



National Park Service
U.S. Department of the Interior
Big Thicket National Preserve
Kountze, Texas

Removal of Hurricane Rita Related Debris in the Little Pine Island – Pine Island Bayou Corridor Unit Environmental Assessment

April 2008





United States Department of the Interior

NATIONAL PARK SERVICE

Big Thicket National Preserve
6044 FM 420
Kountze, Texas 77625
(409) 951-6700



IN REPLY REFER TO:

April 11, 2008

Dear Reader:

The National Park Service (NPS) has prepared an Environmental Assessment (EA) to address the potential for increased flooding in communities adjacent to the Little Pine Island – Pine Island Bayou Corridor Unit (LPI Corridor Unit) of Big Thicket National Preserve (Preserve) resulting from post-Hurricane Rita downed trees and woody debris.

In 2005, wind from Hurricane Rita caused a number of trees to fall within the Preserve, and Hardin County officials and private property owners have expressed concern that this debris has contributed to flooding in adjacent communities. In March 2007, NPS hydrologists performed an on-site study of timber blow-down from Hurricane Rita within the LPI Corridor Unit, which determined that there were no post-Hurricane Rita woody debris collections that have increased flooding in the LPI Corridor Unit. However, NPS hydrologists did observe a few areas where downed trees could possibly collect further debris and create obstructions with the potential to increase flooding in the future.

The NPS prepared this EA in compliance with the National Environmental Policy Act (NEPA) to provide the decision-making framework that 1) explores a reasonable range of alternatives to meet project objectives, 2) evaluates potential impacts to park resources and values, and 3) identifies mitigation measures to minimize the degree of these impacts.

The NPS considered all alternatives and chose Alternative B as its Preferred Alternative. Alternative B would allow a one-time removal of select large woody debris and foreign (human) debris from the channel and dispose of it outside of the Preserve. This alternative was chosen because: 1) It best meets the objectives of the project; 2) It is consistent with NPS management policies, laws, regulations, and plans; 3) It would improve the visitor experience in the area by removing obstacles and human debris; 4) It would maintain the ecological integrity of the Bayou.

The NPS encourages public participation throughout the NEPA process. I invite you to voice your ideas, comments, or concerns about this effort. If you wish to comment on the EA, you may post comments online at <http://parkplanning.nps.gov/bith>, or mail or hand-deliver comments to the letterhead address. Comments must be entered into the web-based system or postmarked by May 10, 2008 to be accepted.

Any questions, or requests for a hard copy of the document, should be addressed to Chris Peapenburg, at 409-951-6802.

Sincerely,

Todd W. Brindle
Superintendent



SUMMARY

The National Park Service (NPS) is conducting an environmental assessment (EA) to analyze ways to address Hurricane Rita related large woody debris (LWD) and foreign debris in portions of the Little Pine Island – Pine Island Bayou Corridor Unit (LPI Corridor Unit) of Big Thicket National Preserve (Preserve) that could potentially contribute to out-of-bank flows or atypical flooding and affect communities adjacent to the Preserve. LWD is defined as branches, large limbs, and trees that have fallen into the bayou. Foreign debris includes building materials, appliances, tires, etc. The project area consists of the portion of the LPI Corridor Unit beginning at the Woodway Boulevard Bridge and continuing east to the boundary of the LPI Corridor Unit at U.S. Highway 69. The project is needed to address potential future effects where LWD (Type II and III) and accumulations of foreign debris could possibly collect further debris and create obstructions that could change the current potential for out-of-bank flows or atypical flooding beyond what currently exists.

In 2005, heavy wind from Hurricane Rita caused a number of trees to fall within the Preserve, and Hardin County officials and private property owners have expressed concern that this LWD has contributed to out-of-bank flows and atypical flooding in adjacent communities. In March 2007, after meeting with Preserve staff and local county representatives, NPS hydrologists performed an on-site reconnaissance of timber blow-down related to Hurricane Rita within the LPI Corridor Unit (see Appendix A, Reconnaissance Trip Report). The reconnaissance determined that there were no Hurricane Rita related LWD collections that have increased the flood stage in the Preserve LPI Corridor Unit. However, the NPS hydrologists did observe a few areas where LWD could possibly collect further debris and create obstructions with the potential to contribute to out-of-bank flows or atypical flooding beyond what currently exists (NPS 2007b). In March 2008, another on-site reconnaissance was conducted by Preserve staff. The group determined that LWD and foreign debris collections were still present within the LPI Corridor Unit.

In July 2007, Hardin County submitted an application to the Office of Rural Community Affairs for the Hurricane Rita Disaster Recovery second supplemental set aside grant (Hardin County 2007). The application included a request for funding of over 70 projects to remove downed trees, limbs, leaves, and shifted soil the County sustained as a result of Hurricane Rita to alleviate blocked drainages that had not previously flooded and other areas of the County experiencing increased flooding with less amounts of rainfall. The County proposed addressing the issues by removing debris from identified problem areas throughout the County including drainage ditches, streams, and bayous. Pine Island Bayou was identified as an area greatly in need of debris removal. However, because portions of the bayou are located in the Preserve, the County indicated that the NPS stipulated a study must be conducted on the types of debris in the bayou and the effects of removing such debris on the ecosystem. The study and potential debris removal were included in activities for the Pine Island Bayou project. On July 24, 2007, Hardin County and the Preserve signed a Memorandum of Agreement for Hardin County to provide funding through donation for the study and other work necessary to comply with the National Environmental Policy Act (NEPA) and other applicable federal laws for the proposal to remove debris deposited or caused to be deposited by Hurricane Rita in the LPI Corridor Unit of the Preserve (NPS 2007b).

This EA evaluates three alternatives. Alternative A is the no action alternative, which represents the baseline or benchmark from which to compare the impacts of the action alternatives. In this case “no-action” means that the project area would continue to be managed for the preservation of floodplain values, allowing natural processes to evolve, with no removal of LWD and foreign debris. Under alternative B (Preferred Alternative), the NPS (through a contractor) would conduct a one-time removal of Hurricane Rita related LWD and foreign debris within the active channel of the

bayou in the project area using a helicopter and associated ground crew, a boat and barge, or a combination of the two methods. Only debris identified as having the potential to create complete blockages of the active channel and result in a change to the current potential for out-of-bank flows or atypical flooding beyond what currently exists would be removed. All removed LWD and foreign debris would be disposed of outside of the Preserve at a disposal site previously used by Hardin County for similar activities. Alternative C would be similar to alternative B; however, debris would be broken up to eliminate its structural integrity and allowed to remain in the channel and/or floodplain. Potential methods for breaking up debris would include a ground crew accessing debris on foot and using chain saws, hand saws, and other appropriate hand-held equipment to break up debris; a ground crew accessing debris by boat during high water and using chain saws, hand saws, and other appropriate hand-held equipment to break up debris; or a combination of the three methods.

This EA has been prepared in compliance with NEPA to provide the decision-making framework that (1) analyzes a reasonable range of alternatives to meet project objectives; (2) evaluates potential issues and impacts to Big Thicket National Preserve's resources and values; and (3) identifies mitigation measures to lessen the degree or extent of these impacts. Resource topics that have been addressed in this document because the resultant impacts could be measurable include floodplains/wetlands, water resources, soils, vegetation, fish and wildlife, species of special concern, visitor use and experience, park operations and management, and adjacent communities. All other resource topics have been dismissed because the resource did not exist within the LPI Corridor Unit or project area, or the project would result in no or negligible effects to those resources and a full analysis was not considered to be necessary. No major effects are anticipated as a result of this project. Public scoping was conducted to assist with the development of this document, and the majority of commenters supported the removal of debris from the project area.

Public Comment

If you wish to comment on this EA, you may do so online at the NPS website "Planning, Environment, and Public Comment" <http://parkplanning.nps.gov>, or you may mail comments to Todd Brindle, Superintendent; Big Thicket National Preserve; 6044 FM 420; Kountze, Texas 77625. This EA will be on public review for 30 days ending **May 10, 2008**. Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment, including your personal identifying information, may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

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PURPOSE AND NEED

Introduction

Big Thicket National Preserve (Preserve) is located in eastern Texas, northeast of Houston. The Preserve was established by the Act of October 11, 1974, Pub. L. No. 93-439, 88 Stat. 1254, codified as amended at 16 United States Code (U.S.C.) §698-698e, as the nation's first Preserve "to assure the preservation, conservation, and protection of the natural, scenic, and recreational values of a significant portion of the Big Thicket area in the State of Texas and to provide for the enhancement and public enjoyment thereof." The Preserve encompasses more than 97,000 acres comprised of nine land units and six water corridors located in Jefferson, Hardin, Liberty, Polk, Tyler, Jasper and Orange Counties (Figure 1). The Little Pine Island – Pine Island Bayou Corridor Unit (LPI Corridor Unit) of the Preserve is located in the southern portion of the Preserve east of the Lance Rosier Unit and west of the Beaumont Unit. The project area consists of the portion of the LPI Corridor Unit beginning at the Woodway Boulevard Bridge and spanning east to the boundary of the LPI Corridor Unit at U.S. Highway 69 (Figure 2).

The Pine Island Bayou watershed, which expands outside of the Preserve, has a history of flooding. This is due to high clay and silt soil content and its nearly flat (slopes less than one percent) topography. This combination results in the accumulation of surface runoff due to poor drainage which contributes to flooding. As a result of flood damage from stream overflows along the Little Pine Island – Pine Island Bayou corridor in 1963, 1975, and 1979, the U.S. Army Corps of Engineers conducted a feasibility study on flood damage prevention for the Pine Island Bayou watershed (USACE 1985). The study was conducted to "determine the feasibility of measures for the reduction of flood damages and the solution to other water and land-related problems." Nine alternatives were examined, including purchase and removal of existing structures in the 5- and 10-year floodplain along Little Pine Island Bayou. The feasibility report found that there was no economically feasible nonstructural or structural means of reducing existing flood damages in the Pine Island Bayou watershed. In 1994, the remnants of Tropical Storm Rosa caused flood waters to rise to a record of 12.5 feet above flood stage in Pine Island Bayou. This flood caused 26 counties to be declared Federal Disaster Areas and regionally took 20 lives; forced the evacuation of 14,000 people from their homes; caused over 700 million dollars in damages; closed Interstate 10 between Beaumont and Houston; closed the Port of Houston; and contaminated several areas by dispersing pollutants, fresh water, and mud (USGS 1995).

In September 2005, Hurricane Rita made landfall between Sabine Pass, Texas and Johnsons Bayou, Louisiana, and resulted in approximately \$10 billion dollars in damage; caused nine counties to be declared Federal Disaster Areas; resulted in a loss of power for over 2 million people; and resulted in extensive wind damage. The Beaumont area sustained severe wind damage which resulted in an estimated 25 percent of trees being uprooted and extensive damage to property from the wind and falling trees (Hurricane Rita 2008).

The wind from Hurricane Rita caused a number of trees to fall within Little Pine Island – Pine Island Bayou, and Hardin County officials and private property owners have expressed concern that this large woody debris (LWD) has contributed to out-of-bank flows and atypical flooding in adjacent communities. LWD is defined as branches, large limbs, and trees that have fallen into the bayou. In March 2007, after meeting with Preserve staff and local county representatives, National Park Service (NPS) hydrologists performed an on-site reconnaissance of timber blow-down related to Hurricane Rita within a portion of the LPI Corridor Unit of the Preserve (see Appendix A) (NPS

Figure 1 – Big Thicket National Preserve and Vicinity

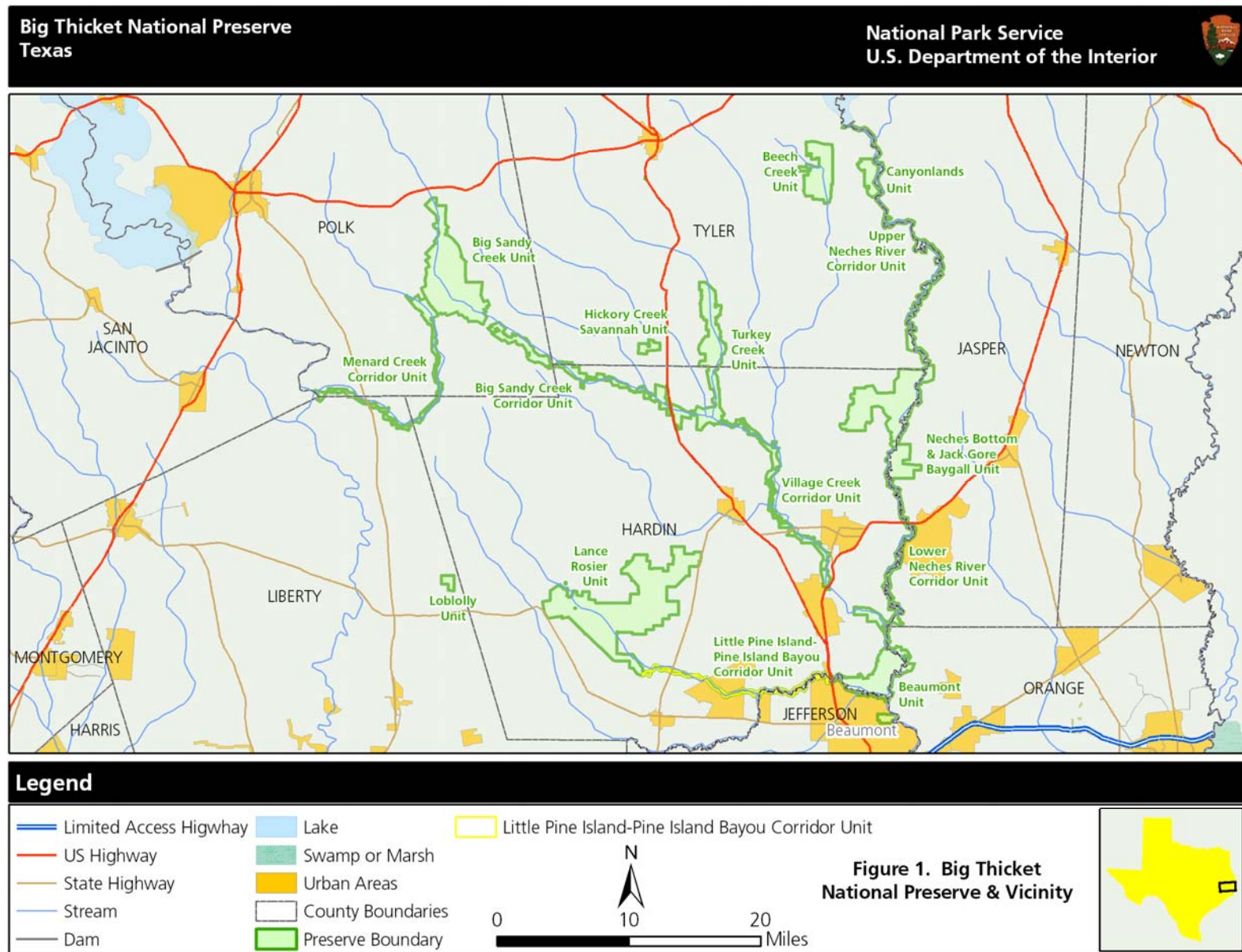
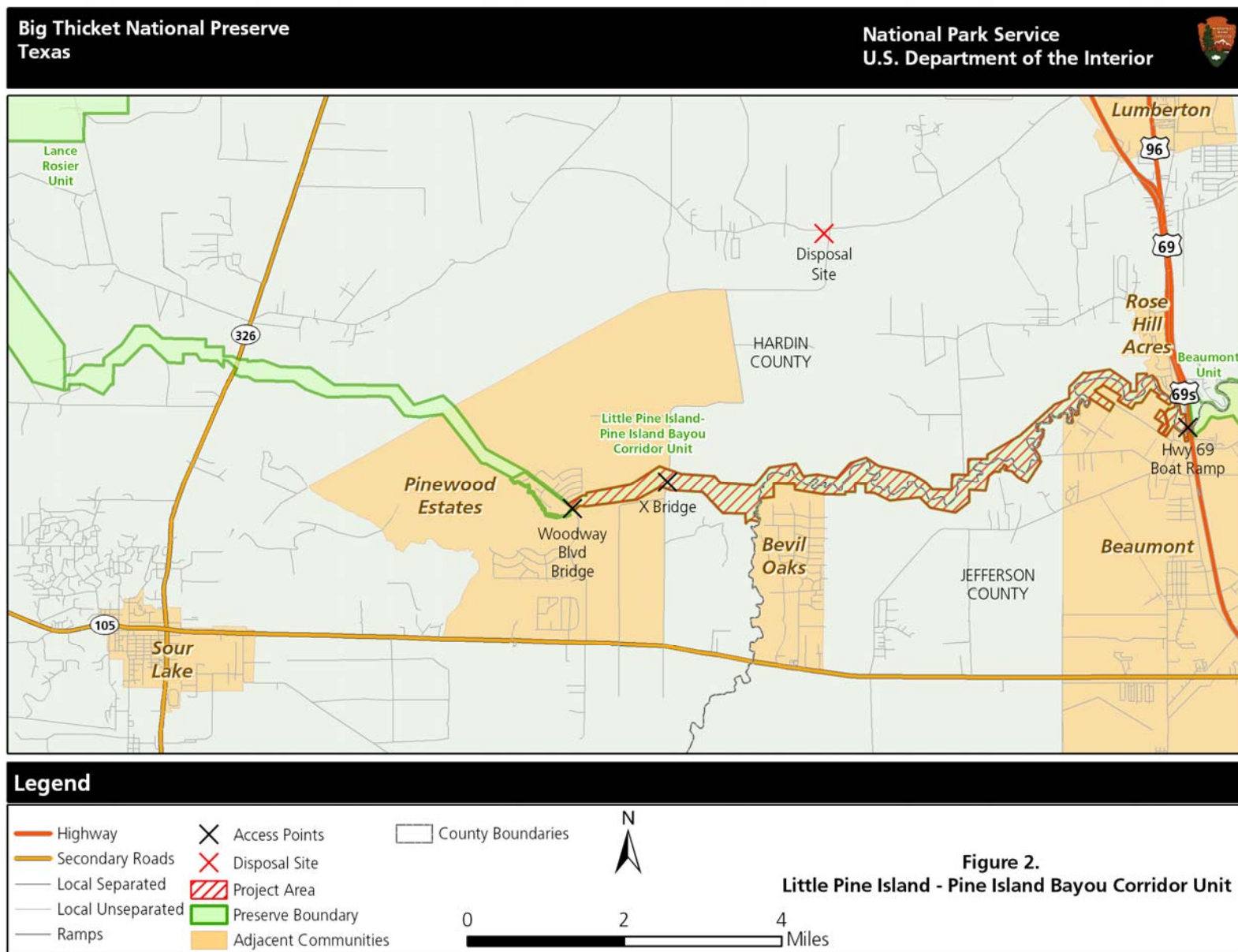


Figure 2 – Little Pine Island – Pine Island Bayou Corridor Unit



2007b). NPS hydrologists identified three types of LWD within the channel. The three types are classified as follows:

Type I - Small to medium diameter logs (less than 2 to 3 feet in diameter) that extended from bank to bank yet were basically contained within the active channel below bank-full elevation;

Type II - large diameter logs (greater than 3 ft) that had fallen across and spanned the channel at a relatively high elevation (top of the banks);

Type III - a compound woody debris collection that contained different sized logs and brush, including large diameter trees high in the channel and smaller diameter trees lower in the channel.

For the purposes of this EA, these definitions were further refined based on the recognition that some LWD collections observed may meet all the criteria listed for one of the types in the Reconnaissance Trip Report (NPS 2007b), except the diameter of the logs. The NPS determined that such debris collections would still warrant characterization as Type I, II, or III debris collections, so the definitions were revised to remove specific diameters. The refined definitions are as follows:

Type I – Any accumulation of woody debris and downed trees, of any size, that is contained primarily within the active channel (below bank-full) and does not extend substantially above the top of the banks;

Type II – Downed trees that are long enough to span the channel, and in fact extend from bank-to-bank at an elevation at or above the top of the bank, and are of sufficient size (diameter and length) to serve as “structural components” in the potential formation of more substantial debris jams; and

Type III – Large collections of woody debris and downed trees of any size that span the channel from at least bank-to-bank, and extend to an elevation well above the top of the bank and into both sides of the floodplain.

The reconnaissance determined that there were no Hurricane Rita related LWD collections that have increased the flood stage in the LPI Corridor Unit. However, the NPS hydrologists did observe a few areas where LWD (Type II and III) could possibly collect further debris and create obstructions with the potential to contribute to out-of-bank flows or atypical flooding beyond what currently exists. In March 2008, another on-site reconnaissance was conducted by Preserve Staff, which determined that LWD and foreign debris were still present within the LPI Corridor Unit.

In July 2007, Hardin County submitted an application to the Office of Rural Community Affairs for the Hurricane Rita Disaster Recovery second supplemental set aside grant (Hardin County 2007). The application included a request for funding of over 70 projects to remove downed trees, limbs, leaves, and shifted soil the County sustained as a result of Hurricane Rita to alleviate blocked drainages that had not previously flooded and other areas of the County experiencing increased flooding with less amounts of rainfall. The County proposed addressing the issues by removing debris from identified problem areas throughout the County including drainage ditches, streams, and bayous. Pine Island Bayou was identified as an area greatly in need of debris removal; however, due to portions of the bayou being located in the Big Thicket National Preserve, the County indicated that the NPS stipulated a study of the types of debris in the bayou and the effects of removing such debris on the ecosystem must be done. The study and potential debris removal were included in activities for the Pine Island Bayou project. On July 24, 2007, Hardin County and the Preserve signed a Memorandum of Agreement for Hardin County monetary donation for the study

and other work necessary to comply with the National Environmental Policy Act (NEPA) and other applicable federal laws for the proposal to remove debris deposited or caused to be deposited by Hurricane Rita in the LPI Corridor Unit of Big Thicket National Preserve (NPS 2007b).

Purpose

The purpose of this project is to address Hurricane Rita-related LWD and other accumulations of foreign debris (e.g., building materials and appliances) in portions of the LPI Corridor Unit with the potential to collect further debris and create obstructions that could contribute to out-of-bank flows or atypical flooding beyond what currently exists.

Need

Although the Pine Island Bayou watershed has an established history of flooding, many residents adjacent to the LPI Corridor Unit believe that LWD and foreign debris related to Hurricane Rita has contributed to out-of-bank flows and atypical flooding in adjacent communities. In addition, a field reconnaissance identified areas of LWD and foreign debris with the potential to collect further debris and create obstructions that could contribute to out-of-bank flows or atypical flooding beyond what currently exists (NPS 2007b).

The project is needed to address potential future effects where LWD (Type II and III) and accumulations of foreign debris could possibly collect further debris and create obstructions that could change the current potential for out-of-bank flows or atypical flooding beyond what currently exists.

Objectives

Consistent with the guidance and bounds set by NPS management policies, laws, and other regulations, the objectives for this project are to:

- Work cooperatively with the public and county government to protect Preserve resources and values, avoid and resolve potential conflicts, enhance visitor use and experience within the LPI Corridor Unit, and address mutual interests in the quality of life of community residents.
- Considering the extent it is compatible with public safety, allow weather-related processes and associated disturbances to recover as naturally possible.
- Prevent impairment of Preserve resources and limit impacts on Preserve operations and management.

Relationship to Regulations, Policies, and Plans

Guiding Regulations and Policies

National Environmental Policy Act (NEPA)

NEPA is implemented through regulations of the Council on Environmental Quality (CEQ) (40 Code of Federal Regulations (CFR) Parts 1500–1508). The NPS has in turn adopted procedures to comply with the Act and the CEQ regulations, as found in NPS Director's Order #12, Conservation Planning, Environmental Impact Analysis, and Decision-making (NPS 2001), and its accompanying handbook, and the Department of the Interior regulations implementing NEPA (Department Manual 12).

National Parks Omnibus Management Act of 1998 (NPOMA)

NPOMA (16 USC § 5901 et seq.) underscores NEPA in that both are fundamental to NPS park management decisions. Both acts provide direction for articulating and connecting the ultimate resource management decision to the analysis of impacts, using appropriate technical and scientific information. Both also recognize that such data may not be readily available, and they provide options for resource impact analysis should this be the case.

Organic Act, as amended

The 1916 NPS Organic Act (16 USC § 1) commits the NPS to making informed decisions that perpetuate the conservation and protection of park resources unimpaired for the benefit and enjoyment of future generations. In the Organic Act, Congress directed the U.S. Department of the Interior and the NPS to manage units of the national park system “to conserve the scenery and the natural and historic objects and wildlife therein and to provide for the enjoyment of the same in such a manner and by such a means as will leave them unimpaired for the enjoyment of future generations” (16 USC § 1). Congress reiterated this mandate in the Redwood National Park Expansion Act of 1978 by stating that NPS must conduct its actions in a manner that will ensure no “derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress” (16 USC § 1a-1).

The Organic Act and its amendments afford the NPS latitude when making resource decisions about visitor recreation and resource preservation. Despite this discretion, courts consistently interpret the Organic Act and its amendments to elevate resource conservation above visitor recreation. See *Michigan United Conservation Clubs v. Lujan*, 949 F.2d 202, 206 (6th Cir. 1991) (holding that in enacting the Organic Act “Congress placed specific emphasis on conservation”); *National Rifle Ass’n of America v. Potter*, 628 F. Supp. 903, 909 (D.D.C. 1986) (stating that “in the Organic Act Congress speaks of but a single purpose, namely, conservation”). By these acts Congress “empowered [the NPS] with the authority to determine what uses of park resources are proper and what proportion of the parks resources are available for each use” (*Bicycle Trails Council of Marin v. Babbitt*, 82 F.3d 1445, 1453 [9th Cir. 1996]). The *NPS Management Policies 2006* also recognize that resource conservation takes precedence over visitor recreation. The policy dictates “when there is a conflict between conserving resources and values and providing for enjoyment of them, conservation is to be predominant” (NPS 2006a, sec. 1.4.3).

Because conservation remains predominant, the NPS seeks to avoid or to minimize adverse impacts on park resources and values. Yet, the NPS has discretion to allow negative impacts when necessary and appropriate to fulfill the purposes of the park, as long as the impact does not constitute an impairment (NPS 2006a, sec. 1.4.3).

While some actions and activities cause impacts, the NPS cannot allow an adverse impact that constitutes resource impairment (NPS 2006a, sec. 1.4.3). The Organic Act prohibits actions that permanently impair park resources unless a law directly and specifically allows for the action (16 USC § 1a-1). An action constitutes an impairment when its impacts “harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values” (NPS 2006a, sec. 1.4.5). To determine impairment, the NPS must evaluate “the particular resources and values that would be affected; the severity, duration, and timing of the impact; the direct and indirect effects of the impact; and the cumulative effects of the impact in question and other impacts” (NPS 2006a, sec. 1.4.5). This EA, therefore, analyzes the

effects of the management alternatives on Preserve resources and values and determines if these effects would cause impairment.

Migratory Bird Treaty Act

Protection under the Migratory Bird Treaty Act makes it unlawful to pursue, hunt, kill, capture, possess, buy, sell, purchase, or barter any migratory bird, including the feathers or other parts, nests, eggs, or migratory bird products. In addition, this act serves to protect environmental conditions for migratory birds from pollution or other ecosystem degradations.

Endangered Species Act

The Endangered Species Act of 1973 requires examination of impacts on all federally-listed threatened, endangered, and candidate species. Section 7 of the Endangered Species Act requires all federal agencies to consult with the U.S. Fish and Wildlife Service (or designated representative) to ensure that any action authorized, funded, or carried out by the agency does not jeopardize the continued existence of listed species or critical habitats.

Clean Water Act

The purpose of the Clean Water Act is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." To enact this goal, the U.S. Army Corps of Engineers has been charged with evaluating federal actions that result in potential degradation of waters of the United States and issuing permits for actions consistent with the Clean Water Act. The U.S. Environmental Protection Agency (EPA) also has responsibility for oversight and review of permits and actions, which affect waters of the United States.

Executive Orders

Floodplains

Executive Order 11988, Floodplain Management, requires each agency to 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 for (1) acquiring, managing, and disposing of Federal lands and facilities; (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.

Wetlands

For regulatory purposes under the Clean Water Act, the term wetlands means "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas." Executive Order 11990, Protection of Wetlands, requires each agency to provide leadership and 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 for (1) acquiring, managing, and disposing of Federal lands and facilities; (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.

National Park Service Management Policies

This is the basic NPS-wide policy document, adherence to which is mandatory unless specifically waived or modified by the NPS Director or certain Departmental officials, including the Secretary. Several sections from the *NPS Management Policies 2006* (NPS 2006a) are particularly relevant to the proposal to address Hurricane Rita related downed trees and woody debris in the LPI Corridor Unit, as described below.

Fish and Wildlife

The NPS will maintain as parts of the natural ecosystems of parks all plants and animals native to park ecosystems by preserving and restoring the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations and the communities and ecosystems in which they occur; restoring native plant and animal populations in parks when they have been extirpated by past human-caused actions; and minimizing human impacts on native plants, animals, populations, communities, and ecosystems, and the processes that sustain them (NPS 2006a, sec 4.4.1).

Natural Phenomena and Floodplains

The NPS policy guiding management after a natural phenomena directs that “Landscapes disturbed by natural phenomena, such as landslides, earthquakes, floods, hurricanes, tornadoes, and fires, will be allowed to recover naturally unless manipulation is necessary to protect other park resources, developments, or employee and public safety.” The proposed action is designed to both allow for as much natural recovery in the Preserve as possible, while protecting the safety of people by eliminating or reducing atypical out-of-bank flooding (NPS 2006a, sec 4.1.5).

In managing floodplains on park lands, NPS management policy directs that NPS will (1) manage for the preservation of floodplain values; (2) minimize potentially hazardous conditions associated with flooding; and (3) comply with the NPS Organic Act and all other federal laws and executive orders related to the management of activities in flood-prone areas, including Executive Order 11988 (Floodplain Management), NEPA, applicable provisions of the Clean Water Act, and the Rivers and Harbors Appropriation Act of 1899. Specifically, the NPS will:

- protect, preserve, and restore the natural resources and functions of floodplains;
- avoid the long- and short-term environmental effects associated with the occupancy and modification of floodplains; and,
- avoid direct and indirect support of floodplain development and actions that could adversely affect the natural resources and functions of floodplains or increase flood risks (NPS 2006a, sec 4.6.4).

Geologic Resources

The NPS will preserve and protect geologic resources and features from adverse effects of human activity, while allowing natural processes to continue. These policies also state that the NPS will strive to understand and preserve the soil resources of park units and to prevent, to the extent possible, the unnatural erosion, physical removal, or contamination of the soil, or its contamination of other resources (NPS 2006a, sec 4.8.2).

Species of Special Concern

The NPS is required to inventory, monitor, and manage state and locally listed species in a manner similar to its treatment of federally listed species to the greatest extent possible. The NPS is also required to inventory other native species that are of special management concern to parks (such as rare, declining, sensitive, or unique species and their habitats) and manage them to maintain their natural distribution and abundance (NPS 2006a, sec 4.4.2.3).

Water Resources

The NPS will perpetuate surface waters and groundwaters as integral components of park aquatic and terrestrial ecosystems. NPS policies also require protection of water quality consistent with the Clean Water Act (NPS 2006a, sec 4.6.1).

Director's Orders

Cultural Resources

Director's Order 28B: Archeology, and NPS-28: Cultural Resource Management Guideline (NPS 1998) affirm a long-term commitment to the appropriate investigation, documentation, preservation, interpretation, and protection of archeological resources inside units of the National Park System. As one of the principal stewards of America's heritage, the NPS is charged with the preservation of the commemorative, educational, scientific, and traditional cultural values of archeological resources for the benefit and enjoyment of present and future generations. Archeological resources are nonrenewable and irreplaceable, so it is important that all management decisions and activities throughout the National Park System reflect a commitment to the conservation of archeological resources as elements of our national heritage.

NPS Director's Order 28: Cultural Resource Management, defines ethnographic resources as any site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it (NPS 1998). According to DO-28 and Executive Order 13007 on sacred sites, the NPS should attempt to preserve and protect ethnographic resources.

Floodplains

In compliance with Executive Order 11988, the NPS, under Director's Order 77-2: Floodplain Management, will strive to preserve floodplain values and minimize hazardous floodplain conditions. According to Director's Order 77-2: Floodplain Management, certain construction within a 100-year floodplain requires preparation of a Statement of Findings for floodplains.

Wetlands

In compliance with Executive Order 11990, the NPS under Director's Order 77-1: Wetlands Protection, strives to prevent the loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. In accordance with Director's Order 77-1: Wetlands Protection, proposed actions that have the potential to adversely impact wetlands must be addressed in a Statement of Findings for wetlands.

Big Thicket National Preserve Enabling Act

The Preserve was established by the Act of October 11, 1974, Pub. L. No. 93-439, 88 Stat. 1254, codified as amended at 16 U.S.C. §§ 698-698e (2000), as the nation's first Preserve "to assure the preservation, conservation, and protection of the natural, scenic, and recreational values of a significant portion of the Big Thicket area in the State of Texas and to provide for the enhancement and public enjoyment thereof." The Big Thicket, often referred to as a "biological crossroads," is a transition zone where southwestern deserts, central plains, eastern forests, and southeastern

swamps intersect. In recognition of this diversity, the Preserve was designated a Biosphere Reserve in 1978 by the United Nations Educational, Scientific and Cultural Organization (UNESCO). It shares this distinction among 332 biosphere reserves in 85 countries worldwide. The biosphere reserve program (Man and the Biosphere Program) is based on the concept that it is possible to achieve a sustainable balance between the conservation of biological diversity, economic development and maintenance of associated cultural values.

Big Thicket National Preserve Plans

Existing plans must be examined to ensure that proposed actions are consistent with plan provisions. These include the Big Thicket National Preserve *General Management Plan (1980)*, Big Thicket National Preserve Oil and Gas Management Plan (NPS 2005), the Big Thicket National Preserve Fire Management Plan (NPS 2004), and the Big Thicket National Preserve Resource Management Plan (NPS 1996). Following is information pertaining to how this proposal meets the goals and objectives of these plans.

General Management Plan (1980)

The Big Thicket National Preserve *General Management Plan (1980)* outlines the following objectives for natural resource management and management zoning:

- To perpetuate and protect the Preserve's unique mixture of temperate and subtropical botanical communities;
- To initiate joint planning and natural resource management programs with neighboring landowners to promote continued compatible land use;
- To proceed with research activities that provide baseline data necessary for future planning and management efforts and for the evaluation of the environmental impacts of human use on the Preserve.

Most of the Preserve is designated a "natural zone," which places management emphasis on conservation of natural resources and processes while providing for uses that do not adversely affect these resources and processes. The LPI Corridor Unit contains a development zone, specifically an access/circulation development subzone north of Bevil Oaks. The development zone allows for areas in the Preserve to be used for certain types of development to serve the needs of park management and visitors. It does not automatically ensure full development of these areas, rather permits development to be considered. This subzone has not been developed to date.

The special use zone includes lands within the Preserve where uses are carried out by other agencies or private interests. The LPI Corridor Unit also contains several subzones for transportation and utilities. When the Preserve's *General Management Plan (1980)* was published, a subzone for exploration/mining existed within the unit, but as the nonfederal oil and gas operations within this area ceased, it has reverted to the natural environment subzone in accordance with the plan.

The *General Management Plan (1980)* also outlines a general development plan for the LPI Corridor Unit which states that "the NPS will assist and encourage the state to develop a water access point with parking for 10 vehicles, EPA-approved self-contained toilets, a 1/4-mile roadway, and a wayside exhibit at the junction of Texas 105 and Pine Island Bayou. If this proves infeasible, the NPS will develop a similar site on Preserve land at the confluence of Little Pine Island Bayou and Pine Island Bayou." As stated above in the discussion regarding the development zone, neither of these plans have been implemented to date.

The proposal to address Hurricane Rita related LWD and foreign debris in the LPI Corridor Unit of Big Thicket National Preserve is consistent with the *General Management Plan (1980)* objectives and management for the following reasons: due to the nature of the project addressing already downed trees and woody debris, it would not affect the unique mixture of temperate and subtropical botanical communities; it would allow for joint planning with neighboring landowners to promote continued compatible land use through evaluation of flooding within the Preserve and adjacent communities; it would provide baseline data on flooding and the effects of LWD and foreign debris to contribute to out-of-bank flows or atypical flooding beyond what currently exists that could assist with future planning and management efforts; it places management emphasis on conservation of natural resources through the types and degrees of methods proposed to address LWD and foreign debris; and it is consistent with management zones by ensuring minimum impact on the natural and ecological integrity of the Preserve by the types and degrees of methods proposed to address LWD and foreign debris, yet providing environmentally compatible recreational activities through the potential opportunities that would be created in the area for water users.

Oil and Gas Management Plan

The Big Thicket National Preserve Oil and Gas Management Plan requires management of the Riparian Corridors Special Management Area (which includes the LPI Corridor Unit) as No Surface Use for drilling and production operations unless there is no other practicable alternative (documented in a Statement of Findings (DO 77-2)). Operations could be permitted adjacent to existing roadways or within previously disturbed areas subject to current legal and policy requirements. The plan also allows for geophysical exploration within the 100-year floodplain with a 500' offset from perennial, intermittent, or ephemeral watercourses, but does not permit staging areas unless there is no practicable alternative. Vehicle use associated with geophysical exploration activities would not be permitted on or across saturated or flooded soils in "C" and "D" hydrologic classes (see Chapter 3 Soil for definition of classes).

The proposal to address Hurricane Rita related LWD and foreign debris in the LPI Corridor Unit of Big Thicket National Preserve is consistent with the Oil and Gas Management Plan objectives and management because the types and degrees of methods proposed would involve no surface use (as defined in the plan) of the project area riparian corridor and would only utilize, if at all, previously disturbed areas for debris staging and disposal.

Fire Management Plan

The Big Thicket National Preserve Fire Management Plan requires an aggressive suppression response in the Stream Corridor Fire Management Unit (which includes the LPI Corridor Unit) to protect adjacent values-at-risk, including the use of natural barriers and handline construction, particularly on stream floodplains, but also dozer-plow use along the boundary or around the fire when essential. The plan further states that the use of Single-Engine Air Tankers, heavy air tankers, and helicopters with buckets for suppression should also be considered.

The proposal to address Hurricane Rita related LWD and foreign debris in the LPI Corridor Unit of Big Thicket National Preserve is consistent with the Fire Management Plan objectives and management because the types and degrees of methods proposed would be similar to or not exceed in intensity any of the actions that would be associated with an aggressive suppression response should a fire occur in the area. The Fire Management Plan also allows the use of aircraft for suppression activities, which is consistent with one of the methods of proposed removal of LWD and foreign debris.

Resource Management Plan

The Big Thicket National Preserve Resource Management Plan outlines the following natural resource management objectives for the Preserve:

- To perpetuate, protect, interpret, and where appropriate restore, the Preserve's unique mixture of temperate and sub-tropical botanical and biological communities.
- To establish and nurture partnerships with appropriate state and federal agencies and other entities for the purpose of managing significant scenic and natural resources of the Preserve in a manner that will assure their integrity and "health" of the great ecosystem.
- To initiate joint planning, educational and natural resource management programs with neighboring landowners and the general public to promote good land stewardship and to minimize conflicting uses that might be detrimental to the resources of the Preserve and region.
- To continue an aggressive research program that provides baseline data necessary to facilitate the future planning and management decision process, and for the evaluation of the environmental impacts of human use on Big Thicket National Preserve.

The Resource Management Plan specifically addresses flooding issues in the Preserve and recommends that Preserve staff attempt to stay abreast of the issue and proposals through the legislative and administrative processes of the State of Texas and continue to maintain a dialogue with other agencies and comment on proposals as they develop.

The proposal to address Hurricane Rita related LWD and foreign debris in the LPI Corridor Unit of Big Thicket National Preserve is consistent with the Resource Management Plan objectives and management for several reasons: due to the nature of the project addressing already LWD and foreign debris it would not affect the unique mixture of temperate and subtropical botanical and biological communities; it would establish and nurture partnerships with appropriate state and federal agencies and other entities to assure the integrity of natural resources and "health" of the ecosystem through the types and degrees of methods proposed to address LWD and foreign debris and the emphasis on natural and ecological integrity of the Preserve; it would initiate joint planning, educational and natural resource management programs with neighboring landowners and the general public to promote good land stewardship and to minimize conflicting uses that might be detrimental to the resources of the Preserve and region through providing baseline data on flooding and the effects of LWD and foreign debris to contribute to out-of-bank flows or atypical flooding beyond what currently exists; it would provide baseline data on flooding and the effects of LWD and foreign debris to contribute to out-of-bank flows or atypical flooding beyond what currently exists that could assist with future planning and management efforts; and it is part of the effort of Preserve staff to stay abreast of flooding issues and continue to maintain a dialogue with other agencies.

Impairment

NPS *Management Policies 2006*, require analysis of potential effects to determine whether or not actions would impair park resources (NPS 2006a). The fundamental purpose of the national park system, established by the Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve park resources and values. NPS managers must always seek ways to avoid, or to minimize to the greatest degree practicable, adversely impacting park resources and values. However, the laws do give the NPS the management discretion to allow

impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, as long as the impact does not constitute impairment of the affected resources and values.

Although Congress has given the NPS the management discretion to allow certain impacts within parks, that discretion is limited by the statutory requirement that the NPS must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise. The prohibited impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values. An impact to any park resource or value may constitute an impairment, but an impact would be more likely to constitute an impairment to the extent that it has a major or severe adverse effect upon a resource or value whose conservation is:

- necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park;
- key to the natural or cultural integrity of the park; or
- identified as a goal in the park's *General Management Plan (1980)* or other relevant National Park Service planning documents.

Impairment may result from NPS activities in managing the park, visitor activities, or activities undertaken by concessionaires, contractors, and others operating in the park. A determination on impairment is made under each alternative in the *Conclusion* section of *Environmental Consequences* for each of the resource topics carried forward in this chapter.

Unacceptable Impacts

The impact threshold at which impairment occurs is not always readily apparent. Therefore, the NPS will apply a standard that offers greater assurance that impairment will not occur. The NPS will do this by avoiding impacts that it determines to be unacceptable. These are impacts that fall short of impairment, but are still not acceptable within a particular park's environment. Park managers must not allow uses that would cause unacceptable impacts; they must evaluate existing or proposed uses and determine whether the associated impacts on park resources and values are acceptable.

Virtually every form of human activity that takes place within a park has some degree of effect on park resources or values, but that does not mean the impact is unacceptable or that a particular use must be disallowed. Therefore, for the purposes of these policies, unacceptable impacts are impacts that, individually or cumulatively, would:

- be inconsistent with a park's purposes or values, or
- impede the attainment of a park's desired future conditions for natural and cultural resources as identified through the park's planning process, or
- create an unsafe or unhealthful environment for visitors or employees, or
- diminish opportunities for current or future generations to enjoy, learn about, or be inspired by park resources or values, or
- unreasonably interfere with
 - park programs or activities, or
 - an appropriate use, or

- the atmosphere of peace and tranquility, or the natural soundscape maintained in wilderness and natural, historic, or commemorative locations within the park.
- NPS concessioner or contractor operations or services.

In accordance with NPS *Management Policies 2006*, park managers must not allow uses that would cause unacceptable impacts to park resources. To determine if unacceptable impact could occur to the resources and values of Big Thicket National Preserve, the impacts of proposed actions in this environmental assessment were evaluated based on the above criteria. A determination on unacceptable impacts is under each alternative in the *Conclusion* section of *Environmental Consequences* for each of the resource topics carried forward in this chapter.

Appropriate Use

Section 1.5 of NPS *Management Policies 2006* (NPS 2006), *Appropriate Use of the Parks*, directs that the NPS must ensure that park uses that are allowed would not cause impairment of, or unacceptable impacts on, park resources and values. A new form of park use may be allowed within a park only after a determination has been made in the professional judgment of the park manager that it will not result in unacceptable impacts.

Section 8.1.2 of NPS *Management Policies 2006* (NPS 2006), *Process for Determining Appropriate Uses*, provides evaluation factors for determining appropriate uses. All proposals for park uses are evaluated for

- consistency with applicable laws, executive orders, regulations, and policies;
- consistency with existing plans for public use and resource management;
- actual and potential effects on park resources and values;
- total costs to the NPS; and
- whether the public interest will be served.

Park managers must continually monitor all park uses to prevent unanticipated and unacceptable impacts. If unanticipated and unacceptable impacts emerge, the park manager must engage in a thoughtful, deliberate process to further manage or constrain the use, or discontinue it.

The proposal to address Hurricane Rita related LWD and foreign debris in a portion of the LPI Corridor Unit of Big Thicket National Preserve is consistent with applicable laws, executive orders, regulations and policies (as discussed more fully under the *Relationship to Regulations, Policies, and Plans* section) because the types and degrees of methods proposed to address LWD and foreign debris place management emphasis on the natural and ecological integrity of Preserve resources and processes, strive to preserve floodplain values and minimize hazardous floodplain conditions, and allow for as much natural recovery in the Preserve as possible, while protecting the safety of people by potentially eliminating or reducing the potential for LWD and foreign debris to contribute to out-of-bank flows or atypical flooding beyond what currently exists.

As discussed in the *Relationship to Regulations, Policies, and Plans* (Big Thicket National Preserve Plans) section of this document, the proposal to address Hurricane Rita related LWD and foreign debris in a portion of the LPI Corridor Unit is consistent with existing Preserve plans for public use and resource management.

The actual and potential effects to Preserve resources and values from the proposal to address Hurricane Rita related LWD and foreign debris in a portion of the LPI Corridor Unit of Big Thicket National Preserve would be negligible to minor. Moderate effects on health and safety of Preserve workers could be experienced as a result of helicopter use for addressing debris. The proposal would not cause impairment of, or unacceptable impacts on, Preserve resources and values.

On July 24, 2007, Hardin County and the NPS Big Thicket National Preserve signed a Memorandum of Agreement for Hardin County to provide funding through donation for the study and other work necessary to comply with NEPA and other applicable federal laws for the proposal to remove debris deposited or caused to be deposited by Hurricane Rita in the LPI Corridor Unit of Big Thicket National Preserve (NPS 2007b). Therefore, the total costs to the Service would be nominal.

The majority of the public that commented during the 30-day scoping period supported the removal of Hurricane Rita related LWD and foreign debris from the Preserve because of the impacts that flooding has on public safety and local communities. Based on the feedback on the proposal and information relating to flooding trends in the Pine Island Bayou watershed since Hurricane Rita that the NPS received during the scoping period, the public interest would be served in addressing Hurricane Rita related LWD and foreign debris in a portion of the LPI Corridor Unit. Public interest in the protection of resources would also be served, since the NPS is limiting actions to those that would result in minimal disturbance and impacts to natural and cultural environments.

For the reasons described in this section, the NPS finds that the proposal to address Hurricane Rita related LWD and foreign debris in a portion of the LPI Corridor Unit is an appropriate use of the Big Thicket National Preserve.

Scoping

Scoping is a process to identify the resources that may be affected by a project proposal, and to explore possible alternative ways of achieving the proposal while minimizing adverse impacts. Big Thicket National Preserve conducted both internal scoping with appropriate NPS staff and external scoping with the public and interested/affected groups and agencies.

Internal scoping was conducted by an interdisciplinary team of professionals comprising NPS resource specialists from the Big Thicket National Preserve, the NPS Intermountain Region, NPS blasting specialists, NPS aviation specialists, and the private contractor working with the NPS on the EA. Interdisciplinary team members met on October 16–17, 2007 to discuss the purpose, need, and objectives for the project; various alternatives; potential environmental impacts; past, present, and reasonably foreseeable future projects that may have cumulative effects; and possible mitigation measures. Over the course of the meeting, team members also conducted a site visit to view examples of LWD and foreign debris in the Little Pine Island Bayou, as well as the communities being affected by flooding.

On November 15, 2007, the NPS published a scoping brochure detailing their intentions to prepare a Draft Environmental Assessment of Hurricane Rita Debris in the LPI Corridor Unit of Big Thicket National Preserve. The NPS wished to determine the scope of issues to be address in the EA, identify significant issues related to debris removal at the Preserve, and obtain feedback on initially proposed alternatives. The NPS conducted a 30-day public scoping period (ending December 14, 2007) and invited the public to send written comments to the Superintendent or to enter them on-line in the NPS Planning, Environment and Public Comment (PEPC) system. Press releases were also

distributed to local media. During the 30-day scoping period, 67 pieces of correspondence were received. More information regarding scoping can be found in *Comments and Coordination*.

Impact Topics Retained for Further Analysis

Impact topics for this project have been identified on the basis of federal laws, regulations, and orders; NPS *Management Policies 2006*; and NPS knowledge of resources at Big Thicket National Preserve. Impact topics that are carried forward for further analysis in this EA are listed below along with the reasons why the impact topic is further analyzed.

Floodplains/Wetlands

Approximately 98 percent of the project area is located within the 100-year floodplain and contains associated wetlands; therefore this topic was retained for further analysis.

Water Resources

The Little Pine Island – Pine Island Bayou is the main waterway in the project area. In addition, several tributaries enter the bayou throughout its course through the project area. This impact topic was therefore retained for further analysis.

Soils

Because of its location within the 100-year floodplain, the Little Pine Island – Pine Island Bayou contains soil classes “C” and “D,” which are composed of clayey textured hydrological soils. Soils that are composed of a high clay content are moderately to highly erodible. Typically, soils with high clay content are most subject to compaction. Due to the existence of sensitive soils within the project area and the potential for unnatural erosion and contamination of the soil, this impact topic was retained for further analysis.

Vegetation

The project area contains flatland and floodplain hardwood forest communities, which are generally located along the inner floodplain next to the channel of waterways in the vicinity of the Preserve. Both communities exemplify the original and seemingly impenetrable “Big Thicket” and appear to be endemic to it (NPS 2005). This impact topic was therefore retained for further analysis.

Fish and Wildlife

The Preserve’s unique natural features and species diversity have earned it designation as an International Biosphere Reserve and Globally Important Bird Area. The Big Thicket hosts about 60 mammal species, in addition to 92 reptile and amphibian species, more than 1,800 invertebrate species, 97 fish species, and at least 176 bird species.

Due to these designations and the abundance and diversity of fish and wildlife species within the Preserve, this topic was retained for further analysis.

Species of Special Concern

Of the 22 species listed as endangered, threatened, or candidate in Hardin and Jefferson Counties by the U.S. Fish and Wildlife Service and/or Texas Parks and Wildlife, approximately three are

known or have potential to occur within the project area. Therefore, this impact topic was retained for further analysis.

Visitor Use and Experience

Although the LPI Corridor Unit receives limited visitor use due to it being a relatively inaccessible portion of the Preserve, there is a potential to affect visitor use and experience as a result of this proposal. Therefore, this topic was retained for further analysis.

Park Operations and Management

Due to concerns raised by Preserve staff about the level of effort the project would take, effects of the project effort on Preserve staff, as well as concerns raised regarding diversions from other management programs and operations to address, oversee, and coordinate this project, this impact topic was retained for further analysis.

Adjacent Communities

Little Pine Island and Pine Island Bayous flow through Hardin and Jefferson Counties in southeast Texas. The communities within these counties directly adjacent to the project area within the Preserve include Pinewood Estates, Bevil Oaks, Beaumont, and Rose Hill Acres (Figure 2). Specific issues for management consideration relative to adjacent communities to the project area include flooding and the associated health and safety risks, access, and noise from proposed activities within the project area. Therefore, this impact topic was retained for further analysis.

Impact Topics Dismissed From Further Analysis

Impact topics that were dismissed from further analysis in this EA are listed below along with the reasons why the impact topic was dismissed.

Air Quality

The Clean Air Act of 1963 (42 U.S.C. 7401 et seq.) was established to promote the public health and welfare by protecting and enhancing the nation's air quality. The act establishes specific programs that provide special protection for air resources and air quality related values associated with National Park Service units. Section 118 of the Clean Air Act requires a park unit to meet all federal, state, and local air pollution standards. Further, the Clean Air Act provides that the federal land manager has an affirmative responsibility to protect air quality related values (including visibility, plants, animals, soils, water quality, cultural resources, and visitor health) from adverse pollution impacts.

Proposed actions could result in temporary increases of vehicle exhaust, emissions, and fugitive dust in the general project area as a result of the use of boats to access LWD and foreign debris. Any exhaust, emissions, and fugitive dust generated would be temporary and localized. Overall, the project could result in a negligible degradation of local air quality, and such effects would be temporary. Therefore, air quality was dismissed as an impact topic.

Archeological Resources

The NPS protects and manages archeological resources in its custody through effective research, planning, and stewardship and in accordance with the policies and principles contained in the NPS Management Policies 2006 and the appropriate director's orders. Proposed actions are unlikely to adversely affect archeological resources for the following reasons: access by vehicles and

equipment would be confined to previously disturbed areas; boat access would be confined to the bayou channel in the project area; pedestrian access would be confined primarily within the bayou channel; mitigation measures would be implemented that reduce the risk of spills of fuel or other contaminants and the possibility that any such spill would affect more than a localized area; crews would leave the root balls of trees in place to minimize erosion during flood events; the alteration of the flood regime under the action alternatives is expected to be negligible; and finally, any known archeological sites in the project area would be identified during consultation with the SHPO and avoided. Therefore, archeological resources were dismissed as an impact topic.

Ethnographic Resources

The NPS protects and manages ethnographic resources in its custody through effective research, planning, and stewardship and in accordance with the policies and principles contained in the NPS Management Policies 2006 and the appropriate director's orders. Of the five tribes that have historical associations with the Big Thicket area, the Alabama-Coushatta Tribe of Texas has had an association with the Little Pine Island – Pine Island Bayou Corridor Unit since their arrival in the Big Thicket area in the 1700s (NPS 2005). Proposed actions are unlikely to adversely affect ethnographic resources for the following reasons: access by vehicles and equipment would be confined to previously disturbed areas; boat access would be confined to the bayou channel in the project area; pedestrian access would be confined primarily within the bayou channel; mitigation measures would be implemented that reduce the risk of spills of fuel or other contaminants and the possibility that any such spill would affect more than a localized area; crews would leave the root balls of trees in place to minimize erosion during flood events; and the alteration of the flood regime under the action alternatives is expected to be negligible. Further, communication with the Tribe has verified that they have no concerns about the project. Therefore, ethnographic resources were dismissed as an impact topic.

Historic Structures

According to NPS-28 Cultural Resource Management Guideline, structures are material assemblies that extend the limits of human capability. Some historic structures, such as homesteads, logging camps and mills, steamboat landings, abandoned communities, and early oil and gas production sites, exist in the Preserve, but no known structures exist within the project area. As needed, architectural surveys will be conducted if structural remains are encountered during removal activities. Such structures would be avoided to prevent impacts. Therefore, this impact topic was dismissed from further analysis.

Museum Collections

As described in Director's Order #24: NPS Museum Collections Management, the NPS is custodian in perpetuity of irreplaceable and priceless museum collections that include objects, specimens, and archival and manuscript materials representing cultural and natural resources in the United States. Such museum collections are housed at Beaumont Annex and in various museums and universities; however, there are no structures within the area of potential effect that house museum collections. Therefore, this impact topic was dismissed from further analysis.

Cultural Landscapes

According to NPS-28 Cultural Resource Management Guideline, a cultural landscape is a reflection of human adaptation and use of natural resources, and is often expressed in the way land is organized and divided, patterns of settlement, land use, systems of circulation, and the types of structures that are built. Voth Mill is the only known landscape or structure within the project area.

However, it does not meet the requirements for eligibility for listing in the National Register of Historic Places. In keeping with the mission of the NPS to preserve cultural resources, the mill will be interpreted by the park as a historic feature and managed as a cultural landscape. However, it does not merit analysis in this EA because the mill would not be affected by the proposal. Therefore, this impact topic was dismissed from further analysis.

Indian Trust Resources

Secretarial Order 3175 requires that any anticipated impacts to Indian trust resources from a proposed project or action by the Department of Interior agencies be explicitly addressed in environmental documents. The federal Indian trust responsibility is a legally enforceable fiduciary obligation on the part of the United States to protect tribal lands, assets, resources, and treaty rights, and it represents a duty to carry out the mandates of federal law with respect to American Indian and Alaska Native tribes. There are no Indian trust resources at Big Thicket National Preserve. The lands comprising the Preserve are not held in trust by the Secretary of the Interior for the benefit of Indians due to their status as Indians. Therefore, the project would have no effects on Indian trust resources, and this topic was dismissed from further consideration.

Prime and Unique Farmlands

The Farmland Protection Policy Act of 1981, as amended, requires federal agencies to consider adverse effects to prime and unique farmlands that would result in the conversion of these lands to non-agricultural uses. Prime or unique farmland is classified by the U.S. Department of Agriculture's Natural Resources Conservation Service, and is defined as soil that particularly produces general crops such as common foods, forage, fiber, and oil seed; unique farmland produces specialty crops such as fruits, vegetables, and nuts. In order to be considered prime and unique, the farmland must be irrigated. The Preserve, and specifically the project area, does not irrigate any of its lands; and, therefore does not contain prime or unique farmlands. Therefore, the topic of prime and unique farmlands was dismissed from further consideration.

Socioeconomics

The proposal to address Hurricane Rita related LWD and foreign debris in the project area would neither change local and regional land use nor appreciably impact local businesses or other agencies. Implementation of the proposed action could provide a negligible beneficial impact to the economies of adjacent communities due to slight increases in employment opportunities. Any increase in workforce, however, would be temporary and negligible, lasting only as long as project activities. Because the impacts to the socioeconomic environment would be negligible, this topic was dismissed.

Environmental Justice

Executive Order 12898: General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. The proposed action would not have disproportionate health or environmental effects on minorities or low-income populations or communities due to its location in the Preserve. Workers hired to conduct activities would also not be hired based on their race or income. Therefore, the topic of environmental justice was dismissed.

Geologic Resources

According to *NPS Management Policies 2006*, the NPS will preserve and protect geologic resources as integral components of park natural systems. The NPS will (1) assess the impacts of natural processes and human activities on geologic resources; (2) maintain and restore the integrity of existing geologic resources; (3) integrate geologic resource management into Service operations and planning; and (4) interpret geologic resources for park visitors.

The project area is located in an area of the Preserve that does not contain significant topographic or geologic features, and any proposed actions would therefore have a negligible effect on geological resources. Because effects would be negligible, this topic was dismissed from further analysis in this document.

Soundscapes

According to *NPS Management Policies 2006*, park natural soundscape resources encompass all the natural sounds that occur in parks, including the physical capacity for transmitting those natural sounds and the interrelationships among park natural sounds of different frequencies and volumes. The NPS will preserve, to the greatest extent possible, the natural soundscapes of parks.

The sources of noise impacts (helicopter, passenger vehicles, chain saws, work crews, and boat motors) from activities proposed in the Preserve would not remain in the project area, or even in one particular portion of the project area, for any extended period of time. Also, the greatest sources of noise, chainsaws and a helicopter, would only remain in limited portions of the project area for very brief periods of time (a few hours or minutes). Therefore, this impact topic was dismissed from further analysis.

ALTERNATIVES CONSIDERED

The National Environmental Policy Act (NEPA) requires that federal agencies develop a range of reasonable alternatives and provide an analysis of what impacts the alternatives could have on the human environment (the natural and physical environment and the relationship of people with that environment). The alternatives under consideration must include a “no-action” alternative as prescribed by 40 Code of Federal Regulations (CFR) 1502.14.

The two action alternatives presented in this chapter were derived from the recommendations of an interdisciplinary planning team and through feedback from the public during the public scoping process. The interdisciplinary planning team comprises National Park Service (NPS) resource specialists from the Big Thicket National Preserve (Preserve), the NPS Intermountain Region, NPS blasting specialists, NPS aviation specialists, and the private contractor working with the NPS on the environmental assessment (EA).

Description of Alternatives Carried Forward

No Action Alternative (Alternative A)

The no action alternative is a continuation of current conditions and “sets a baseline of existing impacts continued into the future against which to compare impacts of action alternatives” (NPS Director’s Order 12, Section 2.7). Under the no action alternative, the NPS would not remove any large woody debris (LWD) or foreign debris related to Hurricane Rita. LWD is defined as branches, large limbs, and trees that have fallen into the bayou. Foreign debris includes building materials, appliances, tires, etc. The NPS would continue to maintain, restore, and protect the natural resources, functions, and values of floodplains within the Preserve and would allow weather-related processes and the associated disturbances to recover naturally.

Actions Common to the Action Alternatives (Alternatives B and C)

Under both alternatives B and C, the NPS (through a contractor) would conduct a one-time effort to address Hurricane Rita related LWD and foreign debris accumulations within the bayou channel of the project area that could possibly collect further debris and create obstructions that could change the current potential for out-of-bank flows or atypical flooding beyond what currently exists. As described in the *Purpose and Need* chapter, for the purposes of this EA, the following

definitions were used to characterize woody debris in the stream channel:



Type I – Any accumulation of woody debris and downed trees, of any size, that is contained primarily within the active channel (below bank-full) and does not extend substantially above the top of the banks (Figure 3).

Figure 3. Type I Debris



Figure 4. Type II Debris

Type II – Downed trees that are long enough to span the channel, and in fact extend from bank-to-bank at an elevation at or above the top of the bank, and are of sufficient size (diameter and length) to serve as “structural components” in the potential formation of more substantial debris jams (Figure 4).



Figure 5. Type III Debris

Type III – Large collections of woody debris and downed trees of any size that span the channel from at least bank-to-bank, and extend to an elevation well above the top of the bank and into both sides of the floodplain (Figure 5).

Type I debris could not be shown to create obstructions that could change the current potential for out-of-bank flows or atypical flooding beyond what currently exists, therefore, only LWD and foreign debris meeting the above Type II and III definitions would be addressed by activities. Based on the Reconnaissance Trip Report (see Appendix A) (NPS 2007b), approximately four locations of Type II and III debris would be encountered. Activities would follow all NPS policies and safety requirements. A final determination of debris locations would be made by NPS prior to commencing activities. An NPS staff member would be on-site during activities to identify eligible debris on a case-by-case basis for the contractor.

Foreign debris, such as building materials, manufactured items, and other loose foreign debris encountered within the bayou channel at Type II and III debris locations would be removed only if it could be accomplished using the same access and disturbance as the methods described under the alternatives. All foreign debris would be disposed of in the county landfill. Items not accepted by the county landfill (tires, batteries, appliances that use freon, etc.) shall be legally disposed of at

alternate sites as provided by Hardin County. Permits and/or licenses, as well as costs for hauling and disposing of material, would be the responsibility of the contractor.

The public would be notified in advance of closures in portions of the Preserve in order to address debris within the bayou channel in a safe manner. Because this would be a one-time debris removal project, the NPS would not conduct subsequent monitoring.

Remove Large Woody Debris and Foreign Debris from the Channel and Dispose of it Completely (Alternative B, Preferred Alternative)

The NPS chose Alternative B as its Preferred Alternative because it best meets the objectives of the project; it is consistent with NPS management policies, laws, regulations, and plans; it would improve the visitor experience in the area by removing obstacles and human debris; and it would maintain the ecological integrity of the Bayou.

Under alternative B, all LWD and foreign debris that meet the definition of Type II or Type III (excluding root balls and/or stumps) related to Hurricane Rita would be removed from the bayou channel and disposed of outside of the Preserve. One or a combination of the following methods would be used to remove debris. Methods implemented would be based on on-the-ground conditions of the bayou at the time of removal.

Helicopter. This method would involve both a ground crew and helicopter for debris removal activities during either periods of high or low water in the bayou. A ground crew would access eligible LWD and foreign debris collections within the Preserve on foot or by small boat. Root balls on trees, if present, would be cut off by ground crews. The helicopter would lower a grapple or choker for the ground crew to attach to individual trees or woody debris collections. Once the debris was attached, the helicopter would pull the debris out, fly it to the disposal site, and drop it. The process would then be repeated until all eligible LWD and foreign debris collections were removed. The helicopter flight path would be restricted to locations outside of public areas, neighborhoods, and high tension electrical transmission lines. It is assumed that given the location of the disposal site, it would take approximately 5 minutes or less per round trip to pick up and drop debris. Helicopter use would only occur by approved methods as determined with NPS aviation specialists.

Boat/Barge. This method would involve the use of a boat and barge during a period of high water in the bayou to access eligible LWD and foreign debris collections for removal. The equipment would access debris collections within the bayou channel from three access points along the Preserve's Little Pine Island – Pine Island Bayou Corridor Unit (LPI Corridor Unit) (see Figure 2). The boat/barge method would utilize a 10-foot wide working space, which would require removal of some standing trees within the bayou channel itself. Multiple round trips to debris collection locations would be required, depending on the size and weight of the debris. Debris would then be hauled from collection locations in standard dump trucks to the disposal site.

The debris disposal site that is proposed for this project was used by Hardin County immediately after Hurricane Rita for county debris removal activities. As such, Hardin County has an existing agreement with the landowner of the property to use the site for this purpose. The National Park Service would utilize this agreement through the County for debris disposal. The disposal site is located approximately 4 miles north/northeast of the project location (Figure 2). All woody debris would be ground up and spread out on the property as compost. Disposal of foreign debris is discussed in the *Actions Common to the Action Alternatives (Alternatives B and C)* section above.

Eliminate the Structural Integrity of Large Woody Debris and Foreign Debris in the Channel (Alternative C)

Under alternative C, eligible LWD related to Hurricane Rita (Type II or Type III) would be broken up by removing the logs and other debris that provide the "structure" for the potential accumulation of additional debris that could change the current potential for out-of-bank flows or atypical flooding beyond what currently exists. One or a combination of the following methods would be used, and remnants of LWD would be left in the bayou active channel. Removal and disposal of foreign debris is discussed in the *Actions Common to the Action Alternatives (Alternatives B and C)* section above. The methods implemented would be based on on-the-ground conditions of the bayou at the time of activities.

Overland Routes. This method would involve a ground crew that would access eligible LWD and foreign debris collections related to Hurricane Rita within the bayou on foot during a period of low water. The ground crew would utilize chain saws, saws, and other appropriate hand-held equipment to cut up eligible LWD and leave it in the active channel of the bayou.

Boat. This method would involve a ground crew that would access eligible LWD and foreign debris collections related to Hurricane Rita within the bayou by boat during a period of high water within the bayou. The ground crew would utilize chain saws, saws, and other appropriate hand-held equipment to cut up eligible LWD.

Alternatives Considered and Dismissed

During the development of the interdisciplinary team's recommendations and the public scoping period, the NPS received a number of suggestions for alternatives. The NPS considered the following alternatives but deemed them to be unreasonable for the reasons provided. The options below were not carried forward in this EA.

Remove all Type I, II, and III Debris

Removal from the Bayou Channel. Under this option, all LWD and foreign debris related to Hurricane Rita (that is, Types I – III) would be removed from the bayou active channel and disposed of outside of the Preserve boundary. This option was dismissed because Type I debris could not be shown to create obstructions that could change the current potential for out-of-bank flows or atypical flooding beyond what currently exists. This option would therefore not meet the purpose and need of the project which is to address potential future effects where LWD and accumulations of foreign debris could possibly collect further debris and create obstructions that could change the current potential for out-of-bank flows or atypical flooding beyond what currently exists.

Remove from the Bayou Channel and Floodplain. Under this option, all LWD and foreign debris related to Hurricane Rita would be removed from the bayou active channel and floodplain and be disposed of outside of the Preserve boundary. This option was dismissed because if the debris is not in a location where it would enter the active channel, it would not cause backwater effects that result in flooding of adjacent communities. This option would therefore not meet the purpose and need of the project which is to address potential future effects where LWD and accumulations of foreign debris could possibly collect further debris and create obstructions that could change the current potential for out-of-bank flows or atypical flooding beyond what currently exists.

Remove Woody Debris and Live Woody Vegetation

Removal from the Bayou Channel. Under this option, live woody vegetation and all identified LWD and foreign debris related to Hurricane Rita would be removed from the bayou active channel and disposed of outside of the Preserve boundary. This option was dismissed because live woody vegetation does not create flow obstructions or substantially affect the flood stage and, therefore, removal of live woody vegetation would not meet the purpose and need of the project which is to address potential future effects where LWD and accumulations of foreign debris could possibly collect further debris and create obstructions that could change the current potential for out-of-bank flows or atypical flooding beyond what currently exists. Removal of live vegetation would also increase impacts to vegetation.

Remove from the Bayou Channel and Floodplain. Under this option, live woody vegetation and all identified LWD and foreign debris related to Hurricane Rita would be removed from the bayou active channel and floodplain and be disposed of outside of the Preserve boundary. This option was dismissed because live woody vegetation within the active channel and floodplain does not create flow obstructions or substantially affect the flood stage and, therefore, removal of live woody vegetation would not meet the purpose and need of the project which is to address potential future effects where LWD and accumulations of foreign debris could possibly collect further debris and create obstructions that could change the current potential for out-of-bank flows or atypical flooding beyond what currently exists. Removal of live vegetation would also increase impacts to vegetation.

Overland Method

This method would involve the use of heavy machinery to both access and remove eligible LWD and foreign debris collections related to Hurricane Rita. Access routes would be created to eligible debris collections locations and heavy machinery would be utilized to remove LWD and foreign debris. This method was dismissed because it would result in environmental impacts that could be avoided using other methods.

Grinder Method

This method would involve the use of grinding equipment during a period of low water to remove eligible LWD and foreign debris from the bayou channel. The grinder is a tracked vehicle that is approximately 18 feet wide. Debris would be ground in place and deposited on the bayou channel bottom as the grinder reached it, however, all live trees and vegetation in the grinder's path would also be removed. This method was dismissed because it would result in environmental impacts that could be avoided using other methods.

Amphibious Vehicles Method

This method would involve the use of amphibious tracked or rubber tire vehicles during a period of drought in the bayou to access eligible LWD and foreign debris collections for removal. The equipment would access debris collections within the bayou channel from 3 access points along the Preserve's LPI Corridor Unit. The amphibious vehicle method would utilize a 10-foot wide working space, which would require removal of some standing trees within the bayou channel itself. Multiple round trips to debris collection locations would be required, depending on the size and weight of the debris. Due to the design of this equipment (that is, tracked or rubber tires), it would be expected to result in a large amount of disturbance to the soil substrate along the bottom of the bayou and at entry/exit points on the banks of the bayou from multiple round trips required for

debris collection and climbing in/out of the bayou itself. This method was dismissed because it would result in environmental impacts that could be avoided using other methods.

Explosives Method

This method would involve a ground crew that would access eligible LWD and foreign debris collections related to Hurricane Rita within the bayou on foot during a period of low water. The ground crew would utilize explosives to eliminate the structural integrity of eligible LWD and foreign debris. Only approved methods for explosives would be used as determined by the NPS blasting specialist. Methods could include, but would not be limited to, placing explosives on top of or within debris piles and drilling holes in debris for placement of explosives. This method was dismissed because it would result in potential impacts to previously undiscovered cultural resources, noise impacts, and impacts to fish and wildlife species.

Mitigation Measures

The following mitigation measures would be followed during the implementation of any action alternative:

General

- NPS personnel would identify debris to be removed or broken up and continuously monitor the work.
- Spills would be prevented/contained and reported to NPS.
- To minimize possible petrochemical spills from debris removal equipment, the contractor would regularly monitor and check equipment to identify and repair any leaks.
- Fueling of vehicles and equipment would take place outside the Preserve whenever possible; if fueling within the Preserve is required, these activities would be attended by no less than two persons, and would be completed over a physical barrier, such as a tarp, and absorbent materials.

Wetlands

- Ground crews would avoid damaging any part or whole of wetland vegetation.

Water Resources

- No boat/helicopter/chain saw/vehicle fuels would be allowed to enter the water or adjacent floodplain.
- Only four stroke boat motors would be utilized for boats.

Soils

- To minimize the amount of ground disturbance from ground crews, crews would be limited to five members in any area.
- Employees and debris removal crews would be required to park on roads or in previously disturbed areas to minimize the amount of ground disturbance at the access sites.
- Root balls that are integrated into the soils would be detached before the LWD was removed.

Vegetation

- Weed control measures (e.g., cleaning/washing of vehicles/vessels, equipment, and personal equipment before entering/re-entering the Preserve) would be implemented to help minimize the potential for the introduction and spread of nonnative species.

Species of Special Concern

- NPS personnel trained in the identification of both Rafinesque's big-eared bat and wood storks would accompany debris contractors into the project area, and would survey the area immediately surrounding debris locations for the species. Work would be postponed if either species is encountered.

Park Operations

- As appropriate, helicopter operations would be coordinated with NPS aviation specialists to minimize the risks to health and safety.
- The regular use of two way communications between ground and flight crews would minimize risks associated with the use of the helicopter.
- Area closures would minimize the potential for health and safety impacts to Preserve visitors during debris removal activities.
- County would hire contractor to perform work.

Alternative Summaries

Table 1 summarizes the major components of alternatives A, B, and C, and compares the ability of these alternatives to meet the project objectives (the objectives for this project are identified in the *Purpose and Need* chapter).

Table 1. Summary of Alternatives and Ability to Meet Project Objectives

Alternative Elements	Alternative A – No Action	Alternative B (Preferred Alternative) – Remove Large Woody Debris and Foreign Debris from Channel and Dispose of outside Preserve	Alternative C – Eliminate Structural Integrity of Large Woody Debris and Foreign Debris
Project Objectives	Meets Project Objectives?	Meets Project Objectives?	Meets Project Objectives?
Work cooperatively with the public and county government to protect Preserve resources and values, avoid and resolve potential conflicts, and address mutual interests in the quality of life of community residents.	No. Not taking action would not address mutual interests in the quality of life of community residents or exhibit NPS willingness to work cooperatively with the public and county government.	Yes. Removal of LWD and foreign debris that have the potential to result in atypical flooding in the future would satisfy mutual interests in the quality of life of community residents and exhibit willingness to work cooperatively with the public and county government.	Yes. Breaking up LWD and foreign debris that have the potential to result in atypical flooding in the future would satisfy mutual interests in the quality of life of community residents and exhibit willingness to work cooperatively with the public and county government.
Considering the extent it is compatible with public safety, allow weather-related processes and associated disturbances to recover as naturally as possible.	Yes. Not addressing LWD and foreign debris related to Hurricane Rita would allow weather-related processes and associated disturbances to recover naturally.	Yes. Removal of LWD and foreign debris related to Hurricane Rita would be a one-time action that would be compatible with public safety and allow natural processes within the bayou to continue in the long term.	Yes. Breaking up LWD and foreign debris related to Hurricane Rita would be a one-time action that would be compatible with public safety and allow woody debris to continue its natural path through the bayou channel as well as allow natural processes within the bayou to continue in the long term.

Alternative Elements	Alternative A – No Action	Alternative B (Preferred Alternative) – Remove Large Woody Debris and Foreign Debris from Channel and Dispose of outside Preserve	Alternative C – Eliminate Structural Integrity of Large Woody Debris and Foreign Debris
Prevent impairment of Preserve resources and limit impacts on Preserve operations and management.	Yes. Not addressing LWD and foreign debris related to Hurricane Rita would result in no impacts to Preserve resources and Preserve operations and management.	Yes. Removal of LWD and foreign debris related to Hurricane Rita would not result in impairment to Preserve resources or Preserve operations and management.	Yes. Breaking up LWD and foreign debris related to Hurricane Rita would not result in impairment to Preserve resources or Preserve operations and management.

Table 2 summarizes the anticipated environmental impacts for alternatives A, B and C. Only those impact topics that have been carried forward for further analysis are included in this table. The *Environmental Consequences* chapter provides a more detailed explanation of these impacts.

Table 2. Environmental Impact Summary by Alternative

Impact Topic	Alternative A – No Action	Alternative B (Preferred Alternative) – Remove Large Woody Debris and Foreign Debris from Channel and Dispose of outside Preserve	Alternative C – Eliminate Structural Integrity of Large Woody Debris and Foreign Debris
Floodplains	The no action alternative would have long-term, local, negligible, adverse impacts on floodplain values as a result of leaving the debris in the channel. Although it is not certain to occur, should the Type II or III LWD collections accumulate additional debris in the future, they could create complete channel obstructions, which would result in greater impacts on flood elevations. Cumulative impacts would be long-term, localized, moderate, and adverse, with the proposed actions contributing only slightly to these impacts.	Alternative B would have long-term, local, negligible beneficial impacts to floodplain values due to the possibility of alleviating some of the potential for blockages to form as a direct result of existing debris in the channel; any greater benefits would be difficult to predict given the uncertainty of the potential for these complete channel blockages to form. Cumulative impacts would be long-term, localized, and moderate, with the proposed actions contributing only slightly to these impacts.	Implementation of alternative C would have long-term, local, negligible beneficial impacts to floodplain values; any greater benefits would be difficult to predict given the uncertainty of the potential for these complete channel blockages to form. Cumulative impacts would be long-term, localized, and moderate, with the proposed actions contributing only slightly to these impacts.
Wetlands	The no action alternative would result in no effect or negligible, long-term, beneficial impacts to wetland function or values because debris removal would not be conducted and wetlands would remain in their current state. Cumulative impacts would be long-term, localized, minor to moderate, and adverse, with the proposed actions contributing only slightly, if at all, to these impacts.	Alternative B would result in short-term, local, negligible adverse impacts to wetland function and values because debris removal could potentially cause some local disturbance of wetland areas. Because foreign debris would be removed, some polluting materials in the project area would also be removed, which have long-term, local, negligible to minor, beneficial effects. Cumulative impacts would be long-term, localized, minor to moderate, and adverse, with the proposed actions contributing only slightly to these impacts.	Alternative C would result in short-term, local, negligible adverse impacts to wetland function and values because breaking up of debris could potentially cause some local disturbance of wetland areas. Because foreign debris would be removed, some polluting materials in the project area would also be removed, which have long-term, local, negligible to minor, beneficial effects. Cumulative impacts would be long-term, localized, minor to moderate, and adverse, with the proposed actions contributing only slightly to these impacts.
Water Resources	The no action alternative would result in long-term, local, negligible adverse impacts to water resources. Cumulative impacts would be long-term, localized, minor, and adverse, with the proposed actions contributing only slightly to these impacts.	Implementation of alternative B would result in short-term, local, negligible adverse, and long-term, local, negligible beneficial impacts to water resources. Cumulative impacts would be long-term, localized, and minor, with the proposed actions contributing only slightly to these impacts.	Implementation of alternative C would result in short-term, local, negligible adverse, and long-term, local, negligible beneficial impacts to water resources. Cumulative impacts would be long-term, localized, minor, and adverse, with the proposed actions contributing only slightly to these impacts.

Impact Topic	Alternative A – No Action	Alternative B (Preferred Alternative) – Remove Large Woody Debris and Foreign Debris from Channel and Dispose of outside Preserve	Alternative C – Eliminate Structural Integrity of Large Woody Debris and Foreign Debris
Soils	The no action alternative would result in primarily negligible impacts to soils because LWD and foreign debris removal would not occur and the environment of the project area would not be disturbed. Cumulative impacts would be long-term, localized, minor to moderate and adverse, with the proposed actions contributing only slightly to these impacts.	Alternative B would have a short-term, local, negligible adverse impact on soils in the project area a result of potential disturbance from ground and boat crews and their associated activities during debris removal. Alternative B in the long-term would have negligible impacts on soils due to the minimal effects of debris removal on out-of-bank flows that would reduce future flood elevations by less than 1-foot, and may possibly be undetectable. Soils would continue to adapt to the flood regime after the debris removal is complete. Cumulative impacts would be long-term, localized, minor to moderate, and adverse, with the proposed actions contributing only slightly to these impacts.	Alternative C would have a short-term, local, negligible adverse impact on soils in the project area a result of potential disturbance from ground and boat crews and their associated activities during the break up of debris. Alternative C in the long-term would have negligible impacts on soils due to no noticeable effect on the potential for out-of-bank flows or atypical flooding beyond what currently exists. Even if the remnants of the LWD collections are transported downstream and redistributed within the active channel, only negligible effects are expected on future flood elevations. Therefore, the impacts of alternative C on soils in the project area would be long-term negligible as soils would continue to adapt to the flood regime after the debris is broken up. As the project area is located in a floodplain, the effects of potential increased upstream flood elevations would have a negligible long-term impact on the soils in the project area. Cumulative impacts would be long-term, localized, and minor to moderate, with the proposed actions contributing only slightly to these impacts.
Vegetation	The no action alternative would result in no short-term impacts to vegetation because debris removal would not be conducted. Long-term, local, negligible beneficial effects on these floodplain plant communities would result from the continued flooding that helps shape the natural structure, diversity, and distribution of the plant communities. Cumulative impacts would be long-term, localized, moderate, and adverse.	Alternative B would have short-term, local, negligible to minor, adverse impacts on vegetation from the disturbances associated with use of a helicopter and/or an boat and barge for debris removal, including the removal of standing trees in the channel during use of the boat/barge. Because the natural processes that shape these plant communities in the project area would not be noticeably altered under this alternative, there would be no change in the influences on the structure, distribution, and diversity of these plant communities, and continued flooding under alternative B would have long-term, local, negligible beneficial effects on vegetation. Cumulative impacts would be long-term, localized, moderate, and	Alternative C would have short-term, site-specific and local, negligible, adverse impacts as a result of disturbances associated with use of overland access on foot and/or by boat. Because the natural processes that shape these plant communities in the project area would not be noticeably altered under this alternative, there would be no change in the influences on the structure, distribution, and diversity of these plant communities, and continued flooding under alternative B would have long-term, local, negligible beneficial effects on vegetation. Cumulative impacts would be long-term, localized,

Impact Topic	Alternative A – No Action	Alternative B (Preferred Alternative) – Remove Large Woody Debris and Foreign Debris from Channel and Dispose of outside Preserve	Alternative C – Eliminate Structural Integrity of Large Woody Debris and Foreign Debris
Fish and Wildlife	Leaving the approximately four Type II and Type III LWD collections in place under the no action alternative would allow them to be continued to be used by fish and wildlife as sources of food, refuge and habitat, resulting in long-term, negligible beneficial impacts. Cumulative impacts would be long-term, localized, moderate, and adverse, with the proposed actions contributing only minor benefits to overall cumulative impacts.	adverse, with the proposed actions contributing only slightly to these impacts. Removing the approximately four Type II and Type III LWD collections from the bayou under this alternative would disturb fish and wildlife, destroy aquatic habitats, and remove potential food sources for fish and other wildlife from the ecosystem at those locations where the debris is removed. Repositioning of woody debris and/or cutting down standing trees in the active channel to allow the passage of a boat/barge would also disturb and destroy fish and wildlife habitat, while removing foreign debris would be beneficial. Overall, removing the LWD collections under this alternative would result in short and long-term, minor adverse impacts. Cumulative impacts would be long-term, localized, and moderate, and adverse with the proposed actions contributing slightly to these impacts.	moderate, and adverse, with the proposed actions contributing only slightly to these impacts. While breaking up the approximately four Type II and Type III LWD collections and leaving the remnants in the active channel under this alternative would allow the LWD to continue functioning beneficially in the ecosystem, it would still potentially cause adverse impacts to fish and wildlife. Under this alternative, adverse impacts could result from increasing turbidity, altering or destroying habitat, and creating noise disturbances. Overall, breaking up the LWD collections under this alternative would result in short and long-term, negligible to minor adverse impacts. Cumulative impacts would be long-term, localized, moderate, and adverse with the proposed actions contributing slightly to these impacts.
Species of Special Concern	Leaving the approximately four Type II and Type III LWD collections in place under the no action alternative would not impact any species of special concern, which would continue to be protected by the Preserve in accordance with all applicable federal, state and NPS laws and regulations. Cumulative impacts would be long-term, localized, minor, and adverse, with the proposed actions contributing only slightly, if at all, to these impacts.	Removing the approximately four Type II and Type III LWD collections from the bayou under this alternative would create noise disturbances that would adversely impact the three species of special concern, but these, along with any other potential impacts would only be short-term and negligible. Cumulative impacts would be long-term, localized, minor, and adverse, with the proposed actions contributing only slightly to these impacts.	Breaking up the approximately four Type II and Type III LWD collections and leaving the remnants in the bayou under this alternative would create noise disturbances that would adversely impact the three species of special concern. However, by employing the mitigations measures indicated, these and any other potential adverse impacts would only be short-term and negligible. Cumulative impacts would be long-term, localized, minor, and adverse, with the proposed actions contributing only slightly to these impacts.
Visitor Use and Experience	Overall, implementation of no action alternative would result in no effect on visitor use and experience as it would remain at present conditions. Cumulative impacts would be long-term, localized, minor, and adverse, with the proposed actions not contributing to these impacts.	Overall, implementation of alternative B would result in short-term, negligible adverse effects from temporary closures and long-term negligible beneficial impacts from removal of Type II and Type III debris on visitor use and experience. Cumulative impacts would be long-term, localized, minor and adverse	Overall, implementation of alternative C would result in short-term, negligible adverse effects from temporary closures and long-term negligible beneficial impacts from eliminating the structural integrity of Type II and Type III debris on visitor use and experience. Cumulative impacts would be long-term, localized, minor, and adverse

Impact Topic	Alternative A – No Action	Alternative B (Preferred Alternative) – Remove Large Woody Debris and Foreign Debris from Channel and Dispose of outside Preserve	Alternative C – Eliminate Structural Integrity of Large Woody Debris and Foreign Debris
Park Operations and Management	The no action alternative would result in no short-term impacts to Preserve operations or health and safety because debris removal would not be conducted. Long-term, negligible to minor adverse impacts would result from the impacts on operations from staff commitments that may be required to address inquiries from the public about flooding. There would be no changes in the potential effects on health and safety risks to employees or visitors as a result of leaving the debris in the channel. Cumulative impacts would be long-term, localized, minor, and adverse, with the alternative contributing only slightly to these impacts.	Alternative B would have short- and long-term, negligible to moderate adverse impacts on Preserve operations and health and safety as a result of removal by helicopter or boat/barge. The absence of the debris in the project area would have no effects on health and safety risks to employees or visitors. Removal of debris could have long-term minor adverse and beneficial impacts on operations based on possible demands of community outreach efforts. Cumulative impacts would be long-term, localized, moderate, and adverse.	Alternative C would have short-term and long-term, negligible to moderate adverse impacts on Preserve operations and health and safety from the use of overland removal and/or a boat. The absence of the debris in the project area would have no effects on health and safety risks to employees or visitors. Removal of debris could have long-term minor adverse and beneficial impacts on operations based on possible demands of community outreach efforts. Cumulative impacts would be long-term, localized, moderate, and adverse.
Adjacent Communities	Overall, implementation of no action alternative would result in long-term minor to moderate adverse impacts on adjacent communities, as the potential for flooding increases with the possibility that obstructions within the bayou could be formed if Type II and III debris is not removed from the Preserve. However, this is currently not occurring. Cumulative impacts would be long-term, localized, moderate, and adverse, with the proposed actions contributing only slightly to these impacts.	Overall, implementation of alternative B would result in long-term negligible beneficial impacts on adjacent communities as the potential for flooding decreases with the removal of debris in the bayou. In addition, there would be short-term negligible to minor adverse impacts resulting from the noise created from these removal activities. Cumulative impacts would be long-term, localized, minor, and adverse, with the proposed actions contributing only slightly to these impacts.	Overall, implementation of alternative C would result in long-term negligible beneficial impacts on adjacent communities as the potential for flooding decreases with breaking up the structural integrity of debris in the bayou. In addition, there would be short-term negligible adverse impacts resulting from the noise created from activities. Cumulative impacts would be long-term, localized, minor, and adverse, with the proposed actions contributing only slightly to these impacts.

Identification of the Environmentally Preferred Alternative

The environmentally preferred alternative is determined by applying the criteria suggested in NEPA, which guides the Council on Environmental Quality (CEQ). The CEQ provides direction that “[t]he environmentally preferable alternative is the alternative that will promote the national environmental policy as expressed in NEPA’s Section 101:

- fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
- assure for all generations safe, healthful, productive, and esthetically and culturally pleasing surroundings;
- attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences;
- preserve important historic, cultural and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice;
- achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life’s amenities; and
- enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Based on the analysis presented in this document, alternative C (Eliminate Structural Integrity of Large Woody Debris and Foreign Debris) is the environmentally preferred alternative because it best meets the definition established by the CEQ. Alternatives B and C meet all of the criteria for the environmentally preferred alternative at various levels; however, the degree of environmental effects resulting from eliminating the structural integrity of LWD and foreign debris would be less than removal of LWD and foreign debris, as under alternative B. Alternative A, the No Action Alternative, meets the majority of the definition established by the CEQ; however, it does not assure for all generations safe surroundings or attain the widest range of beneficial uses of the environment without risk of health and safety due to the possibility for LWD and foreign debris (Type II and III) to collect further debris and create obstructions that could change the current potential for out-of-bank flows or atypical flooding beyond what currently exists.

AFFECTED ENVIRONMENT

Floodplains/Wetlands

Floodplains

Area topography, soils, and climate all combine to produce a unique flood regime in southeast Texas. The most notable of these factors being its proximity to the Gulf of Mexico moisture source, as well as the effects of tropical storms and easterly waves. Intense storms result in large magnitude runoff events; however, flood peaks are attenuated by broad flat valleys that produce slow-moving, long-duration floods (NPS 2005).

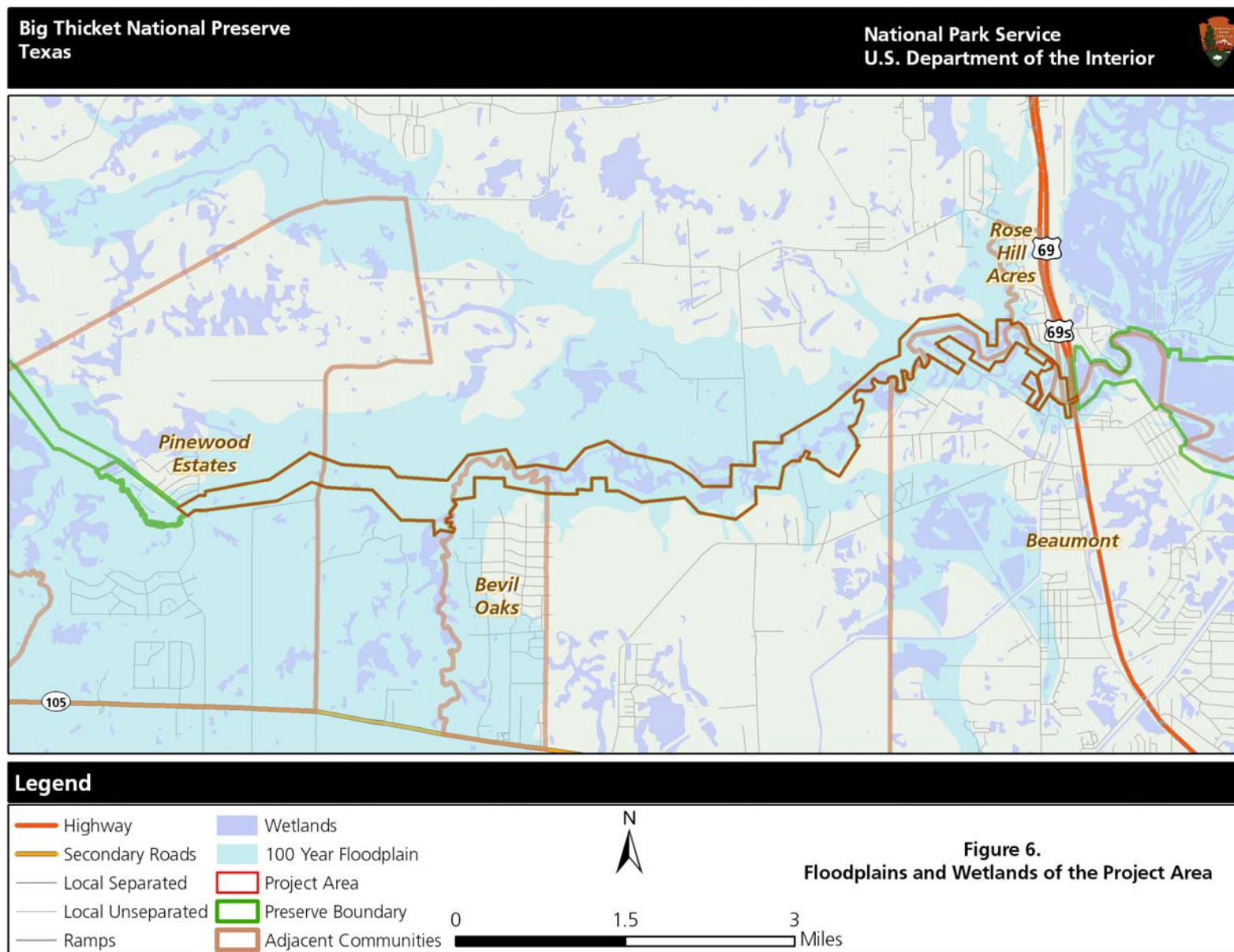
In the southern portion of the Big Thicket National Preserve (Preserve) where the Little Pine Island – Pine Island Bayou Corridor Unit (LPI Corridor Unit) is located, the land surface is nearly level and slopes are generally less than one percent. In addition, the high clay and silt content of soils in the area is a major factor contributing to the accumulation of surface runoff. The problems of poor drainage on flatlands cannot be separated from flooding problems (NPS 2005).

Floodplains comprise roughly 50 percent of the Preserve, and most of the Preserve's wetlands are located in floodplains (Figure 6). Similarly, the water corridor units and riparian corridors are located in floodplains and consist primarily of floodplain forests. A generalized list of floodplain resources, functions, values and uses includes: food chain production; fish and wildlife habitat; research, educational, and recreational opportunities; hydrologic and sediment modification; groundwater recharge or discharge; water quality; and maintenance of biodiversity (NPS 2005).

In an area of relatively poor drainage, rains from a tropical storm have the potential to create "catastrophes." In October of 1994, the remnants of Tropical Storm Rosa caused flood waters to rise to a record of 12.5 feet above flood stage on Pine Island Bayou. This flood caused 26 counties to be declared Federal Disaster Areas and, regionally, took 20 lives, forced the evacuation of 14,000 people from their homes, caused over 700 million dollars in damages, closed Interstate 10 between Beaumont and Houston, closed the Port of Houston, and contaminated several areas by dispersing pollutants, fresh water, and mud (NPS 2005).

The threshold of flood damages for both Pine Island and Little Pine Island bayous is the 5-year flood which has been estimated at 8000 and 4000 cubic feet per second, respectively (USACE 1985). The U.S. Geological Survey has operated a streamflow gauging station on Pine Island Bayou since October 1967. Extremely high peak flows have occurred in April 1979, June 1979, May 1989, June 2001, and October 2006. The highest peak flow occurred in October 1994 when the gauge recorded a peak flow of 48,800 cubic feet per second (USGS 2007a).

Figure 6 – Floodplains and Wetlands of the Project Area



Several flood mitigation plans came out of the U.S. Army Corps of Engineers "Flood Damage Prevention Feasibility Report for the Pine Island Bayou Watershed," though none at this time have been accepted or implemented (NPS 2005).

Wetlands

Wetlands include areas inundated or saturated by surface or groundwater for a sufficient length of time during the growing season to develop and support characteristic soils and vegetation. The National Park Service (NPS) classifies wetlands based on the U.S. Fish and Wildlife Service Classification of Wetlands and Deepwater Habitats of the United States, or the Cowardin classification system. Based on this classification system, a wetland must have one or more of the following attributes:

- the habitat at least periodically supports predominantly hydrophytic vegetation (wetland vegetation);
- the substrate is predominantly undrained hydric soil; or
- the substrate is non-soil and saturated with water, or covered by shallow water at some time during the growing season (NPS 2005)

Wetlands are significant in that they provide important habitat for the wildlife of the Preserve. Some functions of wetlands are interdependent with the surrounding landscape. For example, wetlands dampen the effects of storms by reducing flood crests and flow rates, thereby reducing flooding in surrounding areas. The effectiveness of wetlands for flood abatement may vary, depending on the size of the area, type and condition of vegetation, slope, the location of the wetland in the flood path and the saturation of wetland soils before flooding. A one-acre wetland can typically store about three-acre feet of water, or one million gallons. An acre-foot is one acre of land, about three-quarters the size of a football field, covered one foot deep in water. Three acre-feet describes the same area of land covered by three feet of water. Trees and other wetland vegetation help slow the speed of flood waters. This action, combined with water storage, can actually lower flood heights and reduce the water's destructive potential (EPA 2006)

A variety of amphibians, reptiles, birds, and mammals require wetlands during substantial parts of their lives, and depend on wetlands spaced throughout the landscape. Other creatures have adapted to wetlands that maintain standing water for only a few weeks to a month during the year, and remain dry the rest of the year. Wetlands also provide essential habitat for 60 percent of all threatened and 40 percent of all endangered species. Overall, each type of wetland may provide similar functions but for different organisms (NPS 2005).

At least 40 percent of the Preserve is comprised of wetlands that can be classified in three systems: palustrine, riverine, and lacustrine wetlands. A palustrine system of inland, nontidal wetlands is characterized by the presence of trees, shrubs, and emergent vegetation (vegetation that is rooted below water but grows above the surface). Palustrine wetlands range from permanently saturated or flooded land (as in marshes, swamps, and lake shores) to land that is wet only seasonally (as in vernal pools). Riverine systems relate to a system of inland wetlands and deep-water habitats associated with nontidal flowing water, characterized by the absence of trees, shrubs, or emergent vegetation. The term lacustrine relates to a system of inland wetlands and deep-water habitats associated with freshwater lakes and reservoirs, characterized by the absence of trees, shrubs, or emergent vegetation.

The majority of the wetlands in the LPI Corridor Unit are in the eastern portion of the unit to the east of the Bevil Oaks subdivision. These wetlands are almost exclusively Palustrine Freshwater Forested/Shrub Wetland type (FWS 2007a).

Water Resources

Water Quality

The Pine Island Bayou watershed drains about 657 square miles before entering the Neches River just upstream of the city of Beaumont. The watershed is largely wooded but contains substantial industrial and residential development. The watershed slopes in a southeasterly direction and varies in elevation from about two feet above mean sea level at the confluence with the Neches River to about 160 feet at the watershed divide (NPS 2005).

Water quality of Little Pine Island Bayou was considered the worst in the region throughout its length (NPS 2005). Little Pine Island Bayou water quality has long been impacted by saltwater (brine) in the Saratoga and Sour Lake area. Historically, saltwater or brine and other oil and gas wastes from the salt dome area near Saratoga were transported and impounded near Little Pine Island Bayou. Today, the lower end of the impoundment area and containment levees occupies approximately 80 acres within the Lance Rosier Unit. Although most of the impoundment area is outside the Preserve, surface and subsurface water flows across and through the Unit. Elevated chloride levels in the bayou and Pine Island Bayou watershed are partially attributed to oil field brine (NPS 2005).

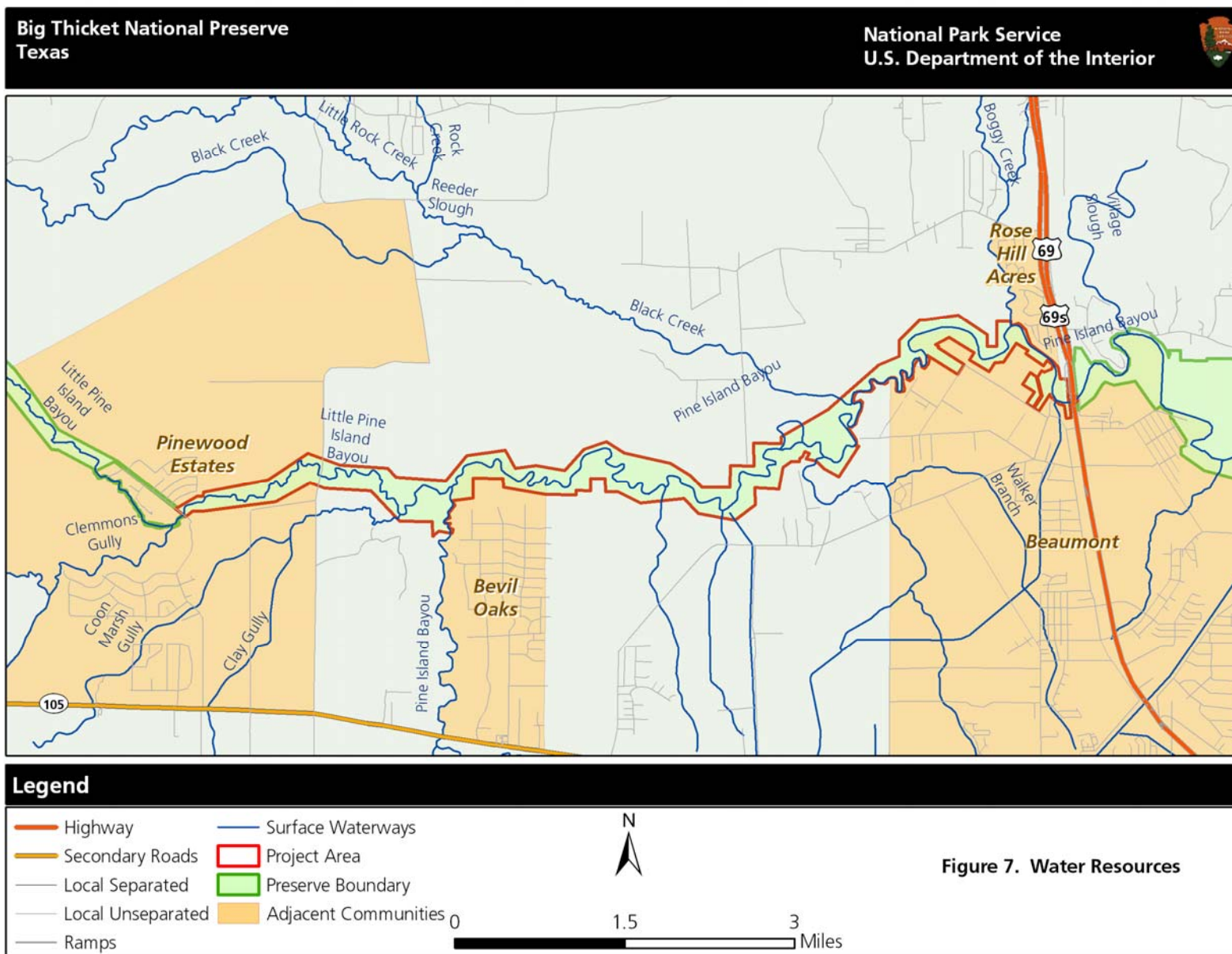
According to the Texas Water Quality Inventory in 2004, the Texas Commission on Environmental Quality indicated that the lower 25 miles of the Little Pine Island Bayou did not meet the standards for aquatic life use due to depressed dissolved oxygen levels. The Texas Commission on Environmental Quality assigned this section of the Little Pine Island Bayou as a Category 5, which signifies that the “water body does not meet applicable water quality standards or is threatened for one or more designated uses by one or more pollutants.” Also, the Little Pine Island Bayou is also impacted by high levels of fecal coliform, total dissolved solids, and sulfates. In addition to oilfield brine, probable contributors to high levels of pollutants have been identified as urban runoff and municipal sewer discharges (NPS 2005).

The NPS has divided the water resources of the Preserve into three categories based on a combination of ambient water quality and monitoring status. Category 1 waters are those streams whose water quality presently ranges from very good to excellent. Category 2 waters are those already exhibiting water quality degradation for one or more parameters, often due to non-point source pollution and/or legally permitted point-source discharges. Category 3 waters are those major stream segments within the Preserve which are included in the Texas Surface Water Quality Standards (NPS 2005) and are routinely monitored by the U.S. Geological Survey. The NPS has determined that Little Pine Island Bayou is a Category 2 stream (NPS 2005).

Flow Characteristics

Little Pine Island and Pine Island Bayous flow through the LPI Corridor Unit from the eastern boundary of the Lance Rosier Unit near the intersection of Rt. 326 to the western boundary of the Beaumont Unit. Several tributaries enter Little Pine Island Bayou along the way, including Clemmons Gully just to the west of the Woodway Avenue bridge in the center of Pinewood Estates (Figure 7). Little Pine Island Bayou and Pine Island Bayou join just to the west of the Bevil Oaks subdivision. Several other tributaries join the Pine Island Bayou before the corridor unit ends. The

Figure 7 – Water Resources



entire corridor unit lies within the 100-year floodplain, which is several miles wide near the Bevil Oaks and Pinewood Estates areas.

The U.S. Geological Survey has operated a streamflow gauging station on Pine Island Bayou since October 1967. Analysis of the flow record from this gauging station indicates that peak flows generally occur in January, February, and June. Extremely high peak flows have occurred in April 1979, May 1989, June 2001, and October 2006. The highest peak flow occurred in October 1994 when the gauge recorded a peak flow of 48,800 cubic feet per second (USGS 2007a).

Soils

The soils within the Preserve are characteristic of those developed under a mild climate, with abundant rainfall, in a mixed conifer-deciduous forest. Two broad categories of soils are found: a highly leached, acidic, sandy to loamy textured soil with a lower less-permeable zone of clay accumulation; and a more clayey textured, less permeable soil that is subject to either high water tables or periods of extensive flooding. The latter soils shrink and swell with changes in seasonal moisture. In general, the sandier soils tend to occur in uplands, and clayey textured soils are found in swales, lowlands, floodplains, and wetlands (NPS 2005). The sandier textured soils typically belong to hydrologic soil classes "A" and "B" that generally occur in the uplands, and the more clayey textured soils to classes "C" and "D." The water corridor units typically have less than 30 percent of classes "A" and "B," and the majority of soils are within classes "C" and "D." For the purposes of this plan the Preserve will evaluate soil classes "C" and "D" because these soil types are likely to be found in the Little Pine Island – Pine Island Bayou corridor and floodplain (see Table 3).

Table 3. Soil Classes Found in the Project Area

Hydrologic Soil Class	"C" Soils	"D" Soils
Composition	High clay content, water retardant layer, moderately fine to fine textured (sandy clay loams)	Fine textured, thin clayey soils with claypan or clay layer near surface
Location	Generally found in wetlands and floodplains	Generally found in wetlands and floodplains
Permeability	Low	Very low
Erodibility	Moderate to high	Moderate to high
Compaction	Moderate	High
Shrink / Swell Potential	Moderate	High
Flooding Frequency	Occasional to frequent	Frequent
Run-off Potential	Moderate	High
Infiltration Rate	Low	Low
Recharge Potential	Low	Low

Soils formed in floodplains range from loamy to clayey, and occur on old oxbows to moderately well-drained natural levees adjacent to stream channels. Soils that are composed of a high clay content are moderately to highly erodible. Erosion also depends on the rainfall energy, slope, slope length, vegetative cover, and site conservation or management practices. Even though most slopes within the Preserve are relatively flat (less than two percent), soil erosion control is necessary whenever vegetative cover is removed or when water is concentrated and flow velocities are high.

Typically, soils with high clay content are most subject to compaction. Clayey soils that are composed of expansive clays will tend to expand and contract with seasonal moisture variations. Due to the water budget of the area, flat topography, and high seasonal water tables, the depth of shrinkage cracks produced in clayey soils will probably not exceed one to two feet. In the Little Pine Island – Pine Island Bayou, flooding frequency ranges from occasional to frequent (NPS 2005).

Occasional flooding infers that flooding is expected infrequently under usual weather conditions, and there is a five to 50 percent chance of flooding in any year or flooding occurs five to 50 times in 100 years. Soils are covered by flowing water for shorter durations, generally ranging from two to seven days. Such soils are typically relatively permeable and occur on level or depressional landscapes, or are soils with restricted permeability on low sloping or swampy terrain.

Frequent flooding infers that flooding is likely to occur often under usual weather conditions; more than a 50 percent chance of flooding in any year, but less than a 50 percent chance of flooding in all months of any year. Soils are covered by flowing water for long durations, generally ranging from seven to 30 days. Soils will typically occur on level or depressional landscapes with restricted surface drainage or restricted permeability. Usually only water tolerant plants will be present.

Vegetation

Vegetation is a fundamental component of the biological diversity of the Preserve. Roughly 1,300 species of trees, shrubs, forbs, and grasses have been documented growing in the Preserve (Harcombe 2007). A variety of environmental factors including geography, climate, and soil contribute to the botanical diversity of the Preserve. The Big Thicket lies at an ecotone between forests to the east and prairies to the west. Moderated by warm Gulf breezes, the climate of the region is sub-tropical with relatively high levels of rainfall that are evenly distributed throughout the year. Just a short distance west, rainfall begins to drop off quickly, and this sudden transition partly explains why the Big Thicket is the farthest western extent of many eastern plant species. Soil conditions ranging from relatively impermeable clays to coarse sands also contribute substantially to the floristic diversity of the Preserve.

The Preserve has relied most frequently on the vegetation classification of Marks and Harcombe (1981) to identify and describe plant communities and to relate the patterns of distribution of species and communities with major environmental gradients. This classification defines and names vegetation on the basis of physiographic position (upland, slope, floodplain, and flatland) and community physiognomy or structure (forest, savanna, or shrub thicket), normally combined with important trees (pine, oak, hardwood). It also emphasizes potential natural vegetation rather than existing or actual vegetation, although potential or actual vegetation may be the same in some types. Potential natural vegetation refers to the structure that would become established if all successional sequences were completed without interference by humans under present climatic and soil conditions (The Nature Conservancy and Environmental Systems Research Institute 1994). This classification is applicable to the Preserve because most of the natural vegetation has been removed in the past.

Floodplain Vegetation Community

Floodplain vegetation communities generally occur along river and creek floodplains throughout the Preserve. The Marks and Harcombe classification system indicates that the project area contains the Flatland and Floodplain Hardwood Forest communities.

The Flatland Hardwood Forest type occurs in the project area on flat, low elevation areas where drainage patterns are poorly developed and precipitation remains ponded for long periods of time. Of all the vegetation communities in the Preserve, this particular community appears to be endemic to the Big Thicket. Dominant deciduous tree species include swamp chestnut oak (*Quercus prinus*), willow oak (*Quercus phellos*) and laurel oak (*Quercus laurifolia*). Jungle-like thickets of dwarf palmetto (*Sabal minor*) often dominate the understory in flatland forests. Along with baygalls (forest seeps), these dense palmetto thickets perhaps best exemplify the original and seemingly impenetrable “Big Thicket” (NPS 2005).

The Floodplain Hardwood Forest is generally referred to as a bottomland hardwood forest and is generally found on larger floodplains of higher order streams. The dominant tree species in the Floodplain Hardwood Forest community include sweetgum (*Liquidambar styraciflua*) and water oak (*Quercus nigra*).

Non-Native Vegetation

Invasive non-native vegetation has increased in the past years because of the highly fragmented nature of the Preserve, which is crossed by numerous pipelines, road corridors, and river channels. Invasives are among the greatest threats to the ecological integrity of the Preserve. Problematic species include Chinese tallow tree (*Sapium sebiferum*), Japanese honeysuckle (*Lonicera japonica*), Chinese wisteria (*Wisteria sinensis*), and Japanese climbing fern (*Lygodium japonicum*). New non-natives recently found in the Preserve include Chinaberry (*Melia azedarach*) and coral ardisia (*Ardisia crenata*). Water hyacinths (*Eichornia crassipes*), aquatic invasives of particular concern, are prolific and getting worse. Also near the Preserve, but not yet found within the boundaries, is giant salvinia (*Salvinia molesta*) (NPCA 2005). The Preserve also contains some exotic but non-invasive plants including Creeping Signal Grass (*Brachiaria plantaginea*), Carpet Grass (*Axonopus furcatus*), Common Mullein (*Verbascum thapsus*), Brazilian vervain (*Verena brasiliensis*), and a variety of lawn and garden weeds (NPS 2006b).

Biosphere Reserve Designation

The Big Thicket, often referred to as a “biological crossroads,” is a transition zone where southeastern swamps, eastern deciduous forest, central plains, pine savannas, and xeric (dry) sandhills intersect. The area provides habitat for rare species and favors unusual combinations of plants and animals.

In recognition of this diversity, the Preserve was designated a Biosphere Reserve in 1978 by the United Nations Educational, Scientific, and Cultural Organization (UNESCO). It shares this distinction among 337 biosphere reserves in 85 countries worldwide. The biosphere reserve program (Man and the Biosphere Program) is based on the concept that it is possible to achieve a sustainable balance between the conservation of biological diversity, economic development, and maintenance of associated cultural values. The validity of this concept is tested, refined, demonstrated, and implemented in the Biosphere Reserves (UNESCO 2007).

Fish and Wildlife

The Big Thicket region has long been recognized for possessing a diverse array of fauna and flora. This area provides habitat for plant and animal species of the southeast swamps, pineywood forest, post-oak belt, Great Plains, southwest deserts, and the coastal prairie (NPS 2005).

The abundant and diverse vegetation of the Preserve supports aquatic and terrestrial habitats for a variety of fish and wildlife. Many studies of specific types of wildlife, such as inventories of mammals, have been performed in the Big Thicket region over the past century. Some of the most thorough inventories were conducted shortly after the Preserve's establishment in 1974. The following section summarizes these studies, literature reviews, and wildlife observations to describe fauna believed to inhabit the Preserve. Rare, threatened, and endangered species of plants and animals are discussed under the Species of Special Concern section.

Mammals

Of the 181 mammals listed for Texas, 60 are either documented or believed to inhabit the Preserve. The most common mammals found in the Preserve that would also likely be found in the project area are the Virginia opossum (*Didelphis virginiana*), gray fox (*Urocyon cinereoargenteus*), common raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), American mink (*Neovison vison*), muskrat (*Ondatra zibethicus*), American beaver (*Castor canadensis*), deer, and several species of bats, mice, rats, and rabbits (NPS 1974). Several large species are now extirpated in the Big Thicket due to a variety of factors including habitat destruction and overhunting. These include the jaguar (*Panthera onca*), ocelot (*Leopardus pardalis*), red wolf (*Canis rufus*) and the Louisiana subspecies of the American black bear (*Ursus americanus luteolus*). Although occasional sightings of black bears have been reported near the Preserve, no populations are believed to be reproducing in east Texas (NPS 2005).

Birds

Birds are the most visible and diverse group of vertebrate fauna found in the Preserve. Currently 176 species have been documented. This figure is thought to be low, because no comprehensive inventory of birds has ever been performed. The Preserve lies on a major migratory flyway, and many species of birds are transient during spring and fall migrations. Birds found in the Big Thicket predominantly consist of three categories: passerines (including many neotropical songbirds), raptors and waterfowl. The abundance and variety of birds in the Big Thicket contribute to one of the favorite visitor activities, bird watching (NPS 2005). The most abundant streamside species in the Preserve are white-eyed vireo (*Vireo griseus*), red-eyed vireo (*Vireo olivaceus*), northern cardinal (*Cardinalis cardinalis*), and northern parula (*Parula americana*) (Harcombe et al. 1996). These species are also expected to be the most common in the project area as well. Other birds commonly observed in the Preserves riparian and forested swamp habitat are the Louisiana waterthrush (*Seiurus motacilla*), prothonotary warbler (*Protonotaria citrea*), Swainson's warbler (*Limnothlypis swainsonii*), yellowthroat warbler (*Geothlypis trichas*), red-shouldered hawk (*Buteo lineatus*), and yellow-crowned night heron (*Nycticorax violaceus*) (Harcombe et al. 1996).

On July 26, 2001, the American Bird Conservancy recognized the Preserve as a Globally Important Bird Area joining thousands of others around the world. American Bird Conservancy's Important Bird Areas Program was launched in 1995 and has concentrated on identifying and documenting the very top sites throughout all 50 states—those of significance on a global level. For a site to be included, it must, during at least some part of the year, contain critical habitat that supports (1) a significant population of an endangered or threatened species; (2) a significant population of a

Watch List species; (3) a significant population of a species with a limited range; or (4) a significantly large concentration of breeding, migrating or wintering birds, including waterfowl, seabirds, wading birds, raptors or landbirds (American Bird Conservancy 2007).

Major water birds found within the Preserve include the great blue heron (*Ardrea herodias*), little blue heron (*Egretta caerulea*), green-backed heron (*Butorides striata*), snowy egret (*Egretta thula*), snow goose (*Chen caerulescens*), black-crowned night heron (*Nycticorax nycticorax*), and yellow crowned night heron, though the yellow-crowned night heron is rarely seen (Harcombe et al. 1996).

Reptiles and Amphibians

Approximately 85 species of reptiles and amphibians are believed to inhabit the Preserve. This figure represents roughly 33 percent of the 235 species of reptiles and amphibians in Texas. The most diverse group of reptiles in the Big Thicket is snakes. Texas has 68 species of snakes, and half of these inhabit the Big Thicket. Other types of reptiles include skinks, lizards, turtles, and the American alligator (*Alligator mississippiensis*) which have been sighted in the Neches River (Harcombe et al. 1996). Three types of amphibians including frogs, toads, and salamanders inhabit the Big Thicket (NPS 2005).

Fish

Of all faunal groups in the Preserve, fish are perhaps the most thoroughly inventoried: 92 species are believed to inhabit Preserve waters. In small tributaries, the most abundant species of fish include minnows, darters, bass, and bullhead catfish (*Ameiurus* spp.). This pattern shifts in larger tributaries, which are dominated by channel, blue and flathead catfish (*Ictalurus punctatus*, *Ictalurus furcatus*, *Pylodictis olivaris* respectively); sunfish; largemouth and spotted bass (*Micropterus salmoides* and *Micropterus punctulatus*); and crappie (*Pomoxis* spp.) (NPS 2005).

Invertebrates

The Lepidopteran fauna of the small Big Thicket region, the insect family that includes butterflies and moths, totals approximately 2,000 species, or about one fifth of the number known from America north of Mexico (Bordelon and Knudson 1999). In aquatic environments, insects and mussels are the most thoroughly documented species. Comprehensive inventories in the Village Creek drainage have documented 249 species of common macroinvertebrates including dragonflies, caddisflies, mayflies and stoneflies. Three species of aquatic insects are endemic to the Big Thicket region and two are candidates for federal listing. Thirty-four species of mussels, including the Texas heelsplitter (*Potamilus amphichaenus*) live in the Lower Neches River watershed. This portion of the watershed includes most of the units of the Preserve (NPS 2005).

Species of Special Concern

Under the Endangered Species Act of 1973, the NPS has responsibility to address impacts to federally-listed threatened, endangered, candidate and species proposed for listing. Also, NPS policy requires that State-listed species, and others identified as species of management concern by the park, are to be managed in parks in a manner similar to those that are federally-listed. Big Thicket National Preserve does not have any species of management concern identified. Thus, federal and state-listed species will be addressed in this plan/EA following federal law and NPS policy.

The terms “threatened” and “endangered” describe the official federal status of certain species in the Preserve as defined by the Endangered Species Act. The term “candidate” is used officially by the U.S. Fish and Wildlife Service when describing those species for which the Service has on file sufficient information on biological vulnerability and threats to support issuance of a “proposed rule to list,” but issuance of the proposed rule is precluded. No candidate species are currently believed to inhabit the Preserve. Texas has enacted regulations similar to the Endangered Species Act that confer threatened and endangered status to certain species that inhabit areas in the state. NPS policies dictate that federal candidate species, proposed species and state-listed threatened and endangered species are to be managed to the greatest extent possible as federally-listed threatened and endangered species. Therefore, these species are included in this discussion.

A listing of species of proposed, candidate, threatened and endangered species specific to the Big Thicket is problematic to compile because listed species are rare by default, and current, comprehensive inventories of flora and fauna in the Preserve are incomplete. Moreover, the U.S. Fish and Wildlife Service publishes lists by county, and political boundaries do not coincide with natural boundaries such as habitats or ecoregions. Since the LPI Corridor Unit is located in Hardin and Jefferson counties, not all of the species listed for these counties (such as marine species) have suitable habitat. Nonetheless, all federally-listed and State-listed species believed to occur permanently or transiently (such as migrating birds) in the Preserve based on past inventories, existing and potential habitat, documented sightings, and professional judgment are listed below.

Of the species listed for the Preserve only the wood stork (*Mycteria americana*), paddlefish (*Polyodon spathula*), and the Rafinesque's big-eared bat (*Corynorhinus rafinesquii*) have been documented in the Little Pine Island Bayou (NPS 2005), and in correspondence with the Texas Parks and Wildlife Department, the Texans Natural Diversity Database only indicated the known presence of the Rafinesque's big-eared bat (Hanna 2008). Therefore, only the above three species are discussed with regards to this proposed action. Information about the species is provided below.

Wood Stork (*Mycteria americana*): Wood storks (state threatened) have been seen in a variety of wetland and riverine locations throughout the Preserve, including along the Little Pine Island Bayou in the Lance Rosier Unit, the Beaumont Unit, and the Lower Neches River Corridor Unit. Storks in the Preserve are believed to be post breeding transients from populations in southern Mexico. While these populations are considered stable, storks from separate breeding populations in Florida are listed as federally endangered due to habitat loss and low numbers. Storks may have bred historically in Texas, but no breeding populations are currently believed to exist. Preferred inland habitat includes large lakes and forested wetlands (NPS 2005).

Paddlefish (*Polyodon spathula*): Paddlefish (State threatened) generally inhabit large rivers in the Mississippi river drainage and adjacent Gulf coastal plain. Paddlefish have been documented in the Lower Neches River and at the confluence of the Neches River and Little Pine Island Bayou. Unlike most large riverine fish, paddlefish are planktivorous as opposed to piscivorous. Paddlefish require cool temperatures, large flows, and gravel bottoms for spawning. The lower Neches River does not typically have flows of sufficient magnitude, and gravel substrate is uncommon, so spawning habitat is considered marginal. Nonetheless, the backwaters of the Neches could provide important feeding areas for paddlefish during the summer months. The Texas Parks and Wildlife Department recently developed a recovery plan for paddlefish in the Neches River that included annual stocking of paddlefish below Dam “B” on the Upper Neches River corridor. The Texas Parks and Wildlife Department is not doing stocking of paddlefish in the lower Neches River. The effectiveness of paddlefish recovery has yet to be documented (NPS 2005).

Table 4. Listed Species Within the Preserve and Project Area

Common Name	Scientific Name	Type	Federal Status ^a	State Status ^b	H ^c	J ^d	Documentation ^f	
							In BITH	In LPI Unit
American Swallow-tailed Kite	<i>Elanoides forficatus</i>	Bird	N/L	T	•	•	No nests	No
Bachman's Sparrow	<i>Aimophila aestivalis</i>	Bird	N/L	T	•		Yes	No
Bald eagle	<i>Haliaeetus leucocephalus</i>	Bird	N/L	T	•		Yes	No
American Peregrine Falcon	<i>Falco peregrinus anatum</i>	Bird	N/L	E	•		Yes	No
Arctic Peregrine Falcon	<i>Falco peregrinus tundrius</i>	Bird	N/L	T	•	•	Yes	No
Piping Plover	<i>Charadrius melodus</i>	Bird	T	T	•	•	No	-
Red-cockaded Woodpecker	<i>Picoides borealis</i>	Bird	E	E	•		Not recently	No
White-faced Ibis	<i>Plegadis chihi</i>	Bird	N/L	T	•	•	No	-
Wood Stork	<i>Mycteria americana</i>	Bird	N/L	T	•	•	Yes	Yes
Blue Sucker	<i>Cycleptus elongatus</i>	Fish	N/L	T	•		Yes	No
Creek Chubsucker	<i>Erimyzon oblongus</i>	Fish	N/L	T	•		One	No
Paddlefish	<i>Polyodon spathula</i>	Fish	N/L	T	•		Yes	Yes
Louisiana Black Bear	<i>Ursus americanus luteolus</i>	Mammal	T	T	•	•	No	-
Black Bear	<i>Ursus americanus</i>	Mammal	N/L	T	•	•	No	No
Rafinesque's Big-eared Bat	<i>Corynorhinus rafinesquii</i>	Mammal	N/L	T	•	•	Yes	Yes
Red Wolf ^e	<i>Canis rufus</i>	Mammal	E	E	•	•	No	-
Texas Trailing Phlox	<i>Phlox nivalis</i> var. <i>texensis</i>	Plant	E	E	•		Yes	No
Alligator Snapping Turtle	<i>Macrolemys temminckii</i>	Reptile	N/L	T	•	•	Yes	No
Louisiana Pine Snake	<i>Pituophis melanoleucus ruthveni</i>	Reptile	C	T	•		Yes	No
Northern Scarlet Snake	<i>Cemophora coccinea copei</i>	Reptile	N/L	T	•	•	No	-
Canebrake Rattlesnake	<i>Crotalus horridus atricaudatus</i>	Reptile	N/L	T	•	•	Unk	Unk

^aFederal status taken from U.S. Fish and Wildlife Service on <http://www.fws.gov/endangered/> and http://ecos.fws.gov/tess_public/StateListingAndOccurrence.do?state=TX

^bState status from Texas Parks and Wildlife Department's website on Rare, Threatened, and Endangered Species of Texas <http://gis.tpwd.state.tx.us/TpwEndangeredSpecies/DesktopDefault.aspx>

^cTexas Parks and Wildlife Department's List of Rare Species in Hardin County ^dTexas Parks and Wildlife Department's List of Rare Species in Jefferson County

^eRed Wolf Extirpated, no current plans to re-introduce in Texas ^fDocumentation according to Big Thicket National Preserve Oil and Gas Management Plan EIS December 2005.

Notes: Interior Least Tern and Navasota Ladies'-Tresses were on the list for the Oil and Gas Management Plan EA but are not currently on either county list (per Texas Parks and Wildlife Department)

-coastal bird and reptile species not included in this list due to habitat requirements

Of the species listed for the Preserve only the wood stork (*Mycteria americana*), paddlefish (*Polyodon spathula*), and the Rafinesque's big-eared bat (*Corynorhinus rafinesquii*) have been documented in the Little Pine Island Bayou (NPS 2005), and in correspondence with the Texas Parks and Wildlife Department, the Texans Natural Diversity Database only indicated the known presence of the Rafinesque's big-eared bat (Hanna 2008). Therefore, only the above three species are discussed with regards to this proposed action. Information about the species is provided below.

Wood Stork (*Mycteria americana*): Wood storks (state threatened) have been seen in a variety of wetland and riverine locations throughout the Preserve, including along the Little Pine Island Bayou in the Lance Rosier Unit, the Beaumont Unit, and the Lower Neches River Corridor Unit. Storks in the Preserve are believed to be post breeding transients from populations in southern Mexico. While these populations are considered stable, storks from separate breeding populations in Florida are listed as federally endangered due to habitat loss and low numbers. Storks may have bred historically in Texas, but no breeding populations are currently believed to exist. Preferred inland habitat includes large lakes and forested wetlands (NPS 2005).

Paddlefish (*Polyodon spathula*): Paddlefish (State threatened) generally inhabit large rivers in the Mississippi river drainage and adjacent Gulf coastal plain. Paddlefish have been documented in the Lower Neches River and at the confluence of the Neches River and Little Pine Island Bayou. Unlike most large riverine fish, paddlefish are planktivorous as opposed to piscivorous. Paddlefish require cool temperatures, large flows, and gravel bottoms for spawning. The lower Neches River does not typically have flows of sufficient magnitude, and gravel substrate is uncommon, so spawning habitat is considered marginal. Nonetheless, the backwaters of the Neches could provide important feeding areas for paddlefish during the summer months. The Texas Parks and Wildlife Department recently developed a recovery plan for paddlefish in the Neches River that included annual stocking of paddlefish below Dam "B" on the Upper Neches River corridor. The Texas Parks and Wildlife Department is not doing stocking of paddlefish in the lower Neches River. The effectiveness of paddlefish recovery has yet to be documented (NPS 2005).

Rafinesque's Big-eared Bat (*Corynorhinus rafinesquii*): Rafinesque's big-eared bat (*Corynorhinus rafinesquii*) is State listed as threatened. This bat is easily distinguished from other bats by its immense ears. East Texas is considered the western distributional limit of this species. Preferred habitat for this species includes hollow trees, crevices behind bark, and dry leaves, although it is most frequently found in occupied and abandoned buildings. A temporary roost of Rafinesque's big-eared bats was documented in the LPI Corridor Unit in 1995, and occurrences elsewhere in the Preserve are likely (NPS 2005).

Visitor Use and Experience

Visitor use within the Preserve consists of day uses like picnicking, swimming, hiking, canoeing, boating and bird watching, camping, fishing, and hunting and trapping.

All streams within the Pine Island Bayou upstream to U.S. Highway 69 are limited to canoes and hand-launched boats with no more than 5-horsepower motors (NPS 1980).

Although development within the Preserve has followed a conservative approach, with careful siting and sustainable design being applied when development is warranted to retain natural qualities and processes, the *General Management Plan (1980)* outlined a general development plan for the LPI Corridor Unit which states that "the NPS will assist and encourage the state to develop a water access point with parking for 10 vehicles, EPA-approved self-contained toilets, a 1/4-mile

roadway, and a wayside exhibit at the junction of Texas 105 and Pine Island Bayou. If this proves infeasible, the NPS will develop a similar site on Preserve land at the confluence of Little Pine Island Bayou and Pine Island Bayou” (NPS 1980).

Park Operations and Management

The Preserve’s *General Management Plan (1980)* identifies three management zones: natural, development, and special use zones. This zoning system recognizes differences in resources and focuses future management on particular types of activities and developments appropriate for each zone. Management zoning specifies how the Preserve is to be managed at full plan [GMP] implementation, not merely how the area is currently managed (NPS 1980).

The project area is within all three of these zones. The natural zone places management emphasis on conservation of natural resources and processes while providing for uses that do not adversely affect these resources and processes. This zone also contains a natural environment subzone, in which the project area is located. This subzone is managed to ensure minimum impact on the natural and ecological integrity of the Preserve and to provide for environmentally compatible recreational activities.

The development zone allows for areas in the Preserve to be used for certain types of development to serve the needs of park management and visitors. It does not automatically ensure full development of these areas; rather it permits development to be considered. The special use zone includes lands within the Preserve where uses are carried out by other agencies or private interests. The project area contains the exploration/mining subzone, transportation subzone, and utilities subzone.

The major portion of the LPI Corridor Unit is in the natural environment subzone. This subzone is managed to ensure minimum impact on the natural and ecological integrity of the Preserve and to provide for environmentally compatible recreational activities. All streams within this subzone except the Neches River and the Pine Island Bayou upstream to U.S. Highway 69 are limited to canoes and hand-launched boats with no more than 5-horsepower motors (NPS 1980).

The Preserve staff manage public land in seven of the nine counties of this region of the state. There are five divisions that focus on specific elements of Preserve management, as described below: administration, maintenance, resources management, resources and visitor protection, and interpretation and education. The combined goals of the Preserve staff are to ensure that resources are protected, facilities are in good operating condition, users and visitors gain some level of appreciation and understanding, and users and visitors are generally safe while in the Preserve (NPS 2007a).

Administration Division oversees all internal personnel matters, provides for purchasing and contracting, the Preserve budget, manages correspondence, and all information technology.

Maintenance Division oversees all facility construction and repair work, administers service contracts, designs and constructs new facilities, provides for consumable water testing, and responds to emergency repairs as needed.

Resources Management Division oversees all issues regarding natural and cultural resources, conducts research or administers contracts to conduct research, oversees the oil

and gas management program, works with cooperators and researchers, and manages the Preserve fire program.

Resources and Visitor Protection Division oversees all levels of visitor protection and law enforcement, conduct search and rescue operations, assists the resources management division with resource protection, and oversees the Preserve-wide safety program.

Interpretation and Education Division oversees all visitor use operations including the visitor center operation, manages the educational program, provides naturalist walks and field trips, participates in community events and festivals, produces all in-house publications, and maintains news media contacts (NPS 2007a).

Health and Safety

While the Preserve attempts to make every visitor trip to the Preserve one without unreasonable risk, as with any activity anywhere there is some risk of injury. To promote visitor safety at the Preserve, safety components are included in most publications and brochures provided to the visitors. Safety notifications and policies are also included in most programs presented to Preserve staff and are posted at various visitor use sites throughout the Preserve. Safety for both the employee and the visitor is a component of every employee's performance standards (M. Peapenburg, pers. comm., 2007).

The Preserve has job safety analysis and other tools that help direct the Preserve staff in taking appropriate safety measures at work. The Preserve consistently updates their policies to comply with NPS safety policies and Occupational Safety and Health Administration regulations. In the case of an employee accident the Preserve follows Department of the Interior and NPS guidelines, which include providing for first aid and/or medical treatment as quickly as possible, reporting the incident to the appropriate supervisor and to a Protection Ranger for investigation, and reporting any injuries to the Superintendent and to the human resources staff (M. Peapenburg, pers. comm., 2007).

Adjacent Communities

Pine Island Bayou flows for approximately 90 miles through Hardin and Jefferson counties in southeast Texas before its confluence with the Neches River. The communities within these counties directly adjacent to the Preserve within the project area include (Figure 2):

- Pinewood Estates -Located within Hardin County and occurs both south and north of the Preserve near the western edge of the project area, with a population of 1,633.
- Bevil Oaks – Located in Jefferson County with a population of 1,346. Located approximately two-miles east of Pinewood Estates and directly south of the Preserve.
- Beaumont – Located in Jefferson County with a population of 113,866. The city is bordered on the east by the Neches River and to the north by Pine Island Bayou.
- Rose Hill Acres – Located in Jefferson County with a population of 480. This community is located at the eastern edge of the project, directly to the north.

The communities of Pinewood Estates, Bevil Oaks, and Rose Hill Acres are composed of primarily forested lands and pine plantations, with residential areas interspersed. There is also some clearing for small-scale agriculture (pasture) on these adjacent lands. The city of Beaumont is the largest city in the region and is the County Seat of Jefferson County. Beaumont is made up primarily of

residential and mixed use areas. Specific issues related to adjacent communities to the project area include flooding and the associated health and safety risks and access.

Flooding

According to the most recent Federal Emergency Management Agency (FEMA) flood insurance rate maps, each of the four communities described above lies partially within the 100-year floodplain of Pine Island Bayou (Figure 6). The Pine Island Bayou watershed, which encompasses all or a portion of each community, has an extensive history of flooding. This is due to high clay and silt soil content and its nearly flat (slopes less than one percent) topography. This combination results in the accumulation of surface runoff due to poor drainage which contributes to flooding (see the *Floodplains* and *Wetlands* section above). A large number of structures within communities of the watershed are flood-prone due to the presence of substantial residential development on the fringes of some of the bayous and creeks. The communities of Bevil Oaks and Pinewood Estates contain numerous residential structures within the 100-year floodplain. In 1985, it was estimated that there were 780 residential structures in the floodplain between both of these communities.

As a result of flood damage from stream overflows along the Little Pine Island – Pine Island Bayou corridor in 1963, 1975, and 1979, the U.S. Army Corps of Engineers conducted a feasibility study on flood damage prevention for the Pine Island Bayou Watershed (USACE 1985). The study was conducted to “determine the feasibility of measures for the reduction of flood damages and the solution to other water and land-related problems.” Nine alternatives were examined, including purchase and removal of existing structures in the 5- and 10-year floodplain along Little Pine Island Bayou. The feasibility report found that there was no economically feasible nonstructural or structural means of reducing existing flood damages in the Pine Island Bayou Watershed.

In May 1989, a slow moving storm system caused flooding in the Bevil Oaks area. Eleven homes in Bevil Oaks were flooded as a result of these heavy rains (USGS 2003).

In October 1994, the remnants of Tropical Storm Rosa caused flood waters to rise to a record of 12.5 feet above flood stage in Pine Island Bayou. This flood caused 26 counties to be declared Federal Disaster Areas and regionally took 20 lives; forced the evacuation of 14,000 people from their homes; caused over 700 million dollars in damages; closed Interstate 10 between Beaumont and Houston; closed the Port of Houston; and contaminated several areas by dispersing pollutants, fresh water, and mud (USGS 1995).

In September 2005, Hurricane Rita made landfall between Sabine Pass, Texas and Johnsons Bayou, Louisiana and resulted in approximately \$10 billion dollars in damage; caused nine counties to be declared Federal Disaster Areas; resulted in a loss of power for over 2 million people; and resulted in extensive wind damage. The Beaumont area sustained severe wind damage which resulted in an estimated 25 percent of trees being uprooted and extensive damage to property from the wind and falling trees (Hurricane Rita 2008). Since Hurricane Rita, many of the communities adjacent to the LPI Corridor Unit claim they are experiencing flooding with less rainfall and it takes floodwaters much longer to recede.

According to the Beaumont Enterprise, a local newspaper, serious flooding in the Little Pine Island Bayou area occurred in October 2006 and also in 1979, 1994, and 1998 (Smith 2007).

Access

All three of the existing access points to the project area are within adjacent communities to the Preserve (Figure 2). Two of the access points are within Pinewood estates at the Woodway Boulevard bridge and X bridge. The third access point is in Beaumont at the U.S. Highway 69 boat ramp.

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ENVIRONMENTAL CONSEQUENCES

This chapter analyzes the potential environmental consequences, or impacts, that would occur as a result of implementing each of the alternatives discussed in *Alternatives*. Topics analyzed in this chapter include floodplains/wetlands, water resources, soils, vegetation, fish and wildlife, special of special concern, visitor use and experience, park management and operations, and adjacent communities. All remaining impact topics were dismissed as discussed in the *Purpose and Need*. A description of the affected environment for each resource topic included in this chapter is contained in *Affected Environment*. Direct, indirect, and cumulative effects, as well as impairment and unacceptable impacts are analyzed for each resource topic carried forward. Potential impacts are described in terms of type, context, duration, and intensity. General definitions are defined as follows, while more specific impact thresholds are given for each resource at the beginning of each resource section.

Type describes the classification of the impact as either beneficial or adverse, direct or indirect:

Beneficial: A positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.

Adverse: A change that moves the resource away from a desired condition or detracts from its appearance or condition.

Direct: An effect that is caused by an action and occurs in the same time and place.

Indirect: An effect that is caused by an action but is later in time or farther removed in distance, but is still reasonably foreseeable.

Context describes the area or location in which the impact would occur. Are the effects site-specific, local, regional, or even broader?

Duration describes the length of time an effect would occur, either short-term or long-term:

Short-term impacts generally last only during activities, and the resources resume their conditions following activities.

Long-term impacts last beyond the period of activities, and the resources may not resume their conditions for a longer period of time following activities.

Intensity describes the degree, level, or strength of an impact. For this analysis, intensity has been categorized into negligible, minor, moderate, and major. Because definitions of intensity vary by resource topic, intensity definitions are provided separately for each impact topic analyzed in this Environmental Assessment.

Assumptions for Analysis

The following assumptions are used in each resource topic analysis below.

- Based on the Reconnaissance Trip Report (NPS 2007b), approximately 4 locations of Type II and III debris would be encountered. A final determination of debris locations will be made by NPS prior to commencing activities.

- Under alternative B, all debris would be cut up into manageable pieces for removal.
- Under alternatives B and C, methods for addressing large woody debris (LWD) and foreign debris would be implemented based on on-the-ground conditions of the bayou at the time of activities. LWD is defined as branches, large limbs, and trees that have fallen into the bayou. Foreign debris includes building materials, appliances, tires, etc. The following analyzes the use of each method individually throughout the project area. If more than one method is ultimately implemented, the impacts would be a combination of those described below.

Cumulative Analysis

The Council on Environmental Quality (CEQ) regulations, which implement the National Environmental Policy Act of 1969 (42 USC 4321 et seq.), require assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative impacts are considered for all alternatives.

Cumulative Impact Analysis Area – All Resources

The impact analysis area for cumulative impacts is the 100 year floodplain of the Little Pine Island – Pine Island Bayou bounded by U.S. Highway 69 on the east, Highway 105 on the south, Highway 326 on the west, and Highway 421 on the north. The cumulative impact analysis area is shown in Figure 8.

Past, Present, and Reasonably Foreseeable Actions

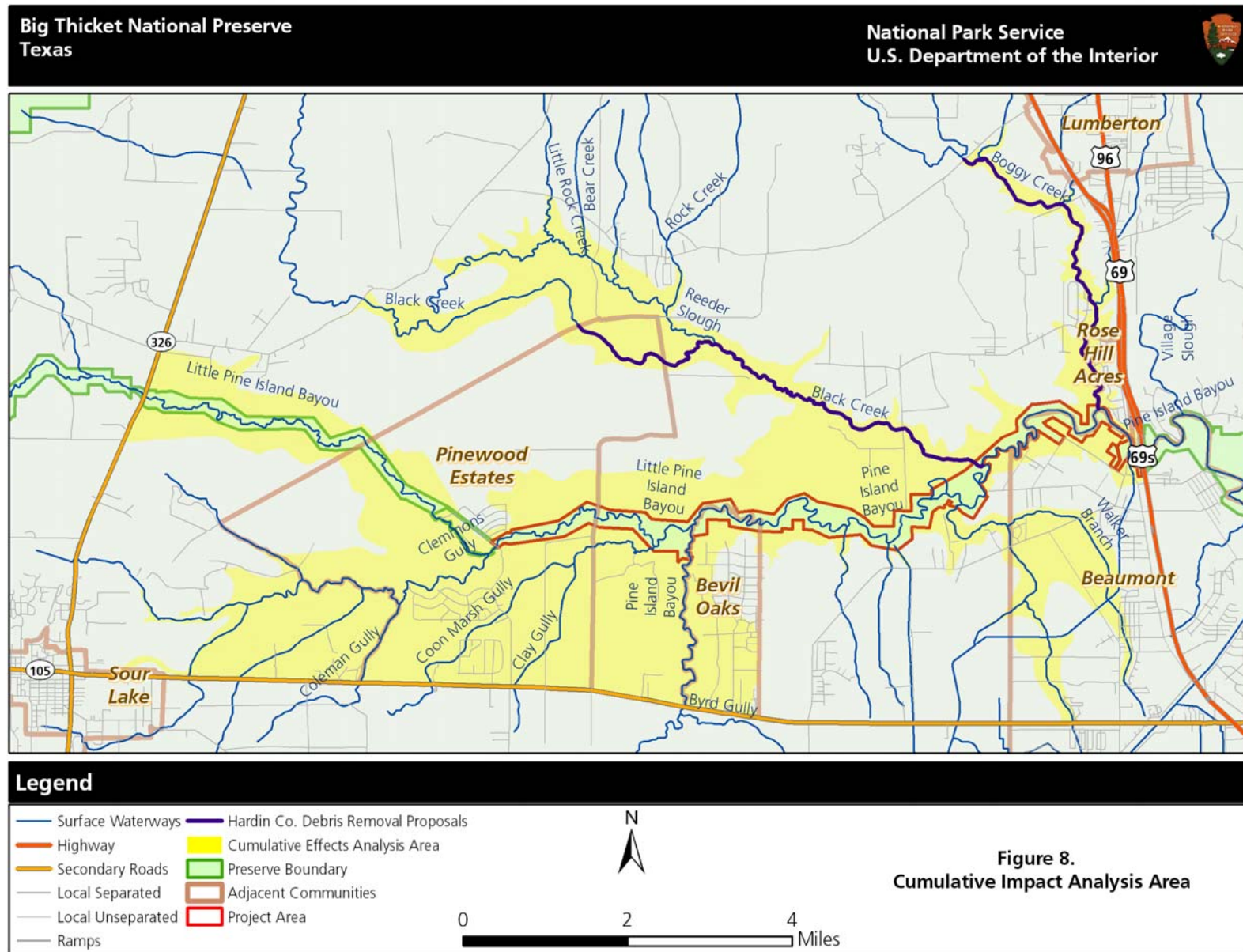
Cumulative impacts were determined by combining the impacts of the alternatives with other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify other ongoing or reasonably foreseeable future projects within the cumulative impact analysis area. Given this, the following projects were identified for the purpose of conducting the cumulative effects analysis.

NPS X-Bridge Removal. The X-bridge over the Little Pine Island Bayou was closed on 2002 and removed shortly thereafter due to safety concerns as a result of the bridge structure being deteriorated during high water.

NPS Exotic Plant Removal. In 2004, the NPS treated 50 acres along the south bank of Pine Island Bayou bordering the Bevil Oaks development for Chinese tallow removal. Treatment consisted of cutting the Chinese tallow trees and treating the stumps with Garlon 3a. The cut trees were left in-place. NPS also treated 1/10 of an acre of kudzu near a dump site between Tram Road and the Bayou. In 2006, 17.5 acres of Chinese privet (*Ligustrum sinense*) and Chinese tallow were cut and sprayed at Voth Mill. This site will receive another treatment in the summer of 2008.

Hardin County Debris Removal. The county is proposing to remove all storm debris including downed and damaged trees, hanging tree limbs, brush, logs, tree limbs, building materials, rubbish, flood debris, foreign materials, and other obstructions from drainage ways through five separate projects. The total length of all projects is approximately 65,360 feet (12.4 miles).

Figure 8 – Cumulative Impact Analysis Area



- **Paula Branch and Boggy Creek** – Beginning at a point on Paula Branch approximately 3,200 feet south of Sheffield Street and heading south to the intersection of Boggy Creek and then south again to F.M. Highway 421. Total length is approximately 21,023 feet.
- **Paula Branch** – Beginning on the west side of U.S. Highway 69 and 287 heading southwest following the existing ditch where Paula Branch crosses the abandoned Southern Pacific Railroad right-of-way. Total length is approximately 4,406 feet.
- **Boggy Creek** – Beginning at F.M. Highway 421 and heading southeast along Boggy Creek to Park Road. Total length is approximately 7,640 feet.
- **Boggy Creek** – Beginning at Park Road and heading south along Boggy Creek, crossing Keith Road, and continuing south along Boggy Creek to Pine Island Bayou. Total length is approximately 22,650 feet.
- **3 Segments** – Segment 1: Beginning in the west ditch at the abandoned Southern Pacific Railroad right-of-way north of Neely Road heading south along the ditch to the intersection with Boggy Creek; Segment 2: Beginning in the east ditch of the abandoned Southern Pacific Railroad near the west end of Tallino Lane, heading south along the east ditch to the intersection with the Highway Department drainage ditch crossing with the railroad; Segment 3: From east ditch of the Southern Pacific Railroad approximately 1,400 feet south from the beginning of Segment 2, heading southwest with the existing drainage ditch to the intersection with Boggy Creek.

Woodway Boulevard Bridge. The county is proposing to raise the Woodway Boulevard bridge over the Little Pine Island Bayou by three feet

Private Development Proposals. One proposal for a subdivision development within the 100-yr floodplain has been proposed in Hardin County. The proposed subdivision borders the Preserve north of Bevil Oaks and would be a total of 2,600 acres. Hardin County would require retention ponds and levees in the subdivision.

Large areas within the managed timberland have been converted to pine plantation and development for residences and a golf course. Along pipeline corridors, development has changed the dominant cover type to grass or herbaceous species. Areas have also been cleared of vegetation for roads and oil and gas locations.

County Maintenance Activities. All county roads and ditches are maintained on a regular basis through mowing, general repairs, and debris removal activities.

Oil and Gas Development. About 55 oil and gas well surface locations have been developed within the cumulative effects analysis area. Most of these wells were dry holes, and were plugged and abandoned soon after drilling. Very few are currently producing. Two wells outside the project area have been directionally drilled under the LPI Corridor Unit. These wells represent the extent of the development within the unit. No well locations have been developed within the project area and there are no plans to pursue such development. According to Railroad Commission of Texas digital data, most of the oil and gas development within the area has been in the East Sour Lake Field.

Field production facilities for oil and gas development typically consisting of wellheads, flowlines, 3 to 5 fluid storage tanks, and various separation and treatment vessels have been developed at oil and gas locations throughout the cumulative effects analysis area. Other equipment that may have

been installed at these facilities includes artificial lift and gas compression equipment. Pipeline valve stations and other aboveground facilities may have also been developed within the area.

Seven existing pipeline segments cross the project area. Six transport natural gas, and the other transports crude oil. They vary in size from 4.5 to 20 inches in diameter. Thirty pipeline segments cross the cumulative effects analysis area. They transport a variety of products including butane, crude oil, ethylene, liquified petroleum gas, natural gas, natural gas liquids, propylene and propane.

Logging. The predominant coverage type in the cumulative impacts analysis area is almost all managed timberland and different age classes are present throughout the area due to harvests. Harvests have been mostly clearcut type operations in large contiguous blocks. Large areas within the managed timberland have been converted to pine plantation.

Livestock Grazing. There are several large prairies to the west of the development in Pinewood Estates, north of Hwy 105. These prairies are remnants of a presettlement prairie cover type that generally followed Hwy 105 from about the western edge of development in Pinewood up to the intersection with FM 770 southwest of Saratoga (Schafale and Harcombe 1981). They have been present since at least the 1930s and have likely been grazed from the establishment of settlement in the area to the present. There is no other evidence of grazing in the cumulative effects analysis area.

Floodplains

Intensity Level Definitions

The methodology used for assessing impacts to floodplains was based on the known and potential 100 and 500 year floodplains within the Preserve, review of existing literature and studies, information provided by Preserve staff and NPS hydrologists, and professional judgment. The thresholds for this impact assessment are as follows:

Negligible: Impacts could result in a change to floodplains or increase the elevation of any given flood, but the change would not be of any measurable or perceptible consequence.

Minor: Impacts could result in a change to floodplains or increase the elevation of any given flood, but the change would be of little consequence. Operations would have minimal risk and have few mitigation measures.

Moderate: Impacts could result in a change to floodplains or increase the elevation of any given flood; the change would be measurable and consequential. Mitigation measures, if needed to offset adverse effects, could be extensive, but would likely be successful.

Major: Impacts would result in a noticeable change to floodplains or the elevation of any given flood; the change would result in a severely adverse or substantially beneficial impact. Extensive mitigation measures would be needed to offset any adverse effects, and their success would not be guaranteed.

Impacts of Alternative A – No Action

Under alternative A, the NPS would not take any action to remove large woody debris (LWD) (Type II or III) and foreign debris from the bayou channel of the project area and the floodplain would continue to function at its current level. At the time of the site visit conducted by the NPS in March 2007, the NPS hydrologists did not observe any LWD collections that appeared to be detrimental in

affecting flood stages. The report states that LWD may become problematic if it accumulates to a great enough height or lateral extent that would substantially affect out-of-bank flows or increase upstream flood elevations (that is, backwater effects) (NPS 2007b). Based on NPS observations, there were no such obstructions currently present and none that obviously would become such obstructions. However, Type II debris collections were identified as having the potential of becoming a complete channel obstruction with the potential to increase flood elevations if they accumulate additional debris, and one Type III debris collection was identified by the NPS as the most likely to contribute to backwater effects (NPS 2007b). The NPS concluded that there is no certainty that these debris collections would become problematic and contribute to increases in flood elevations, especially given the dynamic nature of the bayou (NPS 2007b). However, the *potential* for the collections to become obstructions over time was recognized.

A flood damage feasibility study conducted by the U.S. Army Corps of Engineers in and around the project area in 1985 supports the conclusion that debris of this nature has minimal effects on flood elevations. The feasibility study estimated that the water surface in Little Pine Island and Pine Island Bayous would only be lowered by 1 foot under an alternative that would have involved clearing 4.75- and 24-mile reaches on each bayou, respectively. Clearing was to be accomplished by removing all debris, trash, stumps, fallen trees, and limbs from the channel, as well as shrubs and small trees from both sides of the bayous, extending 12-½ feet from each side of the banks on Little Pine Island and 50 to 75 feet on Pine Island. Conversely, it can be assumed that leaving all of this material in the channel and on the banks only results in a 1-foot increase throughout this system. Therefore, when compared to the alternatives in the feasibility study, it is likely that the Type II and Type III LWD collections that would remain under alternative A would not have an appreciable effect on flood elevation.

As a result, leaving the Type II and III debris in the channel is not expected to change the current potential for out-of-bank flows or atypical flooding beyond what currently exists. In light of the backwater effects created by the confluence of the Little Pine Island and Pine Island Bayous, changes in backwater effects would also be minimal. Therefore, alternative A would have no effect on flood elevations as a result of leaving the debris in the channel. Although it is not certain to occur, should the Type II or III debris collections accumulate additional debris in the future, they could create complete channel obstructions, which would result in increased flood elevations. In addition, not removing any foreign debris in the channel would not have an effect on flood elevations.

Leaving LWD and foreign debris in the bayou channel would affect other values associated with a naturally functioning floodplain, which are discussed in other sections of this chapter under their respective impact topics (e.g., wetlands, wildlife and wildlife habitat, vegetation).

Cumulative Impacts: Other past, present, and reasonably foreseeable actions within the vicinity of the project area have affected or could affect area floodplains and flood elevations. Hardin County's proposed Hurricane Rita Debris Removal Project would involve the removal of all storm debris along a 12.4 mile length of Boggy Creek and Paula Branch, extending out to a width of 20 feet from the banks on either side of Boggy Creek and Paula Branch. This project would involve the removal of floodplain vegetation and natural debris loads from the floodplain system in and around both Boggy Creek and Paula Branch. Flood elevations in these areas would be lowered; however, this would affect downstream floodplain resources by increase flow velocities and creating erosion of floodplain soils resulting in deposition of soils downstream, which would affect floodplain vegetation. Overall, this would increase flood elevations and/or duration downstream. While this may provide some localized beneficial effects in the Boggy Creek and Paula Branch areas, the

clearing of a considerable amount of floodplain vegetation and natural debris loads from these areas would result in long-term minor adverse impacts near the confluence of Boggy Creek and Pine Island Bayou due to potential increases in the velocity of stream flow at downstream locations.

Oil and gas development and associated field production facilities, past logging, as well as past and continuing development in the floodplain, have also contributed to cumulative adverse impacts. Past logging and oil and gas development and associated field production facilities within the floodplain has and will continue to contribute to the removal of natural floodplain vegetation and creation of impervious surface due to the clearing and construction of roads. Past residential development in the floodplains has also removed natural floodplain vegetation and affected floodplain functioning. One proposed subdivision development borders the Preserve north of Bevil Oaks and would include 2,600 acres in the floodplain. Development of the subdivision, along with required retention ponds and levees, would involve the removal of considerable amounts of natural floodplain vegetation and the installation of impervious surface for the construction of roads and residential structures. The levees also have the potential to affect the floodplains in the project area by changing the natural course of water and therefore possibly encouraging erosion of floodplain soils which would adversely affect floodplain functions downstream. These land use changes have and would most likely continue to result in increased stormwater runoff to the Pine Island Bayou, which can increase flood flows and elevations. Development in the floodplain would result in long-term, moderate local adverse impacts to floodplain resources in the analysis area.

The effects of the actions described above, when combined with no effect of actions under alternative A, would result in long-term, localized, moderate adverse impacts on floodplains in the area of analysis.

Conclusion: Alternative A would have no effect on floodplain values as a result of leaving the debris in the channel. Although it is not certain to occur, should the Type II or III LWD collections accumulate additional debris in the future, they could create complete channel obstructions, which would result in increased flood elevations. Cumulative impacts would be long-term, localized, moderate, and adverse, with the proposed actions contributing only slightly to these impacts. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Big Thicket National Preserve (2) key to the natural or cultural integrity of the Preserve; or (3) identified as a goal in the Preserve's *General Management Plan (1980)* or other relevant National Park Service planning documents, there would be no impairment of the Preserve's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of *NPS Management Policies 2006*.

Impacts of Alternative B (Preferred Alternative)

Helicopter

Using this method, a contractor would use a ground crew and helicopter to conduct a one-time removal of Type II and III LWD and foreign debris at approximately four locations based on the Reconnaissance Trip Report (NPS 2007b). The final number of debris collections, including foreign debris, to be removed would be determined by the NPS staff member that would accompany the contractor during the removal effort. The act of removing this debris by helicopter would have no impacts on the function of the floodplain as this method would not involve any permanent land disturbance or alteration of topography in the floodplain. No change to flood elevations would be associated with this removal method.

Boat/Barge

This method would involve a contractor with a boat and barge that would access eligible LWD and foreign debris collections for a one-time removal during a period of high water in the bayou. The final number of debris collections, including foreign debris, to be removed would be determined by the NPS staff member that would accompany the contractor during the removal effort. The act of removing this debris by boat and barge would have no impacts on the function of the floodplain as this method would not involve any permanent land disturbance or alteration of topography in the floodplain. No change to flood elevations would be associated with this removal method.

Impact Analysis of the Effects of Removal of Type II and III Debris and Foreign Debris

Under alternative B, the one-time removal of eligible LWD and foreign debris (excluding root balls and/or stumps) in the project area would have minimal effects on the flood elevations as they are not currently considered complete channel obstructions, with the potential to substantially affect out-of-bank flows or increase backwater effects (NPS 2007b). This alternative would remove the *potential* for these debris collections to accumulate additional debris over time, reducing the potential for these types of complete channel blockages to form at these locations in the future and to result in increased flood elevations.

Compared to the alternatives evaluated by the U.S. Army Corps of Engineers in their 1985 feasibility study to clear 4.75 and 24 miles of Little Pine Island and Pine Island Bayous, respectively, this project would remove a very limited amount of material that has minimal potential to contribute to increases in flood elevations (see alternative A for more details). Although alternative B would result in the removal of eligible LWD and foreign debris, there would be no removal of vegetation outside of the channel in the floodplain, as was considered in the U.S. Army Corps of Engineers feasibility study. Therefore, when compared to alternatives in the feasibility study to clear portions of both Pine Island and Little Pine Island Bayou, which would have caused water to flow more rapidly through the system but would have resulted in only a 1-foot reduction in water surfaces, removal of woody debris under alternative B would result in much smaller, possibly undetectable changes to flood elevations in the project area.

Although the LWD collections are not currently considered to be contributing to upstream backwater effects (NPS 2007b), their removal would alleviate the potential for complete blockages to form in these locations that could result in out-of-bank flows or atypical flooding. The one-time removal of Type II and III LWD from the bayou channel would have long-term, local, negligible adverse impacts to floodplains by reducing flood elevations; any greater effects would be difficult to predict given the uncertainty of the potential for these complete channel blockages to form. In addition, removing any foreign debris in the channel would not have an appreciable impact on flood elevations.

Cumulative Impacts: Cumulative impacts would be essentially the same as described for alternative A. Actions in and outside the Preserve, including Hardin County's Hurricane Rita Debris Removal Project, oil and gas development and associated field production facilities, logging, and past and continued residential development in the floodplain adjacent to the Preserve would continue to affect flood potential and result in long-term localized moderate adverse impacts. The impacts of these actions, when combined with the long-term negligible adverse impacts of the actions under alternative B, would continue to result in long-term, localized, moderate adverse impacts on floodplains in the area of analysis.

Conclusion: Alternative B would have long-term, local, negligible adverse impacts to floodplain values due to the unnatural reduction in floodplain elevations from removal of existing debris in the

channel; any greater effects would be difficult to predict given the uncertainty of the potential for these complete channel blockages to form. Cumulative impacts would be long-term, localized, and moderate, with the proposed actions contributing only slightly to these impacts. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Big Thicket National Preserve (2) key to the natural or cultural integrity of the Preserve; or (3) identified as a goal in the Preserve's *General Management Plan (1980)* or other relevant National Park Service planning documents, there would be no impairment of the Preserve's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies 2006*.

Impacts of Alternative C

Overland Routes

This method would involve a ground crew that would access eligible LWD and foreign debris collections within the project area on foot for a one-time effort to break up the structural integrity of the LWD during a period of low water and remove as much foreign debris as possible. The ground crew would utilize chain saws, saws, and other appropriate hand-held equipment to cut up eligible LWD and leave it in the active channel of the bayou. The act of eliminating the structural integrity of LWD by a ground crew equipped with saws would have no impacts on the function of the floodplain as this method would not involve any permanent land disturbance or alteration of topography in the floodplain. No change to flood elevations would be associated with this method.

Boat

This method would involve a ground crew that would access eligible LWD and foreign debris collections within the project area during a period of high water for a one-time effort to break up the structural integrity of the LWD and remove as much foreign debris as possible. The ground crew would utilize chain saws, saws, and other appropriate hand-held equipment to cut up eligible LWD and leave it in the active channel of the bayou. The act of eliminating the structural integrity of LWD by utilizing a boat and a crew equipped with hand-held equipment would have no impacts on the function of the floodplain as this method would not involve any permanent land disturbance or alteration of topography in the floodplain. No change to flood elevations would be associated with this method.

Impact Analysis of the Effects of Eliminating the Integrity of Type II and III Debris and Removing Foreign Debris

Under alternative C, the one-time effort to eliminate the structural integrity of Type II or Type III LWD collections in the project area would have minimal effects on flood elevations, as they are not currently considered to be complete channel obstructions that could substantially affect out-of-bank flows or increase backwater effects (NPS 2007b). As with alternative B, this alternative would remove the *potential* for these debris collections to accumulate additional debris over time, reducing the potential for these types of complete channel blockages to form at these locations in the future.

Although the debris would not be removed completely under this alternative, leaving the remnants in the active channel would not noticeably affect the potential for out-of-bank flows or atypical flooding beyond what exists currently. As described for alternative A, the analysis of alternatives to clear the Little Pine Island and Pine Island Bayous in the flood damage feasibility study conducted by the U.S. Army Corps of Engineers in 1985 indicated that these projects would cause water to move faster through the system, but would only lower water surfaces by 1 foot. Conversely, it can be

assumed that leaving all of this material in the channel and on the banks only results in a 1-foot increase throughout this system. Therefore, when compared to the alternatives in the feasibility study, it can be concluded that the remnants of the Type II and Type III debris collections that would be left in the project area would not have an appreciable effect on flood elevation, even if it is transported downstream and redistributed in the channel.

The one-time effort to break up the structural integrity off Type II and III debris from the bayou channel would have long-term, local, negligible adverse impacts to floodplain values; any greater effect would be difficult to predict given the uncertainty of the potential for these complete channel blockages to form. In addition, removing any foreign debris in the channel would not have an appreciable impact on flood elevations.

Cumulative Impacts: Cumulative impacts would be essentially the same as described for alternative A. Actions in and outside the park, including Hardin County's Hurricane Rita Debris Removal Project, oil and gas development and associated field production facilities, logging, and past and continued residential development in the floodplain adjacent to the Preserve would continue to affect flood potential and result in long-term moderate adverse impacts. The impacts of these actions, when combined with the long-term negligible adverse impacts of the actions under alternative C, would continue to result in long-term, localized, moderate adverse impacts on floodplains in the area of analysis, since any effects of the proposed actions would contribute only a very small increment to overall cumulative impacts.

Conclusion: Implementation of alternative C would have long-term, local, negligible adverse impacts to floodplain values; any greater effect would be difficult to predict given the uncertainty of the potential for these complete channel blockages to form. Cumulative impacts would be long-term, localized, and moderate, with the proposed actions contributing only slightly to these impacts. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Big Thicket National Preserve (2) key to the natural or cultural integrity of the Preserve; or (3) identified as a goal in the Preserve's *General Management Plan (1980)* or other relevant National Park Service planning documents, there would be no impairment of the Preserve's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Wetlands

Intensity Level Definitions

Considerations for this analysis included the potential for actual removal activities to disturb or alter wetlands functions and values. In addition, the analysis considers the effects of the potential changes in flood elevations described in *Floodplains* on wetlands and their functions and values. The thresholds for this impact assessment are as follows:

Negligible: Operations would affect wetlands but would not alter wetland functions and values. Reclamation would not be necessary.

Minor: The change to wetlands functions and values in terms of area, composition and structure would be detectable but inconsequential. Wetland processes, functions and integrity would remain unaffected. Mitigation measures, if needed to offset adverse effects, would be simple and successful.

Moderate: Impacts to wetlands would be readily apparent, but would only temporarily affect the wetland's composition and structure. Wetland processes, function, and integrity would also be temporarily affected. Mitigation measures, if needed to offset adverse effects, would be extensive and likely successful.

Major: Operations would cause substantial alteration to wetland functions and values. Wetland processes, function, and integrity would be altered to the point where the wetland area, structure, and composition would permanently change. Extensive mitigation measures would be needed to offset any adverse effects, and their success would not be guaranteed. Reclamation of disturbed areas may not be attainable.

Impacts of Alternative A – No Action

Under alternative A, there is no potential for physical disturbance of wetland areas because the NPS would not take any action to remove Type II or III LWD and foreign debris from the bayou channel of the project area. As described under *Floodplains*, leaving the Type II and Type III woody debris collections, as well as foreign debris, in the channel is not expected to change the current potential for out-of-bank flows or atypical flooding beyond what currently exists. As a result, it is unlikely that any wetlands would be created or lost due to flooding that could occur under alternative A. The wetlands in the project area are flood-adapted and this flooding would continue to recharge wetland areas with supplies of water, nutrients and sediments (National Academy of Sciences 1999). As a result, there would be no change in wetland functions or values.

Because foreign debris would not be removed, any polluting materials in the project area would continue to affect water quality, which could degrade wetlands. However, this alternative would not increase the potential for such impacts. Therefore, there would be long-term, local, negligible adverse effects under alternative A that would not change wetland functions and values in the project area. As described under *Floodplains*, should the Type II or III LWD and foreign debris collections accumulate additional debris in the future, they could create complete channel obstructions, which would result in greater impacts on flood elevations. However, this is a natural process that would support wetland functions and values.

Cumulative Impacts: Other past, present, and reasonably foreseeable actions within the vicinity of the project area have affected or could affect area wetlands. Hardin County's proposed Hurricane Rita Debris Removal Project would involve the removal of all storm debris along a 12.4 mile length of Boggy Creek and Paula Branch, extending out to a width of 20 feet from the banks on either side of Boggy Creek and Paula Branch. This project would directly impact riparian and palustrine wetlands bordering the stream channel by removal of vegetation and disturbance of soils. Past residential development and road construction in the area of analysis has also likely resulted in direct loss of wetlands. Currently, there is a proposal for a 2,600-acre residential subdivision that borders the Preserve north of Bevil Oaks. According to NWI maps, there are wetlands located in the general area of the proposed development. Because this development would be located in a floodplain in an area where wetlands exist, it can be assumed that there would be some impact to wetlands from such a large development proposal. Therefore, this development and other past developments would most likely result in long-term, minor to moderate local adverse impacts to wetland functions and values in the cumulative impacts analysis area.

Oil and gas development and associated field production facilities and past logging have also contributed to cumulative adverse impacts. Past and current oil and gas development has and will continue to contribute to the removal of natural vegetation, some of which was likely located in or

near wetlands. Oil and gas operation can leak oil and brine and contribute to the contamination of soils in wetland areas. Logging and grazing also have directly affected vegetated sites in the area of analysis, with again the likelihood that portions of the affected areas were previously wetlands.

The effects of the actions described above, when combined with the negligible beneficial, if any, impacts under alternative A, would result in long-term, localized, minor to moderate adverse impacts on wetlands in the area of analysis. Any benefits derived from the proposed actions would contribute only a very small increment to overall cumulative impacts.

Conclusion: Alternative A would result in no effect or negligible, long-term, beneficial impacts to wetland function or values because LWD and foreign debris removal would not be conducted and wetlands would remain in their current state. Cumulative impacts would be long-term, localized, minor to moderate, and adverse, with the proposed actions contributing only slightly, if at all, to these impacts. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Big Thicket National Preserve (2) key to the natural or cultural integrity of the Preserve; or (3) identified as a goal in the Preserve's *General Management Plan (1980)* or other relevant National Park Service planning documents, there would be no impairment of the Preserve's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of *NPS Management Policies 2006*.

Impacts of Alternative B (Preferred Alternative)

Helicopter

The one-time removal of Type II and III LWD and foreign debris at approximately four locations by a ground crew and helicopter could disturb wetlands if LWD or foreign debris is submerged in a wetland area and is removed. There could also be some trampling of wetland soils or vegetation by the ground crew, but any of these impacts would be temporary and would not have any lasting, noticeable effects on wetland function or values especially given the rapid rate of recovery in this warm, moist climate. As a result, there could be short-term, local, negligible adverse impacts from potential disturbances during removal activities. Although National Wetland Inventory data are available for the project area, the exact locations of debris removal are unknown at this time, and the extent of potential impacts to wetlands could vary depending on whether or not they are present in the removal areas (that is, there would be no impacts if there are no wetlands in the area of removal).

Boat/Barge

The one-time removal of eligible Type II or Type III LWD and foreign debris by boat could have short-term, local, negligible adverse impacts to wetlands as there could be some standing trees removed to allow passage of the boat/barge. If downed trees are located in a wetland, their removal could also disturb wetlands. However, the impacts would be temporary and would not have any lasting, noticeable effects on wetland function or values due to the ability of wetlands to continue to function even after individual plants are removed, as well as the rapid recovery that would be expected in this climate. As described for helicopters, the exact locations of debris removal are unknown at this time, and the extent of potential impacts to wetlands could vary depending on whether or not they are present in the removal areas (that is, there would be no impacts if there are no wetlands in the area of removal).

Impact Analysis of the Effects of Removal of Type II and III Debris and Foreign Debris

As described under *Floodplains*, removing the approximately four Type II and Type III LWD collections, as well as foreign debris, would have minimal effects on out-of-bank flows and would

reduce future flood elevations by less than 1-foot, and may possibly be undetectable. Therefore, it is unlikely that any wetlands would be created or lost due to flooding that could occur under alternative B. As described in alternative A, these flood-adapted wetlands in the project area would continue to be recharged with water, nutrients, and sediments during future flood events (National Academy of Sciences 1999). As a result, there would be no change in wetlands functions or values. Because foreign debris would be removed, some polluting materials in the project area would also be removed, which would remove a potential source of impacts on wetlands. Ultimately, this would have long-term, local, negligible to minor, beneficial effects because any improvements would not be noticeable.

Cumulative Impacts: Cumulative impacts would be essentially the same as described for alternative A. Actions in and outside the park, including the Hardin County Hurricane Rita Debris Removal Project, oil and gas development, logging, and past and continued residential and road development in the area adjacent to the Preserve would continue to affect wetlands and result in long-term local minor to moderate adverse impacts. The impacts of these actions, when combined with the short-term, negligible, adverse and long-term, negligible to minor, beneficial impacts of the actions under alternative B, would result in long-term, localized, minor to moderate adverse impacts on wetlands in the area of analysis. The proposed actions would contribute only slightly to these impacts and any benefits derived from the proposed actions would contribute only a very small increment to overall cumulative impacts.

Conclusion: Alternative B would result in short-term, local, negligible adverse impacts to wetland function and values because debris removal could potentially cause some local disturbance of wetland areas. Because foreign debris would be removed, some polluting materials in the project area would also be removed, which would have long-term, local, negligible to minor, beneficial effects. Cumulative impacts would be long-term, localized, minor to moderate, and adverse, with the proposed actions contributing only slightly to these impacts. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Big Thicket National Preserve (2) key to the natural or cultural integrity of the Preserve; or (3) identified as a goal in the Preserve's *General Management Plan* (1980) or other relevant National Park Service planning documents, there would be no impairment of the Preserve's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Impacts of Alternative C

Overland Routes

This method would involve a ground crew that would access eligible LWD and foreign debris collections within the project area on foot for a one-time effort to break up the structural integrity of the LWD during a period of low water and remove as much foreign debris as possible. The ground crew would utilize chain saws, saws, and other appropriate hand-held equipment to cut up eligible LWD and leave remnants in the active channel of the bayou. This could have short-term, local, negligible adverse impacts on wetlands due to the potential for trampling of wetland vegetation and soils by ground crews during the extraction. Any impacts would be temporary and would not have any lasting, noticeable effects on wetland functions or values, especially given the rapid recovery that would be expected in this climate. As described for alternative B, the exact locations of debris removal are unknown at this time, and the extent of potential impacts to wetlands could vary depending on whether or not they are present in the removal areas (that is, there would be no impacts if there are no wetlands in the area of removal).

Boat

This method would involve a ground crew that would access eligible LWD and foreign debris collections within the project area during a period of high water for a one-time effort to break up the structural integrity of the LWD and remove as much foreign debris as possible. The crew would operate from the boat within the channel and would utilize chain saws, saws, and other appropriate hand-held equipment to cut up eligible LWD, leaving the remnants in the channel. As a result, the crews would not be walking in areas where they could trample wetland vegetation or soils. In addition, no vegetation would have to be removed in the channel to operate the boat. Therefore, eliminating the structural integrity of downed trees and woody debris by utilizing a boat and a crew equipped with hand-held equipment would have no impacts on wetland functions and values as this method would not involve any disturbance or alteration to wetlands.

Impact Analysis of the Effects of Eliminating the Integrity of Type II and III Debris and Removing Foreign Debris

Under alternative C, all LWD that meet the definition of Type II or Type III would be broken up to eliminate the “structure” that contributes to the potential accumulation of additional debris that could result in atypical out-of-bank flooding. The remnants of LWD would be left in the active channel, but as described under *Floodplains*, breaking up the structural integrity and leaving the remnants of the approximately four Type II and Type III LWD collections in the active channel, as well as removing foreign debris, is not expected to have a noticeable effect on the potential for out-of-bank flows or atypical flooding beyond what currently exists. If the remnants of the LWD collections are transported downstream and redistributed within the active channel, only negligible effects are expected on future flood elevations.

As a result, it is unlikely that any wetlands would be created or lost due to flooding that could occur under alternative C. These flood-adapted wetlands in the project area would continue to be recharged with supplies of water, nutrients, and sediments during future flooding (National Academy of Sciences 1999). As a result, there would be no change in wetlands functions or values. Because foreign debris would be removed, some polluting materials in the project area would also be removed, which would remove a potential source of impacts on wetlands. Ultimately, this would have long-term, local, negligible to minor, beneficial effects because any improvements would not be detectable.

Cumulative Impacts: Cumulative impacts would be essentially the same as described for alternative A. Actions in and outside the park, including the Hardin County Hurricane Rita Debris Removal Project, oil and gas development, logging, and past and continued residential and road development in the area adjacent to the Preserve would continue to affect wetlands and result in long-term minor to moderate adverse impacts. The impacts of these actions, when combined with the short-term, negligible adverse impacts and long-term, negligible beneficial effects of the actions under alternative B, would result in long-term, localized, minor to moderate adverse impacts on wetlands in the area of analysis. The proposed actions would contribute only slightly to these impacts, and any benefits derived from the proposed actions would contribute only a very small increment to overall cumulative impacts.

Conclusion: Alternative C would result in short-term, local, negligible adverse impacts to wetland function and values because debris removal could potentially cause some local disturbance of wetland areas. Because foreign debris would be removed, some polluting materials in the project area would also be removed, which have long-term, local, negligible to minor, beneficial effects. Cumulative impacts would be long-term, localized, minor to moderate, and adverse, with the proposed actions contributing only slightly to these impacts. Because there would be no major,

adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Big Thicket National Preserve (2) key to the natural or cultural integrity of the Preserve; or (3) identified as a goal in the Preserve's *General Management Plan (1980)* or other relevant National Park Service planning documents, there would be no impairment of the Preserve's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Water Resources

Intensity Level Definitions

The methodology used for assessing impacts to water resources (mainly water quality and flow characteristics) was based on review of existing literature and studies, information provided by Preserve staff and NPS hydrologists, and professional judgment. The thresholds for this impact assessment are as follows:

Negligible: Impacts would result in a change to water resources but the change would be so slight that it would not be of any measurable or perceptible consequence. Water quality and flow characteristics would be consistent with historical or baseline conditions. These changes would not affect the Little Pine Island-Pine Island Bayou.

Minor: Impacts would result in a detectable change to water resources of the Little Pine Island-Pine Island Bayou, but impacts would be expected to be small, of little consequence, and localized. Water quality and flow characteristics would be consistent with historical or baseline conditions. Mitigation measures, if needed to offset adverse effects, would be simple and successful.

Moderate: Impacts would result in a change to water resources that would be readily detectable and localized. Occasional alterations of historical or baseline water quality or flow characteristics may occur. Mitigation measures, if needed to offset adverse effects, could be extensive, but would likely be successful.

Major: Impacts would result in a change to water resources that would have substantial consequences on a regional scale. Frequent alterations in the historical or baseline water quality and stream flow conditions would occur over a large area and could result in modifications to the natural channel and instream flow characteristics. Extensive mitigation measures would be needed to offset any adverse effects, and their success would not be guaranteed.

Impacts of Alternative A – No Action

It is the nature of a floodplain to convey excess water during times of heavy, prolonged precipitation events. Under alternative A, the NPS would not take any action to remove Type II or III LWD and foreign debris from the bayou channel of the project area. As described under *Floodplains*, leaving the approximately four Type II and Type III LWD collections in the channel is not expected to change the current potential for out-of-bank flows or atypical flooding beyond what currently exists. Therefore, any changes in streamflow from a corresponding decrease in water conveyance and possible increase in localized flooding upstream of the blockages would be minimal.

Flood events could continue to cause the inundation of adjacent floodplain communities which could transport pollutants from developed areas into the receiving waters of the bayou. Because foreign debris would not be removed, any polluting materials in the project area would continue to affect water quality. Therefore, alternative A would have long-term, local, minor adverse effects that would not appreciably change streamflow or water quality in the project area.

Cumulative Impacts: Other past, present, and reasonably foreseeable actions within the vicinity of the project area have affected or could affect area water resources, including Hardin County's Hurricane Rita Debris Removal Project DRS-0702, continued residential development in the floodplain adjacent to the Preserve, and oil and gas development and associated field production facilities. Hardin County's proposed project would involve the removal of all storm debris along a 12.4 mile length of Boggy Creek and Paula Branch, extending out to a width of 20 feet from the banks on either side of Boggy Creek and Paula Branch. The clearing of a considerable amount of vegetation along these streams could result in long-term local adverse impacts to water resources due to potential increases in the velocity of stream flow at these downstream locations and sedimentation from disturbance of the banks. Short-term, local, adverse impacts to water quality would occur, as the vegetation along the banks is currently providing water quality benefits by slowing and filtering stormwater that flows into the bayou over the land surface, thereby reducing the amount of pollutants and sediment that enter the water. This project would also provide local, beneficial impacts to water quality because the project also involves the removal of trash and other foreign materials from the riparian area, thus preventing these potentially hazardous and polluting materials from entering the waters of the bayou.

Continuing development in the floodplain and oil and gas development and associated field production facilities also contribute to cumulative impacts. Development of the subdivision, along with required retention ponds and levees, would involve the removal of considerable amounts of natural vegetation and the installation of acres of impervious surface for the construction of roads and residential structures. The levees also have the potential to affect the water resources in the project area by changing the natural course of water and therefore possibly encouraging erosion of floodplain soils which would adversely affect water quality (non-point source pollution) and flow characteristics downstream. Logging can result in a large amount of vegetation removal at one time, with resultant increased runoff of sediments to surrounding waterways. Oil and gas development and associated field production facilities would also contribute to the potential removal of natural vegetation and creation of impervious surface due to the construction of roads, fluid storage tanks, pipeline valve stations, and other aboveground facilities. This would result in impacts to water quality from increased stormwater runoff combined with a decrease in the amount of vegetation available to provide the positive benefits of pollutant filtration, soil stabilization, and water temperature moderation. Also, in the event of a flood, there is the potential for floodwaters to inundate the floodplain development and transport pollutants from the developed area into the receiving waters of the Bayou. .

The effects of the past, present, and future actions described above, when combined with the long-term minor adverse impacts of actions under alternative A, would result in long-term, localized, minor adverse impacts on water resources in the area of analysis. The proposed actions would contribute only slightly to these impacts.

Conclusion: Alternative A would result in long-term, local, negligible adverse impacts to water resources. Cumulative impacts would be long-term, localized, minor, and adverse, with the proposed actions contributing only slightly to these impacts. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific

purposes identified in the establishing legislation of Big Thicket National Preserve (2) key to the natural or cultural integrity of the Preserve; or (3) identified as a goal in the Preserve's *General Management Plan (1980)* or other relevant National Park Service planning documents, there would be no impairment of the Preserve's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Impacts of Alternative B (Preferred Alternative)

Helicopter

Potential impacts of a one-time removal of eligible LWD and foreign debris by helicopter and ground crew would include fuel leaks (from the helicopter or hand held equipment) in an area adjacent to or within the bayou channel that could impact water quality. However, mitigation measures (e.g., spill prevention and containment procedures, including regularly checking equipment for fuel leaks and making necessary repairs) would be implemented to help offset the potential for water quality impacts from these situations. In addition, one-time removal would make the potential for these impacts temporary, and the volumes of fuel or other petroleum products (e.g., oil) that could be released would be relatively small, especially from handheld equipment. Therefore, any potential spills are expected to be of little consequence and would have short-term, local, negligible adverse impacts to water quality. Removal activities are not expected to alter the rate at which surface water flows across these areas because any compaction of soils or loss of vegetation from trampling by ground crews would be minimal, and would be expected to recover rapidly given the climate of the area.

It is assumed that the helicopter take-off and landing site is located in a previously disturbed upland area, and that appropriate measures are in place to eliminate the potential for fuel spills to enter any nearby receiving waters. In addition, because it is currently being used by Hardin County for disposal of debris removed from their efforts the disposal site is assumed to be in a previously disturbed area with the appropriate erosion and sedimentation controls to prevent any impacts to water quality in any nearby waters. As a result, helicopter take-off and landing, as well as disposal of debris, would not affect water resources.

Boat/Barge

This method would involve the one-time use of a boat and barge during a period of high water in the Bayou to access eligible LWD and foreign debris collections for removal. The only potential impacts of removing this debris by boat or barge would be the potential for a fuel leak adjacent to or within the bayou channel, as well as the potential for the removal of individual standing trees. Mitigation measures (e.g., spill prevention and containment procedures, including regularly checking equipment for fuel leaks and making necessary repairs) would be implemented to help offset the potential for water quality impacts from the use of the boat/barge and handheld equipment. In addition, one-time removal would make the potential for these impacts temporary, and the volumes of fuel or other petroleum products (e.g., oil) that could be released would be relatively small, especially from handheld equipment. Although there is the potential to remove individual standing trees with this method, the resulting changes in streamflows through the system are expected to be minimal. Therefore, this alternative could have short-term, local, negligible to minor, adverse impacts on water resources.

Impact Analysis of the Effects of Removal of Type II and III Debris and Foreign Debris

As described under *Floodplains*, removing the approximately four Type II and Type III LWD collections, as well as foreign debris, would have negligible effects on out-of-bank flows and would reduce future flood elevations by less than 1-foot, and may possibly be undetectable. As a result,

there would be minimal changes in the potential for flood events that cause the inundation of adjacent floodplain communities and that transport pollutants from developed areas into the receiving waters of the bayou. Because foreign debris would be removed, some polluting materials in the project area would also be removed, which would help improve water quality, albeit slightly.

The 1985 U.S. Army Corps of Engineers flood damage feasibility study estimated that complete clearing (as described under *Floodplains*) of some reaches of Little Pine Island and Pine Island Bayous would cause water to move faster through the system. Although alternative B would result in the removal of four eligible LWD and foreign debris collections, there would be no removal of vegetation outside of the channel in the floodplain, as described in the U.S. Army Corps of Engineers feasibility study. Therefore, when compared to alternatives to clear portions of both Pine Island and Little Pine Island Bayous, and when taking into account the substantial backwater effects created by the confluence of Little Pine Island and Pine Island Bayous, alternative B would result in much smaller, possibly undetectable changes in streamflow.

Therefore, this alternative would have long-term, local, negligible, beneficial impacts on water resources by removing potential sources of water quality impacts (foreign debris) as well as alleviating the potential for blockages to form in the area of Type II and Type III debris collections.

Cumulative Impacts: Cumulative impacts would be essentially the same as described for alternative A. Actions in and outside the park, including the Hardin County Hurricane Rita Debris Removal Project, oil and gas development and associated field production facilities, logging, and past and continued residential development in the floodplain adjacent to the Preserve would continue to affect water resources and result in long-term minor adverse impacts. The impacts of these actions, when combined with the short-term, negligible adverse, and long-term, negligible beneficial impacts of the actions under alternative B, would result in long-term, localized, minor adverse impacts on water resources in the area of analysis. Any benefits derived from the proposed actions would contribute only a very small increment to overall cumulative impacts.

Conclusion: Implementation of alternative B would result in short-term, local, negligible adverse, and long-term, local, negligible beneficial impacts to water resources. Cumulative impacts would be long-term, localized, and minor, with the proposed actions contributing only slightly to these impacts. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Big Thicket National Preserve (2) key to the natural or cultural integrity of the Preserve; or (3) identified as a goal in the Preserve's *General Management Plan (1980)* or other relevant National Park Service planning documents, there would be no impairment of the Preserve's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Impacts of Alternative C

Overland Routes

This method would involve a ground crew that would access eligible LWD and foreign debris collections within the project area on foot for a one-time effort to break up the structural integrity of the LWD during a period of low water and remove as much foreign debris as possible. The ground crew would utilize chain saws, saws, and other appropriate hand-held equipment to cut up eligible downed trees and woody debris and leave the remnants in the active channel of the bayou. The only potential impacts of this method on water quality would be from the potential for a fuel leak adjacent to or within the bayou channel. Mitigation measures (e.g., spill prevention and containment procedures, including regularly checking equipment for fuel leaks) would be

implemented to help offset the potential for water quality impacts from the use of handheld equipment. In addition, one-time removal would make the potential for these impacts temporary, and the volumes of fuel or other petroleum products (e.g., oil) that could be released would be relatively small, especially from handheld equipment. Also, any trampling by the ground crew of vegetation or soils would be minimal and would not affect the ability of these areas to filter pollutants or stabilize soils and reduce erosion/sedimentation, and therefore would not affect water quality.

Removal activities are not expected to alter the rate at which surface water flows across these areas because any compaction of soils or loss of vegetation from trampling by ground crews would be minimal, and would be expected to recover rapidly given the climate of the area. Therefore, this method would have short-term, local, negligible adverse impacts on water resources from the minimal potential for temporary impacts on water quality.

Boat

This method would involve a ground crew that would access eligible LWD and foreign debris collections within the project area during a period of high water for a one-time effort to break up the structural integrity of the LWD and remove as much foreign debris as possible. The impacts of using a boat to conduct break up activities would be similar to those described for the use of the boat/barge under alternative B. These would include the temporary potential for relatively small fuel leaks from the boat or handheld equipment to affect water quality. Mitigation measures (e.g., spill prevention and containment procedures, including regularly checking equipment for fuel leaks) would be implemented to help offset the potential for water quality impacts from this method. As a result, there would be short-term, local, negligible adverse impacts on water resources. Use of a boat would not affect streamflows as it would not require the removal of any in-channel vegetation.

Impact Analysis of the Effects of Eliminating the Integrity of Type II and III Debris and Removing Foreign Debris

Under alternative C, all LWD that meet the definition of Type II or Type III would be broken up to eliminate the "structure" that contributes to the potential accumulation of additional debris that could result in atypical out-of-bank flooding. The remnants of debris would be left in the active channel, but as described under *Floodplains*, breaking up the structural integrity and leaving the remnants of the approximately four Type II and Type III LWD collections in the active channel, as well as removing foreign debris, is not expected to have a noticeable effect on the potential for out-of-bank flows or atypical flooding beyond what currently exists. Even if the remnants of the LWD collections are transported downstream and redistributed within the active channel, only negligible effects are expected on future flood elevations.

As a result, there would be minimal changes in the potential for flood events that cause the inundation of adjacent floodplain communities and that transport pollutants from developed areas into the receiving waters of the bayou. Because foreign debris would be removed, some polluting materials in the project area would also be removed, which would help improve water quality, albeit slightly. Breaking up the structural integrity of these debris collections would also help alleviate the potential for blockages to form in the area in the future. However, based on the conclusions from U.S. Army Corps of Engineers feasibility study discussed under alternative A in *Floodplains*, it can also be concluded that the remnants of the Type II and Type III debris collections that would be left in the project area would not have an appreciable effect on streamflows, even if it is transported downstream and redistributed in the channel. This is especially true in light of the backwater effects created by the confluence of Little Pine Island and Pine Island Bayous. Therefore,

this alternative would have long-term, local, negligible, beneficial impacts on water resources from removing a potential source of water quality impacts (foreign debris) and alleviating the potential for future blockages to occur in the vicinity of these debris collections.

Cumulative Impacts: Cumulative impacts would be essentially the same as described for alternative A. Actions in and outside the park, including the Hardin County Hurricane Rita Debris Removal Project, oil and gas development and associated field production facilities, logging, and past and continued residential development in the floodplain adjacent to the Preserve would continue to affect water resources and result in long-term minor adverse impacts. The impacts of these actions, when combined with the short-term, negligible, adverse and long-term, negligible beneficial impacts of the actions under alternative C, would result in long-term, localized, minor adverse impacts on water resources in the area of analysis. Any benefits derived from the proposed actions would contribute only a very small increment to overall cumulative impacts.

Conclusion: Implementation of alternative C would result in short-term, local, negligible adverse, and long-term, local, negligible beneficial impacts to water resources. Cumulative impacts would be long-term, localized, minor, and adverse, with the proposed actions contributing only slightly to these impacts. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Big Thicket National Preserve (2) key to the natural or cultural integrity of the Preserve; or (3) identified as a goal in the Preserve's *General Management Plan (1980)* or other relevant National Park Service planning documents, there would be no impairment of the Preserve's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Soils

The methodology for assessing impacts on soils is based on professional judgment and was developed through consultation with NPS staff and other experts.

Intensity Level Definitions

Negligible: Alteration to soils would be so slight that it would not affect the soils ability to sustain biota, water quality, and hydrology, such that reclamation would not be necessary.

Minor: Alteration to soils would affect its ability to sustain biota, water quality, and hydrology, such that reclamation would be achievable within 2 years. Mitigation measures, if needed to offset adverse impacts, would be simple and successful.

Moderate: Alteration to soils would affect its ability to sustain biota, water quality, and hydrology, such that reclamation would be achievable within 3-5 years. Mitigation measures, if needed to offset adverse impacts, could be extensive but would likely be successful.

Major: Alteration to soils would have a lasting impact on the geology/soil's ability to sustain biota, water quality, and hydrology, such that reclamation could not successfully be achieved. Extensive mitigation measures would be needed to offset any adverse impacts and their success could not be guaranteed.

Impacts of Alternative A – No Action

Under the alternative A, the NPS would not remove any LWD or foreign debris from the project area. Because project area soils were formed in a floodplain, they have adapted to the occasional

to frequent flooding of the Bayou. As described under *Floodplains*, leaving the Type II and Type III woody debris collections, as well as foreign debris, in the channel is not expected to change the current potential for out-of-bank flows or atypical flooding beyond what currently exists. Changes in backwater effects would also be minimal. Should the Type II or III debris collections accumulate additional debris in the future, they could create complete channel obstructions, which would result in greater impacts on flood elevations. Soils could also accumulate around these obstructions over time, especially near the banks of the Bayou. In general, flooding that occurs within the project area is beneficial to the soils through soil deposition and nutrient cycling. Some erosion could also occur, particularly to soils upstream of the project area, if obstructions are fully realized over the long term. Alternative A overall would have long-term, negligible beneficial impacts on soils.

Cumulative Impacts: Other past, present, and reasonably foreseeable actions within the vicinity of the project area have affected or could affect area soils. Any resource management project that occurs within or near the Preserve has the potential to impact soils within the project area. The removal of the X-bridge over the Little Pine Island Bayou in 2002 had a negligible impact on the soils of the project area. The NPS conducted an exotic plant management plan in 2004, which involved the treatment of 50 acres along the south bank of Pine Island Bayou for Chinese tallow removal, which resulted in minimal disturbance of soils from accessing the area with equipment. Further treatment of exotic plants in the area is scheduled for the summer of 2008. Hardin County is currently conducting a debris removal project in the communities and waterways surrounding the project areas, involving the removal of all storm debris along a 12.4 mile length of Boggy Creek and Paula Branch and extending out to a width of 20 feet from the banks on either side of Boggy Creek and Paula Branch. The removal of storm debris collections by Hardin County on the banks of area streams would result in soil compaction and increase erosion of exposed soils.

In Hardin County, a subdivision has been proposed in the 100-yr floodplain, which would require retention ponds and levees in the subdivision. The levees have the potential to affect the soils in the project area by changing the natural course of water and possibly encouraging erosion. This development and others have resulted in the direct loss of soils under the footprint of all the permanently developed sites, roads, and associated facilities. Similarly, oil and gas activity within the cumulative effects analysis area has disturbed or removed soils during the development of wellpads, flowlines, and access roads; and soils have likely become contaminated with hydrocarbons, saltwater or other chemicals due to oil and gas activity. These effects are expected to continue because of existing production activities, and any future developments inside or outside of the LPI Corridor Unit.

Large areas within the managed timberland of Hardin County have been converted to pine plantation, changing the dominant cover type from trees to grass or herbaceous species during part of the cutting and regrowth cycle. Grazing occurs in the prairies to the west of Pinewood Estates. All of these practices could lead to higher rates of runoff and erosion in the project area and create negligible to minor impacts on soils.

The effects of the past, present, and future actions described above, when combined with the impacts of actions under alternative A, would result in long-term, localized, minor to moderate adverse impacts on soils in the area of analysis. The proposed actions would contribute only slightly to these impacts.

Conclusion: Alternative A would result in primarily negligible impacts to soils because LWD and foreign debris removal would not occur and the environment of the project area would not be

disturbed. Cumulative impacts would be long-term, localized, minor to moderate and adverse, with the proposed actions contributing only slightly to these impacts. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Big Thicket National Preserve (2) key to the natural or cultural integrity of the Preserve; or (3) identified as a goal in the Preserve's *General Management Plan (1980)* or other relevant National Park Service planning documents, there would be no impairment of the Preserve's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Impacts of Alternative B (Preferred Alternative)

Helicopter

Under this method, helicopters and ground crews would locate and remove Type II and III debris from approximately four locations and transport it to a predetermined disposal site.

Ground crews would break apart the debris and assist the helicopter crews with removal. The ground crews would leave the root systems of downed trees intact which would mitigate the potential for erosion. While accessing the debris locations the ground crews could cause some trampling, loss of understory vegetation and other disturbance in the project area; however ground crews would be limited in numbers to reduce trampling and other disturbances. The use of machinery such as chain saws, saws, or other equipment could negatively affect the soil in the project area if the machinery leaks petrochemicals into the surrounding soil. To mitigate this potential problem the contractor would regularly monitor and check debris removal equipment and identify and repair any leaks. The impacts of this method would be short term, local, negligible, and adverse.

Boat/ Barge

Under the boat and barge method, boats and crews would locate and remove Type II and III debris from approximately four locations and transport it to a predetermined disposal site. Access points for this machinery would be in areas of previously disturbed sites, such as boat ramps and county roads. A boat and barge would access the debris site with crews to gather woody debris and boats would be used to haul the debris out of the project area to the designated disposal site.

Crews would break apart and collect the debris and load it onto the barges for removal. If it is required for crews to get out of the boats onto the banks of the Bayou in order to break apart LWD, then crews could cause some trampling, soil compaction, and loss of understory vegetation and other disturbance in the project area. The use of machinery such as chain saws, saws, or other equipment could negatively affect the soils in the project area if the machinery leaks petrochemicals into the surrounding soil. To mitigate this potential problem the contractor would regularly monitor and check debris removal equipment and identify and repair any leaks. The impacts of this method would be short term, local, negligible, and adverse.

Impact Analysis of the Effects of Removal of Type II and III Debris and Foreign Debris

The root system of downed trees would remain in place, which could promote bank stability and decrease the potential for erosion in the project area. Woody debris would be removed from the project area to a designated site outside of the Preserve. This site would be a previously disturbed area and debris would be chipped and spread over the designated site to recycle nutrients back into the soil and minimize erosion in the area. Removal activities would be supervised by an NPS staff member who would identify specific debris for removal. These mitigation measures would decrease the amount of disturbance on the soils of the area.

Because project area soils were formed in a floodplain, they have adapted to the occasional to frequent flooding of the Bayou. As described under *Floodplains*, removing the approximately four Type II and Type III LWD collections, as well as foreign debris, would have minimal effects on out-of-bank flows and would reduce future flood elevations by less than 1-foot, and may possibly be undetectable. Therefore, the impacts of alternative B on soils in the project area would be long-term negligible as soils would continue to adapt to the flood regime after the debris removal is complete.

Cumulative Impacts: Cumulative impacts would be essentially the same as described for alternative A. Actions in and outside the park, including the Hardin County Hurricane Rita Debris Removal Project, resource management projects, oil and gas development and associated field production facilities, logging, grazing, and past and continued residential development in the floodplain adjacent to the Preserve would continue to affect soils and result in long-term minor to moderate adverse impacts. The impacts of these actions, when combined with the short-term negligible adverse impacts of the actions under alternative B, would result in long-term, localized, minor to moderate adverse impacts on soils in the area of analysis. The proposed actions would contribute only slightly to these impacts.

Conclusion: Alternative B would have a short-term, local, negligible adverse impact on soils in the project area a result of potential disturbance from ground and boat crews and their associated activities during debris removal. Alternative B in the long-term would have negligible impacts on soils due to the minimal effects of debris removal on out-of-bank flows that would reduce future flood elevations by less than 1-foot, and may possibly be undetectable. Soils would continue to adapt to the flood regime after the debris removal is complete. Cumulative impacts would be long-term, localized, minor to moderate, and adverse, with the proposed actions contributing only slightly to these impacts. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Big Thicket National Preserve (2) key to the natural or cultural integrity of the Preserve; or (3) identified as a goal in the Preserve's *General Management Plan (1980)* or other relevant National Park Service planning documents, there would be no impairment of the Preserve's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Impacts of Alternative C

Overland Routes

This method would involve a ground crew that would access eligible LWD and foreign debris collections within the project area on foot for a one-time effort to break up the structural integrity of the LWD during a period of low water and remove as much foreign debris as possible. Ground crews would break apart woody debris using hand-held machinery. While accessing the debris locations the ground crews could cause some trampling, loss of understory vegetation and other disturbance in the project area; however ground crews would be limited in numbers to reduce trampling and other disturbances. The use of machinery such as chain saws, saws, or other equipment could negatively affect the soil in the project area if the machinery leaks petrochemicals into the surrounding soil. To mitigate this potential problem the contractor would regularly monitor and check debris removal equipment and identify and repair any leaks. The impact of the use of overland routes and ground crews on soils in the project area would be short term, local, negligible and adverse.

Boats

This method would involve a ground crew that would access eligible LWD and foreign debris collections within the project area during a period of high water for a one-time effort to break up the structural integrity of the LWD and remove as much foreign debris as possible. Crews would break apart debris and leave it in place in the Bayou. If it is required for crews to get out of the boats onto the banks of the Bayou in order to break apart LWD, then crews could cause some trampling, soil compaction, and loss of understory vegetation and other disturbance in the project area. The use of machinery such as chain saws, saws, or other equipment could negatively affect the soils in the project area if the machinery leaks petrochemicals into the surrounding soil. To mitigate this potential problem the contractor would regularly monitor and check debris removal equipment and identify and repair any leaks. The impacts of this method would be short term, local, negligible, and adverse.

Impact Analysis of the Effects of Eliminating the Integrity of Type II and III Debris and Removing Foreign Debris

The root system of downed trees would likely remain in place, which could promote bank stability and decrease the potential for erosion in the project area.

Because project area soils were formed in a floodplain, they have adapted to the occasional to frequent flooding of the Bayou. As described under *Floodplains*, breaking up the structural integrity and leaving the remnants of the approximately four Type II and Type III LWD collections in the active channel, as well as removing foreign debris, is not expected to have a noticeable effect on the potential for out-of-bank flows or atypical flooding beyond what currently exists. Even if the remnants of the LWD collections are transported downstream and redistributed within the active channel, only negligible effects are expected on future flood elevations. Therefore, the impacts of alternative C on soils in the project area would be long-term negligible as soils would continue to adapt to the flood regime after the debris removal is complete.

Cumulative Impacts: Cumulative impacts would be essentially the same as described for alternative A. Actions in and outside the park, including the Hardin County Hurricane Rita Debris Removal Project, resource management projects, oil and gas development and associated field production facilities, logging, grazing, and past and continued residential development in the floodplain adjacent to the Preserve would continue to affect soils and result in long-term minor to moderate adverse impacts. The impacts of these actions, when combined with the short-term negligible to minor adverse impacts of the actions under alternative C, would result in long-term, localized, minor to moderate adverse impacts on soils in the area of analysis. The proposed actions would contribute only slightly to these impacts.

Conclusion: Alternative C would have a short-term, local, negligible adverse impact on soils in the project area a result of potential disturbance from ground and boat crews and their associated activities during the break up of debris. Alternative C in the long-term would have negligible impacts on soils due to no noticeable effect on the potential for out-of-bank flows or atypical flooding beyond what currently exists. Even if the remnants of the LWD collections are transported downstream and redistributed within the active channel, only negligible effects are expected on future flood elevations. Therefore, the impacts of alternative C on soils in the project area would be long-term negligible as soils would continue to adapt to the flood regime after the debris is broken up. Cumulative impacts would be long-term, localized, and minor to moderate, with the proposed actions contributing only slightly to these impacts. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Big Thicket National Preserve (2) key to the natural or

cultural integrity of the Preserve; or (3) identified as a goal in the Preserve's *General Management Plan (1980)* or other relevant National Park Service planning documents, there would be no impairment of the Preserve's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Vegetation

Intensity Level Definitions

The methodology used for assessing impacts to vegetation communities included identification of the communities in the project area and the potential effects from debris removal activities on the structure, composition, or distribution of plant communities. In addition, the analysis considers the impacts that could occur after debris is removed. The thresholds for this impact assessment are as follows:

Negligible: Operations would not cause discernible alteration to vegetation composition, abundance, and diversity.

Minor: Operations would cause limited alteration to vegetation composition, abundance, and diversity. Mitigation measures, if needed to offset adverse effects, would be simple and successful. Reclamation is readily achievable through natural successional processes.

Moderate: Operations would cause alteration to vegetation composition, abundance, and diversity. Mitigation measures, if needed to offset adverse effects, could be extensive, but would likely be successful. Reclamation is achievable but likely requires additional resources to accomplish goals.

Major: Operations would cause substantial alteration to vegetation composition, abundance, and diversity. Extensive mitigation measures would be needed to offset any adverse effects, and their success would not be guaranteed. Reclamation may not be attainable even with substantial efforts.

Impacts of Alternative A – No Action

Under alternative A, the NPS would not take any actions to remove Type II or III LWD and foreign debris from the bayou channel of the project area. As a result, there would be no short-term impacts on vegetation associated with alternative A.

As described under *Floodplains*, leaving the Type II and Type III LWD collections, as well as foreign debris, in the channel is not expected to change the current potential for out-of-bank flows or atypical flooding beyond what currently exists. As a result, continued flooding could cause the loss of some vegetation due to extended inundation. However, the vegetation in the project area consists of floodplain plant communities. Therefore, the flooding associated with backwater effects is a natural influence on the vegetation, and would not alter the natural structure, diversity, or distribution of the plant communities in the small stretch of the project area upstream of this Type III debris collection. In fact, this flooding would help recharge the plant communities in the project area with fresh supplies of water, nutrients, and sediments. The loss of some more mature trees and the shade they provide could actually promote the growth of new seedlings or saplings. This periodic flooding helps regulate and maintain these communities, including promoting species diversity (National Academy of Sciences 1999). Because these processes would not be altered under this alternative, there would be no change in the influences on the structure, distribution, and

diversity of these plant communities, and continued flooding under alternative A would have long-term, local, negligible beneficial effects on vegetation. As described under *Floodplains*, should the Type II or III debris collections accumulate additional debris in the future, they could create complete channel obstructions, which would result in greater impacts on flood elevations. However, this is a natural process that would continue to shape the plant communities in the project area. Allowing foreign debris to remain in the bayou is not expected to have any effects on structure, distribution, or diversity of vegetation in the project area.

Cumulative Impacts: Other past, present, and reasonably foreseeable actions within the vicinity of the project area have affected or could affect area vegetation. Logging in the vicinity of Preserve has substantially changed the nature of the vegetation in the cumulative impacts analysis area, creating a predominantly managed timberland coverage type of different age classes harvested mostly by clearcut type operations in large contiguous blocks. Large areas within the managed timberland have also been converted to pine plantation, replacing native vegetation communities. Grazing west of Pinewood Estates has also shaped vegetation in remnants of presettlement prairies found in this part of the cumulative impacts analysis area. Although grazing helps maintain these prairies, it also increases the potential for the establishment of nonnative species, either intentionally for pasture grasses or unintentionally from overgrazing.

Any construction or maintenance activities that require excavation or ground disturbance have the potential to affect vegetation. For example, past residential development, as well as construction of a golf course, may have caused temporary impacts on vegetation from trampling, soil compaction, and the potential for the introduction and spread of nonnative plants during construction. In addition, these projects have resulted in the long-term loss of vegetation in this area. Oil and gas developments in the cumulative impacts analysis area occur outside the Preserve, and have similar effects on vegetation, although at a smaller scale. A 2,600-acre private development planned adjacent to the Preserve would also contribute to short- and long-term impacts on vegetation, including the loss of vegetation.

Routine county maintenance activities also result in the local trampling of vegetation and soil compaction. Removal of the X Bridge and weed control efforts may have contributed to such impacts as well. The proposed Hardin County debris removal efforts would have similar short- and long-term impacts as described for construction, including the loss of vegetation.

Activities that have affected, or have the potential to affect, flooding in the area also have the potential to affect vegetation. In the past, actions such as removal of the X Bridge may have alleviated some upstream backwater effects, which may reduce some loss of vegetation upstream. The debris removal proposed by Hardin County, as well as the proposal to raise the Woodway Boulevard bridge, could have similar effects upstream. However, these projects, especially the Hardin County debris removal, also have the potential to increase the velocity of the water moving down the bayou during flood events and increase erosion of soils that support bank vegetation. Coupled with the potential for an increase in downstream flooding, there could be a loss of some downstream vegetation. Because flooding is a natural influence on the vegetation in this area, it would not alter the natural structure, diversity, or distribution of the plant communities.

The effects of the past, present, and future actions described above, when combined with the long-term negligible beneficial impacts of actions under alternative A, would result in long-term, localized, moderate adverse impacts on vegetation in the area of analysis. The benefits of this alternative would have a limited effect on offsetting these impacts.

Conclusion: Alternative A would result in no short-term impacts to vegetation because debris removal would not be conducted. Long-term, local, negligible beneficial effects on these floodplain plant communities would result from the continued flooding that helps shape the natural structure, diversity, and distribution of the plant communities. Cumulative impacts would be long-term, localized, moderate, and adverse. The benefits of this alternative would have a limited effect on offsetting these impacts. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Big Thicket National Preserve (2) key to the natural or cultural integrity of the Preserve; or (3) identified as a goal in the Preserve's *General Management Plan (1980)* or other relevant National Park Service planning documents, there would be no impairment of the Preserve's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Impacts of Alternative B (Preferred Alternative)

Helicopter

Using this method, a contractor would use a ground crew and helicopter to conduct a one-time removal of Type II and III LWD and foreign debris at approximately four locations (2007b). While accessing debris locations, the ground crew could damage understory vegetation in the Flatland and Floodplain Hardwood Forest communities due to trampling and soil compaction. Ground crews could also introduce nonnative species with the potential to compete with natives. However, these impacts would be temporary and weed control measures (e.g., washing of vehicles before entering the Preserve) would be implemented to help minimize the potential for the introduction and spread of nonnative species. As a result, the presence of the ground crew would not have a noticeable effect on the structure or diversity of these plant communities in the project area, and would not affect their distribution in the project area.

Operation of the helicopter would contribute to vegetation impacts at the removal locations. Effects could include potential damage from rotorwash to canopy trees, as well as the potential for debris being removed to damage other vegetation as it is lifted from ground level through the canopy. However, the rotorwash would actually limit the potential for debris to become snagged by temporarily spreading the canopy beneath the helicopter. It is assumed that any such disturbances would recover fairly quickly given the rapid recovery of vegetation in this area from the warm, moist climate. Therefore, use of a helicopter and the associated ground crew for debris removal at these locations would have short-term, site-specific (in the vicinity of helicopter use), negligible, adverse impacts on vegetation from trampling, rotorwash disturbance, soil compaction, and the minimal potential for the introduction and spread of non-native species.

It is assumed that the helicopter take-off and landing site is located in a previously disturbed area already used for such operations. In addition, the disposal site is assumed to be in a previously disturbed area as it is currently being used by Hardin County for disposal of debris removed from their efforts. As a result, helicopter take-off and landing, as well as disposal of debris, would not affect vegetation.

Boat/Barge

Two of the three access points (the Woodway Boulevard Bridge and X Bridge) would require that the boat and/or barge access the project area from the banks of the bayou. As a result, launching could cause the trampling of some vegetation, as well as soil compaction, at the launch site. However, the use of the boat and barge would be limited to periods of high water, which would reduce the distance that the equipment would have to cross, limiting the potential impacts. Vegetation at the third access point (U.S. Highway 69 Boat Ramp) would not be affected as the

boat and barge would be launched from a ramp. The potential for nonnative species to be introduced or spread during operation of the boat and/or barge would be minimized by the requirement to wash the equipment prior to entering the Preserve.

Maneuvering the boat or barge once in the bayou would likely require removing some standing trees in the channel itself, which could include mature cypress trees that contribute to the structure and diversity of the vegetation in the project area; however, this would not affect the distribution of the plant communities.

Getting LWD and foreign debris removed from the bayou would require transporting it to one of the access points, where it would be unloaded from the boat/barge, loaded onto vehicles, and hauled to the disposal site. Because this method would only be used during periods of high water, it would reduce the distance that the debris would have to be moved to get it out of the bayou, as well as the distance that vehicles would have to cross for loading. As a result, this would minimize the trampling and erosion that is likely to occur at the access points from removing the debris and staging vehicles for hauling. It is assumed that any such disturbances would recover fairly quickly the rapid recovery of vegetation in this area that results from the warm, moist climate. As a result, there would be no effect on the overall structure, diversity, or distribution of the plant communities in the project area from these activities.

Considering these effects, the use of the boat/barge for debris removal at these locations would have short-term and long-term, local, minor, adverse impacts on vegetation from the trampling, the loss of standing trees in the channel, soil compaction, and the minimal potential for the introduction and spread of non-native species.

Hauling the debris to the disposal site would not affect vegetation. As described for alternative A, the disposal site is assumed to be in a previously disturbed area (it is currently being used by Hardin County for the same purposes). As a result, hauling and disposal of debris would not affect vegetation.

Impact Analysis of the Effects of Removal of Type II and III Debris and Foreign Debris

Regardless of the method used under alternative B, as described under *Floodplains*, removing the approximately four Type II and Type III LWD collections, as well as foreign debris, would have minimal effects on out-of-bank flows and would reduce future flood elevations by less than 1-foot, and may possibly be undetectable. The removal of Type II and III debris collections would alleviate some of the potential for complete blockages to form. Because these are floodplain plant communities, the periodic inundation during flooding that would continue to occur is a natural influence on the vegetation, and although some individual plants may be lost, would not alter the natural structure, diversity, or distribution of the plant communities in the project area. As described for alternative A, this flooding would actually serve to help regulate and maintain these communities by promoting water, nutrient, and sediment exchange, as well as promoting species diversity (National Academy of Sciences 1999).

Also, as described in *Water Resources*, because this alternative would not involve the removal of large amounts of vegetation from the riparian areas outside of the channel, there would be very small, possibly undetectable, changes in the velocity of the water moving down the bayou during flood events. As a result, there would be no detectable changes in downstream erosion or flooding with the potential to result in the loss of vegetation. Because the natural processes that shape these plant communities in the project area would not be noticeably altered under this alternative, there would be no change in the influences on the structure, distribution, and diversity of these plant

communities, and continued flooding under alternative B would have long-term, local, negligible beneficial effects on vegetation. Removing foreign debris from the bayou is not expected to have any effects on structure, distribution, or diversity of vegetation in the project area.

Cumulative Impacts: Cumulative impacts would be essentially the same as described for alternative A. Actions in and outside the park, including the Hardin County Hurricane Rita Debris Removal Project, oil and gas development and associated field production facilities, logging, and past and continued residential development in the floodplain adjacent to the Preserve would continue to affect vegetation and result in long-term moderate adverse impacts. The impacts of these actions, when combined with the short-term, local, negligible to minor adverse impacts, and long-term, local negligible beneficial impacts of the actions under alternative B, would result in long-term, localized, moderate adverse impacts on vegetation in the area of analysis. The short-term effects of the proposed actions would contribute only slightly to these impacts, and any benefits would not offset the long-term effects.

Conclusion: Alternative B would have short-term, local, negligible to minor, adverse impacts on vegetation from the disturbances associated with use of a helicopter and/or a boat and barge for debris removal, including the removal of standing trees in the channel during use of the boat/barge. Because the natural processes that shape these plant communities in the project area would not be noticeably altered under this alternative, there would be no change in the influences on the structure, distribution, and diversity of these plant communities, and continued flooding under alternative B would have long-term, local, negligible beneficial effects on vegetation. Cumulative impacts would be long-term, localized, moderate, and adverse, with the proposed actions contributing only slightly to these impacts. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Big Thicket National Preserve (2) key to the natural or cultural integrity of the Preserve; or (3) identified as a goal in the Preserve's *General Management Plan* (1980) or other relevant National Park Service planning documents, there would be no impairment of the Preserve's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Impacts of Alternative C

Overland Routes

This method would involve a ground crew that would access eligible LWD and foreign debris collections within the project area on foot for a one-time effort to break up the structural integrity of the LWD during a period of low water and remove as much foreign debris as possible.

Ground crews accessing debris locations to break up eligible Type II and III debris could cause some loss of understory vegetation in the Flatland and Floodplain Hardwood Forest communities due to trampling. Ground crews could also cause soil compaction, as well as introduce or spread nonnative species with the potential to compete with natives. However, weed control measures (e.g., washing of vehicles before entering the Preserve) would be implemented to help minimize the potential for the introduction and spread of nonnative species. The effects from the ground crew would not noticeably affect the structure or diversity of these plant communities in the project area, and would not alter their distribution in the project area. As a result, this method would have short-term, local, negligible adverse impacts on vegetation from trampling, soil compaction, and the minimal potential for the introduction and spread of nonnative species. Because the remnants of the debris would be left in the bayou active channel, there would be no disposal impacts.

Boat

This method would involve a ground crew that would access eligible LWD and foreign debris collections within the project area during a period of high water for a one-time effort to break up the structural integrity of the LWD and remove as much foreign debris as possible. Impacts from the use of a boat would be similar to those described for the boat/barge method under alternative B. Two of the three access points (the Woodway Boulevard Bridge and X Bridge) would require that the boat access the project area from the banks of the bayou, but because the boat would only be used during periods of high water, the potential for impacts associated with launching (e.g., trampling of vegetation) would be reduced as described for boat/barge. Vegetation at the third access point (U.S. Highway 69 Boat Ramp) would not be affected as the boat would be launched from a ramp. The potential for nonnative species to be introduced or spread during operation of the boat would be minimized by the requirement to wash the equipment prior to entering the Preserve. Maneuvering a boat within the bayou is not expected to require removal of vegetation. Because the remnants of the debris would be left in the bayou active channel, there would be no disposal impacts.

Considering these effects, the use of a boat for debris removal at these locations would have short-term, site-specific (primarily at the access points), negligible, adverse impacts on vegetation from the trampling, the temporary loss of vegetation, soil compaction, and the minimal potential for the introduction and spread of non-native species. Because the remnants of the debris would be left in the Bayou active channel, there would be no disposal impacts.

Impact Analysis of the Effects of Eliminating the Integrity of Type II and III Debris and Removing Foreign Debris

Under alternative C, all woody debris and downed trees that meet the definition of Type II or Type III would be broken up to eliminate the “structure” that contributes to the potential accumulation of additional debris that could result in atypical out-of-bank flooding. The remnants of debris would be left in the active channel, but as described under *Floodplains*, breaking up the structural integrity and leaving the remnants of the approximately four Type II and Type III LWD collections in the active channel, as well as removing foreign debris, is not expected to have a noticeable effect on the potential for out-of-bank flows or atypical flooding beyond what currently exists. Even if the remnants of the LWD collections are transported downstream and redistributed within the active channel, only negligible effects are expected on future flood elevations.

As a result, the periodic inundation during flooding that would continue to occur is a natural influence on the vegetation, and would not alter the natural structure, diversity, or distribution of the plant communities in the project area. As described for alternatives A and B, this flooding would actually serve to help regulate and maintain these communities by promoting water, nutrient, and sediment exchange, as well as promoting species diversity (National Academy of Sciences 1999).

Also, as described for alternative B, this alternative would result in small, possibly undetectable, changes in the velocity of the water moving down the bayou during flood events. As a result, there would be no detectable changes in downstream erosion or flooding with the potential to result in the loss of vegetation. Because the natural processes that shape these plant communities in the project area would not be noticeably altered under this alternative, there would be no change in the influences on the structure, distribution, and diversity of these plant communities, and continued flooding under alternative C would have long-term, local, negligible beneficial effects on vegetation. Removing foreign debris from the bayou is not expected to have any effects on structure, distribution, or diversity of vegetation in the project area.

Cumulative Impacts: Cumulative impacts would be essentially the same as described for alternative A. Actions in and outside the park, including the Hardin County Hurricane Rita Debris Removal Project, oil and gas development and associated field production facilities, logging, and past and continued residential development in the floodplain adjacent to the Preserve would continue to affect vegetation and result in long-term moderate adverse impacts. The impacts of these actions, when combined with the short-term, local, negligible adverse impacts, and long-term, local negligible beneficial impacts of the actions under alternative C, would result in long-term, localized, moderate adverse impacts on vegetation in the area of analysis. The short-term effects of the proposed actions would contribute only slightly to these impacts, and any benefits would not offset the long-term effects.

Conclusion: Alternative C would have short-term, site-specific and local, negligible, adverse impacts as a result of disturbances associated with use of overland access on foot and/or a boat. Because the natural processes that shape these plant communities in the project area would not be noticeably altered under this alternative, there would be no change in the influences on the structure, distribution, and diversity of these plant communities, and continued flooding under alternative B would have long-term, local, negligible beneficial effects on vegetation. Cumulative impacts would be long-term, localized, moderate, and adverse, with the proposed actions contributing only slightly to these impacts. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Big Thicket National Preserve (2) key to the natural or cultural integrity of the Preserve; or (3) identified as a goal in the Preserve's *General Management Plan (1980)* or other relevant National Park Service planning documents, there would be no impairment of the Preserve's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Fish and Wildlife

The methodology for assessing impacts on fish and wildlife is based on professional judgment and was developed through consultation with NPS staff and other experts, and review of relevant literature.

The thresholds of change for the intensity of an impact are defined as follows.

Intensity Level Definitions

Negligible: Impacts would result in a change to a population or individuals of a species or a resource, but the change would be well within the range of natural fluctuations.

Minor: Impacts that would affect a few individuals of a wildlife species or have very localized impacts upon their habitat. The change would have barely perceptible consequences to the species or habitat function. Sufficient habitat would remain functional to maintain viability of all species. Impacts would be outside of critical reproduction periods for sensitive species. Mitigation measures, if needed to offset adverse effects, would be simple and successful.

Moderate: Impacts that would cause measurable effects on: (1) a relatively small percentage of the population of a wildlife species, (2) the existing dynamics between multiple species (e.g., predator-prey, herbivore-forage, vegetation structure-wildlife breeding habitat), or (3) a relatively large habitat area or important habitat attributes. A wildlife population or habitat might deviate from normal levels under existing conditions, but would remain indefinitely viable within the Preserve. Response to disturbance by some

individuals could be expected, with some negative impacts to feeding, reproduction, or other factors impacting short-term population levels. Sufficient habitat would remain functional to maintain variability of all native wildlife species. Some impacts might occur during critical periods of reproduction or in key habitat for sensitive native species. Mitigation measures, if needed to offset adverse effects, could be extensive, but would likely be successful.

Major: Impacts that would have drastic and permanent consequences for a wildlife species population, dynamics between multiple species, or almost all available unique habitat. A wildlife population or its habitat would be permanently altered from normal levels under existing conditions, and the species would be at risk of extirpation from the Preserve. Frequent responses to disturbance by some individuals would be expected, with negative impacts to feeding, reproduction, or other factors resulting in a decrease in population levels. Extensive mitigation measures would be needed to offset any adverse effects and their success would not be guaranteed.

Impacts of Alternative A – No Action

Large river-floodplain ecosystems provide valuable ecological functions such as maintenance of biodiversity; retention, recycling, and conversion of potentially polluting nutrients into useful biomass; production of fish, wildlife, and forests; and the provision of corridors for migratory fish and wildlife. Annual river flooding helps regulate and maintain these ecosystems by promoting exchanges of water, sediment, nutrients, and organisms between rivers and their floodplains, while larger infrequent flooding events help maintain habitat and species diversity. Fish and wildlife living within floodplains have also adapted over time to exploit, tolerate, and escape naturally occurring, seasonal, flooding events as well as larger, more infrequent floods (National Research Council 1999).

As part of the river-floodplain ecosystem large woody debris is a vital component of streams and rivers and is necessary to maintain an ecologically healthy and stable ecosystem. LWD creates a variety of in-stream flow conditions and provides for a variety of fish and wildlife habitat and biodiversity. LWD can alter stream flows in such ways as to allow pools and riffles to develop in areas where they would not normally develop, providing fish with refuges from high velocity flows and spawning habitat (ODNR 2002, Bragg and Keshner 1999). LWD also provides fish with feeding sites, nursery areas for larvae and juvenile fish, and cover from predation. During periods of low flow water is oxygenated as it flows over LWD, increasing the availability of oxygen for fish and other aquatic species. For invertebrates, LWD provides stable attachment sites for feeding, crevices for concealment and protection from predators, a direct food source, and a stable habitat both above and below the water line for egg deposition (Waters and River Commission 2000; Wallace et. al 1996). For birds, mammals, and reptiles, exposed LWD provides resting, foraging, and lookout sites (DPIW, 2003).

Under the alternative A the NPS would take no action to remove the approximately four areas of Type II and Type III LWD and foreign debris collections associated with Hurricane Rita. The debris would remain in place and continue to provide a variety of habitats for fish and wildlife and contribute to the biodiversity of the Little Pine Island Bayou ecosystem. As described under *Floodplains*, leaving the approximately four Type II and Type III LWD collections in the channel is not expected to change the current potential for out-of-bank flows or atypical flooding beyond what currently exists. Therefore, there would be no effect on fish and wildlife resulting from future flooding events, for floodplain species have adapted to these naturally occurring events. Also described under *Floodplains*, should the Type II or III debris collections accumulate additional debris

in the future, they could create complete channel obstructions, which would result in greater impacts on flood elevations. Regardless of the potential degree of impact on flood elevations under these circumstances, fish and wildlife species living within the river and floodplain are adapted to exploiting, tolerating or escaping these larger, infrequent, natural flood events and would not be impacted by them.

Under this alternative, no additional effort would be made to remove foreign debris within the water corridor. This would cause some long-term adverse impacts to the ecosystem; however, the intensity of the impact (that is negligible, minor, moderate, major) can not be analyzed at this time without knowing the types and general amount of foreign debris that potentially would have been encountered and removed had an action to remove the LWD been undertaken. Overall, leaving in place the few LWD collections that are being proposed for removal would result in long-term, negligible beneficial impacts on fish and wildlife within the Little Pine Island Bayou.

Cumulative Impacts: Other past, present, and future planned actions within the Preserve and the local region have affected or have the potential to impact fish and wildlife. Removal of the X-Bridge across the Little Pine Island Bayou, while probably causing short-term adverse impacts to wildlife from noise and to macroinvertebrates and fish habitat through increased sedimentation and soil disturbance temporarily decreasing water quality in the local area, provides little long-term benefits or impacts to fish and wildlife. Continued development of lands surrounding the Preserve including the proposal to develop a total of 2,600 acres north of Bevil Oaks could stress fish and wildlife species that reduce the resiliency of the local populations, resulting in long-term incremental loss of fish and wildlife, and habitat decline through changes in water quality and quantity, particularly to bottomland hardwood forests. Past and present oil and gas operations in and adjacent to the project area also have adversely impacted fish and wildlife to varying degrees. Impacts have included direct loss of terrestrial habitat at oil and gas sites and indirect adverse effects from construction. Past, present and future logging operations also impact fish and wildlife in the region. A major source of non-point pollution and erosion in the region is the harvest of local timber (Harcombe et al 1996). Clear cut operations also remove large areas of wildlife habitat and fragment populations. Livestock grazing in areas outside of the Preserve could increase soil erosion due to greater vegetative ground cover loss, soil compaction, and destabilization of river/stream banks impacting the water quality and aquatic habitat of nearby streams and waterways. These impacts would be short and long-term, negligible to minor, adverse.

NPS has removed exotic plants in Pine Island Bayou in the past and has plans to treat 17.5 acres of Chinese privet and Chinese tallow at Voth Mill in the summer of 2008. The removal of exotic vegetation provides long-term benefits to wildlife, as it helps to restore native vegetation that is the preferred habitat and food source of local wildlife.

Hardin County's proposal to remove all storm debris from water ways totaling approximately 12.4 miles could have long-term adverse impacts on both fish and wildlife within the waterways affected and could have long-term impacts on the dispersal of species throughout the waterways of the region since they are tributaries to the Pine Island Bayou. The importance of in-stream LWD is illustrated by a study conducted for the Satilla River in Georgia (Harcombe and Callaway 1997). It was estimated that removal of all the LWD in the Satilla River would eliminate approximately 40 percent of the insect population and would likely result in a significant reduction in the fish population since many fish depend almost entirely on a food base of drifting invertebrates. Studies also showed that LWD support greater biomass and diversity of macroinvertebrates than sandy or muddy stream bottoms (Harcombe and Callaway 1997).

Assessment of fish and wildlife species diversity by Harcombe et al. (1996) suggest regional declines in fish and some stream invertebrate groups, partially attributed to regional modification of waterways. Modification of waterways may change the overall amount and timing of stream flows, directly impacting stream channel morphology (structure or form), rate of meandering or migration, sedimentation, water quality, and the amount and type of aquatic habitat. These changes may indirectly impact the growth, availability, and regeneration of bottomland hardwood forests. A majority of mammals, birds, reptiles, amphibians, fish, and invertebrates depend on bottomland hardwood forests for all or part of their life cycle.

The effects of the past, present, and future actions described above, when combined with the long-term minor beneficial impacts of actions under alternative A, would continue to result in long-term, localized, moderate adverse impacts on fish and wildlife in the area of analysis, since any effects of the proposed actions would contribute only a small increment to overall cumulative impacts.

Conclusion: Leaving the approximately four Type II and Type III LWD collections in place under alternative A would allow their continued use by fish and wildlife as sources of food, refuge and habitat, resulting in long-term, negligible beneficial impacts. Cumulative impacts would be long-term, localized, moderate, and adverse, with the proposed actions contributing only small benefits to overall cumulative impacts. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Big Thicket National Preserve (2) key to the natural or cultural integrity of the Preserve; or (3) identified as a goal in the Preserve's *General Management Plan (1980)* or other relevant National Park Service planning documents, there would be no impairment of the Preserve's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Impacts of Alternative B (Preferred Alternative)

Helicopter

Using this method to remove the approximately four Type II and Type III LWD collections, wildlife could be disturbed along the routes that ground personnel take to access the debris locations and at the debris sites themselves. Disturbance from noise (from personnel and chain saws or other hand equipment used to cut off the root balls on trees) and the presence of contractor personnel would likely result in the temporary dislocation of wildlife along the routes and at the sites, but would be highly localized and temporary in nature, with wildlife resuming normal activities once the personnel have left the areas. Use of small boats to access the sites could result in some hydraulic fluid or gasoline leaking into the waters of the Little Pine Island Bayou from the normal operation of the boat motors. Any leaks would be quickly dispersed by the movement of the boats and from the natural flow of the river water, and would have negligible effects on the local water quality and aquatic habitat. If the LWD sites are accessed by boat during lower water levels, some bottom sediments might be disturbed by prop wash from the boats causing slight increases in turbidity levels. However, these effects would be highly localized and temporary in nature and would likely have little effect on the aquatic habitat and wildlife.

Operation of the helicopter would contribute to impacts on wildlife at the debris removal locations and along the flight paths from the removal locations to the debris disposal area located approximately 4 miles away to the north-northeast. Noise and rotorwash from the helicopter would likely disturb wildlife, especially birds and mammals. Wildlife could be startled and temporarily dispersed along the flight path. It is estimated that it would take approximately 5-minutes per round trip to pick up LWD from the river and drop it off at the disposal site, so even

with multiple trips to one LWD location, the dispersing of wildlife would be temporary in nature with wildlife resuming normal activities once the helicopter operations were concluded. The downwash from the helicopter rotors is powerful and if there are nesting birds in the area of operations, the downwash could potentially destroy nests or knock any nest bound chicks out of their nest, likely resulting in their death. The potential for this would only occur in the immediate vicinity of the debris collections to be removed, which constitutes only a small portion of the bayou. It is assumed that the helicopter take-off and landing site is located in a previously disturbed area already used for such operations. In addition, the LWD disposal site is assumed to be in a previously disturbed area as it is currently being used by Hardin County for disposal of debris removed from their efforts. As a result, helicopter take-off and landing, as well as disposal of debris, would not affect fish and wildlife.

Overall, the impacts from helicopter operations, the use of ground crews or small boats, and the removal of the Type II and Type III woody debris would result in long-term, minor adverse impacts on fish and wildlife.

Boat/Barge

In using this method to remove the approximately four Type II and Type III woody debris locations, noise from the boats and chain saws or other hand held equipment and the presence of contractor personnel would likely result in the dislocation of wildlife along the water routes taken to the debris locations and at the debris locations themselves. This impact would be temporary in nature, with wildlife resuming normal activities once the boats and personnel have completed the operation. Temporary dislocation of wildlife from the boat access points would also be expected. The use of boats under this alternative could result in some hydraulic fluid or gasoline leaking into the waters of the Little Pine Island Bayou from the normal operation of the boat motors. Any leaks would be quickly dispersed by the movement of the boats and from the natural flow of the river water, and would have negligible effects on the local water quality and aquatic habitat. Launching and recovery of the boats/barge at the three access points would likely disturb some bottom sediments increasing the turbidity in the water, but this would be highly localized, very short in duration and have negligible impacts on fish and other aquatic organisms. In addition, operations would be conducted during high water, so boat/barge operations would not cause any other increases in turbidity that could affect aquatic organisms.

The impacts of removing the approximately four LWD debris collections from the ecosystem would be the same as discussed under the helicopter method above. In addition, the use of a boat/barge requires a working clearance of 10-feet. Any woody debris encountered that impedes movement down the river to the debris removal locations would be repositioned (that is left within the bayou channel) to allow passage of the boat/barge. While repositioning debris does not remove it from the ecosystem and thus allows it to continue functioning beneficially in the ecosystem, it can still potentially cause adverse impacts. Repositioning of the woody debris may disturb sediment and cause short-term increases in turbidity downstream of the site. Depending on the extent of the repositioning, or if it requires cutting the debris, existing aquatic habitat and food sources may be destroyed. Removal of some standing trees within the bayou channel may also be required to allow passage of the boat/barge. This would destroy some tree dwelling wildlife habitat, but would also create woody debris habitat, either aquatic or terrestrial, depending on where tree was placed after removal.

Overall, using a boat/barge to remove the approximately four Type II and Type III LWD collections would result in long-term, negligible to minor adverse impacts to fish and wildlife. If no or very little woody debris needs to be repositioned and/or only a couple of standing trees need to be

removed to allow passage of the boat/barge, then impacts would be negligible. However, if larger amounts of woody debris needs to be repositioned or numerous standing trees need to be cut down in the bayou channel, then impacts would likely be minor.

Impact Analysis of the Effects of Removal of Type II and III Debris and Foreign Debris

Removing the Type II and Type III LWD collections would disturb and destroy aquatic habitats and remove potential food sources for fish and other wildlife from the ecosystem at those locations where the debris is removed. Short-term disturbance of sediment during removal of the debris as well as long-term erosion and mobilization of sediment after removal may bury benthic invertebrates such as mussels inhabiting the immediate area or just downstream. Given the relatively few debris collections to be removed the results of this action would be long-term, minor adverse. As new sources of woody debris collect in the river from falling branches and trees, the impacts of removing these few debris collections would eventually be naturally mitigated. As described under *Floodplains*, removing the approximately four Type II and Type III LWD collections would have minimal effects on out-of-bank flows and would reduce future flood elevations by less than 1-foot, and may possibly be undetectable. Reducing naturally occurring flood elevations would diminish their ecological role in the river-floodplain ecosystem. However, because present and future flood elevations would not be appreciably altered, any adverse impacts to fish and wildlife would be negligible.

Any removal of foreign debris from within the bayou channel when accessing the debris locations would be beneficial to the ecosystem, removing potential pollutants. However, the intensity of the impact can not be analyzed without knowing the types and general amount of foreign debris existing within the bayou that would be removed.

Cumulative Impacts: Cumulative impacts would be essentially the same as described for alternative A. Actions in and outside the park, including the Hardin County Hurricane Rita Debris Removal Project, oil and gas development and associated field production facilities, logging, and past and continued residential development in the floodplain adjacent to the Preserve would continue to affect fish and wildlife and result in long-term moderate adverse impacts. The impacts of these actions, when combined with the long-term minor adverse impacts of the actions under alternative B, would result in long-term, localized, moderate adverse impacts on fish and wildlife in the area of analysis. The proposed actions would contribute slightly to these impacts.

Conclusion: Removing the approximately four Type II and Type III LWD collections from the bayou under this alternative would disturb fish and wildlife, destroy aquatic habitats, and remove potential food sources for fish and other wildlife from the ecosystem at those locations where the debris is removed. Repositioning of woody debris and/or cutting down standing trees in the active channel to allow the passage of a boat/barge would also disturb and destroy fish and wildlife habitat, while removing foreign debris would be beneficial. Overall, removing the LWD collections under this alternative would result in short and long-term, minor adverse impacts. Cumulative impacts would be long-term, localized, and moderate, and adverse with the proposed actions contributing slightly to these impacts. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Big Thicket National Preserve (2) key to the natural or cultural integrity of the Preserve; or (3) identified as a goal in the Preserve's *General Management Plan (1980)* or other relevant National Park Service planning documents, there would be no impairment of the Preserve's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies 2006*.

Impacts of Alternative C

Overland Routes

This method would involve a ground crew that would access eligible LWD and foreign debris collections within the project area on foot for a one-time effort to break up the structural integrity of the LWD during a period of low water and remove as much foreign debris as possible. Similar to the ground crews used in the helicopter method under alternative B, wildlife could be disturbed along the routes that the personnel take to access the debris locations and at the debris sites themselves. Noise from chain saws or other hand held equipment and the presence of contractor personnel would likely result in the temporary dislocation of wildlife along the access routes and at the sites. Any dislocation would be highly localized and temporary in nature, with wildlife resuming normal activities once the personnel have left the areas and the action is complete.

Cutting up the woody debris and leaving it in the active channel is similar to repositioning woody debris. Therefore, the impacts would be the same as described for repositioning of woody debris described under the boat/barge method of alternative B.

Boat

This method would involve a ground crew that would access eligible LWD and foreign debris collections within the project area during a period of high water for a one-time effort to break up the structural integrity of the LWD and remove as much foreign debris as possible. Most of the impacts to fish and wildlife under this method would be similar to those resulting from using a boat/barge under alternative B. The only difference is that the targeted Type II and Type III woody debris collections, once broken up would be left in the bayou channel and not removed from the ecosystem. This would allow the debris to continue to function beneficially within the bayou, but may still cause long-term adverse impacts similar to those described for repositioning woody debris for the boat/barge method under alternative B.

Similar to Overland Routes, because present and future flood elevations would not be appreciably altered by breaking up the LWD collections and leaving the remnants in the active channel, any adverse impacts to fish and wildlife from small changes in present or future flood elevations would be negligible. Therefore, the impacts of using a boat would be short and long-term negligible to minor adverse impacts, with the intensity of the impacts dependent upon the amount of woody debris that needs to be repositioned to allow the boat to navigate the river.

Breaking up the woody debris and leaving it in the active channel is similar to repositioning woody debris. Therefore, the impacts would be the same as described for repositioning of woody debris described under the boat/barge method of alternative B. Similar to Overland Routes, because present and future flood elevations would not be appreciably altered by breaking up the LWD collections and leaving the remnants in the active channel, any adverse impacts to fish and wildlife from small changes in present or future flood elevations would be negligible.

Impact Analysis of the Effects of Eliminating the Integrity of Type II and III Debris and Removing Foreign Debris

As described under *Floodplains*, breaking up the structural integrity and leaving the remnants of the approximately four Type II and Type III LWD collections in the active channel is not expected to have a noticeable effect on the potential for out-of-bank flows or atypical flooding beyond what currently exists. Even if the remnants of the LWD collections are transported downstream and redistributed within the active channel, only negligible effects are expected on future flood elevations. Reducing naturally occurring flood elevations would diminish their ecological role in the

river-floodplain ecosystem. However, because present and future flood elevations would not be appreciably altered, any adverse impacts to fish and wildlife would be negligible.

Because of the relatively few woody debris collections being cut up and the fact that the debris is being left in the active channel, using overland routes to remove the Type II and Type III woody debris locations would result in short and long-term, negligible to minor adverse impacts.

Any removal of foreign debris from within the bayou channel when accessing the debris locations would be beneficial to the ecosystem, removing potential pollutants, and therefore beneficial to fish and wildlife.

Cumulative Effects: Cumulative impacts would be essentially the same as described for alternative A. Actions in and outside the park, including the Hardin County Hurricane Rita Debris Removal Project, oil and gas development and associated field production facilities, logging, and past and continued residential development in the floodplain adjacent to the Preserve would continue to affect fish and wildlife and result in long-term moderate adverse impacts. The impacts of these actions, when combined with the negligible to minor adverse impacts of the actions under alternative C, would result in long-term, localized, moderate adverse impacts on fish and wildlife in the area of analysis. The proposed actions would contribute slightly to these impacts.

Conclusion: While breaking up the approximately four Type II and Type III LWD collections and leaving the remnants in the active channel under this alternative would allow the LWD to continue functioning beneficially in the ecosystem, it would still potentially cause adverse impacts to fish and wildlife. Under this alternative, adverse impacts could result from increasing turbidity, altering or destroying habitat, and creating noise disturbances. Overall, breaking up the LWD collections under this alternative would result in short and long-term, negligible to minor adverse impacts. Cumulative impacts would be long-term, localized, moderate, and adverse with the proposed actions contributing slightly to these impacts. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Big Thicket National Preserve (2) key to the natural or cultural integrity of the Preserve; or (3) identified as a goal in the Preserve's *General Management Plan* (1980) or other relevant National Park Service planning documents, there would be no impairment of the Preserve's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of *NPS Management Policies* 2006.

Species of Special Concern

Intensity Level Definitions

The methodology for assessing impacts on fish and wildlife is based on professional judgment and was developed through consultation with NPS staff and other experts in the field, and review of relevant literature.

The thresholds of change for the intensity of an impact are defined as follows:

Negligible: Impacts would result in a change to a population or individuals of a species of management concern, but the change would be well within the range of natural fluctuations

Minor: An action that would affect a few individuals of a species of management concern or have very localized impacts upon their habitat. The change would have barely perceptible

consequences to the species or habitat function. Sufficient habitat would remain functional to maintain species viability. Impacts would be outside of critical reproduction periods. Mitigation measures, if needed to offset adverse effects, would be simple and successful.

Moderate: An action that would cause measurable effects on: (1) a relatively small percentage of the species population, (2) the existing dynamics between multiple species (e.g., predator-prey, herbivore-forage, vegetation structure-wildlife breeding habitat), or (3) a relatively large habitat area or important habitat attributes. A population or habitat might deviate from normal levels under existing conditions, but would remain indefinitely viable within the Preserve. Response to disturbance by some individuals could be expected, with some negative impacts to feeding, reproduction, or other factors impacting short-term population levels. Mitigation measures, if needed to offset adverse effects, could be extensive, but would likely be successful.

Major: An action that would have drastic and permanent consequences for a species population, dynamics between multiple species, or almost all available unique habitat. A population or its habitat would be permanently altered from normal levels under existing conditions, and the species would be at risk of extirpation from the Preserve. Frequent responses to disturbance by some individuals would be expected, with negative impacts to feeding, reproduction, or other factors resulting in a decrease in population levels. Extensive mitigation measures would be needed to offset any adverse effects and their success would not be guaranteed.

Impacts of Alternative A – No Action

There are no federally listed species in the project area to be impacted, and the three state listed species that would occur there (wood stork, paddlefish and Rafinesque's big eared bat) would not be impacted because no action would be taken to remove the approximately four Type II and Type III LWD collections. The Preserve would also continue to protect all species of special concern in accordance with all applicable federal, state and NPS laws and regulations.

As described under *Floodplains*, leaving the approximately four Type II and Type III LWD collections in the channel is not expected to change the current potential for out-of-bank flows or atypical flooding beyond what currently exists. Therefore, there would be no effect on any species of special concern resulting from future flooding events, for these species have adapted to these naturally occurring events. Also described under *Floodplains*, should the Type II or III debris collections accumulate additional debris in the future, they could create complete channel obstructions, which would result in greater impacts on flood elevations. Regardless of the potential degree of impact on flood elevations under these circumstances, the species of special concern within the river and floodplain are adapted to exploiting, tolerating or escaping these larger, infrequent, natural flood events and would not be impacted by them.

Under this alternative, no additional effort would be made to remove foreign debris within the water corridor. This could cause some long-term adverse impacts to paddlefish by affecting its aquatic habitat, however, the intensity of the impact (that is negligible, minor, moderate, major) can not be analyzed at this time without knowing the types and general amount of foreign debris that potentially would have been encountered and removed had an action to remove the LWD been undertaken.

Cumulative Impacts: Other past, present, and future planned actions within the Preserve and the local region have the potential to affect the species of special concern found within the project area. NPS has removed exotic plants in Pine Island Bayou in the past and has plans to treat 17.5

acres of Chinese privet and Chinese tallow at Voth Mill in the summer of 2008. Voth Mill is the one location where the Rafinesque's big-eared bat has been documented in the Little Pine Island Bayou unit. Conducting a bat survey of the trees to be cut would ensure that no impacts would result from the removal of the Chinese tallow trees.

Hardin County's proposal to remove all storm debris from water ways totaling approximately 12.4 miles could have short and long-term negligible to minor adverse impacts on the wood stork. The debris removal operations would temporarily disperse the wood stork from the vicinity of the operations. More importantly, the removal of the all of the storm debris may reduce fish populations in the waterways being cleaned (see cumulative impacts discussion under Fish and Wildlife), thereby reducing the wood storks foraging habitat.

Past and continued development of lands surrounding the Preserve, including the proposal to develop a total of 2,600 acres north of Bevil Oaks, could increase displacement of species of special concern and increase stress that reduce the resiliency of local populations, resulting in long-term incremental loss of species of special concern primarily influenced through loss of habitat and changes in water quality and quantity. Past and present oil and gas operations adjacent to the project area also have adversely impacted species of special concern through the direct loss of terrestrial habitat at oil and gas sites. Also, construction of roads, flowlines and pipelines that cross rivers and streams increase erosion and sedimentation that adversely impact water quality and aquatic habitats that support the paddlefish and the wood stork. Past, present and future logging operations also may impact the species of special concern. A major source of non-point pollution and erosion in the region is the harvest of local timber (Harcombe et al 1996). Increased pollution and sedimentation to waterways degrades water quality and aquatic habitats for the paddlefish and wood stork. Clear cut operations used to harvest timber also remove large areas of habitat for the Rafinesque's big-eared bat that can fragment populations.

These past, present and futures actions, when added to the minimal, if any, impacts of the actions under alternative A would have cumulative, long-term minor adverse impacts on the wood stork, Rafinesque's big-eared bat and paddlefish.

Conclusion: Leaving the approximately four Type II and Type III LWD collections in place under alternative A would not impact any species of special concern which would continue to be protected by the Preserve in accordance with all applicable federal, state and NPS laws and regulations. Cumulative impacts would be long-term, localized, minor, and adverse, with the proposed actions contributing only slightly, if at all, to these impacts. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Big Thicket National Preserve (2) key to the natural or cultural integrity of the Preserve; or (3) identified as a goal in the Preserve's *General Management Plan (1980)* or other relevant National Park Service planning documents, there would be no impairment of the Preserve's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Impacts of Alternative B (Preferred Alternative)

Helicopter

Using this method to remove the approximately four Type II and Type III LWD collections would have short-term negligible adverse impacts on the three species of special concern that may be encountered in the project area. Any wood storks in the area of the woody debris collections or along the access routes of the small boats (if they are used) or the flight paths of the helicopters

would likely be disturbed by the noise generated by the personnel, their hand tools (e.g. chain saws), the boats and the helicopter and flee the area. This disturbance would be localized to the area of operations and only occur during the short time that the debris removal operations were taking place.

The only documented occurrences of the Rafinesque's big-eared bat in the project area were the use of the Voth Mill as a temporary roosting site by a single bat in 1995 and again in October 1996 (Hanna 2008). However, its preferred roosting habitat also includes hollow trees, crevices behind bark, and dry leaves which make it likely that the bat inhabits other areas of the project area. Any bats that may be roosting in the vicinity of the woody debris collections aren't likely to be disturbed by the presence of ground personnel. However, they may be disturbed by the noise from chainsaws and /or the noise from the helicopter. In addition, rotorwash of the helicopter may disturb their roosting habitat by bending the trees or loosening bark and leaves. These disturbances may cause the bat to flee its roosting site, but it is likely that it would be able to readily find another site nearby. Disturbance of the bat could be mitigated by performing a bat survey of the areas immediately surrounding the woody debris collections prior to commencing removal activities, though bats may still escape detection, especially if they are roosting higher up in trees. If a bat is found the debris removal would then be postponed pending coordination with the U.S. Fish and Wildlife Service and other methods may need to be utilized for debris removal.

The project area likely does not contain spawning habitat for the paddlefish, but the fish may forage in project waters. Paddlefish are highly mobile and noise from ground personnel and the helicopter would likely disperse the fish from the immediate vicinity of the woody debris collections. Paddlefish are planktivorous and increased sediments in the water column could impact their feeding by getting caught in their gills. However, due to the noise created during the debris removal operations, it is unlikely that the paddlefish would be feeding in the localized area where sediments would be resuspended due to removing the debris.

Boat/Barge

Under this method the impacts to the species of special concern would be similar to those under the helicopter method and would be short-term negligible adverse. Additionally, cutting down standing trees within the channel to provide a 10-ft operating clearance for the boat/barge could potentially kill a Rafinesque's big-eared bat if it is roosting in the tree. Adverse impacts of this nature could be mitigated by conducting a bat survey of the tree prior to cutting it down.

Impact Analysis of the Effects of Removal of Type II and III Debris and Foreign Debris

As described under *Floodplains*, removing the approximately four Type II and Type III LWD collections would have minimal effects on out-of-bank flows and would reduce future flood elevations by less than 1-foot, and may possibly be undetectable. Reducing naturally occurring flood elevations would diminish their ecological role in the river-floodplain ecosystem. However, because present and future flood elevations would not be appreciably altered, any adverse impacts to species of special concern would be negligible.

Any removal of foreign debris from within the bayou channel when accessing the debris locations would be beneficial to the ecosystem, and subsequently beneficial to the species of special concern. However, the intensity of the impact can not be analyzed without knowing the types and general amount of debris existing within the bayou that would be removed. Overall, the impacts from helicopter operations, the use of ground crews or small boats, and the removal of the Type II and Type III woody debris would result in short-term negligible adverse impacts on species of special concern.

Cumulative Impacts: Cumulative impacts would be essentially the same as described for alternative A. Actions in and outside the park, including the Hardin County Hurricane Rita Debris Removal Project, oil and gas development and associated field production facilities, logging, and past and continued residential development in the floodplain adjacent to the Preserve would continue to affect species of special concern and result in long-term minor adverse impacts. The impacts of these actions, when combined with the negligible adverse impacts of the actions under alternative B, would result in long-term, localized, minor adverse impacts on the species of special concern in the area of analysis. The proposed actions would contribute only slightly to these impacts.

Conclusion: Removing the approximately four Type II and Type III LWD collections from the bayou under this alternative would create noise disturbances that would adversely impact the three species of special concern, but these, along with any other potential impacts would only be short-term and negligible. Cumulative impacts would be long-term, localized, minor, and adverse, with the proposed actions contributing only slightly to these impacts. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Big Thicket National Preserve (2) key to the natural or cultural integrity of the Preserve; or (3) identified as a goal in the Preserve's *General Management Plan (1980)* or other relevant National Park Service planning documents, there would be no impairment of the Preserve's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of *NPS Management Policies 2006*.

Impacts of Alternative C

Overland Routes

This method would involve a ground crew that would access eligible LWD and foreign debris collections within the project area on foot for a one-time effort to break up the structural integrity of the LWD during a period of low water and remove as much foreign debris as possible. Using this method would have short-term negligible adverse impacts on the three species of special concern that may be encountered in the project area. Any wood storks in the area of the woody debris collections would likely be disturbed by the noise generated by the personnel, and their hand tools (e.g. chain saws) and flee the area. This disturbance would be localized to the area of operations and only occur during the short time that the debris removal operations were taking place.

Roosting Rafinesque's big-eared bats may be disturbed by the noise from the use of handheld equipment, but similar to alternative B, if they flee their roost, they would likely be able to find another roosting location nearby, and any impacts may be mitigated by conducting a bat survey of the immediate vicinity of the woody debris and delaying operations if a bat is found.

Impacts to paddlefish would be similar to those under alternative B and would likely entail temporary dispersion of any fish in the vicinity of the woody debris.

Boat

Impacts to species of special concern would be similar to the boat/barge method under alternative B and would be short-term, negligible, and adverse.

Similar to Overland Routes, because present and future flood elevations would not be appreciably altered by breaking up the LWD collections and leaving the remnants in the active channel, any

adverse impacts to species of special concern from small changes in present or future flood elevations would be negligible.

Impact Analysis of the Effects of Eliminating the Integrity of Type II and III Debris and Removing Foreign Debris

As described under *Floodplains*, breaking up the structural integrity and leaving the remnants of the approximately four Type II and Type III LWD collections in the active channel is not expected to have a noticeable effect on the potential for out-of-bank flows or atypical flooding beyond what currently exists. Even if the remnants of the LWD collections are transported downstream and redistributed within the active channel, only negligible effects are expected on future flood elevations. Reducing naturally occurring flood elevations would diminish their ecological role in the river-floodplain ecosystem. However, because present and future flood elevations would not be appreciably altered, any adverse impacts to species of special concern would be negligible.

Because of the relatively few LWD collections being cut up and the fact that they are only being accessed by foot, using overland routes to break up the structural integrity of the Type II and Type III LWD collections would result in short-term, negligible adverse impacts to species of special concern.

Any removal of foreign debris from within the bayou channel when accessing the debris locations would be beneficial to the ecosystem, and subsequently beneficial to the species of special concern.

Cumulative Impacts: Cumulative impacts would be essentially the same as described for alternative A. Actions in and outside the Preserve, including the Hardin County Hurricane Rita Debris Removal Project, oil and gas development and associated field production facilities, logging, and past and continued residential development in the floodplain adjacent to the Preserve would continue to affect species of special concern and result in long-term minor adverse impacts. The impacts of these actions, when combined with the negligible adverse impacts of the actions under alternative C, would result in long-term, localized, minor adverse impacts on the species of special concern in the area of analysis. The proposed actions would contribute only slightly to these impacts.

Conclusion: Breaking up the approximately four Type II and Type III LWD collections and leaving the remnants in the bayou under this alternative would create noise disturbances that would adversely impact the three species of special concern. However, by employing the mitigations measures indicated, these and any other potential adverse impacts would only be short-term and negligible. Cumulative impacts would be long-term, localized, minor, and adverse, with the proposed actions contributing only slightly to these impacts. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Big Thicket National Preserve (2) key to the natural or cultural integrity of the Preserve; or (3) identified as a goal in the Preserve's *General Management Plan (1980)* or other relevant National Park Service planning documents, there would be no impairment of the Preserve's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Visitor Use and Experience

The methodology for assessing impacts on visitor use and experience is based on professional judgment and was developed through consultation with NPS staff and other experts.

Intensity Level Definitions

Negligible: Changes in visitor use and/or experience would be below or at the level of detection. There is no expectation for endangering visitor health and safety.

Minor: Changes in visitor use and/or experience would be detectable, although the changes would be slight. Few visitors would be affected. There is little expectation for endangering visitor health and safety with the application of mitigating measures.

Moderate: Changes in visitor use and/or experience would be readily apparent. Many visitors would be affected and would likely express an opinion about the effects. Extensive mitigation is necessary to reduce risk of endangering visitor health and safety.

Major: Changes in visitor use and/or experience would be readily apparent and have important consequences. Most visitors would be affected and would likely express a strong opinion about the effects. Extensive mitigating measures could not reduce risk of endangering visitor health and safety.

Impacts of Alternative A – No Action

Under alternative A, the NPS would not take any action to remove the Type II or III debris or foreign debris from the Bayou channel within the project area. Therefore, visitor use and experience would not be affected by noise or other effects from debris removal activities. As described under *Floodplains*, leaving the approximately four Type II and Type III LWD collections in the channel is not expected to change the current potential for out-of-bank flows or atypical flooding beyond what currently exists. Therefore, flooding would still occur consistent with the historical peaks of the Little Pine Island-Pine Island Bayou.

Visitors attempting travel on water within the LPI Corridor Unit would likely be required to portage around LWD within the channel. However, this should be an expectation of visitors as LWD naturally occurs in streams with forested banks and in lower order streams whose channels are less wide than the surrounding vegetation is tall. In much of Little Pine Island Bayou in the project area, LWD tends to create impediments to even small vessel (canoe or kayak) traffic. Under alternative A, visitor use and experience would remain at present conditions. Therefore, the selection of alternative A would have no effect on visitor use or experience within the project area.

Cumulative Impacts: Other past, present, and reasonably foreseeable actions within the vicinity of the project area have affected or could affect visitor use and experience to a minimal extent, especially with respect to access and noise. Activities conducted by the Preserve such as elimination of removal of the X bridge and exotic plant removal have caused and may continue to cause short-term, temporary closures of the Preserve to visitors. This has and is expected to have short-term negligible effects on visitor use and experience. Activities associated with construction, oil and gas operations, county maintenance, and logging operations would increase noise levels, resulting in short-term minor adverse impacts to visitors within the vicinity of where these noise generating activities are taking place, and these impacts would continue intermittently over time.

The effects of the past, present, and future actions described above, when combined with no effect of actions under alternative A, would result in long-term, localized, minor, adverse impacts on visitor use and experience. The proposed actions would not contribute to these impacts.

Conclusion: Overall, implementation of no action alternative would result in no effect on visitor use and experience as it would remain at present conditions. Cumulative impacts would be long-term, localized, minor, and adverse, with the proposed actions not contributing to these impacts.

Implementation of this alternative would not result in any unacceptable impacts and is consistent with *NPS Management Policies 2006*.

Impacts of Alternative B (Preferred Alternative)

Helicopter

Under this method, the Type II and III woody debris and foreign debris would be removed from the project area with the use of a helicopter and ground crew. During removal activities, all of portions of the LPI Corridor Unit would be temporarily closed to public use resulting in an inconvenience to potential users. The public would be notified in advance of closures in these portions of the Preserve in order to address debris within the Bayou channel in a safe manner. The effects to visitor use and experience from closures would be short-term, negligible and adverse because use of the area would be temporarily disrupted, requiring visitors to either go elsewhere in the Preserve or come back at a later time.

Boat/Barge

Under this method, a boat and barge would be used during a period of high water in the Bayou to access and remove eligible LWD and foreign debris. During removal activities, all of portions of the LPI Corridor Unit would be temporarily closed to public use resulting in an inconvenience to potential users. The public would be notified in advance of closures in these portions of the Preserve in order to address debris within the Bayou channel in a safe manner. The effects to visitor use and experience from closures would be short-term, negligible and adverse because use of the area would be temporarily disrupted, requiring visitors to either go elsewhere in the Preserve or come back at a later time.

Impact Analysis of the Effects of Removal of Type II and III Debris and Foreign Debris

Removal of the approximately four Type II and Type III LWD collections, as well as foreign debris, would have long-term, negligible beneficial effects on visitor use and experience due to the continued existence of Type I debris in the Bayou channel. Removal of Type II and III debris would result in removal of some obstructions to water users within the Bayou, however, Type I debris would still remain in the channel providing some obstructions for water users.

Cumulative Impacts: Cumulative impacts would be similar to those described for alternative A. Actions such as logging and proposed private development of several subdivisions as well as construction, oil and gas operations, county maintenance, and logging operations, would continue to affect visitor use and experience from noise levels in the area, resulting in long-term localized minor adverse cumulative impacts. The impacts of these actions, when combined with the short-term, negligible adverse effects and the long-term negligible beneficial impacts of alternative B, would result in long-term, localized, minor adverse impacts on visitor use and experience.

Conclusion: Overall, implementation of alternative B would result in short-term, negligible adverse effects from temporary closures and long-term negligible beneficial impacts from removal of Type II and Type III debris on visitor use and experience. Cumulative impacts would be long-term, localized, minor and adverse. Implementation of this alternative would not result in any unacceptable impacts and is consistent with *NPS Management Policies 2006*.

Impacts of Alternative C

Overland Routes

This method would involve a ground crew that would access eligible LWD and foreign debris collections within the project area on foot for a one-time effort to break up the structural integrity

of the LWD during a period of low water and remove as much foreign debris as possible. During activities, all of portions of the LPI Corridor Unit would be temporarily closed to public use resulting in an inconvenience to potential users. The public would be notified in advance of closures in these portions of the Preserve in order to address debris within the Bayou channel in a safe manner. The effects to visitor use and experience from closures would be short-term, negligible and adverse because use of the area would be temporarily disrupted, requiring visitors to either go elsewhere in the Preserve or come back at a later time.

Boat

This method would involve a ground crew that would access eligible LWD and foreign debris collections within the project area during a period of high water for a one-time effort to break up the structural integrity of the LWD and remove as much foreign debris as possible. During activities, all of portions of the LPI Corridor Unit would be temporarily closed to public use resulting in an inconvenience to potential users. The public would be notified in advance of closures in these portions of the Preserve in order to address debris within the Bayou channel in a safe manner. The effects to visitor use and experience from closures would be short-term, negligible and adverse because use of the area would be temporarily disrupted, requiring visitors to either go elsewhere in the Preserve or come back at a later time.

Impact Analysis of the Effects of Eliminating the Integrity of Type II and III Debris and Removing Foreign Debris

Breaking up the structural integrity of the approximately four Type II and Type III LWD collections, as well removing as foreign debris where possible, would have long-term, minor beneficial effects on visitor use and experience due to the continued existence of Type I debris in the Bayou channel. Breaking up the structural integrity of Type II and III debris would likely result in the removal of or a path through obstructions for water users within the Bayou, however, this would be dependent on whether remnants of the LWD collections could be transported downstream and redistributed within the active channel. Type I debris would still remain in the channel providing some obstructions for water users and could require portage around these obstructions.

Cumulative Impacts: Cumulative impacts would be similar to those described for alternative A. Actions such as logging and proposed private development of several subdivisions as well as construction, oil and gas operations, county maintenance, and logging operations, would continue to affect visitor use and experience from noise levels in the area, resulting in long-term localized minor adverse cumulative impacts. The impacts of these actions, when combined with the short-term, negligible adverse effects and the long-term minor beneficial impacts of alternative C, would result in long-term, localized, minor adverse impacts on visitor use and experience.

Conclusion: Overall, implementation of alternative C would result in short-term, negligible adverse effects from temporary closures and long-term negligible beneficial impacts from eliminating the structural integrity of Type II and Type III debris on visitor use and experience. Cumulative impacts would be long-term, localized, minor, and adverse. Implementation of this alternative would not result in any unacceptable impacts and is consistent with *NPS Management Policies 2006*.

Park Operations and Management

Implementation of a project can affect the Preserve operations by influencing the number of employees needed; the type of duties that need to be conducted; when/who would conduct these duties; how activities should be conducted; and administrative procedures. For the purpose of this

analysis, the human health and safety of Preserve employees is also evaluated. The methodology used to assess potential changes to Preserve operations is as follows:

Intensity Level Definitions

Negligible: Preserve operations and facilities would not be affected, or the effects would be at low levels of detection and would not have an appreciable effect on Preserve operations.

Minor: The effect would be detectable, but would be of a magnitude that would not have an appreciable effect on Preserve operations and facilities. If mitigation was needed to offset adverse effects, it would be simple, likely successful.

Moderate: The effects would be readily apparent and would result in changes in Preserve operations and facilities in a manner noticeable to staff and the public. Mitigation measure would be necessary to offset adverse effects, would likely be successful.

Major: The effects would be readily apparent and would result in a substantial change in Preserve operations and facilities in a manner noticeable to staff and the public. Mitigation measure to offset adverse effects would be needed, would be extensive and their success could not be guaranteed.

Impacts of Alternative A – No Action

Under alternative A, the NPS would not take any actions to remove Type II or III debris from the Bayou channel of the project area. As a result, there would be no short-term impacts to Preserve operations or health and safety.

There could be some long-term impacts on Preserve operations, primarily administration and interpretation/education, should continued flooding under alternative A generate additional need for outreach or coordination. This responsibility would fall to current employees and could temporarily increase work loads when such needs arise, potentially reducing time available for other duties. However, it would not require adding employees, and the effects on operations would not be appreciable as such these divisions are responsible for such activities on a day-to-day basis. As a result, there would be long-term, but temporary, negligible to minor adverse impacts on preserve operations.

There would be no changes in the potential effects on health and safety risks to employees or visitors as a result of leaving the debris in the channel.

Cumulative Impacts: Other past, present, and reasonably foreseeable actions within the vicinity of the project area have affected or could affect preserve operations and health and safety. These include oil and gas development inside or affecting the Preserve, removal of the X Bridge, and exotic plant control. Some oil and gas operations that occur outside the Preserve are directionally drilling to access minerals below the park unit. This requires Preserve staff to coordinate and prepare compliance documents associated with such operations. Similarly, oil and gas projects within the Preserve require management, compliance document production, and monitoring. Other projects within the Preserve, such as removal of the X Bridge or exotic plant control, require temporary commitments of staff during implementation, and in the case of exotic plant control, require follow on monitoring and treatment (such as that scheduled for 2008) that also require staff commitments. There are some risks to employees when they undertake such projects. However, these are activities that are fairly routine for maintenance and resource management staff, and do not have substantial effects on other Preserve operations or health and safety. Private

developments and oil and gas operations that occur or are planned adjacent to the Preserve create the potential for encroachment that creates law enforcement, maintenance, and other issues for the Preserve. All of these actions require the use of varying levels of preserve resources and result in long-term, negligible to minor adverse impacts on preserve operations.

The effects of the past, present, and future actions described above, when combined with the long-term negligible adverse impacts of actions under alternative A, would result in long-term, localized, minor, adverse impacts on preserve operations. The proposed actions would contribute only slightly to these impacts.

Conclusion: Alternative A would result in no short-term impacts to Preserve operations or health and safety because debris removal would not be conducted. Long-term, negligible to minor adverse impacts would result from the impacts on operations from staff commitments that may be required to address inquiries from the public about flooding. There would be no changes in the potential effects on health and safety risks to employees or visitors as a result of leaving the debris in the channel. Cumulative impacts would be long-term, localized, minor, and adverse, with the alternative contributing only slightly to these impacts. Implementation of this alternative would not result in any unacceptable impacts and is consistent with *NPS Management Policies 2006*.

Impacts of Alternative B (Preferred Alternative)

Helicopter

Under this option, approximately four debris collections would be removed by helicopter during periods of low water. The county would handle all coordination with and costs for the helicopter contractor, but the NPS would provide input to ensure protection of resources and visitors during removal operations. Prior to conducting the removals, the NPS would notify the public and would establish closures. In addition, an NPS staff member would have to accompany the ground crew to identify debris eligible for review. This could temporarily increase work loads of maintenance, resource management, interpretation/education, administration, and resources and visitor protection staff from the need to coordinate with the county and its contractor, issue public notices, and enforce closures. These activities could temporarily decrease staff availability for other duties, but would not appreciably affect Preserve operations. As a result, there would short-term, minor, adverse impacts on Preserve operations.

The use of the helicopter, as well as hand-held equipment such as saws, would create the potential for health and safety risks to the NPS staff member and/or contractor involved in the removal efforts. Steps would be taken to minimize this potential, such as the use of a grapple when it is determined that exposure to personnel is deemed too dangerous, and the regular use of two way communications between ground and flight crews. The rotorwash would also increase vertical visualization by spreading of the canopy trees, which would increase sight lines between the ground and flight crews. The contractors would also be responsible for ensuring that flight and ground crews are properly trained and that equipment is maintained to minimize health and safety risks. In addition, all necessary safety precautions would be followed, including those identified by NPS aviation specialists. There would be minimal hazards from trips and falls for the ground crew involved in the removal efforts. Although it is expected that these operations could occur safely and effectively given these measures, there would be short-term, minor to possibly moderate adverse impacts on health and safety from the potential risks associated with use of the helicopter, handheld equipment such as saws, and potential for trips and falls during removal efforts. Area closures would minimize the potential for impacts to Preserve visitors during removal activities. The hauling and disposal of the material would not affect Preserve operations or health and safety of Preserve employees or visitors.

Boat/Barge

As with the helicopter, the county would handle all coordination with and costs for the debris removal contractor. However, the NPS would have to provide input to ensure protection of resources and visitors during removal operations. Prior to conducting the removals, the NPS would notify the public and would establish closures to protect visitors. In addition, an NPS staff member would have to accompany the contractor to identify debris eligible for removal, as well as help identify standing trees within the channel for removal. This could temporarily increase work loads of maintenance, resource management, interpretation/education, administration, and resources and visitor protection staff from the need to coordinate with the county and its contractor, issue public notices, and enforce closures. These activities could temporarily decrease staff availability for other duties, but would not appreciably affect Preserve operations. Impacts would be short-term, adverse, and minor.

The use of the boat/barge would increase health and safety risks (e.g., accidents during launching and operating equipment) for the NPS staff member and contractors involved in the removal efforts. In addition, the use of handheld equipment such as saws would also contribute to these safety risks. However, all applicable safety precautions would be followed, as described for the helicopter (e.g., proper training, maintenance of equipment, following NPS and industry protocols). As a result, there would be short-term, negligible, adverse impacts on health and safety from the potential risks associated with use of the boat/barge. Area closures would minimize the potential for impacts to Preserve visitors during removal activities. The hauling and disposal of the material would not affect Preserve operations or health and safety of Preserve employees or visitors.

Impact Analysis of the Effects of Removal of Type II and III Debris and Foreign Debris

As described for alternative A, should continued flooding under alternative B generate additional need for outreach or coordination, there could be some long-term impacts on Preserve operations, primarily administration and interpretation/education. This responsibility would fall to current employees, temporarily increasing work loads and reducing time available for other duties, but would not require adding employees. The effects on operations would not be appreciable as these divisions are responsible for such activities on a day-to-day basis, and although the impacts would be long-term, negligible to minor, and adverse, they would occur on an intermittent and temporary basis. The removal of debris may also alleviate some community concerns regarding flooding, resulting in less outreach required to address those concerns and beneficial effects. Conversely, the one-time removal of debris may increase requests to do more debris removal in the future, resulting in minor adverse effects.

The absence of the debris in the project area would have no effects on health and safety risks to employees or visitors.

Cumulative Impacts: Cumulative impacts would be similar to those described for alternative A. Actions in and outside the park, including oil and gas operations, removal of the X Bridge, exotic plant control, and private developments outside the Preserve boundary, would continue to affect preserve operations and result in long-term localized minor adverse cumulative impacts. The impacts of these actions, when combined with the negligible to moderate impacts of the actions under alternative B, would result in long-term, localized, minor to moderate adverse impacts on preserve operations in the area of analysis.

Conclusion: Alternative B would have short- and long-term, negligible to moderate adverse impacts on Preserve operations and health and safety as a result of removal by helicopter or

boat/barge, and possible beneficial effects related to alleviation of concerns about the debris. The absence of the debris in the project area would have no effects on health and safety risks to employees or visitors. Cumulative impacts would be long-term, localized, moderate, and adverse. Implementation of this alternative would not result in any unacceptable impacts and is consistent with *NPS Management Policies 2006*.

Impacts of Alternative C

Overland Routes

This method would involve a ground crew that would access eligible LWD and foreign debris collections within the project area on foot for a one-time effort to break up the structural integrity of the LWD during a period of low water and remove as much foreign debris as possible.

As with other options discussed in alternative B, the county would handle all coordination with and costs for a contractor to access debris overland. However, the NPS would have to provide input and prior to conducting the activities, the NPS would also need to notify the public and establish closures to protect visitors. In addition, an NPS staff member would have to accompany the ground crew to identify debris eligible to break up. This could temporarily increase work loads of maintenance, resource management, interpretation/education, and resources and visitor protection staff from the need to coordinate with the county and its contractor, issue public notices, and enforce closures. These activities could temporarily decrease staff availability for other duties, but would not appreciably affect Preserve operations. Therefore, impacts would be short-term, minor, and adverse.

Accessing the project area on foot would create minimal hazards from trips and falls for the ground crew involved in the breaking up of debris. This crew would also use hand-held equipment such as saws that would create the potential for health and safety risks to the NPS staff member and/or contractor involved in the removal efforts. However, steps would be taken to minimize this potential, such as ensuring that ground crews are properly trained and that equipment is maintained to minimize health and safety risks. Although it is expected that these operations could occur safely and effectively given these measures, there would be short-term, negligible adverse impacts on health and safety from the potential risks associated with accessing the project area on foot and the use of handheld equipment such as saws. Area closures would minimize the potential for impacts to Preserve visitors during removal activities.

Boat

This method would involve a ground crew that would access eligible LWD and foreign debris collections within the project area during a period of high water for a one-time effort to break up the structural integrity of the LWD and remove as much foreign debris as possible.

Impacts from the use of the boat would be similar to those described for the boat/barge under alternative B. The county would handle all coordination with and costs for the boat contractor, but the NPS would have to provide input, notify the public, and establish closures to protect visitors. In addition, an NPS staff member would have to accompany the contractor to identify debris eligible for review. This could temporarily increase work loads of maintenance, resource management, and resources and visitor protection staff from the need to coordinate with the county and its contractor, issue public notices, and enforce closures. These activities could temporarily decrease staff availability for other duties, but would not appreciably affect Preserve operations. Therefore, impacts would be short-term, minor, and adverse to Preserve operations.

The use of a boat would increase health and safety risks (e.g., accidents during launching and operating equipment) for the NPS staff member and contractor involved in the activities. In addition, the use of handheld equipment such as saws would also contribute to these safety risks. However, all applicable safety precautions would be followed, as described for alternative B (e.g., proper training, maintenance of equipment, following NPS and industry protocols). Although it is expected that these operations could occur safely and effectively given these measures, there would be short-term, negligible adverse impacts on health and safety from the potential risks associated with accessing the project area by boat and the use of handheld equipment such as saws. Area closures would minimize the potential for impacts to Preserve visitors during removal activities.

Impact Analysis of the Effects of Eliminating the Integrity of Type II and III Debris and Removing Foreign Debris

As described for alternative A, should continued flooding under alternative C generate additional need for outreach or coordination, there could be some long-term, negligible to minor, adverse impacts on Preserve operations, primarily administration and interpretation/education. This responsibility would fall to current employees, intermittently and temporarily increasing work loads and reducing time available for other duties, but would not require adding employees. The effects on operations would not be appreciable as these divisions are responsible for such activities on a day-to-day basis. The dispersing of debris may also alleviate some community concerns regarding flooding, resulting in less outreach required to address those concerns and beneficial effects. Conversely, the dispersing of debris may increase requests to do more debris removal in the future, resulting in minor adverse effects.

Cumulative Impacts: Cumulative impacts would be similar to those described for alternative A. Actions in and outside the park, including oil and gas operations, removal of the X Bridge, exotic plant control, and private developments outside the Preserve boundary, would continue to affect preserve operations and result in long-term localized minor adverse cumulative impacts. The impacts of these actions, when combined with the negligible to moderate adverse impacts of the actions under alternative C, would result in long-term, localized, minor to moderate adverse impacts on preserve operations in the area of analysis.

Conclusion: Alternative C would have short-term and long-term, negligible to moderate adverse impacts on Preserve operations and health and safety from the use of overland removal and/or a boat, and possible beneficial effects related to alleviation of concerns about the debris. The absence of the debris in the project area would have no effects on health and safety risks to employees or visitors. Cumulative impacts would be long-term, localized, moderate, and adverse. Implementation of this alternative would not result in any unacceptable impacts and is consistent with *NPS Management Policies 2006*.

Adjacent Communities

Impacts to adjacent communities were determined qualitatively based on the existing hydrology of the Pine Island Bayou watershed created by Hurricane Rita and the impacts on adjacent communities, with regards to flooding and the activities associated with the removal/manipulation of debris.

Intensity Level Definitions

Impact threshold definitions focus on flooding potential and noise impacts from activities in the Preserve on adjacent communities to the project area, and are defined as follows:

Negligible: Effects on adjacent communities would be at or below the level of detection.

Minor: The effects on adjacent communities would be small but detectable. The impact would be slight and would affect only a few adjacent landowners directly adjacent to the Preserve's boundary. Mitigation measures, if needed to offset adverse effects, would be simple and successful.

Moderate: The effects on adjacent communities would be readily apparent. Changes would be limited and confined within the community, and they would affect more than a few landowners within the study area. Mitigation measures, if needed, to offset adverse effects occurring outside the Preserve, would likely succeed.

Major: The effects on adjacent communities would be readily apparent. Changes would be substantial, extend beyond the political boundaries of the community, and would affect the majority of landowners within the study area, and possibly beyond. Extensive mitigation measures would be needed to offset any adverse effects, and their success would not be guaranteed.

Impacts of Alternative A – No Action

Under alternative A, the NPS would not take any action to remove the Type II or III debris or foreign debris from the Bayou channel within the project area therefore no effects to adjacent communities from noise or access to the project area would be realized. As described under *Floodplains*, leaving the approximately four Type II and Type III LWD collections in the channel is not expected to change the current potential for out-of-bank flows or atypical flooding beyond what currently exists. Therefore, adjacent communities would still experience flooding consistent with the historical peaks of the Little Pine Island-Pine Island Bayou, but there would be no effect to adjacent communities from out-of-bank flows or atypical flooding as a result of leaving the Type II or III debris in the project area of the Preserve. However, should the Type II or III debris collections accumulate additional debris in the future, they could create complete channel obstructions, which would result in greater impacts on flood elevations and therefore increase the potential for atypical flooding in adjacent communities each time the area receives a large rain event. This increased potential would not be expected to create conditions where people or structures are exposed to a risk of loss, injury, or death from floods much beyond the current potential. As a result, any adverse impacts to adjacent communities that could result from the development of obstructions created from woody debris deposited from Hurricane Rita would be minor to moderate and of long duration.

Cumulative Impacts: Other past, present, and reasonably foreseeable actions within the vicinity of the project area have affected or could affect adjacent communities, especially with respect to flooding potential and noise. Actions on areas adjacent to the preserve that would decrease the overall amount of vegetation and add impervious surfaces within the watershed, including logging and private development of several subdivisions, would increase the overall amount of runoff during storm events and increase the overall potential for flooding to occur. By increasing the overall flooding potential of these areas, there would be long-term minor adverse impacts to adjacent communities. Additionally, activities that would increase overall noise levels, would also affect these communities. Activities associated with construction, oil and gas operations, county maintenance, and logging operations would increase noise levels, resulting in short-term minor adverse impacts to landowners living within the vicinity of where these noise generating activities are taking place, and these impacts would continue intermittently over time.

The effects of the past, present, and future actions described above, when combined with the long-term minor to moderate adverse impacts of actions under alternative A, would result in long-term, localized, moderate, adverse impacts on adjacent communities. The proposed actions would contribute only slightly to these impacts.

Conclusion: Overall, implementation of alternative A would result in long-term minor to moderate adverse impacts on adjacent communities, as the potential for atypical flooding increases with the possibility that obstructions within the bayou could be formed if Type II and II debris is not removed from the Preserve. This however is currently not occurring. Cumulative impacts would be long-term, localized, moderate, and adverse, with the proposed actions contributing only slightly to these impacts. Implementation of this alternative would not result in any unacceptable impacts and is consistent with *NPS Management Policies 2006*.

Impacts of Alternative B (Preferred Alternative)

Helicopter

Under this method, the Type II and III woody debris and foreign debris would be removed from the project area with the use of a helicopter and ground crew. Those residents living near the locations of eligible debris for removal would be impacted by the noise generated from this type of operation. The adverse impacts however would be short-term and minor as the noise generated from these operations would be localized and last only as long as necessary to remove the debris. In addition, the route used by the helicopter to transport the LWD and foreign debris to the pre-determined disposal site avoids large power line structures, roads, and populated areas. As a result, there would be no threat to the safety of the residents of the adjacent communities from this type of operation.

Adjacent communities could experience some short-term negligible effects from ground crews accessing debris locations with vehicles and equipment. Any removal activities necessitating access across private property would require property owner approval.

Boat/Barge

Under this method, a boat and barge would be used during a period of high water in the Bayou to access and remove eligible LWD and foreign debris. The use of a barge would not likely create enough noise to impact near-by residents outside of the preserve's boundary. The noise created from the use of an boat, however, would impact only those residents living within the immediate vicinity of the removal. Like the helicopter, noise created from the boat would have short-term negligible adverse impacts to local residents. Local residents living nearby these staging areas for debris removal and along the routes to the disposal site would be impacted by the increased truck traffic and noise generated from this type operation. These adverse impacts however would be short-term and minor as this increase in truck traffic and noise generated from these operations would be localized and last only as long as was necessary to remove the debris.

Access to debris locations would occur from the three access sites identified in Figure 2. Although these sites are located within adjacent communities, no disturbance to community residents would be expected as they are in already disturbed, higher use areas.

Impact Analysis of the Effects of Removal of Type II and III Debris and Foreign Debris

As described under Floodplains, removing the approximately four Type II and Type III LWD collections, as well as foreign debris, would have negligible effects on out-of-bank flows and would reduce future flood elevations by less than 1-foot, and may possibly be undetectable. Therefore, removal of debris would have minor effects on flooding of adjacent communities in the short-term. In the long-term, the removal of debris would alleviate any potential for obstructions within the Bayou to form, resulting in long-term negligible beneficial impacts to the communities adjacent to the Preserve. The overall potential for flooding to occur within the communities adjacent to the Preserve would be consistent with the historical peaks of the Little Pine Island-Pine Island Bayou.

Cumulative Impacts: Cumulative impacts would be similar to those described for alternative A. Actions such as logging and proposed private development of several subdivisions as well as construction, oil and gas operations, county maintenance, and logging operations, would continue to affect adjacent communities by altering flooding potential and noise levels in the area, resulting in long-term localized minor adverse cumulative impacts. The impacts of these actions, when combined with the long-term negligible beneficial impacts and short-term negligible to minor adverse impacts of alternative B, would result in long-term, localized, minor adverse impacts on adjacent communities.

Conclusion: Overall, implementation of alternative B would result in long-term negligible beneficial impacts on adjacent communities as the potential for atypical flooding decreases with the removal of debris in the bayou. In addition, there would be short-term negligible to minor adverse impacts resulting from the noise created from these removal activities. Cumulative impacts would be long-term, localized, minor, and adverse, with the proposed actions contributing only slightly to these impacts. Implementation of this alternative would not result in any unacceptable impacts and is consistent with *NPS Management Policies 2006*.

Impacts of Alternative C

Overland Routes

This method would involve a ground crew that would access eligible LWD and foreign debris collections within the project area on foot for a one-time effort to break up the structural integrity of the LWD during a period of low water and remove as much foreign debris as possible. Adjacent communities could experience some short-term negligible effects from ground crews accessing debris locations with vehicles and equipment; however, the noise and disturbance generated would be localized and last only as long as is necessary to break up the debris. Any removal activities necessitating access across private property would require property owner approval.

Boat

This method would involve a ground crew that would access eligible LWD and foreign debris collections within the project area during a period of high water for a one-time effort to break up the structural integrity of the LWD and remove as much foreign debris as possible. The use of a boat to access debris locations would not likely create enough noise to impact near-by residents outside of the preserve's boundary. The noise created from the use of a boat would not result in a measurable increase in the overall noise that currently occurs within and adjacent to the bayou. As a result, noise created from the use of a boat would have short-term negligible adverse impacts to local residents. The noise would be localized and last only as long as necessary.

Access to debris locations would occur from the three access sites identified in Figure 2. Although these sites are located within adjacent communities, no disturbance to community residents would be expected as they are in already disturbed, higher use areas.

Impact Analysis of the Effects of Eliminating the Integrity of Type II and III Debris and Removing Foreign Debris

As described under *Floodplains*, breaking up the structural integrity and leaving the remnants of the approximately four Type II and Type III LWD collections in the active channel, as well as removing foreign debris, is not expected to have a noticeable effect on the potential for out-of-bank flows or atypical flooding beyond what currently exists. Therefore, breaking up the structural integrity of debris would have negligible effects on flooding of adjacent communities in the short-term. Remnants of the LWD collections could be transported downstream and redistributed within the active channel, but only negligible effects are expected on future flood elevations if this occurs. In the long-term, breaking up the structural integrity of debris could alleviate the potential for obstructions within the Bayou to form, resulting in long-term negligible beneficial impacts to the communities adjacent to the Preserve. The overall potential for flooding to occur within the communities adjacent to the Preserve would be consistent with the historical peaks of the Little Pine Island-Pine Island Bayou.

Cumulative Impacts: Cumulative impacts would be similar to those described for alternative A. Actions such as logging and proposed private development of several subdivisions as well as construction, oil and gas operations, county maintenance, and logging operations, would continue to affect adjacent communities by altering flooding potential and noise levels in the area, resulting in long-term localized minor adverse cumulative impacts. The impacts of these actions, when combined with the long-term negligible beneficial impacts and short-term negligible to minor adverse impacts of alternative C, would result in long-term, localized, minor adverse impacts on adjacent communities.

Conclusion: Overall, implementation of alternative C would result in long-term negligible beneficial impacts on adjacent communities as the potential for flooding decreases with breaking up the structural integrity of debris in the bayou. In addition, there would be short-term negligible adverse impacts resulting from the noise created from activities. Cumulative impacts would be long-term, localized, minor, and adverse, with the proposed actions contributing only slightly to these impacts. Implementation of this alternative would not result in any unacceptable impacts and is consistent with *NPS Management Policies 2006*.

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CONSULTATION AND COORDINATION

External Scoping

External scoping was conducted to inform various agencies and the public about the proposal to address Hurricane Rita related LWD and foreign debris in portions of the LPI Corridor Unit of the Preserve and to generate input on the preparation of this EA. Foreign debris includes woody debris, building materials, appliances, etc. This effort was initiated with the distribution of a scoping brochure which was bulk-mailed to over 600 residents in the Pinewood Estates, Bevil Oaks, Lumberton, and Beaumont areas. All adjacent landowners on the Preserve's mailing list database were included in the mailing. In addition, the press releases were sent to local news organizations, and the scoping brochure was posted on the National Park Service (NPS) "Planning, Environment, and Public Comment" internet website. With this scoping brochure, the public was given 30 days to comment on the project beginning November 15, 2007.

In addition to the aforementioned public entities, the following agencies and Native American tribes were sent scoping information or were contacted for information regarding the project:

Federal Agencies

U.S. Army Corps of Engineers – Galveston District
U.S. Department of Agriculture – Forest Service
U.S. Department of Agriculture – Natural Resources Conservation Service, Beaumont and Liberty Field Offices
U.S. Geological Survey – Texas District
U.S. Department of Interior – Fish and Wildlife Service, Clear Lake Field Office
Federal Emergency Management Agency

State Agencies

Texas Parks and Wildlife Department
Texas General Land Office
Texas Historical Commission
Texas Forest Service
Texas Department of Transportation
Texas Office of Rural Community Affairs
Governor's Office

Affiliated Native American Groups

Alabama-Coushatta Tribe of Texas

In response to the scoping letter brochure, three local newspapers—*Hardin County News*, *Beaumont Enterprise*, and *Silsbee Bee*—published articles based on information contained in the brochure and provided by the Preserve.

During the 30-day scoping period, 67 pieces of correspondence were received from the public through letters, telephone calls, and visitor contact. The majority of commenters supported alternative B, the removal of Hurricane Rita related downed trees and woody debris from the Preserve because of the impacts flooding has on safety and local communities. Several commenters supported alternative A, the no action alternative due environmental impacts, lack of scientific

support, and park mandates related to the action alternatives. A few commenters supported alternative C, breaking up the debris and leaving it in place due to environmental impacts.

One state agency, the Texas Parks and Wildlife Department, responded to the scoping brochure. The Texas Parks and Wildlife Department supported the alternative A. If another alternative was to be chosen, the Texas Parks and Wildlife Department would prefer that the NPS choose alternative C, which would allow the woody debris to remain on site and create microhabitat for a variety of species. The Texas Parks and Wildlife Department identified the Rafinesque's Big-Eared Bat (*Corynorhinus rafinesquii*) as a state-listed species that has been documented in the project area. If during debris removal, the project area is found to contain other rare species, natural plant communities, or special features, the Texas Parks and Wildlife Department recommended that precautions be taken to avoid impacts to them.

The scoping brochure was sent to the Alabama-Coushatta Tribe of Texas for comment and consultation on November 15, 2007. A response from the tribes has not been received to date. No specific cultural areas of concern have been noted in the project area.

Internal Scoping

Internal scoping was conducted by an interdisciplinary team of professionals comprising NPS resource specialists from the Preserve, the NPS Intermountain Region, NPS blasting specialists, NPS aviation specialists, and the private contractor working with the NPS on the EA. Interdisciplinary team members met on October 16–17, 2007 to discuss the purpose, need, and objectives for the project; various alternatives; potential environmental impacts; past, present, and reasonably foreseeable future projects that may have cumulative effects; and possible mitigation measures. The team also gathered background information and discussed public outreach for the project. Over the course of the meeting, team members also conducted a site visit to view examples of downed trees and woody debris in the Little Pine Island Bayou, as well as the communities being affected by flooding. The results of the October 2007 meeting are documented in this EA.

Agency Consultation

NOTE: This section will be populated once consultation with the State Historic Preservation Office and U.S. Fish and Wildlife Service has been completed.

List of Recipients and Public Review

The EA will be released for public review in May 2008. To inform the public of the availability of the EA, the NPS will publish and distribute a letter or press release to various agencies, tribes, and members of the public on the Preserve's mailing list, as well as place an ad in the local newspaper. Copies of the Environmental Assessment will be provided to interested individuals, upon request. Copies of the document will also be available on the National Park Service website "Planning, Environment, and Public Comment" <http://parkplanning.nps.gov>.

The EA is subject to a 30-day public comment period ending May 10, 2008. During this time, the public is encouraged to submit their written comments to the NPS address provided at the beginning of this document. Following the close of the comment period, all public comments will be reviewed and analyzed, prior to the release of a decision document. The National Park Service will issue responses to substantive comments received during the public comment period, and will make appropriate changes to the EA, as needed.

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APPENDIX A

RECONNAISSANCE TRIP REPORT, MARCH 2007



United States Department of the Interior

NATIONAL PARK SERVICE
Water Resources Division
1201 Oak Ridge Drive, Suite 250
Fort Collins, CO 80525

April 13, 2007

IN REPLY REFER TO:
L54 (2380)
BITH/General

Memorandum:

To: Superintendent, Big Thicket National Preserve

Through: Bill Jackson, Chief, Water Resources Division

From: Michael Martin, Hydrologist, Water Operations Branch
Sue Braumiller, Hydrologist, Water Resources Division
John Reber, Intermountain Region Water Coordinator

Subject: Trip report for travel to Big Thicket National Preserve, March 19-20, 2007

Introduction:

Natural Resource Program Center (WASO-WRD) and Intermountain Regional Office (IMR) staff traveled to Big Thicket National Preserve (BITH) to meet with local county representatives and park staff to perform an on-site reconnaissance of timber blow-down from Hurricane Rita, and its potential to increase flooding conditions in a local community, Pinewood Estates.

After traveling to the park on Monday, we met with park staff and Third Precinct Commissioner Mr. Ken Pelt for Hardin County, Texas, to discuss the issue, background, and possible treatment options. After the initial meeting we visited the community of Pinewood Estates, where flooding frequency has reportedly increased in recent times, and observed the Little Pine Island Bayou (LPIB), the water course in question, at several locations. On Tuesday we met with a local river guide to float LPIB between Pinewood Estates and the confluence with Big Pine Island Bayou (BPIB) about 5 river miles downstream.

The purpose of directly accessing the bayou was to identify and locate any substantial channel obstructions, specifically woody debris collections that could possibly contribute to a backwater effect and increase upstream flood elevations. Additionally, we performed a general assessment of the hydraulic conveyance capacity of the channel and floodplain in its present state.

Discussion:

During the flood of October 2006, the Hardin County Commissioner participated in a helicopter flyover of LPIB with the purpose of assessing flood conditions on the bayou in general, and Pinewood Estates in particular. During that reconnaissance trip, the Commissioner observed at least two substantial collections of timber and other woody debris that appeared to have formed “debris jams” in the channel of LPIB. These debris jams appeared to have substantial mass and an elevation above the stage of the ensuing flood (Ken Pelt, Pers. Comm., 2007)

It was correctly hypothesized that one or more substantial logjams in the channel and on the overbanks of LPIB could increase the flood stage and inundate an even greater area in the already flood prone terrain. Consequently, a direct assessment of any channel blockages as well as a general characterization of channel and floodplain conveyance potential was needed for this reach of the bayou.

Due to the thick riparian vegetation, numerous sloughs, bogs, and wetland areas characteristic of the Big Thicket, and the general lack of roads, the only way to directly observe the flow hydraulics in LPIB was to navigate the channel with small watercraft.

Direct Observations:

During the reconnaissance trip, we observed three general types of woody material in LPIB: **Type I**) small to medium diameter logs (less than 2 to 3 feet in diameter) that extended from bank to bank yet were basically contained within the active channel below bankfull elevation; **Type II** - large diameter logs (greater than 3 ft) that had fallen across and spanned the channel at a relatively high elevation (top of the banks); and **Type III** - a compound woody debris collection that contained different sized logs and brush, including large diameter trees high in the channel and smaller diameter trees lower in the channel. We viewed this third type of debris collection as potentially causing the greatest obstruction to high flows and, consequently, more likely to affect upstream flood elevations. The second type of woody material, large diameter logs spanning the channel at the top of the banks, could also develop into substantial flow obstructions by collecting more debris over time.

Additionally, we made a general assessment of the amount of living timber (as opposed to deadfall) present in the channel and the relative density of living timber and collections of deadfall on the overbanks. Lastly, the general morphological character of the channel and overbanks was assessed throughout the reach.

Of the three general types of woody material present in LPIB, we observed:

Type I – 8 to 10 of the first type, relatively small timber, bank to bank, but low elevation (Figure 1).

Type II – 3 of the second type, large diameter tree(s) spanning the channel at top of bank elevation (Figure 2).

Type III – 1 of the third type, a compound collection of woody debris that provides complete or near-complete obstruction of the active channel (Figure 3).

The single Type III debris collection was located approximately 200 yards downstream from an old bridge (now removed except for its abutments), which is roughly 2 ½ miles upstream from the confluence with BPIB. The Type I and Type II debris was observed at intervals above the old bridge in the area 2 ½ to 5 miles above the confluence with BPIB – i.e., over a reach approximately 2 ½ miles in length downstream from Pinewood Estates.

We estimate that about 10 to 20 percent of the high-water channel included appreciable stands of living timber, and all of that, fairly small and not extremely dense. That is, much of LPIB was open channel at water levels existing at the time of our reconnaissance. Furthermore, while we observed continuous stands of living timber and numerous concentrations of deadfall on the overbanks, nowhere did we see a combination of wood (living and or dead) that was continuous enough to act as a significant hydraulic barrier to overbank flows. We also did not observe extensive timber blow-down on the floodplain.

Interestingly, as we approached the confluence with BPIB, the whole system appeared to lose grade with dramatically reduced flow velocities and a much less defined channel (lower banks with a less distinct floodplain). Within about two miles of the confluence, the banks of LPIB disappeared completely and the morphology of the bayou took on the characteristics of a swamp (at the time of the reconnaissance). Flow in LPIB was almost imperceptible in this reach, indicating a substantial backwater effect from the confluence with BPIB, which was flowing strongly on March 20. These observations suggest that the confluence of BPIB and LPIB creates a backwater zone for LPIB for at least some flow rates, although factors downstream of the confluence may compound the backwater condition. On the day of our reconnaissance, no substantial concentrations of woody debris were visible in this reach (the area of backwater). A previous reconnaissance trip of BPIB conducted by park staff on 2/26/2007 from Bevel Oaks Subdivision (the take out point of our trip) to about three miles downstream, was also unable to locate any extensive “logjams” or other flow obstructions, despite reports that such collections of woody debris did exist (Lisa Jameson, BITH, Pers. Comm., 2007).

Conclusions:

During our reconnaissance of LPIB, we observed some large woody debris and living timber in the active channel that certainly adds hydraulic roughness to the system during flow events, and likely raises the stage of the bayou at low to moderate flows. However, we did not observe any extensive collections of woody debris that would create complete blockages of the active channel and result in substantial increases in flood stage, with the possible exception of the combination of debris, brush, and live trees identified about 200 yards downstream from the old bridge (approximately 2 ½ miles above the confluence with BPIB), which was described in the previous section as Type III woody material. Additionally, we observed backwater conditions up to two miles above the confluence with BPIB. The backwater appeared to be due to combined BPIB and LPIB flows, possibly compounded by factors downstream of the confluence of the two.

While we did not observe any debris collections that appeared to be detrimental in affecting flood stages, all of the large trees spanning the channel at bankfull (Type II debris) could possibly create such conditions in the future (Figure 4).

The collections of woody debris, brush, and (or) living trees that we observed in LPIB were largely contained in the active channel (Type I). While this sort of woody material certainly reduces the flow conveyance of LPIB (raising the stage and maintaining elevated stages for longer periods of time) under flow rates that occur with some frequency, it would exert a diminished hydraulic affect during out of bank flows, such as those resulting in flood conditions in Pinewood Estates, since a large portion of flood waters move over the floodplain at these times. Additionally, Type I materials (deadfall, brush, and living trees) are dispersed at a great many locations in LPIB, particularly between Pinewood Estates and the old bridge, and are an important component of the bayou ecosystem, providing both refuge and a nutrient base.

Recommendations:

The following recommendations are presented with the understanding that woody debris is a substantial benefit to aquatic ecosystems. Woody debris collections may become problematic if they accumulate to a great enough height and lateral extent that they substantially affect out-of-channel flows and potentially increase upstream flood stages. During our site visit, we did not observe any such obstructions, nor did we identify any woody debris collections that would obviously become such obstructions. Sediment transport (including woody debris) is a highly dynamic, episodic process, and therefore, all of the woody debris collections we observed are subject to remobilization and redistribution.

Type I debris collections: Woody debris within the active channel should remain in the LPIB stream system to provide habitat, refuge, foodbase and other ecological functions associated with such material. This is especially true of the Type I debris collections we identified because they are subject to fairly frequent inundation. If at some time in the future, park staff would like to consider providing un-hindered boat access through LPIB, then limited breaching of the more problematic debris collections could probably be accomplished with little or no effect on the aquatic ecosystem.

Type II debris collections: Cross-channel, woody debris collections, such as that pictured in Figure 4, have a potential of becoming a complete channel obstruction and affecting flood levels upstream. Consequently, breaching these potential barriers, located primarily above the old bridge (2 ½ to 5 miles upstream of the confluence with BPIB), could be beneficial in reducing this potential. Trees spanning the channel of LPIB at bankfull elevation could be cut into several pieces and dispersed on the adjacent floodplain without significantly affecting the flow carrying capacity of the floodplain. This task could possibly be accomplished during the dry season with appropriate timber harvesting tools. However, before undertaking such an operation, it is important to remember that these woody debris collections are only *potential* obstructions, with no certainty that will become problematic.

Type III debris collections: The single Type III debris collection identified (about 200 yards downstream of old bridge crossing) was the only site where a substantial backwater effect appeared possible. Given the relatively easy access, hand cutting and redistribution of the more “structural” logs during the dry season would not only reduce the potential obstruction, but would also allow a simple logistics and feasibility assessment of this type of operation.

cc:

BITH – Hoagland

1211 – Wise

2370 – Dickison

2380 – Jackson, Rosenlieb, Smillie

USGS – Patterson



Figure 1 – Type I woody debris, small to medium diameter logs that extend from bank to bank but are relatively low in the channel. This type of debris collection creates hydraulic roughness and may increase flow stage and decrease flow capacity during low to moderate flow events. During high magnitude, out-of-bank flows, this type of woody debris jam exerts a diminished effect on floodflows. This type of woody debris within the channel is an important part of river/bayou ecosystems, providing substrate, foodbase and refuge for aquatic organisms.



Figure 2 – Type II woody debris, large diameter logs that completely span the channel at a relatively high elevation. This type of debris collection may affect the higher magnitude, out-of-bank flows to some degree, however, unless the blockage is more complete, the effect would be fairly minimal. Through time, this type of debris jam could evolve into a more problematic channel obstruction by collecting more debris and becoming a complete or near complete channel obstruction.



A



B

Figure 3 – Type III debris. Photo A - view from upstream. Photo B - large diameter log on downstream side of debris jam.



Figure 4 – An example of a Type II debris collection that has potential of becoming a complete channel obstruction.