forest habitat is worthy for consideration.	Yes. The unit has a high percentage of quality unbroken mature bottomland forest.	No. Although Linville Bayou Unit requires minimal invasive species treatments, with a heavy occurrence of Chinese tallow around the boundary, regular treatments to ensure encroachment does not occur.	N/A	No.

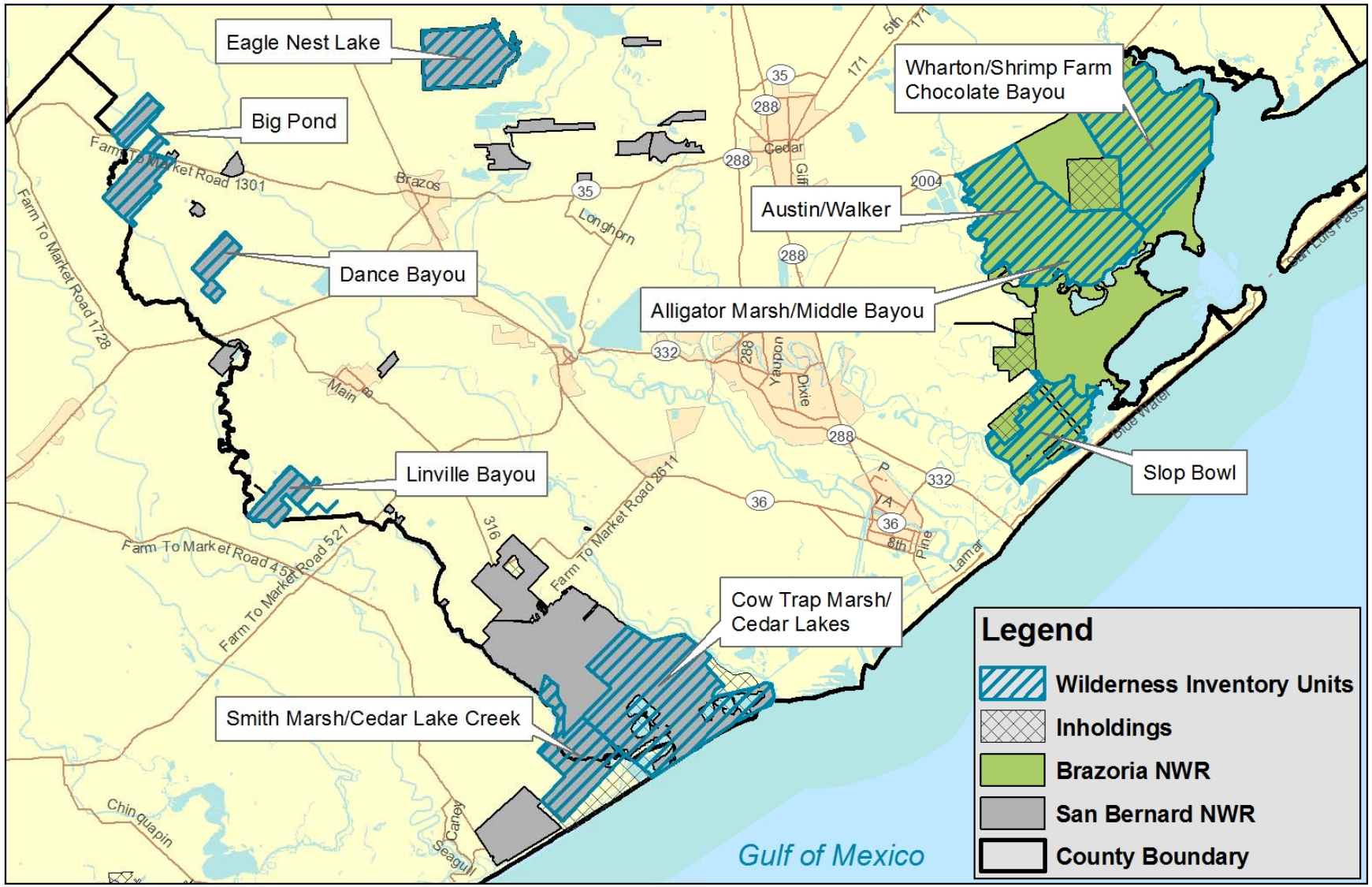
San Bernard Austin's Woods Unit: Eagle Nest Lake.	One tract totaling 4,500 acres.	No. Contiguous acres are less than 5,000 acres, however the unique wetland habitat is worthy for consideration	Yes. The Eagle Nest Unit includes a 2,000-acre lake/emergent marsh that is unusual and unique in this area.	No. The unit is traversed by two pipeline corridors and two County roads and includes more than 1,000 acres of prairie and forest that require restoration including invasive species treatments. Restoration and treatment will need to be reoccurring.	N/A	No.

U.S. Fish & Wildlife Service

Texas Mid-coast National Wildlife Refuge Complex

Brazoria, Fort Bend, Matagorda and Wharton Counties

Map H-1. Wilderness Inventory Units



PRODUCED IN THE DIVISION OF REFUGE PLANNING
ALBUQUERQUE, NEW MEXICO
LAND STATUS CURRENT TO: 5/31/09
MAP DATE: June 2012
BASEMAP: N/A
MERIDIAN: N/A
FILE: TMC_wilderness_units_6_4_2012sk

0 3 6 12 Miles

0 3 6 12 Kilometers

UTM ZONE 15
NAD 83

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Land Protection Plan

Austin's Woods
San Bernard National Wildlife Refuge
Brazoria, Fort Bend, Matagorda and Wharton Counties

Texas

Bald cypress along Linville Bayou in the Columbia Bottomlands, San Bernard NWR

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Washington, D.C. 20240

JUN 25 2013

In Reply Refer To:
FWS/ANRS /047649

Memorandum

To: Regional Director, Region 2

From: Director

Subject: Approval to Proceed with Publication and Distribution of the Final Planning Documents for the Expansion of the Austin's Woods Units on San Bernard National Wildlife Refuge, Brazoria, Fort Bend, Matagorda, and Wharton Counties, Texas

I approve your request dated March 1, 2013, to increase the current acquisition cap from 28,000 to 70,000 acres within the already established acquisition boundary for the Austin's Woods Units of San Bernard National Wildlife Refuge to meet the protection goal identified in the 1997 Austin's Woods Conservation Plan.

This request is based on the preferred alternative (Alternative B) in the draft Comprehensive Conservation Plan that was initiated for the Texas Mid-coast National Wildlife Refuge Complex, including San Bernard National Wildlife Refuge. Federal, State, and local conservation organizations have supported and continue to support the Service's protection and stewardship of the Austin's Woods conservation effort as described in the plan.

The Decision Package you submitted for my review included an Environmental Assessment, Land Protection Plan, and other related documents indicative of detailed planning. These documents comply with the requirements of the Director's land acquisition planning procedures memo dated August 11, 2000.

The lands targeted for protection will assist the refuge in addressing two priority conservation objectives: implementing the North American Waterfowl Management Plan and conserving migratory birds in decline. Ensure that subsequent funding requests related to this project are accompanied by specific biological objectives. Additionally, requests should include a commitment of additional funding sources, when applicable.

1. Introduction and Project Description

The Southwest Region of the U.S. Fish and Wildlife Service (Service) currently has approval to acquire up to 28,000 acres of bottomland hardwoods as part of the San Bernard National Wildlife Refuge (NWR) in accordance with the Austin's Woods Conservation Plan (Plan). The 1997 Decision Document for the Austin's Woods Conservation Plan authorized "…the acquisition of fee and easement interests of no more than 28,000 acres from willing sellers and donors in Brazoria, Fort Bend, Matagorda and Wharton Counties, Texas." With the strong support and assistance of local government, local businesses, the National Fish and Wildlife Foundation (NFWF), and other conservation organizations, the Service has successfully conserved lands which are now a part of the National Wildlife Refuge System. A lack of funding opportunities, exacerbated by the economic recession has impeded conservation by state, county, and private partners. Partners have been less able to contribute towards the 70,000-acre protection goal. However, partners have been extremely valuable assisting with the Service's acquisition by contributing donated funds as partial matches and applying for and receiving grants toward the Service's acquisition efforts. The Service proposes to increase the 28,000 acre cap by an additional 42,000 acres (to a total of 70,000 acres); continuing conservation efforts in the Columbia Bottomlands and associated habitats. This expansion would remain within the approved project geographical boundary in Brazoria, Matagorda, Fort Bend, and Wharton counties in Texas.

This Land Protection Plan (LPP) has been prepared to support continued conservation efforts within the Austin's Woods Conservation Project. The original Conservation Plan, approved in 1997 was intended to counter the rapid destruction of prime, old-growth bottomland hardwood forests in the Columbia Bottomlands ecosystem. That Plan responded to concerns shared by the Service, the Texas Parks and Wildlife Department (TPWD), local government agencies, conservation organizations and landowners over preserving a sustainable portion of this internationally-significant ecosystem. The original overall goal shared by all of the project partners was to protect approximately 10 percent of the estimated original 700,000-acre ecosystem to sustain plant and animal populations and maintain the ecosystem's diversity.

The Columbia Bottomlands are an important link to the history of Texas. Stephen F. Austin chose this area for the location of his First Colony of 300 in 1828. The first capital of Texas was located in the center of the bottomlands in East Columbia. From this history both names: Austin's Woods and Columbia Bottomlands were derived and are essentially interchangeable. The Service generally refers to the project as Austin's Woods but the habitat and ecosystem as the Columbia Bottomlands.

1.1 Project Description

Region 2 proposes this 42,000-acre expansion of the San Bernard NWR in order to achieve the project goals of the Austin's Woods Conservation Partnership; to conserve at least 10 percent of the historic bottomland forest. Since 1995, the Service has been working with other Federal and State agencies, non-profit organizations and private landowners to conserve, through fee title acquisition and conservation easements this unique and internationally important wetland forest ecosystem.

The project is located in the broad combined floodplains of the lower Brazos, San Bernard and Colorado Rivers and smaller creeks and bayous. This forested habitat is the southern-most bottomland forest on the Gulf of Mexico and lies within the Coastal Prairies and Marshes Ecoregion. The Columbia Bottomlands are the only significant expanse of forest adjacent to the Gulf of Mexico along the western side. Its southern edge extends to within 6 miles of the Gulf of Mexico and forms a passageway that reaches 50 miles inland (Figure. 1).

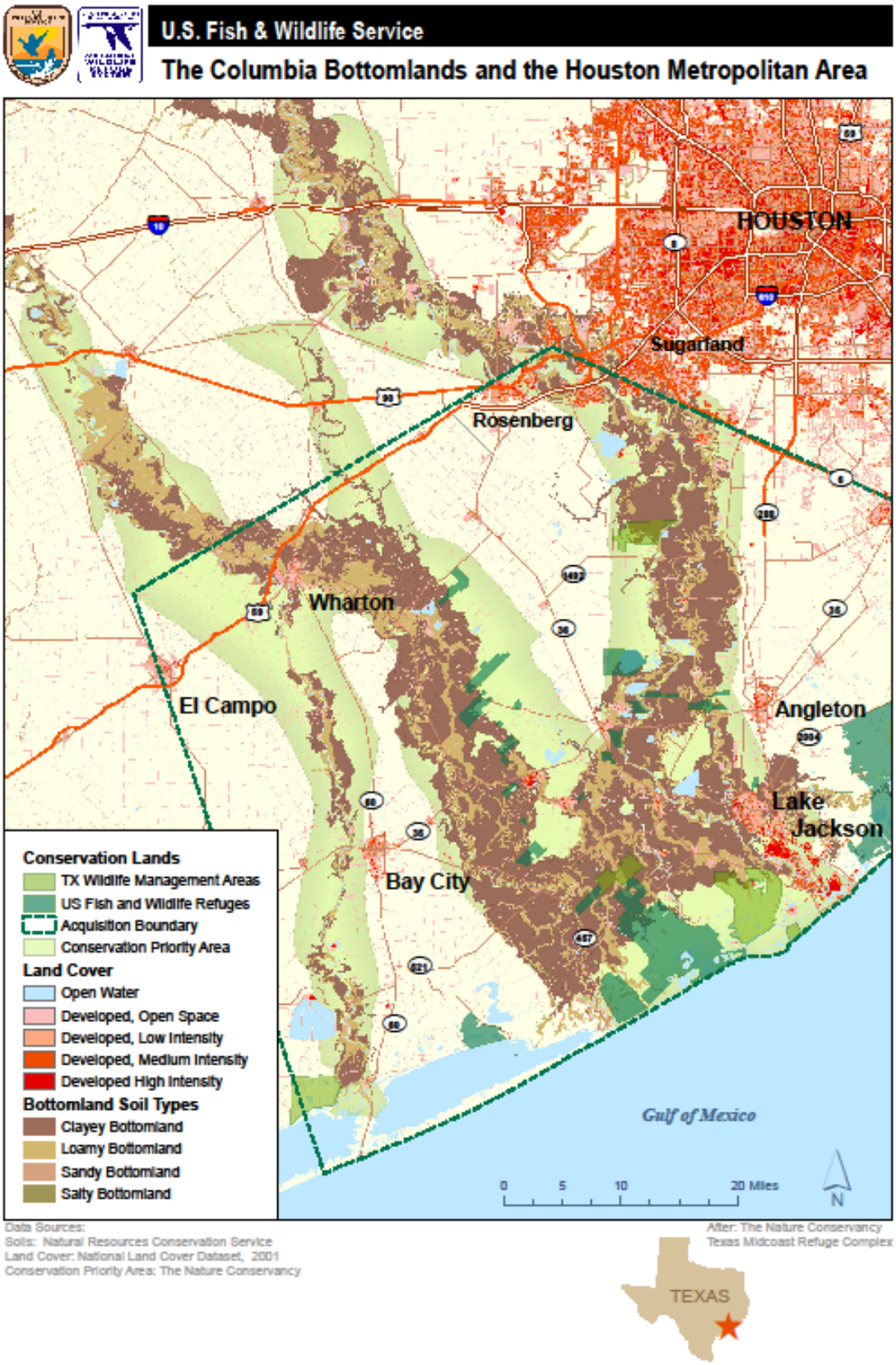
Bottomland hardwood forests are extremely diverse and productive habitats. In addition to neo-tropical migrants, the forested areas are important resting, breeding, feeding, and escape habitats for a great number of other birds. Waterfowl winter in the bottomlands and associated wetlands and prairie wetlands. A significant population of bald eagles are year-round residents, building large nests and raising their young throughout the area.

The Austin's Woods Conservation Plan was approved by the Service in April 1997, to conserve parts of the Columbia Bottomlands ecosystem, a critically important area for millions of migrating birds that use it as a staging area between wintering habitats in the Caribbean and South America and breeding habitats in North America. In the 1997 Decision Document, the Service agreed to:

1. Be a part of the long-term monitoring effort;
2. Assist local agencies and other entities in protection efforts;
3. Provide technical assistance and Partners for Wildlife funds;
4. Hold conservation easements when other organizations are unable; and
5. Acquire fee and easement interests in lands when other organizations are unable.

Although the primary goal is conservation of bottomland forests, coastal prairie, and open water habitats have been acquired when offered along with the forested habitats. These adjacent habitats are integral parts of the ecosystem in that they can often provide transition habitats which support additional wildlife species. Coastal prairies are the primary habitat which has been acquired. Three units with nearly 2,000 acres of former prairie habitat have been acquired. These habitats generally require restoration, but when restored, are representatives of a once vast ecosystem where today only 1-2 percent of the historic prairie remains intact.

Figure 1.


U.S. Fish & Wildlife Service
The Columbia Bottomlands and the Houston Metropolitan Area
HOUSTON
Sugarland
Rosenberg
Wharton
El Campo
Angleton
Lake Jackson
Bay City
Gulf of Mexico
Conservation Lands
TX Wildlife Management Areas
US Fish and Wildlife Refuges
Acquisition Boundary
Conservation Priority Area
Land Cover
Open Water
Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Developed High Intensity
Bottomland Soil Types
Clayey Bottomland
Loamy Bottomland
Sandy Bottomland
Salty Bottomland
0 5 10 20 Miles
N
Data Sources:
Soils: Natural Resources Conservation Service
Land Cover: National Land Cover Dataset, 2001
Conservation Priority Area: The Nature Conservancy
After: The Nature Conservancy
Texas Midcoast Refuge Complex
TEXAS

Reflecting the concept of a bio-reserve network, the Austin's Woods Conservation Plan is an active land acquisition and conservation program administered by the Service along with its governmental and non-governmental partners. In response to local concerns about maintaining land use options for private landowners, an important aspect of the plan is the emphasis on cooperation with local conservation partners. The Service has not designated an all-encompassing "acquisition boundary" that would impact non-Service lands across the Columbia Bottomlands area. This strategy allows for promoting private conservation efforts (e.g., conservation easements and habitat management cooperatives) but does not restrict development or other land uses on private lands adjacent to refuge units. The Service acquires lands from willing sellers and donors, particularly where local conservation initiatives are not feasible. The outcome is a mosaic of land blocks that collectively protect the regional ecosystem and maintain essential ecological functions.

Through this LPP, the Service proposes to continue conservation efforts up to 70,000 acres within the Columbia Bottomlands as outlined in the 1997 Austin's Woods Conservation Plan, Land Protection Compliance Document and Conceptual Management Plan. Specifically the Service will

1. Cooperate and assist other agencies and organizations in conserving a network of lands within the Columbia Bottomlands ecosystem for migratory birds, native fish, resident wildlife, and plants and their habitats, including species that are endangered or threatened with becoming endangered.
2. Promote scientific research and participate in long-term monitoring to ensure biological integrity within the Columbia Bottomlands;
3. Work with partners and where applicable, restore fish, wildlife, and their habitats within the Columbia Bottomlands;
4. Provide and enhance opportunities for the public to participate in compatible wildlife-dependent recreation (hunting, fishing, wildlife observation, photography, environmental education and interpretation);
5. Foster understanding and instill appreciation of the diversity and interconnectedness of fish, wildlife, and plants within the Columbia Bottomlands; and
6. Acquire fee and easement interests in lands when other organizations are unable.

1.2 Authorizing Legislation and Refuge Purposes

The project will continue under the same acquisition authorities approved in the 1997 land protection plan. Those authorities are the Migratory Bird Conservation Act of 1929, the Fish and Wildlife Act of 1956, and the Refuge Recreation Act of 1962.

The purposes of Austin's Woods units in the San Bernard NWR are as follows:

"...for use as an inviolate sanctuary, ... for any other management purposes, ... for migratory birds." Migratory Bird Conservation Act (16 U.S.C. 715d).

"...for the development, advancement, management, conservation, and protection of fish and wildlife resources . . . " 16 U.S.C. 742(a)(4) and " . . . for the benefit of the United States Fish

and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude . . . " 16 U.S.C. 742(b)(1) (Fish and Wildlife Act of 1956).

"…suitable for— (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species…" 16 U.S.C. 460k-1 "…the Secretary … may accept and use … real … property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donor …" 16 U.S.C. 460k-2 (Refuge Recreation Act (16 U.S.C. 460K-460k-4), as amended).

1.3 Related Actions and Activities

Migratory Bird Conservation Plans - The project directly addresses the objectives of migratory bird conservation plans including the Texas Mid-coast Initiative of the Gulf Coast Joint Venture of the North American Waterfowl Management Plan, the Texas Wildlife Action Plan, and the Land Bird Protection Plan. Associated with the bottomland forest are green ash swamps, slow moving bayous, fresh and tidally influenced creeks and rivers. In addition, adjacent to the forest are several natural lakes and wet prairies. Conservation of these wetlands helps sustain waterfowl and water bird populations by protecting winter, migratory and breeding habitats for waterfowl. Securing acreage along the Gulf Coast is a priority in conservation plans for this region. Prairie bird populations, including bobwhite quail, sparrows and raptors are some of the fastest declining populations in the nation. The proposal targets acreage in the Gulf Coast Prairie (BCR 37), an area of continental significance for North American ducks, geese, and swans. In line with the Gulf Coast Joint Venture's implementation plan for the Texas Mid-coast region, the project prevents additional loss and degradation of wetlands in a highly threatened area.

National Wildlife Refuge System – Within the project area are Brazoria NWR, located 6 miles northeast of Freeport, Texas and Big Boggy NWR, located 15 miles northeast of Matagorda, Texas. Brazoria NWR, established in 1966, includes more than 44,400 acres of salt marsh, open water, and coastal prairie habitats. Big Boggy NWR, established in 1982 includes more than 4,500 acres of salt marsh habitat. The San Bernard NWR was established on November 7, 1968, with the acquisition of 14,906 acres. Since that date, 38,572 acres have been added to the Refuge through fee title purchases and fee title and conservation easement donations, bringing the total to 53,478 acres as of May 4, 2012. Since 1997, the Service has acquired more than 24,500 acres of bottomland, prairie and wetland habitats under the Austin's Woods Conservation Plan. All of the above refuges are displayed on Figure 2. Raising the cap on the Service's contribution to the overall protection goal an additional 42,000 acres will enable the Service to continue to work with partners, and eventually fulfill the overall conservation goal established in 1997. Working with multiple partners and utilizing a variety of funding sources has been the key to past success in the Austin's Woods Project. The Service will continue to work with these partners, seek out new partners and utilize a variety of funding mechanisms to facilitate conservation.

Eagle Nest Lake Unit was acquired as a partnership with the Natural Resource Conservation Service. The 2000-acre lake will be restored to its original function as an emergent marsh. The Service is planning on providing public use opportunities around this natural wetland.

Table 1 outlines previous acquisition means and acreage acquired. To date, there have been a total of 45 acquisitions. Approximately 30 percent of the acreage conserved by the Service was acquired through direct donations and grants. Many parcels acquired in the past utilize a combination of funding sources. For instance, private donations through a non-profit organization are combined with a grant and Migratory Bird Conservation Act funds.

Table 1. Previous Austin's Wood Projects

Funding source	**Projects**	**Value of land or donation funds**
Donation of easement	5	$665,000
Donation of fee title	4	$2,365,000
Donation of funds used toward fee title purchase	12	$856,000
Wetland Mitigation Funds	4	$1,725,000
Clean Air or Water Act Violations	3	$1,290,039
Grants (NAWCA, CIAP) used for fee title purchase	9	$3,427,360
Federal Acquisition Funds (MBCF, LWCF)	22	$20,070,533
	Total	$30,453,932

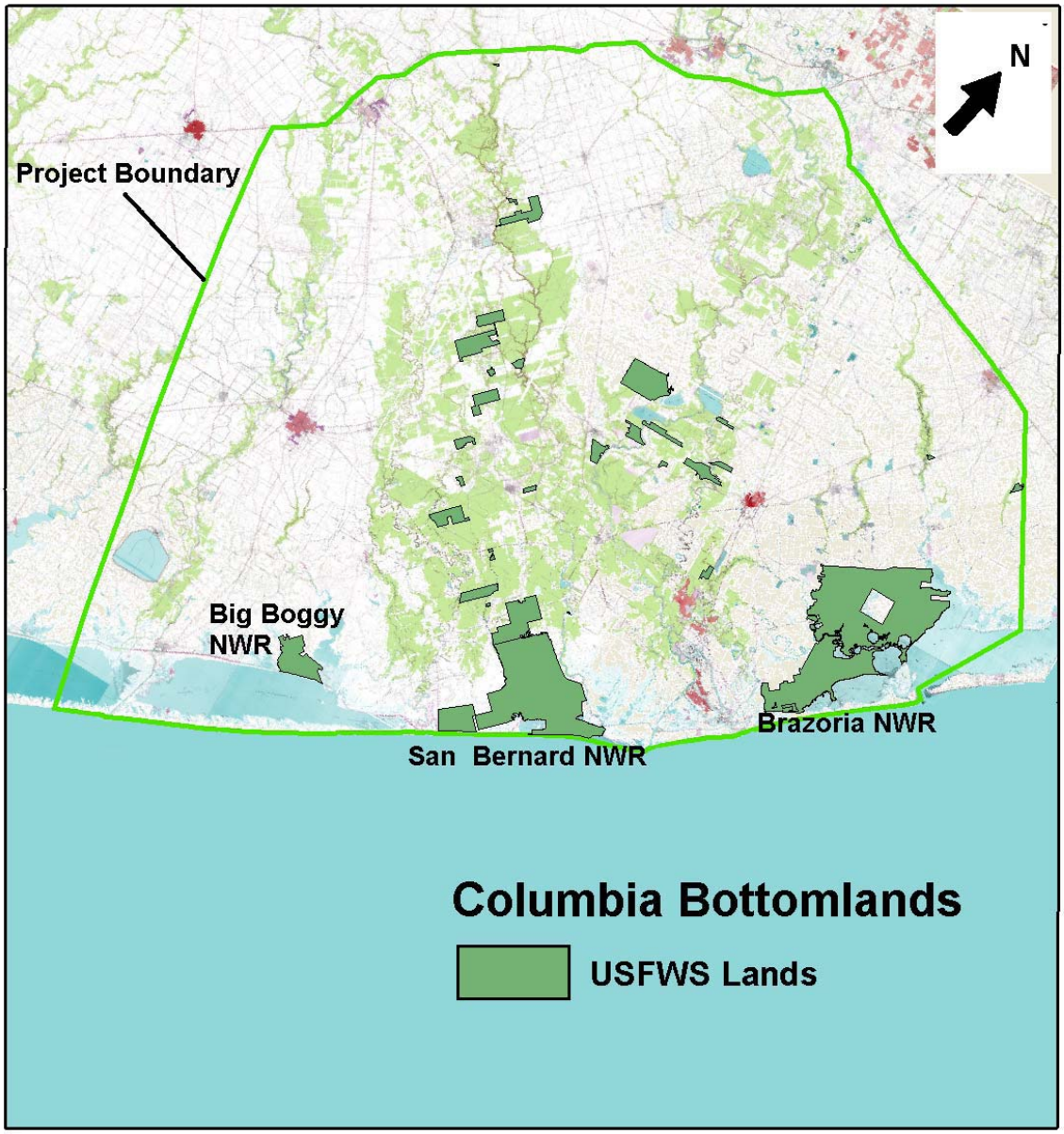


Figure 2, U.S. Fish and Wildlife Service lands within the Austin Woods Conservation Plan Boundary.

Other Conservation Programs

- Conservation Easements held by non-profit organizations – Several non-profit organizations, including: Cradle of Texas Conservancy, Bayou Land Conservancy, Texas Land Conservancy, and Ducks Unlimited hold donated conservation easements within the Columbia Bottomlands. All are active partners in the Austin's Woods Conservation Project and the Service provides information on these options to land owners interested in Conservation. The majority of these donations are mitigation for development. Two mitigation banks have been recently established within the Project area. One of these areas is located adjacent to the Dance

Bayou Unit and the other adjacent to the Hudson Woods Unit. Both of the projects involve extensive forest restoration and some wetland restoration.

- Texas Parks and Wildlife – Two Wildlife Management Areas (WMA) and one state park are within the Austin's Woods Conservation Project. Justin Hurst WMA is located less than five miles south of Freeport Texas. Although the WMA is primarily marsh, the upper edge includes forested wetlands. The Nannie M. Stringfellow WMA shares a boundary with the Stringfellow/McNiel Unit of the Refuge. The WMA was acquired by the Texas Department of Transportation as mitigation for road expansion through the bottomlands. The Brazos Bend State Park is a popular destination on the Brazos River west of Rosharon, Texas. The Service notifies TPWD when contacted by a landowner that is near or adjacent to existing State areas and the land owner is interested in conservation opportunities so TPWD can consider the opportunity to participate. In addition, TPWD can assist private landowners with advice on wildlife enhancement and management on private lands.

- Natural Resource Conservation Service (NRCS) – Department of Agriculture, NRCS works extensively with private lands owners within a variety of agricultural and conservation programs. Utilizing the Wetland Reserve Program, NRCS has purchased conservation easements on six properties within the Austin's Woods Project Area. All but one of these easements is held in perpetuity. In addition to purchasing the easement, NRCS will provide funding for on-the-ground restoration; including invasive species control, planting, and restoring natural drainage on these easements.

- Partners for Fish and Wildlife – This program is administered by the Service and provides financial and technical assistance, and works cooperatively with landowners to voluntarily restore and enhance wildlife habitat on private land. There are several past projects within the project area.

- Gulf Coast Bird Observatory (GCBO) – GCBO is a non-profit organization that promotes the conservation of lands and wildlife, sound science and environmental education. Their headquarters is located in the Columbia Bottomlands and they have partnered with the Service on research as well as assisted with the donation of funds toward acquisition through the Texas Birding Classic, a state-wide birding competition.

2. Resources to be Protected and Their Status

2.1 Habitat

The ecosystem protected under this plan encompasses bottomland hardwood wetland forest and associated wetlands and prairie habitats. The bottomland forests of the ecosystem, which often appear to be like tropical rainforests, have high wildlife and wetland values. This ecosystem is the only expanse of forested wetlands adjacent to the Gulf of Mexico in Texas.

The bottomland forests of what is now Brazoria, Fort Bend, Matagorda and Wharton Counties were known to the settlers of the mid 1800s as the "canebrake forest" due to the understory of

native bamboo. In 1838, the extent of the forest in the project area was described by an early settler as "a district of canebrake and forest, forty miles wide and sixty miles in length." In 1900, the forest still occupied nearly 700,000 acres, an area of over 1,000 square miles of bottomland hardwood forest adjacent to the Gulf of Mexico. In 1995 a Columbia Bottomlands (Four County) Task Force estimated that only 177,000 acres of forest remained. Today, much more of the forest has been cleared, drained or altered, and it is estimated that only 150,000 acres remain. In addition to the bottomland forest, the floodplain ecosystem also has a variety of other wetland habitats, including bayous, sloughs, marshes, ponds, lakes, along with areas of native prairie.

Because the timber in the Columbia Bottomlands was not of high commercial value, tracts of old-growth forest remain, even today. Instead of selling timber, settlers cleared the land for grazing and other agriculture uses. Those practices continue to the present. Today, many acres are cleared for housing development as well as roads and pipeline rights-of-way. The forest is increasingly fragmented as Houston and local cities and towns expand. Although many landowners and cities have promoted the conservation of trees, even in suburban communities, these open forests and parks do not have the multiple canopy layers and undergrowth needed to support a diversity of migratory birds.

The project mitigates threats to the natural community by conserving some of the remaining forests, and restoring forest and prairie habitats. The Columbia Bottomlands ecosystem continues to lose thousands of acres of forested habitat each year. Remaining bottomland tracts are threatened with urbanization, logging, drainage and clearing for agriculture. Levee districts are being created where thousands of acres are cleared and removed from the floodplain for development. Since recent court decisions, many very valuable wetlands are no longer considered jurisdictional by the Army Corps of Engineers (ACOE); this has resulted in the acceleration of habitat loss. Other threats include pipeline construction, road building, and power line construction - a swath of trees is cut for every corridor, further fragmenting the forest. The economic forces driving the destruction of forest habitat are very difficult to counter. Few landowners can afford to keep the land as forest and garner a higher value through agriculture. The project alleviates the threats through a system-based protection initiative that serves to avoid conflicts with industry: rather than being in a position of

Natural pot-hole prairie wetlands on the Buffalo Creek Unit provide habitat for waterfowl, rails and waterbirds 45 miles inland from the Gulf of Mexico. Since acquired in 2007, the Service has been working to restore native prairie diversity and control invasive species on this 800-acre prairie.

opposing individual activities, the initiative offers landowners economic alternatives to habitat destruction. Having this system-based project area allows flexibility in protecting properties, as long as the protection objective is met. The flexibility and willing-seller aspect of the initiative means conflicts over individual tracts are avoided or minimized.

Several remnant prairies have been acquired along with adjacent bottomland forest. Although native coastal prairie once stretched from Louisiana across the coastal plains to south Texas, less than one percent of the historic prairie exists in a natural state. Easily cleared for agricultural and development, coastal prairie is recognized as an endangered habitat. More than 1,000 plant species created a diverse ecosystem; much of this diversity is forever lost. However, where prairies have been acquired by the Service, these prairies are being restored to provide native habitat for prairie wildlife. To date, approximately 1,800 acres of former prairie have been conserved by the Service as well as the adjacent bottomland forest. Invasive species treatment, seeding and shredding native hay across the field, and fire are being used to restore native prairie habitats. It is hoped that larger prairies near Damon, Texas may one day allow for the future reintroduction of Attwater's prairie-chickens.

2.2 Wildlife

The Columbia Bottomlands habitat supports a great diversity of wildlife. The bottomlands are home to large populations of both resident and migratory wildlife, including more than 400 different wildlife species. The refuge, as part of the Texas Coastal Plain, annually provides critical habitat for numerous neotropical migrants which pass through the area during fall and spring migration. The freshwater fishery within the Columbia Bottomlands consists primarily of marshes, creeks, sloughs, bayous, the San Bernard River, Brazos, and Colorado Rivers. Oxbow lakes such as Scoby and Sally Lakes are scattered across the landscape. These lakes can support native and non-native fisheries. The forests are diverse with localized populations of uncommon species. The wildlife that this project provides habitat for includes waterfowl and waterbirds, Nearctic-Neotropical migrant birds, as well as resident reptiles, amphibians and mammals.

Prothonotary Warbler

This ecosystem is especially important for Nearctic-Neotropical migratory birds because of its proximity to the Gulf of Mexico. Millions of Nearctic-Neotropical migrants make landfall in the bottomlands during spring migration and also use the area during fall migration. Migrating birds depend on bottomland forests for rest and feeding before and after crossing the Gulf of Mexico on fall and spring migration, respectively. In 1997, the Columbia Bottomlands Task Force found that 237 species of birds, totaling at least 29 million individuals, migrate through the forest every year. This is the chief

spatially explicit rationale for proposing additional protection for this project area. The bottomlands provide habitat to more than 30 species of warblers, including the Swainson's warbler and Prothonotary warbler. The Swainson's warbler nests in the project area in thick understory, specifically cherry-laurel thickets. The Prothonotary warbler is unique because they nest in low cavities of bald cypress, willows, and sweet gum. The cavities may be in trees near or over standing water and usually created by woodpeckers (Cornell 2012). Other migrant passerines include many species of sparrows, vireos, tanagers, thrushes, orioles, wrens, swallows, grosbeaks, and buntings. Dr. Sidney Gauthreaux, Jr., using Doppler radar (Figure 3), documented that the Columbia Bottomlands is a major stopover area for these migrants.

2.3 Climate Change Management Adaptation and Mitigation

Department of Interior Secretarial Orders 3226 and 3289 direct the Service to "…consider and analyze potential climate change impacts when undertaking long-range planning exercises….and/or when making major decisions regarding the potential utilization of resources under the Department's purview," and to "coordinate an effective response to its impacts on …the land, water, ocean, fish and wildlife, and cultural heritage resources…" A rapidly changing climate presents challenges to habitat conservation nation-wide. In the Texas Mid-coast area the coastal San Bernard NWR may be impacted by sea-level rise, increased drought, more erratic weather events, overall warming of habitats, and changes in plant and animal phenology (timing of life events like budding, migration, and nesting) for species occurring on the refuge. The Service's strategic response to climate change involves three core strategies: adaptation, migration and engagement (USFWS 2011). The Austin's Woods Conservation Plan provides the elements necessary to minimize the impact on wildlife: resilience, redundancy, adaptation potential, habitat connectivity, drought-tolerant plant communities, natural hydrology, and large and connected ecosystem segments.

Through adaptation, the impacts of climate change on wildlife can be reduced by conserving habitats expected to be resilient. Intact ecosystems are more able to react and adapt to climate change and still support a variety of wildlife than damaged ecosystems with low species diversity. This was evident during the recent drought cycle. A census by the Texas Forest Service showed that the loss of trees, primarily water oaks in the Columbia Bottomlands, were prevalent along edges rather than in the intact forest (Merritt 2012). Further, the Refuge Columbia Bottomland units withstood the drought much better than the other forests surrounding the greater Houston communities, where millions of trees died.

The expansion of the refuge inland is essential to adapt to the anticipated impacts on the refuge coming as a result of climate change without losing critically important habitat for coastal bird species and fisheries resources on the Texas Gulf Coast. The project is essential in adding a buffer of higher elevation lands (20 to 50 feet above sea-level) to the lower marshes and salt

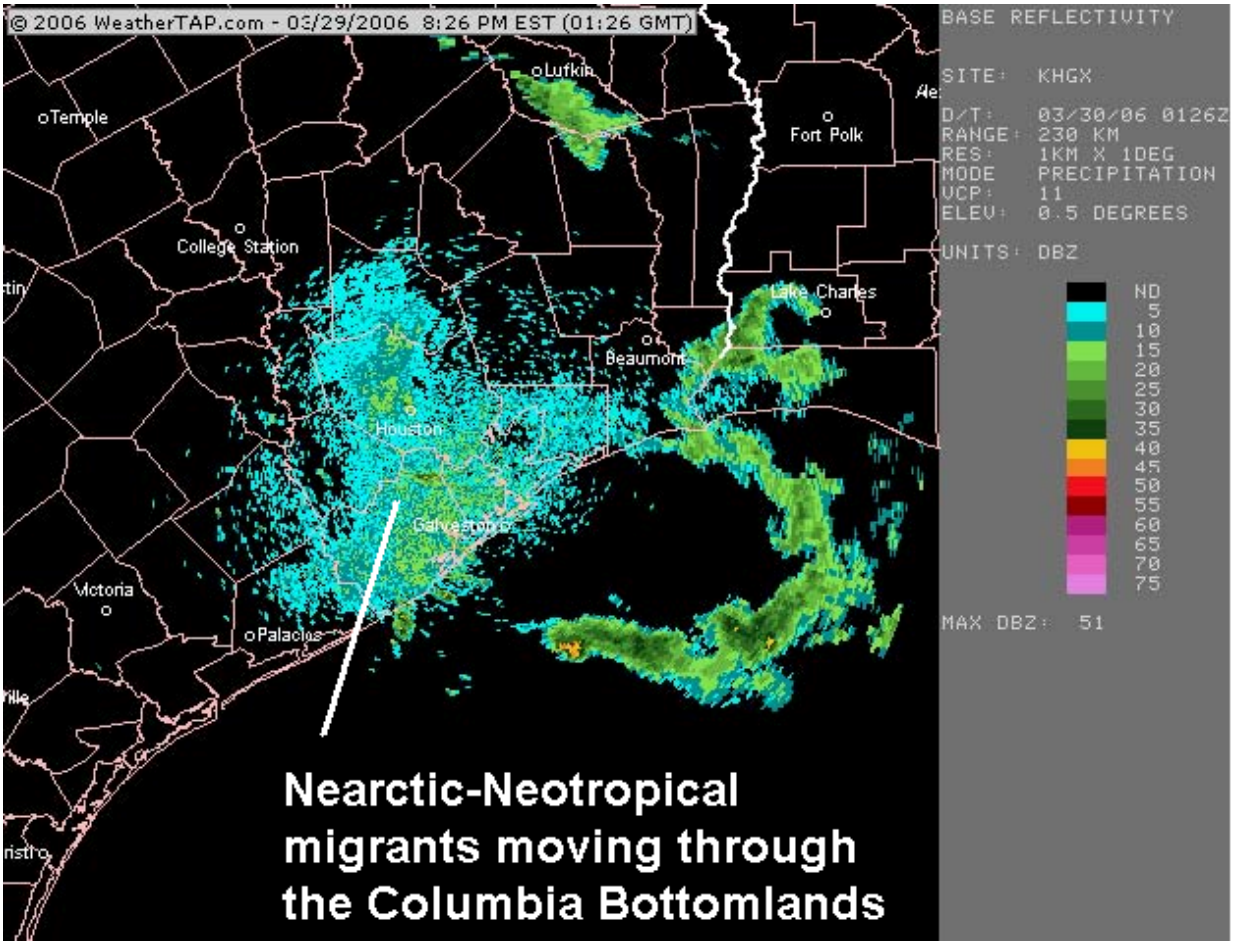


Figure 3. Doppler radar showing movement of Nearctic-Neotropical migrants moving through the Columbia Bottomlands.

marshes of the San Bernard NWR. The adjacent bottomlands help facilitate and allow the movement of coastal species inland as sea level rises in the coming decades. Located inland from the coastal marshes along the Gulf of Mexico, tracts in the Columbia Bottomlands sit at a sufficiently high elevation that they would not be inundated by sea-level rise (based on current worse-case predictions). However, the tracts will provide a buffer to lower-lying lands which may be inundated by rising sea levels due to climate change. The tracts will provide a species reservoir and habitat for a variety of species which may need to move along corridors as changes in climate occur. Future plant and animal species composition may shift with climate change, but the land will still provide quality habitat for forest, and prairie dependent species.

The Refuge may also manage its resources to help mitigate climate change impacts. In November, 2002, the NFWF contracted with Winrock International to provide the Service and the project partners with a detailed baseline study of carbon sequestration potentials of the Columbia Bottomlands. Based on the study specific to the forest biomass of the Columbia Bottomlands, the conservation of forested wetlands will prevent the release of over 78 metric tons of carbon per acre into the atmosphere. If the lands are not conserved, they are likely to be deforested, resulting in the release of carbon.

3. Project Implementation

3.1 Protection Alternatives Considered

No Action

Under the No Action Alternative, continuation of current management, the Service would be limited to 28,000 acres of land acquisitions (fee title and conservation easement) in accordance with the Austin's Woods Conservation Plan of 1997. The plan set a goal for the Austin's Woods Conservation Partnership to conserve 10 percent of the historic bottomlands forest (70,000 acres). To date, the Service has been very successful in working with other Federal and State agencies, non-profit organizations and private landowners to conserve parts of the Columbia bottomland as part of the National Wildlife Refuge System and has nearly met its 28,000 acre acquisition cap. However, a lack of funding exacerbated by the economic recession has impeded conservation by state, county, and private partners. Partners have been less able to contribute towards the 70,000-acre protection goal. This alternative would hamper the Service's ability to continue its conservation efforts in the Columbia Bottomlands. Under this alternative, the Service would not acquire additional fee title and conservation easements (over 28,000 acres), severely diminishing the potential of ever meeting the recommendation of the 1995 task force; that conservation of 10 percent of the original ecosystem was needed in order to sustain this unique ecosystem. Without the Service's funding mechanisms, leadership, ability to leverage partner contributions, and position as the primary contact for landowners interested in finding ways to conserve their lands, future conservation will be limited. The future of the Columbia Bottomlands would be subject to the discretion of the landowners whether the land would stay in an undeveloped setting or be converted to other uses in the long-term, which may include eventual development. The current quantity of land in conservation status is not adequate to protect either the ecosystem or dependent wildlife species. If the Service stops land acquisition now, less than five percent of the historical ecosystem will be conserved. By preserving less than ten percent, the ecosystem may not be able to sustain its botanical diversity on which substantial populations of migratory wildlife species depend. We could lose populations, or even species, of plants with subsequent consequences to resident and migratory wildlife.

Acquisition and/or Management by Others

The alternative was thoroughly considered in the 1997 Austin's Woods Conservation Plan, and was found not be practical in and of itself. This alternative is an ongoing and important part of current management (the no action alternative). In addition to acquisition, the Service has facilitated contacts between landowners and the Department of Agriculture, NRCS to conserve lands through the Wetland Reserve Program. NRCS has purchased permanent conservation easements on 7,700 acres in the Columbia Bottomlands. However, most landowners are not interested in holding conservation lands and the fee title is later purchased by the Service. This is primarily due to the fact that most land owners do not wish to continue to pay taxes on lands where income from the land is curtailed due to conservation and wetland restoration actions. However, in partnering with NRCS the Service accepts the constraints of their conservation easements, works with NRCS on wetland restoration and restores and manages other habitat values including controlling invasive species and restoring native coastal prairie on agricultural lands. In an area that has heavy development pressure due to the proximity of the Houston

Metropolitan Area, this partnership may have been the only means by which these acres could have been conserved.

The TPWD manages one state park, one state historical site, and two WMAs within the project boundary. The Stringfellow WMA which shares a common boundary with San Bernard NWR enabled the conservation of the largest block of forest and a migratory corridor reaching from the coast nine miles inland. The Service will continue to share information about potential projects within the vicinity of existing State areas with TPWD as funding opportunities may arise in the future.

The Service has facilitated the conservation of smaller tracts through donations of conservation easements to area land trusts where the location or size of the property was not suitable for acquisition by the Service. The Service will continue to seek opportunities, working with partners to help all landowners interested in conservation of natural forested habitats. Private land trusts have conserved approximately 1,800 acres.

The TPWD and a host of conservation groups continue to advocate for this preservation effort. However, because of the current slow economic recovery, these entities do not have the necessary resources to acquire, and manage the habitat. Therefore, the land acquisition functions in the Austin's Woods Conservation Plan largely fall to the Service.

Acquisition in Fee and Conservation Easement

Purchase of fee title has been the primary means through which acquisition has occurred in the past. Although funding through the traditional refuge funding mechanisms, Migratory Bird Conservation Act Fund and Land and Water Conservation Fund, has been the primary source, the Service has received substantial assistance from other sources. Working with non-profit organizations, private funds have been raised, and wetland mitigation funds have been held for use in future acquisitions. Both the Trust for Public Land and The Conservation Fund have purchased and held lands as the Service completes due diligence and secures funding for acquisition. The National Fish and Wildlife Foundation has been instrumental in nearly all acquisitions, providing guidance, assisting with landowner negotiations, buying and holding tracts until the Service could obtain the funds, and purchasing appraisals. Under this plan, the Service would continue to be opportunistic and utilize a variety of funding avenues for fee title acquisition.

The purchase of conservation easements has not been readily employed in the past due to the desires of several landowners. Since the purpose of this program is the conservation of forested landscapes, residual rights would preclude the ability to use the land for agriculture (including grazing). Although landowners can reduce their taxes by showing a reduction in their owned value, without an income from the land, few landowners are interested in this approach. Landowners interested in easement opportunities are generally conservation-oriented, where they enjoy the natural landscape and generally own small (<100 acres) tracts.

3.2 U.S. Fish and Wildlife Service Land Acquisition Policy

Land interests are acquired only from willing sellers/donors and are subject to the availability of funding. The presence of a national wildlife refuge would not mean increased regulation of adjacent private land uses. The Service acquires lands and interests in lands, such as easements, and management rights in lands through leases or cooperative agreements, consistent with legislation or other congressional guidelines and executive orders, for the conservation of fish and wildlife and to provide wildlife-dependent public use for recreational and educational purposes. When land is needed to achieve those objectives, the Service seeks to acquire the minimum interest necessary to reach those objectives. If fee title is required, the Service gives full consideration to extended use reservations, exchanges, or other alternatives that will lessen the impact on the owner and the community. Donations of desired lands or interests are accepted. In all fee title acquisition cases, the Service is required by the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646) to offer 100 percent of the property's appraised market value, as set out in an approved appraisal that meets professional standards and federal requirements.

We only propose fee acquisition when adequate land protection is not assured under other ownerships, active land management is required, or we determine the current landowner would be unwilling to sell a partial interest such as a conservation easement. Generally, the lands we would acquire in fee require more than passive management to meet the wildlife conservation goals.

Conservation easements leave the parcel in private ownership, while allowing the Service involvement in land management decisions in a way that enables us to meet our conservation goals, as well as being able to provide some assistance to the landowner with stewardship and management of their lands. Easements are a property right, and typically are perpetual. If a landowner later sells the property, the easement continues as part of the title. The structure of such easements would provide permanent protection of existing wildlife habitats while also allowing habitat management or improvements and access to sensitive habitats, such as for endangered species or migratory birds. We would determine, on a case-by-case basis, and negotiate with each landowner, the extent of the rights we would be interested in buying. Those may vary depending on the configuration and location of the parcel, the nature of wildlife activities in the immediate vicinity, the needs of the landowner, and other considerations. In general, easement acquisition would maintain the land in its current configuration with no further subdivision or development.

Properties subject to easements generally remain on the tax rolls and taxes are still paid by the landowner. The Service does not pay refuge revenue sharing (i.e., funds the Service pays to counties in lieu of taxes) on easement rights. Easements generally work best when:

- only minimal management of the resource is needed, but there is a desire to ensure the continuation of current undeveloped uses and to prevent fragmentation over the long term;
- a landowner is interested in maintaining ownership of the land, does not want it to be substantially altered, and would like to realize the benefits of selling development rights;
- current land use regulations do not limit the potential for adverse management practices;

- the protection strategy calls for the creation and maintenance of a conservation area that can be accommodated with passive management; or
- only a portion of the parcel contains lands of interest to the Service.

On easement lands the opportunities for wildlife-dependent public uses, partnerships, or scientific research would be at the discretion of the landowner. These uses would be considered on lands owned in fee title by the Service.

While land owned by the U.S. Government is not taxable by state or local authorities, the Service has a program in place to compensate local governments for foregone tax revenues. The Refuge Revenue Sharing Act of June 15, 1935, as amended (16 U.S.C. 715s) requires the Service to make payments to local taxing authorities, typically counties, to at least partially offset the loss of local tax revenues as a result of federal acquisition of private property. The Service makes annual payments to local taxing authorities, based on the estimated values of lands that the Service owns located in those jurisdictions. The actual Refuge Revenue Sharing payment does vary from year to year because Congress may or may not appropriate sufficient funds to make full payment.

3.3 Priority Species and Protection Priorities

In 1997, the project was focused on protection of a rapidly declining Columbia Bottomlands ecosystem. Since the project is to ensure conservation of a once 700,000-acre ecosystem, it is important the elements of strategic habitat conservation be incorporated to ensure effective conservation. Biological planning requires the identification of priority species, development of population objectives, and identification of landscape-scale threats. The need to conserve the Columbia Bottomlands ecosystem is identified in the following plans and initiatives reviewed by the planning team:

- Texas Conservation Action Plan
- Gulf Coast Joint Venture Mid-coast Initiative Area
- North American Waterfowl Management Plan
- Mottled Duck Conservation Plan
- North American Landbird Conservation Plan
- Partners in Flight- Gulf Coastal Prairie (BCR 37)

In the Texas Conservation Action Plan, four forest types found within the Columbia Bottomlands are listed in the Rare Communities database as vulnerable or imperiled. These are Columbia Bottomlands Ash Flats, Columbia Bottomlands Bald-cypress forest, Upper Texas Coast Live Oak Forest and Water Oak – Live Oak Forest. In addition, Alfisol Coastal Prairie, which is listed as imperiled/critically imperiled is the principle adjacent habitat to the forest and also conserved by the Austin's Woods Conservation Plan. Among the Species of Greatest Conservation Needs, with the Action Plan, 38 species birds, eight species of mammals and 12 species of reptiles and amphibians are found within the Columbia Bottomlands. These include the following vulnerable (V) and imperiled (I) species: Rafinesque's big-eared bat (V), Southeaster myotis (V), mountain lion (I), swallow-tailed kite (I), Bald Eagle (V), northern harrier (V), American woodcock (I), chuck-will's-widow (V), prothonatary warbler (V), worm-

eating warbler (V), Swainson's warbler (V), Louisiana waterthrush (V), grasshopper sparrow (V), Henslow's sparrow (I), eastern box turtle (V), and ornate box turtle (V).

The Gulf Coast Joint Venture has identified population goals for waterfowl. Mallards, wood ducks and hooded mergansers are the primary species that benefit from the forested wetlands of the Columbia Bottomlands. The flooded bayou's, sloughs and swamps within the Columbia Bottomlands provides habitat to meet the 72,819 goal set for mallards in the Mid-coast initiative area. Inland Freshwater lakes and prairie potholes associated with the Columbia Bottomlands provide significant inland freshwater resources for wintering waterfowl. In 2011, following a two-year drought, biologists estimated more than 75,000 ducks on Eagle Nest Lake. The Mottled duck Conservation Plan, identifies "former coastal prairie dominated by active agriculture, idle fields, grazing pastures, seasonal wetlands, and more intensively managed water, delivery" as one of two priority habitats for mottled ducks (Wilson, 2007). These agricultural areas, associated with the Columbia bottomland ecosystem can provide seasonal, semi-permanent, and permanent natural wetlands.

Partners in Flight has determined a list of bird species of high conservation concern for each Bird Conservation Region (BCR). For the Gulf Coastal Prairie (BCR 37), 16 of the 33 species are associated with the Columbia Bottomlands and adjacent prairie habitats. Some species including painted bunting, yellow-billed cuckoo, and acadian flycatchers nest across the bottomlands, whereas prothonotary warbler, Swainson's warbler and summer tanager have a much narrow niche within the bottomlands that are suitable for nesting. The Landbird Working Group for the Gulf Coast Joint Venture selected a subset of the BCR 37 species for which to build a habitat model as a focal species. All three grassland species, northern bobwhite quail, loggerhead shrike and Le Conte's sparrow occur on the bottomland associated prairies. Winter songbird surveys on restored prairies adjacent to the Columbia Bottomlands have shown a significant increase in Le Conte's sparrows over a two-year period, post restoration (USFWS, unpublished data). Nearly 75% of Loggerhead shrikes detected on breeding bird surveys in BCR 37 were in the Texas Mid-coast initiative area.

Bird Conservation Region 37's riverine bottomland hardwood forests are key migration corridors due to their generally rich avian food resources and proximity to the Gulf of Mexico (Vermillian et al. 2008). The Landbird Working Group selected three warbler species to cover the stratification of coastal landbird migration habitat including canopy species (Cerulean), mid-story (golden-winged) and understory species (Swainson's). Specific migration habitat characteristics is difficult to determine, however several generalizations have been made: 1) the more complex habitats support increased bird species richness (Moore et al. 1990); 2) long-term patterns of migrant use along the Gulf of Mexico indicate that the vicinity of Longitude 95 degrees West receives consistent, high use annually (Barrow et al. 2005); and 3) migrating birds exhibit selective use of some habitats over others (Petit 2000). The working group identifies the protection of large (> 10,000 acres) parcels of forested habitats less than 6 miles from the Gulf of Mexico as the number one priority, followed by protection of large parcels beyond 6 miles from the Gulf of Mexico. Conservation of the bottomland forests adjacent to the Gulf of Mexico as stopover and staging habitat for Neartic-Neotropical migrant landbirds is critical for the conservation of these species (Barrow et al. 2005). Mature forests with old growth trees and well developed mid and under stories are the priority habitat. These tracts provide significant edge

habitats from natural openings and gap succession among the intact forest as well as edges created by right of ways and property lines. Secondary to intact forests are those that can restore quickly as previous management has left much of the canopy in place and mid and lower stories can regenerate themselves.

This project is a critical component of the Texas Mid-coast National Wildlife Refuge Complex Comprehensive Conservation Plan (Chapter 4). Specifically it accomplishes the following objectives:

Objective 2 *(Ecoregional Goal)* - Conservation of Columbia Bottomlands Ecosystem
Conserve approximately 1,000-2,500 acres annually through Service acquisition authorities, while working with partners to conserve an overall minimum of 10 percent of the historic Columbia Bottomlands forest.

The Columbia Bottomlands is a unique forested hardwood species ecosystem within the Gulf Cost Prairies and Marshes Ecoregion which extends to within 4 miles of the Gulf of Mexico. This ecosystem, recognized for its importance for migratory songbirds, is threatened by agricultural and commercial development and encroachment of invasive species. Plant and animal diversity is tied to topography, differences in soil, hydrology, and succession stages across the larger landscape. Thereby conservation of tracts spread across the historic ecosystem is required to ensure diversity and functionality of this already fragmented forest is maintained.

Objective 1 (Habitat Management Goal) – Bottomland Hardwood Forests
Manage all bottomland forests to promote natural succession toward old growth stages (80+ year old forest) which increases diversity and reduces the impacts of catastrophic events, including; droughts, wildfire, invasive species and flooding and high winds on species diversity and populations.

Agricultural and commercial development and the encroachment of invasive species continually threaten the Columbia Bottomlands, which is a regionally limited ecosystem. Plant and animal diversity is tied to topography, differences in soil, hydrology, and successional stages across the larger ecosystem rather than to individual tracts. Therefore, conservation of tracts spread across the ecosystem is preferred rather than one large unit. The bottomland forests are critical for migratory songbirds and native wildlife (Barrow, W. et. al. 2000). In addition, the bottomland forests store large amounts of carbon in their foliage, roots, and soil, and offer opportunities for carbon-offsets with local industry (Delaney, M. et. al. 2002). Natural bottomland forests also buffer flooding related to heavy rainfall common on the Texas coast, protecting human communities.

Objective 2 (Habitat Management Goal)– Coastal Prairie
Throughout the life of this CCP, protect, restore and manage 19,000 acres of coastal prairie habitat toward a climax prairie community, while promoting rare endemic species such as prairie coneflower and sharp gay feather through planting or seed dispersal (of refuge produced seed) on 100 acres annually.

Once part of an immense ecosystem covering 9 million acres from Mexico through Texas and into Louisiana, the coastal prairie underwent intensive manmade development starting in the mid-20th century (Allain et. al. 2003) and now totals approximately 250,000 acres in Texas, which includes areas that contain natives prairies species that have been managed and/or restored. Less than 1 percent of (unaltered) natural coastal prairies remain in existence and remaining prairie are continually threatened by agricultural and commercial development, invasive species, and suppression of wildfire (Grace et. al. 2000).

Although the focus of the acquisition program is bottomland forests, the Complex has acquired adjacent prairie habitat in conjunction with the forest on several units; all of which have required restoration. Restoration of prairies presents a variety of challenges including the constant assault of non-native vegetation and their ability to out-compete native flora and introducing a seed source to encourage diversity. The Complex has been successful at rehabilitating disturbed areas into functional, diverse, and productive prairies and producing a native seed source used to continue the restoration process on newly acquired lands.

Objective 2 (Wildlife Goal) – Forest birds
Throughout the life of the CCP, protect and manage existing mature forest and restore units requiring restoration due to cattle grazing, clearing, logging, etc, to provide floral diversity and high stem density at all canopy layers to provide habitat for 80 percent of the following indicator forest breeding bird species (Swainson's, prothonatary and hooded warblers, yellow-breasted chat, acadian flycatcher, barred owl, downy woodpecker, yellow-throated vireo, northern parula, and summer tanager).

The Austin Woods Conservation Plan identifies the need to protect forested habitats in the Columbia Bottomlands for the preservation of migratory birds. For the past ten years, a variety of research and monitoring projects occurred in the bottomlands. These projects generally focus on continuing to gather information on species' habitat associations to aid management in decision making concerning priorities for conservation and restoration of existing units. During migration, bottomland hardwood forest are particularly valuable to a large variety of warblers, vireos, thrushes, tanagers, buntings, goatsuckers, and other forest birds that seek out forest resources after a long flight to recuperate and refuel. In Mississippi, research has demonstrated that neotropical migrants using coastal forests are found in increasing abundance with increasing density of forest trees and increasing numbers of insects in forest understories (Buler et. al. 2007).

Accomplishment of these habitat management objectives are a key focus of management on the Complex and will contribute to the population goals discussed below.

Priority Species

Based on the above plans, the Refuge has selected six priority species to represent a larger group of wildlife species with similar needs in the Columbia Bottomlands and associated habitats; prothonotary warbler, Swainson's warbler, acadian flycatcher, painted bunting, loggerhead shrike, and Le Conte's sparrow. With the exception of the Le Conte's sparrow (wintering

species), Partners in Flight has identified that management actions, including conservation and restoration of habitats, would have an impact on stabilizing or reversing populations decline.

Prothonotary warbler, Swainson's warbler, and Acadian flycatcher
Mature forested bottomlands are the priority habitat. They provide structural complexity to support breeding as well as wintering and transient species. The presence of nesting Swainson's is an indicator of the quality of understory habitat, which is severely impacted by brush-hogging, and cattle grazing within the bottomlands. The presence and number of prothonotary warblers is an indication of the hydrological component on each tract, as they will only nest in the wetter areas. Swainson's warblers require high stem densities and nest in association with heavy concentrations of small trees such as rhododendron (Lanham and Miller 2006) or switchcane or beneath vine tangles with a non-vegetated leaf litter below (Graves 2002). Prothonotary warblers are cavity nesters that select snags in flooded areas and frequently forage in the forest mid-story (Petit 2000).

Unlogged forests with all layers intact provide the greatest densities of Acadian flycatchers (Twedt and Somershoe 2009). For migrating songbirds, it appears that birds probably settle in response to gross habitat features such as vegetation density or stratification and then search for resources based on other factors (Moore and Aborn 2000).

Painted bunting, Loggerhead shrike, and LeConte's sparrow
Degradation and loss of habitat has occurred throughout the prairies along the Texas coast. The San Bernard NWR is part of a small network of conservation lands along the Gulf Coast which offer a remnant of high quality habitat, essential for continued survival. Forest edges as well as the transition zone between forest and prairie provide habitat for loggerhead shrikes and painted buntings to catch food but also nesting habitat along the denser forested edges which provide nest protection. Although originally considered to be a "bonus", bottomland tracts with a prairie component are now a high priority. Although the prairies have been impacted by past agricultural practices, through restoration efforts, we can provide habitat for wintering grassland species, as well as loggerhead shrikes, mottled ducks and hopefully in the future Attwater's prairie-chickens.

Painted bunting nest in the grasslands during the summer, using the cover for nest site concealment and feeding on seeds and insects provided by the variety of prairie plants that exist in non-grazed grasslands. This species benefits from burn timing; which targets woody species and allows nesting birds' time to complete nesting attempts. Loggerhead shrike uses grassland with light scrub or tree components from which it scans for food from perches. Trees and shrubs with ample canopy scattered in large expanses of open area and absence of chemical application are correlated with the presence of this species in some portions of its range (Yosef 1996). LeConte's sparrow overwinter in the coastal prairies associated with the bottomlands. LeConte's sparrows prefer tall grass, sparse to moderate litter, and little woody vegetation (Baldwin 2005).

Together these species represent a mosaic of coastal prairie and grassland habitat associated with the bottomland forest ecosystem to support habitat needs for a number of migrants.

Population Goals

Very limited information is available to set habitat goals for forest breeding birds. Work in the Mississippi Alluvial Valley identified patch sizes required to support 500 nesting pairs of forest breeding birds. These ranged from 4,446 acres for red-eyed vireo to 21,000 acres for white-breasted nuthatches. Although we have not determined patch requirements for the Columbia bottomlands, occurrence data from point counts on a mature bottomland forest show similar trends. Acadian flycatchers, Northern parula, and yellow-billed cuckoo are the most common encountered on point counts on two separate bottomland units. Among breeding birds, Swainson's warbler, hooded warbler, painted bunting, and yellow-throated vireo are encountered less, however, their presence is an indicator of the development of structural diversity. The population goal identified in the CCP is to provide habitat for 80 percent of the indicator forest breeding bird species (Swainson's, prothonatary and hooded warblers, yellow-breasted chat, Acadian flycatcher, barred owl, downy woodpecker, yellow-throated vireo, northern parula, and summer tanager) on a bottomland unit. Dance Bayou (original acquisition 640 acres) has long been considered an excellent representative of old growth habitat from the time of acquisition. Over the past 14 years, point counts have been conducted on the unit.

During drought years, prothonotary warblers and other water associated species are not encountered. However, over time, the species counts have stayed consistent. The McNeal Unit (1,276 acres), prior to being acquired was grazed and under-brushed. Initial point counts for two years on this unit showed that a number of the more rare species (including Swainson's warbler, summer tanager, yellow-throated vireo and prothonotary warbler) were for the most part nonexistent; painted buntings were the only rare species encountered during the first year. In 2012, an updated count was completed. Initial analysis indicates a significant increase in species presence and diversity over a 10-year period. Species present include prothonotary warbler, hooded warbler, and summer tanager. A second year of point counts and further analysis will be completed this year.

Point counts at Dance Bayou indicate that in the best habitat, all indicator species including priority species can be found in mature bottomland forests across 400 acres of a 1,300-acre contiguous forest. Ninety percent of the forest outside the boundaries of the unit have been cleared and are utilized as open pasture creating an isolated forest. Although separated from other forest, the unit appears capable of maintain breeding populations of all forest indicator and priority species identified for the bottomlands.

Partners in Flight population goals for loggerhead shrike are to double the current Texas population by providing habitat for 81,386 pairs in the Mid-coast Initiative Area. The Columbia Bottomlands goal is to provide habitat for 500 pairs, totaling 10,000 acres of suitable habitat including forest/grassland transition areas. From previous research on Brazoria NWR, LeConte's sparrow densities are 2 birds per acre on lands managed for wildlife. Within the Columbia Bottomlands, on suitable habitat, the refuges goal is to maintain this same population density.

Monitoring
For the past ten years, a variety of research and monitoring projects occurred in the bottomlands. These projects generally focus on continuing to gather information on species' habitat associations to aid management in decision making concerning priorities for conservation and restoration of existing units. During migration, bottomland hardwood forest are particularly valuable to a large variety of warblers, vireos, thrushes, tanagers, buntings, goatsuckers, and other forest birds that seek out forest resources after a long flight to recuperate and refuel. In Mississippi, research has demonstrated that neotropical migrants using coastal forests are found in increasing abundance with increasing density of forest trees and increasing numbers of insects in forest understories (Buler et. al. 2007). Research and monitoring associated with this project include wintering forest songbird banding, spring migratory songbird banding, Swainson's and prothonotary warbler nesting, bird call point counts in late winter and spring, and flora inventory.

Protection Priorities

Micro-topography, a result of the movement of historic waterways across the landscape, plays a role in the diversity within the bottomlands. The once vast 700,000-acre forest along the Brazos, San Bernard and Colorado Rivers is a series of patches with varying degrees of diversity today. The larger units are able to encompass more of this topographical diversity and hence provides for a greater suite of bird species. Whenever the opportunity arises to add tracts adjacent to already conserved lands, these are given a priority in order to build larger contiguous units. The existing Service units form corridors along three primary waterways, the Brazos River, the San Bernard River, and the Oyster Creek/Bastrop Bayou drainage. Waterways provide migration corridors for neartic-neotropical birds as they move inland. Having units arrayed along these drainages provides the best possible means of protecting the floral diversity across the landscape as well as provide a series of migratory stopover sites along these waterways.

The Austin's Woods Conservation Plan, approved in 1997, addressed the need for biological integrity of each individual acquired tract as well as the contribution that each tract makes to the integrity of the overall project area. In the Plan, the Service identified 15 criteria for evaluating each proposed new satellite addition to the San Bernard NWR. Although these criteria provided guidance on a macro level for the initial project, additional information on how they impact indicator species has been added. In addition, the criteria have been rewritten as a question and ranked into primary and secondary priorities. In evaluating a parcel, secondary priority criteria will be considered if not all of the primary criteria are met.

Primary Priorities

1. Does the unit provide high quality old growth undisturbed habitat?
   Discussion: Northern parula, and acadian flycatcher are associated with mature trees and utilize the canopy for nesting there. Downy woodpecker is expected in forests of sufficient age to contain rotten limbs and trunks for cavity excavation.

2. Does the unit include exceptional/unique plant communities (e.g., canebrakes, willow swamps, bald cypress swamps, Carolina cherry laurel, (also known as wild peach) stands, rare Brazoria palm stands, and southern red cedar stands, and coastal prairie?

   Discussion: Swainson's Warbler and Hooded Warbler utilize areas with thick groundcover to conceal their nests, located on or near the ground- canebrakes, high densities of cherry laurel, and palm or palmetto stands can be utilized by these species. Prothonotary warbler is strongly associated with water bodies and tends to select nesting cavities in flooded habitats- tracts that contain bayous, ponds, and ash or willow swamps will be most likely to host this species. Southern Red Cedar is an attractive cover plant because of its thick and evergreen nature- when found on forest edges and associated prairies it is a great nest host for Loggerhead Shrike and likely appeals to midstory nesters that utilize trees in edges and gaps, such as yellow-billed cuckoo.

Brazoria Palms are found only in the south central part of the project area near Sweeney, TX

3. Is the size of tract greater than 1,200 acres or does it have the potential to have adjacent lands conserved that would meet this criteria?

   Discussion: Larger parcels ensure the presence of greater diversity. However smaller parcels should not be overlooked especially if they have high biological value and are in proximity to other conserved areas, migration corridors or possess an important biological component for species of concern. The project goal is the protection of a connected landscape of large parcels (10,000 acres) of forested habitats less than 6 miles inland and forests along the primary rivers/creeks, which are utilized as migration corridors, followed by protection of large parcels beyond 6 miles from the Gulf of Mexico.

4. Does the tract compliment, is adjacent to, or near other protected areas, particularly where natural links exist such as the same hydrologic system or seed dispersal corridors?

   Discussion: Acquisition would establish linkage between other protected sites.

private conservation areas enables the protection of lands to establish more than

5. Would acquisition maximize maintenance of natural ecological functions and processes (e.g., natural hydrological patterns)?
   Discussion: Prothonotary Warbler is associated with waterbodies (see above). Manipulations to influence watersheds should be evaluated beforehand for conflicts with existing wildlife communities that could be impacted- examples are Swainson's Warbler and Hooded Warbler. Elimination of Swainson's Warbler habitat by human-induced flooding is documented in scientific literature.

6. Does the unit have a high degree of structural (plant community and topographic) complexity?
   Discussion: Even canopy-associated species such as Northern Parula Warbler and Acadian Flycatcher may benefit from the higher arthropod biomass and soft mast available in a forest with an understory and midstory present. Further, these layers host other species not typically associated with the canopy, such as Hooded Warbler, Swainson's Warbler, and Painted Bunting (all can be treefall gap nesters within the forest). Other species of concern that can utilize two or more layers, such as Yellow-billed Cuckoo, are expected to benefit from the higher food availability and higher nest site availability of mature forests that contain both a midstory and understory. These layers can regenerate over time with rest, on units that have been acquired after underbrushing and some degree of logging activity.

7. Does the unit have great restoration potential with basic ecological processes; natural hydrological components, species presence intact and minimal invasive species?
   Discussion: The majority of the previous acquired parcels have been intact forests. However where restoration has been required, natural revegetation is the primary means by which restoration occurs. Invasive species is the principle issue during restoration and management of existing units.

8. Does the unit influence hydrologic or watershed patterns?
   Discussion: Manipulations to influence watersheds should be evaluated beforehand for conflicts with existing wildlife communities that could be impacted- examples are Swainson's warbler and hooded warbler. Elimination of Swainson's warbler habitat by human-induced flooding is documented in scientific literature.

Secondary Priorities

1. No minimum size, if the majority of criteria are met.

2. Expansion capability
   Discussion: Will acquisition of this site add to adjacent acquisitions or other protection strategies to build a larger unit?

3. Are there other known exceptional biological elements?
   Discussion: An element is an exceptional biological occurrence such as an active bald eagle nest, a rare plant population, or a heron rookery.

4. Human-caused disturbance to the communities (e.g., roads, houses, utility corridors, etc.) present but minimized presence of intact natural biological diversity characteristics of healthy bottomland hardwood forests?

5. Is the unit in proximity to existing developments and threatened with irreversible loss; is there a high potential for public use opportunities?
   Discussion: A good example is the Dow Woods Unit which is within the City Limits of Lake Jackson. The unit was donated to the Service and in cooperation with our Friends group, the Service provides nearly three miles of accessible walking trails where people can still see deer, armadillo and wood ducks and experience nature.

6. Is fragmentation of surrounding habitats minimal?
   Discussion: Even for smaller units (<1500 acres) or units that receive a high degree of human disturbance, factors that could increase ranking for acquisition include: location along a perceived migration corridor such as a river or stream; location adjacent to other desirable forest regardless of ownership; inclusion of unique plant resources such as Florida corkwood and uncommon tree species such as White Oak, Nuttall Oak, or Willow Oak; uncommon wildlife species such as three-toed box turtles, timber rattlesnake, Swallow-tailed Kite; and highly unique wildlife microhabitats such as timber rattlesnake den sites.

7. Does the parcel have good restoration potential with most basic ecological processes; natural hydrological components, species presence intact and invasive species controllable without impacting other components?
   Discussion: Restoration should be primarily by natural succession with species nearby to lend toward diversity. Areas requiring planting or seeding must be minimal.

8. Can the level and kind of current disturbance be minimized through management actions?
   Discussion: Even though nearly all of the bottomland tract have existing pipelines, the Service has be successful in working with companies to minimize the impact of maintenance through, timing maintenance when vulnerable species would be presence or requiring engineering controls to minimize disturbance.

3.4 Acquisition Funding Alternatives

Under the San Bernard NWR's legislative authorities, the Service can acquire lands to be added to the National Wildlife Refuge System from willing sellers and donors through purchase or donation of either fee title or a conservation easement. This project has demonstrated the use of more innovative protection scenarios and accessed more funding sources than perhaps any other

refuge protection project in the nation (see Table 1, page I-8). Funding sources used to date, and which may be used in the future, include the Migratory Bird Conservation Act Fund, the Land and Water Conservation Fund, the National Fish and Wildlife Foundation, the North American Wetlands Conservation Act, the Coastal Impact Assistance Program of the Texas State General Land Office; donations and loans from the Houston Audubon Society, Houston Sierra Club, Gulf Coast Bird Observatory, The Conservation Fund, The Nature Conservancy, Trust for Public Land, Dow Chemical Company, ConocoPhillips Petroleum Company, The John O'Quinn Foundation, and numerous private landowners (plus project partner donations). The Service will continue to work with multiple partners, utilizing a variety of funding mechanisms to facilitate conservation.

3.5 Coordination

Since 1997 when the acquisition began, the Service has developed and nurtured strong partnerships in the area with landowners, public entities, and conservation organizations. The process of identifying, evaluating, and selecting tracts for refuge acquisition involves staff from the Service, TPWD, NFWF, NRCS, ACOE, Texas Commission on Environmental Quality (TCEQ), and county officials. Other partner organizations such as the Trust for Public Land, The Conservation Fund, The Nature Conservancy, as well as local organizations such as the Houston Audubon Society, Houston Sierra Club, Houston Wilderness, the Community Foundation of Brazoria County, and the Gulf Coast Bird Observatory have been essential to the success of this project. Communication with these organizations began with NEPA compliance and collaboration has continued on a regular basis since 1997. As key conservation tracts were added to the Refuge, partners have provided additional support. Their contributions include: funds toward tract acquisitions, providing land consultation services, and holding title to tracts until funding is secured. Of particular importance, in 1999, NFWF established a special fund for the Austin's Woods Conservation Project and provides expert land consultation. Since that initial agreement, NFWF has held in trust and provided several million dollars to the project from private sources and helped administer key public grants. The ACOE and Environmental Protection Agency have provided mitigation funds to NFWF for acquisition. Several local companies including the Dow Chemical Company, Shintech Corporation and ConocoPhillips have donated land to the Service for conservation. Because of the project's and partnerships' successes, opportunities for future collaborations are increasing and will continue to provide non-Service funding. Public support has continued to grow throughout the project's history, as the Service engaged local governments and provided public use opportunities on units near communities.

This LPP being completed as part of The Texas Mid-coast National Wildlife Refuge Complex (Complex) Draft Comprehensive Conservation Plan (CCP), which will be available for public review and comment in the summer of 2012. All comments will be addressed prior to the final decision.

3.6 Sociocultural Impacts

Impacts on Local Population and/or Economy

Refuge lands require very little in the way of services and infrastructure from local governments and often generate tax revenues from tourism. Nature tourism trends will continue to increase as the economy recovers. The refuge's location near Houston has encouraged visitors who want to experience natural areas instead of developed urban environments. Refuge visitors contribute to the local economy through their retail services purchases. Visitors from outside the local area bring an influx of new money to the local economy which stimulates growth and circulation to other economic sectors, such as construction, in the local economy.

The potential exists for some decline in tax revenue to local governments (as lands come under Service ownership). However, this decline may or may not occur, since those lost tax revenues would be at least partially offset by the Service through the Refuge Revenue Sharing Act. The actual Refuge Revenue Sharing payment varies from year to year because Congress may or may not appropriate sufficient funds to make full payment. San Bernard NWR Refuge Revenue Sharing payments for 2010 were $53,891 total to Brazoria, Fort Bend, and Matagorda Counties.

Impacts on Aesthetic and Visual Resources

Expanding population and increasing urban development spreading out from the metropolitan area of Houston, the fouth largest city in the Nation, are causing changes to the former rural nature of the four-county project area. Many city dwellers like the prospect of living in the rural and forested areas of the project area, along with the appeal of less expensive lands than those closer to Houston. Ironically, the urban expansion tends to diminish the rural qualities that attract people in the first place. One result of the refuge is the saving of open spaces that will continue to contribute to the positive perceptions of open spaces of residents and visitors in the project area.

Impacts on Public Use Opportunities

Because the Refuge is located close to Houston, Texas, the fourth largest city in the country, the Service would like to provide public use opportunities at some of the bottomland units. Most visitors come to the Refuge to view wildlife and enjoy nature. The Service will continue to offer public hunting, fishing, wildlife observation and wildlife photography, interpretation and environmental education opportunities as it has on other Austin's Woods units owned by the San Bernard Refuge. Demand for outdoor recreation is high in the greater Houston metropolitan area; however, public use opportunities are limited by a relative lack of public lands (only about 5% of Texas lands are held in federal, state, or

Visitors kayaking on Cedar Lake Creek.

local government ownership-(*LandWatch.com*). Where the Refuge only has a conservation easement, the public is not allowed on the property, unless the landowner approves. Additional lands acquired in fee will offer more public use opportunities than what the Refuge offers now. As it has in the past, the acquisition units selected for public use development are done so only after evaluating the cost/benefit of doing so. These units are generally located near population centers and provide unique observation opportunities.

The refuge must balance wildlife observation opportunities with the conservation and protection of habitats and species. Most newly acquired units will not be open for wildlife observation in order to ensure that the conservation of lands is meeting the purpose for which they were conserved, primarily migratory birds.

Environmental education is a critical first step in providing visitors with an awareness of the refuge and the Refuge System and will ultimately translate into support for the refuge and the Refuge System mission. Environmental education provides a way for people to connect with nature through a "hands on" approach, and provides educational experiences that are not easily gained in a classroom. An environmental education center has been developed at the Hudson's Woods Unit. This has become a popular venue for classes to teach place-based environmental education about the unique habitats of the Columbia Bottomlands. College students have used several of the tracts for research that also benefits the refuge in learning more about the resources and providing impetus for adaptive management of the refuge. Environmental education will continue to be an important public use. The addition of new units will allow for the use of new outdoor "laboratories" for students of all ages.

The Discovery Outpost (right) provides environmental education opportunities for school children and Refuge Junior Naturalists (left) at Hudson Woods. Woods Unit.

Currently the refuge provides 6 miles of trails on four of the existing bottomland units. Associated observation decks, restrooms are provided at two sites. The development of these facilities has been partially funded through grants and donations. Most recently, the Dow Woods Unit, near Lake Jackson provides 2.5 miles of accessible walking trails and was funded with more than $250,000 in grants and donations to the Refuge's Friends Group. New opportunities in the bottomlands, including hunting for deer and feral hogs are being planned through the CCP for the Complex and will be opened following appropriate documentation and NEPA assessment.

References

Allain, L., V. Malcolm , S. Johnston, D. Patton, R.E. Stewart Sr. and N. Milam. 2003. Paradise Lost? The Coastal Prairie of Louisiana and Texas. U.S. Government Printing Office. Pamphlet: Washington, D.C. 39 pp.

Baldwin, H.Q. 2005. Effects of fire on home range size, site fidelity, and habitat associations of grassland birds overwintering in southeast Texas. M.S. thesis. Louisiana State University, 76 pp.

Barrow, W. C., L. A. Johnson-Randall, M. S. Woodrey, J. Cox, E. Ruelas I., C. M. Riley, R. B. Hamilton, and C. Eberly. 2005. Coastal forests of the Gulf of Mexico: a description and thoughts on their conservation. Bird Conservation Implementation and Integration in the Americas: Proceedings of the Third International Partners in Flight Conference, C. J. Ralph and T. D. Rich, editors pp. 450-464.

Buler, J., F. Moore and S. Woltmann. 2007. A Multi-Scale Examination of Stopover Habitat Use by Birds. Ecology 88 (7):1789-1802.

Cornell Laboratory 2012. All about Birds Website (www.allaboutbirds.org/prothonotary _warbler), accessed February 2012

Graves, G.R. 2002. Habitat characteristics in the core breeding range of the Swainson's warbler. Wilson Bulletin 114(2):210-220.

Delaney M., S. Brown and D. Shoch. 2002. The Carbon content of Austin Woods/Columbia bottomland hardwood forests, Winrock International, Arlington VA.

Grace, J.B., L. Allain and C. Allen. 2000. Vegetation Associations in a Rare Community Type- Coastal Tallgrass Prairie. Plant Ecology 147:105-115.

Lanham, J. and S. Miller. 2006. Monotypic Nest Site Selection by Swainson's Warbler in the Mountains of South Carolina. Southeastern Naturalist 5(2):289-294.

Merritt, M. 2012. Personal Communication, Texas Forest Service, January 2012

Moore, F.R., P. Kerlinger, and T.R. Simons. 1990 Stopover on a Gulf coast barrier island by

spring trans-Gulf migrants. Wilson Bulletin 102:487-500

Moore, F.R. and D.A. Aborn. 2000. Mechanisms of en route habitat selection: how do migrants make habitat decisions during stopover? Studies in Avian Biology 20:34-42.

Petit D.R. 2000. Habitat use by landbirds alon nearctic-neotropical migration routes: implication for conservation of stopover habitats. Studies in Avian Biology 20:15-33

Twedt, D., and S. Somershoe. 2009. Bird Response to Prescribed Silvicultural Treatments in Bottomland Hardwood Forests. Journal of Wildlife Management 73(7):1140–1150.

Vermillion, W., J. William Eley, B. Wilson, S. Heath, and M. Parr, 2008 Partners in Flight, Bird Conservation Plan, Gulf Coastal Prairie Bird Conservation Region (BCR 37), Gulf Coast Joint Venture, Gulf Coast Bird Observatory, 78pp.

Wilson, B.C. 2007. North American Waterfowl Management Plan, Gulf Coast Joint Venture: Mottled Duck Conservation Plan. North American Waterfowl Management Plan, Albuquerque, NM. 27 pp. + appendixes.

USFWS 2010. Rising to the Urgent Challenge: Strategic Plan for Responding to Accelerating Climate Change, U.S. Fish and Wildlife Service, Department of Interior.

Yosef, R. 1996. Loggerhead Shrike (*Lanius ludovicianus*). *In* The Birds of North America, No. 231 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

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Appendix K: References

Abell, R.A., D.M. Olson, E. Dinerstein, P.T. Hurley, et al. 2000. Freshwater ecoregions of North America: A Conservation Assessment. Washington, D.C.: Island Press. 368 pp.

Allain, L., V. Malcolm , S. Johnston, D. Patton, R.E. Stewart Sr. and N. Milam. 2003. Paradise Lost? The Coastal Prairie of Louisiana and Texas. U.S. Government Printing Office. Pamphlet: Washington, D.C. 39 pp.

American Oystercatcher Working Group, Erica Nol and Robert C. Humphrey. 2012. American Oystercatcher (*Haematopus palliatus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/082 doi:10.2173/bna.82

Armstrong, Neal E. 1987. The ecology of open-bay bottoms of Texas: a community profile. U.S. Fish and Wildlife Service Biological Report 85(7.12). 104 pp.

Austin, J.E., and A.L. Richert. 2001. A comprehensive review of the observational and site evaluation data of migrant whooping cranes in the United States, 1943-99. U.S. Geological Survey, Northern Prairie Wildlife Research Center, Jamestown, North Dakota, and State Museum, University of Nebraska, Lincoln, Nebraska. 157 pp.

Bailey, V. 1905. Biological survey of Texas. North American Fauna. 25:1-222.

Baldwin, H.Q. 2005. Effects of fire on home range size, site fidelity, and habitat associations of grassland birds overwintering in southeast Texas. M.S. thesis. Louisiana State University, 76 pp.

Barrow, W.C., and I. Renne. 2001. Interactions between migrant landbirds and an invasive exotic plant: the Chinese tallow tree. Flyway 8:11.

Barrow, W.C., L.A. Johnson Randall, M.S. Woodrey, J. Cox, E. Ruelas Inzunza, C.M. Riley, R.B. Hamilton, and C. Eberly. 2005. Coastal forests of the Gulf of Mexico: a description and some thoughts on their conservation. General Technical report PSW-GTR-191, U.S. Department of Agriculture, Forest Service, Washington, D.C.

Behler, J.A., and F.W. King. 1996. Field Guide to North American Reptiles and Amphibians. National Audubon Society. Alfred A. Knopf, New York. 743 pp.

Bisbee, Ron. 2010. Some Recollections on the History of the Texas Mid-Coast Refuge Complex and the Friends of Brazoria Wildlife Refuges. Presented at Partnerships Advanced Training, Texas Master Naturalists – Cradle of Texas Chapter, June 9, 2010.

Bookhout, T.A. 1995. Yellow Rail (*Coturnicops noveboracensis*). *In* The Birds of North America, No. 139 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D.C.

Boutton, T.W., X. Dai, M. Hailemichael, R.J. Ansley and K.E. Jessup. 2006. Soil carbon and nitrogen storage in response to fire in a temperate mixed-grass savanna. Journal of Environmental Quality 35:1620–8.

Bowles D.E. and T.L. Arsuffi. 1993. Karst aquatic ecosystems of the Edwards Plateau region of central Texas, USA: A consideration of their importance, threats to their existence, and efforts for their conservation. Aquatic Conservation: Marine and Freshwater Ecosystems, 3:317-329.

Brennan, L.A. 1999. Northern Bobwhite (*Colinus virginianus*). *In* The Birds of North America, No. 397 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Brennan, L., S. DeMaso, F. Guthery, J. Hardin, C. Kowaleski, S. Lerich, R. Perez, M. Porter, D. Rollins, M. Sams, T. Trail, and D. Wilhelm. 2005. Where have all the quail gone? The Texas quail conservation initiative: a proactive approach to restoring quail populations by improving wildlife habitats. Texas Parks and Wildlife Publication PWD RP W7000-1025.

Brown, R.E., and J.G. Dickson. 1994. Swainson's Warbler (*Limnothlypis swainsonii*). *In* The Birds of North America, No. 126 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Brown, S., C. Hickey, and Harrington, eds. 2001. The U.S. Shorebird Conservation Plan, 2nd ed. Manomet Center for Conservation Sciences: Manomet, MA.

Buehler, D.A. 2000. Bald Eagle (*Haliaeetus leucocephalus*). *In* The Birds of North America, No. 506 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Buler, J., F. Moore and S. Woltmann. 2007. A Multi-Scale Examination of Stopover Habitat Use by Birds. Ecology 88 (7):1789-1802.

Butler, J.A., C. Broadhurst, M. Green, and Z. Mullin. 2004. Nesting, nest predation and hatchling emergence of the Carolina diamondback terrapin, *Malaclemys terrapin centrata*, in northeastern Florida. American Midland Naturalist 152(1):145-155.

Cahoon, D.R., J.W. Day and D.J. Reed. 1999. The influence of surface and shallow subsurface soil processes on wetland elevation, a synthesis. Current Topics in Wetland Biogeochemistry 3:72-88.

Carr Jr., J.T. 1967. The climate and physiography of Texas: Austin, Texas Water Development Board Report 53. 27 pp.

Chipman D. E., "CABEZA DE VACA, ALVAR NUNEZ," *Handbook of Texas Online* (http://www.tshaonline.org/handbook/online/articles/fca06), accessed June 13, 2011. Published by the Texas State Historical Association.

Conner J.V. and R.D. Suttkus. 1986. Zoogeography of freshwater fishes of the western Gulf slope. *In* Hocutt C.H. and E.O. Wiley (Ed.). The zoogeography of North American freshwater fishes (pp. 413-456). New York, NY: John Wiley & Sons.

Corbat, Carol A. and Peter W. Bergstrom. 2000. Wilson's Plover (*Charadrius wilsonia*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/516 doi:10.2173/bna.516

Cryan, P.M., and J.P. Veilleux. 2007. Migration and the use of autumn, winter, and spring roosts by tree bats, pp. 153-175. *In* Bats in Forests: Conservation and Management (M. J. Lacki, J. P. Hayes, and A. Kurta, eds.). The Johns Hopkins University Press, Baltimore, MD.

Deegan, L. A. 1993. Nutrient and energy transport between estuaries and coastal marine ecosystems by fish migration. Canadian Journal of Fisheries and Aquatic Sciences. 50:74-79.

Delaney M., S. Brown and D. Shoch. 2002. The Carbon content of Austin Woods/Columbia bottomland hardwood forests, Winrock International, Arlington VA.

Desrochers, A., and S.J. Hannon. 1997. Gap crossing decisions by forest songbirds during the post-fledging period. Conservation Biology 11:1204-1210.

Draud, M., M. Bossert and S. Zimnavoda. 2004. Predation on hatchling and juvenile diamondback terrapins (*Malaclemys terrapin*) by the Norway rat (*Rattus norvegicus*).

Dyes, J.C. 1993. Nesting birds of the coastal islands: a naturalist's year on Galveston Bay. Austin, TX: University of Texas Press. 137 pp.

Duke, T. and W. L. Kruczynski. 1992. Report on the status and trends of emergent and submerged vegetated habitats of Gulf of Mexico coastal waters. EPA 800-R-92-003.

Dudley, N. (Editor). 2008. Guidelines for Applying Protected Areas Management Categories. Gland, Switzerland: IUCN. 85 pp.

Eddleman, W.R., R.E. Flores, and M.L. Legare. 1994. Black Rail (*Laterallus jamaicensis*).

In The Birds of North America, No. 123 (A. Poole and F. Gill, eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C.: The American Ornithologists' Union.

Elliot, L. and K. McKnight. 2000. U.S. Shorebird Conservation Plan, Lower Mississippi/Western Gulf Coast Shorebird Plan**,** Gulf Coastal Prairie Working Group Mississippi Alluvial Valley/West Gulf Coastal Plain, Lafayette, LA. 64 pp.

Fang, X., and H.G. Stefan. 1998. "Temperature Variability in the Lake Sediments." Water Resources Research, 34(4):717-729.

Farquhar, C.C. 1992. White-tailed Hawk. *In* The Birds of North America, No. 30 (Poole, P. Stettenheim, and F. Gill, eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C.: The American Ornithologists' Union.

Feinberg, J.A., and R.L. Burke. 2003. Nesting ecology and predation of diamondback terrapins, *Malaclemys terrapin*, at Gateway National Recreation Area, New York. Journal of Herpetology 37(3):517-526.

Gabry, S.W. and A.D. Afton. 2000. Effects of winter marsh burning on abundance and nesting activity of Louisiana seaside sparrows in the gulf coast chenier plain. Wilson Bulletin 112(3):365-372.

Gauthreaux, Jr. Sidney A. 2002. Radar Ornithology and Bird Conservation. Available at: http://www.gcbo.org/. Accessed March 27, 2012.

Given, A.M. 2005. Movements and habitat use of wintering yellow rails wintering at the Texas Mid-Coast National Wildlife Refuge Complex in Southeast Texas. M.S. thesis. Cape Gireardeau, MO. Southeastern Missouri State University. 80 pp.

Glass, P. 1994. An analysis of the advisability and need of creating new colonial waterbird nesting islands in Galveston Bay, Texas. Appendix to: Fish and Wildlife Coordination Report Houston-Galveston Navigation Channels, Texas Project. Clear Lake: Texas. 32 pp.

Gochfeld, Michael and Joanna Burger. 1994. Black Skimmer (*Rynchops niger*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/108 doi:10.2173/bna.108

Gosse, D., R. McDowell and R. Evans. 2002. Upper West Gulf Coastal Plan Ecoregional Plan. The Nature Conservancy.

Gosselink, J.G., C. L. Cordes, J. W. Parsons. 1979. An ecological characterization study of the Chenier Plain coastal ecosystem of Louisiana and Texas, Vol. 1–3. U.S. Fish and Wildlife Service, Office of Biological Services, Washington, D.C.

Gould, F.W., G.O. Hoffman, and C.A. Rechenthin. 1960. Vegetational areas of Texas. Texas Agric. Exp. Sta., Leaflet 492:1-4.

Grace, J.B., L. Allain and C. Allen. 2000. Vegetation Associations in a Rare Community Type- Coastal Tallgrass Prairie. Plant Ecology 147:105-115.

Grand, J.B. 1988. Habitat selection and social structure of mottled ducks in a Texas coastal marsh [dissertation]. College Station (TX): Texas A&M University. 79 pp.

Graves, G.R. 2001. Factors governing the distribution of Swainson's warbler along a hydrological gradient in Great Dismal Swamp. Auk 118(3):650-664.

Graves, G.R. 2002. Habitat characteristics in the core breeding range of the Swainson's warbler. Wilson Bulletin 114(2):210-220.

Haig, S.M., and E. Elliott-Smith. 2004. Piping Plover. The Birds of North America Online. (A. Poole, Ed.) Ithaca: Cornell Laboratory of Ornithology; Retrieved from The Birds of North American Online database: http://bna.birds.cornell.edu/BNA/account/Piping_Plover/.

Harrington, B.A. 2001. Red Knot (*Calidris canutus*). *In* The Birds of North America, No. 563 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Haukos, D., P. Walther and J. Neaville. 2004. Status of the Mottled Duck in Louisiana, Texas and Mexico. Report to Region 2 Regional Office, U.S. Fish and Wildlife Service. Albuquerque, NM.

Haukos, D.A. and L.M. Smith. 2004. Plant communities of playa wetlands in the Southern Great Plains. Special Publications, No. 47. Museum of Texas Tech University, Lubbock, TX. 66 pp.

Herkert, J.R., P.D. Vickery and D.E. Kroodsma. 2002. Henslow's Sparrow (*Ammodramus henslowii*). *In* The Birds of North America, No. 672 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences: Philadelphia, PA and The American Ornithologists' Union: Washington, D.C.

Hogan, J.L. 2003. Occurrence of the diamondback terrapin (*Malaclemys terrapin littoralis*) at South Deer Island in Galveston Bay, Texas, April 2001-May 2002. U. S. Geological Survey Open-File Report 03-022. 24 pp.

Howe, M.A. 1989. Migration of radio-marked whooping cranes from the Aransas-Wood Buffalo population: Patterns of habitat use, behavior, and survival. USFWS, Fish Wildl. Tech. Rpt 21. 33 pp.

Igl, L., and B. Ballard. 1999. Habitat Associations of Migrating and Overwintering Grassland Birds in Southern Texas. Condor 101 (4):771-782.

IPCC. 2007. Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Core Writing Team: R.K Pachauri and A. Reisinger, eds. IPCC: Geneva, Switzerland. 104 pp.

IUCN. 2005. World Commission on Protected Areas Strategic Plan.

James, F.C, and H.H. Shugart. 1970. A quantitative method of habitat description. Am. Birds 24:721-736.

Johnson, K.A. and S.A. Temple. 1980. The migration ecology of the whooping crane. Unpublished report prepared under contract 14-16-0009-78-034 to USFWS. U. of Wisconsin, Madison, Wisconsin. 87 pp.

Jones, Jr., J.K., Armstrong, D.M., and J.R. Choate. 1985. Guide to mammals of the plains states. University of Nebraska Press, Lincoln, Nebraska.

Knopf, F.L. 1994. Avian assemblages on altered grasslands. Stud. Avian Biol. 15:247-257.

Kushlan, J.A., M. J. Steinkamp, K. C. Parsons, J. C. Martin, A. Cruz, M. Coulter, I. Davidson, L. Dickson, N. Edelson, R. Elliot, R. M. Erwin, S. Hatch, S. Kress, R. Milko, S. Miller, K. Mills, R. Paul, R. Phillips, J. E. Saliva, B. Sydeman, J. Trapp, J. Wheeler, and K. Wohl. 2002. Waterbird Conservation for the Americas: The North American Waterbird Conservation Plan, Version 1. Waterbird Conservation for the Americas: Washington, D.C. 78 pp.

Kuyt, E. 1992. Aerial radio-tracking of whooping cranes migrating between Wood Buffalo National Park and Aransas National Wildlife Refuge, 1981-84. Occas. Pap. 74, Canadian Wildl. Service. 53 pp.

Lanham, J. and S. Miller. 2006. Monotypic Nest Site Selection by Swainson's Warbler in the Mountains of South Carolina. Southeastern Naturalist 5(2):289-294.

Larkin, T.J. and G.W. Bomar. 1983. Climatic atlas of Texas. Tex. Dep. Water Resources, Austin, TX.

Leezer, C. and C. Britt Bousman. 2006. Archaeological Investigations at the Levi Jordan State Historic Site, Brazoria County, Texas, by Carole Leezer. Principal Investigators: Texas Antiquities Permit No. 3800.

Lockhart, M.L. and B. Freeman. 2004. *The Texas Ornithological Society Handbook of Texas Birds.* Texas A&M University Press. College Station, TX. 261 pp.

Lovejoy, S.B. 1992. Sources and quantities of nutrients entering the Gulf of Mexico from surface waters of the United States. EPA 800-R-92-002.

Lowther, P.E., and R.T. Paul. 2002. Reddish Egret (*Egretta rufescens*). *In* The Birds of North America, No. 633 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Lowther, P.E. 2005. Le Conte's Sparrow (*Ammodramus leconteii*). The Birds of North America Online (A. Poole, ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/224doi:10.2173/bna.224.

Manlove, C.A., B.C. Wilson and C.G. Esslinger. 2002. North American Waterfowl Management Plan, Gulf Coast Joint Venture: Coastal Mississippi Wetlands Initiative. North American Waterfowl Management Plan. Albuquerque, N.M. 28 pp.

Manning, R.E. 1989. Social research in wilderness. *In* Wilderness Benchmark 1988. Proceedings of the National Wilderness Colloquium. Asheville, North Carolina: Southeastern Forest Experiment Station.

McMahon, G., S.M. Gregonis, S.W. Waltman, J.M. Omernik, T.D. Thorson, J.A. Freeouf, A.H. Rorick, and J.E. Keys. 2001. Developing a spatial framework of common ecological regions for the conterminous United States. Environmental Management 28(3):293-316.

Merrit, K. 1981. Mottled duck pair counts. San Bernard National Wildlife Refuge. 6 pp.

Meyer, K.D. 1995. Swallow-tailed Kite (*Elanoides forficatus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/138 doi:10.2173/bna.138

Miller, S.M. 2003. First report of a double-brooded Swainson's warbler. Wilson Bulletin 115(1):94-95.

Mirande, C., R. Lacy and U. Seal. 1993. Whooping Crane (*Grus americana*) conservation viability assessment workshop report. Captive Breeding Specialist Group, International Union for Conservation of Nature. Apple Valley, MN.

Moore, F.R. and D.A. Aborn. 2000. Mechanisms of en route habitat selection: how do migrants make habitat decisions during stopover? Studies in Avian Biology 20:34-42.

Moorman, T.E., and P.N. Gray. 1994. Mottled Duck. *In* The Birds of North America, No. 81 (A. Poole and F. Gill, eds.), Philadelphia, PA and The Academy of Natural Sciences; Washington, D.C.: The American Ornithologists' Union.

Moulton, D.W., T.E. Dahl, and D.M. Dall. 1997. Texas Coastal Wetlands. Status Trends, Mid 1950s to early 1990s. 79 pp.

National Marine Protected Areas Center (NMPAC). 2009. National Marine Protected Areas Center Strategic Plan 2010 – 2015. Available at: http://www.mpa.gov.

North American Bird Conservation Initiative, U.S. Committee. 2009. The State of the Birds, United States of America, 2009. U.S. Department of Interior. Washington, D.C. 36 pp.

Nemec, K. 1995. The diamondback terrapin. Public outreach handout. U.S. Fish and Wildlife Service. Clear Lake, Texas. 2 pp.

Oberholser, H.C., E.B. Kincaid, Jr. 1974. The Bird Life of Texas. University of Austin Press. Austin, TX. 1100 pp.

Omernik, J.M., S.S. Chapman, R.A. Lillie, and R.T. Dumke. 2000. Ecoregions of Wisconsin. Transactions of the Wisconsin Acadamy of Sciences, Arts, and Letters 88:77-103.

Page, Gary W., Lynne E. Stenzel, G. W. Page, J. S. Warriner, J. C. Warriner and P. W. Paton. 2009. Snowy Plover (*Charadrius nivosus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/154 doi:10.2173/bna.154

Paul, R.T. 1991. Status report – *Egretta rufescens* (Gmelin) Reddish Egret. U.S. Fish and Wildlife Service, Houston, TX. 73 pp.

Peters, K.A., R.A. Lancia, and J.A. Gerwin. 2005. Research notes. Swainson's warbler habitat selection in a managed bottomland hardwood forest. Journal of Wildlife Management 69 (1):409-417.

Pilchek, T. 2001. Personal Communication. Texas Parks and Wildlife, Private Lands Biologist.

Post, W. 1974. Functional analysis of space related behavior in the seaside sparrow. Ecology 55:564-575.

Post, W. and J.S. Greenlaw. 2009. Seaside sparrow (*Ammodramus maritimus*), The birds of North America online. (A. Poole, ed.), Ithaca: Cornell Lab of Ornithology. Retrieved from the birds of North America online: http://bna.birds.cornell.edu/bna/species/127doi:10.2173/bna.127.

Rich, T.D., C.J. Beardmore, H. Berlanga, P.J. Blancher, M.S. W. Bradstreet, G.S. Butcher, D.W. Demarest, E.H. Dunn, W.C. Hunter, E.E. Iñigo-Elias, J.A. Kennedy, A.M. Martell, A.O. Panjabi, D.N. Pashley, K.V. Rosenberg, C.M. Rustay, J.S. Wendt and T.C. Will. 2004. Partners in Flight North American Landbird Conservation Plan.

Cornell Lab of Ornithology. Ithaca, NY. Partners in Flight website: http://www.partnersinflight.org/cont_plan/. Accessed March 2005.

Ricketts, T.H., E. Dinerstein, D.M. Olsen, C.J. Loucks, W. Eichbaum, D.DellaSala, K. Kavanagh, P. Hedao, P.T. Hurley, K.M. Carney, R. Abell, and S. Walters. 1999. Terrestrial ecoregions of North America. Island Press, Washington, D.C., USA.

Ricklis, R.A. 1997. The Karankawa Indians; ecological study of cultural tradition and change. Austin, TX. University of Texas Press. 231 pp.

Robbins, C.S. 1983. Distribution and migration of seaside sparrow. *In* T.L. Quay, J.B. Funderburg, Jr., D.S. Lee, E.F. Potter, and C.S. Robbins, eds. *The Seaside Sparrow, its Biology and Management.* Occas. Paps. North Carolina Biol. Surv. Raleigh, NC. USA. pp. 31-40.

Robbins, M.B. and B.C. Dale. 1999. Sprague's Pipit (*Anthus spragueii*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/439 doi:10.2173/bna.439

Rush, S., E. Soehren, M. Woodrey, C. Graydon, and R. Cooper. 2009. Occupancy of Select Marsh Birds within Northern Gulf of Mexico Tidal Marsh: Current Estimates and Projected Change. Wetlands, 29(3):798-808.

Ryder, R.A., and D.E. Manry. 1994. White-faced Ibis (*Plegadis chihi*). *In* The Birds of North America, No. 130 (A. Poole and F. Gill, eds.). Philadelphia, PA. The Academy of Natural Sciences; Washington, D.C. The American Ornithologists' Union.

Salwasser, H., S.P. Mealey and K. Johnson. 1984. Wildlife population viability: a question of risk. Transactions of the North American Wildlife and Natural Resource Conference 49.

Shields, M. 2002. Brown Pelican (*Pelecanus occidentalis*). *In* The Birds of North America, No. 609 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Smeins, F.E., D.D. Diamond, and W. Hanselka. 1991. Coastal prairie, in Ecosystems of the world, natural grasslands. R.T. Coupland (Editor), Amsterdam: Elsevier Press.

Speer, R. 1995. Spring shorebird use at Brazoria National Wildlife Refuge Complex, Texas. Progress report available from U.S. Fish and Wildlife Service, Texas Mid-Coast NWRC. 22 pp.

Sprigg, W.A. and T. Hinkley. 2000. *Preparing for a Changing Climate: The Potential of Climate Variability and Change – Southwest.* A Report of the Southwest Regional Assessment Group. Institute for the Study of Planet Earth, Tucson, AZ. Available at: http://www.ispe.arizona.edu/research/swassess/report.html.

Stahlecker, D.A. 1992. Using national wetlands inventory maps to quantify whooping crane stopover habitat in Oklahoma. Proc. N. Am. Crane Workshop 6:62-68.

Stauffer, D.F. and L.B. Best. 1980. Habitat selection by birds of riparian communities: evaluating effects of habitat alterations. Journal of Wildlife Management. 44:l-l 5.

Stephen, W.J.D. 1979. Whooping crane sightings in Prairie Provinces 1977 and 1978. Blue Jay 37:163-168.

Stewart, R.E. 1975. Breeding birds of North Dakota. Harrison Smith, Lund Press. Minneapolis, MN. 295 pp.

Stutzenbaker, C.D. 1988. The Mottled Duck: its life history, ecology and management. Texas Parks and Wildlife Department, Austin, TX. 209 pp.

Tassone, J.F. 1981. Utility of hardwood leave strips for breeding birds in Virginia's central Piedmont. M.S. Thesis. Virginia Polytech. Inst and State Univ., Blacksburg, Virginia. 83 pp.

Texas Comptroller of Public Accounts, 2009. Texas In Focus: Gulf Coast Region. 66 pp.

Texas Comptroller of Public Accounts, 2010. Texas In Focus: Gulf Coast Region. 70 pp.

Texas Parks and Wildlife Department. 2005. Texas Wildlife Action Plan. Austin: Texas. 1100 pp.

Texas Parks and Wildlife Department – Wildlife Fact Sheet. Available at: www.tpwd.state.tx.us/huntwild/wild/species.

The Nature Conservancy. 2002. The Gulf Coast Prairies and Marshes Ecoregional Conservation Plan. Gulf Coast Prairies and Marshes Ecoregional Planning Team, The Nature Conservancy, San Antonio, TX, USA. 27 pp.

Thatcher, B.S., D.G. Krementz and M.S. Woodrey. 2006. Henslow's Sparrow winter survival estimates and response to prescribed burning. Journal of Wildlife Management 70(1):198-206.

Twedt, D., and S. Somershoe. 2009. Bird Response to Prescribed Silvicultural Treatments in Bottomland Hardwood Forests. Journal of Wildlife Management 73(7):1140–1150.

Twilley, R. et al. 2001. Confronting climate change in the Gulf Coast Region: Prospects for Sustaining our Ecological Heritage: A report of the Union of Concerned Scientists and the Ecological Society of America. UCS Publications, Cambridge, MA.

UNEP. 2008. Summary of protection by Country and Territory on January 31, 2008 (XLS). World Database on Protected Areas. Available at: http://www.unep.

U.S. Department of Agriculture. 2007. United States Department of Agriculture Ag Census Report. National Agricultural Statistic Service: questions and answers. Available at: http://www.agcensus.usda.gov/Publications/2007/Full_Report/CenV1US1.txt.

U.S. Environmental Protection Agency. AirCompare Report. Available at: http://www.epa.gov.

U.S. Department of Energy, Office of Science. 1999. Carbon Sequestration Research and Development. 26 pp.

U.S. Department of the Interior. 2006. Wetland Status of the Texas Gulf Coast. U.S. Geological Survey, National Wetlands Research Center: Lafayette, LA. Available at: http://www.nwrc.usgs.gov/ factshts/019-00.pdf.

U.S. Fish and Wildlife Service. 1956. Memo dated May 17, 1956.

U.S. Fish and Wildlife Service. 1956. Memo dated July 20, 1956, from George E. Barclay Regional Supervisor, Branch of Wildlife Refuges, to John C. Gatlin, Regional Director, Region 2. Albuquerque, NM.

U.S. Fish and Wildlife Service. 1963. Biological Reconnaissance Report. San Bernard National Wildlife Refuge. May 6, 1963.

U.S. Fish and Wildlife Service. 1963. Memo dated October 21, 1963.

U.S. Fish and Wildlife Service. 1965. Biological Reconnaissance Report. Brazoria National Wildlife Refuge. April 1965.

U.S. Fish and Wildlife Service. 1965. Proposal to Migratory Bird Conservation Commission.

U.S. Fish and Wildlife Service. 1981. Final Environmental Impact Statement for the Proposed Acquisition of Big Boggy Marsh, Matagorda, Texas.

U.S. Fish and Wildlife Service. 1981. Memo to Senator John G. Tower.

U.S. Fish and Wildlife Service. 1982. Mottled duck nesting investigation, San Bernard National Wildlife Refuge. 25 pp.

U.S. Fish and Wildlife Service. 1994. Whooping Crane Recovery Plan. Albuquerque, NM. 92 pp.

U.S. Fish and Wildlife Service. 1997. Final Proposed Austin's Woods Conservation Plan, Land Protection Compliance Document and Conceptual Management Plan - Austin's Woods Units of the Brazoria national Wildlife Refuge Complex. Southwest Region, Albuquerque, NM. April 1997.

U.S. Fish and Wildlife Service. 2001. Endangered and threatened wildlife and plans; final determination of critical habitat for wintering piping plovers. Final Rule. Federal Register 66(132) 50 CFR Part 17.

U.S. Fish and Wildlife Service. 2006. National Survey – 15 Year Trend Information. Available at: http://wsfrprograms.fws.gov/subpages/NationalSurvey/15_year_trend.htm. Accessed April 2011.

U.S. Fish and Wildlife Service. 2006. Strategic Habitat Conservation: Final Report of the National Ecological Assessment Team. Arlington, VA. 45 pp.

U.S. Fish and Wildlife Service. 2009. Texas Mid-coast Refuge Complex: Trends and Predicted Sea Level Rise Impacts to Coastal Wetlands. Southwest Region, Albuquerque, NM. 37 pp.

U.S. Fish and Wildlife Service. 2009b. Texas Mid-Coast Refuge Complex, Brazoria and Matagorda Counties, TX, Endangered Wildlife and Plants; Permits, Sacramento, Delevan, Colusa, and Sutter National Wildlife Refuges, Glenn, Colusa, and Sutter Counties, CA. 74 Federal Register 119 (23 June 2009) 29714-5.

U.S. Fish and Wildlife Service. 2010. Rising to the Challenge: Strategic Plan for Responding to Accelerating Climate Change. U.S. Fish and Wildlife Service, Arlington, VA.

U.S. Fish and Wildlife Service. Piping Plover Critical Habitat: questions and answers. Available at: http://www.fws.gov/plover/q&a.html.

U.S. Fish and Wildlife Service. United States Fish and Wildlife Service. Available at: http://wsfrprograms.fws.gov/ subpages/National Survey/15_year_trend.htm. Accessed April 2011.

U.S. General Accounting Office. 2001. GAO-02-64R Wildlife Refuge Oil and Gas Activity. Available at: http://www.gao.gov/search?q=oil+andgas+refuge.

U.S. Geological Survey. 1973. Report 163. Texas Department Water Resources. 40 pp.

U.S. Geological Survey. 2001. A Primer on Water Quality. Available at:

http://pubs.usgs.gov/fs/fs-027-01/.

U.S. North American Bird Conservation Initiative Committee. 2000. North American Bird Conservation Initiative: Bird Conservation Region Descriptions. U.S. Fish and Wildlife Service, Division of Bird Habitat Conservation: Arlington, VA.

Webb, J.W. 1997. Columbia Bottomlands avifauna habitat inventory: Phase II. Gulf Coast Bird Observatory, Lake Jackson, Texas. 24 pp.

Werler, J. E., and J. R. Dixon. 2000. Texas snakes: identification, distribution, and natural history. Austin, TX: University of Texas Press. 437 pp.

White, W.A., and Paine, J.G. 1992. Wetland plant communities, Galveston Bay System: Galveston Bay National Estuary Program, Publication GBNEP-16. 124 pp.

Wilson, B.C., and C.G. Esslinger. 2002. North American Waterfowl Management Plan, Gulf Coast Joint Venture: Texas Mid-Coast Initiative. North American Waterfowl Management Plan, Albuquerque, NM. 28 pp.

Yosef, R. 1996. Loggerhead Shrike (*Lanius ludovicianus*). *In* The Birds of North America, No. 231 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

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Appendix L. Service Response to Public Comment

This appendix summarizes the comments that were received on the Draft Comprehensive Conservation Plan and Environmental Assessment (CCP/EA) for Texas Mid-coast National Wildlife Refuge Complex. The Draft CCP/ EA was released for public review and comment from August 15,2012 to September 20, 2012. The public was notified of the release of the Draft CCP and EA with a Notice of Availability in the *Federal Register* on August 15, 2012 (Volume 77, Number 158, pp. 49011-49015) and again on August 21, 2012 (Volume 77, Number 162, pp. 50523-50526) because the incorrect comment period end date was published in the first notice. Notification was also provided through local media outlets (local newspapers, radio station, and television) and public notices that were posted at all refuge offices.

The document was made available to approximately 170 individuals, organizations, elected officials, and local, state, and federal agencies; and an electronic copy was made available on the Service's website. An open house was held during the comment period (on August 29, 2012) at the Complex headquarters, providing the public with an opportunity to discuss the plan with Service staff. Despite being heavily advertised, only eight individuals attended this event; no comments were submitted at the open house meeting. The Service received a total of four written comments (three via email and one letter from the Houston Regional Group of the Sierra Club). The comments received and the Service's responses are as follows.

E-mail Comment 1 (associated with Brazosport Birders):
I found a few mistakes:

3.6.1.4 Partnerships page 3-93
Add Brazosport Birders (we provided open house volunteers for Brazoria National Wildlife Refuge for over 20 years and provide volunteers still for different projects, including keeping the bird checklist up to date).

Page 3-65
Caption under photo should read Gulf Coast Bird Observatory, not Gulf Coast Observatory.

5.6.1.7 Gulf Coast Bird Observatory
Remove "Participate in Texas Birding Classic". We are no longer associated with the Classic.

I have also contacted Jennifer about adding a section about utilizing the refuges for the Christmas Bird Counts of Brazoria, Brazos Bend, Freeport, and San Bernard.

Response:
Thank you for your comments. Corrections to the identified sections were made as suggested.

E-mail Comment 2 (associated with Friends of Brazoria Wildlife Refuges):
What a wonderful set of documents you have created with the TMCNWRC CCP and EA plans! Their scope is truly impressive and encompassing, and they will be a valued reference resource for understanding the path of managing our refuges over the next 15 years. I am sure that I and

other members of the Friends board of directors will be wearing pages out as we frequently use these documents to organize our part of support for the Texas Mid-coast NWRs.

After ten hours of reading, I admit that I reverted to scanning the documents, pausing to read in detail those areas where I am engaged or find of particular interest. I only found two typos: Page 2-10: Columia should be Columbia. southern most should be southern-most.

I was personally pleased to see three of my photos used in the CCP document: Page 3-82, Seining; Page 3-83 Crabbing; and Page 3-127 Pond Life.

Table 3-12 is missing the Dow Woods Bayou Loop Trail.

I am a student of climate, and so paid particular attention to these sections. On the future trajectory of climate impacts, we disagree. In looking at your climate assumptions, I am reminded of a quote attributed by Daniel Patrick Moynihan, to paraphrase, "You are entitled to your own opinion, but you are not entitled to your own facts."

To wit: Page 1-15: "The U.N. Intergovernmental Panel on Climate Change (IPCC) reports that direct temperature measurements at weather stations worldwide suggest that the surface of Earth has warmed, on average, 34°F in the last 100 years (IPCC, 2007). Data for the Southwest show an increase in temperature of 34°F to 35°F during the past century and project an increase in temperature of 40.1°F to 43°F in the future." That's +18.9 ^{O}C rising to +23.9 ^{O}C! The peak of the last interglacial (Eemian) briefly rose to 5 ^{O}C above today, so your claim to an ~ 20 ^{O}C rise in 100 years is incredible! So your temperature numbers are incorrect and did not come from the IPCC. The 2007 IPCC TR4, section 3.1, "...surface temperatures have increased by about 0.74 ^{O}C over the past hundred years (between 1906 and 2005)...", i.e. = 1.35 ^{O}F. The computer models used by the IPCC project an energy imbalance of 3.7 W/m2 for a doubling of CO_2, which yields a temperature gain of between 1.5 ^{O}C and 4.5 ^{O}C, with the most common estimates being around +2.5-3.0 ^{O}C.

Page 1-15: "The last ten years have been the warmest decade on record, during which global sea level has risen about 8 inches."

The 2007 IPCC TR4, FAQ 5.1, "Estimates for the 20th century show that global average sea level rose at a rate of about 1.7 mm per year." = 6.7 inches for those 100 years as opposed to your misstated 8 inches in ten years. Houston & Dean, 2007 provide updated numbers through 2010 and show no acceleration in SLR. Another source, report a 3.2 mm/yr SLR in the last decade = 1.3 inches; see http://sealevel.colorado.edu/current/sl_noib_global_sm.jpg .

Since there is nothing the Complex can do to mitigate the warming of the globe, and since adaptive measures will be taken in the management of our refuges to SLR, your climate sections are really a case of no harm, no foul. In the process, we can rejoice that the increase of CO_2 is fertilizing plant growth.

Response:
Thank you for your comments and support.

The typographical errors identified on page 2-10 were corrected as suggested and the Bayou Loop Trail was added to Table 3-12.

According to Service policy, the pictures taken by refuge volunteers belong to the Service, so photo credit is shown as USFWS; however, we acknowledge that the photos shown on pages 3-82 (Seining), 3-83 (Crabbing), and 3-127 (Pond Life) were taken by refuge volunteer, Marty Cornell. We appreciate the assistance and support provided by all of our volunteers.

Thank you for pointing out the errors presented in the second paragraph of section 1.3.3.1 (Climate Change). The incorrect numbers were mistakenly included in the second paragraph of that section; it has have been corrected as follows.

"The U.N. Intergovernmental Panel on Climate Change (IPCC) reports that direct temperature measurements at weather stations world-wide suggest that the surface of Earth has warmed, on average, 1.0 °C (1.8 °F) in the last 100 years (IPCC 2007). Data for the Southwest show an increase in temperature between 1.1°C (2 °F) to 1.7°C (3.1 °F) during the past century and project an increase in temperature of 4.5°C (8.1 °F) to 6.1°C (11 °F) in the future (Sprigg and Hinkey 2000). Estimates for the 20th century show that global average sea level rose at a rate of about 1.7 mm per year, which equals 17.0 centimeters (6.7 inches) for those 100 years. The increase of carbon dioxide (CO2) within the earth's atmosphere has been linked to the gradual rise in surface temperature commonly referred to as global warming. The IPCC also concludes that substantial increases in global average temperatures will cause major changes in ecosystem structure and function, species' ecological interactions, and species' geographical ranges. These projected changes have enormous implications for management of fish, wildlife, and their habitats around the world. "

Email comment 3:
While Defenders of Wildlife is not able to submit detailed comment on the draft CCP, they would like the Refuge to refer to criteria developed in the Defenders of Wildlife fact sheet "Climate Change and National Wildlife Refuge Planning" to ensure that climate change is comprehensively considered and addressed.

Response 6: The Refuge reviewed the Defenders of Wildlife fact sheet and using best available data, integrated climate change throughout the CCP. For more information, please refer to the following sections of the CCP:

- Section 1.1, Purpose and Need for the CCP
- Section 1.3.3.1, Climate Change
- Section 1.3.3.2, Strategic Habitat Conservation and Gulf Coast Prairie Landscape Conservation Cooperative
- Section 1.3.3.3, National Conservation Plans and Initiatives
- Section 2.3.1, Ecoregion Issues
- Section 3.3.1.5, Estimated Future Habitat Conditions due to Climate Change
- Section 3.3.1.6. Concerns Regarding Refuge Habitat
- Section 3.3.2.9, Concerns Regarding Wildlife Populations

- Section 3.6.5.4, Concerns Regarding Special Management Areas
- Chapter 4, Ecoregional Objective 1
- Appendix I, Land Protection Plan for Austin's Woods

The following comments were received from the Sierra Club:
Note: The following sentence was included at the end of each comment within the commentors letter. "The public must have this information so that it can review, comment on, and understand all the environmental impacts of the CCP." In an attempt to streamline this appendix, this sentence has been removed from each comment listed below; we do not feel it is helpful to repeatedly mention this sentence throughout this appendix. Otherwise, the comments are shown verbatim, followed by the Service response.

Comment 1:
Page 1-16, 1.3.3.2 Strategic Habitat Conservation and Gulf Coast Prairie Landscape Conservation Cooperative, are targets and goals the same thing? If not how do they relate to each other? Please be specific.

Response: Targets and goals are the same in this situation. In section 1.3.3.2, under the five key principles of SHCs we have changed "setting targets" to "setting goals" to avoid confusion.

Comment 2:
Page 2-5, Table 2-3, Addressing the Issues Raised During Scoping, Issues that are outside the scope of this Plan, urbanization and development, stream channelization, and reintroduction of species are listed as outside the scope of the CCP. However, depending on the exact set of circumstance these three issues may be appropriately found inside the scope of the CCP.

For instance, if urbanization and development affects the Complex, like is noted with wildland-urban interface and fire or other affects on the Complex then this issue should be addressed in this CCP. In addition, there are drainage districts that want to claim an easement through federal property to dredge a natural channel deeper and wider and which alter the hydrology beyond the Complex and affects the hydrology on the Complex. In addition, an easement that the FWS has on Cedar Lake Creek has been the focus of a management controversy between the landowner and the drainage district.

Further, the CCP talks about the reintroduction of species both endangered and other species (American Bison). Reintroduction of species should in the Complex be covered in the CCP.

Response:
Thank you. In response to your comment, we reviewed the table and particularly the issues outside of the scope of this CCP. We moved urbanization and development in to the category of addressed by the CCP. This decision is based on the inclusion of the Land Protection Plan in Appendix I. By providing a conservation alternative to a land owner interested in selling their land, the Service does address this issue. However the Complex has no authority with regards to stream channelization outside of the refuge boundaries. Within the boundaries of the refuge,

including conservation easements, the Complex would address any request for bank clearing and channelization through the Appropriate Use and Compatibility Policies. The Complex does not have enough information regarding plans or impacts to fully evaluate reintroduction of any species at this time. The Complex has not been identified for the reintroduction of any endangered species other than as a possibility to be evaluated. If the Service chooses to do so in the future, planning, including additional NEPA will need to be completed.

Comment 3:
Page 2-9, Erosion, FWS should mention the Gulf Intracoastal Waterway (GIWW) now since later in the CCP (page 8-85, "The GIWW is a major source of erosion, leading to saltwater intrusion and the subsequent degradation of freshwater marshes. This project affects all three refuges in the Complex"; page 3-5, "... and the Gulf Intracoastal Waterway has had significant impacts on coastal marshes"; page 3-45, "Erosion along the edges of the GIWW has been significant since it was first dredged ... However acres of marsh are lost annually as vessel wakes, tides, and wind driven wave-action erode fine marsh sediments along exposed shorelines"; and page 3-49, "The GIWW is now three to four times wider than when originally dredged. This equates to a direct loss of marsh habitat as well as opening up channels into once isolated wetlands.") FWS identifies the GIWW as one of the major reasons for erosion on the Complex. The Sierra Club believes that stopping this erosion on all three refuges should be one of the number one priorities of the Complex.

Response:
Thank you for your comment. We have added the GIWW to the erosion issue statement on page 2-9 as suggested. The Service has no control over the use or maintenance of the GIWW; the erosion problems identified in the CCP are outside of our management authority. The Service will continue use best management practices and address/minimize potential erosion for management actions on refuge lands.

Comment 4:
Page 2-9, Land Management and Other Land Use Practices, the CCP states "in addition ... is solely determined by the Water Development Boards." What boards is FWS referring to? Please be specific.

Response:
Thank you for your comment. The last sentence of the Land Management and Other Land Use Practices issue statement on page 2-9 was clarified; Water Development Boards was changed to River Authorities.

Comment 5:
Page 3-8, Marine Environments, the CCP mentions "Gulf sturgeon". The FWS should state how the Gulf Sturgeon is doing and whether management of the Complex can assist in the recovery of this vanishing fish.

Response:
Thank you for your comment. The Gulf sturgeon only occurs in the eastern region of the northern Gulf of Mexico. It has never been known to occur in the western subregion (south of

Galveston Bay) of the northern Gulf of Mexico. The Complex does not play a role in the recovery of this species since it is outside of the none or historical range of the Gulf Sturgeon.

Comment 6:
Page 3-31, Environmental Contaminants, FWS does not mention in the CCP Hoskins Mounds and the controversy about contaminants on this 2,500 acre in-holding that Chevron is required by deed to give to the FWS. The Sierra Club is very concerned that the FWS never even mentions Hoskins Mounds as a viable acquisition and why it has refused to accept this donation. It is the Sierra Club's understanding that there are no contaminant issues left at Hoskins Mound but that the FWS regional office is afraid that there might be hidden contaminant issues. Chevron has conducted its due diligence and cleaned up the area and FWS must accept the donation of this key in-holding. The CCP must talk about Hoskins Mound and its status. The acquisition of Hoskins Mound should be a goal of this CCP.

Response:
Thank you for your comment. No change has been made in response to your comment; this section reviews environmental contaminant or sources of potential contamination that could affect the refuge. Other than from the oil and gas operations, the Complex does not consider the Hoskins Mound in-holding a potential for contamination. The Complex shares your concerns regarding the future of this substantial in-holding. This property being completely surrounded by the refuge as well as the unique habitat resources, does make it a priority for acquisition. The Service has completed a baseline study on the property, which should aid in moving forward with acquisition, if in the future, Chevron Texaco chose to dispose of this property.

Comment 7:
Page 3-48, 3.3.1.5 Estimated Future Habitat Conditions due to Climate Change, the Sierra Club appreciates that the FWS has provided a detailed discussion about the potential impacts of climate change on the Complex. What does "would function at a level 24 of long-term productivity" mean?

Response:
Thank you for your comment. The phrase reference above was an editorial error. That sentence, which is toward the end of the third paragraph in section 3.3.1.5 has been clarified. It now reads as "…would function at a level where productivity would offset predicted losses."

Comment 8:
Page 3·52, Habitat Fragmentation, the CCP states"... these rights-of-way … enable the transport and introduction of invasive species, direct take of wildlife, and alteration of adjacent habitats increase light reaching the canopy floor alters species composition." It is important that the FWS talk about how these impacts will be reduced. The same is true for livestock grazing which can introduce non-native invasive plant species. What does FWS plan to do to combat this impact due to ROWs and livestock grazing? Be specific.

Response:
Thank you for your comment. The Service considers each request for right-of-way or other permits on a case-by-case basis and stipulations are included in the permit to avoid and minimized impacts. For clarification, the following sentence was added to the Habitat

Fragmentation paragraph on page 3-52.

"Due to these policies no new pipeline right-of-ways have been constructed through bottomland habitats that have been acquired by the Service."

Comment 9:
Page 3-57, Smalltooth Sawfish, the Sierra Club urges the FWS to do everything it can to assist in the recovery, including reintroduction, of the Smalltooth Sawfish into Texas waters at the Complex and other coastal habitats.

Response:
Thank you for your comment. As explained in our response to comment #2, reintroductions of threatened and endangered species on the Complex are not planned at this time and are outside the scope of this CCP.

Comment 10:
Page 3·67, 3.3.2.2 Focal/Representative Species, FWS should state how the focal species it will use were chosen over other species. The public should be given more information. For instance, the U.S. Forest Service provided a public comment period on its proposal to change its indicator species.

Response:
Thank you for your comment. Information was added to the introductory paragraph of section 3.3.2.2, to help clarify the selection of focal species. The selection was made through an evaluation of the ecological significance, management significance, policy mandates and our effect this species through management actions as outlined in the Strategic Habitat Conservation Technical Implementation Guide. This list should be considered flexible but the current species helped to guide the goals, objectives and strategies found in the CCP.

Comment 11:
Page 3-93, 3.6.1.4 Partnerships, the Sierra Club should be listed as a partner.

Response:
Thank you for your comment. The Sierra Club was added to section 3.6.1.4 as requested.

Comment 12:
Page 3-93, 3.6.1.6 Law Enforcement and Resource Protection, the Sierra Club supports the addition of at least three additional law enforcement positions so that the very sprawled-out Complex can be covered fully.

Response:
The Service appreciates your support for additional law enforcement personnel. Table 5-2 identifies personnel needed beyond current levels to implement our proposed action identified in the CCP.

Comment 13:
Page 3-104, Haying, the CCP should show where "prescribed fire cannot be implemented due

to an expansion of WUI areas" and how many acres and linear feet these areas cover.

Response:
The following verbal description was added to this section. "Two units, Halls Bayou near Santa Fe, Texas and Fire Hall Units near Demi John are currently hayed." It is impractical to provide a map for these units since they are so small (they would not show up clearly on a refuge map) and further development is continually occurring around the refuges. The Service evaluates the need for haying in WUI areas on a case-by-case basis.

Comment 14:
Page 3-110, Dune and Beach, the CCP states "The Complex is extremely concerned about the beach resources, where unlimited access is contrary to refuge purposes." The Sierra Club supports fencing off the San Bernard Beach and dunes so that motorized vehicles cannot access this area and providing regular patrols to catch those who illegally drive here. A public education program is also needed for this issue

Response:
In response to your comment, we have added the following text to the Dune and Beach section. "San Bernard NWR is currently working with the Texas General Land Office to further protect the San Bernard Beach. Bollards were installed in 2011 to notify the public that the upper beach is part of Refuge and limit access. The Service needs to continue to educate the public on the importance of beach resources." Fencing is impractical; the high tide would constantly throw debris into it, making maintenance difficult (if not impossible).

Comment 15:
Page 3-111, Feral Hog, the Sierra Club supports an aerial hunting program to reduce feral hog numbers on the Complex.

Response:
Thank you for your support of our feral hog management program.

Comment 16:
Page 3-123, Fishing, the CCP states"... encourage anglers to collect and discard excess and old fishing line, hooks, and sinkers, since wildlife are known to die after ingesting this debris." The Sierra Club supports education but also strong enforcement to catch those who trash out the Complex and create death traps for wildlife.

Response:
Thank you for your support. The Service will continue ongoing education and enforcement efforts.

Comment 17:
Page 3-133, Waterways, Brazoria NWR, Christmas Bay is mentioned here in the CCP. However, in the rest of the CCP not a word is said about the importance of Christmas Bay, how it has been designated a Coastal Preserve, and what FWS is going to do in the CCP to protect Christmas Bay, its seagrass beds, and other natural resources from

degradation.

Response:
Thank you for your comment. We have added information on the Coastal Preserve Program under sections 1.3.3.5 and 3.1.4 of the CCP.

Comment 18:
Page 3-136, 3.6.5.2 Research Natural Areas (RNA), the CCP mentions Christmas Point Research Natural Area but says nothing about where it is located, what is there, and why it is a RNA.

Response:
Thank you for your comment. The records concerning the Christmas Point RNA are sparse. Our files contain a Natural Area Information Form and a map and indicate that it was established August, 1973, but there is no detail about why it was established.

Comment 19:
Page 4-1, 4.1 Ecoregional Goal, instead of saying "To contribute to conservation efforts" say "To implement conservation efforts".

Under Objective 1 – Managing Landscapes, instead of saying "habitat shifts in an attempt to enable best management practices" say "habitat shifts to implement best management practices".

Page 4-2, 4.1 Ecoregional Goal, the citation for Donnelly, 2009, is not found in the references on pages B-97 and B-98 or K-1 through K-13. Please include this study with the references.

Page 4-2, 4.1 Ecoregional Goal, the Houston Sierra Club should be included as a partner.

Page 4-3, Strategies, 10., the five year timeframe for modeling Columbia Bottomlands response to climate change should be changed to three years. If this habitat is as important and in danger of vanishing as the FWS states in the CCP it needs attention sooner, not later.

Objective 2 – Conservation of Columbia Bottomland Ecosystem, instead of acquiring 1,000-2,500 acres/year the Sierra Club suggests that the acquisition of 2,500-5,000 acres/year be the goal. If this habitat is as important and in danger of vanishing as the FWS states in the CCP it needs attention sooner, not later.

Response:
Thank you for your comments. Changes to the Ecoregion Goal (pages 4-1 and 4-2), Objective 1-Managing Landscapes, and the Strategy on page 4-3, were made as suggested.

In response to your comment about the “Donnelly 2009” citation, we have made appropriate corrections within the text and Appendix K. Donnelly, the Service employee who authored the paper was incorrectly listed in the citation. The citation should have been shown as USFWS

2009, which was included in the EA references (pages B-97 and B-98), but was inadvertently left out the Appendix K of the Draft CCP.

In response to your comment about Objective 2 – Conservation of Columbia Bottomland Ecosystem, no changes to the document we made. The objective of acquiring 1,000-2,500 acres/year was established based on the past 15 years of acquisition. Although during 2012, more than 10,000 acres were conserved in one year. This year aside, the average has been 1,400 acres/year. Based on the complexity and limitations of putting together traditional and non-traditional funding, it is unlikely that this will change in the foreseeable future. A goal of 2,500-5,000 is unrealistic based on past experience.

Comment 20:
Page 4-4, Habitat Management Goal, Objective 1 – Bottomland Hardwood Forests, here FWS states that old growth is 80+ years but on page 3-6 and in other places in the CCP FWS states that old growth is 50 to 100 years old. Which statement is correct? FWS must be consistent. The Sierra Club's viewpoint is that 50 year old trees are not old growth.

Response:
A change was made on page 3-6 to make it consistent with this section, which states that old growth is 80+ years.

Comment 21:
Page 4-5, Objective 1 – Bottomland Hardwood Forests, Strategies, 10., the FWS throughout this CCP talks about step-down plans. FWS does not say how these plans provide for public participation and input. The Sierra Club requests that this issue be addressed. For instance, the Sierra Club wants to participate and provide public input on the Habitat Management Plan. How is this done?

In addition, FWS should prioritize land acquisition so that additional Brazoria Palm habitat is acquired.

Response:
Thank you for your interest in our planning process. It is the responsibility of the Refuge Manager to ensure that all environmental compliance requirements are completed before project or plan implementation. The level of NEPA compliance (Categorical Exclusion, EA or EIS) and associated public involvement necessary is determined when planning is initiated. The public will be notified about future opportunities for public involvement for projects and step-down plans as appropriate.

The Service agrees that the acquisition of additional Brazoria palm habitat is a priority and has taken advantage of every opportunity to purchase Brazoria palm habitat when it has been available from a willing seller.

Comment 22:
Page 4-5, Objective 2 – Coastal Prairie, less than 1% of the 9 million acres of coastal prairie means that less than 9,000 acres exist. However FWS states that within Texas 250,000 acres

exist. Which figure is correct? The public must have this information so that it can review, comment on, and understand all the environmental impacts of the CCP.

Under the photo on page 4-5, of a lightning caused wildfire near Cedar Lake Creek the word "consumed" is used. FWS knows that prairie is not consumed by wildfire. Prairie is restored, rejuvenated, or simply functions better naturally due to wildfire. One of FWS purposes is to educate the public. By using the word "consumed" the FWS undermines environmental education with alarmist hype instead of scientific explanation. Remove the word "consumed" and use a more appropriate and accurate term.

Page 4-6, Strategies, the Sierra Club is very disappointed that FWS does not have a conservation strategy for native coastal tallgrass prairie. There is a need for more acquisition of coastal tallgrass prairie so that can it be restored and additional habitat provided for the reintroduction of species like American Bison, Attwater's Prairie Chicken, and others.

The Sierra Club supports a strategy with a goal of a certain number of acres acquired and restored each year to coastal tallgrass prairie. This acquisition will is needed since the climate change section of the CCP states plainly that a lot of coastal tallgrass prairie may become marsh habitat as sea level rise occurs. The Sierra Club wants to participate via public input on the Habitat Management Plan.

Response:
Clarification has been added to the rationale under objective 2. Both figures are correct based on the literature citations we have provided. The 1 percent of 9 million acres represents the total unaltered (never plowed; never touched) coastal prairie that is remaining. The 250,000 acres of coastal prairie in Texas includes lands with native prairie species that have been managed and/or restored.

Under the photo on page 4-5, “consumed” was changed to “burned” as suggested.

The following strategies were added:
13. Acquire prairie and former prairie habitat associated with Columbia Bottomland Forest Ecosystem.
14. Restore fallow fields and non-native pasture to native prairie habitat.

Comment 23:
Page 4-8, Objective 3 – Wetlands, Strategies, 3., the FWS should state clearly how it will "Protect refuge shorelines and dunes from human disturbance to maintain the natural function of these areas." The Sierra Club wants to participate in public input on the Habitat Management Plan.

Response:
Thank you for your comments. Clarification was added to strategy number 3, which now reads “Protect refuge shorelines and dunes from human disturbance to maintain the natural function of these areas by restricting vehicle traffic above high tide lines.” Another strategy was also added. It is listed as strategy number 4 and states that the refuge will “Work with GLO to limit access to San Bernard Beach.”

Comment 24:
Page 4-9, Objective 1 -Waterfowl, Strategies, 3., the Sierra Club supports making recovery of the Mottled Duck one of the top priorities for the CCP. The Sierra Club supports, at a minimum, at least 2,000 acres of restored Mottled Duck nesting habitat for the CCP.

Page 4-9, Strategies, 4., the FWS should provide an estimate of the increase in acres of Wolfweed and Sargent wetlands that it will occur due to the CCP. The public must have this information so that it can review, comment on, and understand all the environmental impacts of the CCP.

Page 4-9, Strategies, 1., the Sierra Club supports acquisition of water rights so that the Complex will have long-term access to water.

Response:
Thank you for your comments. Mottled duck recovery is one of the Complex's top priorities; however, due to past prairie restoration efforts, prairie habitat (nesting habitat) is not the limiting factor. Targeting brooding habitat near prairie habitat, as stated in Objective 1, will be the most effective way to enhance mottled duck production.

We have edited Strategy 4, on page 4-9, to indicate that managed wetlands at San Bernard would be increased by 400 acres. We have also added the following stategy under Objective 1, which is shown as strategy 7, "Continue research programs on mottled ducks including brood and molter banding programs."

The Service also shares your concerns about water rights and will continue to pursue opportunities to purchase water rights from willing sellers as they become available.

Comment 25:
Page 4-10, Objective 2 – Forest birds, Strategies, 2., the Sierra Club supports the reintroduction of Eastern Wild Turkey to the Complex. However, the Sierra Club urges FWS to understand the failure of reintroduction of Eastern Wild Turkey in the National Forests of Texas and especially Sam Houston National Forest so that it does not repeat costly failures.

Page 4-10, Strategies, 5., the Sierra Club recommends that a forest bird habitat monitoring protocol not just be developed but also implemented in this strategy.

Response:
Thank you for your comments. As stated in the strategy, the Service will evaluate the protential for reintroduction. During this evaluation, the Service will utilize the best available science during planning and implementation to ensure the best chance of success.
Strategy 5, under objective 2 (Forest Birds) has been edited as suggested. It now reads as following, "Within one year, develop and implement a forest bird habitat monitoring protocol such as a modified James and Schugart vegetation sample."

Comment 26:
Page 4-12, Objective 3 – Grassland and Secretive March Birds, Strategies, 3. and 7., the Sierra Club is *very* concerned about using non-native invasive species, cows, to conduct habitat management. It would be far better to spend money on how American Bison can be introduced to the coastal tallgrass prairie, not salt marsh, so that one native grazing species would be integrated back into its native habitat.

The Sierra Club is *very* concerned about FWS ineptness with regard to the Hoskins Mound donation (about 2,500 acres) that Chevron has offered. The Sierra Club finds it ridiculous that the FWS regional office cannot get to a final resolution about this valuable in-holding so that Chevron can donate the land to the Complex. Things have gotten so bad that Chevron does not want to talk to FWS because it has not been able to make a determination about contaminants and the work that Chevron has done to remove contaminants from the site. Further delay is not acceptable. FWS must move on this issue now. This situation has been sitting on the *stove* for over five years. It is time to fish or cut bait. Don't throw this once in a lifetime opportunity away.

Response:
Thank you for your comments. Although grazing by domestic cattle is being presented in this plan, an additional grazing implementation plan still needs to be prepared. This plan will identify goals and objectives for grazing as well as implementation strategies and the specific impacts of this implementation as well as a monitoring program to ensure habitat and wildlife benefits are occurring from this management activity. It is anticipated that implementation of grazing on the Complex will not be a “typical” program and that by implementing light intensity; cool season grazing will benefit the prairie as well as the wildlife it supports. Although bison are a viable option, the ability to move domestic cattle on and off the refuge to meet the objectives of the grazing program increases the likelyhood of meeting the objectives of the program including invasive species control and increasing diversity.

We agree that Hoskins Mound would be a valuable addition to the refuge; however, we take exception to being characterized as inept in regard to acquiring this inholding. There are certain requirements that the Service has to complete before accepting any parcel of land. One of these is that it must have a contaminant evaluation. During the initial evaluation in 2005, the Service had questions regarding contamination of soils and ground water due to the presence of elemental sulfur in the surface soils. The Service has not pursued the Hoskins Mound tract more vigorously in recent years due to limited staffing and because there have been no imminent threats to the parcel and the current owners re-evaluated their landholdings and chose to hold on to the parcel for now. In addition, there have been other acquisition priorities. With the available (limited) funding and staff, our priority on the Complex has been the acquisition of bottomland hardwood forest in accordance with the Austin’s Woods Plan. The Service will pursue acquisition of inholdings (including Hoskins Mound) in the future, as funds and manpower allow.

Comment 27:
Page 4-12, Objective 4– Colonial Waterbird Colonies, Strategies, 2. And 7., how many new islets for nesting birds will be created and where.

Response:
This question cannot be answered at this time; the size and placement will be determined based on the amount of dredge spoil generated.

Comment 28:
Page 4-14, Objective 5 – Shorebirds, Strategies, 6., the Sierra Club supports the protection of beach habitat in San Bernard NWR. How will vehicle access be restricted?

Page 4-14, Strategies, 4., 10 years is too long for development of a shorebird monitoring protocol. A more reasonable time is 3-5 years. The FWS must tell the public why development and implementation of a shorebird monitoring protocol takes so long.

Response:
Thank you for your support. See response to comment #14 for methods used to restrict vehicle access.
Stategy 6 on page 4-14 was changed to "Protect four miles of beach habitat of San Bernard NWR by restricting vehicle access above mean high tide, establishing education programs and regular law enforcement patrols."
Stategy 4 on page 4-14 was changed to "Continue shorebird monitoring protocol that was established in 2011."

Comment 29:
Page 4-15, Objective 6 – Reptiles and Amphibians, Strategies, 6., since Texas Parks and Wildlife Department already has a way to survey American Alligators the Sierra Club does not understand why FWS needs five more years to implement a monitoring protocol.

Response:
Thank you for your comment. No change was made. The State's alligator monitoring flights only monitor a portion of the refuge and are not a good indication of total population. We do not feel that they are an adequate means of assessing Complex-wide alligator populations.

Comment 30:
Page 4-16, Objective 7 – Mammals, Strategies, 3., the Sierra Club supports reducing feral hog populations all over the Complex.

Page 4-16, Strategies 6., the Sierra Club supports monitoring bat habitat and populations.

Response:
Thank you for your support.

Comment 31:
Page 4-17, Objective 1 – Visitation, Strategies, 9., people are not customers. They are owners of the NWR System. There is a difference. Treat the people as owners and not customers.

If the FWS proposes to charge people, the owners, an entrance fee of $3/person to visit the people's San Bernard and Brazoria NWRs, then FWS must discuss in detail why this fee is needed, what it will pay for, how it will affect those who have little money but visit the Complex or would like to visit the Complex, and how it affects those who do not want to pay to have access to their property.

A fee is not charged at Trinity River NWR, Anahuac NWR, Texas Point NWR, and McFaddin NWR. What makes the Complex different from these? The Sierra Club is opposed, in most cases, to entrance fees for lands that the public owns. What are the impacts that the entrance fee will have on the public? The National Environmental Policy Act (NEPA) requires that the FWS adequately address this issue in the EA. But FWS says not one word about this proposal's impacts on the public. The Sierra Club opposes this entrance fee.

Response:
Thank you for your comment. We have reconsidered the practicality of charging an entrance fee. Since there is no consistent way to implement this proposal, we have decided to remove it from consideration. All references to an entrance fee in the CCP have been removed and it has been dropped from Alternative B in the EA.

Comment 32:
Page 4-20, Objective 4 – Interpretation, Strategies, 11., what does TMC mean?
Response:
TMC is the acronym we commonly use for Texas Mid-coast NWR Complex. We have changed this to Complex, which is the term consistently used throughout the CCP.

Comment 33:
Page 4-22, Objective 6 – Fishing, Strategies, 4., FWS states "allowing non- motorized access along the beach to the San Bernard River." Bicycles are non- motorized vehicles but should not be allowed because they can cause damage to dune and beach habitats.

Response:
Thank you for your comment. We disagree that bicycles should not be allowed. Based on past experience, we do not anticipate any adverse effects from the limited bicycle use that may occur.

Comment 34:
Page 4-24, Objective 8 – Outreach, Strategies, 3., five years is a lot of time for development of portable interpretive displays. Three years is a more reasonable timeframe.

Page 4-24, Strategies, 5., eight years is a long time to develop outreach tools. Three years is a more reasonable timeframe.

Response:
Thank you for your comment. Strategies 3 and 5 under Objective 8 provide timeframes that we feel are reasonable based on expected staffing levels and Complex priorities. It would not be realistic to expect these strategies to be implemented in shorter timeframes.

Comment 35:
Page 4-25, Objective 9 – Law Enforcement and Visitor Safety, the Sierra Club supports a strategy that requires the hiring of at least 3 additional law enforcement officers so that there are at least 5 law enforcement officers at the Complex. The Complex is far too large in number of acres, linear feet of boundary, and distance between refuges for two law enforcement officers.

Response:
The Service appreciates the Sierra Club's support for hiring additional law enforcement offices; however, the current law enforcement deployment model does not allow expansion of law enforcement numbers at this time. Table 5-2 of the CCP identifies additional personnel beyond current levels to implement the CCP.

Comment 36:
Page 4-27, Objective 11 – Cultural Resources, Strategies, 5., 10 years is far too long for the development of exhibits about historical connections between people and the land. Five years is a more reasonable timeframe.

Response:
Thank you for your input. We maintain that 10 years is a reasonable timeframe for this activity. The only historical site on the Complex that is accessible has already been interpreted and we will continue to assess the need for interpretive material as additional sites are identified.

Comment 37:
Page 4-29, Objective 4, Strategies, 1., the public must have the opportunity to participate and comment on any EA, special use permit, and other documents that deal with oil/gas activities on the Complex.

Response:
This is already common practice for the Complex. Every EA for oil and gas activities goes out for a 30-day public comment period.

Comment 38:
Page 5-3, Table 5-2, Additional Personnel Needs Beyond Current Levels, the Sierra Club supports adding all of these positions to the Complex as well as 3 additional law enforcement personnel.

Response:
Thank you for your input. See response to comment #35.

Comment 39:
Page 5-11, 5.2.2 Compatibility, the Sierra Club has concerns about Mosquito Control, Livestock Grazing, Cooperative Farming, and Bicycling on the Complex. There is no way that Mosquito Control can be thought of as being compatible. Aerial use of poisons on the Complex affects fish and wildlife and vegetation resources. Livestock Grazing using non-native cows is not good for native coastal tallgrass prairie. If FWS desires that a native grazer of coastal tallgrass prairie (not salt grass or wet soils) be present then reintroduction

of American Bison should be pursued. Bicycling on open roads is fine and the Sierra Club supports this type of bicycle use. The Sierra Club however, does not support mountain bike use on hiking trails and on closed roads at Hudson Woods. The Sierra Club prefers that cooperative farming be phased out and the FWS begin the restoration to coastal tallgrass prairie of long-term heavily farmed lands. This will result in fewer waterfowl but if prairie potholes and other features are restored then there will be less impacts on waterfowl. Positive impacts include the provision of more habitat for grassland species of birds which have been declining significantly in the past 20 years.

Response:
Thank you for your input, but we disagree with your position. The scope of these activities is limited and they will be implemented to meet specific management objectives, as described in Appendix C. Each of these activities has been thoroughly evaluated and they have been determined to be compatible, which means that they do not materially detract from the purpose(s) of the refuge(s).

Comment 40:
Pages 5·12 through 5-14, 5.4.1 Current Step-Down Plans and 5.4.2 Future Step-Down Plans, the Sierra Club urges FWS to provide a public participation and input period for these plans. The public, as owners of the NWRs, should have the right to provide review and comment on these plans. In particular the Sierra Club requests the opportunity to participate in the development of the Oil and Gas Management Plan.

Response:
Appropriate levels of NEPA compliance will be completed for each of the proposed step-down plans. If an EA is found to be warranted, public involvement will be requested.

Comment 41:
Page 5-15, Moist-Soil Management, the Sierra Club supports acquisition of additional water rights so that even during dry periods or droughts the Complex is able to maintain the three refuges for wildlife habitat.

Response:
Thank you for your support. The Service will continue to pursue opportunities to purchase water rights from willing sellers as they become available.

Comment 42:
Pages 5-18 and 5·19, 5.5.2.1 Biological Management Projects, the Sierra Club supports these restoration plans. In particular, the Sierra Club understands that trespass cattle have been allowed to degrade part of the Slop Bowl because no fence has installed to keep them out. It is time to stop this trespass so that this incompatible and illegal use no longer affects fish and wildlife values on Brazoria NWR.

The Sierra Club is very supportive of projects that address erosion control and bank stabilization due to GIWW impacts and turkey reintroduction into the Columbia Bottomlands.

Response:
Thank you for your support.

Comment 43:
Pages 5-23 and 5·24, 5.6 Partnerships and 5.6.1.2 Austin Woods Conservation project: A Partnership Project, the Houston Sierra Club should be listed as a partner.

Response:
Thank you for your input; however, we did not change the list in sections 5.6 and 5.6.1.2. Not all partners are listed, only those primary partners that contributed funds and manpower.

Comment 44:
Page B-7, 1.8.1 Ecoregion Issues, the Sierra Club supports the Complex in taking a landscape-scale approach to management.

Response:
Thank you for your support.

Comment 45:
Page B-8, Disturbance, if increased air traffic and boat use are important issues with regard to disturbance of wildlife the CCP should discuss these issues in detail and state how the environmental impacts will be minimized. The Sierra Club does not see the discussion of these issues or mitigation for these issues.

Response:
Thank you for your comment. We feel that disturbance has been adequately discussed in the CCP and analyzed in the EA. Ecoregion issues, such as disturbance, which result in impacts to wildlife and habitat outside of the Complex are outside our control.

Comment 46:
Page B-13, Entrance Fees, FWS states that members of the public were split about entrance fees. On pages B-42 and B-50, FWS proposes in Proposed Alternative B that a $3 entrance fee be charged.

There is zero discussion about this decision. The Trinity River NWR, Anahuac NWR, Texas Point, and McFaddin NWR have no entrance fees. Anahuac proposed an entrance fee about five years ago and then withdrew that proposal.

The Sierra Club supports entrance fees for National Parks and for special services like campgrounds and developed facilities. However, entrance fees raise serious questions about free public access, social equity, and the potential to transform recreational management of public land from public service orientation to commercial enterprise. This may drive FWS to provide services for those who pay ·and who want more expensive and more environmentally damaging activities versus those who cannot pay and participate in less environmentally degrading activities like hiking and nature study.

The Sierra Club requests that FWS withdraw this entrance fee proposal. If this does not occur then FWS must provide a detailed discussion and analysis about the impacts the fee can have on the public who own NWRs but would not have access to them unless they pay a second time (people already pay taxes every April 15th to support the professional management of public lands). The U.S. Congress often chooses to subsidize extractive industrial use of our public lands like oil/gas drilling, grazing, etc. while charging fees for low-impact recreational activities. Families should not have to pick-up this additional tab for industry every time they want to use their NWRs.

The Sierra Club is also concerned about the fiscal and financial inequity that working class and poor people must assume with an entrance fee. Three dollars may not seem like much to some but for many, particularly in these depressed times, that is money that could decide for one of the owner's of the NWRs that they cannot afford and will result in their being turned away from the natural beauty that they own and so they cannot fish, hike, enjoy nature study and environmental education.

When the Sierra Club takes people to the Complex it tells visitors that they own NWRs and they can come back any time they want and enjoy them. The Sierra Club also tells people that they have a responsibility to take care of NWRs. To build a constituency FWS should not charge the owners of NWRs (public lands) money to see and enjoy what they already own.

Enclosed is a study as printed in the Journal of Leisure Research entitled, "Do User Fees Exclude Low-income People from Resource-based Recreation?". This study states, in part, "Since fees do have a significant negative impact on participation by low-income people, how should public agencies respond? Of the usual justifications given for fees, many are little more than attempts to rationalize excluded users, avoiding any moral issues involved. For example, many managers focus on agency welfare, turning excluded users into little more than an accounting problem. Similarly, a focus on resource protection or economic efficiency can support fee programs with little consideration of which visitors get excluded. The currently popular "customer" orientation can accomplish a similar result. Since low-income people are less likely to participate in many forms of resource-based recreation, they can simply be defined as "not our customers." Each of these strategies is in full play in recreation management and research; what is missing is a sense of public need or mission."

"These caveats aside, visitor exclusion highlights a critical problem in recreation policy – the problem of public purpose. In general, for the public sector to be involved in an activity, there needs to be a public purpose for it – some public need that must be fulfilled, some public goal that must be accomplished. This is certainly true for public lands, and it is this public purpose that must drive policy."

"Thus, the key question with regard to fees becomes: How do fees enhance or detract from an agency's ability to fulfill its missions? ... Our data clearly suggest that fees have had a negative impact on participation for nearly half of low- income households ... If low-income people are, in fact, excluded from public parks and recreation areas, then serious policy questions are raised about the very purpose of public recreation ... However, when agencies begin to

act like entrepreneurs seeking self-funding through fees, and low-income people are excluded, the public purpose- the very reason for public ownership- is defeated ... Our results suggest that fees undercut this mission: they are a major step in the gentrification of recreational resources. When the parks are reserved for the comfortably well-off, will they continue to be publicly necessary?"

The Sierra Club urges FWS to abandon this ill-thought-out idea. The Sierra Club supports on pages B-36 and B-46 no entrance fee but an emphasis on voluntary contributions.

Response:
Thank you for your comments. As we stated in our response to comment #31 we have reconsidered the practicality of charging an entrance fee. This proposal was not well thought out and we have decided to withdraw its consideration from the CCP and EA. The section on Entrance Fees (now found on pages B-43 and B-51) have been changed to indicate that voluntary contributions would be accepted and donation boxes would be added to public use area under Alternative B. Alternative C would be the same as Alternative B.

Comment 47:
Page B-14, 1.8.6 Addressing Issues in the CCP and EA, FWS states that certain issues are outside the scope of the CCP but were considered in developing it. The Sierra Club disagrees. The issues mentioned are not outside the scope of the CCP.

For instance, Fragmentation disrupts the landscape-scale ecoregion, ecosystems and refuges; Commercialization is part of what a entrance fee will introduce into the Complex and oil/gas operations represent commercialization inside the Complex; Urbanization is already affecting the Complex by reducing the opportunities to buy Columbia Bottomlands and other ecosystem lands and create more of a urban-wildland emphasis which the Complex has stated has led to more mowing on the boundaries; Prairie/Habitat Conversion is a landscape- scale problem that flows onto the Complex particularly since there are few natural wild seed sources left; Residential Development affects the Complex like Urbanization; Incompatible Forestry and Livestock Production Practices help destroy prairie and Columbia Bottomland Ecosystems, reduce the number of tracts that are suitable for purchase, and creates an avenue for invasive species to move onto the Complex; and finally Stream Channelization alters hydrology on the Complex even if done outside its boundaries. All of these issues are important to discuss and are not outside the scope of the CCP. Mitigation against these intrusive outside, and sometimes inside forces, must be addressed in the CCP.

Response:
Thank you for your comments. Additional clarification about how issues were address was incorporated into section 1.8.6 of the EA.

Comment 48:
Page B -16, 2.2 Alternatives Considered but Dismissed from Detailed Analysis, the Sierra Club disagrees that elimination of the farming program and buying mineral rights should be dismissed from analysis. For the farming program, reduction or elimination ensures that FWS focuses on its core duties, which is ecosystem restoration (wetlands and prairies).

As mentioned in the CCP a lot of coastal tallgrass prairie restoration is needed on the Complex. A reduction in waterfowl numbers would occur if farming were eliminated but an increase in coastal tallgrass prairie dependent bird and other species would occur and the creation of prairie potholes will reduce the impacts of reductions. So there would be a trade-off and this does "contribute to the objectives and goals outlines in the plan".

Once coastal tallgrass prairie restoration is underway the costs and work required for farming will no longer be required. The management of coastal tallgrass prairies is more within the traditional FWS focus than farming and can be accomplished. In addition, by farming to increase population densities of waterfowl FWS inadvertently crowds birds together so that if disease occurs it can spread quicker and to a greater number of individuals.

With the buying of mineral rights the FWS has simply dismissed the idea with nothing more than a statement that "this is infeasible" and that it would take more staff and budget to do. Where is the documentation to support these assertions? How much time does FWS spend currently working on oil/gas issues and thus could save if over time mineral rights could be acquired? How much would this cost? What do mineral rights sell for? Where is the analysis that supports these statements? The Sierra Club understands that buying mineral rights is not easy but over the long-term it means that the Complex can more precisely operate for fish and wildlife benefits than its present attempts to minimize interference with and the need to mitigate for damages caused by oil/gas exploration, drilling, and production (including transportation).

Response:
Thank you for your comments. The Service considers farming an essential part of management and the current farming program does not interfere with or limit our habitat restoration efforts.

During the land acquisition process, the Service inquires if there are any oil and gas minerals associated with the property and whether or not the landowner is interested in selling them. For those that are willing to sell the Service will acquire those interests. Unfortunately, the majorities of oil and gas mineral interests have been separated from the surface interest and are held by other entities.

Response:
The Service understands the Sierra Club's concerns about the aerial use of herbicides and takes all necessary measure to minimize potential impacts. The following clarification was added to the paragraph to describe what the Service does to minimize potential impacts from the aerial application of herbicides. "The Complex utilizes drift retardant to minimize drift; spraying is only conducted in areas where there are no sensitive resources (i.e,. species that could be adversely impacted) and where private lands would not be impacted."

Comment 53:
Page B-28, Farming Program**,** FWS should define "Rent equivalents" so the public understands what this term means.

Response:
A description of what constitutes a "rent equivalent" was provided within description of the Farming Program on page B-27 of the CCP. To further clarify and reiterate, the paragraph now reads as follows. "A Cooperative Farming Agreement is prepared annually and identifies field and crops planted as well as compensation to the government, which could include direct payment, crops left in field, or rent equivalents. Rent equivalents may include discing in non-farmed marshes; purchase of herbicide used to spray invasive trees and brush on irrigation laterals and/or track-hoe or excavator work on irrigation laterals. Additional rent equivalents include maintenance of feeder ditches, pipes, and water control structures and water credits purchased by farmer to be used by the refuge as duck or shorebird water following harvest."

Comment 54:
Page B-29, Water Purchases, the Sierra Club supports the FWS in an aggressive acquisition program for water rights or the purchase of water so that fish, wildlife, and ecosystem needs are met.

Response:
Thank you for your support. The Service will continue to pursue the purchase of water rights from willing sellers when they are available.

Comment 55:
Pages B-37 through B-43, Alternative B – (Proposed Action) and B-69, the Sierra Club does not support this alternative because it requires an entrance fee, allows bicycling in Hudson Woods and on other gated roads and hiking trails, focuses too much emphasis on farming, does not address erosion and marsh issues due to the GIWW sufficiently, and re-introduces livestock grazing.

Nowhere in the CCP/EA does FWS state that livestock grazing can be harmful to Complex ecosystems. Livestock grazing is responsible for the introduction of non-native invasive plant species into coastal tallgrass prairies and other habitats. Local ranchers are pressuring FWS to open up the Complex to unlimited livestock grazing (notice the phrase used on page B-39, "acreage to be grazed determined annually" – an open checkbook of a phrase if ever there was one) because non-grazed Complex prairies have recovered from livestock grazing that those local ranchers have supported. There is no need for livestock grazing. Reduction of phragmites cane can be ccomplished in other ways (herbicides, mowing, mechanical removal, burning, etc.) and does not require livestock grazing.

If a grazing animal must be reintroduced then it needs to be a native species, like the American Bison, and it needs to be introduced into coastal tallgrass prairie and not in wet soil salt marshes where a lot of rutting, trampling, and other damage is done due to livestock grazing. The introduction of a small American Bison herd would instantly bring attention to the Complex unlike anything else and the Sierra Club believes people would come out just to see them. Then environmental education could easily be accomplished for adults and children and an explanation about wildlife management techniques could be introduced.

The Sierra Club is concerned about the inconsistency of the CCP with regard to mountain

bikes. On the one hand the CCP states that bicycles are welcome on open roads. On the other hand, on pages B-43 and B-50, the CCP states that roads that are not open and specific trails now will be open to mountain bikes. The Sierra Club does not support allowing mountain bikes to go through the wet and moist habitats and closed roads of Hudson Woods. This will create rutting of soil, erosion of soil, trampling of vegetation, introduce non-native invasive plant species, and because there are always some people who do not follow the rules, will result in user created trails.

There are also safety and trail conflicts between those who seek a quiet, wilderness experience and those who want to buzz through areas on mountain bikes where exertion is an important part of the ride. The Sierra Club sees where the use of mountain bikes on the Dow Woods trail makes sense because it is a hard surface. However, using earthen surfaces results in modifying the environment and creates an incentive to go faster. There is no analysis about expanding the use of mountain bikes to more units, including Columbia Bottomlands habitats, there is no discussion about environmental impacts (including disturbance to wildlife), there is no discussion about user conflicts and safety, and there is no discussion about what limits, mitigation, monitoring, and law enforcement will be required to ensure that damage is not done.

Response:
Thank you for you comments. The Service has selected Alternative B because it best meetings the Complex's vision for the future, the purpose for which the Refuges were established, and the habitat, wildlife, and visitor services goals identified in the CCP .

The Sierra Club's opinion that "Local ranchers are pressuring the Service to open the Complex to unlimited livestock grazing…." is misinformed and incorrect. The Service proposes to use limited grazing for specific management purposes, including control of invasive species and increasing natural diversity created historically from the interaction of both grazing and fire as reaccuring disturbance. The implementation of the program at this time includes only seasonal grazing, where cattle are removed from the refuge during the growing season to allow recovery. Additional comments on grazing were addressed in responses to comment number 80.
In regard to comments on entrance fees, farming , bicycling, and wilderness, please see responses to comment number 31 (for entrance fees); 48 and 79 (for farming); 78 (for bicycling), and 82 (for wilderness).

Comment 56:
Pages B-43 through B-47, Alternative C, of all the three alternatives the Sierra Club prefers this alternative because it is the most environmentally protective alternative. Alternative C does not have an entrance fee, addresses GIWW erosion and marsh habitat restoration more completely, increases restoration efforts due to climate change more, looks at purchasing water rights and will purchase water when available, will reduce farming by 500 acres, would restore 500 acres to coastal prairie, would provide for more feral hog control, would address exotic ants more aggressively, and would emphasize voluntary contributions to the Complex.

The Sierra Club recommends changing Alternative C in the following ways to make it even more environmentally protective:

1. Allow mountain bikes only on open roads except for the Dow Woods hard surface trail.
2. Require that there be an acquisition program for coastal tallgrass prairie.
3. Require that the Hoskins Mound donation by Chevron is accepted.
4. Prioritize GIWW erosion and marsh restoration for all three refuges as one of highest priorities and seek a national consensus for mitigation with the Corps and other interested parties.
5. Provide more sites for climate change monitoring than the four planned (at least 10 should be implemented including some on Big Boggy NWR).

6. Page B-44 and pages 1-1 through 1-22, Draft Land Protection Plan Austin's Woods San Bernard National Wildlife Refuge Brazoria, Fort Bend, Matagorda, and Wharton Counties, Texas, conduct a study about the 10% goal for Columbia Bottomlands protection to determine whether this is scientifically valid under today's changing environment. The Sierra Club favors the protection of 150,000 to 200,000 acres as being more sustainable with multiple landscape linkages between·the three rivers to allow for movement of organisms and as mitigation for habitat fragmentation.

A larger area saved makes sense when looking at how the original habitat has been destroyed and the remainder fragmented. Of the original 700,000 acres only 150,000 acres may remain (most in degraded condition that needs restoration). This is only 21.43% of the original total so barely one-fifth of the original acreage is left today. Saving 10% means only 70,000 acres are protected. Saving 150,000 to 200,000 acres means 21.43% to 28.57% of the original acreage is saved.

The addition of multiple habitat bridges between the three rivers, the Colorado, San Bernard, and Brazos, will add additional sustainability for the land acquisition effort. Larger, connected, preserves have been shown to fight better the loss of species from an area. Larger and better connected units will become more crucial in the future as more habitat is developed and further fragmented around the protected acres. A larger, more connected, Columbia Bottomlands is necessary and a study about this issue would guide FWS on the precise acreage that should be acquired, restored, and protected. If the study indicates that protection of sufficient acreage is still not enough so that the Columbia Bottomlands program is totally sustainable then additional mitigation measures are necessary to minimize further impacts on this ecosystem and should be proposed and implemented in the CCP.

7. Add an education program about non-native invasive plant and animal species like Chinese Tallow and Feral Hogs. The education program would be supplemented by partnerships with nearby and adjacent landowners to remove these species and if possible restore natural replacement species.

8. Implement a comprehensive program to educate people about and provide barriers for beach and dune ecosystems near Cedar Lakes so that the area is biologically and ecologically protected.

Response:
Thank you for your input. Alternative C was not selected for a number of reasons determined by the EA (Appendix B). The suggested changes provided above have been addressed in our responses to other comments within this appendix (see #__) as they relate to Alternative B and we see no reason to modify Alternative C.

Comment 57:
Pages B-53 through B-54, 4.1 Definition of Terms and page 8-63, the CCP unfortunately has not resulted in FWS implementing a recent court ruling about assessment of impacts and the methodology used. United States District Judge John D. Bates stated, in part, in Sierra Club v. Mainella the following:

"Because NPS's impairment analysis served as its NEPA analysis, the flaws in the impairment analysis also apply to the environmental assessment. Those shortcomings are, first, NPS's lack of explanation as to how it reached its conclusions, typically simply describing the impacts followed by a conclusion that the impact was not an impairment or, in the case of NEPA, that it was not "significant"; and second, the use of the descriptors "negligible", "minor", "moderate", and "major" that are largely undefined or are defined in a manner that includes few objective bounds ... nowhere explained the basis for its conclusion that potentially "moderate" impacts could not be significant under NEPA ... There is no basis in the administrative record for accepting NPS's conclusion that even a "minor" impact is not significant under NEPA, because there are no determinate criteria offered for distinguishing a "minor" impact from a "moderate" or "major" impact other than NPS's conclusory say-so ... the seeping regulations still require the agency to explain why they {dismissed issues} will not have a significant effect on the human environment ... Thus, the EA must provide a realistic evaluation of the total impacts and cannot isolate a proposed project, viewing it in a vacuum ... In short, NPS's three findings of no significant impact are, the court concludes, arbitrary and capricious for many of the same reasons as are the impairment determinations. In each decision, NPS has failed to take a "hard look" at impacts on the Preserve from adjacent surface activities, as evidenced by the lack of explanations supporting its conclusions and, in particular, its methodology of describing impacts using conclusory labels and then setting forth a bare conclusion without explanation as to the significance of an impact. NPS also failed to provide an adequate cumulative impacts analysis that included the other oil and gas operations in the Gore Baygall Unit … However, NPS's ultimate conclusions that the drilling activities would not result in impairment of park resources and values under the Organic Act, or a significant impact on the human environment under NEPA, are not supported by reasoned explanations, and hence are arbitrary and capricious and an abuse of discretion."

FWS has not quantified in the CCP assessment, analysis, and evaluation all the environmental impacts. The methodology used has the "conclusory statements" that Judge Bates ruled against. Judge Bates stated in his decision that the descriptors "negligible", "minor", "moderate", and "major" are largely undefined or are defined in a manner that includes few objective bounds. These descriptors have been used by FWS but are largely undefined and with few objective bounds. FWS has failed to take the "hard look" that Judge Bates stated must be done. Some of the conclusory statements that are used which are not defined

include:

1. cannot be reasonably expected
2. impacts are so small
3..can be reasonably expected
4. limited effect
5. affect a small area
6. have apparent and detectable effects
7. would be readily apparent
8. relatively large area
9. not extreme or excessive
10. readily apparent and substantial effects
11. would be readily apparent
12. would substantially change
13. immediately surrounding
14. to any appreciable degree (a new term that is not found under the definitions of environmental impacts found on pages 8-53 through 8-55 but is found on page 8-63)

All of these conclusory and undefined words and phrases leave the public in a quandary about what the environmental impacts are, what their intensity is, and how different alternatives can be compared and differentiated. The public and decision-makers need this information clearly stated and transparently presented so that it can be reviewed, commented on, and understood in relation to the environmental impacts of the alternatives. The FWS has not implemented Judge Bates' ruling in a convincing and complete manner. The Sierra Club objects that FWS ignores Judge Bates' decision.

FWS has failed to take the "hard look" that Judge Bates requires it to do. The public must have this information so that it can review, comment on, and understand all the environmental impacts of the CCP.

For an EA/EIS, dictionary usage of words or phrases will not suffice to provide the public with a clear picture of what the intensity, significance, and context of environmental impacts are. An all qualitative assessment, analysis, and evaluation of environmental impacts is not sufficient to deal with the clearly articulated CEQ requirements in Section 1502.14, that the EAIEIS "should present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decision-maker and the public".

Quantitative assessment, analysis, and evaluation are necessary to ensure that alternatives and environmental impacts are clearly defined and shown in the EA!EIS.As stated in the CEQ NEPA implementing regulations, Section 1500.1(b), Purpose, "NEPA procedures must insure that environmental information is available to public officials and citizens ... The information must be of high quality. Accurate scientific analysis ... are essential to implementing NEPA".

As stated in Section 1501.2(b), "Identify environmental effects and values in adequate

detail so they can be compared to economic and technical analyses."

As stated in Section 1502.8, "which will be based upon the analysis and supporting data from the natural and social sciences and the environmental design arts."

As stated in Section 1502.18(b), about the Appendix, "Normally consist of material which substantiates any analysis fundamental to the impact statement".

As stated in Section 1502.24, "Agencies shall insure the professional integrity, of the discussions and analyses ... They shall identify any methodologies used and shall make explicit reference by footnote to the scientific and other sources relied upon for conclusions in the statement."

FWS has mostly relied for analysis for this CCP on "best professional judgment". "Best professional judgment" is where a group of people, using their experience, decide what is important. This level of assessment, analyses, and evaluation for environmental impacts and alternatives is an insufficient foundation upon which to base an EAIEIS.

The qualitative description of phrases used to describe environmental impacts or the protectiveness of an alternative do not provide the public with the degree of comparison required by the CEQ's mandatory NEPA implementing regulations. These regulations state, in Section 1502.14, Alternatives including the proposed action, that, "This section is the heart of the EIS ... it should present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decision-maker and the public ... Devote substantial treatment to each alternative in detail ... so that reviewers may evaluate their comparative merits."

The CEQ also states, in Section 1502.16 and (d), Environmental consequences, that, "This section forms the scientific and analytic basis for the comparisons ... The environmental effects of alternatives including the proposed action the comparisons under Section 1502.14 will be based on this discussion."

FWS has not clearly compared and made apparent the distinctiveness of each alternative and its impacts or protectiveness. This is not accomplished when phrases like "readily apparent" are used instead of quantitative information or more detailed and clear descriptions of qualitative information. The Sierra Club requests that FWS clarify and detail clearly the comparative differences between each alternative and define clearly what the words or phrases used mean.

The use of "best professional judgment" is not a substitute when quantitative information is available to show what impacts are or could be. This is the concern that the Sierra Club if FWS develops and uses a methodology that is based on "best professional judgment" but the public is not told what phrases mean.

Response:
Thank you, but we disagree with your comments.

The language used in this analysis is typical of CCPs throughout the county. It is accepted and appropriate for this type of plan-level NEPA document. Contrary to your repeated assertion that the terminology is not defined and "The public must have this information so that it can review, comment on, and understand all the environmental impacts of the CCP" the general public has apparently had no concerns with our management activities or analysis, which is evident by the general lack comments provided by public.

It is the Complex's opinion that all CEQ requirements have been addressed in this EA. The purpose of the EA is not only to provide information to the public and the decision-maker, but also to determine if there are significant impacts resulting from an action, thereby determining if an EIS is necessary. It is the opinion of the Service that the terminology provided in section 4.1 has been adequately defined and supports the analysis, which concludes that the proposed action (implementation of the CCP) would not result in significant impacts.

Comment 58:
Page B-55, Climate Change**,** FWS stares"... there should be little or no net change in the quantity of carbon sequestered at the Complex from any of the proposed management alternatives." There is no analysis that demonstrates this is true. Where is the documentation that provides a comparison between the alternatives?

The Sierra Club appreciates that the Secretary of the Interior, in Secretarial Order No. 3285 and 3289 has determined that climate change is a critical issue to focus on and deal with. The Sierra Club is also pleased that FWS released on September 21, 2001 "Rising to the Challenge" Strategic Plan for Responding to Accelerating Climate Change. The Sierra Club appreciates the attempt to provide a picture of what impacts climate change may have on the Complex. However, the FWS must do more in a site specific manner.

As FWS has documented in the CCP climate change will alter existing ecosystems; make it more difficult for plants and animals to adapt successfully to these changed ecosystems; and make it more difficult for FWS to manage the Complex for the species, landscape, and ecosystems that these refuges were originally acquired for.

FWS should prepare and include in the CCP a climate change ecological resilience and resistance plan (CCERRP). The CCERRP would assess, analyze, evaluate, and prioritize the biological and ecological elements in the Complex and the effects that climate change has had and will have on these elements. The CCERRP would assist plants, animals, and ecosystems in adapting to climate change and would require monitoring of changes and mitigation measure effectiveness. The CCERRP would be based on:

1. Protection of existing functioning ecosystems in the Complex.

2. Reduction of stressors on ecosystems in the Complex.

3. Restoration of natural functioning ecological processes in the Complex.

4. Use of natural recovery in the Complex, in most instances.

5. Acquisition of buffers and corridors to expand and ensure connectivity of ecosystems in the Complex.

6. Intervention to manipulate (manage) ecosystems in the Complex only as a last resort.

7. Reduction of climate change gases from the Complex.

Some but not all of these elements are found within the CCP. The CCP must be revised so that all of these elements are addressed. One way that FWS can reduce climate change gases is if its requires that oil/gas activities provide C02 reductions via the integration of energy saving programs during exploration, drilling, and production operations.

Response:
The sentence that states "Overall , there should be little or no net change in the quantity of carbon sequestered at the Complex from any proposed management alternatives" is incorrect and has been removed. Clarification/analysis has been added to section 4.3.1. The Complex has addressed climate changes issues and considered energy saving methods to the extent possible in the CCP and EA (see response to Email comment #3). Not all elements listed above can be address at this time. The Complex has not yet received guidance on stepping down the objectives of the Service's national climate change adaptation plan to the site-specific level. Many of the objectives and topics discussed above (including the CCERRP) are beyond the Complex's current capacity.

Comment 59:
Pages B-57 through B-59, Herbicide Application, FWS states "The federal and state governments regulate herbicides to ensure that they do not pose unreasonable risks. The EPA requires extensive test data from herbicide producers to show that their products are safe to use. EPA scientist and analysts carefully review these data to determine whether to register (license) an herbicide and whether certain restrictions on use are needed."

Enclosed are a series of fact sheets that demonstrate that EPA registration of pesticides does not ensure that pesticides are safe to use. This includes the use of "inert ingredients" that may not be benign, whether pesticides are safe to use, the problem with aerial use of pesticides due to drift, and do pesticides create a health risk. FWS should be careful when using stock phrases about the safety of pesticides and the EPA process that is used to register them.

Response:
Thank you for your comments. The sentence that said "The EPA requires extensive test data from herbicide produces to show their products are safe to use" has been changed to "The EPA requires extensive test data from herbicide producers prior to licensing and determining restriction on use."

The Service shares your concerns of herbicide drift and utilizes a variety of tools to maximize limited funding and resources on the war against invasive flora throughout the refuge. In Section 4.2 of the EA under Impacts from Herbicide Application" the Refuge evaluates existing and

potential impacts of the use of herbicides and identifies the guidelines and requirements needed in order to utilize herbicide application. In addition to these guidelines and requirements and Service policy, the refuge also identifies additional mitigation measures used to minimize impacts from the use of herbicides.

Comment 60:
Page 8-59, Petroleum Development Impacts, FWS rates the environmental impacts of petroleum development as "adverse, long-term, site- specific, and of negligible to minor intensity." The Sierra Club vigorously disagrees with FWS. When looking at impacts of petroleum development all impacts from exploration, drilling, and production (including transportation) must be assessed. With dozens of pipelines cross-crossing the Complex (essentially as roads), well pads, roads to well pads, truck traffic, etc., how can these overall impacts be anything, except major? The Sierra Club requests a copy of the FWS analysis that was done to come up with the impact rating.

Response:
Thank you for your comments. Based on the amount of petroleum development over the last 10 years and our ability to work with exploration companies to limit the impact of operations, the evaluation of impacts being adverse, long-term, site specific, and of negligible to minor intensity is accurate. Over the past ten years, only five wells have been requested and permitted. Of these, one has never been drilled, two did not make production quantity and were never developed and the site restored and two wells were developed. In addition, 5 previous wells have been plugged and the site restored. The Service requires the preparation of a detailed Environmental Assessment and Operations Plan prior to permitting oil and gas operations. Within this plan, requirements to protect refuge resources from undue harm are stipulated and all efforts to minimize the impact on refuge resources are made. Seismic operations cause the greatest amount of impact, primarily because they occur across the landscape rather than at a specific site. Even with these operations, all efforts are made to minimize impacts including allowing only smaller, lightweight, maneuverable drillers into bottomlands so the trees are not removed during operations.

Comment 61:
Page B-61, Fishing, FWS states "Trash is the single greatest impact on the refuges associated with this use." It is much worse than trash. Some of the "trash" left is toxic, like lead, some of the "trash" wraps around wildlife or is swallowed by wildlife and kills it, like monofilament line, some of the "trash" may acclimatize species to associate humans with food (Alligators and gulls), like bait used or food scraps left. So the problem is much bigger than trash.

Response:
Thank you for your comments. This Fishing section was edited to include the impacts of trash on wildlife resources as well as included our efforts to control trash and the impacts of trash. The following information was added to the end of the second paragraph.

“Trash left from fishing activities can be harmful to wildlife. Monofilament line can entangle wildlife or be ingested. Ingested lead sinkers can cause lead poisoning and food scraps are not healthy for wildlife. In an effort to control trash, the refuge has installed monofilament recycling

containers at fishing areas. Trash is removed from fishing areas on a weekly basis. Fishing areas are shut down if trash gets out of hand."

Comment 62:
Page B-62, Other Common Effects**,** there is no analysis about the impacts that noise, transportation, waste management, etc. has on the Complex, its wildlife, and visitors. All that is provided is a statement that there are "negligible or at most minor effects". What is this statement based upon? Where is the analysis and documentation that backs up this assertion?

Response:
Thank you for your comment. This section is intended to document the impacts that the Service's actions have on resources, not the impacts that outside actions have on the Complex.

Comment 63:
Pages B-63 through B-64, 4.3.1 Impacts on Air Quality**,** this assessment is incomplete. The air pollution that is generated by oil/gas development, vehicles of the staff and visitors, and boats of staff and visitors and its impacts on the Complex is not provided.

Response:
Thank you for your comments. We feel that impacts to air quality have been accurately and completely assessed. While we may not have specifically listed every activity that could have negligible impacts to air quality, we clearly mention that "Management actions and activities associated with Alternative A…." This includes public uses.

Comment 64:
Pages B-64 through B-66, 4.3.2 Impacts on Water Resources, the analysis is not complete because it does not include water pollution generated on the Complex from oil/gas development and sewage from staff and visitors.

Response:
Thank you for your comment. We believe that sections 4.3.2 and 4.2 (as referenced) adequately address the impacts of refuge activities, including oil and gas activities, on water resources. Impacts from sewage from staff and visitors were not mentioned because we do not feel that this is an issue. The vault septic systems placed throughout the Complex effectively eliminate potential water pollution.

Comment 65:
Page B-77, 4.4.4 Impacts on Resident, Native Wildlife, Alternative C, FWS should also state that this alternative will restore 500 acres to coastal tallgrass prairie which will benefit native wildlife.

Response:
Thank you for your comment. The change, as suggested, was incorporated into this section.

Comment 66:
Page B-78, 4.4.5 Impacts on Threatened and Endangered Species, Alternative C, FWS should

state that this alternative will restore 500 acres to native tallgrass prairie which will benefit threatened and endangered species. Therefore, Alternative C has more beneficial impacts than Alternative B.

Response:
Thank you for your comment. The change, as suggested, was incorporated into this section. The conclusion was changed to "slightly more beneficial than" instead of "same as" Alternative B.

Comment 67:
Pages B-78 and B-79, 4.5.1 Impacts on Local Population and or Economy, FWS should state that buying land will benefit the economy and local landowners. FWS ignores the Alternative B economic impacts on people who will have to pay an entrance fee.

Response:
Thank you for your comment. The following statement was added to the end of the second paragraph under the Alternative B analysis. "The Service's land acquisition benefits the economy by sustaining land values at current and rising levels. In addition, funds generated from land sales are available for other economic benefits to the landowner."

The proposal to charge entrance fees was withdrawn from consideration, so further analysis is not necessary.

Comment 68:
Pages B-79 and B-80, 4.5.2 Impacts on Aesthetic and Visual Resources, FWS fails to acknowledge the erosion control infrastructure that currently exists at the GIWW and the proposed additional GIWW infrastructure (pages B-65 and B-66).

Response:
Thank you for your comments. In response to you comments, the following changes to section 4.5.2 were made. Under Alternative A, the following sentence was added "Existing erosion control structures, including revetment geotubes and oyster reef domes, can detract from aesthetics." Under Alternative B, the following sentence was added "Increased erosion control would further detract from aesthetics along the GIWW."

Comment 69:
Page B-82, 4.5.3 Impacts on Public Use Opportunities, Alternative B – Proposed Action, FWS ignores the impacts that an entrance fee will have on low-income people and others who either cannot or do not want to pay a fee. FWS ignores the idea that these lands are owned by the public and that requiring people to pay to see and enjoy their public lands when they have already paid income taxes is not fair or appropriate.

FWS also ignores the potential impacts that can occur by opening hiking trails or closed roads in Hudson Woods to mountain bikes.

Response:
Thank you for your comments. The proposal to charge entrance fees was withdrawn from consideration, so further analysis is not necessary.

The following paragraph, concerning the impacts of mountain bike use, was added under Alternative B. "Alternative B would allow bicycles on the trails a Hudson Woods. This would increase opportunities for visitors to access remote areas along Oyster Creek. Based on current levels of bicycle use on other areas of the refuge conflicts between users are not anticipated."

Comment 70:
Pages B-83 through B-92, 4.6 Assessment of Cumulative Impacts, FWS fails to assess and show cumulative impacts are required by Council on Environmental Quality NEPA regulations.

FWS fails to name specific cumulative actions that may have cumulative effects on the Complex. For instance, under air quality, recently DOW in Freeport announced that it would expand its facilities to take advantage of the availability of natural gas. Freeport LNG is currently undergoing a Federal Energy Regulatory Commission (FERC) NEPA process so that it can export natural gas.

There is no discussion about any specific residential, industrial, commercial projects (cumulative actions) and their potential affects and intensity of those affects on the Complex. There is no discussion about oil/gas development (exploration, drilling, and production (including transportation) offsite and what cumulative impacts this has had both on and off the Complex. There is no discussion of cumulative actions, like DOW seeking off-site reservoirs, and what cumulative impacts this may have both on and off the Complex. There is no discussion of cumulative actions that may have cumulative impacts on water quality both in and out of the Complex. Texas Commission on Environmental Quality (TCEQ) permits could be listed including those recently granted and those currently being sought.

FWS gets the cumulative actions and impacts analysis wrong by stating repeatedly that "the impacts from proposed management activities (all alternatives) would not be cumulatively significant." It is not just the cumulative actions and impacts on the Complex that must be analyzed but cumulative actions and impacts off the Complex that must be analyzed and then added to those cumulative actions and impacts that affect the Complex. In other words NEPA requires that all cumulative actions and impacts, whether on or off the Complex, be assessed including all past, present, and future foreseeable actions.

This has not been done by the FWS in this analysis. The Sierra Club has seen cumulative impact analysis from other agencies where future foreseeable projects are named and their cumulative impacts assessed (right now the Federal Highway Administration's proposed Grand Parkway, Segment B, DEIS comment period is ongoing and the DEIS has such an analysis). FWS must do the same. FWS says little or nothing about how cumulative actions and impacts outside the Complex effect and the magnitude of the effects for bottomland hardwood forests, migratory birds, wetland and aquatic habitats, prairie habitats, resident, native wildlife (For instance, where is the discussion about road kill?}, threatened and

endangered species, aesthetic and visual resources, hunting, wildlife observation and wildlife photography, environmental education, interpretation, and local population and or economy. For instance, what is the percent growth in population and the economy currently and what is predicted for the next 15 years? These are the questions, analysis, and data that must be obtained but FWS has not done the work. It must do so. The public must have this information so that it can review, comment on, and understand all the environmental impacts of the CCP.

Response:
Thanks you for your comments.

We disagree with your interpretation the adequacy of our cumulative effects analysis. We acknowledge that there are cumulative impacts occurring to resources outside of the Complex; however, our ongoing and proposed management actions do not add to those negative impacts.

The EA considers other state, federal and private actions. While we do not detail every specific action occurring around the complex, we have clearly stated that development, urbanization, and industrialization have adverse effects on area resources. We agree and acknowledge that these activities can impact the Complex; however, our responsibility under NEPA is to disclose if and how our actions incrementally add to cumulative impacts on the biological environment. We have determined that **our** impacts are not significant, when considered along with other state, federal and private actions. For instance, the City of Houston may have significant adverse impacts on air quality. However, the Complex's contribution to green house gases is insignificant, particularly when you consider the filtering effect the natural habitat (that we restore, protect, and manage) has on air quality. The existence of the Complex, with the acquisition of additional lands and restoration of degraded habitats, functionally mitigates and/or ameliorates some of the adverse effects (such as habitat loss) of activities occurring outside of the Complex.

The impacts of our management actions are not significant or additive to those resource impacts occurring outside of the Complex. It is also, not our responsibility to analyze how non-Service actions impact the Complex itself, but to look at the impacts of our management on the physical, biological and socioeconomical environment on a larger scale and disclose how our actions add to the impacts cause by other state, federal and private actions

It is the Complex's opinion that all CEQ requirements have been addressed in this EA.

Comment 71:
Page B-92, 4.7 Short-Term Uses Versus Long-Term Productivity, FWS states "would cause short-term negative impacts … from the improved visitor experience would produce long-term benefits for the Complex's entire ecosystem." The FWS forgets to analyze the impacts of an entrance fee on public visitation and that Complex lands are owned by the public and accessible to them freely.

FWS states that "The key to protecting and ensuring the refuges' long-term productivity is to find the threshold where public uses do not degrade or interfere with the refuges' natural

resources." But FWS does not mention carrying capacity and what it is for various natural resources so that the degradation and interference mentioned does not occur.

Response:
Thank you for your comments. For clarification, this section was edited as follows.

At the end of first paragraph, “Complex’s entire” was removed from the last sentence.

On the second paragraph, first two sentences were replaced with the following:

“Inventory and monitoring refuge resources is an essential part of ensuring long-term productivity. Resources are impacted by a variety of natural influences, including climate and storm events. Adding additional stressors through public use opportunities, oil and gas development, and short-term construction activities can have detrimental effects if coupled with other stressors. The Refuges ability to manage habitats, control short-term disturbance and buffer uncontrollable events will enable population sustainability. Within the limited public use areas at each refuge, it is expected that repetitive disturbance and infrastructure does impact populations. However by limiting the area of impact the refuge hopes to obtain a balance between providing opportunities for visitors and meeting the needs of wildlife.”

Comment 72:
Page B-92, 4.8 Unavoidable Adverse Effects and Mitigation Measures, FWS states "The Complex expects these impacts to be minor and or short-term in duration" but then does not name them. The public must have this information so that it can review, comment on, and understand all the environmental impacts of the CCP. FWS does not mention the impacts that entrance fees will have on the public who owns the Complex and should have free access to it.

Response:
The impacts are clearly named and discussed in this section. For further clarification, the second sentence of the introductory paragraph now reads “The Complex expects the impacts described below to be minor and/or short-term in duration.”

Comment 73:
Page B-93, 4.9 Irreversible and Irretrievable Commitment of Resources, FWS states "The Proposed Action would result in some unavoidable harm or harassment to some wildlife" but then does not describe or name the unavoidable harm or harassment to which wildlife species.

Response:
Thank you for your comment. The quoted sentence was deleted; it was not appropriate for this section.

Comment 74:
Pages B-93 through B-97, Table EA 4-2 Summary of Environmental Effects by Alternative,

FWS fails to state or acknowledge what the impacts are of entrance fees and allowing mountain bikes on hiking trails or closed roads.

Response:
Entrance fees were withdrawn from consideration and Table EA 4-2 was updated accordingly.

Comment 75:
Pages C-3 through C-8, Draft Compatibility Determination, Hunting, FWS states there are no long-term and cumulative impacts. However, displacement of users by hunting is a long-term and cumulative impact that should be stated and discussed.

Response:
We disagree with the statement "…displacement of users by hunting is a long-term and cumulative impact that should be stated and discussed." Hunting areas on the Complex are separate from other public use areas. Under the existing hunt program, there is no user conflict.

Comment 76:
Pages C-9 through C-13, Draft Compatibility Determination, Fishing, FWS states there are no long-term and cumulative impacts but lead sinkers and monofilament line discarded by fishing creates trash and kills wildlife and are long-term and cumulative impacts that should be stated and discussed.

Response:
The fishing CD was edited for clarification.

Comment 77:
Pages C-41 through C-44, Draft Compatibility Determination, Boating, FWS states there are no cumulative impacts but noise and visual presence by boating creates disturbance and is a long-term and cumulative impact that should be stated and discussed. FWS lumps airboats with other craft that are much less intrusive and cause less disturbance. Airboats have much greater impacts and should be analyzed separately than small motor boats (which are not defined but should be defined), canoes, and kayaks.

Response:
Thank you for your comment. The Boating CD remains unchanged. We agree that airboats are more intrusive that other boats; however, they are typically only used by hunters for access; these sportsmen have a vested interest in minimizing wildlife disturbance and we have not documented problems with use of boats to access hunting and fishing areas.

Comment 78:
Pages C-45 through C-48, Draft Compatibility Determination, Bicycling, FWS states there are no cumulative impacts but rutting, safety, illegal trails, and wildlife disturbance by mountain bikes are long-term and cumulative impacts that should be stated and discussed. FWS fails in the CCP/EA to discuss how it will monitor and enforce rules to keep people

on mountain bikes from causing illegal actions.

Response:
Thank you for your comment. The Compatibility Determination for bicycling was edited because bicycling at Hudson Woods was left off the location for the activity. Last year, San Bernard reported only 25 bicycling visits. Of these visits, the majority are children on a bicycle accompanying their parents as they walked the trail. There are only a few visitors who choose to bicycle the tour loop road or bicycle the trails as the primary mode of transportation. Based on the historical light use and there has never been outreach from bicyclist to open the trails, with this Compatibility Determination, we do not anticipate a large increase in bicyclist on the refuges. This activity could result in some deterioration of the trails with rutting but regular maintenance to ensure the trails are safe for all visitors will ensure needed repairs are made.

Comment 79:
Pages C-54 through C-57, Draft Compatibility Determination, Cooperative Farming, FWS states there are no cumulative impacts but by farming it not only keeps hundreds of acres from being restored to natural ecosystems but also creates a water pollution problem with fertilizer and pesticide use and costs money which could be used elsewhere to manage natural ecosystems. These cumulative impacts should be stated and discussed.

Response:
Thank you for your comment. The Compatibility Determination for farming has been edited and the potential of pollution from fertilizer application addressed. In 2013, the Cooperative Farmer will plant the first fields that can be classified as organically farmed. In time, we hope to convert most if not all fields to organic farming.

Comment 80:
Pages C-58 through C-62, Draft Compatibility Determination, Cooperative Grazing, FWS states there are no cumulative impacts but by livestock grazing results in trampling of vegetation, rutting of soil, and uses up important food sources that could instead be used by wildlife. In addition, the huge amount of organic manure causes water pollution problems. In addition, cattle like to rest in wet or riparian areas which causes wildlife habitat problems and the potential spread of non-native invasive plant species. These cumulative impacts should be stated and discussed. The Sierra Club opposes the reintroduction of livestock cattle into the Complex because it is not needed and has not been justified.

Response:
Thank you for your comment. Depending on the grazing pressure, grazing can be harmful to the environment. However under careful implementation that includes an annual inventory and monitoring of prairie conditions, grazing can be beneficial, increasing diversity, and providing habitat for some species that cannot be sustained in a fire alone management approach. Prior to implementing a grazing program that would utilize only cool season pasture grazing and/or high intensity – short duration grazing to target invasive species, a grazing management plan will be prepared. This plan will identify the goals and objectives for grazing as well as implementation

strategies and the specific impacts of this implementation as well as a monitoring program to ensure habitat and wildlife benefits are occurring from this management activity. Because this plan is yet to be written, the Complex cannot address specific grazing issues because efforts to eliminate adverse impacts will be addressed at that time.

Comment 81:
Pages C-63 through C-68, Draft Compatibility Determination, Pesticide Application to Control Mosquito Populations, FWS states there are no long-term and cumulative impacts but mosquito control causes pesticide drift, kills wildlife, kills wildlife foods, and poisons ecosystems. These cumulative impacts should be stated and discussed. The Sierra Club opposes mosquito control which is not compatible as wildlife management on the Complex and has not been justified.

Response:
Thank you for your comment. This Compatibility Determination does not provide an unlimited use of pesticides across the refuges. The Complex has been working with the Brazoria County Mosquito Control District to better understand population dynamics of breeding mosquitoes. This Compatibility Determination limits acreages to limited specific and identified upland areas. In addition, any spraying conducted on the refuge will have to be when populations are exceeding a threshold that without spraying, human and wildlife health are being jeopardized.

Comment 82:
Pages H-1 through H-8 and Map H-1 Wilderness Inventory Units, the part of this inventory that the Sierra Club finds totally unacceptable is page H-3, Evaluation of Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation and Table H-2, Minimum Criteria Inventory. The idea that Big Pond, Dance Bayou; Linville Bayou, and other units (not all units are shown as wilderness inventory units which we do not understand) are disqualified as being potential wilderness study areas due to their lack of solitude or primitive and unconfined recreation is simply unbelievable and makes no sense.

If anything these units have provided to the Sierra Club, when we have visited them, some of the best places for solitude and primitive recreation (hiking, nature study, birding, etc.) of any of the places we have visited in Texas. When the Sierra Club visits these areas we rarely see or hear humans or any motorized vehicles. It is *very* easy to get lost in the Columbia Bottomlands and coastal prairies and marshes of Brazoria and San Bernard National Wildlife Refuges.

If FWS would make an honest attempt to assess solitude and primitive recreation in these units it is the Sierra Club's contention that this criteria would not disqualify these areas. If FWS wants to disqualify these areas due to pipelines, roads, and other human impacts, okay, the Sierra Club sees your point. But if FWS disqualifies these areas based upon solitude and primitive recreation we say that FWS is either totally na'ive and ignorant about wilderness inventory assessment or has purposefully disqualified these areas inappropriately.

The Sierra Club requests that the solitude and primitive recreation criteria assessment be redone for these areas.

Response:
Thank you for your comments. The bottomland forests, especially the larger and older forests are special places. However, these areas can and are impacted by oil and gas activities, maintenance on existing pipeline, utility corridors and invasive species control. These events are irregular but cannot be avoided. Within the past year, we have worked with an exploration company completing a large 3-D seismic operation west of West Columbia. This project included operations across five existing units and one pending acquisition. For more than eight months, crews and environmental monitors were permitted to access these areas. Although we have not sold any new easements since the acquisition, we do accept the terms of numerous existing easements when each parcel is acquired. Within the past year we have worked with three companies to permit maintenance work on existing easements including; replacing pipe or sections of a pipe and replacing utility line poles. Nearly all bottomland tracts have pipeline or ROW facilities which require regular and sometimes intrusive maintenance that can interrupt solitude and the values of wilderness.

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Reddish egret at Brazoria National Wildlife Refuge.
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