

**MANAGEMENT PLAN FOR
YAMATO SCRUB NATURAL AREA**

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THE PALM BEACH COUNTY NATURAL AREAS SYSTEM

MANAGEMENT STATEMENT

The Palm Beach County Natural Areas System is comprised of those environmentally sensitive lands that are owned or leased by the County and managed as Natural Areas by the County's Department of Environmental Resources Management. These Natural Areas were selected on the basis of their biological characteristics and were acquired to preserve the rare and diverse native ecosystems present on these sites and the endangered, threatened, and rare species of plants and animals that live there.

Purpose and Goals of the Natural Areas System

- o The purpose of the Natural Areas System is to protect historic native ecosystems and their biological diversity throughout Palm Beach County. Examples of each ecosystem shall be acquired and managed to preserve in perpetuity the full complement of plants and animals characteristic of that ecosystem. The management of each Natural Area shall be coordinated with that of the other Natural Areas in the system to support existing populations and to reflect in perpetuity the subtropical biological diversity characteristic of Palm Beach County in pre-development times.*
- o The wilderness values of each Natural Area shall be preserved.*
- o Where a Natural Area currently is physically or biologically connected to another publicly- or privately-owned Natural Area, attempts shall be made to maintain that connection through additional land acquisitions, regulatory preserve set-asides, conservation easements, interlocal agreements, and other appropriate actions.*

Management Considerations

- o The Natural Areas in the system shall be available to the public for passive, resource-based recreation, environmental education, and scientific research. Public use shall not take precedence over ecosystem protection. Proposed public uses shall take into account the specific environmental conditions of each Natural Area, and may be modified in response to changing environmental conditions.*
- o Facilities for passive public use shall be provided on each site. These facilities shall be designed to have a minimal impact on native ecosystems and shall be located in previously disturbed areas as much as possible.*

- o Facilities, structures, or roads other than management or access roads that would cause fragmentation of a Natural Area shall not be permitted within a Natural Area. The establishment of compatible land uses and activities on lands adjacent to a Natural Area shall be encouraged.
- o To the extent possible, fire-maintained native ecosystems shall be burned at the appropriate interval and season, as determined by historical data, to maintain those ecosystems. Burns shall be conducted by trained personnel, using a prescribed burn plan that addresses safety and smoke concerns. The seasonality of prescribed burns may be adjusted for initial fuel reduction burns and site safety constraints.
- o Where ecosystems within a Natural Area have been impacted by invasive, non-native plant infestations, land-clearing activities, drainage, or flooding, attempts shall be made to restore those ecosystems to their previous condition or to a natural ecosystem best suited to the existing conditions on the Natural Area.
- o The special requirements of listed species shall be considered in developing management strategies for each Natural Area, but management for an individual species shall not take precedence over management of an entire ecosystem or be allowed to have a detrimental impact on that ecosystem's complement of species.

Management Plan Development

- o A specific management plan, based on biological, hydrological, and historical information and interpretation of this information, shall be written for each Natural Area that takes into account the environmental conditions found on that Natural Area. Each management plan shall address the strategies and techniques that will be used to manage and restore native ecosystems, to protect listed species, to control the occurrence of invasive, non-native plants and animals, to allow for appropriate public access, and to prevent unauthorized access and activities. Each plan shall be reviewed by the Palm Beach County Natural Areas Management Advisory Committee (NAMAC), a citizens' advisory board, and the public shall be invited to comment on the plan at a public hearing held by NAMAC in the community in which the site is located. Following NAMAC review of the comments received, the plan shall be sent to the Board of County Commissioners for approval. Each approved plan shall be subsequently reviewed at least every five years by NAMAC.

EXECUTIVE SUMMARY

The Yamato Scrub Natural Area was originally the Yamato Scrub Conservation and Recreational Lands (CARL) Project and is composed of a large State-owned tract and a smaller tract that is jointly owned by the City of Boca Raton and Palm Beach County. The Natural Area is located within the northern portion of the City of Boca Raton. The total area of the site is approximately 217 acres. Palm Beach County leases the majority of the site from the State of Florida. This site was acquired in two purchases in 1994 and 1997. Funds for the acquisitions were provided from the Palm Beach County Environmentally Sensitive Lands Bond Issue Referendum of March 12, 1991, the City of Boca Raton Environmentally Sensitive Lands Referendum of October 12, 1991, and Florida's Preservation 2000 Program through the Conservation and Recreational Lands program. Acquisition of this Natural Area has assisted Palm Beach County and the City of Boca Raton in implementing several policies within their respective Comprehensive plans.

Scrub, pine flatwoods, scrubby flatwoods, drained basin marsh, and prairie hammock are the predominant natural communities present on the site. The Natural Area contains important habitats for many rare and/or endemic plant and animal species. Thus far, 12 plant and 15 animal species recorded for the site have been listed as having some degree of endangerment by at least one government agency or nonprofit environmental organization.

The primary objective for management of this site is to ensure the preservation of high-quality scrub, mesic flatwoods, scrubby flatwoods, and prairie hammock vegetative communities and their associated wildlife populations. The secondary objectives are to provide for passive recreation, environmental education, and scientific research consistent with protecting the natural resources of the Natural Area.

Fire exclusion and suppression, draining of wetlands by lowering ground water levels, exotic pest plant invasion, illegal dumping, construction of adjacent roads and buildings, and off-road vehicle traffic have all impacted the site. These factors must be dealt with in the management of the Natural Area. The management plan must also deal with the special challenges associated with managing an isolated natural area that is surrounded by urban and suburban environments.

To protect the natural vegetation communities and wildlife of the site, public use must remain limited to passive, non-consumptive recreation; environmental education; and scientific study. Footpaths, handicapped-accessible nature trails, and interpretive displays will provide valuable opportunities for the public to observe the site's distinctive plant communities and associated animals, while also imparting an appreciation of their biological uniqueness. Parking facilities and educational materials will be developed to enable use of the site for environmental education. Scientific research will include monitoring of populations of rare and/or endemic species and evaluation of restoration and management techniques.

This management plan has been developed to provide basic information on the resources of the Natural Area and the management strategies that will be implemented to protect those resources. A stewardship report will be provided to the Division of State Lands each year. The management plan for the Yamato Scrub Natural Area will be reviewed at least once every five years by the Palm Beach County Natural Areas Management Advisory Committee and revised as necessary on the basis of new information, improvements in management techniques, or other relevant factors.

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I. GENERAL INFORMATION

A.1 Location and Description

The 217-acre Yamato Scrub Natural Area is located in the northern portions of the City of Boca Raton in Palm Beach County, a large, rapidly-growing county. The population of the county in 1999 was estimated to be 1,042,200. The Natural Area is within the municipal limits of the City of Boca Raton, which had a 1999 estimated permanent population of 70,000 (Figure 1). It is bounded on the east side by the CSX Railroad and Interstate 95. It is bordered on the south side by the Arvida Park of Commerce industrial park and Clint Moore Road, and on the west side by the Arvida Park of Commerce industrial park, the Lake Worth Drainage District (LWDD) E-4 (El Rio) Canal, and Congress Avenue. It is bordered on the north side by the Boca Commerce Center industrial park, NW 6th Avenue and the Alliant Foods warehouse. The northwest corner of the Natural Area fronts on Congress Avenue, a four-lane divided highway that is a major north-south transportation route in coastal Palm Beach County (Figure 2). The site is also divided into north and south halves by Clint Moore Road, a four-lane divided highway that narrows to two lanes east of the Natural Area, and by the LWDD L-40 Canal.

John D. MacArthur State Park is 29 miles to the north of the Natural Area, Hugh Taylor Birch State Recreation Area is 16 miles south of the site, and John U. Lloyd State Recreation Area is 20 miles to the south. The Arthur R. Marshall Loxahatchee National Wildlife Refuge is 8 miles to the west, and the Everglades Wildlife Management Area (Conservation Area No. 2A) is 12 miles to the southwest. The Delray Oaks Natural Area is 0.7 miles to the north and the Seacrest Scrub Natural Area is 5.2 miles to the north. Other significant coastal parks and preserves within a 5-mile radius of the site, listed from north to south, are Caloosa, Morikami, and Atlantic Dunes County Parks; Leon Weekes Environmental Preserve in Delray Beach; Patch Reef, Spanish River, Red Reef, and Sugar Sands Greater Boca Raton Beach and Park District Parks; Rosemary Ridge, Gopher Tortoise, Serenoa Glade, Cypress Knee and Blazing Star Nature Preserves in the City of Boca Raton; South Inlet County Park, and Deerfield Island Park in Broward County. All of the previously-mentioned sites that are within a 6.5-mile radius of the Natural Area are identified in Figure 1. Since the Natural Area is separated from these other public lands by significant barriers such as major roads and large developed areas, there are no potential ecological or recreational linkages other than pedestrian pathways or bicycle lanes.

A legal description of the property is provided in Appendix D. According to the surveys, the total acreage of the site is 217.12 acres. This acreage does not include the canal banks and maintenance roads on the LWDD L-40 and E-4 Canals. The acreage breakdown of the two tracts within the Natural Area is as follows: State-owned tract - 206.74 acres (Williams, Hatfield, and Stoner, 1996); and the City- and County-owned tract - 10.38 acres (Keith and Schnars, 1992). The location of these two tracts within the Natural Area is shown in Figure 3.

A.2 Management Constraints

The Yamato Scrub Natural Area will be managed under the single-use concept by Palm Beach County. The CARL project portion of the site must be managed under the constraints imposed by the 50-year state management lease from the Board of Trustees of the Internal Improvement Trust Fund (BTITF) of the State of Florida (Appendix F). This lease states that the County shall manage the leased premises only for the conservation and protection of natural and historic resources, and for resource-based public outdoor recreation which is compatible with the conservation and protection of these public lands, as set forth in

subsection 253.023(11), Florida Statutes. Under Section 253.034, Florida Statutes, the County must submit a management plan for the leased premises that is in accordance with Chapters 18-2 and 18-4, Florida Administrative Code (FAC). This management plan must be submitted within a year of the effective date of the lease. The plan must contain the information required under subsection 259.032, Florida Statutes.

The size, shape, and location of the Natural Area does not pose management constraints that would limit management options, although the proximity to Interstate 95 does limit some of the options for prescribed burning. The portions of the site proposed for public-use facilities were historically wetlands, but are currently uplands not susceptible to flooding because of a regional drawdown of the water table by the drainage canal network. Otherwise, the most significant management constraint on the Natural Area is the requirement to protect rare and endangered plants, animals, and ecosystems. There are no other known legislative or executive constraints that affect the development or management of the site. The Natural Area is not within an aquatic preserve or a designated area of critical State concern, and is not under study for such a designation.

The BTIITF holds a 100% title interest in the 206.74 acres of the Yamato Scrub Natural Area that were purchased under the CARL Program as a joint city/county/state acquisition. The State-owned portion of the Natural Area is leased to Palm Beach County for management under a 50-year lease that runs until the year 2047. A copy of this lease is provided in Appendix F. Copies of deeds are provided in Appendix E.

A.3 Easements and Encumbrances

There are six easements affecting the Natural Area - two on the CARL project tract and four on the City- and County-owned tract. Florida Power and Light (FPL) has a 36-foot utility easement on the southern border of the LWDD L-40 Canal in the CARL tract. This easement is used primarily for access to the Boca Teeca substation and contains a 12-foot-wide lime rock road that is accessed via the Boca Raton Shrine Club property. This easement also contains an electrical transmission line. Also on the CARL tract is a 15-foot City of Boca Raton utility easement along portions of the northern border of Clint Moore Road. The City uses this easement for a water force main.

There are four easements on the City- and County-owned tract. The northern 82 feet of this tract is an easement for the LWDD L-40 Canal. Immediately south of the LWDD easement is a 20-foot FPL easement for an electrical transmission line. Another FPL easement is found on the western 12 feet of this tract, however, it appears to be unused as all power poles are located west of the easement. A 10-foot utility easement runs along the southern border of the tract just north of the Clint Moore Road right-of-way. Copies of easements are provided in Appendix E.

An electrical distribution line runs along the eastern 10 feet of the State-owned tract from the L-40 Canal to the Alliant Food Service property. It is not known whether FPL has an easement for this distribution line.

The only other encumbrance on the Natural Area are several old BTIITF deeds retaining oil, mineral, and right-of-way reservations on various portions of the State-owned tract (Appendix E). Since the BTIITF is now the owner of the State-owned tract, these reservations are now incorporated into the BTIITF's 100% ownership.

A.4 Public Involvement in Plan Development

On August 16, 1994, the Palm Beach County Board of County Commissioners adopted Resolution 94-1051, which established a seven-member Natural Areas Management Advisory Committee (NAMAC) to review and comment on management plans developed by staff for natural areas acquired and/or managed by the County and to hold public hearings on these plans prior to their review and adoption by the Board. The members of NAMAC were first appointed on November 1, 1994. The membership categories are: a member with experience in the management of natural areas, a biological scientist, a professional educator with knowledge of South Florida ecosystems, a representative of a local municipal government public recreation program, a member of the Palm Beach County Parks & Recreation Department staff, a citizen having an interest in natural areas, and a member of the County's Conservation Lands Acquisition Selection Committee (CLASC). Upon sunset of CLASC or its successor committee, this position will be filled by a citizen with an interest in natural areas. In order to meet state standards for the required advisory group, representatives of the Palm Beach County Soil and Water Conservation District and the City of Boca Raton have been added to NAMAC to participate in the review of the Yamato Scrub management plan.

As part of their responsibilities, the members of NAMAC held a joint public hearing with the City's Parks and Recreation Advisory Board and Environmental Advisory Board on the proposed management plan for the Yamato Scrub Natural Area on December 7, 2000 at the Gumbo Limbo Nature Center in Boca Raton. The publicly-noticed public hearing was held in the evening, and followed an afternoon open house at which the public was able to review and discuss the management plan and a display of the plan for the public use facilities with County staff. Copies of the plan were available at public facilities such as libraries for two weeks prior to the open house and public hearing, and were available to the public at the offices of the County's Department of Environmental Resources Management for four months prior to the public hearing. Members of the public who could not attend the hearing to submit written or oral comments were allowed to submit written comments to the County during the week following the hearing. A summary of public comments received during the public hearing process is contained in Appendix K. NAMAC members will take those comments into consideration prior to their approval of the plan and recommendation to forward it to the Board of County Commissioners. Members of the public also may comment on the plan at the time it is considered by the Board. Another public hearing will be held in Tallahassee by the State's Acquisition and Restoration Council (ARC) after BCC approval. ARC members will take these comments under consideration during their review and final approval of the management plan for the State. No public opinion surveys are anticipated to be conducted prior to adoption of the plan. However, visitors to the site and user groups could be surveyed prior to the first review and revision of the plan if a volunteer group project or student project is proposed. No other mechanisms for public input are proposed at this time.

A.5 History

The Yamato Scrub was formed by a long series of natural processes dating back millions of years. The former wetlands north of the site were originally the estuary of a river that flowed into the Atlantic Ocean when sea levels were higher. Sand from river transport and littoral drift built up in dunes on the south side of the estuary, and on the Atlantic shoreline south of the estuary mouth. These dunes became the scrub natural community found in the northern and eastern portion of the site. At the southern and western shoulders of the dune, shallower sand deposits resulted in the formation of the present-day pine flatwoods communities. In the low area between the dunes where no sand was deposited, a basin marsh formed that existed until recent drainage lowered the water table. When ocean water levels fell, and the Pamlico Ridge formed to the east of the Natural Area, the ridge blocked the estuary mouth, and a freshwater marsh referred

to as the Yamato Marsh formed (Austin 1977). Excess water from the Yamato Marsh system and the basin marsh on site flowed south through a north-south wet prairie/marsh swale to the Hillsboro River, which had cut through the Pamlico Ridge. Vegetation type was largely determined by elevation - scrub was found at elevations 15 feet and higher, pine flatwoods between 15 feet and 11 feet in elevation, wet prairie and basin marsh between 11 and 9 feet in elevation, and deep freshwater marshes below 9 feet in elevation.

The first major disturbance in the vicinity of the Yamato Scrub Natural Area was the clearing in 1890 of a sand road that connected the northern and southern portions of what was then Dade County. This road ran from Lantana at the southern end of Lake Worth to Lemon City at the northern end of Biscayne Bay. This road would have been located approximately one mile east of the Natural Area, but an exact location is not known. Early street maps of Boca Raton show a county road existing on the same location that would later be occupied by U.S. Highway 1 or Federal Highway. It is possible that all or portions of the county road became U.S. 1. The next disturbance was the construction in 1895 of Henry Flagler's Jacksonville, St. Augustine and Indian River Railroad (the present-day Florida East Coast Railroad), which was located approximately 3/4 of a mile east of the site. The first settler in Boca Raton, Thomas Rickards, built a home the same year.

Flagler received most of the land adjacent to the railroad from the State of Florida as an incentive to build the railroad. He wanted to encourage the production of agricultural commodities on this land as a way to produce freight and passengers for his trains to carry. Flagler's Model Land Company sold some of the railroad land to Joseph Sakai in 1903, and worked with him to encourage Japanese immigrants to come to the area and farm Sakai's land. The first immigrants came in 1904 (Palm Beach Post, 1999) to what was now known as the Yamato Colony. Yamato is reportedly the Japanese word for "large, peaceful country". There were apparently difficulties in getting the immigrants entry into the United States, and railroad correspondence indicated that the immigrants had to be classified as "students" to get approval.

The Japanese settled on the north and south sides of Yamato Road just east of the Interstate 95 interchange. This area was just south of the Natural Area, and was on the same sand ridge that contains the scrub natural community on this site. The immigrants primarily raised pineapples as a cash crop, but also grew silk, tea, tobacco, rice, and peppers (Austin 1977). The colony thrived initially, and had 50 acres under cultivation by 1906. It grew to 40 to 50 persons and 10 dwellings by 1908 (Miami Herald 1944). Yamato Road was built eastward to connect to the Florida East Coast (FEC) Railroad and the county road. The profitability of pineapple farming declined when the FEC Railroad reached Key West in 1912 and provided easier and quicker transportation to northern markets for competing Cuban growers. Fungal diseases also reduced pineapple yields. Without a profitable cash crop, the younger members of the Yamato Colony drifted away to other pursuits, and the colony began a gradual decline which accelerated in the 1920s (Miami Herald 1944). However, the colony remained viable long enough to have a post office and a general store, and a railroad station was constructed at Yamato Road and the FEC railroad tracks in 1907 (Austin 1977).

Other settlers also arrived in the Boca Raton area, and grew vegetables on the muck lands west of what would become the Atlantic Intracoastal Waterway, and citrus on the sand ridges. In the early 1910s, the state built Dixie Highway parallel to the FEC Railroad. In 1915, the Lake Worth Drainage District (LWDD) was formed, and began to dig a network of canals to drain the area west of the coastal ridge and east of State Road 7/U.S. Highway 441 that lay between Okeechobee Road and the Hillsboro Canal. Major north-

south canals called equalizing canals were dug every 2 to 2.5 miles, and smaller east-west lateral canals were dug every half mile. Equalizing Canal 4 (known as the E-4 Canal in northern part of the site and the El Rio Canal in the southern) forms the western boundary of the northern portion of the Natural Area, while Lateral Canal 40 (L-40 Canal) cuts the site in half. The E-4 Canal ran mostly through the center of a wetland swale system that was located between the coastal sand ridges and the more westerly pine flatwoods. It had a divide structure at the northwest portion of the site where Congress Avenue currently crosses the canal. This structure appears in a 1940 aerial photograph (USDI 1940) as a sand berm with a culvert going through the berm. The structure held water in the canal at a higher level on its northern side, presumably to allow for irrigation of nearby farm fields. The L-40 Canal extended eastward from a wetland swale system through the Yamato Scrub ridge to an arm of the Yamato Marsh that lay in the present-day Hidden Valley and Boca Teeca developments.

Initially, the LWDD canal system was not as wide or deep as it is presently, and was not as effective at draining the former wetlands on the Natural Area as it is today. The spoil from the canal excavations was placed along the canal banks, limiting direct surface flows into the canals. Although the canals did result in reduced and shallower hydroperiods in the site's wetlands, they did not end the functioning of the wetlands until a much later date.

In the 1920s, the Florida land boom was in full swing in the Boca Raton area, which previously only had agriculture as an industry. The Delray Manors subdivision was platted north of Yamato Road and east of the FEC Railroad, but only a few streets were cleared and no houses were built. Addison Mizner and his Mizner Development Company made plans to develop up to 16,000 acres in the Boca Raton area. In 1925, the City of Boca Raton was incorporated. Mizner Development platted the Villa Rica subdivision south of Yamato Road and east of the FEC Railroad, the Floresta subdivision north of Palmetto Park Road, and began construction of a grand resort hotel on the west shore of Lake Boca Raton. This hotel opened as the Cloister Inn in 1926. The roads in the Villa Rica subdivision were cleared, but no homes were built. Homes were built in the Floresta subdivision. In 1927, U.S. Highway 1 or Federal Highway was constructed through Boca Raton east of Dixie Highway, and the Seaboard Airline Railroad (present-day CSX Railroad) was built west of the city limits. The CSX Railroad today forms the eastern border of the Yamato Scrub Natural Area. Construction of this railroad was likely the impetus for the cutting of all of the slash pine trees on site which were large enough to have saleable timber. The existing cut lighter pine stumps at this site seem to date back to about this time.

The Florida land boom collapsed in the late 1920s after two devastating hurricanes and the end of the land speculation bubble as investors withdrew their money. Mizner Development Company went bankrupt and the Cloister Inn and surrounding lands were purchased by Clarence Geist. Geist called the inn and its grounds the Boca Raton Club, and his Spanish River Land Company filed plats and tried to sell lots. After Geist died in 1938, it was revealed that he had lost money on his real estate activities in Boca Raton. The City of Boca Raton and the Geist interests collaborated in the construction of the first Boca Raton airport in 1936. This airport consisted of a triangle of grassed runways and was located in drained wet prairie west of the El Rio Canal and north of Glades Road. The airport flooded after heavy rains. Federal Works Project Administration funds were sought for paved runways and a hangar building, but were apparently never obtained.

The first aerial photographs of the Natural Area were taken from a blimp by the U.S. Army in 1927, and were

compiled into a coastal map by the U.S. Coast and Geodetic Survey in 1930 (USCGS 1930). These photographs are no longer in the public domain and were not available to ERM. The coastal map shows a site in which the natural communities seem to be intact. The LWDD Canals, Seaboard Airline Railroad, and Yamato Road are present, as are the clearings for the Yamato Colony. The Yamato Marsh is labeled as a grassy slough, but some of the higher spots are being shown as cultivated fields. A jeep trail is shown on the map heading westward from Dixie Highway, across the FEC Railroad tracks, and around the southern end of the Boca Teeca arm of the Yamato Marsh. The trail then turned and headed northwest, crossing the Seaboard track and into the Natural Area scrub ridge. The trail continued northwest until it crossed the L-40 Canal, where it swung to the northeast and followed what was then the ecotone between the scrub community and the pine flatwoods. When the scrub ridge swung back to the west, the trail followed the ecotone westward and left the Natural Area when it crossed the sand berm control structure in the E-4 Canal. Portions of this jeep trail still exist in the northern and eastern portions of the site today. The first aerial photographs available to ERM were taken in 1940 by the U.S. Army Air Force (USDI 1940). They do not show many changes from the 1930 map. They show the City airport and the Yamato Colony clearings, which are now regrowing with vegetation. Water is still present in the Yamato Marsh, but the higher spots are exposed, and some are being farmed.

In 1941, Boca Raton had a population of around 400 persons, and the Yamato Colony had dwindled to two families (Miami Herald 1944). The United States' entry into World War II would cause drastic changes. The Army Air Force was looking for locations for year-round training bases, and Boca Raton lobbied heavily for a base to be located at its airport. Despite an Army visit that occurred when there was six inches of water on the runways, the airport was selected as the Army Air Force's main base for radar training. By December 1942, the Army had acquired or leased 5,820 acres of land, including most of the Yamato Colony and the Boca Raton Club. The base roughly extended westward from the FEC Railroad tracks to the Seaboard tracks and the present location of Military Trail, south to Palmetto Park Road but excluding the Floresta subdivision, and northward to the L-40 Canal. The only portion of the natural area within the base's border was the City- and County-owned tract north of Clint Moore Road. A 1945 map shows that the eastern border of the base was the same as the western border of the southern part of the Natural Area (U.S. Engineer Office 1945).

Construction of the Boca Raton Army Air Field started on June 29, 1942 and was completed on January 14, 1943. Construction companies were hired from all over south and central Florida and approximately 800 buildings were constructed along with a water and sewer plant. Two new runways were constructed to form another triangle north of the existing triangular runways, and all the runways were paved. Total cost for the air field was \$10 million. The air field and facilities were constructed in the flood prone area west of the El Rio Canal, while the buildings were constructed on the higher scrub ridge east of the canal. The buildings were laid out in a dispersed, random fashion with minimal removal of existing vegetation, in order to reduce potential damage from enemy air raids. The only air base facilities near the Natural Area were the pistol and rifle ranges, which were constructed in the former wet prairie southwest of the natural area, north of Yamato Road and east of the El Rio Canal. A ditch was dug near the El Rio Canal to provide fill for a raised sandbank to stop bullets, and firing lines were established at 100, 200, and 300 yards.

The treatment of the two remaining Yamato families was especially unusual. They were well-regarded by their neighbors, and were considered no threat to the nation's war effort, so they were not interned as were many other persons of Japanese descent (Miami Herald 1944). After selling their land to the Army, they

moved elsewhere in the area. One house was moved offsite and the other used for base housing. The farm sheds and buildings were torn apart to resemble a bombed village, and used as a training and obstacle course to teach aviators how to survive when shot down (Miami Herald 1944). This obstacle course was located in the former wet prairie located just north of present-day Spanish River Boulevard and east of the El Rio Canal (U.S. Engineer Office 1945).

By 1945, the air base hit its peak population of 16,000 persons stationed on site. After the war ended, the personnel were quickly discharged or transferred and the base was down to 2,500 persons by May 1946. In 1947, the decision was made to close the air base and move the remaining personnel to Kessler Field in Mississippi. A strong hurricane in the late summer of 1947 caused \$3 million in damage to the base, and the base shutdown was accelerated. In 1949, the air field portion of the base, including the El Rio Canal, was turned over to Boca Raton to run as a commercial airport, and the other lands sold off to private individuals. The Boca Raton Club had already been sold off in 1944 and had been renamed the Boca Raton Hotel and Resort. Joe Moore bought the eastern portions of the base containing the housing areas and buildings, and platted them as the Boca Hills subdivision. Lots and buildings were sold to individuals, many of whom were former military personnel who had been stationed in the area during the war. They liked living in Florida, and decided to return. Today, virtually all of the air base's wooden buildings are gone, but some of the larger, more substantial buildings remain. Many of these buildings can be identified by their peculiar "H" shape. Most of the air base roads became Boca Raton streets, including portions of major roads such as Spanish River Boulevard, Boca Raton Boulevard, and NW 20th Street, which was the main base entrance. The northern and western portion of the air base, including the City- and County-owned tract, were sold to M.A. Weaver in 1950. He resold these lands to Arthur V. Davis in 1952, who transferred ownership to the Arvida Corporation in 1958.

During the 1920s and 1930s, taxes were not paid on the land in the southern and eastern portions of the Natural Area. The Trustees of the Internal Improvement Fund (TTIIF) of the State of Florida gained title to the land under a 1937 law, and began to convey it to others for back taxes owed, while retaining oil, mineral and road right-of-way reservations. TTIIF deeds were issued between 1942 and 1951 and some of the land was conveyed several times. Deeds were issued to Lake Worth Drainage District, W.S. Carper, Boca Raton Land Corporation, Neil MacMillan, and Palm Beach County.

The 1947 hurricane and other tropical storms caused widespread flooding in south Florida. In 1948, Congress authorized the Central and South Florida Project to provide flood control, water supply, and protection of fish and wildlife resources in the region. The project would lead to the construction of 1,000 miles of canals and levees, 150 water control structures, and 16 major pump stations. The project would have a major effect on the region, with many wetlands systems drained or channelized, but would not effect the Yamato Scrub area until the early 1960s. However, localized drainage efforts for agricultural purposes continued, and a 1953 photograph (USDI 1953) shows a decline in flooded areas within the Yamato Marsh. The photograph also shows a new north-south drainage ditch running south from the L-40 Canal to the CSX Railroad, approximately 600 feet east of the El Rio Canal. This ditch increased the drainage of the wet prairie and basin marsh, including the portions in the City- and County-owned tract of the Natural Area. This ditch is still present in this tract today as a dry swale. The 1953 photograph also seems to indicate that a wildfire had occurred at the Natural Area several years earlier. This wildfire would have been the last natural fire to occur in the southern portion of the site.

Land holdings were rapidly changing hands at this time, although no construction of dwellings was occurring. A 1955 land atlas shows that the northern portion of the Natural Area was owned by Stonehenge Florida Corporation, while the southern portion was still owned by Boca Raton Land Company. By 1958, the southern portion was now owned by the Florida Boca Raton Housing Association and Centar Development Corporation. In 1958 and 1959, the City of Boca Raton annexed the Natural Area, and zoned it light industrial in the mid-1960s.

In the early 1960s, the Central and South Florida Project began to affect the site. The LWDD L-38 Canal, which previously terminated at the E-4 Canal, was extended eastward for 1.75 miles to the Atlantic Intracoastal Waterway (ICW) as the much wider C-15 Canal. The E-4 Canal between the C-15 Canal and the sand berm control structure was also widened at this time. Previously, the only outfalls for the E-4 Canal were the Boynton Canal to the north and the Hillsboro Canal to the south. Both of these canals were some distance away from the Yamato Marsh, which limited the drainage ability of the E-4 Canal. With a new direct route to the ICW, water levels dropped further in the E-4 Canal and virtually all the standing water in the Yamato Marsh had disappeared in a 1965 aerial photograph (Palm Beach County Property Appraiser 1965). The portions of the marsh north of the Natural Area were converted to cattle pasture by the MacMillian family and a cattle corral is present in the 1965 photograph. All the water in the basin marsh within the Natural Area also seems to have disappeared, leaving a herbaceous depression with scattered cabbage palms and remnant patches of sawgrass.

Development reached the vicinity of the Natural Area in the early 1960s. By 1962, the Hidden Valley Country Club had built a golf course on the portion of the Yamato Marsh lying east of the CSX Railroad and between the C-15 and L-40 Canals. The golf course was built in the lowest portion of the marsh, and roads were built on the surrounding higher land for housing. A new north-south canal was also dug between the C-15 and L-40 Canals approximately 600 feet east of the CSX Railroad. Houses were also being built at this time in the previously platted Delray Manors and Villa Rica subdivisions. Florida Atlantic University was founded in 1964 on the City-owned portion of the old air base. The airport was reduced to the area surrounding the northwest runway, and the rest of the site turned over to the university. Buildings were constructed on and between the former runways, and many of the old runways were used for parking areas.

Other changes are also visible in the 1965 aerial photograph. An electric power transmission line had been recently constructed, running north along the west side of the El Rio Canal from below the Natural Area to the L-40 Canal. The power line turned east and cut through the Natural Area on the south bank on the L-40 Canal until it crossed the CSX Railroad. The power line then turned north and paralleled the railroad tracks until it crossed the C-15 Canal. Portions of the low scrub on the south bank of the L-40 Canal were cleared at this time to permit installation of power line poles. The jeep trail that cut across the scrub ridge in the southern portion of the Natural Area had fallen into disuse and had nearly disappeared by 1965. Vehicles were instead coming up from Yamato Road and paralleling the east side of the CSX tracks. They crossed the L-40 Canal on the east side of the CSX embankment, and crossed the railroad tracks, turning west on a new trail north of the L-40 Canal until it rejoined the older jeep trail. The new trail north of the L-40 Canal continued west past the jeep trail junction until it reached the E-4 Canal, where it turned north and paralleled the canal until it rejoined the jeep trail at the sand berm crossing. The 1965 photograph also shows some signs of a wildfire having occurred recently in the northwest portion of the site west of the former wetland. Charred areas are still visible today at the base of some of the cabbage palms in this area. This would have been the last known wildfire in the northern portion of the site.

The 1965 aerial photograph also shows a series of north-south cuts 200 feet apart in the vegetation in the southern portion of the Natural Area. These cuts were presumably for survey purposes to determine the elevation of the scrub ridge. The Boca Teeca Corporation purchased the entire Natural Area and the land east of the southern portion in 1967. Development of the land east of the Natural Area proceeded rapidly, and a golf course and condominium buildings are visible in a 1970 aerial photograph (Palm Beach County Property Appraiser 1970). The golf course was built on both the remnants of the Yamato Marsh and also on the scrub ridge. By 1970, Yamato Road had been extended as a two-laned paved road across the CSX Railroad and the El Rio Canal to Military Trail. Congress Avenue extended south to the C-15 Canal, where it stopped right after crossing the canal by a bridge. The 1970 aerial photograph also shows northwest-southeast survey cuts in the southern portion of the natural area; they are presumably for the extension of Clint Moore Road.

A surge in electrical transmission facility construction occurred at this time. The 1970 aerial photograph shows the newly-built Boca Teeca substation, which is located just south of the L-40 Canal and just west of the CSX Railroad. To provide access to this substation, a shellrock road was constructed on the east side of the El Rio Canal from Yamato Road to the L-40 Canal, where it turned east along the south bank of the canal and connected to the substation. This road runs through the western and northern portion of the City and County-owned tract, but Florida Power and Light (FPL) access rights have been terminated on this tract. FPL still has access rights on the portion of this road in the state-owned tract. Another FPL substation is present just west of the El Rio Canal and just north of the L-40 Canal. This substation was accessed from the west by a road on the north side of the L-40 Canal.

The 1970s were the decade of the roads at the Yamato Scrub Natural Area. In the early 1970s, Congress Avenue was extended southward as a two-lane road to Yamato Road. This road crossed the C-15 Canal, turned southwest and crossed the E-4 Canal over the old sand berm control structure, and turned and headed south to Yamato Road on a line 1000 feet west of the canal. This road now forms a portion of the western boundary of the Natural Area. The road was constructed on the eastern half of the right-of-way next to the site, with the western half reserved for future expansion. Congress Avenue was a deserted, low-traffic road in an uninhabited area when it was first constructed. The old jeep trail connected to Congress and provided an access for illegal dumpers, who for the next decade would dump huge amounts of used tires, other auto parts, and construction debris on either side of the western 500 feet of the trail. This debris was removed during site cleanup prior to acquisition.

In the mid-1970s, Interstate 95 was constructed just east of the CSX Railroad with an interchange at Yamato Road. A four-lane section of Clint Moore Road was constructed through the Natural Area at the same time. This section began at Congress Avenue and went east along the southern border of the City and County-owned tract. The road then curved to the southeast, crossing the Natural Area, the CSX Railroad and I-95 on an overpass with raised embankment, and connecting to Jeffrey Street in the Boca Teeca development. The embankment had a golf cart underpass built through it, presumably because the Boca Teeca Corporation had hopes of building another golf course on the Natural Area. Clint Moore Road was named after Clint Moore, a farmer and paving contractor who came to the area in the 1920s, and who sold the land for the original sections of the road to the County.

A 1977 aerial photograph (Palm Beach County Property Appraiser 1977). shows that the Arvida Corporation had established a plant nursery on its property south of Clint Moore Road and opposite the City and County-

owned tract. This nursery was located in the former wet prairie between the El Rio Canal and a drainage ditch. Two of the 1960s survey cuts were being used by off-road vehicles - one led northwards from Clint Moore Road to the western edge of the Boca Teeca substation, the other led south from Clint Moore Road into the scrub where skateboarders had built a huge wooden ramp. The photograph shows that E-4 Canal had been widened between Congress Avenue and the L-40 Canal, with the spoil being dumped on the west side of the canal. Additional construction was also going on at the FPL substation west of the E-4 Canal. The sawgrass areas in the former basin marsh within the site had declined and thinned out to the point that Brazilian pepper could invade these areas, and this exotic pest plant is visible on aerial photographs for the first time.

The E-4 Canal between Congress Avenue and the L-40 Canal, and the L-40 Canal within the Natural Area were deepened and widened around 1980. The spoil from both canals was piled on the Natural Area on the east side of the E-4 Canal and the north side of the L-40 Canal. The E-4 Canal spoil is still present in a linear series of sand piles, although these piles were disturbed somewhat to remove imbedded debris during site cleanup prior to acquisition. Along the L-40 Canal, the spoil was leveled in the western section adjacent to the prairie hammock and disturbed former basin marsh, and piled up in the eastern portions that crossed the scrub ridge. The amount of spoil excavated in the eastern portion was so much that the piles reached heights of twelve feet, and the piles were so large that they completely covered and eliminated the old jeep trail north of the L-40 Canal. The rest of this trail west of the spoil piles and next to the E-4 Canal also fell into disuse at this time.

The excavation for the L-40 Canal was deep enough to reach calcareous materials, which was rapidly colonized by Australian pines when exposed in the spoil piles. It is presumed that this canal was deepened to provide better drainage for the Hidden Valley and Boca Teeca developments. The deepening and widening of the canals were the final death blow for the former wetlands within the Natural Area. The deeper canals pulled ground water levels down to a little as 4 feet in elevation. Brazilian peppers rapidly spread and covered the former wetland areas with muck soils, while pine flatwoods vegetation and weedy grasses invaded the areas with sandy soils. Standing water only occurred for short periods of time in small depressions that were underlain by hardpans or other impervious soil layers.

The 1980s saw a surge in construction in the vicinity of the Natural Area. The Boca Raton Golf and Tennis Club was under construction on the land north of the L-40 Canal and west of Congress Avenue and the E-4 Canal. A 1984 aerial photograph (Palm Beach County Property Appraiser 1984) shows the scrub ridge on this site being leveled and the dirt spread in the adjacent portions of the Yamato Marsh. The Arvida Corporation had also begun to develop its land holdings west of the Natural Area and south of Clint Moore Road as the Arvida Park of Commerce, which was an industrial park. The area just west of the Natural Area was platted in mostly 5-acre lots as Plat No. 6. Arvida also sold the land containing the City- and County-owned tract to the Hemingway Corporation in 1979. After being transferred to a trustee, the City- and County -owned tract was sold to Knight Investments, Inc. in 1985.

A 1984 aerial photograph (Palm Beach County Property Appraiser 1984) shows that Park of Commerce Boulevard had been extended from the west across the El Rio Canal, after which it turned north and ran along the east side of the old drainage ditch. It stopped short of connecting to Clint Moore Road, being blocked by the Arvida Nursery, which had expanded its growing area to the east from the original site. One industrial lot was already developed by 1984, and the aerial photograph shows that the AGES Group jet engine overhaul facility was under construction adjacent to the southwest corner of the natural area. The

1984 photograph also shows that Clint Moore Road has been extended to Military Trail from Congress Avenue, and the Yamato Road has been widened to four lanes on both sides of the I-95 interchange.

In 1983, the Royal Palm Audubon Society of Boca Raton developed a citizen's initiative to protect in perpetuity examples of each type of historic ecosystem that was present in the County in pre-development times. These ecosystems were called "wilderness islands" as many were isolated by urban and agricultural development. The best examples of these ecosystems were proposed to be identified throughout the county, and purchased for preservation. These "wilderness islands", one of which was the Yamato Scrub, were to be used and enjoyed without harm by present and future generations. In 1984, other conservation groups and individuals joined with Royal Palm Audubon Society to form the Coalition for Wilderness Islands (CWI), and to take the Wilderness Islands proposal to the Palm Beach County Board of County Commissioners. The Board accepted this proposal in concept.

Industrial development was also occurring in the vicinity of the northern portions of the Natural Area in the early 1980s. Development of 44 acres of the Boca Teeca-owned land northeast of the site was underway in 1984 as the Boca Commerce Center. Site preparation for a warehouse/office complex is visible in the 1984 aerial photograph. The warehouse/office complex was built on the scrub ridge, while dredge and fill activities were undertaken on the Yamato Marsh portions of the 44-acre site. Access to the construction site was by a fill road extending from Congress Avenue along the northern border on the Natural Area. Construction vehicles were also using the old jeep trail, which connected the construction site to Congress Avenue, and which appears to be significantly wider in the 1984 photograph. The current NW 6th Avenue entrance was not built until the buildings were constructed. Dumping of undesirable soils is visible in the northern portion of the former basin marsh.

In 1983, the remaining 283 acres of the Boca Teeca-owned land, including 207 acres of the Natural Area, were approved by the City of Boca Raton for development as an industrial/warehouse/office park called the Kovens Commerce Center. Only 7 acres of this site was scheduled for preservation. Because of the size and impacts of the project, it was declared to be a Development of Regional Impact (DRI), which required review by the Treasure Coast Regional Planning Council (TCRPC). There was substantial public opposition to the project, based largely on the need to preserve the dwindling scrub habitat in Palm Beach County, and TCRPC wanted up to 115 acres of the site preserved. A development order was issued in November 1984 releasing the northern 167 acres of the project, called Area A, for development. Area A included most of the Natural Area north of the L-40 Canal. No development was allowed in the 115-acre Area B, which was mostly south of the L-40 Canal, until further study determined how much of Area B would need to be preserved to protect its existing environmental and natural resource values. If the study indicated that a portion of Area B could be developed consistent with preserving these values, then an amended application for development approval would be submitted and treated as a substantial deviation from the original development order (TCRPC 1984).

The 1984 development order did not require any preserves in Area A, but required that all listed plant and animal species in Area A be relocated to Area B prior to development. In 1985, ten gopher tortoises out of an estimated population of 54 tortoises in Area A were relocated to Area B. In 1986, 21 scrub lizards were relocated from Area A to Area B, and 60 Florida mice were trapped in Area A. The surviving 37 Florida mice were relocated into Area B, the others having been eaten by predators while in the traps, or having died of unknown causes during the two weeks they were held in captivity before relocation (Richardson, et al. 1986).

In 1984, CWI worked for state preservation of the Yamato Scrub. It applied to the Florida Department of Community Affairs (DCA), which was then administering the Conservation and Recreational Lands (CARL) Program, for state acquisition of 260 acres of the Yamato Scrub. The application was not successful, but resulted in state officials visiting the site and in DCA preparing a report on the site. CWI also held a half-day educational program on the site that year. In 1985, the City of Boca Raton, supported by CWI and using the DCA report, unsuccessfully resubmitted the 260-acre acquisition proposal to CARL. The City, without the support of CWI, resubmitted the site as a smaller 56-acre project in 1986, but the proposal was also unsuccessful. A 65-acre proposal was approved for project assessment in 1987 and for project design analysis in 1988, but the City requested that further action be deferred until DRI issues on the site were resolved. In 1991, the City's and County's joint proposal for the 247-acre Yamato Scrub CARL project received enough votes to be accepted for ranking. The project was ranked 43rd on the 1992 CARL Priority List.

In 1986, as part of the Wilderness Islands proposal, the County agreed to fund an inventory of native ecosystems in Palm Beach County by two Florida Atlantic University professors and their students (Iverson and Austin, 1988). The study was completed in 1988, with additional work in 1989. An advisory committee was established in 1989 to recommend which sites should be acquired and how to fund the acquisition program. In 1990, the committee recommended 14 priority sites for acquisition, and a bond referendum. The Yamato Scrub was one of the 14 priority sites. The County scheduled a \$100 million Environmentally Sensitive Lands Bond Issue Referendum for March 12, 1991. The referendum passed by 2 to 1 margin. The City of Boca Raton followed a similar course, and City voters approved a \$12 million bond referendum in October 12, 1991 to purchase environmentally sensitive lands within the City. The Yamato Scrub was one of the sites eligible for City purchase with bond funds.

Two research prescribed burns on the scrub natural community in the Natural Area were conducted in early 1986 by Kovens Commerce Center consultants. The purpose of these burns were to maintain habitat diversity. Both burn sites were roller chopped and most of the sand pines present were felled several weeks prior to the burn. The first burn, in January 1986, was on the southernmost 10 acres of the Natural Area. The second burn, in February 1986, was on approximately 10 acres between Clint Moore Road and the L-40 Canal. Both burns resulted in an unacceptably dense scrub oak monoculture. Sand pine regeneration was minimal and the few sand pine seedlings that appeared were eaten by rabbits (Austin 2000). It appeared that the roller chopping cut and fragmented the scrub oaks' root systems, resulting in resprouting from the cut root ends that was far more numerous than the amount of resprouting from burned scrub oaks with intact root systems.

A July 1986 study by the developer's consultants concluded that it was necessary to preserve all of Area B south of Clint Moore Road, which was approximately 64 acres, in order to preserve the existing environmental and natural resource values of Area B (Richardson, et al., 1986). The developer did not ultimately accept this conclusion, presumably because it would result in a larger preserve size than the standard 25% of native habitat that was recommended by TCRPC. A new consultant was hired, who recommended in 1988 that only 29 acres was necessary to be preserved in Area B (Gaby and Gaby, 1990). TCRPC objected to this recommendation because the preserve was less than 25% of the native habitat. In December 1990, the developer submitted to TCRPC a substantial deviation application for development approval for the site, now known as Boca Commerce Center, that met the 25% requirement by preserving 46.5 acres of the site. The proposed preserves consisted of 15.7 acres in Area A, 21.2 acres in Area B, and 9.8 acres in various edges, setbacks, and buffers. The new proposal also requested that 65 acres of the

site be approved for 1,083 dwelling units, which required a land use amendment and created new problems with traffic impacts.

While the development proposals for the Kovens/Boca Commerce Center were in process, other changes were occurring in the vicinity of the Natural Area. Survey cuts were visible in the northern portion of the Natural Area in a 1987 aerial photograph (Palm Beach County Property Appraiser 1987). In 1987, Congress Avenue was widened to four lanes, as was Clint Moore Road west of Congress Avenue. By 1987, the Arvida Nursery was gone and the land platted as Arvida Park of Commerce Plat No. 9. Park of Commerce Boulevard was extended to connect to Clint Moore Road, and additional buildings were being built adjacent to the southern portion of the Natural Area. In 1988, a Marriott hotel was built north of the existing Boca Commerce Center buildings.

Early in 1991, the owners of Boca Commerce Center sold 19 acres of the site to Kraft Foods. In December 1991, they signed a option contract with the Nature Conservancy, who was an agent for the County, to sell more than 200 acres of the site for 82.5% of the appraised value. In March 1992, a joint acquisition agreement for the Yamato Scrub was approved in which CARL would provide 50% of the funds, the County 34%, and the City 16%. A second option contract was signed in June 1992 with the owners of the Boca Commerce Center that reduced the sale acreage to accommodate drainage and road needs for the Kraft tract. In July 1992, the Nature Conservancy obtained an option to purchase the 10-acre Knight tract in the Yamato Scrub for 82.5% of appraised value.

An economic recession started in late 1991, resulting in the demand for industrial parcels disappearing and land values falling. Activity on Boca Commerce Center DRI substantial deviation application stalled, as concurrency issues and traffic impacts remained unresolved, and the application expired in March 1992. When the appraisal values for the Boca Commerce Center were released in August 1992, the \$11.7 million contract price was well below the \$30 million expectations of the owners. The appraisers cited the bulk sale of the property and the 10-year estimated buildout of the site as the reasons for the lower value. The owners objected to the appraisal methods, said that they were misled about the value of the property, and claimed that the entity who signed the contract on their behalf wasn't authorized to sign it. The owners failed to provide information and perform required tasks under the contract. In early 1993, the County, City and State all agreed to sue the owners to force them to fulfill the contract, and legal proceedings were filed in March 1993.

The Knight tract owners accepted the appraised values and moved to sell their property. Because state regulations required that the largest tract be purchased first, the State could not participate in the purchase of the Knight tract. The City agreed to provide the State's share along with its share, which was 66% of the purchase price. The County agreed to provide the other 34%, and share ownership with the City. After issues relating to site cleanup and future assessments were resolved, the City and the County purchased the Knight tract for \$1,402,500 in March 1994. The City provided \$925,650, and the County \$476,850 of the purchase price.

After the County filed its law suit, other lawsuits were filed in relation to the Boca Commerce Center tract acquisition. Settlement offers were made by the Boca Commerce Center owners to sell half of the site and put a regional mall on the other half, and to pay the County to drop its claims against the property. These settlement offers were rejected. The ownership of the property came into question, and a bankruptcy proceeding was filed. The real estate market rebounded and demand for industrial land revived. In late

1995, a settlement was reached. The price for 207 acres of the Boca Commerce Center was set at \$17.5 million with the State providing 33.1% of the funds, the County 45.5%, and the City 21.4%. The County agreed to pay 2/3 of the unpaid back taxes and the City agreed to pay the remaining 1/3. It would take another year for all the complications of the settlement to be worked out. In February 1997, the Boca Commerce Center tract was purchased, with the State providing \$5,800,000, the County \$7,956,000, and the City \$3,744,000.

In 1993, construction began on a Congress Avenue/I-95 interchange and a Park-and-Ride lot just north of the Natural Area on land formerly owned by the Knight interests. This interchange was reportedly the result of active lobbying by the Knight interests. Although Kraft indicated a willingness to consider selling its tract for preservation, they were unwilling to wait until the Boca Commerce Center litigation was over. Construction of the Alliant Food warehouse on the Kraft tract began in 1993. NW 6th Avenue was extended 200 feet and a 2.5-acre stormwater retention area was constructed west of the Kraft site in the former basin marsh. The retention area was scraped down and an earth berm constructed around its perimeter. This retention area has since been colonized by transitional wetland species such as wax myrtle, saltbush, and coastal plain willow, as well as exotic plant species. A linear strip of scrub was preserved on the southern border of the Kraft tract, just north of the Natural Area.

The Boca Raton Shrine Club also grew tired of waiting for the litigation to be settled and built a meeting hall and a parking lot on their 3-acre tract in 1994. This tract lay between Clint Moore Road and the L-40 Canal and separated the City- and County-owned tract from the Boca Commerce Center tract. The remaining vacant tracts in the Arvida Park of Commerce adjacent to the southern portion of the Natural Area were either developed or under construction by 1996. A self-storage facility was built in 1997 on the land west of the City- and County-owned tract between Clint Moore Road and the L-40 Canal. The northern portion of the Natural Area received extensive use by off-road motorcycles during the period of litigation. Operators of these vehicles widened existing trails, created new trails, and built ramps and jumps. The ramps were removed during the pre-acquisition clean-up, and use by off-road motorcycles ceased after the County fenced off the access points.

A 50-year management lease to the County for the Boca Commerce Center tract was executed on February 24, 1998 (Appendix F). Construction of the Peninsula Corporate Center began on the property formerly owned by the Knight interests northwest of the Natural Area and west of Congress Avenue in 1999. Costco purchased the commercially-zoned land west of the E-4 Canal and the Natural Area, east and south of Congress Avenue, and north of the L-40 Canal in 1999, presumably for a superstore. A 2-acre cutthroat grass relocation project was started in 1999 in a portion of the former wetland west of the Kraft stormwater retention area. Brazilian peppers were removed, the site was scraped down a foot, and a temporary irrigation system was installed. Cutthroat grass clumps were brought in and planted from another site that was being developed. A small wildfire occurred on the north side of the L-40 Canal in the eastern portion of the Natural Area in May 2000.

B. NATURAL RESOURCES

The Yamato Scrub Natural Area represents a small remnant of an extensive mosaic of upland and wetland communities formerly present along the coastline of southeastern Florida. Agriculture, urbanization, road and railroad construction, beach erosion, hydrologic modifications, and several other human disturbances have eliminated or severely modified the majority of the upland natural communities in this area. Now, only a small percentage remains. Freshwater wetland communities have been preserved primarily in the western sections of the region. They are rare within the urbanized portions of southeastern Florida. The Natural Area is not a designated area of state concern or under study for such designation, and is not within an aquatic preserve.

The acquisition of sites like the Yamato Scrub Natural Area is an important part of the process of preserving examples of rare natural communities and rare and/or endemic plant and animal species in southeastern Florida. If the goal of preserving these historic remnants is to succeed, however, management of these sites must be conducted in a pro-active manner. Managers must recognize that these sites are disturbed fragments of larger historic ecosystem mosaics, and management activities must include the elimination or mitigation of as many unnatural disturbances to the remaining natural communities as possible.

In order to develop meaningful management objectives, policies and procedures, a thorough inventory and assessment of the site's natural resources must be conducted. Information must be obtained on: physiography and topography; soils; water resources, hydrology, and climate; mineral resources; unique natural features; natural communities and their constituent floras; fish and wildlife; listed natural features and species; and outstanding native landscapes. Within these categories, it is critical to identify the disturbance processes that may have altered ecosystem structures and functions, and thereby affect long-term management goals.

The following sections offer an initial attempt to provide this information. However, much work remains to be done, and every effort has been made to identify information gaps where they exist. Common names are used in the text for species recorded on the Yamato Scrub Natural Area. The scientific names of plants and animals recorded on the site are listed in Appendixes A and B, respectively. The scientific name is used when a unique common name does not exist for the taxon, or if the species has not been recorded for the project site.

B.1 PHYSIOGRAPHY AND TOPOGRAPHY

Using the system developed by Brooks (1982), Florida lies within the Coastal Plain Province as defined in *Physiography of Eastern United States* (Fenneman 1938). The bulk of the state belongs in the Florida Section, which Brooks defines as "...a distinctive physiographic unit characterized by the influences that solution of the underlying limestones have had on the development of topographic features." The mostly underlying limestone was deposited during the Cretaceous, Tertiary, and Quaternary periods. Sand is the dominant surficial material.

Brooks uses four major classical principles to define the physiographic subdivisions of the Florida Section: (1) rock and soil type; (2) geological structure of the underlying rocks; (3) geomorphic processes; and (4) relief. Additional principles are used to define minor divisions. He also believes that "...there is a direct relationship between the natural vegetation and the physiographic units as now distinguished."

Most of southeastern Florida is located within the Gold Coast-Florida Bay District. Although this area is dominated by the Everglades, the extreme eastern portion is composed mostly of a series of relict dunes and/or shoals along the eastern coastline. This area is called the Southern Atlantic Coastal Strip (Brooks 1982). It extends from approximately Juno Beach southward into extreme southern Dade County. Davis (1943) also recognized this physiographic division, which he termed the Atlantic Coastal Strip and the Miami Rock Ridge. He described the southern portions of this division (almost exactly corresponding to Brooks' Southern Atlantic Coastal Strip) as "a barrier ridge between the Everglades basin and the sea", which is composed of "sand ridges and elongated depressions" with rocklands in the southern portion.

The two northernmost divisions of the Southern Atlantic Coastal Strip are the Palm Beach-Deerfield Ridge and the Green Acres Sandy Prairie. The Palm Beach-Deerfield Ridge lies to the east of the Green Acres Sandy Prairie and encompasses a narrow band of peninsular Palm Beach County as the the barrier islands within the county. The soils are dominated by well-drained sands and elevations reach 48 feet above sea level. Scrub vegetation with some sand pine is described by Brooks as the typical vegetation. In contrast, the Green Acres Sandy Prairie has elevations mostly under 20 feet and is described by Brooks as a gently sloping plain dominated by pine flatwoods and wet prairie. The Yamato Scrub straddles the border between the Palm Beach-Deerfield Ridge and the Green Acres Sandy Prairie.

Iverson and Austin (1988) divided Palm Beach County into a number of biogeographic regions, which correlated the biological and physiographic features of the county. Along the eastern edge of Palm Beach County, they identified the Present Dune immediately adjacent to the Atlantic Ocean and the Pamlico Dune Ridge, an area of Pleistocene dunes generally separated from the Present Dune by a series of sloughs, rivers, and lakes. This biogeographical region approximately corresponds to Brooks' Palm Beach-Deerfield Ridge. In most portions of the County, a low area called the Pamlico Slough is present immediately to the west of the Pamlico Dune Ridge. Further to the west, there is a series of fragmented dunes that are collectively called the West Pamlico Ridge. This biogeographic region is present in the southern and northern portions of the county, but is absent in the central portions. To the west of the West Pamlico Ridge is an area of pine flatwoods know as the Pamlico Flatlands. The Pamlico Slough, West Pamlico Ridge, and Pamlico Flatlands roughly correspond to Brooks' Green Acres Sandy Prairie physiographic division. The Yamato Scrub Natural Area lies in both the Pamlico Dune Ridge and the Pamlico Slough biogeographical regions.

The historic soils of the Pamlico Dune Ridge are classified in the well-drained St. Lucie-Urban land-Paola association, (United States Soil Conservation Service [SCS] 1978). Both Iverson and Austin (1988) and Fernald (1989) identify scrub as the dominant community on the Pamlico Dune Ridge. The soils of the Pamlico Slough were partly classified as the poorly-drained Basinger association by SCS (1978).

The Treasure Coast Region, while neither a physiographic nor a biogeographic region, is often used to describe or evaluate natural communities or species in southeastern Florida (e.g., Fernald 1989). The Treasure Coast Region is a political unit regulated by the Treasure Coast Regional Planning Council, which encompasses Indian River, St. Lucie, Martin, and Palm Beach counties.

The Yamato Scrub Natural Area is composed of a variety of landforms and former wetlands. The upland portions of the site contain a moderate amount of relief, with ridges being most pronounced in the southern

portion of the site. The ridges in the northern half of the site are lower and have less evident relief. According to topographical maps (USDI 1962, TCRPC 1984), elevations in the site range from 11 feet above sea level in the former wetlands to a little over 30 feet above sea level in the southern portion of the site, just north of the AGES group jet engine repair facility.

B.2 SOILS

Brown et al. (1990) urged that caution should be used when using soil maps, even at the scales of county soil maps, because soil properties are highly variable over the landscape. Despite these limitations, the Palm Beach County soil map (SCS 1978) is a very useful tool in determining the historic distributions of natural communities and floras as well as in predicting responses of natural communities to alterations of historic hydrology and fire frequency. The following descriptions of soil series, soil phases, and vegetation are based almost exclusively upon the above-mentioned soil map and accompanying descriptions. SCS (1989) correlated soil types with ecological communities in Florida, and these correlations are listed for each soil series. Fernald (1989) classified certain soils as having historically supported scrub or xeric vegetation. His classification of each soil series also is included in the following descriptions.

Although the present tense is used for description, most soils in Palm Beach County have been modified by hydrologic manipulations and other disturbances. The entire upland portion of the Yamato Scrub Natural Area is classified within the St. Lucie-Urban land-Paola association, which is described as nearly level to sloping, excessively drained soils that are sandy throughout. A large area of former wetlands in the northern portion of the site is classified as the Basinger association, which is described as nearly level, poorly drained soils that are sandy throughout. Three soil series are found at the site: Immokalee, Pompano, and St. Lucie. Each soil series is represented at the site by one soil phase (Figure 5).

B.2.a Immokalee Soils

The Immokalee series consists of nearly-level, poorly-drained, sandy soils in broad, flatwoods areas. These soils formed in deep, sandy marine sediments. Under natural conditions, the water table is within 10 inches of the surface for 2 to 4 months during wet periods. It is within 10 to 40 inches for 8 months or more during most years, but is below 40 inches in dry periods. The surface layer is black fine sand in the upper 4 inches and dark gray fine sand in the lower 7 inches. The subsurface layers are composed of 1) gray fine sand, to a depth of 18 inches; 2) light gray sand to a depth of 37 inches; 3) black and very dark gray fine sand to a depth of 45 inches; 4) black fine sand, weakly cemented with organic matter to a depth of about 58 inches; 5) loose dark reddish brown fine sand to a depth of 79 inches; and 6) loose brown fine sand below 79 inches.

Permeability is rapid to a depth of 37 inches, moderate or moderately rapid to a depth of 79 inches, and rapid below that. The available water capacity is medium in the weakly-cemented layer and low or very low in all other layers. Natural fertility is low. SCS (1989) lists south Florida flatwoods as the typical ecological community found on this soil. Fernald (1989) did not consider Immokalee soils to support scrub or xeric vegetation.

This series is represented at the Yamato Scrub Natural Area by Immokalee fine sand, which is described as having the characteristics typical for the series. Included in this soil mapping unit are small areas of

Myakka, Basinger, Wabasso, and Oldsmar soils. The natural vegetation is described as including slash pine, saw palmetto, gallberry, fetterbush, pineland three-awn (*Aristida* sp.), and many other grasses. At this site, Immokalee fine sand is predominantly found in the northwestern portion of the site where it is associated with a large area of mesic and scrubby flatwoods. A sliver of this soil type is found sandwiched between the Pompano and St Lucie sand soil types in the north-central portion of the site where it is associated with scrubby flatwoods.

B.2.b Pompano Soils

The Pompano series consists of nearly-level, poorly-drained, deep, sandy soils in broad, grassy sloughs, concave depressions, and drainageways. These soils formed in thick beds of sandy marine sediments. Under natural conditions, the water table is within 10 inches of the surface for 2 to 6 months in most years, and within 30 inches for more than 9 months. Water covers depressions for more than 3 months in most years. The surface layer is dark grayish brown fine sand about 8 inches thick. The subsurface layers are light gray fine sand to a depth of about 32 inches, followed by pale brown fine sand to a depth of 52 inches. Below this is very pale brown fine sand that extends to a depth of 80 inches or more. Permeability is rapid in all layers. The available water capacity is very low. Organic matter content and natural fertility is low. SCS (1989) lists cypress swamp and freshwater marsh and ponds as the typical ecological communities found on this soil. Fernald (1989) did not consider Pompano soils to support scrub or xeric vegetation.

This series is represented at Yamato Scrub Natural Area by Pompano fine sand, which is described as having the characteristics typical for the series. Included in this soil mapping unit are small areas of Basinger, Anclote, Immokalee, Holopaw, and Riviera soils; and soils that have a brownish yellow, iron stained layer. The natural vegetation is wax myrtle, melaleuca, pineland three-awn, sand cordgrass, and other grasses. Scattered cypress, slash pine, and cabbage palm trees grow in some places. At this site, Pompano fine sand is located in the northern portion and is surrounded by Immokalee soil on all sides. It is associated with the former basin marsh and prairie hammock natural communities.

B.2.c St. Lucie Soils

The St. Lucie series consists of nearly-level to sloping, excessively-drained, deep, sandy soils on long, narrow, dune-like ridges and isolated knolls near the Atlantic coast. They formed in thick beds of marine or aeolian sand. Under natural conditions, the water table is below a depth of 60 inches. Generally, the soil surface layer is gray sand about 5 inches thick. The subsurface layer is white sand that extends to 80 inches or more. Permeability is very rapid in both layers. The available water capacity is very low in both layers. Organic-matter content and natural fertility are very low in both layers. SCS (1989) lists sand pine scrub as the typical ecological community found on this soil. Fernald (1989) considered St. Lucie sand a primary scrub soil; Sand pine scrub is the most common association, and scrubby flatwoods occur in some areas. Other xeric associations (including xeric hammocks) occasionally occupy elevated ridges along major river corridors.

This series is represented at the Yamato Scrub Natural Area by one soil phase, St. Lucie fine sand, 0 to 8 percent slopes, which is described as having the characteristics typical for the series. Included in this

mapping unit are small areas of Paola, Palm Beach, and Pomello soils. The natural vegetation is described as including sand pine, scrub oaks (*Quercus* spp.), saw palmetto, rosemary, cacti (*Opuntia* spp.), reindeer moss, and sparse clumps of threeawn and Natal grasses. This soil phase is the dominant soil at the Yamato Scrub Natural Area and occupies nearly all of the eastern portion of the site. It is associated primarily with the scrub natural community.

B.3 ARCHAEOLOGICAL AND HISTORICAL RESOURCES

A review in 1984 by the Bureau of Historic Sites and Properties of the Florida Department of State of both the National Register of Historic Places and the Florida Master Site File has determined that there are no known archaeological sites on the Natural Area (TCRPC 1984). Data from similar environmentally sensitive lands in Palm Beach County indicate that there is low potential for unrecorded sites to be present on this site.

B.4 WATER RESOURCES, HYDROLOGY, AND CLIMATE

B.4.a Water Resources

There are no natural bodies of water currently existing on Yamato Scrub Natural Area. The former wetlands on the site were found at elevations between 10 and 11 feet above sea level. Current ground water levels range between 4 to 6 feet above sea level. During the rainy season, small areas of standing water occur briefly in depressional areas that are underlain by pockets of impermeable soils. The Lake Worth Drainage District L-40 Canal ditch bisects the Natural Area, and a portion lies within the City- and County-owned tract. The control elevation for this canal and the adjacent El Rio/E-4 Canal is 4.3 feet. During the rainy season, water backs up in these canals to a height of 6 feet. During the dry season, water levels fall to 4 feet or less and ground water flows out of the Natural Area into the L-40 Canal. Water levels in the L-40 Canal rarely exceed 3 feet in depth. The low control elevations for these two canals have eliminated the basin marsh community at this site and have dropped the ground water levels by at least six feet.

B.4.b Hydrology

Two aquifers separated by confining beds lie beneath the natural area. The Surficial Aquifer System is a shallow non-artesian layer of unconsolidated sand and shell, with discontinuous clay and silt lenses overlying limestone and sandstone that ranges in thickness from 150 to 350 feet. Water in this shallow aquifer is replenished primarily by rainfall. Some recharge also occurs by infiltration from surface water features, including freshwater marshes. During periods of drought, the availability of water in the Surficial Aquifer is reduced significantly and saltwater intrusion has occurred in coastal areas. This system is the primary source of fresh water for eastern Palm Beach County and historically provided water resources critical to wetland and upland natural communities.

In eastern Palm Beach County, the Surficial Aquifer System is composed of the Turnpike Aquifer, which is the northern extension of the Biscayne Aquifer. This aquifer extends from Juno Beach south to the county line. The most permeable portion of this aquifer is about 92 feet thick and is generally found between 45 and 137 feet below sea level. The productivity of this zone is roughly double that of other portions of the

Surficial Aquifer, and most County well-fields are located in this portion of the Surficial Aquifer. Within the region, water quality varies considerably, but the highest quality of groundwater is generally found in the coastal ridge area where the Natural Area is located. Because of the deep sandy soils at the site have minimal confining layers, the surface waters at the Yamato Scrub Natural Area have been eliminated because of the direct connection to the much lower groundwater levels.

The Floridan Aquifer begins at a significant distance below the Surficial Aquifer. In Palm Beach County, the top of this artesian aquifer begins at depths ranging from 800 to 1,000 feet below the land surface. This aquifer is composed primarily of limestone and dolomite and is about 1,000 feet thick. The water quality of this aquifer is poor because the water is both highly mineralized and relatively corrosive. The Floridan Aquifer is not suitable as a source of potable water, but has been used both as a source of brackish water for reverse osmosis water treatment plants, and as a site for aquifer storage and retrieval of fresh water.

Improper storage or disposal of hazardous wastes pose a serious threat to the groundwater resources of the Natural Area. Environmental audits were performed on all tracts within the site prior to initial acquisition. No hazardous waste sites were found during these audits. Some small areas of potential hazardous waste associated with significant areas of illegal dumping were located during the audits. These areas were cleaned up and the waste materials disposed of properly prior to the acquisitions. The audits noted that a gas stations in the vicinity of the site had a leak in its underground storage tanks, but the contaminated area has been cleaned up and was located too far away to affect the Natural Area.

Davis (1943) reviewed the impacts of drainage on the Everglades; average soil subsidence following drainage was estimated at 1.5 feet during the first 10 years following drainage. Most of this subsidence was caused by the slow oxidation of organic soils above the water table. It is likely that there has been subsidence of the pockets of organic soils in the former basin marsh. These pockets were both surficial and shallow, and only a thin layer of fine black particles can be found today. Iverson and Austin (1988) noted that the regional lowering of the water table could lead to successional changes in ecosystems and to invasion of sites by exotic species. Due to the lack of organic matter and the natural depth to water table, it is not likely that the areas of St. Lucie soils have been greatly impacted by drainage. The Immokalee soils would likely become more xeric if the water table has dropped. The Pompano soils have a reduced or non-existent hydroperiod, and have been invaded by exotic and transitional native plant species, thereby reducing the presence of characteristic native wetland species.

B.4.c Climate

The average temperature in Palm Beach County is 75 degrees Fahrenheit; the average rainfall is 62 inches (SCS 1978). More important than water quantity is the temporal distribution of rainfall. A distinct dry season generally occurs from November through May, and a wet season from June through October. Although the rainy season may start any time between May and July, years in which the onset of the rainy season is delayed beyond the end of June are generally considered drought years (Snyder, et al. 1990). Rainfall within the rainy season is also unevenly distributed, with most of the rainfall occurring in June and September (Snyder, et al. 1990). Average daily high and low temperatures vary little over eastern Palm Beach County. More important to vegetation are freezing temperatures, which can occur any year. Hard freezes, such as those experienced in the winters of 1976/77 and 1989/90, may play a major role in the

long-term distribution of frost-sensitive flora.

Hurricanes, tropical storms, and tornadoes often strike south Florida. Gentry (1974) estimated that hurricanes hit south Florida every three years. All three of these weather events bring high winds, which may lead to tree fall, snapped trees, and broken branches in forest communities. Although these storms infrequently strike individual areas, they undoubtedly influence the composition of vegetation and may help maintain high levels of biological diversity in natural communities. In addition, Myers (1990) speculates that windthrow may be as important as fire in maintaining coastal scrub, especially in the Florida Panhandle. Heavy rains and flooding associated with tropical storms and hurricanes also may influence natural communities. Although south Florida had been spared a major hurricane for 30 years, the damage caused by Hurricane Andrew in 1992 made it clear that hurricanes can cause major changes in natural communities.

Lightning from frequent rainy season thunderstorms can also be a factor in influencing natural communities. Florida has the highest rate of cloud to ground lightning strikes in the United States. National Weather Service data indicates that coastal Palm Beach County receives an average of 21 cloud to ground lightning strikes per square mile annually. These frequent lightning strikes are a major cause of mortality for large slash and sand pines, and can also cause wildfires. Lightning-caused fires peak in May and June at the beginning of the rainy season when summer thunderstorm season starts and the vegetation and litter layers are still dry.

B.5 FISH AND WILDLIFE SPECIES AND THEIR HABITATS

A total of 2 species of arachnids, 25 species of insects, 1 species of fish, 6 species of amphibians, 20 species of reptiles, 78 species of birds, and 10 species of mammals have been recorded at the Yamato Scrub Natural Area (Appendix B). Of these, 15 are listed for protection or special management by a government agency or Florida Natural Areas Inventory (FNAI) (Table 2). The surveys for wildlife at this site are considered preliminary and will be expanded in the future. The resident, casual, and migratory wildlife recorded at the Yamato Scrub Natural Area fully utilize the varied habitats preserved at the site. Some species are habitat-specific (such as many scrub species), while others have general habitat requirements (such as the raccoon). The preservation, restoration, and management of the variety of habitat types at the Yamato Scrub Natural Area is critical to the long-term preservation of wildlife species indigenous to the site.

One species of invertebrate (imported fire ant) and six species of vertebrate wildlife (the Cuban brown anole, European starling, greenhouse frog, house sparrow, red-masked parakeet, and rock dove) recorded at the site are not native to the south Florida mainland. These species are discussed in more detail in subsection D.6.g, Exotic animal control.

B.6 LISTED SPECIES

B.6.a. Listed Species -Flora

Twelve plant species recorded at the Yamato Scrub Natural Area have been listed by at least one government agency or FNAI (Table 1). Listed plant species range from relatively common, threatened species such as reflexed wild pine, to the rare and globally imperiled sand dune spurge. These species can be ranked according to their degree of rarity. The following list includes a brief description of each taxon, its general location on the site, and the listing categories. Listings by FNAI are from a 1999 FNAI booklet; listings by the Florida Department of Agriculture and Consumer Services (FDACS) and the United States Fish and Wildlife Service (USFWS) are from the Florida Game and Fresh Water Fish Commission (1997). The listing categories used by these agencies are defined in Appendix C. Proposed management actions for these species are found in subsection D.6.c Listed plant species.

PRIORITY A

Priority A taxa are those plant species that are considered by FNAI to be imperiled or critically imperiled in the state. These taxa should receive the highest level of management attention. Under no circumstances should extirpations of these species at the Yamato Scrub Natural Area be allowed to occur. If possible, efforts should be made to increase the size of each population.

Burrowing four-o'clock (*Okenia hypogaea*)

This perennial forb was first recorded at the then-undeveloped Kraft tract at the Yamato Scrub Natural Area in 1974 (Richardson 1985) and again by ERM in 1991. It was discovered on a dirt pile dumped within the former basin marsh, and may have originated from dumped beach cleaning debris. The Kraft site was developed in 1993, and this plant was probably extirpated from the site at that time. Institute for Regional Conservation (IRC) staff were unable to locate this plant in adjacent undeveloped areas in 1998. Wunderlin (1998) listed it as being rare on dunes from St. Lucie County southward along the east coast. Long and Lakela (1971) listed its habitat as sea beaches and hammocks. Burrowing four-o'clock is listed as G3/S2 by FNAI; it is not listed by USFWS; it is listed as endangered by FDACS.

Hand fern (*Ophioglossum palmatum*)

This epiphytic fern was recorded by ERM in 2000 at the Yamato Scrub Natural Area growing on a single cabbage palm in the west-central portion of the site. The cabbage palm is growing in the ecotone between the prairie hammock and scrubby flatwoods communities. The total known population of this fern is one plant on one palm. Wunderlin (1998) lists hand fern as rare in the central and southern peninsula of Florida; its habitat is hammocks where it is epiphytic on cabbage palms. Long and Lakela (1971) describe it as a rare epiphyte on cabbage palms in hammocks in south Florida. It is listed as G4/S2 by FNAI; it is not listed by USFWS; it is listed as endangered by FDACS.

Sand dune spurge (*Chamaesyce cumulicola*)

This endemic herb was recorded at the Yamato Scrub Natural Area by Richardson, et al. in 1986, by Gaby and Gaby in 1990, by ERM in 1991, and by IRC in 1998. Over 30 plants were found by IRC, mostly in disturbed areas such as bordering the railroad tracks and the former basin marsh, and on portions of the canal banks and roadside edges. Wunderlin (1998) listed it as occasional in peninsular Florida; its habitat is dunes and scrub. Long and Lakela (1971) describe it as endemic to coastal dunes of south Florida. It was listed as a scrub indicator species in the Treasure Coast region by Fernald (1989). It is listed as G2/S2 by FNAI; it is not listed by USFWS; it is listed as endangered by FDACS.

PRIORITY B

Priority B taxa are those plant species that are considered by FNAI to be rare in the state. These taxa should receive significant management attention. Under no circumstances should extirpations of these species be allowed to occur at the Yamato Scrub Natural Area. If possible, Priority B species with small populations should have the size of their population increased, so long as this does not adversely impact natural community level management.

Curtiss' milkweed (*Asclepias curtissii*)

This endemic perennial forb was recorded at the Yamato Scrub Natural Area by Richardson, et al. in 1986, by Gaby and Gaby in 1990, and by ERM in 1991. No plants were seen by IRC in 1998. No more than three individual plants have been seen along the old jeep trail in the northern portion of the site in the scrub natural community. Because of the small size and inconspicuous appearance of this plant when not in bloom (Ward 1978); individuals in open sandy trails are often the only ones spotted, even though more plants may be present in more vegetated areas. It also has a long period of dormancy during which the above-ground portions of the plant are absent. Given these characteristics, it is difficult to estimate its current population. Wunderlin (1998) listed it as occasional in the central and southern peninsula of Florida; its habitat is scrub. Long and Lakela (1971) list it as endemic to peninsular Florida; its habitat is sandy soil. It was listed as a scrub indicator species in the Treasure Coast Region by Fernald (1989). Curtiss' milkweed is listed as G3/S3 by FNAI; it is not listed by USFWS; it is listed as endangered by FDACS.

Cutthroat grass (*Panicum abscissum*)

This perennial grass was recorded at the Yamato Scrub Natural Area by Treasure Coast Regional Planning Council staff in the early 1990s, by ERM in 1996, and by IRC in 1998. Over 3,000 plants are estimated to occur in small glades and remnant patches in the mesic flatwoods natural community. Another several thousand clumps were relocated from another site in 1999 to a 2-acre cutthroat grass restoration project on the Natural Area. Wunderlin (1998) listed it as being rare and endemic to central Florida, occupying wet flatwoods and seepage areas. Hitchcock (1950) describes it as being found in sandy or swampy woods of central Florida. Cutthroat grass is listed as G3/S3 by FNAI; it is not listed by USFWS; it is listed as endangered by FDACS.

Large-flowered rosemary (*Conradina grandiflora*)

This endemic shrubby mint was recorded at the Yamato Scrub Natural Area by Richardson, et al. in 1986, by Gaby and Gaby in 1990, by ERM in 1991, and by IRC in 1998. In 1990, many plants were recorded growing in scrub habitat along the old jeep trails, and on the edges of the roads and railroad tracks on the perimeter of the Natural Area. Approximately 35 individuals were seen by IRC staff in 1998, and the total population is estimated at 200 plants. Wunderlin (1998) listed it as occasional in the central peninsula of Florida along the east coast; its habitat is scrub. Long and Lakela (1971) listed it as endemic to south Florida; its habitat is pinelands. It was listed as a scrub indicator species in the Treasure Coast Region by Fernald (1989). Large-flowered rosemary is listed as G3/S3 by FNAI; it is not listed by USFWS; it is listed as endangered by FDACS.

Nodding pinweed (*Lechea cernua*)

This endemic forb was recorded at the Yamato Scrub Natural Area by Richardson, et al. in 1986, by Gaby and Gaby in 1990, by ERM in 1991, and by IRC in 1998. IRC estimated the population size in 1998 as approximately 20 plants in open areas along the old jeep trail in the northern portion of the site, but future surveys may be necessary to accurately determine the population size. Wunderlin (1998) listed it as frequent in the central and southern peninsula of Florida; its habitat is scrub. Long and Lakela (1971) listed it as endemic to central and south Florida; its habitat is sand scrub. It was listed as a scrub indicator species in the Treasure Coast Region by Fernald (1989). Nodding pinweed is listed as G3/S3 by FNAI; it is not listed by USFWS; it is listed as threatened by FDACS.

Scrub bay (*Persea borbonia* var. *humilis*)

This endemic tree or shrub was recorded at the Yamato Scrub Natural Area by Richardson, et al. in 1986, by Gaby and Gaby in 1990, by ERM in 1991, and by IRC in 1998. It occurs primarily in scrub along the eastern portions of the Natural Area and its population has been estimated at over 100 individuals. Wunderlin (1998) listed it as frequent in the central peninsula of Florida; its habitat is scrub. Long and Lakela (1971) listed it as endemic to central and south Florida; its habitat is dry sand scrub. It was listed as a scrub indicator species in the Treasure Coast Region by Fernald (1989). Scrub bay is listed as G4/S3 by FNAI; it is not listed by USFWS; it is not listed by FDACS.

PRIORITY C

Priority C species are those plant species that are listed as endangered or threatened by FDACS, but are not listed by FNAI. These species should receive moderate management attention. At a minimum, extirpations of these species should be prevented at the Yamato Scrub Natural Area. If possible, Priority C species with small populations should have the size of their population increased, so long as this does not adversely impact natural community level management.

Common wild pine (*Tillandsia fasciculata*)

This epiphytic bromeliad was recorded at the Yamato Scrub Natural Area by Richardson, et al. in 1986, by Gaby and Gaby in 1990, by ERM in 1991, and by IRC in 1998. Individuals are scattered throughout the site

in scrub, scrubby flatwoods, mesic flatwoods, and prairie hammock communities, and localized population densities can be quite high. The total population is estimated at over 600 plants. Wunderlin (1998) listed three varieties of *Tillandsia fasciculata*; the one occurring on the site is identified as variety *densispica*. This variety was listed as frequent in the central and southern peninsula of Florida; its habitats are cypress swamps and hammocks. Long and Lakela (1971) listed the species as frequent in south Florida; its habitats are cypress swamps and hammocks. The species was listed as being present in coastal scrubs in the Treasure Coast Region by Fernald (1989). Common wild pine is not listed by FNAI; it is not listed by USFWS; it is listed as endangered by FDACS.

Giant wild pine (*Tillandsia utriculata*)

This epiphytic bromeliad was recorded at the Yamato Scrub Natural Area by Richardson, et al. in 1986, by Gaby and Gaby in 1990, by ERM in 1991, and by IRC in 1998. It is common in the upland portions of the site, with a population estimated at over 600 individuals. Wunderlin (1998) listed it as frequent in hammocks and cypress swamps in the central and southern peninsula of Florida. Long and Lakela (1971) listed its habitat in Florida as hammocks. It was listed as being present in coastal scrubs in the Treasure Coast Region by Fernald (1989). Giant wild pine is not listed by FNAI; it is not listed by USFWS; it is listed as endangered by FDACS.

Long strap fern (*Campyloneurum phyllitidis*)

This mostly-epiphytic fern was recorded by at the Yamato Scrub Natural Area by Gaby and Gaby in 1990 and by ERM in 2000. Long strap fern grows in one localized population at the base of the trunks of scrub oaks and on humus accumulations on the north-facing side of a spoil pile on the south side of the L-40 Canal. The population of this fern appears to be growing. Gaby and Gaby reported one plant in 1990; ERM counted at least 25 plants in 2000. Wunderlin (1998) listed long strap fern as occasional in the central and southern peninsula of Florida; its habitat is hammocks where it is epiphytic or grows on rocks. Long and Lakela (1971) described it as occurring in hammocks in south Florida. It is not listed by FNAI; it is not listed by USFWS; it is listed as endangered by FDACS.

Reflexed wild pine (*Tillandsia balbisiana*)

This epiphytic bromeliad was recorded at the Yamato Scrub Natural Area by ERM in 1991, and by IRC in 1998. It has been observed in scattered locations in scrub, scrubby flatwoods, prairie hammock, and mesic flatwoods communities. Its population is estimated at less than 600 individuals. Wunderlin (1998) listed it as occasional in the southern and central peninsula of Florida, its habitat is hammocks and scrub. Long and Lakela (1971) listed its habitats as scrub and hammocks in south Florida. It was listed as being present in coastal scrubs in the Treasure Coast Region by Fernald (1989). Reflexed wild pine is not listed by FNAI; it is not listed by USFWS; it is listed as threatened by FDACS.

PRIORITY D

Priority D species are those that are listed as commercially exploited by FDACS. These species should receive some management attention. At a minimum, extirpations of these species at the Yamato Scrub Natural Area should be prevented. No Priority D species have been recorded at this site.

B.6.b Listed Species - Fauna

Fifteen animal species recorded at the Yamato Scrub Natural Area have been listed for protection or special management by at least one government agency or by FNAI (Table 2). Of these, one is an arachnid, four are reptiles, nine are birds, and one is a mammal. These species can be given a priority rank according to the feasibility of managing a viable population at the site. The following list includes a brief description of each taxon, its general location on the site, and the listing categories. Listings by FNAI are from a 1999 FNAI booklet; listings by the United States Fish and Wildlife Service (USFWS) and the Florida Game & Fresh Water Fish Commission (FGFWFC) are from FGFWFC (1997). The listing categories used by these agencies are defined in Appendix C. Proposed management actions for these species are found in subsection D.6.b Listed animal species.

PRIORITY A

Priority A taxa are those that are considered by FNAI to be critically imperiled, imperiled, or rare in Florida and which are known to occur in viable numbers with a resident or breeding population at the Yamato Scrub Natural Area. These taxa should receive the highest level of management attention. Under no circumstances should extirpations of these taxa be allowed to occur at the Yamato Scrub Natural Area. When possible and appropriate, efforts should be made to increase the sizes of existing populations.

Eastern diamondback rattlesnake (*Crotalus adamanteus*)

This large snake has been recorded in a trash pile within the northern scrub community by ERM in 1996. Although only one individual has been seen, the population is estimated to be 2-3 snakes on approximately 90 acres of suitable habitat. Based on this small estimated population, the long-term viability of this snake species is questionable. This species is native to Florida and the southeastern United States. Throughout much of its range, the eastern diamondback rattlesnake is a gopher tortoise commensal (Cox, et al. 1987). It often inhabits pine flatwoods with a palmetto understory that are bordered by wet prairies (Ashton and Ashton, 1988). It is a carnivore; its diet is primarily small mammals that range from mice to rabbits (Ashton and Ashton, 1988). This species is very vulnerable to collection and to being killed because it has poisonous venom. The eastern diamondback rattlesnake is listed as G5/S3 by FNAI; it is not listed by USFWS; it is not listed by FGFWFC.

Florida mouse (*Peromyscus floridanus*)

This endemic small mammal was recorded at Yamato Scrub Natural Area by Richardson in 1985, by Richardson, et al. in 1986 and by Gaby and Gaby in 1990. Eleven trap lines set in selected areas of the site in February and March 1985 captured 90 individual mice, some more than once (Richardson 1985). In the northern portion of the site, 60 Florida mice were trapped in 1986 and the 37 survivors relocated to the southern portion of the site (Richardson, et al. 1986). The population densities of the two trapped areas were estimated to be 2.64 and 1.79 Florida mice per acre. Assuming an average density of two mice per acre with 138 acres of scrub habitat present, then the estimated population of Florida mice at this site is 276 individuals. The Florida mouse is a frequent gopher tortoise commensal (Cox, et al. 1987). This mouse lives on high sandy ridges where black jack and turkey oaks (*Quercus marilandica* and *Q. laevis*) and scrub palmetto occur (Burt and Grossenheider, 1980). Its habits include sharing gopher tortoise burrows. Florida

mice are mostly nocturnal and feed on acorns, pine seeds, saw palmetto fruits, mushrooms, insects, and various arthropods found in gopher tortoise burrows (Brown 1997). Burt and Grossenheider (1980) list its range as peninsular Florida. This species is most vulnerable to habitat destruction. The Florida mouse is listed as G3/S3 by FNAI; it is not listed by the USFWS; it is listed as a species of special concern by FGFWFC.

Florida scrub lizard (*Sceloporus woodi*)

This small endemic lizard is relatively common, active, and visible at the Yamato Scrub Natural Area and is found primarily in scrub habitats. It was recorded by Richardson, et al. in 1986, by Gaby and Gaby in 1990, by ERM in 1991, and by IRC in 1998. Richardson, et al. captured and released 99 scrub lizards in a population survey in 1985. Gaby and Gaby described scrub lizards as being especially common in the northern scrub community and the shrubby eastern edge and southwest corner of the drained basin marsh in 1990. Scrub lizards historically ranged from Marion County to Collier and Dade counties (Ashton and Ashton, 1991). Its habitats are sand pine scrub and other xeric habitats where dry, well-drained, deep sandy soils with open patches of unvegetated sand are present (Jackson 1973a, Fernald 1989). Densities of more than 12 lizards per acre have been recorded (Jackson and Telford, 1974). The population of scrub lizards at this site is estimated at 200 individuals. The Florida scrub lizard prefers early successional scrub, where it feeds primarily on ants, adult beetles, and orthopterans (Jackson 1973b). It is listed as a common or characteristic species of coastal scrubs in the Treasure Coast Region by Fernald (1989). The Florida scrub lizard is listed as G3/S3 by FNAI; it is not listed by USFWS; it is not listed by FGFWFC.

Gopher tortoise (*Gopherus polyphemus*)

Although a recent population survey for this species has not been performed at the Yamato Scrub Natural Area, a relatively large population of this medium-sized tortoise is thought to inhabit the site. Berish (1991) identified the Yamato Scrub as critical gopher tortoise habitat in a FGFWFC study. Richardson, et al. (1986) did a complete survey of the site in 1986 and determined that there were 155 active and inactive gopher tortoise burrows present. Cox, et al. (1987) recommends the use of conversion factor of 0.614 (Auffenberg and Franz, 1992), which, when using the Richardson data, yields a total of 95 tortoises for the site. Relocation trapping on the northern portion of the site in 1986, however, only yielded 10 tortoises in an area where the number of burrows present should have produced 54 tortoises (Richardson, et al. 1986). The shortfall in gopher tortoises can be attributed in part to poaching, in part to inefficient removal techniques (pulling tortoises from burrows with a flexible pipe with a hook at the tip), and in part to a conversion factor that may not be appropriate for this site. Gaby and Gaby noted in 1990 that gopher tortoises were still present in the area where they were supposedly all trapped and removed. IRC staff observed in 1998 that evidence of the presence of gopher tortoises was clear and that they were frequent throughout the open areas of the site, especially the drained basin marsh.

Breining, et al. (1988), however, pointed out that poor detectability of gopher tortoise burrows may lead to an underestimation of gopher tortoise densities. In addition, conversion factors may vary tremendously among habitat types and sites. If possible, a conversion factor should be developed for each habitat type on a site (Breining, et al. 1988). Even using a relatively low conversion factor that would result in only one tortoise for every three acres, there would be more than 70 tortoises present at the Yamato Scrub Natural

Area. A more extensive field survey than those performed to date would need to be conducted in order to obtain a more accurate estimated population for the entire site.

The gopher tortoise is historically known from throughout the southeastern coastal plain of the United States, wherever well-drained sandy soils, an abundance of herbaceous ground cover, and an open canopy and understory layer are found (Cox, et al. 1987). Breininger, et al. (1988) report higher densities of gopher tortoises in open, disturbed areas than in undisturbed natural communities. Of the soil series present at this site, St. Lucie and Immokalee soils are considered to be preferred gopher tortoise soils (Cox, et al. 1987). Breininger, et al. (1988) recommended that a combination of poorly-drained and well-drained areas within scrub and slash pine associations be preserved within any site, in order to provide for optimum gopher tortoise habitat. The gopher tortoise forages on a wide variety of plant taxa, and non-plant items may supply a significant amount of nutrients to the diet (Macdonald 1985). Herbaceous plants, however, provide the bulk of the gopher tortoise diet.

The gopher tortoise is known as a keystone species in Florida natural areas because of the important role that this species plays in relation to other plants and animals in upland natural communities. At least 81 species of animals are known to use gopher tortoise burrows (Speake 1981). Gopher tortoise burrow commensals thus far recorded at the Yamato Scrub Natural Area include the black racer, box turtle, Carolina wren, coral snake, cotton mouse, cotton rat, eastern coachwhip, eastern cottontail rabbit, eastern diamondback rattlesnake, eastern indigo snake, eastern narrowmouth toad, Florida mouse, gray fox, greenhouse frog, green anole, ground skink, mole skink, northern bobwhite, opossum, raccoon, six-lined racerunner, southeastern five-lined skink, and southern toad. Additional commensal species, especially arachnids and insects, are probably present at this site. The gopher tortoise also plays an important role in the distribution of flora in gopher tortoise habitats by providing open, sandy areas near the burrow entrances for seedling establishment (Laessle 1942).

In southeastern Florida, the gopher tortoise was historically found along the elevated Southern Atlantic Coastal Strip in Martin, Palm Beach, Broward, and Dade counties. In the Treasure Coast Region, the gopher tortoise is now restricted to disjunct populations (Fernald 1989). Cox, et al. (1987) estimated that 40-50 tortoises distributed over 25-50 acres represents a viable population. When considered as a whole site, the Yamato Scrub Natural Area is easily capable of sustaining a viable population of gopher tortoises. However, Clint Moore Road is a four-lane road with heavy high-speed traffic. It represents a formidable barrier to gopher tortoise movement and effectively separates the gopher tortoise population into two isolated populations. The northern population, which is estimated at 50 tortoises, meets minimum viability thresholds, but the gopher tortoise population on the southern portion of the site falls below minimum viability standards with an estimated population of 20 tortoises. This population should increase when a prescribed burning program is instituted, but it still may be necessary to artificially move tortoises from the northern portion of the site into the southern portion to prevent inbreeding depression and maintain this population. Gopher tortoise is listed as G3/S3 by FNAI; it is not listed by USFWS; it is listed as a species of special concern by FGFWFC.

Red widow spider (*Latrodectus bishopi*)

Gaby and Gaby (1990) recorded numerous red widow spiders in areas dominated by saw palmettoes in the northern portion of the Yamato Scrub Natural Area. The red widow spider population is believed to be

substantial, but additional surveys will be necessary to determine the approximate size of the population. It is considered to be endemic to scrub in central and southeastern Florida (Franz and Deyrup, 1994), although it has also been reported from pine rocklands in Dade County. It almost always makes its nests in scrub palmetto or saw palmetto fronds (Franz and Deyrup, 1994), but Gaby and Gaby (1990) recorded nests in scrub oaks, fetterbush, gallberry and sand pine at the Yamato Scrub Natural Area. Since very little is known about this species, the red widow spider is listed as G2/S2 by FNAI; it is not listed by USFWS; it is not listed by FGFWFC.

PRIORITY B

Priority B species are those that are considered to be rare in Florida by FNAI, but for which a viable resident population is not known to occur at the Yamato Scrub Natural Area, or the species is transitory in southeastern Palm Beach County. These species should receive significant management attention. Under no circumstances should extirpations of resident species at the Yamato Scrub Natural Area be allowed to occur. If viable numbers of a resident species are recorded at, or become established at, the Natural Area, then these species should be elevated to Priority A. Efforts also should be made to provide suitable habitats for transitory species, so long as this does not adversely impact natural community level management.

American redstart (*Setophaga ruticilla*)

This migratory songbird was first recorded at the Yamato Scrub Natural Area by Gaby and Gaby in 1990. Kale and Maehr (1990) list its habitats in Florida as pine scrub, mangrove, hardwood swamp, cypress swamp, mesic hammock, mixed pine and hardwood forest, pine flatwoods, urban and agricultural environments, and sandhill; it hawks for flying insects. Peterson (1947) lists its breeding range as deciduous forests from north Georgia, southern Alabama, and Louisiana north to the Gulf of St. Lawrence and central Manitoba; it winters in the West Indies and in Central and South America. Bond (1980) lists its wintering range as throughout the West Indies, but the species is most numerous in the Greater Antilles (throughout the year); it winters south to Brazil and Peru. De Schauensee and Phelps (1978) list its wintering range as Mexico to northern Peru, the Guianas, and northern Brazil. Terborgh (1989) lists its primary wintering grounds as the West Indies. Kale and Maehr (1990) list it as an uncommon winter resident in south Florida; it does not appear to breed there, but has been found nesting in northwest Florida. It is listed as transitory in coastal scrubs in the Treasure Coast Region by Fernald (1989). The American redstart is listed as G5/S3 by FNAI; it is not listed by USFWS; it is not listed by FGFWFC.

Arctic peregrine falcon (*Falco peregrinus tundrius*)

One individual of this subspecies of the peregrine falcon was spotted by Gaby and Gaby (1990) during the fall migration in 1987. It was seen in the scrub in an area located in the northwestern portion of the site. Migrant falcons can be seen in Florida after the first fall cold front and some remain all winter. Florida represents an important wintering area, especially for the Arctic subspecies (Kale and Maehr 1990). The Arctic peregrine falcon is a transient, and usually inhabits open wetlands and shorelines, preying chiefly on ducks, shorebirds, and seabirds (National Geographic Society 1987). The Arctic peregrine falcon is listed as G4/S2 by FNAI; it is listed as endangered by similarity of appearance by USFWS; it is listed as endangered by FGFWFC.

Eastern indigo snake (*Drymarchon corais couperi*)

A shed skin from this large snake was found within the scrub community at the Yamato Scrub Natural Area in the early 1980s. No sightings or other signs of this snake has been observed since then. If still present, it is unlikely that the population is more than 2-3 snakes on approximately 210 acres of suitable habitat. Based on this small estimated population, the long-term viability of this snake species is questionable. This subspecies is native to peninsular Florida and the Keys, with separated populations in southeastern Georgia, western Florida, and southern Alabama (Stevenson 1976). Throughout much of its range, the eastern indigo snake is a gopher tortoise commensal. It often inhabits dry habitats that are bordered by water (Ashton and Ashton, 1988). It is a carnivore; its diet includes a variety of reptiles, amphibians, small mammals, and birds (Ashton and Ashton, 1988). This species is very vulnerable to collection. The eastern indigo snake is listed as G4T3/S3 by FNAI; it is listed as threatened by USFWS; it is listed as threatened by FGFWFC.

Florida scrub-jay (*Aphelocoma coerulescens*)

This endemic bird was recorded at the Yamato Scrub Natural Area by Gaby and Gaby in 1990. One family group of scrub-jays was recorded as utilizing a portion of the east edge of the scrub north of the L-40 Canal and west of the CSX Railroad right of way. A family was recorded as nesting nearby offsite (Gaby & Gaby 1990), but Gaby and Gaby stated that scrub-jays were restricted on the Natural Area to small portions or fringes. No scrub jays have been observed at the site since 1993, and IRC staff saw no scrub-jays during their surveys in 1998. Scrub-jays favor scrub and scrubby flatwoods in the early stages of regeneration after burning. The lack of fire or inappropriate burning techniques have resulted in little current suitable habitat for these birds.

The Florida scrub jay is restricted to small and isolated patches of scrub, scrubby flatwoods, and coastal strand in peninsular Florida (Fernald 1989). Cox (1984) described optimal scrub jay habitat as: "1) oaks 1-3 meters [3-10 feet] tall covering 50-75% of the area; 2) open space (bare ground or vegetation less than 15 centimeters [6 inches] tall) covering 10-30% of the area; and 3) scattered trees, with no more than 20% canopy cover." Although greater densities are possible, a density of one bird per five acres is probably the greatest that could be maintained on sites managed for scrub community preservation (Cox 1984). The Natural Area contains roughly 150 acres of scrub and scrubby flatwoods. Thus, the greatest number of jays which could be expected to be supported at the Yamato Scrub Natural Area would be 30 birds.

Florida scrub-jays, however, are extremely sedentary, permanently monogamous birds that defend a permanent territory (Woolfenden, 1973; Woolfenden and Fitzpatrick, 1984, 1986; in Fernald 1989). Average territory size is about 23 acres, varying from three to 52 acres (Woolfenden and Fitzpatrick, 1984). Based upon this average territory size, the approximately 164 acres of scrub and scrubby flatwoods at this site, if managed appropriately, could support 7 families of scrub-jays that could potentially persist long-term. This however, does not take into account the fragmentation of the site from adjoining habitats and the long-term effects of inbreeding depression. It is possible, however, that jays could disperse between other scrub fragments in the area, and that gene flow could occur (Richardson 1993; in Gann-Matzen and Carter, 1993). Ron Myers (Pers. Comm. in Trindell, et al. 1990) estimated that 150 acres of optimal scrub was necessary for a viable population of this species. Fitzpatrick, et al. (1991), however, estimated that 750 acres of periodically-burned scrub would be required to support an adequately-protected population. Based upon

the above, it appears that the Yamato Scrub Natural Area is marginal for maintaining a viable population of scrub-jays even if the site is managed appropriately.

In the spring and summer, Florida scrub-jays feed on terrestrial invertebrates, and a few small vertebrates (Fitzpatrick et al. 1991); in the fall and winter, acorns are the principal source of food (Fernald 1989). Other plant foods may be taken, but are apparently unimportant. Introduced foods such as peanuts are readily consumed (Fernald 1989, Fitzpatrick, et al. 1991). The presence of scrub oaks (*Quercus chapmanii*, *Q. geminata*, and *Q. myrtifolia*) is critical to scrub-jay survival. In addition to very specific habitat requirements, Florida scrub-jays are susceptible to predation by feral and domestic cats and competition from blue jays (Trindell, et al. 1990). Blue jays are also nest parasites, and nest predation and parasitism is the major cause of nesting failure among Florida scrub-jays (McGowan and Woolfenden, 1989; in Trindell, et al. 1990). Snakes, crows, sharp-shinned hawks, and other mammal and bird species also prey on scrub jay nests, nestlings, and adults. Florida scrub-jay is listed as G3/S3 by FNAI; it is listed as threatened by USFWS; it is listed as threatened by FGFWFC.

Great egret (*Ardea alba*)

This wading bird has been recorded at the Yamato Scrub Natural Area feeding in the L-40 Canal by ERM in 2000. Great egrets breed throughout much of North America and winter from North Carolina southward. It is a Florida resident, and methodically stalks small fish, amphibians, and invertebrates in open, shallow fresh and saltwater marshes and wetlands. Nesting occurs between January and June with large numbers of other wading birds in thick swamps dominated by low bushes and large trees, and on mangrove-covered coastal islands (Kale and Maehr, 1990). The great egret is listed as G5/S4 by FNAI; it is not listed by USFWS; it is not listed by FGFWFC.

Osprey (*Pandion haliaetus*)

This bird of prey has been recorded numerous times since 1990 on the Yamato Scrub Natural Area along the L-40 and E-4 canals. It breeds from Alaska to the Florida Keys and the West Indies; it winters in Florida and the Gulf states to Central America. The species includes both a resident and a migratory population in Florida. It feeds primarily on fish. Nesting occurs from late spring to early summer (Kale and Maehr, 1990). This species will utilize both natural and human-made structures to create large nests high above the ground. It is not known to nest at this Natural Area. It has historically suffered a decline due to pesticide use. The osprey is listed as G5/S3S4 by FNAI; it is not listed by USFWS; it is listed as a species of special concern (in Monroe County only) by FGFWFC.

Painted bunting (*Passerina ciris*)

This migratory songbird was first recorded at the Yamato Scrub Natural Area by Gaby and Gaby in 1990. Kale and Maehr (1990) list its habitats in Florida as dense, brushy vegetation along roads and woodland edges. It feeds primarily on seeds, but also eats small fruits and insects. National Geographical Society (1987) lists its breeding range as the southeastern and south-central United States and northern Mexico; it winters in Central America. Kale and Maehr (1990) list it as a common winter resident in south and central Florida. It does not appear to breed there, but has been found nesting in western and northeastern Florida. The painted bunting is listed as G5/S3 by FNAI; it is not listed by USFWS; it is not listed by FGFWFC.

Tricolored heron (*Egretta tricolor*)

This wading bird has been recorded at the Yamato Scrub Natural Area feeding in the L-40 Canal by ERM on several occasions since 1996. The tricolored heron breeds from North Carolina to the West Indies and Central America; it winters from California and South Carolina southward. It is a Florida resident, and feeds primarily on fish in saltwater marshes and swamps, and estuaries; it also feeds in freshwater wetlands. Platform nests are created in mangroves or other dense aquatic shrubs, and eggs are laid from late February through July (Kale and Maeher, 1990). It is not known to nest at this Natural Area. Kale and Maeher (1990) considered this species to still be abundant throughout much of peninsular Florida, but suffering population declines due to wetland losses. The tricolored heron is listed as G5/S4 by FNAI; it is not listed by USFWS; it is listed as a species of special concern by FGFWFC.

Wood stork (*Mycteria americana*)

This wading bird has been recorded at the Yamato Scrub Natural Area feeding in the L-40 Canal by ERM in 1996. It breeds in Florida, southern Georgia, Louisiana, Texas, Mexico, the West Indies, and Tropical America and winters in the same general area. It is a Florida resident that feeds primarily on fish, and to a lesser extent on amphibians and reptiles in freshwater swamps and marshes (Kale and Maeher, 1990). Nesting occurs in large colonies in forested wetlands from November to May (Kale and Maeher, 1990). It is not known to nest at this Natural Area. Overdrainage of wetlands and the manipulation of water levels by humans have caused wood stork populations to decline drastically from 75,000 birds in 1930 to the current population of approximately 10,000 birds. The wood stork is listed as G4/S2 by FNAI; it is listed as endangered by USFWS; it is listed as endangered by FGFWFC.

Worm-eating warbler (*Helminthos vermivorus*)

This migratory warbler was first recorded by at the Yamato Scrub Natural Area by Gaby and Gaby in 1990. It is most often encountered in Florida as a migrant from late March to early May and from August to early October where it can be found in mesic and maritime hammocks, and mixed pine/hardwood forests (Kale and Maeher 1990). In Florida, it breeds and nests only in the western panhandle (Kale and Maeher 1990). Although a few birds overwinter in south Florida, this bird is expected to be found at the Natural Area only during its migration. The worm-eating warbler is listed as G5/S1 by FNAI; it is not listed by USFWS; it is not listed by FGFWFC.

PRIORITY C

Priority C species are those listed animal species whose occurrence at the Yamato Scrub Natural Area is considered to be accidental. Management specifically for these species at the site would therefore serve no meaningful purpose. No Priority C species have been recorded at the Yamato Scrub Natural Area.

B.7 PLANT COMMUNITIES

The following discussion provides a general description of the natural and artificial vegetative communities found at the Yamato Scrub Natural Area, together with an assessment of their condition. Wherever possible, the community classifications are based upon the Florida Natural Areas Inventory system (FNAI and DNR, 1990). In some cases, the communities present do not fit well in any FNAI classification, or have been so thoroughly altered that they no longer resemble or function as natural communities (*sensu* FNAI). In these cases, an alternative classification system has been used to supplement or in lieu of the FNAI system. Whenever this has been done, every effort has been made to identify and describe the natural communities that historically occupied the alternatively classified areas. It should be noted that any classification system is artificial and that not all portions of a natural community will fall neatly into discrete classification units.

The plant communities at the Yamato Scrub Natural Area represent a mosaic of historic and artificial communities, including scrub, scrubby flatwoods, mesic flatwoods, drained basin marsh, prairie hammock, and disturbed areas (Figure 4). Except in the case of the drained basin marsh, the historic natural communities of the site are primarily intact. Major modifications to these historic communities have resulted from digging of canals and placing of spoil piles, the lowering of the ground water table, decades of fire exclusion, construction of roads transecting the site, development of adjacent properties, and exotic pest plant invasions. One large area of spoil deposited from the digging of the L-40 Canal through the scrub ridge is located in the east-central portion of the site and is dominated by Australian pine and Brazilian pepper.

The former basin marsh has been severely drained by the lowering of the groundwater level by adjacent canals. It no longer supports any significant amount of wetland vegetation, and is dominated by Brazilian pepper and ruderal grasses. Brazilian pepper dominates the lower areas of the drained basin marsh where muck soils were present, covering approximately 50% of this community. Spoil piles that were created by the digging of the canals are also dominated by exotic species such as Australian pine, and Brazilian pepper. Other modifications to the historic natural communities at the Yamato Scrub Natural Area have been minor. Off-road vehicle (ORV) traffic has caused some damage to the mesic flatwoods and drained basin marshes in the northern portion of the site. Small areas of disturbed scrub have been created by clearing and filling on the edges of the site adjacent to Clint Moore Road. Otherwise, the site is dominated by native plant species. However, several exotic species are beginning to invade the relatively undisturbed portions of the Natural Area. Earleaf acacia, carrotwood, shoebutt ardisia, and Brazilian pepper seedlings, as well as Natal grass, for example, are scattered throughout the site.

Descriptions of each community in this plan are taken from the FNAI text. A comprehensive listing of the plant species recorded at the Yamato Scrub Natural Area is provided in Appendix A. A preliminary list of animal species recorded is provided in Appendix B. Although a detailed plant species inventory was performed at this site, the animal species survey was based on opportunistic observations and it is likely that other species were present but were not observed. These species may be added to the list in the future.

B.7.a Drained Basin Marsh

Basin marsh is characterized as an herbaceous or shrubby wetland situated in a relatively large and irregular shaped basin (FNAI and DNR, 1990). Typical plants found in basin marsh include common reed (*Phragmites australis*), *Panicum* grasses, cutgrass (*Leersia* spp.), southern watergrass (*Luziola fluitans*), pennyworts, Spanish needles (*Bidens bipinnata*), redroot (*Lachnanthes caroliniana*), soft rush (*Juncus effusus*), American lotus (*Nelumbo lutea*), creeping primrose willow (*Ludwigia repens*), arrowhead (*Sagittaria* spp.), coastal plain willow (*Salix caroliniana*), groundseltree, elderberry, spikerush (*Eleocharis* spp.), mild waterpepper (*Polygonum* spp.), buttonbush (*Cephalanthus occidentalis*), and dogfennel. Only *Panicum* grasses, pennyworts, groundseltree, elderberry, and dogfennel have been recorded at the Yamato Scrub Natural Area. Soft rush and Spanish needles do not occur this far south on the east coast of Florida (Wunderlin, et al. 1996). American lotus, although native to Palm Beach County, is not found east of Lake Okeechobee. Common reed, cutgrass, southern watergrass, redroot, creeping primrose willow, arrowhead, coastal plain willow, spikerush, mild waterpepper, and buttonbush could be found at the site in the future if water levels in the basin marsh were restored to historical levels.

Animal species typical of basin marshes include two-toed amphiuma (*Amphiuma means*), lesser siren (*Siren intermedia*), greater siren (*Siren lacertina*), Florida cricket frog (*Acris gryllus*), green treefrog, bull frog (*Rana catesbeiana*), pig frog (*Rana gylio*), leopard frog (*Rana sphenoccephala*), alligator (*Alligator mississippiensis*), eastern mud snake (*Farancia abacura*), green water snake (*Nerodia cyclopion*), banded water snake (*Nerodia fasciata*), striped swamp snake (*Regina allen*), black swamp snake (*Seminatrix pygaea*), great blue heron, great egret, snowy egret (*Egretta thula*), little blue heron (*Egretta caerulea*), tricolored heron, bald eagle (*Haliaeetus leucocephalus*), and northern harrier (*Circus cyaneus*) (FNAI and DNR, 1990).

Only Florida cricket frog, green treefrog, great blue heron, great egret, and tricolored heron have been recorded at the Yamato Scrub Natural Area to date. The apparent absence of numerous described animal species may be due to a combination of several reasons. The basin marsh portion of the site has both been drained as well as reduced in size, and is unable to support species such as the amphiuma, sirens, pig and leopard frogs, alligator, and the mud, water and swamp snakes. This site is out of the range for the bull frog which does not occur south of Brevard County. Other species mentioned such as the bald eagle, northern harrier, and other wading birds may be found at the site in the future as more complete surveys are performed.

Basin marshes are formed in large solution depressions that were formerly shallow lakes. The lake bottom has slowly filled with sediments from the surrounding uplands and with peat derived from plants (FNAI and DNR, 1990). The soils are usually acidic peats. The basin marsh soils at the Yamato Scrub Natural Area are currently classified as Pompano fine sand, but fine black particles in the surface layer indicate that mucky peat was once present. The hydroperiod is generally around 200 days per year in intact basin marsh, but has virtually disappeared in the drained basin marsh. Open areas of relatively permanent water within the marsh, with or without floating aquatic vegetation, are considered to be marsh lakes when they are present.

Fire maintains this open herbaceous community by restricting shrub invasion. The normal interval between fires is one to ten years, with strictly herbaceous marshes burning at intervals of three years or less. Fires during drought periods will often burn into the mucky peat and will convert the marsh into a marsh lake or

create isolated potholes (FNAI and DNR, 1990). Basin marshes are associated with and often grade into wet prairie or lake communities. They may eventually succeed to bog, if succession is not reversed by a muck fire. Many of the plants and animals occurring in basin marshes also occur in floodplain marsh, slough, swale and depression marsh. Large examples of depression marsh, in fact, may be very difficult to distinguish from small examples of basin marsh (FNAI and DNR, 1990). Normal hydroperiods must be maintained, or basin marsh vegetation will change. Shortened hydroperiods, like those at this site, will permit the invasion of mesophytic species, while longer hydroperiods will convert the marsh into a lake. Fire is also necessary to control hardwood encroachment. However, fires during droughts should be avoided to reduce the possibility of a muck fire. Many basin marshes have been degraded by pollution or drained for agricultural uses.

The Yamato Scrub Natural Area contains 16.5 of drained basin marsh comprising approximately 7.6% of the site (Figure 4). All of the basin marsh on the site has been affected by drainage and a groundwater table that has been lowered from 11 feet above sea level to five feet. The last of the surface water in this marsh disappeared in the early 1960s, and the site has not burned since the mid 1960s. Although wisps of sawgrass and maidencane, and clumps of sand cordgrass are still present, most other wetland vegetation has disappeared, leaving only the remains of old *Osmunda* fern clumps. Brazilian pepper forms a dense monoculture in the lower areas where muck soils were once present, while mesic and scrubby flatwoods vegetation, mixed with ruderal and exotic herbs and grasses, has colonized the sandy soils on the edges and higher spots. An approximately 2.1-acre area of Brazilian pepper within the drained basin marsh was removed in 1999, was scraped down a foot, and was replanted with cutthroat grass in an endangered plant relocation project (Figure 4). Animals characteristic of open sandy areas, such as gopher tortoise and scrub lizard are now found in the drained basin marsh. Listed species recorded for drained basin marsh at this site include sand dune spurge, Florida mouse, Florida scrub lizard, and gopher tortoise.

B.7.b Mesic Flatwoods

Typical mesic flatwoods communities are characterized by a low, flat topography, and moderately-to poorly-drained, acidic, sandy soils often overlying an organic or clay hardpan (Abrahamson and Hartnett, 1990; FNAI and DNR, 1990). Generally, an open overstory of pines is present, which in southern Florida almost always consists of south Florida slash pine. The understory is quite variable, but generally includes a dense groundcover layer of herbs and shrubs such as saw palmetto, gallberry, and wiregrass. Other typical plants include St. John's-worts, dwarf huckleberry (*Gaylussacia dumosa*), wax myrtle, coastalplain staggerbush, blueberries, gopher apple, tarflower, bogbuttons (*Lachnocaulon* spp.), blackroot, false foxgloves (*Agalinis* spp.), toothed whitetop aster (*Aster paternis*), yelloweyed grasses (*Xyris* spp.), and cutthroat grass (FNAI and DNR, 1990). All of these plant species have been recorded for this site except for dwarf huckleberry, bogbuttons, false foxgloves, toothed whitetop aster, and yelloweyed grasses. Toothed whitetop aster does not occur in Palm Beach County. Dwarf huckleberry, bogbuttons, false foxgloves, and yelloweyed grasses could be found at the Natural Area in the future.

Animals normally associated with mesic flatwoods include the oak toad (*Bufo quercicus*), little grass frog (*Limnaeodius ocularis*), eastern narrowmouth toad, black racer, red rat snake, eastern American kestrel, brown-headed nuthatch (*Sitta pusilla*), pine warbler, Bachman's sparrow (*Aimophila aestivalis*), cotton rat, cotton mouse, black bear (*Ursus americanus*), raccoon, gray fox, bobcat (*Lynx rufus*), and white-tailed deer (*Odocoileus virginianus*) (FNAI and DNR, 1990). Of these, the eastern narrowmouth toad, black racer, red

rat snake, eastern American kestrel, pine warbler, cotton rat, cotton mouse, gray fox, and raccoon have been documented at the Yamato Scrub Natural Area. The site does not contain sufficient acreage to support the continued presence of black bear, bobcat, and white-tailed deer. National Geographic Society (1987) maps the brown-headed nuthatch as not occurring in counties south of Lake Okeechobee. All of the other mentioned animal species could be found at the Natural Area in the future.

Due to the presence of a subsurface organic hardpan layer or clayey subsoil, mesic flatwoods usually flood for brief periods each year. During the dry season, groundwater is unattainable for many plant species whose roots fail to penetrate the hardpan (FNAI and DNR, 1990). Thus many plants are under the stress of water saturation during the wet season, and under the stress of dehydration during the dry season. Fire frequency in mesic flatwoods has been estimated at 1 to 8 years (FNAI and DNR, 1990). In the absence of fire, mesic flatwoods may develop towards hardwood-dominated forests with a closed canopy that can eliminate the ground cover herbs and shrubs. Very frequent or hot fires can eliminate pine recruitment and eventually transform mesic flatwoods into dry prairie (FNAI and DNR, 1990). Mesic flatwoods is closely associated with and often grades into wet flatwoods, dry prairie, or scrubby flatwoods. The differences between these communities generally are related to minor topographical differences, with wet flatwoods occupying the lower, wetter areas and scrubby flatwoods occupying the higher, drier areas.

There is one large interconnected area of mesic flatwoods at the Yamato Scrub Natural Area, occupying 14.5 acres or 6.7% of the site (Figure 4). This area is found in the northern portion of the site, where it abuts scrub and scrubby flatwoods vegetative communities. Some of the mesic flatwoods at this site is of recent origin, having developed from wet depressional areas that were previously too wet to allow slash pine to survive. The plant species distribution in these areas is somewhat atypical, with an overstory of slash pine and little understory or ground cover other than pine needles, which reflects the recent conversion from a wet depression. Because of the lowering of the ground water table, scrubby vegetation is moving into portions of the mesic flatwoods, and a transition to scrubby flatwoods appears to be occurring. For this reason, finding a good separation line between the mesic and scrubby flatwoods communities is difficult. Otherwise, mesic flatwoods are generally in good condition at this site, with little evidence of disturbance other than fire exclusion and ORV trails. Listed species found in mesic flatwoods on this site include common, reflexed, and giant wild pines, cutthroat grass, eastern diamondback rattlesnake, red widow spider, and gopher tortoise.

B.7.c Prairie Hammock

Prairie hammock is a periodically-inundated plant community that is characterized by a canopy of cabbage palm with a sparse understory of saw palmetto, wax myrtle, marlberry, water oak (*Quercus nigra*), stoppers (*Eugenia* spp.), pigeon plum (*Coccoloba diversifolia*), poison ivy, poisonwood (*Metopium toxiferum*), orchids (*Habenaria* spp.), and lidflowers (*Calyptanthus* spp.) (FNAI and DNR, 1990). Cabbage palm, saw palmetto, wax myrtle, marlberry, and poison ivy, have been recorded in the prairie hammock at the Yamato Scrub Natural Area. Water oak and lidflowers are not native to southeastern Palm Beach County. Poisonwood, stoppers, orchids, and pigeon plum may be recorded in the future. Animals typically associated with prairie hammock include the box turtle, southeastern five-lined skink, black racer, and several species of shrews and rodents (FNAI and DNR, 1990). All of these animals have been recorded at the site, with the exception of shrews, which could be recorded in the future.

This community forms on slightly elevated areas within a prairie or marsh. Soils are variable; they usually consist of sand overlying calcareous marl but may be a more complex association of marl, peat, and sand overlying limestone. Standing water may be present for 10 to 40 days each year. Light ground fires may occur occasionally on drier sites. Prairie hammock may be associated with or grade into hydric hammock, rockland hammock, or shell mound and is considered to represent an advanced seral stage of mesic flatwoods, dry prairie, or marl prairie (FNAI and DNR, 1990).

The prairie hammocks at the Yamato Scrub Natural Area are of natural origin, but have expanded in extent in response to fire suppression and lowered water levels in the adjacent drained basin marsh. There are three areas of prairie hammock in the northern part of the site, totaling 9 acres or 4.1% of the site (Figure 4). Areas of prairie hammocks too small to map occur at the ecotones between drained basin marsh and scrubby flatwoods. The prairie hammocks at this site are dominated by live oaks and cabbage palms. Beautyberry, saw palmetto, and wild coffee are common in the understory. In many areas, Brazilian peppers and other exotic plant species have become established. This community is in a relatively poor condition due to exotic plant invasions, previous dumping activities, and other disturbances associated with the placing of canal spoil piles on the perimeter of the prairie hammock. Listed species recorded in this community include common and reflexed wild pines, hand fern, and gopher tortoise.

B.7.d Scrub

Scrub communities are highly variable in form but generally are characterized by the occurrence of several species of oaks and/or Florida rosemary as dominant shrubs in the understory (Myers 1990). The overstory, if present, consists of a closed-to-open canopy of sand pine. The understory, which is more definitive of the general scrub community, is typically composed of shrubby, evergreen or nearly evergreen oaks that include sand live oak, myrtle oak, Chapman's oak, and scrub oak (*Quercus inopina*). Florida rosemary may be dominant, may be found with oaks, or may be absent (Myers 1990). Other typical plants include saw palmetto, rusty staggerbush (*Lyonia ferruginea*), scrub hickory (*Carya floridana*), scrub palmetto, hog plum, scrub bay, sandyfield beaksedge, milkpeas, and coastalplain staggerbush (FNAI and DNR, 1990). All of these plant species have been recorded at the Yamato Scrub Natural Area, with the exception of rusty staggerbush, scrub hickory, and scrub oak. The range of both of rusty staggerbush and scrub oak is restricted to areas further to the north (Wunderlin, et al. 1996), and they would not be expected to be present. Scrub hickory is very rare in southeastern Palm Beach County, but it could be recorded at this site in the future.

Iverson and Austin (1988) developed a list of 24 indicator plant species for scrub in Palm Beach County. At the time of this assessment, 23 (or 96%) of these species had been recorded at the Yamato Scrub Natural Area (Appendix A). Fernald (1989) also developed a list of scrub indicator plant species for the coastal scrubs of the Treasure Coast. 35 of the 47 species (or 74%) have been found at the Yamato Scrub Natural Area (Appendix A). Scrub, for both of these authors, refers to both scrub and scrubby flatwoods natural communities (sensu FNAI). Listed plant species recorded in the scrub community at the site include Curtiss' milkweed, large-flowered rosemary, nodding pinweed, sand dune spurge, scrub bay, and common, giant, and reflexed wild pines.

Animals typically associated with scrub include red widow spider, scrub wolf spider (*Lycosidea*), oak toad (*Bufo quercicus*), six-lined racerunner, blue-tailed mole skink (*Eumeces egregius lividus*), gopher tortoise,

eastern coachwhip, sand skink (*Neoseps reynoldsi*), Florida scrub lizard, Florida scrub jay, ground dove, yellow-rumped warbler, loggerhead shrike, rufous-sided towhee, Florida mouse, and eastern spotted skunk (Cox, et al. 1987; FNAI and DNR, 1990; Myers 1990). All of these species except the scrub wolf spider, oak toad, blue-tailed mole skink, and sand skink have been recorded at the site. All of the non-recorded species except the blue-tailed mole skink and sand skink could be recorded in the future. Because the range of these skinks is restricted to a few counties in central Florida, they are not expected to be found at the Natural Area. Listed animal species recorded in the scrub community at the site include the Arctic peregrine falcon, American redstart, eastern diamondback rattlesnake, eastern indigo snake, Florida scrub jay, Florida scrub lizard, gopher tortoise, red widow spider, and worm-eating warbler.

Scrub communities occur on sand ridges along former shorelines and are characterized by very-well-drained, nutrient-poor soils, a relatively open canopy, a dense to open understory layer, and a sparse groundcover. They are also one of the many pyric (fire-maintained) communities that occur in Florida (Fernald 1989; Myers 1990). In the prolonged absence of fire, the structure and species composition of these communities will gradually change, often resulting in succession to xeric hammock. Alternatively, where sand pines are present abundantly in the canopy, a dense sand pine forest may develop and shade out most of the other species that are typical of scrub (Fernald 1989). Regular fires occurring at intervals of every 20-80 years may naturally return stands of mature scrub to a younger, more open state (FNAI and DNR, 1990). Much debate exists, however, concerning historic fire frequencies in scrub (Fernald 1989), and this subject deserves further attention in southeastern Florida. Periodic fire is one of the physical disturbances that may maintain the areas of open sand that characterize typical scrub. It probably is necessary for the growth and proliferation of many of the rare and/or endemic species that are found in scrub communities in Florida.

The density of sand pine within a scrub canopy often is a reflection of fire frequency. Individual sand pines usually are killed by fire, but normally are replaced by new sand pines that regrow from seeds. It takes nearly 10 years for the replacement stand of sand pines to mature and begin producing new seeds (Austin 1976). Long-term fire exclusion also may lead to the elimination of sand pines from a scrub site. Myers (1990) estimated that stands of sand pines may begin to break up after 50-70 years, and that individual trees rarely reach 100 years of age. As such, a sequence of fires at relatively short intervals or relatively long intervals may eliminate sand pines from the system entirely. Florida rosemary, which also succumbs to fire and requires 10-15 years to reach reproductive maturity, may be eliminated from scrub because of relatively frequent fires (Johnson 1982). Most of the other scrub species re-sprout readily from root-shoots following fire, although their resistance to fire exclusion varies tremendously.

In spite of these generalizations regarding scrub, it is difficult to extrapolate the history of a scrub site based solely upon vegetative composition. Scrub is a dynamic community, and existing stands reflect a complex interplay of fire frequency, historic land use patterns, and local, site-specific factors such as topography, depth to water table, and relationships to adjoining vegetation. Many different scrub types have been noted in the literature (Fernald 1989). Distinctions between interior versus coastal scrubs, soil color ("white" versus "yellow" sands), and dominant species (sand pine, rosemary, oak) have been noted. Because no differentiation of scrub types occurring in the Treasure Coast Region had been published, Fernald (1989) did not distinguish between scrub types in his mapping units. He did distinguish between scrub and scrubby flatwoods in his discussion and separated scrubby flatwoods into scrubby oak flatwoods and scrubby pine flatwoods. His scrubby oak flatwoods may be equivalent to the oak scrub of other authors (e.g., Duever

1983). Iverson and Austin (1988) also did not distinguish between scrub types in their *Inventory of Native Ecosystems in Palm Beach County*. Differences in scrub types may play an important role in the regional distribution of both flora and fauna, and deserve further attention.

The Nature Conservancy has completed an Element Stewardship Abstract (ESA) for the scrub community. This ESA provides an overview of the ecology and management needs of scrub, and may be of assistance in directing management efforts at the Yamato Scrub Natural Area. FNAI classifies scrub as G2/S2, or a natural community that is imperiled both in the state and globally. Scrub is associated with and often grades into sandhill, scrubby flatwoods, coastal strand, and xeric hammock (FNAI and DNR, 1990). Given the predominance of St. Lucie fine sand (a primary scrub soil) on the site, it seems probable that scrub historically dominated the site. ERM has calculated that the area of intact scrub habitat is 137.6 acres, or 63.4% of the site (Figure 4). The Yamato Scrub Natural Area contains the largest remaining scrub tract in southern and central Palm Beach County.

Scrub is found primarily in the northern, eastern and southern portions of the Natural Area, and gives way to other communities in the western portion of the site. There is a patchy, variable sand pine overstory in this community at the Natural Area. In the southern portion of the site, the sand pines are old and mature, and have begun to die back and topple in windstorms. The sand pines in the northern portion of the site are much younger, and seem to be seeding into the scrubby and mesic flatwoods communities. Sand pines are virtually absent from the two areas burned in 1986 due to burn preparation techniques that were unfavorable for sand pine regeneration. The understory layer is a slightly open to dense thicket of Chapman's oak, sand live oak, myrtle oak, and saw palmetto, with scattered hog plum and scrub palmetto. Underneath the oaks, gopher apple and sand live oak root sprouts are present. In the open sandy areas, dominant herbs include gopher apple, hemlock witchgrass, jeweled blueeyed grass, Deckert's pinweed, and Feay's prairieclover.

B.7.e Disturbed Scrub

Disturbed scrub consists of areas of scrub that were cleared and sometimes leveled, and then left to regenerate. There are five areas of disturbed scrub, totaling 3.1 acres or a little more than 1.4% of the site (Figure 4). Four of these areas are on the north and south sides of Clint Moore Road in the center of site, and were created by excessive clearing for the construction of the road in the mid-1970s. The fifth area is south of the L-40 Canal in the east central portion of the site and was created by canal and electrical transmission line construction. Disturbed scrub typically has many of the same plants as intact scrub, but the plants are smaller and sparser, and there are larger expanses of bare sand. There is also a higher than normal percentage of ruderal and exotic plants such as Brazilian pepper, Natal grass, and muscadine grape. Pioneer, high-light environment scrub plants such as skyblue lupine, narrowleaf silkgrass, Feay's prairieclover, and Deckert's pinweed are more common, and the higher levels of herbaceous plants can provide an important food source for gopher tortoises. This community generally does not burn because the vegetation is too sparse to carry a fire. The animals found in disturbed scrub are similar to those found in scrub. Listed species recorded in the disturbed scrub community at the site include large-flowered rosemary, sand-dune spurge, and gopher tortoise.

B.7.f Scrubby Flatwoods

Scrubby flatwoods communities generally occur in transitional areas between mesic flatwoods and scrub. While some consider scrubby flatwoods as an ecotonal or even an artificial community, others classify it as a discrete community or association (Abrahamson and Hartnett, 1990; FNAI and DNR, 1990). The canopy is usually composed of scattered pines, which may include slash pine or longleaf pine (*Pinus palustris*). The understory is usually dominated by scrub oaks, saw palmetto or scrub palmetto, or a combination of these plants. Other typical plants include coastalplain staggerbush, wiregrass, shiny blueberry, gopher apple, rusty staggerbush (*Lyonia ferruginea*), tarflower, goldenasters, ground lichens (*Cladonia* spp.), scrub bay, garberia (*Garberia heterophylla*), huckleberries (*Gaylussacia* spp.), goldenrods, running oak, pinweeds, and frostweeds (FNAI and DNR, 1990). All of these plants have been recorded at the Yamato Scrub Natural Area except for longleaf pine, rusty staggerbush, garberia, and huckleberry. Longleaf pine, garberia, and rusty staggerbush are not known to occur in Palm Beach County, but huckleberry could be recorded at the Natural Area in the future.

Animals normally associated with scrubby flatwoods include the oak toad (*Bufo quercicus*), pinewoods tree frog (*Hyla femoralis*), gopher tortoise, six-lined racerunner, eastern diamondback rattlesnake, Florida scrub lizard, blue-tailed mole skink (*Eumeces egregius lividus*), sand skink (*Neoseps reynoldsi*), northern bobwhite, ground dove, Florida scrub jay, rufous-sided towhee, southeastern pocket gopher (*Geomys pinetis*), and Florida mouse (Abrahamson and Hartnett, 1990). Of these, the gopher tortoise, six-lined racerunner, eastern diamondback rattlesnake, Florida scrub lizard, northern bobwhite, ground dove, Florida scrub jay, Florida mouse, and rufous-sided towhee have thus far been documented as occurring at the Yamato Scrub Natural Area. Southeastern pocket gopher, blue-tailed mole skink and sand skink would not be expected to occur at this natural area since the southern reaches of their range end to the north. The oak toad and the pinewoods tree frog could be found at the Natural Area in the future.

Scrubby flatwoods differ from other the types of flatwoods in that they occur at slightly higher elevations, on more well-drained soils. The dominant soil on which scrubby flatwoods is located at this site is Immokalee fine sand. Even under extremely wet conditions, scrubby flatwoods will not flood (Abrahamson, et al. 1984). The structure and species composition of scrubby flatwoods is more closely aligned with scrub than with other types of flatwoods. Due to the relatively sparse ground cover, the presence of scrub oaks, and the presence of open, sandy areas, fire frequency in scrubby flatwoods is lower than in other flatwoods communities, and has been estimated at between 8 to 25 years (FNAI and DNR, 1990). In the absence of regular fire, scrubby flatwoods may develop towards scrub on drier sites, or xeric live oak hammock on less well-drained sites (Laessle 1942). A successional pathway from xeric live oak hammock to mesic hammock also has been proposed (Laessle 1942).

For inventory purposes, neither Iverson and Austin (1988) nor Fernald (1989) distinguished between scrub and scrubby flatwoods. Fernald (1989), however, did distinguish between scrub and scrubby flatwoods in his discussion, and differentiated between scrubby pine flatwoods and scrubby oak flatwoods. His scrubby oak flatwoods may be equivalent to the oak scrub of other authors (e.g. Duever 1983). Abrahamson and Hartnett (1990) point out that although the scrubby flatwoods community is nearly endemic to Florida and relatively limited in total area, this natural community has received little study. FNAI lists this community as G3/S3, which is a natural community that is very rare and local, or vulnerable to extinction due to other

factors, both in the state and globally. Scrubby flatwoods are associated and often grade into mesic flatwoods, xeric hammock, scrub, dry prairie, or sandhill.

There are 26 acres of scrubby flatwoods, or 11.9% of the site, at the Yamato Scrub Natural Area (Figure 4). This community is found on both sides of the drained basin marsh in the northern half of the site and occurs predominantly on Immokalee soils. The overstory of the scrubby flatwoods is dominated by scattered slash pines. The understory is a moderately open to dense thicket of sand live oak, myrtle oak, saw palmetto, coastalplain staggerbush, and fetterbush. The ground cover layer is characterized by coastalplain goldenaster, ground lichens, and scattered areas of sparsely-vegetated, open white sandy areas. Listed plant species recorded within scrubby flatwoods at this site include common, giant, and reflexed wild pines. Listed animal species recorded in this community include eastern diamondback rattlesnake, Florida mouse, Florida scrub lizard, gopher tortoise, and red widow spider.

B.7.g Spoil

The spoil community occurs where spoil from canal construction was placed outside the canal right-of-way or easement. Spoil area are found on the east side of the E-4 Canal, the north side of the L-40 Canal, and portions of the south side of the L-40 Canal. They total 6.9 acres or 3.2% of the site. These soil piles were first created in the late 1910s during the construction of the canals, and have been augmented by the deepening and widening of these canals around 1980. Although native vegetation has colonized the spoil piles in a few spots, they are mostly characterized by being covered with Brazilian pepper and Australian pine. Fires are unlikely in the spoil community because of a scarcity of flammable material to carry a fire. The spoil areas have little wildlife usage, but does provide roosting trees for the osprey, a listed species. Listed species recorded in the spoil community include long strap fern and gopher tortoise.

B.7.h Canal

A portion of the L-40 Canal is included in the west central portion of the site. The banks of the canal are covered with exotic and ruderal grasses such as torpedo grass. There are native herbaceous wetland plants growing in patches in the bottom of this shallow canal, and it is utilized by animals typical of wetland habitats. The canal and its banks cover 1.4 acres or less than 0.7% of the Natural Area. Listed species recorded in this canal include great egret, osprey, tricolored heron, and wood stork.

B.8 MINERAL RESOURCES

There are no known oil, gas, or phosphate deposits, or any other mineral resources at the Yamato Scrub Natural Area that have sufficient value that their removal would be commercially viable. A one-half interest in oil rights and a three-quarter interest in mineral resource rights on 144.4 acres of the State-owned tract was previously reserved by the State (Appendix E). The remaining oil and mineral rights on the 144.4 acres and the oil and mineral resources rights on the other 62.3 acres of the State-owned tract were acquired by the State of Florida when it received title to the State-owned tract. The City and the County own the oil and mineral resource rights on the City- and County-owned tract.

B.9 UNIQUE NATURAL FEATURES

Within the context of Palm Beach County, the Pamlico Dune Ridge within the Yamato Scrub Natural Area should be considered a unique natural feature. Very few areas exist in the County where the Pamlico Dune Ridge can be viewed in a relatively unaltered state. There are no coral reefs, springs, rapids, caverns, sinkholes, or state or nationally designated wild and scenic rivers at the Yamato Scrub Natural Area.

B.10 OUTSTANDING NATIVE LANDSCAPES

The entire Yamato Scrub Natural Area should be considered an outstanding native landscape containing relatively unaltered flora, fauna, and geologic conditions.

B.11 RESOURCES ON THE PROPERTY THAT ARE USED IN THE FLORIDA NATURAL AREAS INVENTORY

A letter from the Florida Natural Areas Inventory (FNAI) on the resources that they have listed as occurring on this site is provided in Appendix M.

B.11.a FNAI-listed Natural Communities

Two of the five intact natural communities found at The Yamato Scrub Natural Area have been classified by FNAI as very rare (S3) or imperiled (S2) in the state (FNAI and DNR, 1990). Scrubby flatwoods has been classified as very rare, while scrub has been classified as imperiled in the state. Only basin marsh, mesic flatwoods, and prairie hammock - which together occupy less than 25% of the site - have been classified as apparently secure in the state.

B.11.b FNAI-listed Plants

Eight species of plants at the Yamato Scrub Natural Area are listed by FNAI (1999) as very rare (S3), or imperiled (S2), in the state. Of these, four are classified as very rare (Curtiss' milkweed, large-flowered rosemary, nodding pinweed, and scrub bay), and four are classified as imperiled in the state (burrowing-four-o'clock, cutthroat grass, hand fern, and sand dune spurge).

B.11.c FNAI-listed Animals

Twelve species of animals recorded at the Yamato Scrub Natural Area are listed by FNAI (1999) as very rare (S3), imperiled (S2), or critically imperiled (S1), and one species (red widow spider) is so little understood that its current status is unknown. Of these, nine are classified as very rare (American redstart, eastern diamondback rattlesnake, eastern indigo snake, Florida mouse, Florida scrub jay, Florida scrub lizard, gopher tortoise, painted bunting, and osprey), two are classified as imperiled (Arctic peregrine falcon and wood stork), and one is classified as critically imperiled in the state (worm-eating warbler).

C. USAGE OF THE PROPERTY

C.1 PAST USES

The majority of the Yamato Scrub Natural Area has remained for the most part, as undisturbed native vegetation with minimal past uses. Perimeter and bisecting roads and canals have caused permanent changes to the native vegetation within their rights-of-ways, and clearing, grading, and dumping of canal spoil material have created disturbed areas along the edges of these rights-of-way. Otherwise, the past uses of the site have caused mostly temporary and/or minor problems on small areas scattered throughout the site. All slash pines on the site large enough to have usable timber were logged by the 1920s. Some minor levels of hunting may have occurred on the site from pioneer times to the 1970s, but this site does not appear to ever have contained large populations of game species and the effects of hunting can be considered to be ephemeral. Perimeter disturbances associated with construction of roads and canals and the development of adjacent industrial and commercial properties began in the 1910s and continue today.

The L-40 and E-4/EI Rio Canals were dug by Lake Worth Drainage District in the late 1910s and the canal spoil material was piled along the edges of the canal rights-of-way. The present-day CSX Railroad was constructed in the 1920s. The adjacent Boca Teeca electrical substation was built around 1970 and the transmission lines and access roads associated with this substation cut through portions of the site. Clint Moore Road and Congress Avenue were built in the 1970s and widened in the 1980s. Significant trash, construction debris, and tire dumping occurred where an old jeep trail that connected to Congress Avenue led back into the Natural Area, however, nearly all of the debris on the site was removed prior to initial acquisition by the County. Construction of adjacent industrial buildings began in the early 1980s on portions of the Arvida Park of Commerce and Boca Commerce Center industrial parks and has continued to present. The Boca Raton Shrine Club built their adjacent facility in 1994. A more detailed account of past uses and disturbances can be found in Section A.5, History.

C.2 ACQUISITION PURPOSE

The primary purpose for acquisition of the Yamato Scrub Natural Area is to preserve the largest tract of Atlantic Coastal Ridge scrub left in southern Palm Beach County, and the largest tract of scrub left in Florida south of Juno Beach. It is also been acquired to preserve high-quality examples of mesic flatwoods, scrubby flatwoods, and prairie hammock, and to protect critical habitat for rare and endangered species such as cutthroat grass and the Florida mouse. Acquisition of this site will provide public opportunities for passive recreation activities, environmental education, and scientific research. The preservation of this site will help protect the quality and quantity of groundwater resources and will help Palm Beach County and the City of Boca Raton comply with portions of their respective comprehensive plans. This site will be managed under the "single-use" concept, which means that it will be managed to preserve and restore natural resource values. All portions of the Natural Area are important to preserving natural resource values and no portion should be declared as surplus land.

C.3 VISITOR SERVICES AND PUBLIC ACCESS

The public uses proposed by Palm Beach County with the support of the City of Boca Raton were carefully chosen and designed so as to not have a significant impact on any of the rare and endangered plants,

animals, and natural communities found on the Yamato Scrub Natural Area. At the same time, these public uses will provide for adequate public passive recreational opportunities such as nature appreciation and study, photography, and hiking. The facilities planned also will be available for environmental education and scientific research.

Palm Beach County proposes to construct one parking area on the Yamato Scrub Natural Area (Figure 6). It will provide space for 10 cars and two buses and will include one handicap-accessible space. The parking area will be designed to allow for expansion to up to 30 car parking spaces if site conditions and public usage warrant an expansion. This parking area is located in a portion of the drained basin marsh north of Clint Moore Road that is dominated by exotic and ruderal vegetation. Prior to development of this parking area, the County will survey this area for listed species. If any listed species are found, the parking area location will be adjusted to avoid impacts, or the listed species will be relocated on the site. Public access to this parking area will be via a driveway from Clint Moore Road that will be located opposite Park of Commerce Boulevard. Right-hand and left-hand turn lanes may need to be constructed and the need for these lanes should be investigated. An entrance sign will be erected next to the parking area driveway. An entrance gate will be installed across the driveway to control entry to the parking area. A mounted garbage can will be placed at the parking area, along with a bicycle rack to encourage bicycle use.

A kiosk will be constructed adjacent to this parking area, near the beginning of the nature trail (Figure 6). This kiosk will provide general information about the entire Yamato Scrub Natural Area, such as the geological origins of the site, its topographic features, aquifer recharge significance, natural communities, the protection of listed species and their habitat, and other natural features of interpretive value. The kiosk will be constructed within a disturbed area dominated by exotic and ruderal plants, and thus will not impact any natural communities. A natural area rules sign will be installed next to the kiosk, along with a dedication sign which will designate the site as a Conservation and Recreational Lands project that is a natural area open to the public. The sign will state that the Natural Area has been purchased with funds from the State, the County, and the City, and is managed by the County with the assistance of the City. Handicap-accessible portolets will be located adjacent to the parking area and the pedestrian entrance to the trail system. These portolets will be placed on a concrete slab and screened from view by wood fencing and landscaping. They will meet the need for restroom facilities, without having many of the security and maintenance problems associated with larger, unattended restrooms in an urban area. The decision not to provide regular restroom facilities will be reconsidered if the City agrees to maintain the restrooms.

An approximately 2,000-foot handicap-accessible nature trail is planned for the Natural Area (Figure 6). This trail will originate at the northwest corner of the parking area and proceed northwest through the drained basin marsh into the prairie hammock community until it reaches a footbridge crossing the L-40 Canal. After crossing the canal, the nature trail will run north and then east through the prairie hammock community into the drained basin marsh. The trail will head east, crossing the drained basin marsh, which will either be restored in the vicinity of the nature trail as a freshwater wetland or mesic flatwoods. After crossing the drained basin marsh, the trail will enter the scrubby flatwoods and scrub communities and make a small terminal loop. This nature trail will be 4-inch-thick poured and formed concrete with a non-slip finish, and will be at least 5 feet wide to accommodate wheelchairs. The footbridge will be wood or prefabricated metal, at least 5 feet wide to accommodate wheelchairs, and will have appropriate guardrails and handrails.

In conjunction with the construction of the nature trail, ERM staff will prepare interpretive trail markers. A printed nature trail guide for the entire Yamato Scrub Natural Area will be developed. A recorded nature trail guide on tape for the visually-handicapped will also be prepared. The printed and recorded nature trail guides will be developed and the interpretive markers for the nature trail will be installed when nature trail construction is completed. Additional handicap-accessible interpretive facilities will be developed as necessary to fulfill Americans with Disabilities Act requirements.

A hiking trail system utilizing new and existing trails, and portions of the firebreak/management roads will provide public access to the northern and southern portion of the site (Figure 6). The hiking trails will be unimproved sand trails and the whole system totals 2.4 miles of trails. The northern portion of the site will have a 1.3-mile interior hiking trail loop that connects to the parking area via a 0.1-mile segment of the nature trail. The southern portion of the Natural Area will have a 1.1-mile interior hiking trail loop departing from near the terminus of the nature trail. This hiking trail segment will head south and cross the L-40 Canal via a wood or prefabricated metal footbridge. It will then head southeastward and cross under Clint Moore Road via an existing but unused golf cart underpass. After crossing under Clint Moore Road, the hiking trail will form a large loop in the portion of the site south of Clint Moore Road (Figure 6).

There is only one pedestrian entrance point to the trail system planned at this time, which is from the parking area north of Clint Moore Road (Figure 6). Additional pedestrian entrances from NW 6th Avenue and Park of Commerce Way could be added in the future if conditions warrant additional entrances. If the City builds a multi-use trail on the west side of the Natural Area along the El Rio/E-4 Canal, a pedestrian entrance from this trail should be investigated. If a sidewalk is needed from the parking area driveway to the El Rio Canal in order to connect to the sidewalk extending east from Congress Avenue, it will be constructed by the City (Appendix L).

All major proposed structures and improvements are described above and shown on Figure 6. Responsibilities for funding and constructing these improvements are outlined in an interlocal agreement between the City and the County (Appendix L). Only structures and improvements that will help to achieve the preservation and restoration of the natural resources of the site while providing for compatible public uses are proposed. Proposed public-use facilities such as the trails and parking area will fulfill Americans with Disabilities Act (ADA) requirements. All improvements and major land alterations shall comply with applicable local, state, regional and federal laws and regulations.

The management roads/firebreaks that will be used for portions of the hiking trail system will be located as much as possible on existing paths, trails, and disturbed areas on the site. Public use of existing secondary trails leading off the nature trail, hiking trail, and management roads will be discouraged by appropriate signage and vegetative barriers, by not maintaining these secondary trails, and by encouraging the regeneration of native vegetation in these trails. Prior to construction, all trail locations will be surveyed for listed species. If listed species would be impacted by the trail construction, the trails will be rerouted wherever possible, or the listed species relocated elsewhere on the site. Management roads/firebreaks used as part of the hiking trail system will be unimproved sand roads and will be at least 15 feet wide, which is the standard width of boundary firebreaks used by DEP on state lands. Routine maintenance of the management roads/firebreaks will be accomplished by periodic mowing of these roads.

When the nature trail is completed, ERM staff will train local volunteers to give guided tours of the site as part of the development of a site stewardship group. ERM also will develop an educational slide show by which describes the Yamato Scrub Natural Area and its resources. This slide show will be presented by ERM staff or local volunteers on a request basis. ERM staff will also be available to assist the faculty of local schools in developing educational programs for school use of the natural area. The Palm Beach County Naturescope series is expected to film a half-hour program on the site that will be shown on the cable television Channel 20 that shows County government programs. ERM does not anticipate performing any scientific research other than compiling and interpreting the data from monitoring activities, but will allow researchers affiliated with local institutes of higher learning to conduct scientific research on a permit basis.

The Yamato Scrub Natural Area will be open to the public during daylight hours only. Access hours will be posted at the parking area gate and pedestrian entrance point. It is anticipated that Boca Raton personnel will be responsible for the daily opening and closing of any public access gates, but this responsibility may be delegated to a local resident or a stewardship group if approved by both the County and the City.

C.4 USES THAT ARE NOT APPROPRIATE

Public uses on County-managed natural areas such as the Yamato Scrub Natural Area are regulated by the Natural Areas Ordinance (No. 94-13) which was adopted by the Board of County Commissioners (Appendix G). This ordinance provides for passive recreational activities such as hiking, nature study, and photography; for environmental education; and for scientific research. It prohibits destructive uses such as off-road vehicle use, dumping, and poaching of plants and animals. This ordinance prohibits the cutting of trees, hunting and the use of firearms, and requires special permits for camping, horseback riding, scientific research involving collection of plant and animal specimens or the use of watercraft in wetlands, and night-time use of the Natural Area.

There are no plans for any concessions or support services to be located on the site, nor are there plans to provide a camping area. There are sufficient retail businesses in the vicinity of the Natural Area to supply services normally provided by concessionaires. A camping area is not appropriate given the large area it would impact and the imperiled status of most of the upland natural communities on the site. Horseback riding is not appropriate because of the loose soils found at this site and because this site is located in an urban area far from equestrian communities. Furthermore, the construction of an expanded parking area with room for horse trailers would impact additional areas that are targeted for restoration. Logging and hunting are prohibited by the Natural Areas Ordinance, and the site does not contain commercially viable quantities of timber or significant populations of game species. Mountain bicycle usage of the site is prohibited by the Natural Areas Ordinance, and there are no plans to provide bicycle access to the site from the City's proposed multi-use trail on the western edge of the Natural Area along the El Rio/E-4 Canal except via the sidewalk and bike lanes on Clint Moore Road. There are no natural wetlands or navigable waters on the site, so there is no need to accommodate fishing and boating uses. There are no other alternative activities that were considered but not adopted as acceptable uses for the property.

C.5 OUTPARCELS

The 8.72-acre West Oak tract is still undeveloped with good quality scrub vegetation present and is located just west and adjacent to the southern tip of the Yamato Scrub Natural Area. This tract is owned by NABI, Inc. and the Nature Conservancy has contacted them on behalf of the County about a potential sale of the entire tract or the purchase of an access easement. This tract was within the original CARL project boundary and should be purchased and incorporated into the Natural Area if the landowner becomes willing to sell at appraised value.

D. MANAGEMENT ACTIVITIES

D.1 RESPONSIBILITIES

Management activities will be primarily the responsibility of the County, with assistance from the City of Boca Raton and volunteers from the local community, and will be coordinated under the direction of ERM. An interlocal agreement (Appendix L) has been developed with the City. The City has agreed to provide police and/or park ranger protection and weekly garbage pickup from trash receptacles located on the Natural Area. The City has also agreed to assume responsibility for the daily opening and closing of any gates providing public access to the natural area, although this responsibility may be delegated to a local resident or stewardship group if approved by both the County and the City. County staff will be responsible for the upkeep and maintenance of the fences, gates, trails, management roads, firebreaks, footbridges, interpretive facilities, parking area, and signs.

The City has also agreed to assist the County in the long-term management of the site, including removal of exotic vegetation, removal of trash and debris collected during volunteer activities, periodic prescribed burns, and other activities. All significant debris located within the Natural Area was removed prior to acquisition. Any remaining debris will be removed in a timely manner, unless such removal would cause undesirable damage to natural communities or listed species. A mounted trash can will be installed adjacent to the parking area to encourage the proper disposal of trash generated by site visitors. Periodic site cleanups to remove litter will be conducted as necessary by County and/or City staff with volunteers. Trail maintenance will be performed by County and/or City staff and community volunteers.

The County does not anticipate sharing management of the Natural Area with any other government agencies, but may explore performance of some management tasks by other government agencies. Since this site does not contain commercially-viable quantities of timber, significant populations of game species, or suitable pasture lands, there has been little interest in the site by private land managers. Additionally, there are very few private conservation land managers in heavily-urbanized southeastern Florida. For these reasons, management will have to be performed by public agencies. If any archaeological or historic sites are discovered in the future, Division of Historical Resources management procedures (Appendix H) will be followed in order to protect these resources. Any ground disturbance of previously undisturbed areas will be coordinated with the Division of Historical Resources staff. The collection of artifacts or disturbance of any archaeological or historical site on the project site is prohibited unless prior authorization has been obtained from the Department of State, Division of Historical Resources.

D.2 NEEDS AND PROBLEMS

The Yamato Scrub Natural Area consists predominantly of fire-maintained ecosystems, but has been largely fire suppressed since the mid-1960s. Restoration of a natural fire regime is necessary to maintain the historic plant communities as well as to ensure the continuance of listed species populations. Fire management is addressed in Section D.6, Restoration, Preservation, and Management and in the Fire Management Plan (Appendix J). The construction of drainage canals adjacent to and through the middle of the Natural Area and a regional lowering of the water table have eliminated the natural wetlands on the site, and have triggered major invasions by exotic plants. Deposition of canal spoil material has eliminated areas of native vegetation and replaced them with exotic and ruderal vegetation. Possible restoration of portions of the former wetlands will be addressed in Section D.7, Wetland Restoration.

Surrounding residential and industrial developments are also a source of exotic species invasions. Exotic plants have been planted immediately adjacent to the Yamato Scrub Natural Area, and many have begun to spread into the site. Illegal dumping on the site has included yard clippings, including invasive exotic species. Management activities necessary to deal with exotic plant and animals will be addressed in Section D.6, Restoration, Preservation, and Management. Listed species may require special management attention to ensure that their populations are maintained. Management activities necessary to maintain listed species populations will be addressed in Section D.6, Restoration, Preservation, and Management. No specific research needs have been identified for this site. However, the results of research on the reintroduction of Florida scrub jays to sites less than 200 acres in size and on the management of cutthroat grass on sites with lowered water tables would be applicable to this natural area.

D.3 ADJACENT LAND

The Yamato Scrub Natural Area is bounded on the north side by Congress Avenue and the Boca Commerce Center, on the east side by Boca Commerce Center, the Boca Teeca electrical substation, and the CSX Railroad tracks, and on the south side by the Arvida Park of Commerce, the Boca Raton Shrine Club, and Clint Moore Road. It is bordered on the west side by the Arvida Park of Commerce and the El Rio/E-4 Canal. While these surrounding industrial and residential uses do not directly conflict with the management of the Natural Area, they are a source of exotic plant and domestic pet incursions, and complicate prescribed burn management. The need to convey drainage water from the Boca Teeca and Hidden Valley developments through the site via the L-40 Canal conflicts with the goal of wetland restoration, since the drainage canal draws down adjacent former wetlands on the Natural Area. The site is bisected by Clint Moore Road, and bordered by Congress Avenue. These roads are major four-lane divided thoroughfares and are a significant cause of animal mortality via vehicular traffic.

Within 12 months of final approval of this management plan, ERM will begin a public education campaign to educate the surrounding community on the benefits of managed natural areas and the necessity of invasive plant control and prescribed burns in maintaining the native habitat. As part of the outreach program, local schools will be invited to use the project site for nature study, environmental education, and community service projects.

D.4 SITE PROTECTION

Approximately 7,000 feet of 6-foot green-vinyl-coated chain-link fencing has been installed at various locations around the perimeter of the site where the Natural Area borders unfenced industrial properties (Figure 7). Approximately 900 feet of similar chain-link fencing is needed along the northern border of the site, but is on hold because of the amount of vegetation that would have to be removed and lack of security problems along this border. Post-and-rail fencing has been installed on the portions of the site that border Congress Avenue and Clint Moore Road, and will be installed around the perimeter of the two parking areas. If the City builds a multi-use trail on the west side of the Natural Area along the El Rio/E-4 Canal, post-and-rail fencing will be installed to separate the trail from the Natural Area. Fencing will be installed within disturbed areas whenever possible, to minimize impacts on intact natural communities. Elsewhere on the site, fencing is not planned for the boundaries along the L-40 Canal and the CSX Railroad tracks. Existing fencing and gates block access to these areas and security problems have been minimal. Unless some event such as a prescribed burn opens up these areas to ORV trespass or other problems, the County does not plan additional fencing along these boundaries. If additional fencing becomes necessary, 6-foot galvanized chain-link would be the most likely fencing material to be installed.

Temporary signs identifying the Yamato Scrub site as a natural area were installed within one month of acquisition of each tract. Perimeter signs have been posted on all fence corners and every 500 feet along the perimeter of the Natural Area, stating that the Yamato Scrub site is a protected natural area and citing appropriate County and City ordinances. Sign installations have not significantly disturbed any natural communities on the site. Management access gates are proposed wherever a management road/firebreak connects to a public road, a parking area, or to an access easement (Figure 6). These gates will be predominately green-vinyl-coated chain-link fence gates where they occur with this type of fencing, but there will also be farm gates associated with post-and-rail fencing. These gates will allow vehicular access for management purposes to the project site.

The City of Boca Raton Police Department will assume primary responsibility for public safety and law enforcement on this site. These responsibilities include routine patrols of the boundaries and the prevention of vandalism, trespass, dumping, and damage to the property and natural resources. No on-site manager or security guard is currently proposed for this site. No on-site residence of staff is proposed. The County will attempt to recruit a local steward for the site and/or organize a neighborhood watch group.

The County has adopted a Natural Areas Ordinance (No. 94-13) that regulates public use of the Yamato Scrub Natural Area (Appendix G). This ordinance provides for passive recreational activities such as hiking, nature study, and photography; for environmental education; and for scientific research. It prohibits destructive uses such as off-road vehicle use, dumping, and poaching of plants and animals. This ordinance gives law enforcement personnel the authority to arrest persons damaging a natural area. City Ordinance 4000 also prohibits dumping. No dogs, cats, or other pets will be permitted on the Natural Area.

The Natural Area will be open to the public during daylight hours only. Access hours will be posted at the main entrances. Either City of Boca Raton personnel, or the local steward will be responsible for opening and closing the entrance gate. No vehicles (e.g., ATVs or bicycles) will be permitted beyond the parking area, except to perform maintenance and prescribed burning activities proposed in this management plan.

In the unlikely event that any unforeseen occurrence, either natural or human-caused, severely alters the natural values of the Yamato Scrub Natural Area, ERM staff will assess the nature of the alteration and will take remedial action to secure and/or stabilize the site if necessary. Natural events such as fires, floods and hurricanes may shift the ecology of the site from its present condition and cause damage to human-made structures (i.e., kiosks, signs and fencing), but in no way would severely limit or eliminate the natural values of the site. The first priority following a natural or human-caused event will be to secure the site with fencing to prevent dumping and vandalism.

The Yamato Scrub Natural Area may be closed to public use until the site is stabilized and repairs are made to the structures. The native communities at the site will be managed to naturally regenerate following such an event. The County will inform the Division of State Lands (DSL) and the City of the altered condition of the site and future management plans and objectives. If the natural values of the site are severely limited or eliminated, the County, City, and State will discuss future plans for the site. Management practices will be modified to reflect any new conditions at the site, and the management plan will be updated to reflect these changes. All major events affecting the natural communities at the Yamato Scrub Natural Area will be discussed in the next annual report to the DSL, and when ERM and DSL review and update this management plan at periodic intervals.

D.5 IMPACT ASSESSMENT AND MONITORING

The public uses proposed by Palm Beach County were carefully chosen and designed so as to not have a significant impact on any of the rare and endangered plants, animals, and natural communities found on the Yamato Scrub Natural Area. No specific carrying capacity has been determined for this natural area. However, the site will be managed specifically to promote natural resource values. In general, the size of the parking area (typically ten cars and two buses) is the limiting factor controlling public usage. No off-road vehicles, bicycles, domestic animals, or pets will be allowed past the parking area, so impacts from these sources will be minimal. Except for management purposes, all human traffic within the Natural Area will be by foot. The carrying capacity of the site will be reassessed after the public use facilities have been constructed and are being utilized. The effect of human impacts to the site will be determined by the implementation of a monitoring program, which is described below.

D.5.a Monitoring

A monitoring program will be initiated in the year 2001 to measure whether the management objectives for natural communities and listed species are being achieved. The monitoring program will be designed to evaluate the success of prescribed fires, exotic pest plant treatments, and restoration efforts on disturbed scrub, spoil, and drained basin marsh communities within the Yamato Scrub Natural Area. Management practices will be adjusted if an analysis of the monitoring data reveals that management objectives are not being met. The monitoring program will also be able to provide data to indicate whether the proposed public uses are having a negative impact on vegetation and wildlife populations.

Permanent photographic stations will be established and photographs taken annually for comparison purposes. If wetland restoration measures are undertaken, groundwater monitoring wells will be installed to measure changes in groundwater levels, and to determine the effectiveness of restoration efforts. Periodic surveys of listed species populations will be undertaken to determine population trends. Assistance will be sought from institutions of higher education in carrying out the monitoring program, and in analysis and interpretation of the data collected. These monitoring data will be used as the basis for future revisions of the management plan.

D.5.b Photomonitoring

Photopoint sites will be selected to provide a visual record of changes in vegetative composition over time, including the effects of planned management activities. The method for photomonitoring is the same as that developed for use by the South Florida Water Management District (Van Horn and Van Horn, 1993). A photomonitoring point will be established at a representative area in each management unit. Photopoint posts will be 6 feet long and stand 4.5 feet above ground level. A removable platform that fits over the photopoint will be used as a camera mount. Three to five color images will be taken at each photopoint, and will be combined to produce a 180-degree panorama centered on a pre-determined and repeatable compass heading. One set of images will be taken at each photopoint in a one-year period. When a management unit is burned, changes in vegetation will be measured with photos taken pre-burn and immediately post-burn. Additional post-burn photos will be taken periodically. A reference collection of all images taken will be maintained by ERM and used when the management plan is periodically reviewed.

D.5.c Wildlife Surveys

Wildlife surveys will be performed annually. A systematic wildlife survey will be undertaken each year when migratory species are present. Opportunistic wildlife surveys will also be conducted during other monitoring events and when only year-round residents are expected. The systematic surveys will consist of random walk-throughs of representative areas and/or transects or quadrants described by Schemnitz (1980). These will be two half-day surveys, one from early to mid-morning and one from mid-afternoon to dusk, to observe animals active at different times. Survey information is anticipated to include qualitative and quantitative observations of animals, tracks, burrows/nests, or other signs.

D.5.d Water Quality and Quantity

The Natural Area does not receive any surface runoff from adjacent developed properties. Surface water quality tests will be conducted only when site observations or other data indicate that impacts to water quality may have occurred. If wetland restoration measures are undertaken, 2 to 3 groundwater monitoring wells will be installed to measure changes in groundwater levels, and to determine the effectiveness of restoration efforts. If conditions warrant, samples from these wells can also be tested to determine changes in groundwater quality. Readings from these monitoring wells will be recorded periodically. The exact locations for these wells will be determined prior to their installation. Readings will be plotted against rainfall data obtained from the South Florida Water Management District at the S-40 station on the C-15 Canal, which is one mile northeast of the Natural Area. The data will be used to determine the relationship between rainfall and groundwater levels. Readings also will be analyzed to determine the degree of success of any hydrological restoration measures.

D.5.e Listed Animal Species Surveys

Annual population counts will be made for all endangered and threatened animal species recorded for the Natural Area, in order to track population trends. Animal species of special concern recorded for the site will have their populations or portions of their populations surveyed every two years to determine whether they are experiencing any unusual population declines. Locations of nests or burrows may be pinpointed and mapped by use of a global positioning system (GPS) receiver, which uses satellite signals to determine the longitude and latitude of a particular spot to an accuracy that can approach three to six feet. Surveys will be scheduled at the time of year when the target species is most visible and may be conducted in coordination with other activities. Specific surveys will be developed for specific species. Qualitative evaluations of individual species will be made in conjunction with all quantitative surveys.

D.5.f Listed Plant Species Surveys

Annual population counts will be made for all endangered plant species recorded for the Natural Area in order to track population trends. Endangered plants with populations in excess of 200 individuals may only have a representative portions of their population surveyed. Locations of individual plants or groups of plants may be pinpointed and mapped by use of a GPS receiver. Annual population counts also will be made of threatened plants with extremely limited populations recorded for this site. GPS receivers and mapping will be used for these species as necessary.

Threatened plants with large populations (in excess of 200 individuals) and commercially-exploited plants recorded for the Natural Area will have their populations surveyed periodically to determine whether they are experiencing any unusual population declines. Plants with populations in excess of 200 individuals may only have a representative portions of their population surveyed. Surveys for specific plants will be undertaken at the time of year when those plants are most visible. Qualitative evaluations of individual species will be made in conjunction with all quantitative surveys.

D.5.g Annual Report

ERM will prepare an annual stewardship report to the Division of State Lands. Major structural improvements, management activities, and restoration plans and activities will be discussed in the report, and their degree of success described. The annual report will also include information on any changes to the monitoring plan. A general review of management efforts related to natural vegetation communities and the status of listed species also will be completed at the end of each management year.

D.6 RESTORATION, PRESERVATION, AND MANAGEMENT

The Yamato Scrub Natural Area consists almost entirely of mesic flatwoods, scrub, scrubby flatwoods, prairie hammock, and drained basin marsh natural communities. These communities, most of which can be considered as high-quality within the context of urbanized southeastern Florida, are in a somewhat degraded condition as a result of exotic plant invasions, ORV traffic, and other human-caused disturbances. Maintaining and improving the ecological quality of these communities is the primary management objective for this site. Management efforts will include the restoration of the drained basin marsh areas, as well as the implementation of prescribed burning and exotic plant control programs.

The site will be managed to preserve and restore natural resource values. Scientific research, environmental education, and passive, resource-based recreation will be encouraged as secondary management objectives so long as they do not jeopardize the protection of natural resources. In general, passive recreation will include such activities as nature appreciation and study, hiking, and photography.

Because of the relatively small size of the site, there will be no on-site staffing. However, ERM will create a roving management team that will assume responsibility for management at this site and other County-managed natural areas. This management team will be trained to conduct all levels of management activities, including but not limited to, invasive vegetation control, prescribed burning, and monitoring. City staff and volunteers from local citizens' organizations will provide additional support where feasible and necessary.

The primary goal of site management is to preserve and, where appropriate, enhance historic scrub, scrubby flatwoods, mesic flatwoods, and prairie hammock communities, together with their component species as described in Section B - Natural Resources. Particular care will be exercised to prevent the extirpation of listed species from the site. Habitats for listed species will be managed for the needs of individual species when such management is compatible with the overall management of the ecosystems within the Natural Area. In addition, the restoration and management of disturbed scrub, spoil, and drained basin marsh communities that have developed in disturbed areas will be conducted to enhance the overall biological diversity of the site and/or the specific needs of listed species.

Long-term resource management of the site will begin with the baseline inventory and assessment of natural communities and listed species (Section B). Extensive surveys of this site were conducted by Richardson, et al. in 1986 and Gaby and Gaby in 1990. Opportunistic survey work has been performed by ERM staff since 1996, and a day-long survey of vegetative communities and plant species on portions of this site was conducted by ERM staff on February 16, 2000. In addition to work done by ERM, the Institute For Regional Conservation (IRC) conducted numerous surveys in 1998. These assessments have been used as the basis for determining the management activities necessary to protect, restore, and preserve the natural resources of the site and for determining the location and type of passive public recreation use facilities. Information on all listed species described in the assessment and all new listed species observed will be reported to the Florida Natural Areas Inventory on the forms provided in Appendix N. The protection of the geologic features of the site - the Pamlico dune ridge - will be ensured through the preservation of this site.

The following management objectives and procedures have been developed for the Yamato Scrub Natural Area:

- 1) Maintenance of ecological integrity by ensuring the long-term existence and viability of native biological communities and protection of listed plant and animal species on the Natural Area.
- 2) Provision of viable habitat for other non-listed wildlife species which use, or could potentially use, the site.
- 3) Implementation of a prescribed burn regime that maintains fire-dependent vegetative communities, assists in the restoration of disturbed areas, and adequately addresses safety and smoke concerns.
- 4) Management of disturbed areas so that they do not act as conduits for exotic species to penetrate natural communities.
- 5) Reduction of exotic pest plant vegetation cover to no more than 1% of the total vegetation cover, and exclusion or removal of exotic non-native animals having a detrimental effect.
- 6) Provision of facilities and development of policies for public use that allow for passive resource-based recreational uses, scientific research, and environmental education activities that do not have a detrimental effect on the Natural Area.
- 7) Adoption of appropriate security measures and access control measures to prevent unauthorized activities such as use by off-road vehicles, illegal dumping, collection of plants, poaching, and harassment of animals.
- 8) Removal of existing canal spoil piles and associated exotic plant concentrations. Facilitation of the succession former spoil pile areas to more natural vegetative communities by preventing recolonization by exotic plants and encouraging the recruitment of native vegetation.
- 9) Restoration of drained basin marsh areas to the appropriate wetland or successional upland community by the removal of soil from portions of the drained basin marsh, by removal of exotic

vegetation, by replanting or encouraging the recruitment of native vegetation, and by reestablishing the historic fire regime, with the intent of restoring the drained basin marsh area to basin marsh, mesic flatwoods, or the prairie hammock vegetative communities.

This management plan will be reviewed and updated by ERM and the Division of State Lands as necessary or at least every five years. Major structural improvements and management activities conducted since the last review will be discussed, and their degree of success evaluated. A general review of management efforts related to natural communities and the status of listed species also will be provided as part of the review process.

D.6.a Natural Communities Management

The goal of fragmented natural communities management in southeastern Florida should be to restore and maintain as many of the functions and values of the original natural communities that historically occupied the site as possible. It should be recognized that even the largest and least disturbed sites have experienced significant impacts from changes in the regional water table, air pollution, the loss of large predators, and species extinctions. These types of disturbances are generally irreversible. Almost all sites also have been affected by reversible changes, such as the exclusion of fire and invasion by exotic pest plants. The goal of management of natural communities is to reverse or lessen the impact of as many of the human-caused disturbances to the Yamato Scrub Natural Area as possible.

Five natural vegetation communities are present on the site (Figure 4): drained basin marsh, mesic flatwoods, prairie hammock, scrub, and scrubby flatwoods. Where past human activities have caused the creation of disturbed natural communities, efforts will be made to restore these communities to a pre-disturbance condition. Prescribed burning and invasive vegetation control will be the primary management techniques used. These management activities are discussed in Section D.6.e, Fire management and Section D.6.f, Invasive plant control. The specific types of management and enhancement activities recommended for each vegetation community present on the project site are described in the following sections.

Drained Basin Marsh

The drained basin marsh is no longer viable as a wetland community due to the regional lowering of the water table by the Lake Worth Drainage District canal system. Water levels in most of these canals cannot be raised without flooding adjacent residential developments. A portion of the basin marsh community may be recreated by scraping down the ground surface until the current water table is reached. Otherwise, this community will be encouraged to succeed to mesic flatwoods north of the L-40 Canal, and prairie hammock south of the canal. This succession will be encouraged through the implementation of prescribed burning and invasive plant control programs, and by replanting with native vegetation if funding, personnel, and plant materials are available. A prescribed burning program that covers this community will be initiated within one year of approval of this plan. Special care will be taken with regard to listed species associated with drained basin marshes that may be impacted by prescribed burning. An invasive plant control program will be initiated within one year of approval of this plan. Brazilian pepper, carrotwood, earleaf acacia, Java plum, and rosary pea are considered high-priority species for removal in drained basin marsh.

Mesic Flatwoods

Mesic flatwoods will be enhanced and maintained primarily through the implementation of prescribed burning and invasive plant control programs. A prescribed burning program that covers this community will be initiated within one year of approval of this plan. Special care will be taken with regard to listed species associated with mesic flatwoods that may be impacted by prescribed burning. An invasive plant control program will be initiated in this community within one year of the approval of this plan. Earleaf acacia, Australian umbrella tree, carrotwood, Brazilian pepper, Indian laurel fig, and rosary pea are considered high-priority exotic species for removal in mesic flatwoods. In addition, all ORV roads that are not part of the designated management road/firebreak or hiking trail system will be closed and allowed to regenerate. This community will be encouraged to expand into portions of the drained basin marsh community that are no longer viable as wetlands and which are not included in a wetland restoration project.

Prairie Hammock

The prairie hammock will be enhanced and maintained primarily through the implementation of an invasive plant control program, which will be initiated in this community within one year of the approval of this plan. Australian umbrella tree, bowstring hemp, Brazilian pepper, carrotwood, earleaf acacia, Indian laurel fig, rosary pea, shoebutton ardisia, shrub verbena, and tuberous sword fern are considered high-priority exotic species for removal in prairie hammock. This community has expanded into adjacent portions of the drained basin marsh as water levels receded, and will be encouraged to further expand into portions of the drained basin marsh community that are not slated for wetland restoration and are no longer viable. Fire suppression has also favored the development of this community. The large areas of prairie hammock north and south of the L-40 Canal will be protected from fire, but smaller, isolated patches of this community elsewhere on the site will not receive any special protection under the fire management plan, and will be included as part of any burn unit. This community normally does not carry a fire well due to a sparse understory and is somewhat fire resistant, but these smaller, isolated patches could be negatively affected by the initiation of a prescribed burn program.

Scrub

Scrub will be enhanced and maintained primarily through the implementation of prescribed burning and invasive plant control programs. A prescribed burning program will be initiated within this community within one year of approval of this plan. Special care will be taken with regard to listed species associated with scrub that may be negatively impacted by prescribed burning. An invasive plant control program will be initiated in this community within one year of the approval of this plan. Earleaf acacia, Australian umbrella tree, carrotwood, Brazilian pepper, rosary pea, Natal grass, Indian laurel fig, and Sprenger's asparagus fern are considered high-priority exotic species for removal in scrub. In addition, all ORV roads that are not part of the designated management road/firebreak system or hiking trail system will be closed and allowed to regenerate.

Scrubby Flatwoods

Scrubby flatwoods will be enhanced and maintained primarily through the implementation of prescribed burning and invasive plant control programs. A prescribed burning program that covers this community will

be initiated within one year of approval of this plan. Special care will be taken with regard to listed species associated with scrubby flatwoods that may be negatively impacted by prescribed burning. An invasive plant control program will be initiated in this community within one year of the approval of this plan. Earleaf acacia, Australian umbrella tree, carrotwood, Brazilian pepper, rosary pea, Napier grass, and Sprenger's asparagus fern are considered high-priority exotic species for removal in scrubby flatwoods. In addition, all ORV roads that are not part of the designated management road/firebreak or hiking trail system will be closed and allowed to regenerate.

Disturbed Areas

Disturbed areas will be managed primarily to minimize the growth and spread of exotic species, and to encourage the regeneration of native species. Australian pine, Australian umbrella tree, Brazilian pepper, bowstring hemp, carrotwood, earleaf acacia, Guinea grass, Indian laurel fig, life plant, rosary pea, shrub verbena, Sprenger's asparagus fern, and Vasey grass are considered top-priority species for removal within disturbed areas. Those portions of disturbed areas that will be restored to fire-maintained natural communities will be included in a prescribed burning program that will be initiated within one year of approval of this plan.

D.6.b Listed animal species

In general, the fish and wildlife species at the Yamato Scrub Natural Area will be managed as components of the natural communities of which they are a part. Special care, however, will be exercised to prevent the extirpation of listed fish and wildlife known to occur at this site. For listed taxa with a viable resident population at the natural area (Priority A species), natural community-based management will be conducted in such a way as to maintain these populations and, if appropriate, enhance them. For listed taxa without a viable resident population (Priority B), natural community-based management will be conducted in such a way as to promote their general welfare so long as it does not impact other species or natural communities in a negative way. For listed species which are considered to be accidental at the Yamato Scrub Natural Area (Priority C), no special management activities will be conducted. A brief description of listed fish and wildlife, including special management considerations, if any, is provided in the following subsections.

Fourteen animal species recorded at the Yamato Scrub Natural Areas have been listed for protection or special management by at least one government agency or by FNAI (Table 2), and one is so poorly understood that its listing status is unknown (red widow spider). Of these, one is an arachnid, four are reptiles, nine are birds, and one is a mammal. These species can be given a priority rank according to the feasibility of managing a viable population at the site. The following list includes a brief description of each taxon, its general location on the site, and the listing categories. Listings by FNAI are from a 1999 FNAI booklet; listings by the United States Fish and Wildlife Service (USFWS) and the Florida Game & Fresh Water Fish Commission (FGFWFC) are from FGFWFC (1997). The listing categories used by these agencies are defined in Appendix C. ERM will coordinate with the Florida Fish and Wildlife Conservation Commission (FFWCC) and the FFWCC's Office of Protected Species Management on the management of the site for protection of listed animals. Recommended procedures for management of these species are described below.

PRIORITY A

Priority A taxa are those listed animal species that are known to occur in viable numbers with a resident or breeding population at the Yamato Scrub Natural Area. These species should receive the highest level of management concern. Under no circumstances should extirpations of these species be allowed to occur at the Yamato Scrub Natural Area. When possible and appropriate, efforts should be made to increase the size of existing populations.

Eastern diamondback rattlesnake (*Crotalus adamanteus*)

This large snake has been recorded in the northern scrub community. This species is very vulnerable to collection and to being killed because it has poisonous venom, and will be protected from these actions. The eastern diamondback rattlesnake will also be protected by maintaining the mesic flatwoods community which is its preferred habitat and by encouraging the expansion of mesic flatwoods into non-viable portions of the drained basin marsh.

Florida mouse (*Peromyscus floridanus*)

This small mammal has been recorded primarily in the scrub community at the Yamato Scrub Natural Area, but could be found wherever gopher tortoise burrows are present. As a gopher tortoise commensal, it will be protected by protecting and appropriately managing the gopher tortoise population on site. It will also be protected by maintaining a mosaic of seral stages within the scrub and flatwoods communities at this site through the implementation of a prescribed burn program.

Florida scrub lizard (*Sceloporus woodi*)

This small endemic lizard is thought to be relatively abundant at the Yamato Scrub Natural Area and is found primarily in scrub. No special needs have been identified for this species. It will be protected by maintaining a mosaic of seral stages within the scrub community at the site through the implementation of a prescribed burn program.

Gopher tortoise (*Gopherus polyphemus*)

Although a recent population survey for this species has yet to be completed at the Yamato Scrub Natural Area, a relatively large population of this medium-sized tortoise is thought to inhabit the site. No special needs have been identified for this species. It will be protected by preventing poaching and by maintaining a mosaic of seral stages within the scrub, scrubby flatwoods, and mesic flatwoods communities at the site through implementation of a prescribed burn program. No gopher tortoises will be allowed to be relocated onto the site unless a gopher tortoise survey shows that the site can support additional tortoises, and the relocated tortoises have been tested and found free from upper respiratory tract disease.

Red widow spider (*Latrodectus bishopi*)

Although the current population status of the red widow spiders at the Yamato Scrub Natural Area is unknown, the population is believed to be substantial in the scrub and scrubby flatwoods communities.

Additional surveys will be conducted to determine an estimated population of this species at this site. No special needs have been identified for this species. It will be protected by maintaining a mosaic of seral stages within the scrub community at the site through implementation of a prescribed burning program.

PRIORITY B

Priority B taxa are those listed animal species for which a viable resident population is not known to occur at the Yamato Scrub Natural Area, or the species is transitory in southeastern Palm Beach County. These species should receive significant management concern. If viable numbers of a resident species are recorded at, or become established at, the Yamato Scrub Natural Area, then these species should be elevated to Priority A. Efforts also should be made to provide suitable habitats for transitory species, so long as this does not adversely impact natural community level management.

American redstart (*Setophaga ruticilla*)

This migratory songbird was recorded at the Yamato Scrub Natural Area by Gaby and Gaby in 1990. Kale and Maehr (1990) list its habitats in Florida as pine scrub, mangrove, hardwood swamp, cypress swamp, mesic hammock, mixed pine and hardwood forest, pine flatwoods, urban and agricultural environments, and sandhill. It is listed as transitory in coastal scrubs in the Treasure Coast Region by Fernald (1989). Habitat for this species will be enhanced through the maintenance of scrub, scrubby flatwoods, mesic flatwoods, and prairie hammock communities on the site.

Arctic peregrine falcon (*Falco peregrinus tundrius*)

One individual of this subspecies of the peregrine falcon was spotted by Gaby and Gaby (1990) during the fall migration in 1987. It was seen in the scrub in an area located in the northwestern portion of the site. Migrant falcons can be seen in Florida after the first fall cold front and some remain all winter. Florida represents an important wintering area, especially for the Arctic subspecies (Kale and Maehr 1990). The Arctic peregrine falcon is a transient, and usually inhabits open wetlands and shorelines. No special needs for this bird have been identified. The Arctic peregrine falcon will be protected by maintaining native vegetation on the site that can provide roosting and feeding habitats.

Eastern indigo snake (*Drymarchon corais couperi*)

This large snake has been recorded in the past within scrub at the Yamato Scrub Natural Area. It must be rigorously protected from collection. As a gopher tortoise commensal, it will be protected by protecting and appropriately managing the gopher tortoise population on site. In addition, this species will be protected by maintaining a mosaic of seral stages within the natural communities at the site by implementation of a prescribed burn program.

Florida scrub-jay (*Aphelocoma coerulescens*)

This endemic bird was last recorded at the Yamato Scrub Natural Area in 1993. Efforts will be made to encourage this bird to return to the site. This species requires periodically-burned scrub and scrubby flatwoods, which will be maintained at the site through the implementation of a prescribed burn program. Since scrub-jay eggs and nestlings can be destroyed by fire, and any potentially lethal impact to nests or nestlings would require a taking permit from the USFWS, a 150-foot radius around active scrub-jay nests will be protected from fire during prescribed burns if they return to the site.

Great egret (*Ardea alba*)

This wading bird has been recorded at the Yamato Scrub Natural Area feeding in the L-40 Canal when declining water levels have concentrated aquatic prey species. No special needs have been identified for this species, and water levels in the L-40 Canal are controlled by Lake Worth Drainage District.

Osprey (*Pandion haliaetus*)

This bird of prey has been recorded numerous times since 1990 on the Yamato Scrub Natural Area along the L-40 and E-4 canals. No special needs have been identified for this species. It is possible that it may nest now or in the future in some of the tall Australian pines along the L-40 Canal. If an osprey nest is discovered, visitor uses will be discouraged in the vicinity of the nest, and the possibility of exempting any Australian pine with an active osprey nest from exotic control efforts will be investigated. Osprey habitat will be maintained through the proper management of each community on the site.

Painted bunting (*Passerina ciris*)

This migratory songbird was first recorded at the Yamato Scrub Natural Area by Gaby and Gaby in 1990. Kale and Maehr (1990) list its habitats in Florida as dense, brushy vegetation along roads and woodland edges, and list it as a common winter resident in south and central Florida. No special needs for this bird have been identified. The painted bunting will be protected by maintaining native vegetation on the site that can provide roosting and feeding habitats.

Tricolored heron (*Egretta tricolor*)

This wading bird has been recorded at the Yamato Scrub Natural Area feeding in the L-40 Canal when declining water levels have concentrated aquatic prey species. No special needs have been identified for this species, and water levels in the L-40 Canal are controlled by Lake Worth Drainage District.

Wood stork (*Mycteria americana*)

This wading bird has been recorded at the Yamato Scrub Natural Area feeding in the L-40 Canal when declining water levels have concentrated aquatic prey species. No special needs have been identified for this species, and water levels in the L-40 Canal are controlled by Lake Worth Drainage District.

Worm-eating warbler (*Helmitheros vermivorus*)

This migratory warbler was first recorded by at the Yamato Scrub Natural Area by Gaby and Gaby in 1990. It is most often encountered in Florida as a migrant from late March to early May and from August to early October where it can be found in mesic and maritime hammocks, and mixed pine/hardwood forests (Kale and Maehr 1990). Although a few birds overwinter in south Florida, this bird is expected to found at the Natural Area only during migration periods. No special needs for this bird have been identified. The worm-eating warbler will be protected by maintaining native vegetation on the site that can provide roosting and feeding habitats.

PRIORITY C

Priority C taxa are those listed animal species whose occurrence at the Yamato Scrub Natural Area is considered to be accidental. Management specifically for these species at the site would therefore serve no meaningful purpose. No Priority C species have been recorded at the Yamato Scrub Natural Area.

D.6.c Listed Plant Species

In general, the plant species at the Yamato Scrub Natural Area will be managed as components of the natural communities of which they are a part. Special care, however, will be exercised to prevent the extirpation of listed plant species known to occur at this site. For listed taxa that are considered imperiled in the state by FNAI (Priority A species), natural community-based management will be conducted in such a way as to maintain these populations and, if possible and appropriate, increase them. For listed taxa that are considered rare in the state by FNAI (Priority B), or not listed by FNAI but considered endangered or threatened in the state by FDACS (Priority C), natural community-based management will be conducted in such a way as to promote their general welfare so long as it does not impact other species or natural communities in a negative way. Listed species which are considered commercially exploited in the state by FDACS (Priority D) will be protected from plant removal, but otherwise, no special management activities will be conducted on their behalf.

Twelve plant species recorded at the Yamato Scrub Natural Area have been listed by at least one of the following governmental agencies or nonprofit environmental organizations: United States Department of the Interior, Fish and Wildlife Service (USFWS); Florida Game and Fresh Water Fish Commission (FGFWFC); Florida Department of Agriculture and Consumer Affairs (FDACS); and FNAI. These species are listed in Table 1. Definitions of the listing classifications are provided in Appendix C. ERM will coordinate with the Florida Fish and Wildlife Conservation Commission's Office of Protected Species Management on the management of the site for the protection of listed plants and listed plant habitats. The following sections contain a summary of the recommended procedures for management of these species.

PRIORITY A

Priority A taxa are those plant species that are considered by FNAI to be imperiled or critically imperiled in the state. These taxa will receive the highest level of management concern. Under no circumstances should extirpations of these species at the Yamato Scrub Natural Area be allowed to occur. If possible, efforts should be made to increase the size of each population.

Burrowing four-o'clock (*Okenia hypogaea*)

This perennial forb was recorded at the then-undeveloped Kraft tract at the Yamato Scrub Natural Area by ERM in 1991. It was discovered on a dirt pile dumped within the former basin marsh, and may have originated from dumped beach cleaning debris. The Kraft site was developed in 1993, and this plant was probably extirpated from the site at that time. Its occurrence at this site should be considered an accidental introduction, and no special management activities will be undertaken for this species.

Hand fern (*Ophioglossum palmatum*)

This epiphytic fern was recorded in 2000 by ERM at the Yamato Scrub Natural Area growing on a single cabbage palm in the west-central portion of the site. The cabbage palm is growing in the ecotone between the prairie hammock and scrubby flatwoods communities. The total known population of this fern is one plant on one palm. Hand ferns require high humidity and protection from fire. This species will be protected by enhancing and maintaining the adjacent prairie hammock community, by incorporating the hand fern location into a no burn zone along with the prairie hammock, and by protecting this site from plant collectors.

Sand dune spurge (*Chamaesyce cumulicola*)

This endemic prostrate herb has been recorded at the Yamato Scrub Natural Area growing in disturbed areas such those as bordering the railroad tracks and the former basin marsh, and on portions of the canal banks and roadside edges. It is normally associated with scrub and coastal dune habitats, and will be managed as a component of the scrub community. It will be protected by maintaining a mosaic of seral stages within the scrub community at this site, and by controlling exotic plant species.

PRIORITY B

Priority B taxa are plant species that are considered by FNAI to be rare in the state. These taxa should receive significant management attention. Under no circumstances should extirpations of these species be allowed to occur at the Yamato Scrub Natural Area. If possible, Priority B species with small populations should have the size of their population increased, so long as this does not adversely impact natural community level management.

Curtiss' milkweed (*Asclepias curtissii*)

This endemic perennial forb was recorded in the scrub community along an old jeep trail. Because of the small size and inconspicuous appearance of this plant when not in bloom (Ward 1978), individuals in open sandy trails are often the only ones spotted, even though more plants may be present in vegetated areas. This species will be managed as a component of the scrub community. It will be protected by maintaining open sandy habitats through implementation of a prescribed burn program and by routing management roads and footpaths away from known plant locations.

Cutthroat grass (*Panicum abscissum*)

This perennial grass was recorded at the Yamato Scrub Natural Area in small glades and remnant patches in the mesic flatwoods natural community. Another several thousand clumps were relocated from another site in 1999 to a 2-acre cutthroat grass restoration project on the Natural Area. This grass flowers only after

a fire or when mowed or otherwise disturbed. Cutthroat grass is more vigorous when it experiences seasonal flooding and frequent fires (Yahr, et al., 2000), but is capable of persisting even when drained and fire-excluded, which is its current status at the Natural Area. It will be protected by implementation of a prescribed burn program and by investigating the possibility of raising the control elevation of the E-4 Canal from 4.3 to 8.5 feet. Additional attempts to reestablish cutthroat grass at lower elevations within the drained basin marsh will be considered if the current cutthroat grass restoration project shows sufficient signs of success.

Large-flowered rosemary (*Conradina grandiflora*)

This endemic shrubby mint was recorded at the Yamato Scrub Natural Area growing in scrub habitat along the old jeep trails, and on the edges of the roads and railroad tracks on the perimeter of the site. It will be managed as a component of the scrub community. No special needs for this species have been identified. It will be protected by maintaining a mosaic of seral stages within the scrub community at the site through implementation of a prescribed burn program.

Nodding pinweed (*Lechea cernua*)

This endemic forb was recorded at the Yamato Scrub Natural Area in open areas along the old jeep trail in the northern portion of the site. It will be managed as a component of the scrub community. No special needs for this species have been identified. It will be protected by maintaining a mosaic of seral stages within the scrub community at the site through implementation of a prescribed burn program. Because a hiking trail is planned to go through the area where this plant is found, its population will need to be carefully monitored to determine if the hiking trail is having a negative impact and should be relocated.

Scrub bay (*Persea borbonia* var. *humilis*)

This endemic tree or shrub was recorded at the Yamato Scrub Natural Area in scrub along the eastern portions of the site. It will be managed as a component of the scrub community. No special needs for this species have been identified. It will be protected by maintaining a mosaic of seral stages with the scrub community at this site by implementing a prescribed burn program.

PRIORITY C

Priority C species are those that are listed as Endangered or Threatened by FDACS, but are not listed by FNAI. These species should receive moderate management concern. At a minimum, extirpations of these species should be prevented at the Yamato Scrub Natural Area. If possible, Priority C species with small populations should have the size of their population increased, so long as this does not adversely impact natural community level management.

Common wild pine (*Tillandsia fasciculata*)

This epiphytic bromeliad was recorded at the Yamato Scrub Natural Area growing scattered throughout the site in the scrub, scrubby flatwoods, mesic flatwoods, and prairie hammock communities. It is endangered by the feeding activities of an imported bromeliad weevil that burrows through the central growing point of the plant, which causes the growing point to die and results in the eventual death of the entire plant. There is no known practical treatment for the bromeliad weevil, and it is not known to kill all the bromeliads in a

given population. Although individual plants will be killed by prescribed burning, it is expected that the regenerating trees and shrubs will be recolonized by airborne seeds drifting in from the unburned portions of the site. This species will be protected by having numerous management units, by burning only one unit at any one time in order to maintain a seed source on the unburned portions, and by monitoring mortality caused by the bromeliad weevil.

Giant wild pine (*Tillandsia utriculata*)

This epiphytic bromeliad was recorded at the Yamato Scrub Natural Area in a wide variety of natural communities. It is endangered by the feeding activities of an imported bromeliad weevil that burrows through the central growing point of the plant, which causes the growing point to die, and results in the eventual death of the entire plant. Although individual plants will be killed by prescribed burning, it is expected that the regenerating scrub oaks will be recolonized by airborne seeds drifting in from the unburned portions of the site. This species will be protected by having numerous management units, by burning only one unit at any one time in order to maintain a seed source on the unburned portions, and by monitoring mortality caused by the bromeliad weevil.

Long strap fern (*Campyloneurum phyllitidis*)

This mostly-epiphytic fern has a single localized population of approximately 25 plants at the Yamato Scrub Natural Area. Strap ferns are found in shady, high-humidity environments, and are not fire-tolerant. This population appears to be growing, but is vulnerable to collection and changes in environmental conditions caused by prescribed burning. This species will be protected by protecting this site from plant collectors, by not burning the scrub vegetation adjacent to the strap fern population, and by relocating a portion of the population to the no burn zone areas of the prairie hammock community prior to performing a prescribed burn on the management unit that contains this fern's population.

Reflexed wild pine (*Tillandsia balbisiana*)

This epiphytic bromeliad was recorded at the Yamato Scrub Natural Area in scattered locations in scrub, scrubby flatwoods, prairie hammock, and mesic flatwoods natural communities. Although individual plants will be killed by prescribed burning, it is expected that the regenerating trees and shrubs will be recolonized by airborne seeds drifting in from the unburned portions of the site. This species will be protected by having numerous management units, by burning only one unit at any one time in order to maintain a seed source on the unburned portions, and by protecting this species from plant collection.

PRIORITY D

Priority D species are those that are listed as Commercially Exploited by FDACS. These species should receive some management concern. At a minimum, extirpations of these species at the Yamato Scrub Natural Area should be prevented. No Priority D species have been recorded at this site.

D.6.d Management Units

The successful management of natural communities on relatively small fragmented sites depends heavily upon management unit design. The Yamato Scrub Natural Area is composed of a mosaic of several historic natural communities that have been partially modified by the digging of drainage canals, spoil deposition, fire exclusion, and exotic pest plant invasions, and the creation of an artificial vegetative community dominated by exotic vegetation on a drained wetland. Each of the natural communities were originally part of a greater regional mosaic of upland and wetland ecosystems. Today, the Natural Area is almost completely isolated from nearby remnants of natural communities and is continuously affected by direct and indirect human disturbances. These disturbances include the maintenance of drainage canals, fire exclusion, the dissemination of exotic species from nearby industrial and residential areas, and the construction and maintenance of paved roads and associated utility lines.

The site will be subdivided into seven macro-management units, using management roads, and natural features as boundaries (Figure 7). Macro-management units have been designed to maximize the long-term diversity of natural communities and plant and animal species on the site. As described in the following section on Fire management, these units will be small enough to allow for safe and practical fire management. Macro-management units may be further sub-divided into micro-management units, which represent distinct natural communities and/or seral stages within the macro-management unit.

D.6.e Fire Management

Four of the site's five natural communities are dependent upon fire for their long term restoration and maintenance. Given the extensive alterations that have been made to the local landscape, lightning-induced fire cannot be expected to fulfill the fire needs of these communities. In addition, given the proximity of the Natural Area to adjoining residential and commercial properties, parks, major roads, and other forms of urban and suburban development, the risk of damage to these developments from wildfire is high. As such, the use of a combination of controlled, prescribed fire, together with the construction of firebreaks and other safety precautions, will be necessary to fully achieve the stated management objectives.

The primary responsibility for prescribed burning will be assumed by ERM. Assistance will be requested from the City of Boca Raton Fire-Rescue, in developing a prescribed burn plan for each burn unit, in obtaining a City burning permit, and for the provision of fire-fighting staff and equipment to protect nearby homes and structures from damage. Additional assistance may be provided by the Florida Department of Agriculture and Consumer Services, Division of Forestry (DOF), FFWCC, The Nature Conservancy, and trained volunteers. Fire-related safety training will be required of all County staff and others participating in a prescribed burn. All prescribed burns will comply with the legal mandates stated in the Florida Prescribed Burning Act, Chapter 590.026 of the Florida Administrative Code.

The overall goal of the prescribed burn program is to introduce a fire regime (*i.e.*, a repeatable pattern of fire with predictable results) onto the Yamato Scrub Natural Area that will sustain the predominant native vegetative communities. Specific objectives for different areas of the site will depend upon site conditions and other management objectives for that area. In general, these objectives will include:

- o To ensure the long-term existence and viability of a vegetative community and the listed plant and animal species that utilize that community.

- o To control the regrowth and regeneration of invasive vegetation following treatment or removal activities.
- o To provide viable wildlife habitat for wildlife species that use, or could potentially use, the site.
- o To reduce the danger of wildfire by reducing the build-up of fuels that has resulted from the limited occurrence of fire in recent years.

To prevent destructive wildfires, as well as to adequately control prescribed fires, a network of management roads, natural features, and perimeter firebreaks (Figure 7) will be established as permanent firebreaks within the site. These firebreaks define the macro-management units discussed previously. These roads and natural features, along with site perimeter firebreaks, will serve as the boundaries of the seven burn units and will provide vehicle access for conducting the prescribed burns. Existing trails will be used when possible. New management roads will be constructed as unimproved sand roads where existing trails are either not wide enough or not present. Management roads used as firebreaks and non-road firebreaks will be at least 15 feet wide. Vegetation may be cut along the shoulders of specific management roads and firebreaks, if necessary, to widen them prior to a prescribed burn. After the burn, the vegetation will be allowed to regenerate naturally, and the management roads will be maintained at a width of 10 feet to allow for maintenance vehicle access.

Prior to the construction of a management road or firebreak, the area will be surveyed to verify that the construction would not adversely impact the population of any listed species. If an adverse impact would occur, the location of the road or firebreak will be adjusted to avoid affecting a listed species, or the listed species will be relocated elsewhere on the site. Non-road firebreaks will not receive the same level of maintenance as management roads and may be allowed to partially regenerate between burns. Management roads may be used for other management activities (e.g., exotic pest plant control) and as hiking trails.

The seven burn units range in size from 22.7 to 36.7 acres. They are as large as possible given the safety and logistical constraints affecting this site, so that fires can burn through ecotones (transition zones between vegetation communities) and move in a more natural, spotty fashion across the landscape. The resulting patchwork of burned and unburned stands within a management unit will produce a mosaic of vegetation at various stages of maturity, thereby maximizing diversity within and among communities. This will provide habitat for individual species which typically use, or may even be restricted to, communities in a particular state of maturity. Burn units must not be so large that control of a prescribed fire and attendant smoke becomes difficult or uncertain. Depending on the specific conditions and objectives of a burn, a burn unit may be further subdivided into smaller subunits for conducting the prescribed burn.

Active fire suppression measures that rely upon the use of heavy machinery and plowlines are extremely destructive to vegetation and other natural features. Active fire suppression measures are to be avoided as much as possible, but will be used to safeguard adjacent residences if necessary. If such measures are undertaken to control a fire, all plowlines will be backfilled after the fire has been extinguished, and other disturbed areas will be rehabilitated to the greatest extent possible.

A flexible fire management program will be initiated within one year of the approval of this management plan. The seven burn units will be burned in at intervals ranging from 10 to 40 years, depending on the dominant natural community, and will average approximately one burn every three years. Prior to burning a unit, the unit will be surveyed for fire-intolerant listed plant species and active scrub jay nests. If necessary, individual plants will be relocated outside the burn area or firebreaks will be established around populations of rare plants. If active scrub jay nests are present, a 150-foot radius will be protected from fire by firebreaks or other means, in order to avoid having to obtain a scrub jay taking permit from the USFWS. Areas protected by firebreaks for listed species will not be burned until the next scheduled burn. These unburned areas increase the diversity of the site, and will still be within the normal fire frequency for most of the natural communities if burned at the next scheduled burn. Firebreaks for the protections of listed species will be temporary in nature and will be made by cutting vegetation and not by plowing or disking. A permit will be obtained for the relocation of listed species when required.

Fire management will begin with the prescribed burn of Burn Unit 7 in the spring or summer of 2001, and will follow with the burn of Unit 2 in 2004, Unit 3 in 2007, Unit 4 in 2009, Unit 2 again in 2014, Unit 1 in 2017, Unit 3 again in 2022, Unit 2 again in 2024, Unit 6 in 2025, Unit 5 in 2033, Unit 2 again in 2034, and Unit 3 again in 2037. The cycle will start again with Unit 7 in 2041. The earliest that two burns should end up scheduled for the same year on this rotation is 2097, when the burns for Units 3 and 1 coincide. One of these two burns scheduled for 2097 will need to be shifted to the previous or following year. The burn interval for each unit was chosen based on the dominant natural community. Ten years was selected for Unit 2, which is dominated by mesic flatwoods, 15 years for Unit 3, which is dominated by scrubby flatwoods, and 40 years for Units 1, 4, 5, 6, and 7, which are dominated by scrub. The interval for Unit 3 may have to be reduced to 10 years if mesic flatwoods becomes the dominant natural community following restoration of the drained basin marsh, and the interval for the scrub community may be reduced to 35 years if scrub jays become reestablished on the site.

To the extent possible, the seasonality and frequency of prescribed fires should seek to approximate the natural incidence of fire in the site's communities. Generally, prescribed burns in all communities will be conducted during natural fire season, which extends from March to July. Natural lightning-induced fires normally occur during this time, and the natural incidence of winter fires is presumed to be quite low. Prescribed winter fires, therefore, should be rare in occurrence to ensure that fire events correspond with the fire-adapted life histories and reproductive cycles of resident species. However, where fire has been suppressed for a long period of time and fuel loads have become heavy, prescribed winter fires may be used to begin restoration of a natural fire regime. Winter fires are generally cooler fires that can reduce accumulations of excess fuel while limiting the undesirable destruction of vegetation. In areas such as the Yamato Scrub Natural Area, where safety is of the utmost concern, winter fuel reduction fires may be appropriate, at least in the short term. Pre-burn mechanical cutting of understory vegetation also may be employed to lower fire intensity and reduce flame heights, and to decrease smoke production by the use of backing fires. If a wildfire occurs, the appropriate actions will be taken by the authorized fire emergency response agency.

Prescribed burning in disturbed natural communities is complicated by a spotty and uneven distribution of fuels, with much variation in fuel type. The uneven fuel distribution is a result of previous human-caused alterations and fire suppression at this natural area, and is not typical of these communities. Disturbed areas

will be burned in the same way as undisturbed habitats, although multiple ignition points may be necessary to overcome the patchiness of the vegetation.

A public education campaign will be developed that will include informing residents of areas surrounding the site of the necessity and benefits of fire, the safety features of prescribed burning versus wildfires, and the strategies that will be developed to minimize the impacts of smoke on nearby communities. The County will coordinate with the City prior to conducting a prescribed burn. County staff will meet with local community groups such as homeowners' associations to coordinate with residents, to provide information on the necessity of conducting prescribed burns, and to describe the safety precautions that will be taken to protect adjacent lands. A pre-burn checklist is provided in Appendix J.

The fire management plan is provided as Appendix J. The development of this plan was coordinated with DOF and FFWCC. The plan considers the surrounding land uses, safety issues in the event of a wildfire, and the ecological consequences of specific fire management strategies. It also addresses each of the vegetative communities on the site. A specific burn plan will be prepared for each burn unit prior to conducting a prescribed burn. A summary of key information on prescribed burning is also provided in Appendix J.

D.6.f Invasive Plant Control

Like many fragmented natural areas in southeastern Florida, the Yamato Scrub Natural Area has been invaded by a plethora of exotic plant species. 81 species of exotic plants have been recorded for this site, representing approximately 35% of the plant species recorded. This percentage is not atypical for scrub sites that are surrounded by developed properties and that have experienced the same level of disturbance as the Natural Area. Many of these exotic species have populations of only a few individuals. Additional species of exotic plants may be found during the early management phases, and new species will continue to colonize the site as long as sexually reproducing exotic plant species are present in the surrounding urban and suburban areas. Based on a visual estimate of the site's vegetation composition in 1999, approximately 10% of the vegetation, or the equivalent of 21 acres, consists of exotic species. The exotic plants are concentrated in the disturbed scrub, drained basin marsh, spoil, and prairie hammock natural communities.

In general, exotic plant species have caused substantial disturbances at the Yamato Scrub Natural Area. It must be recognized that exotic species pose a serious threat to the natural communities and listed species, and must be a major management concern. Fortunately, many of the exotic plant species at this site can be considered minor or, at worst, moderate problems. On the other hand, over one-third (31) of the exotic species recorded at this site are included on the Florida Exotic Pest Plant Council's (FLEPPC) 1999 list of Florida's most invasive exotic plant species (Anon. 1999).

For purposes of this management plan, the phrase "invasive species" includes three groups of plants: (1) exotic species (such as Australian pine); (2) invasive native vines (such as muscadine grape); and (3) ruderal species (species which are probably of native origin, but are found almost exclusively in disturbed areas, such as common ragweed. Although exotic species are the traditional targets of eradication activities, invasive native species also can have adverse impacts upon fragmented natural vegetation communities. This is especially true of invasive native vines, which, in the absence of fire, often shade out preferable native trees, shrubs, and herbs. Ruderal species are usually not problematic, but in some cases can slow

down or arrest restoration processes. Some exotic species, such as Madagascar periwinkle (which prefers open disturbed sites), do not have the capacity to invade functioning natural communities. They will be controlled through good management practices such as prescribed burning, and the elimination of unnecessary disturbances, such as off-road vehicle traffic.

Rather than discuss invasive plants strictly on a species-by-species basis, it is often preferable to group them by their habit (form), preferred habitat, degree of invasiveness, and potential (or real) impacts on natural communities. While this method is functional for strategic and operational planning purposes, it is recognized that each exotic plant species is unique, and that control measures may need to be tailored on a species-by-species basis. In the following discussion, exotic plant species have been grouped into six categories: (1) shade-tolerant trees and shrubs; (2) shade-intolerant trees and shrubs; (3) vines; (4) grasses; (5) perennial forbs; and (6) annual and short-lived forbs. Some invasive plant species do not fall easily into these categories and specific priorities may have to be developed for these species. Species of uncertain origin also are discussed, and recommendations for treatment (if any) are given.

An invasive plant control program has been initiated, and will continue on a periodic basis in perpetuity. The majority of the invasive plant treatments are expected to be completed within three years, but removal of some exotic plants in restoration areas will be performed as part of the restoration activities and may be delayed until restoration activity funding is available. If invasive plant treatments are thorough, then the treated natural vegetation communities should be in maintenance condition by the end of the three-year period. A management unit will be considered to be in a maintenance condition (in regard to invasive plant species) when the cover of invasive tree and shrub species does not exceed one percent of canopy or understory layers within any management year. Once a maintenance condition is reached, follow-up treatments of invasive vegetation will be conducted periodically as needed. The following sections offer preliminary management priorities and suggested techniques for each of the categories described above.

Shade-tolerant Trees and Shrubs

In the past, shade-tolerant trees and shrubs were not a major threat to natural communities in southeastern Florida. However, several species of shade-tolerant trees and shrubs have become established within natural communities in the last ten years. These species, which have the ability to invade undisturbed intact systems, are especially problematic in hammocks, drained wetlands, and fire-excluded pyric communities. Exotic shade-tolerant trees and shrubs recorded at the Yamato Scrub Natural Area include Australian umbrella tree, carrotwood, *Citrus* spp., Indian laurel fig, Java plum, loquat, orange jessamine, queen palm, royal poinciana, Santa Maria, shoebutton ardisia, spiral flag, split-leaf philodendron, Surinam cherry, valamuerto, and weeping fig. Most of these species are top priorities for removal. In general, saplings and adults of these species can be controlled with basal treatments of a systemic herbicide such as Garlon 4; seedlings can be hand-pulled. Australian umbrella tree, however, is known to be highly resistant to basal treatments of Garlon 4, and is best treated by cutting down the tree and applying Garlon 3A to the stump.

Shade-intolerant Trees and Shrubs

Shade-intolerant trees and shrubs prefer sunny, often nutrient-poor soils for germination. They generally prefer disturbed areas, and often fix nitrogen. These species are most problematic in disturbed sites and pyric communities, although they may also invade wetlands and disturbed hammocks and tidal swamps.

Invasive shade-intolerant trees and shrubs recorded at the Yamato Scrub Natural Area include Australian pine, bishop cactus, Brazilian pepper, cardboard zamia, castorbean, caesar weed, century plant, cochineal cactus, coconut palm, earleaf acacia, leadtree, melaleuca, Peruvian primrosewillow, shrub verbena, and woman's tongue. Jack-in-the-bush is a native ruderal shrub species.

Bishop cactus, cardboard zamia, caesar weed, century plant, coconut palm, and Peruvian primrosewillow are not expected to be problematic at this natural area; they will be monitored to determine what (if any) actions should be taken in the future. Many of these species were associated with vegetation dump sites, and have already been removed by fence line clearing or site cleanup activities. The remainder of the shade-intolerant trees and shrubs are top priorities for removal. In general, saplings and adults of these species can be controlled with basal applications of Garlon 4; seedlings can be hand-pulled. Melaleuca, however, is best killed by cut-stump treatments with Arsenal, which must be used with care to avoid non-target damage to surrounding native vegetation. Brazilian pepper is a sprawling, shrub-like tree and special treatments such as cutting and shredding may be necessary in dense areas. Cochineal cactus should be bagged and removed by hand.

Vines

This category includes exotic species as well as aggressive native vines. If possible, exotic vines will be eradicated from the Natural Area. Aggressive native vines will be treated as invasive species until each management unit reaches a maintenance condition. After this time, aggressive native vines will be allowed to regenerate until they reach densities and coverages that approximate their historic presence on the site. Vines pose a significant threat to the natural communities of the site because they cover the leaves of shrubs and trees and cause death through reduction of photosynthetic food production. Invasive vines recorded at the Yamato Scrub Natural Area include balsampear, hairy pod cowpea, oceanblue morningglory, love vine, muscadine grape, rosary pea, and white twinevine.

During invasive vegetation control treatments, most species of vines will be cut at a height of six feet and again near ground level if they are growing into canopy trees. The bases of the invasive vines will be hand-pulled or treated with a systemic herbicide such as Garlon 4. The vine stems remaining in the canopy may be left to decompose in the trees. Invasive vines growing on shrubs or saplings under six feet in height will be cut near ground level and removed from the supporting plant. The bases of the vines will be hand-pulled or treated with a systemic herbicide. Lateral stems of vines growing along the ground surface will be cut, hand-pulled and/or treated with a systemic herbicide. These methods should be effective in controlling balsampear, oceanblue morningglory, muscadine grape, and rosary pea. Love vine is a parasitic native vine that may become abundant in pyric natural vegetation communities in the absence of fire. It is difficult, if not impossible, to control without fire. This species will be controlled through implementation of a prescribed burn program. White vine is present in depression marshes and disturbed sites and should not require control so long as periodic prescribed burning is conducted. Hairy pod cowpea is a short-lived annual vine and generally requires no treatment.

Grasses

Exotic grasses can become a significant problem in fragmented natural communities, especially in pyric communities where they may invade open spaces and compete with shade-intolerant shrubs and

groundcovers. Invasive grasses recorded at the Yamato Scrub Natural Area include barnyard grass, Bermuda grass, crowfoot grass, fountain grass, gophertail lovegrass, Guinea grass, Indian crabgrass, napier grass, Natal grass, Pangola grass, St. Augustine grass, smut grass, templegrass, torpedo grass, tropical signalgrass, and Vasey grass. Gophertail lovegrass, barnyard grass, and crowfoot grass are relatively ephemeral and prefer disturbed areas; they are not expected to become a problem at this natural area. Torpedo grass is of undetermined origin and is uncommon at this site except in disturbed areas; it will be monitored to determine what (if any) action should be taken in the future.

The remainder of the exotic grasses at this natural area are top priorities for removal. Napier grass, Guinea grass, and fountain grass are relatively large grasses that pose a serious threat to the natural communities at the Yamato Scrub Natural Area. Fountain grass should be hand-pulled with its inflorescences bagged, and removed from the site (Tunison 1992). Napier grass and Guinea grass should be cut near ground level and allowed to re-sprout; the new growth can then be treated with Roundup or Rodeo. Care should be taken with napier grass not to place cut stems on moist soil because they can resprout and regrow readily. Natal grass, Indian crabgrass, and Pangola grass are best treated through hand-pulling; the seed heads should be bagged and removed from the site as both species readily reestablish from seed. Smut grass and Vasey grass are clump-forming grasses and can be easily treated with Roundup or Rodeo. The remaining grasses (Bermuda grass, temple grass, St. Augustine grass, and tropical signalgrass) are all low stoloniferous or rhizomatous species that are best treated with careful applications of Roundup or Rodeo.

Perennial Forbs

Perennial forbs can become a problem within all types of natural communities, and compete directly with native understory forbs. Exotic perennial forbs recorded at the Yamato Scrub Natural Area include alligator weed, bowstring hemp, Chinese ladder brake fern, creeping oxeye, hydrilla, *Kalanchoe* spp., milk-and-wine lily, oyster plant, Sprenger's asparagus fern, and sword ferns (*Nephrolepis* spp.). Alligator weed and hydrilla are found in the L-40 Canal easement and will be controlled by Lake Worth Drainage District. Chinese ladder brake fern is limited to moist calcareous soils and is not of immediate concern at this site; it should be monitored to determine what (if any) actions should be taken in the future.

The remainder of the perennial forbs at this Natural Area are top priorities for removal. Successful results have been achieved with "basal" applications of Garlon 4 on Sprenger's asparagus fern. Creeping oxeye readily roots from the nodes and should be carefully hand-pulled and bagged or treated with Roundup or Rodeo. Bowstring hemp is difficult to eradicate, but can be successfully eliminated with selective herbicide use in conjunction with repeated excavation of untreated or resprouting underground rhizomes. This plant readily resprouts from any vegetative fragments, so all living plant parts should be bagged and removed from the site. Tuberous sword ferns sometimes have underground tubers and may require repeated hand-pulling; they too should be bagged and removed from the site. Asian sword fern, *Kalanchoe* spp., milk-and-wine lily, and oyster plant are all capable of resprouting from vegetative fragments; after any feasible herbicide treatments has been undertaken, the remaining live plant parts should be hand-pulled, bagged, and removed from the site. Because many of these plants have thick succulent leaves that prevent herbicides from adhering or being absorbed, hand-pulling may be the only way to eliminate these plants.

Annual and Short-lived Forbs

In general, annual or short-lived forbs cause temporary problems and are difficult to eradicate due to high seed production. Most prefer disturbed areas and are not considered to be a major threat at the Yamato Scrub Natural Area. Invasive annual and short-lived forbs recorded at this site include burrnut, coatbuttons, common sowthistle, creeping dayflower, Dixie ticktrefoil, false moneywort, flattop mille grains, hairy indigo, Indian chickweed, lima fanpetals, Madagascar periwinkle, Mascarene Island leafflower, Mexican clovers, Mexican tea, Santa Maria feverfew, smooth rattlebox, shrubby false buttonweed, spiny amaranth, and tasselflowers. None of these plants are considered to be a major problem at the Natural Area at the present time. All will be monitored to determine what (if any) actions should be taken in the future.

D.6.g Exotic Animal Control

One species of invertebrate (the imported fire ant) and five species of vertebrate animals recorded at the Yamato Scrub Natural Area (the Cuban brown anole, European starling, greenhouse frog, red-masked parakeet, and rock dove) are not indigenous to the south Florida mainland. The imported fire ant has been recorded in almost all of the disturbed areas. This aggressive ant has virtually eliminated native fire ants from all native habitats except for intact scrub, and poses a threat to the young of ground nesting birds. There are no effective and acceptable methods to control this ant at this time, but a control strategy may be implemented in the future if effective and acceptable methods are found. Lazell (1989), in a review of the spread of the Cuban brown anole, stated that in the 1940s and 1950s it was known only from the Florida Keys. By 1975, it was known throughout south Florida north to Palm Beach and St. Petersburg. Multiple introductions from the Bahamas and Cuba (representing two subspecies) have facilitated its spread (Lazell 1989; Ashton and Ashton, 1991). It may actively compete with the native green anole. The greenhouse frog was introduced from the West Indies and does not require standing water to breed like most amphibians. It does not seem to compete with native amphibians, and may be filling a niche left open by native amphibians that are currently unable to breed at this site. Potential control efforts for the Cuban brown anole and greenhouse frog will be explored in the future if needed.

European starlings have been seen on the edges of scrub bordering developed areas. The starling was introduced in New York a hundred years ago and quickly spread across the continent. It is bold and aggressive, and often competes successfully with native species for nest holes (National Geographic Society, 1987). These birds also compete with native bird species for food as well. Potential control efforts for this species will be explored in the future. Rock doves have been seen flying overhead throughout the site. Being predominantly urban birds introduced from Europe, it is not expected that these doves use or affect the Natural Area in any significant way. Red-masked parakeets have also been seen flying overhead and are believed to be nesting in nearby residential areas. These parakeets compete for nesting cavities with native birds and are vectors for the spread of large-seeded exotic plants. Potential control efforts for this species will be explored in the future.

D.6.h Restoration and Enhancement Projects

An attempt will be made to reintroduce the Florida scrub jay to the Yamato Scrub Natural Area if this jay has not recolonized the site on its own by 2015. By this time, two of the scrub management units would have been burned and would be in optimum condition to support scrub jays. The most likely source of scrub jays

for reintroduction purposes would be from the large populations at the Juno Dunes and Jupiter Ridge Natural Areas. The reintroduction of scrub jays will be coordinated with USFWS and FFWCC and all necessary permits obtained. Reintroduction efforts will be discontinued if these two agencies do not agree with the reintroduction plan and oppose it. Additional attempts to reestablish cutthroat grass at lower elevations within the drained basin marsh will be considered if the current cutthroat grass restoration project shows sufficient signs of success and other sites needing cutthroat grass relocation become available.

There are 6.9 acres of canal spoil material along the north and south sides of the L-40 Canal and the east side of the E-4 Canal (Figure 4). These spoil piles are within the Natural Area and have displaced native vegetation. They are typically overgrown with Australian pine and Brazilian pepper and other exotic and ruderal plants. Removal of the spoil piles would eliminate a major concentration of exotic plants and would provide additional areas for native plants to colonize. The County will attempt to locate a contractor, developer, or government agency that needs fill material and is willing to remove the spoil at no cost to the County. If necessary, and if funds are available, the County could also hire a contractor to remove the spoil and dispose of it off-site. All spoil material removal will be carefully monitored to make sure that only spoil is being removed and that any spoil areas colonized by native vegetation are flagged and left alone. Spoil removal areas may be planted with plants from native vegetation salvage projects, or with purchased nursery-grown materials, if funding is available. Otherwise, exotic plants will be prevented from recolonizing spoil removal areas and adjacent native vegetation will be encouraged to recolonize these areas.

There are extensive areas of drained basin marsh on the Natural Area that are in need of restoration. Because of the large extent and complex nature of this restoration area, basin marsh restoration will be covered separately in the following Section D.7.

D.7 BASIN MARSH RESTORATION

The drained basin marsh on the Yamato Scrub Natural Area contains the natural community that has been most severely affected by human-caused disturbances. Within the Natural Area, there were historically approximately 13.9 acres of basin marsh north of the L-40 Canal and 4.6 acres south of the canal (Figure 8). Today, no intact basin marsh with a normal hydroperiod remains. All of the basin marsh on the site has been affected by drainage and a groundwater table that has been lowered from 11 feet above sea level to approximately five feet. The last of the surface water in the basin marsh disappeared in the early 1960s, and only wisps of sawgrass and maidencane, the remains of old *Osmunda* fern clumps, and clumps of sand cordgrass indicate that these areas used to be wetlands. Brazilian pepper has formed a dense monoculture in the lower areas where muck soils were once present, while mesic and scrubby flatwoods vegetation, mixed with ruderal and exotic herbs and grasses, has colonized the sandy soils on the edges and higher spots within the wetland.

Reversing the effects of drainage and raising the water table is not possible without causing flooding in nearby residential areas. One way to restore the basin marsh community is to scrape down a portion of this community until the soil surface is again below the ground water table. Another method would be excavate a shallow depression and line it with clay to create a perched wetland that is dependent on rainfall for its water supply. The goal of basin marsh restoration is to recreate a historic seasonal wetland that has 12 to 18 inches of standing water during the wet season, and declining water levels during the dry season. At the end of the dry season there should be a 1 to 2 month period without any surface water in the wetland. The

1 to 2 month period without surface water eliminates a permanent fish population and makes the wetland more conducive to successful amphibian reproduction, a major goal of this wetland restoration.

The 13.9 acres of drained basin marsh north of the L-40 Canal is the targeted area for basin marsh restoration. The 4.6 acres of drained basin marsh south of the L-40 Canal will be partially occupied by a parking area, and the rest of the former marsh will be restored as prairie hammock. The exact size of the basin marsh restoration area will be determined by hydrological and engineering studies, funding sources, and whether the cost of the site scrape down can be covered by the sale or trade of the soil removed. Several groundwater monitoring wells will be installed in order to gather data necessary to determine the correct elevation for a restored marsh whose water levels are determined by ground water levels.

In general, the restored basin marsh will have a central standing water area with a soil elevation set at 12 to 18 inches below the seasonal high groundwater level. This standing water area should have a culvert connection to the L-40 Canal with a stand pipe and boards in order to have flexibility in managing the water level. Plantings in the standing water area will target the species known to historically occur in the wetland - sawgrass, maidencane, sand cordgrass, *Osmunda* ferns. Surface soils from the marsh restoration area may be stockpiled and then spread in the standing water area in order to provide an organic substrate and a seed source for marsh plants. Outside of the standing water area, the soil surface will slope up gradually until it reaches the current soil elevation. These sloping areas will be planted with mesic flatwoods vegetation, or the recolonization of these areas by mesic flatwoods vegetation will be encouraged. Cutthroat grass is known to grow in a band around the edges of wetlands (Yahr, et al., 2000) and its planting around the border of the standing water area will be investigated. Otherwise, all other portions of the 13.9 acres of drained basin marsh north of the L-40 Canal that are not included in the basin marsh restoration project will be managed to succeed to the mesic flatwoods natural community.

The restoration proposal for the drained basin marsh is preliminary and conceptual in nature. All restoration work will require permits from the appropriate regulatory agency. The proposed restoration proposals may need to be modified in order to address agency requirements and comments, and the actual restoration work may differ somewhat from what was proposed above because of changes made to obtain regulatory approval.

D.8 SOIL AND WATER CONSERVATION

The St. Lucie soil series is listed as a sloping soil and has potential for erosion. The Immokalee and Pompano soils are nearly level and have minimal erosion potential. More detailed information on the soils present can be found in Section B.2, Soils, and their locations can be seen in Figure 5. In general, soil disturbing activities will be avoided, except for construction and use of management roads, initial construction of public use facilities, spoil material removal, and wetland restoration activities. All areas disturbed previous to natural area acquisition will be managed to encourage revegetation by native plant species. Grade changes and bare areas created by construction of public use facilities and trails will be stabilized by use of erosion control fabrics and replanting with native vegetation. Management roads and firebreaks will be located to avoid steep slopes wherever possible, or the road will be sited to cross the slope at an angle. Because most of the sloping soils on this natural area have very rapid soil permeabilities of greater than 20 inches per hour, runoff erosion should not be a problem on the management roads and firebreaks. If erosion becomes a problem, appropriate measures will be undertaken to stop or control the

effects of this erosion. Appropriate silt fencing measures will be undertaken for site restoration and facility construction activities with the potential to discharge sediment into surface waters.

D.9 COST ESTIMATES AND PRIORITY SCHEDULE

D.9.a Cost Estimates

Cost estimates for initial site development and long-term management are provided in Tables 3 and 4, respectively. The primary funding source for site development will be funds from the \$100 million Palm Beach County Environmentally Sensitive Lands Bond Referendum passed on March 12, 1991. Responsibility for site development and management is described in the interlocal agreement between the City and County (Appendix L). Staffing for habitat management and facility maintenance will be accomplished with existing City and County personnel, with assistance from community volunteers.

Initial site development is estimated to cost approximately \$671,805 (Table 3). Major expenditures include construction of a parking areas, two footbridges, fencing, a handicapped-accessible nature trail, exotic plant control, spoil material removal, and basin marsh restoration. Funding for initial site development will be provided from the Palm Beach County Environmentally Sensitive Lands bond funds, although grant monies may be sought to fund basin marsh restoration. Some spoil material removal costs may be offset by sale or trade of the spoil material.

Costs of management will be minimized through the cooperation of local citizens' organizations and by coordinating the management of natural areas on a countywide basis. The Royal Palm Audubon Society, the Audubon Society of the Everglades, the Palm Beach County Chapter of the Florida Native Plant Society, the Florida Trail Association,, and the Sierra Club - Loxahatchee Group have all committed to providing volunteer services for the management of environmentally sensitive lands acquired by the County. However, it is recognized by both the County and the City that the management of the Yamato Scrub Natural Area will require more than volunteer assistance. Some activities, such as prescribed burning, herbicide applications, chain saw work, and other hazardous or extremely technical operations, are not suited to volunteers. The County and City will provide such services internally, or via contract where necessary.

The County has established a Natural Areas Stewardship Endowment Fund. The restricted gift funds received from various sources will be invested, and the interest earned will be used to provide operating funds for management of County-owned and County-leased natural areas. The County also will apply for funds available from the State for management purposes, including the Pollution Control Recovery Trust Fund administered by the Florida Department of Environmental Protection (DEP). In addition, funds will be available through implementation of the provisions of Section 9.5 (Vegetation Preservation and Protection) of the Palm Beach County Unified Land Development Code. Fines, and cash payments in lieu of preservation, are placed in a Natural Areas Fund for the acquisition, preservation, and management of natural areas. The monies deposited in the Natural Areas Fund will be available for the management of lands acquired or leased by the County as natural areas. Monies from the sale of development rights on lands purchased by the County as natural areas also will be used for management purposes. Even with the above possible funding sources, the County recognizes the need for additional management funds. ERM will investigate all possible sources for land management funds, whether they are local, state, or federal in origin.

D.9.b Priority Schedule

Initial site development activities will focus on securing the project site against unauthorized use. Fencing, signs and gates were purchased and installed, and invasive vegetation removal started, within one year of acquisition. The management roads will be cleared, the nature trail and parking area will be constructed, and interpretive facilities and materials such as a kiosk, slide show, and nature trail guide will be developed within two years after the final adoption of this management plan. A priority schedule for these activities is provided in Table 5.

D.10 COMPLIANCE WITH STATE AND FEDERAL PLANS

The public uses proposed by Palm Beach County were carefully chosen and designed so as to not have a significant impact on any of the rare and endangered plants, animals, or natural communities found on the Yamato Scrub Natural Area. At the same time, these public uses will provide for adequate public passive recreational opportunities such as nature appreciation and study, photography, and hiking. The facilities planned also will be available for environmental education, and will be constructed in a manner sensitive to aesthetic considerations. The County believes that these public uses comply with the Conceptual State Lands Management Plan provisions calling for balanced public utilization. This management plan has been submitted to the City of Boca Raton for review and comment. The County believes that this management plan is in compliance with the City of Boca Raton Comprehensive Plan.

E. GLOSSARY

Burn unit - an area of predetermined size and shape that remains fixed for monitoring purposes throughout a course of fire management

Commensal species - one species that benefits from another species, while the second species apparently is neither benefitted or harmed by the relationship

Corridor - a route that permits the direct travel or spread of animals or plants from one area or region to another, either by the gradual spread of a population of a species along the route or by actual movement of animals, seeds, pollen, spores, or microbes

Density - the number of individual plants or animals per unit of habitable area

Diversity - the number of species that live together in an ecosystem; a measure of the variety of species in an ecosystem that takes into account the relative abundance of each species

Dominant - the characteristic species in a particular plant community, contributing most to the general appearance and influencing which other plants and animals live there; typically the largest plant species or the one with the greatest areal coverage

Ecosystem - an assemblage of living organisms (plants, animals, microorganisms, etc.) and nonliving components (soil, water, air, etc.) that functions as a dynamic whole through organized energy flows

Ecosystem management - an integrated, flexible approach to management of Florida's biological and physical environments - conducted through the use of tools such as planning, land acquisition, environmental education, regulation, and pollution prevention -- designed to maintain, protect and improve the state's natural, managed, and human communities

Ecotone - a zone of transition between two ecosystems that has characteristics of both

Endemic - a species or other biological grouping whose distribution is restricted to a particular region or locality

Enhancement - an action taken to introduce, reintroduce or restore vegetation and associated animals into an area where the native ecosystem has been disturbed

Feral - an animal that has reverted to a wild or untamed state from a domesticated state

Firebreak - a strip of land where the vegetation has been cut or removed to stop the spread of a fire; it typically does not exceed 15 feet in width and may be used as a management road and/or a hiking trail

- Fire regime - a prevailing condition in which ecosystems have evolved under periodic exposure to natural fires such that the vegetative communities have adapted to, are dependent upon, and are reproductively enhanced by this exposure
- Footpath - a narrow trail with a natural soil base that is intended for foot traffic only and does not have interpretive signage
- Forb - a broad-leaved herbaceous plant that is not a grass
- Habitat - the area or type of environment in which a specific kind of organism normally lives
- Hiking trail - an unpaved footpath with a natural soil base and directional signage only; may be combined with management roads
- Hydroperiod - the average length of time that soils are saturated during a given year
- Hydric - an environment that contains an abundance of moisture
- Inbreeding depression - A state in which a geographically isolated population becomes vulnerable to extirpation and weakened genetically due to the accumulation of deleterious recessive genes
- Kiosk - a small structure used to shelter informational displays
- Listed species - a species that is considered to be endangered or threatened with extinction, or a species of special concern, or a species that has been designated in some way by a jurisdictional governmental agency as meriting special protection or consideration
- Macro-management unit - a large management unit that contains one or more ecosystems
- Management road - an unimproved, single-lane dirt or sand road that is designated for vehicular management activities; it does not exceed 15 feet in width and may be used as a firebreak and/or hiking trail
- Mesic - a moist environment that is drier than a hydric environment, but seldom contains standing water
- Micro-management unit - a small management unit that contains only one ecosystem
- Mitigation - an action taken to lessen the severity or intensity of a human impact on a native ecosystem or offset the impact, either on the site where the impact occurs or at another location
- Mosaic - a pattern of vegetation in which two or more different plant communities are interspersed in patches

- Natural area - an area containing one or more aquatic, terrestrial, or transitional ecosystems or a combination of ecosystems that has essentially retained its primitive conditions; an area that is a least-disturbed known example of a type of natural ecosystem
- Nature trail - a hard-surfaced, handicapped-accessible walking trail with interpretive signage
- Off-road vehicle - a vehicle capable of traveling in roadless areas
- Outstanding Florida Water - a water body designated by the State of Florida Environmental Regulation Commission as worthy of special protection because of its natural attributes
- Passive recreation - any recreational activity which has minimal or no impact on natural resources or ecosystems, such as trail-walking, photography, and plant and wildlife observation
- Physiographic region - a region delineated by a specific topography
- Pyric community - a community resulting from, induced by, or associated with burning
- Relict population - a remnant population of a species that once was widespread
- Restoration - the process of repairing damage caused by human activity or a natural disaster to the diversity and dynamics of a native system
- Rookery - the breeding ground of certain other birds or animals, such as penguins and seals
- Ruderal - a species which generally is considered to be native, but often grows in disturbed areas
- Saltwater intrusion - the introduction of saltwater into a previously fresh water aquifer as a consequence of disturbance of the water pressure in the aquifer; saltwater intrusion often is associated with excessive pumping of wells
- Seed rain - a sudden dispersal of seeds, which can be triggered by fire or another extreme environmental event
- Seral stage - one of the stages in a series of more or less predictable changes in vegetation and animal life as one kind of ecosystem is replaced by another
- Soil phase - a subdivision of a soil type that deviates from the typical character of the soil type
- Sovereign lands or sovereignty lands - those lands including, but not limited to: tidal lands, islands, sandbars, shallow banks, and lands waterward of the ordinary or mean high water line, to which the State of Florida acquired title on March 3, 1845, by virtue of statehood, and of which it has not since divested its title interest

Subcanopy - the layer of shrubs or trees that is below the canopy, or uppermost layer of vegetation in a forest or woodland

Systemic herbicide - a chemical agent used to destroy or inhibit plant growth that is absorbed into and is effective throughout the entire organism

Taxon (plural - taxa) - a general term for any taxonomic category (for example, a species, genus, family, or order)

Transect - a long, narrow area used for sampling vegetation or counting animals; transects are used for the collection and analysis of data such as frequency of occurrence, size, or number of organisms or kinds of organisms

Transitory taxon (plural - taxa) - a species that is present on a site only for a brief period, often as a response to changing environmental conditions

Vegetative community - the plant component of an ecosystem

Viability - the capability of a seed or organism to grow and develop or the capability of a population of a species or a biological community to reproduce and maintain itself indefinitely

Water table - the level below which soil is saturated with water; the surface of the zone of saturation

Xeric - an environment or habitat that is low or deficient in moisture

F. ACRONYMS

ADA - Americans with Disabilities Act

ARC - Acquisition and Restoration Council

BTITF - Board of Trustees of the Internal Improvement Trust Fund

CARL - Conservation and Recreational Lands

CLASC - Palm Beach County Conservation Lands Acquisition Selection Committee

DCA - Florida Department of Community Affairs

DEP - Florida Department of Environmental Protection

DOF - Florida Department of Agricultural and Consumer Services, Division of Forestry

DSL - Division of State Lands

ERM - Palm Beach County Department of Environmental Resources Management

FDACS - Florida Department of Agricultural and Consumer Services

FFWCC - Florida Fish and Wildlife Conservation Commission

FGFWFC - Florida Game and Fresh Water Fish Commission

FLEPPC - Florida Exotic Pest Plant Council

FNAI - Florida Natural Areas Inventory

GPS - Global Positioning System

IRC - Institute for Regional Conservation

LWDD - Lake Worth Drainage District

NAMAC - Palm Beach County Natural Areas Management Advisory Committee

ORV - Off-road Vehicle

SFWMD - South Florida Water Management District

TNC - The Nature Conservancy

TTIIF - Trustees of the Internal Improvement Fund

USFWS - United States Department of the Interior, Fish and Wildlife Service

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