Brochu Preserve
Land Management Plan

FINAL DRAFT

Managed by: Conservation Collier Program

Collier County, Florida

June 2009 – June 2019 (10-yr plan)

Prepared by:

Conservation Collier Staff

Collier County Facilities Management Department

Brochu Preserve

Land Management Plan Executive Summary

Lead Agency: Collier County Board of County Commissioners, Conservation Collier Program

Property included in this Plan: "Brochu Preserve" 9.26-acres. Preserve consists of two adjoining parcels of 4.63-acres each in Section 23, Township 47 South, and Range 27 East of Collier County, Florida.

PROPERTY TAX IDENTIFICATION NUMBERS: 00095520003 & 00095480004

LEGAL DESCRIPTION:

WEST ½ OF THE SOUTHEAST ¼ OF THE SOUTHWEST ¼ OF THE SOUTHEAST ¼ , AND THE EAST ½ OF THE SOUTHEAST ¼ OF SOUTHWEST ¼ OF SOUTHEAST ¼ , LESS THE NORTH 30 FEET AND LESS THE SOUTH 50 FEET THEREOF FOR ROAD RIGHT-OF-WAY PURPOSES, OF SECTION 23, TOWNSHIP 47 SOUTH RANGE 27 EAST, OF COLLIER COUNTY FLORIDA.

Management Responsibilities:

Agency: Collier County - Conservation Collier Program

Designated Land Use: Conservation and natural resource based recreation

Unique Features: Plant communities include pine flatwoods and freshwater marsh with shrub, brush & vines; two listed plant species recorded to date.

Management Goals:

Goal 1: Eliminate or significantly reduce human impacts to indigenous flora and fauna

Goal 2: Develop a baseline monitoring report

Goal 3: Remove or control populations of invasive, exotic or problematic flora and fauna

Goal 4: Determine if prescribed fire and/or mechanical treatments are feasible to decrease woody invasion resulting from past fire exclusion; if so proceed

Goal 5: Restore and maintain native habitats

Goal 6: Develop a plan for public use

Goal 7: Facilitate uses of the site for educational purposes

Goal 8: Provide a plan for security and disaster preparedness

Public Involvement: Public meeting was held in the spring of 2009 with residents and neighbors from surrounding lands. Will coordinate land management efforts with the Corkscrew Island Neighborhood Association.

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1.0 Introduction

The Brochu Preserve is a 9.26-acre natural area comprised of two parcels (4.63-acres each; Folio numbers: 00095520003 and 00095480004) within the boundary of Collier County, Florida. Native plant communities within the preserve include pine flatwoods and freshwater marsh with shrubs, brushes and vines.

A site assessment to determine compliance with Conservation Collier's initial screening criteria was conducted in September 2005 and the Conservation Collier Program purchased the property on August 25, 2006. Collier County's Public Utilities Engineering Department paid $20,000 of the total price ($460,000) of the preserve to secure a 100-foot by 150-foot utility easement over the northwest corner of the western parcel (Folio number 00095520003). Collier County holds a fee simple title to the Brochu Preserve. The Conservation Collier program manages these lands under authority granted by Conservation Collier Ordinance 2002-63 as amended (2007-65; available from www.municode.com). Initial acquisition activities are summarized in table 1.

Table 1: Acquisition History and Status of Brochu Preserve

Year	Benchmark
2005	Property nominated to the Conservation Collier Program
2005	Initial Criteria Screening Report accepted by the Conservation Collier Land Acquisition Advisory Committee (CCLAAC)
2006	Purchase approved by the Board of County Commissioners (BCC) and parcels purchased.
2006	Interim Management Plan completed
2007	Interim Management Plan approved by BCC
2009	Final Management Plan completed

Conservation, restoration and natural resource-based recreation are the designated uses of this preserve. Management activities allowed include those necessary to preserve, restore, secure and maintain this environmentally sensitive land for the benefit of present and future generations. Public use of the site must be consistent with these management goals.

This is the Final Management Plan for the Brochu Preserve. This 10-year management plan will be submitted to the Collier County Board of County Commissioners (BCC) for its approval. When approved, this plan will replace the Interim Management Plan.

1.1 Conservation Collier: Land Acquisition Program and Management Authority

The Conservation Collier program was originally approved by voters in November 2002 and subsequently confirmed in the November 2006 ballot referendum. Both voter-approved referendums enable the program to acquire, preserve, restore, and maintain vital and significant threatened natural lands, forest, upland and wetland communities located in Collier County, Florida for the benefit of present and future generations (Ordinance 2002-63, as amended). Properties must support at least two of the following qualities to qualify for consideration: rare habitat, aquifer recharge, flood control, water quality protection, and listed species habitat. The BCC appointed a Land Acquisition Advisory Committee to consider any selected or nominated properties that an owner has indicated a willingness to sell. The committee recommends property purchases for final approval by the BCC.

Lands acquired with Conservation Collier funds are titled to "COLLIER COUNTY, a political subdivision of the State of Florida, by and through its Conservation Collier program." The BCC

established the Conservation Collier program to implement the program and to manage acquired lands. As such, Conservation Collier holds management authority for the Brochu Preserve.

1.2 Purpose and Scope of Plan

The purpose of the plan is to provide management direction for Brochu Preserve by identifying the goals and objectives necessary to eliminate or minimize any threats to the resources and integrity of the preserve. This text is a working document that establishes the foundation of the ten-year plan by identifying the appropriate management techniques necessary to restore and preserve the resource.

This plan will balance resource restoration and protection with natural resource-based recreational and educational use while looking at restoration needs, listed species protection and maintenance of the site free of invasive, exotic plant and animal species. This plan is divided into sections that incorporate an introduction, descriptions of the natural and cultural resources, projected uses of the property, management issues, and goals and objectives.

1.3 Location of the Brochu Preserve

Brochu Preserve is located approximately 15 miles east of Interstate 75 (I-75) on the north side of Immokalee Road (Figure 1). The preserve is in northern Collier County, Florida in Section 23, Township 47 South, and Range 27 East.

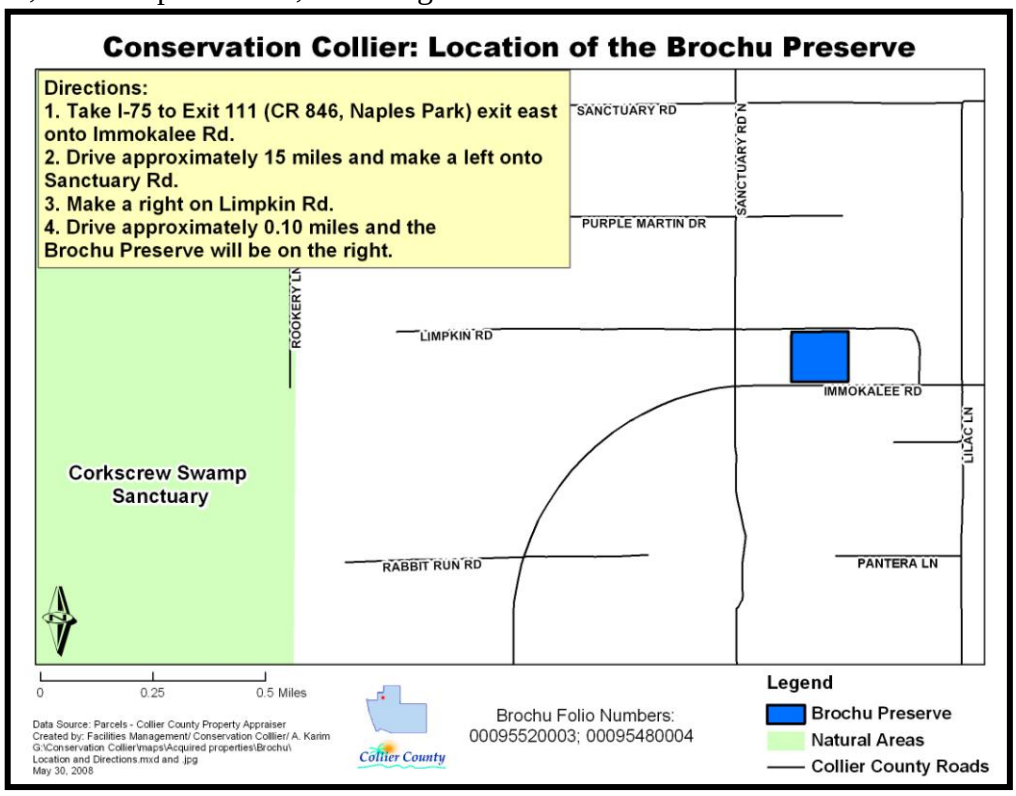


Figure 1: General Location of Brochu Preserve.

1.4 Regional Significance of the Brochu Preserve

Ecosystem services such as the protection of water resources, flood control, maintenance of nutrient cycles, preservation of biological diversity, carbon sequestration, and the availability of recreational lands are imperative for the well-being of the citizens of Collier County and may be achieved through the preservation of natural areas. As of April 2008, approximately 66% (over 860,000 acres) of all lands in Collier County were protected in conservation areas (Figure 2) and managed by private, local, state and federal agencies (FNAI 2008). Collier County's Conservation Collier Program manages the 9.26-acre Brochu Preserve; it contains pine flatwoods and freshwater marsh with shrubs, brushes and vines. Specific information on the plant communities found on the Brochu Preserve may be found in section 2.3 (Natural Plant Communities) of this document.

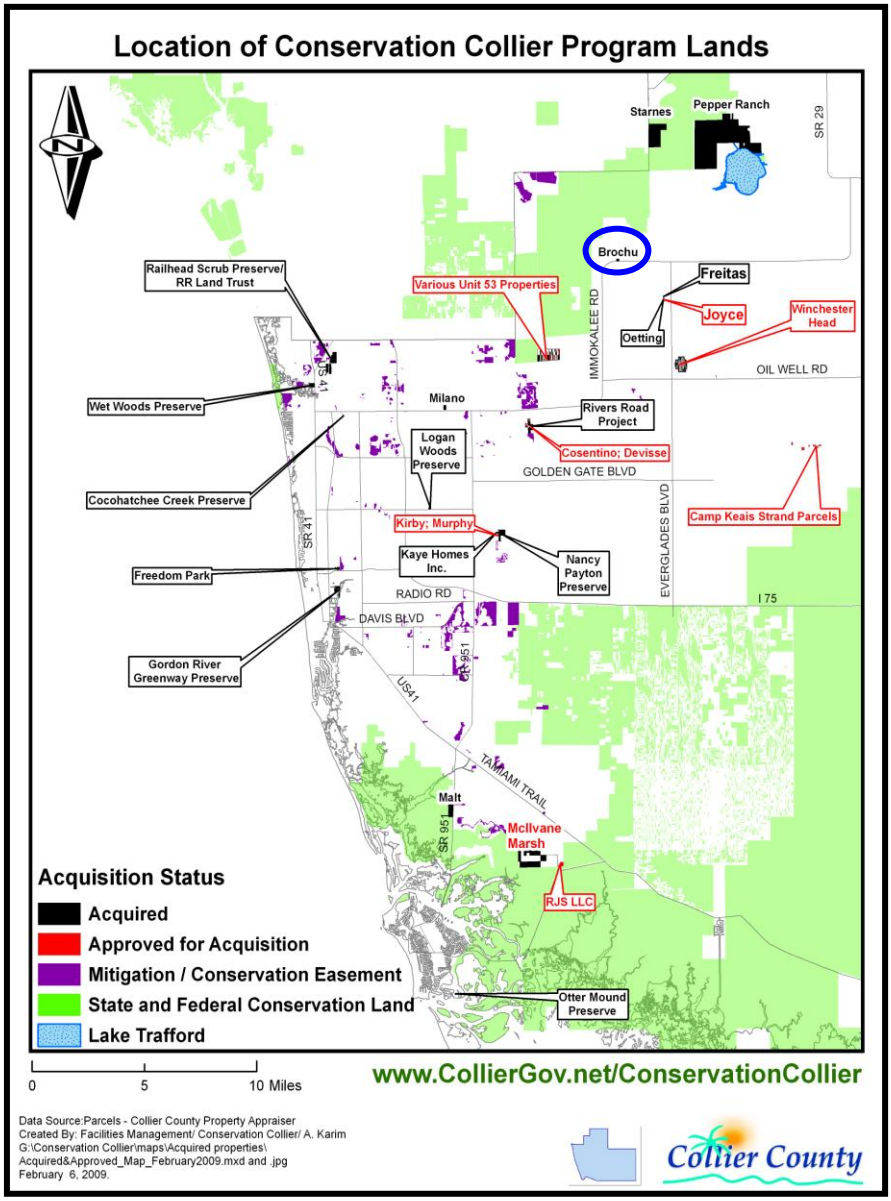


Figure 2: Conserved Lands in Collier County, Florida Including Lands Owned by Conservation Collier.

1.5 Nearby Public Lands and Designated Water Resources

Currently, the closest preserved, natural area to the Brochu Preserve is the National Audubon Society's Corkscrew Swamp Sanctuary. The Sanctuary is part of the Corkscrew Regional Ecosystem Watershed, which is more than 42,000 acres in size and surrounds the Brochu Preserve just over one mile to the north, west, and southwest. These areas are held in both public and private conservation status, which include the headwaters for Collier County's drinking water supplies. Other preserves, in order of increasing distance, are provided in Table 2. Figure 3 shows the locations of these nearby preserves.

Table 2: Public Lands Located near the Brochu Preserve

Name	Approximate Distance (miles)	Direction	Type
Corkscrew Swamp Sanctuary	1.10	NW & W	Private
Corkscrew Regional Ecosystem Watershed	1.30	NE	State
Corkscrew Regional Ecosystem Watershed	1.50	SW	State
Oetting/ Freitas Properties	2.45	SE	Conservation Collier
Unit 53 (Boundary)	4.60	SW	Conservation Collier
Winchester Head (Boundary)	4.90	SE	Conservation Collier
Starnes Preserve	4.95	N/ NE	Conservation Collier
Pepper Ranch	5.13	NW	Conservation Collier
Milano Preserve	9.75	SW	Conservation Collier

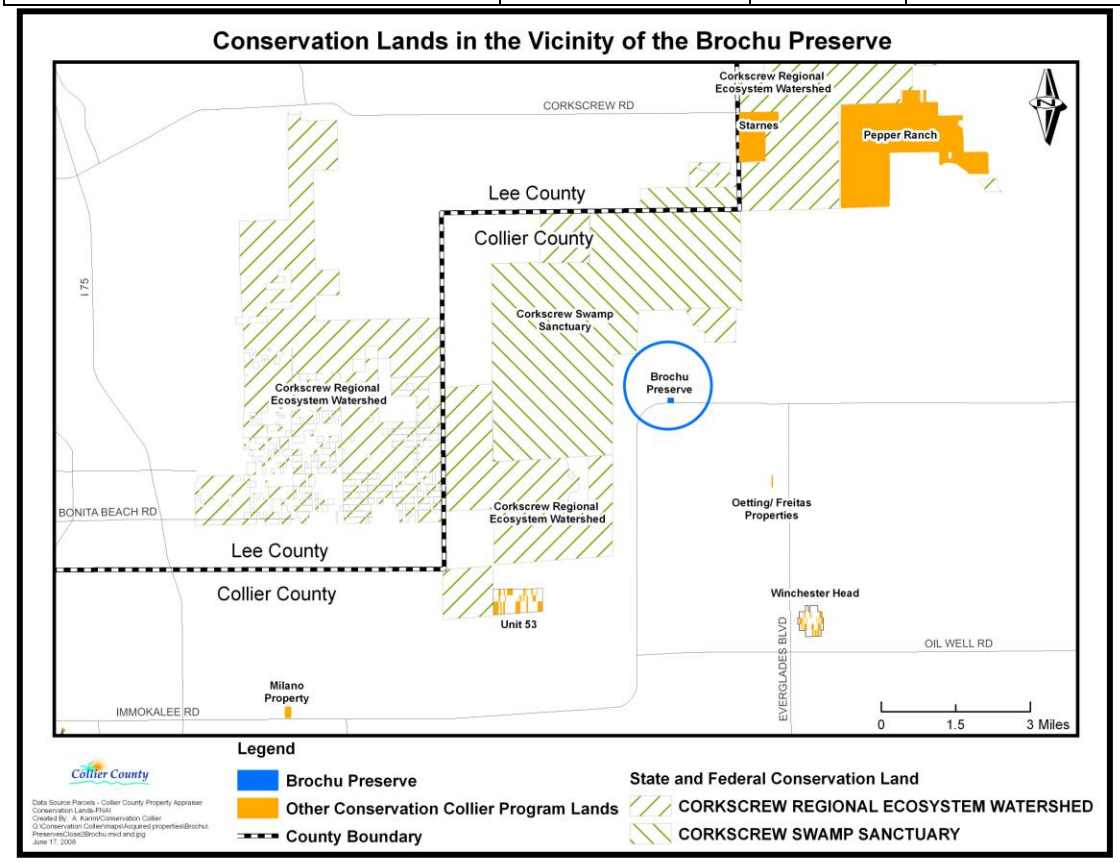


Figure 3: Preserves and Protected Lands in the Vicinity of Brochu Preserve

1.6 Public Involvement

Neighborhood involvement will be sought through direct mailing notices for public meetings to residents and other preserve managers within 2,000 feet of the preserve boundaries. Official public notices will be posted on the County website. Staff will seek to coordinate management actions, such as exotic removal, trail creation and prescribed burning with owners of adjoining lands including the Corkscrew Island Neighborhood Association, Corkscrew Swamp Sanctuary staff and possibly Boy and Girl Scout Troops.

2.0 Natural Resources

2.1 Physiography

Brochu Preserve lies within the Floridian section of the Coastal Plain. The Coastal Plain extends from New Jersey to Texas and was formed mainly from sedimentary rocks deposited in marine environments (USGS 2004).

2.1.1 Topography and Geomorphology

The site is located in the Southwestern Slope region of the South Florida Water Management District. The Light Detection and Ranging (LIDAR) data layer provided by the U.S. Geological Survey, National Wetlands Research Center is a remote sensing system used to collect topographic data. This LIDAR layer has identified the Brochu Preserve to be at an elevation of 19 – 20 ft NAVD (North America Vertical Datum). The land then slopes westward toward the Gulf of Mexico.

2.1.2 Geology

The geology of northern Collier County, where the Brochu Preserve is located, is characterized by complex sequences of interbeded sands, clays, and limestone. Closest to the surface is the Holocene aged Pamlico Sand Formation, approximately ten feet thick and composed primarily of unconsolidated quartz sand and some silt. The Pamlico Sand unconformably overlies the Pleistocene aged Fort Thompson and Caloosahatchee Formations, which vary from a few feet to more than twenty feet in thickness and are characterized by shelly and sandy limestone with vugs and solution cavities (Miller 1986).

Below the Fort Thompson and Caloosahatchee Formations are the Ochopee and Buckingham Members of the Pliocene aged Tamiami Formation, which are at least 200 feet thick in the surrounding areas (Oaks & Dunbar 1974). The Ochopee Limestone unconformably overlies the Buckingham Limestone and/or the equivalent Cape Coral Clay. This unconformity marks the bottom of the surficial aquifer separating it from the brackish underlying aquifer below. Then the Hawthorn Formation, rich in phosphate and other heavy minerals (Scott 1988), overlies the Oligocene age Suwannee Limestone and Eocene age Ocala Limestone that form the Floridan Aquifer System in Southwestern Florida. The Brochu Preserve is located within the Southwestern Slope. Geologically, this is the dominant feature of Collier County (Campbell 1990). Figure 4 provides a current aerial view of the Brochu Preserve including the delineation of the two parcels that make up the preserve.

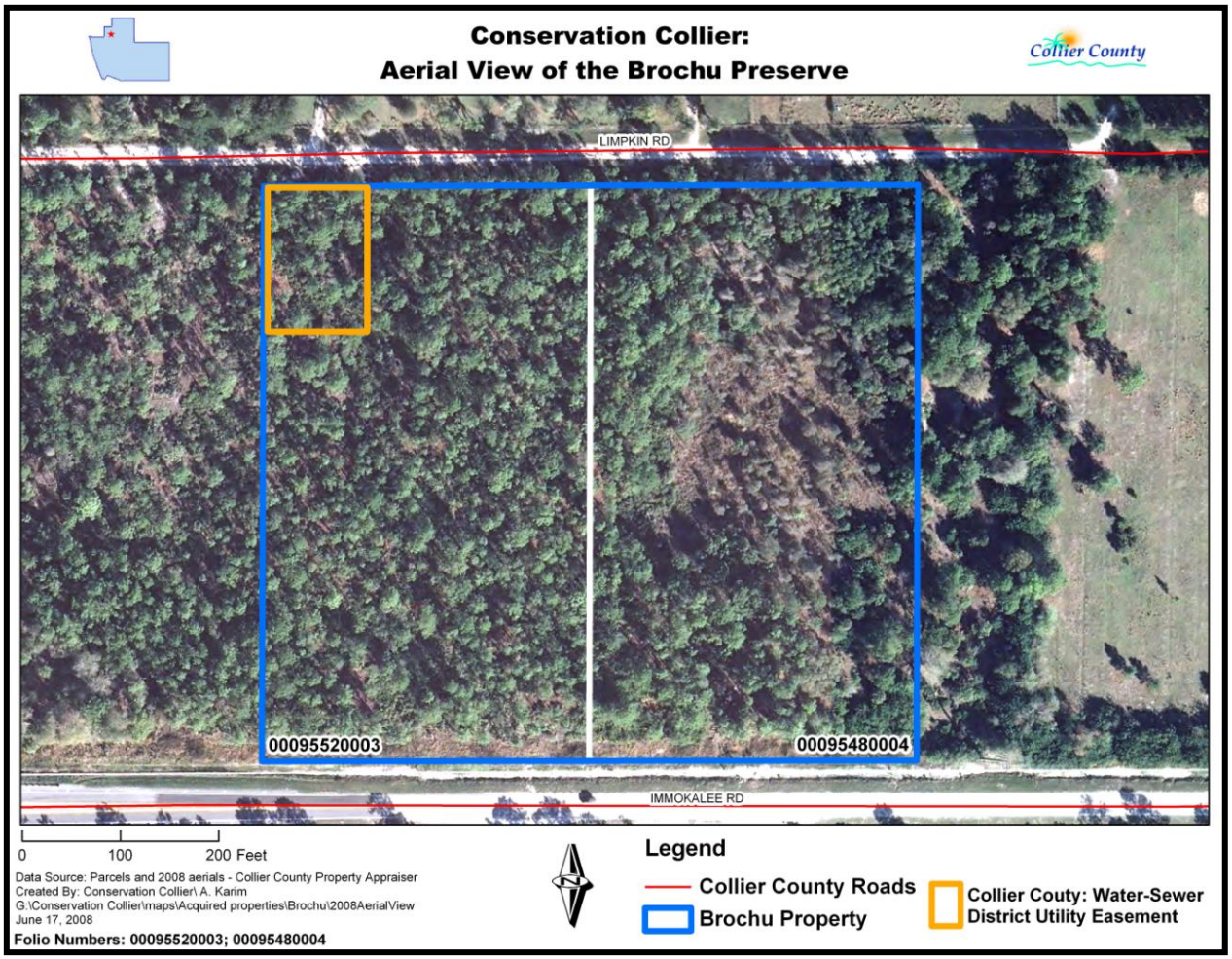


Figure 4: Aerial View of the Brochu Preserve Showing Delineation of Parcels

2.1.3 Soils

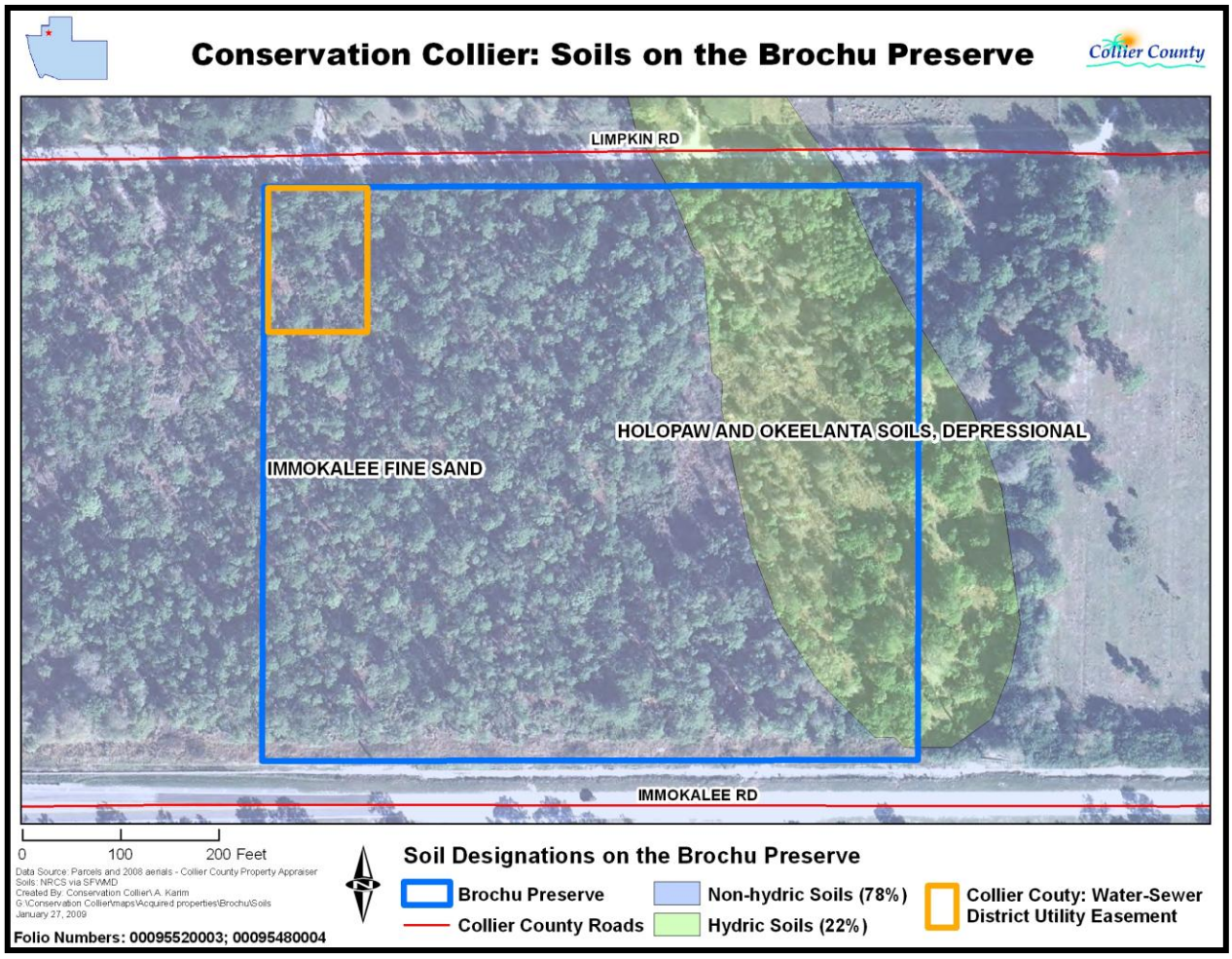
Mapped soils on this parcel were identified as Immokalee fine sand & Holopaw and Okeelanta soils, depressional (Figure 5).

Immokalee fine sand underlies approximately 78% of the Brochu Preserve. This non-hydric soil occupies the western portion of the preserve and a small portion in the northeast corner. Immokalee fine sand is a nearly level and poorly drained soil found in pine flatwoods. During extended dry periods, the water table may recede to a depth of 40+ inches, but under natural conditions, the seasonal high water table is between a depth of 6-18 inches for 1 to 6 months. Natural vegetation consists of South Florida slash pine (*Pinus elliottii*), saw palmetto (*Serenoa repens*), wax myrtle (*Myrica cerifera*) and chalky bluestem (*Andropogon virginicus* var. *glaucus*; Liudahl et al. 1990).

Underlying approximately 22% of the Brochu Preserve, Holopaw and Okeelanta soils are level and very poorly drained resulting in depressions and marshes. During extended dry periods, the water table may recede to a depth of 12 to 40 inches, but under natural conditions, these soils are ponded for six or more months a year. Flora typically associated with these soils include: maidencane (*Panicum hemitomon*), rushes (*Juncus* spp.), sawgrass (*Cladium jamaicense*),

pickerelweed (*Pontederia cordata*), fireflag (*Thalia geniculata*) and a few cypress trees (*Taxodium* spp.; Liudahl et al. 1990).

Figure 5: Soil Units on the Brochu Preserve



2.1.4 Hydrology/Water Management

Surface water flow from these properties generally flows south into the ditch along the north side of Immokalee Road. It then usually flows west and around the Immokalee Road curve until it joins sheet flow to the southwest into the Corkscrew Canal, then ultimately discharges into Naples Bay.

These properties are on the edge of the Big Corkscrew Island, so preserving them provides for a delay in runoff of storm water. It also provides marginal area storage for when large storm events come, which we need in areas that are normally dry.

Near the surface, the aquifer is highly permeable and the groundwater flows toward the west. However, permeability decreases downward from a porous limestone into poorly indurated sandstone cemented by micrite. The aquifer grades from freshwater downward into brackish water due to the proximity of the Gulf of Mexico to the west and the brackish water in the intermediate aquifer made primarily of Miocene aged sediments. Below that, the Hawthorne

formation typically marks the upper boundary of the Floridan aquifer, which is contained within the underlying Oligocene age Suwannee Limestone (Lodge 2005).

Groundwater levels have gone down during the recent decades due to drainage on a regional scale and water management for development purposes. This trend may be very difficult to control and will gradually reduce the extent of the preserve that floods during the summer months and reduce the period of time the preserve wetlands are flooded during the year.

The Surficial Aquifer is an aquifer close to the surface and unconfined, typically associated with the groundwater table. This aquifer is generally limited to smaller uses such as household or small agricultural uses. The Lower Tamiami aquifer is below this aquifer and is recognized as being useful for long-term water needs. According to the South Florida Water Management District's (SFWMD) technical publication 95-02 (Fairbank & Hohner 1995), the Surficial Aquifer recharge capacity on the Brochu Preserve is moderate at 43 to 56 inches annually. The Lower Tamiami Aquifer recharge capacity on the preserve is relatively low at 7 to 14 inches annually.

2.2 Climate

The Brochu Preserve is located in an area of Florida where humid subtropical and tropical savanna climatic patterns overlap, with temperatures moderated by winds from the Gulf of Mexico and the Atlantic Ocean. Sharply delineated wet and dry seasons and average monthly temperatures greater than 64º Fahrenheit characterize a tropical savanna climate. Monthly rainfalls may exceed ten inches during the wet season. On the other hand, humid subtropical climates typically show less extreme rainfall fluctuations between wet and dry seasons and average monthly temperatures is less than 64º Fahrenheit in some months.

The average annual temperature for the coastal portion of Collier County is approximately 75º Fahrenheit. The warmest months are usually July and August. The humidity is high during these months but frequent afternoon thunderstorms prevent excessively high temperatures.

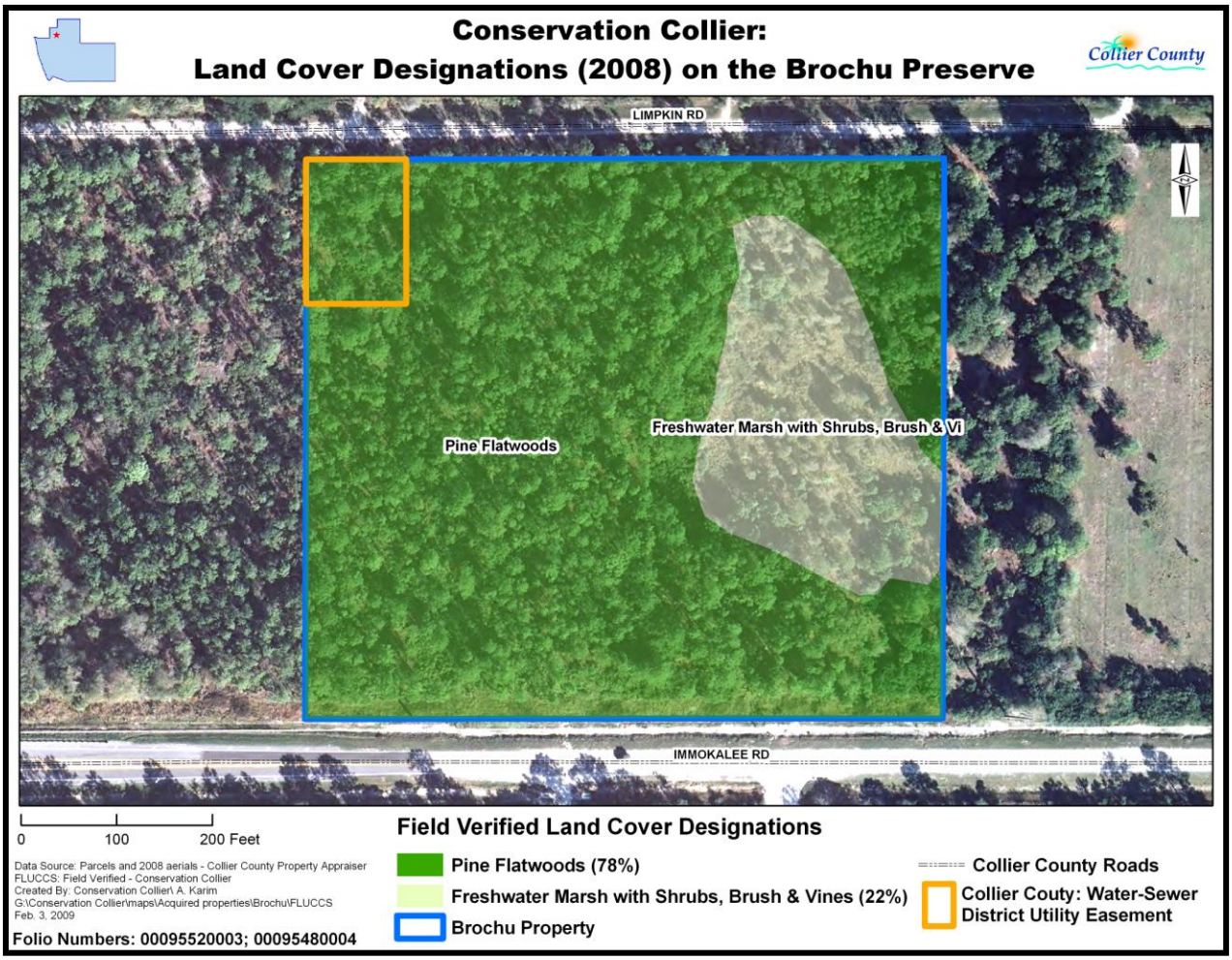
Two-thirds of the annual rainfall occurs in the wet season from May to October. Thunderstorms are frequent during the wet season, occurring every two out of three days between June and September. Rainfall records for the area indicate that there is not significant variation in the annual rainfall throughout much of the county; however, large variations often occur during a single year. The Atlantic hurricane season extends from June through November with peak activity occurring in September and October when ocean temperatures are highest.

2.3 Natural Plant Communities

The term "plant community" refers to the suite of floristic species that form the natural (i.e., native) vegetation of any place. In addition to anthropogenic influences, the combination of factors such as geology, topography, hydrology, underlying soils and climate determine the types of plants found in an area. These plants, in turn determine the animal species that may be found there.

The Florida Land Use, Land Cover Classification System (FLUCCS) created by the Southwest Florida Water Management District in 1995 classifies plant communities and provides GIS layers for users to overlay on property boundaries and aerial images to better determine the plant

communities found there. The FLUCCS designates two plant communities on the preserve: Pine Flatwoods (FLUCCS CODE 411) and Mixed Wetland Hardwoods, Mixed Shrubs (FLUCCS CODE 6172). Site visits by Conservation Collier staff revealed that the latter designation was



inaccurate; a more accurate description would be Freshwater Marsh with Shrub, Brush & Vines (FLUCCS CODE 6417). Staff created a new digital layer showing the location and extent of the native plant communities currently found on the preserve (Figure 6).

Figure 6: Extent of Plant Communities Currently Found on the Brochu Preserve.

The vegetation classification scheme of the Florida Natural Areas Inventory (FNAI) and the Florida Department of Natural Resources (FDNR) (1990) are presented in table 3. This table is based on the plant communities observed on the Brochu Preserve. The following subsections (2.3.1, 2.3.2, 2.3.3 and 2.3.4) provide information about the plant communities observed on the preserve.

Table 3: Summary of Natural Communities on the Brochu Preserve

FNAI Natural Community Type	Global Rank	State Rank	Comments
Mesic Flatwoods	G4	S4	Also called Pine Flatwoods
Basin Marsh	G4	S4	Also called Freshwater Marsh

G4: Apparently secure globally (may be rare in parts of range); **S4:** Apparently secure in Florida (may be rare in parts of range).

2.3.1 Uplands: Pine Flatwoods

A pine flatwood community (FLUCCS CODE 411) dominates approximately 78% of the Brochu Preserve (Figure 6). Pine flatwoods are one of the most wide-ranging terrestrial plant communities in Florida and consequently one of the most influenced by anthropogenic activities (Abrahamson & Hartnett 1990). Fire strongly influences the community structure and composition of these communities.

The term pine flatwoods is a general categorization of areas that are dominated by various species of pine trees. Pine flatwoods may be found in mesic flatlands where the landscape is made up of flat, moderately well drained sandy substrates with a mixture of organic material, often with an underlying hardpan layer. An open canopy forest of widely spaced pine trees with little or no understory but a dense ground cover of herbs and shrubs characterize natural, mesic flatwoods that have been burned regularly (FNAI & FDNR 1990). The USDA Soil Conservation Service classification system refers to these areas as South Florida flatwoods. South Florida flatwoods are typically savannas, a type of plant community intermediate between forest and grassland.

Pine Flatwood Community within the Brochu Preserve. Photo taken by Annisa Karim

Mesic pine flatwoods are also called mesic flatwoods, pine savanna, cabbage palm savanna, and pine barrens. Immokalee fine sand underlies this part of the preserve. Common mesic pine flatwood species such as saw palmetto, wax myrtle (*Myrica cerifera*), cabbage palm and gallberry (*Ilex glabra*) are found in this portion of the preserve.

Mesic flatwoods provide essential forested habitat for a variety of wildlife species including Neotropical migratory birds, wide-ranging large carnivores, mid-sized carnivores, ground-nesting vertebrates, tree-cavity dependent species, tree-nesting species and non-aquatic plant life. "At the current rate of habitat conversion, the mesic pine flatwoods, once the most abundant upland habitat in South Florida, is in danger of becoming one of the rarest habitats in South Florida" (USFWS 1999).

2.3.2 Wetlands: Freshwater Marsh with Shrub, Brush & Vines

A freshwater marsh with shrubs, brushes and vines (FLUCCS CODE 6417) comprises approximately 22% of the Brochu Preserve and is located primarily in the eastern center portion of the preserve (Figure 6).

Freshwater marshes are often scattered among upland, pine flatwoods communities and may therefore be referred to as flatwoods marshes. Sawgrass (*Cladium jamaicense*), swamp lily (*Crinum americanum*), giant leather fern (*Acrostichum danaeifolium*), and native wetland grasses dominate the freshwater marshes; Holopaw and Okeelanta soils comprise the majority of substrate of the freshwater marsh on the preserve.

Freshwater marshes are wetlands usually dominated by herbaceous flora. In Florida, these marshes are influenced by their subtropical location, fluctuating water levels, frequency and intensity of fire, organic matter accumulation and hard water (Kushlan 1990). These factors, combined with the dominant species found within a marsh, dictate the category within which the marsh is placed. Six major categories of freshwater marshes are recognized in Florida. The marsh in the Brochu Preserve is within the "wet prairie" category. These marshes usually have a short (flooded less than 6 months) hydroperiod, a high (more than once every ten years) frequency of fire and low (few centimeters to non-existent) accumulation of organic material (Kushlan 1990).

Currently, the marsh on the Brochu preserve contains and is fringed by invasive, exotic trees – primarily *Melaleuca quinquenervia*. Control measures for exotic plant species on the Brochu Preserve are discussed in section 4 of this document.

Many animal species may be found within or around the perimeter of marshes. Invertebrates make up an important part of the food web and many avian species, especially wading birds, rely on the invertebrates as a primary source of food. The freshwater marsh within the preserve makes up a small portion of the total area but is valuable for the suite of species that may be found there.

Fresh Water Marsh during the dry season on the Brochu Preserve. Note melaleuca (*Melaleuca quinquenervia*) trees fringing the marsh area.
Photo taken by Annisa Karim.

2.4 Native Plant and Animal Species

The 9.26-acre Brochu Preserve contains pine flatwoods (approximately 78%) and a freshwater marsh (approximately 22%). This section discusses the flora and fauna found within these plant communities. The next section (2.5) discusses all listed species in greater detail.

2.4.1 Plant Species

To date, 58 plant species have been recorded on the preserve (Appendix 1). Conservation Collier staff conducted floristic inventories in September 2005 and February 2009. Another survey will be conducted in late fall 2009 and the final list will be added to this plan. Of these 58

plant species, 50 (86%) are native - of which, two are listed by the State of Florida (one is listed as endangered; one is listed as threatened).

2.4.2 Animal Species

Due to the dearth of specific surveys for the occurrence of animal species (in contrast to plants) and the lack of on-site staffing, little is recorded for actual occurrences of animals at the Brochu Preserve. Occurrences of fauna at the preserve are based on direct visual and aural observations by staff during site visits or evidence of activity such as spoor, scat, or burrows, and from the site information available in documents such as the site's initial criteria screening report, the property's interim management plan and anecdotal information from persons with knowledge of the site. Table 4 provides a comprehensive list of animals, both native and non-native, recorded on the Brochu Preserve thus far.

Table 4: Faunal Species Recorded on the Brochu Preserve

Common Name	Scientific Name
Zebra Longwing butterfly	*Heliconius charitonius*
Viceroy butterfly	*Limenitis archippus*
Ruddy Daggerwing	*Marpesia petreus*
Crab-like Spiny Orbweaver spider	*Gasteracantha cancriformis*
Red imported fire ant [a]	*Solenopsis invicta*
Brown anole [a]	*Anolis sagrei*
Southern toad	*Bufo terrestris*
Red-shouldered Hawk	*Buteo lineatus*
Mourning Dove	*Zenaida macroura*
Common Ground-Dove	*Columbina passerina*
Red-bellied Woodpecker	*Melanerpes carolinus*
Tree Swallow	*Tachycineta bicolor*
Blue Jay	*Cyanocitta cristata*
Northern Mockingbird	*Mimus polyglottos*
Feral Pig [a]	*Sus scrofa*

[a] *Non-native species* *list revised February 2009*

Other wildlife species that have not yet been recorded undoubtedly occur at the Brochu Preserve. During migration periods, transient bird species would be expected to utilize this area for short periods of time. The undeveloped character of the adjacent areas and the presence of conservation lands that are being maintained in their natural states may enhance use of the preserve by many mammal, reptile, and amphibian species.

2.5 Listed Species

Official lists of rare and endangered species are produced at the federal level by the United States Fish and Wildlife Service and the National Marine Fisheries Service and at the State level by the Florida Fish and Wildlife Conservation Commission and the Florida Department of Agriculture

and Consumer Services. FNAI produces a list of rare and endangered species, and maintains a database of occurrences of these species in Florida. The Institute for Regional Conservation (IRC) also ranks native plant species by conservation status in the 10-county area of South Florida. The following subsections (2.5.1 and 2.5.2) discuss the listed, rare and protected plant and animal species found within and close to the Brochu Preserve in detail.

2.5.1 Listed Plant Species

The Florida State Statute titled "Preservation of native flora of Florida" (Statute 581.185) provides the following definitions:

- Endangered plants means species of plants native to the state that are in imminent danger of extinction within the state, the survival of which is unlikely if the causes of a decline in the number of plants continue, and includes all species determined to be endangered or threatened pursuant to the federal Endangered Species Act of 1973, as amended, Pub. L. No. 93-205 (87 Stat. 884).
- Threatened plants means species native to the state that are in rapid decline in the number of plants within the state, but which have not so decreased in such number as to cause them to be endangered.

There are two (2) plant species at Brochu Preserve that are listed by the Florida Department of Agriculture and Consumer Services (FDACS), one (1) as endangered and one (1) as threatened (Table 5). A brief description of these species and their status is included in the following paragraphs.

Table 5: Listed Plant Species Detected at the Brochu Preserve

Common Name(s)	Scientific Name	State Status
Stiff-leaved wild-pine, Cardinal airplant	*Tillandsia fasciculata*	E
Reflexed wild-pine, Northern needleleaf	*Tillandsia balbisiana*	T

E: Endangered; **T:** Threatened

Both listed plant species found on the Brochu Preserve are classified as bromeliads. Bromeliads are members of the pineapple family (Bromeliaceae). While some of these species may be found growing terrestrially, most native bromeliads found in Florida are found growing attached to tree trunks and branches and may therefore be referred to as epiphytes (a plant that lives upon other plants; from Greek "epi" = upon "phyte" = plant). The leaves and/or roots of these airplants (depending on the species) absorb the water and nutrients they need from the air and from the rain that falls through the canopy of the tree on which they are found. Since epiphytes use their roots only to anchor themselves to another plant, they are considered non-parasitic. Even though the two listed bromeliad species found on the Brochu Preserve are fairly common in the state, they are listed due to illegal collecting and the destruction of the habitats in which they are found. Additionally, infestation by the introduced Mexican bromeliad weevil (*Metamasius callizona*) has been implicated in the decline of many airplant populations around the state. Currently, there are no control measures in place however, close research and monitoring is taking place.

Stiff-leaved Wild Pine (*Tillandsia fasciculata*), is also known as cardinal airplant and common wild pine. *T. fasciculata* is listed as an endangered plant by the State of Florida and has been in 24 counties throughout Florida (Wunderlin & Hansen 2008). This epiphyte was frequently found in South Florida before the introduction of the Mexican bromeliad weevil. Today, it may be found in hammocks, cypress swamps and pinelands.

View of *T. fasciculata* with water in the "tank".
Photo by Annisa Karim

Like most of the other bromeliads in Florida, this species is often referred to as a "tank" bromeliad because the leaf axils and central stems form a "tank" or reservoir at the base of the plant. These reservoirs capture and hold water, dead and decaying plant matter (leaves, seeds twigs, etc.), and dead and drowning non-aquatic insects; these trapped items provide nutrients for the plant (Larson et al. 2006).

Reflexed wild pine (*Tillandsia balbisiana*) is an epiphytic, "tank" bromeliad and is listed as a threatened plant by the State of Florida. Wunderlin and Hansen reported this species in 22 counties throughout Florida as of 2008 (Wunderlin & Hansen 2008). Reflexed wild pine is an occasional species in South Florida and is usually found in scrub, pinelands, strand swamps, hammocks, mangrove swamps and on shell ridges/mounds.

Tillandsia balbisiana
Photo by Annisa Karim

FNAI maintains a database of occurrences of rare, threatened, and endangered species in Florida. An element is any exemplary or rare component of the natural environment, such as a species, natural community, bird rookery, spring, sinkhole, cave, or other ecological feature. An element occurrence is a single, extant habitat that sustains or otherwise contributes to the survival of a population or a distinct, self-sustaining example of a particular element.

These element occurrence data are built into biodiversity matrices. Each matrix encompasses one (1) square mile and includes all species and natural communities tracked by FNAI, including all federal listed species. The FNAI report for the matrix in which the Brochu Preserve is located identifies five likely elements and 16 potential elements. Of the five likely elements, one has been observed on the preserve, namely mesic pine flatwoods (described in section 2.3.1 of this document). None of the 16 potential elements reported by FNAI have been detected within the preserve. Appendix 2 provides the FNAI Managed Area Tracking Record and Element Occurrence Summary as well as the Biodiversity Matrix Report. Global and state rankings are provided for each species as well as their federal and state status.

2.5.2 Listed Animal Species

No listed wildlife species have been observed onsite or immediately adjacent to the preserve. However**,** FNAI lists the following animal species as "likely" to occur (rare species likely to occur in this matrix – 43523 - based on suitable habitat and/or known occurrences in the vicinity): Florida sandhill crane (*Grus canadensis pratensis*), the wood stork (*Mycteria americana*), the Florida panther (*Puma concolor coryi*) and the Mangrove fox squirrel (*Sciurus niger avicennia*). Eight animal species were reported within FNAI's Biodiversity Matrix 43523 as potential occurrences (site lies within the known or predicted range of species) These include the Eastern indigo snake (*Drymarchon couperi*), the gopher frog (*Rana capito*), the gopher tortoise (*Gopherus polyphemus*) and the red-cockaded woodpecker (*Picoides borealis;* Appendix 2). None of these species have been detected on site.

2.6 Invasive, Non-native and Problem Species

In an ecological context, an invasive species is one that is aggressive in growth and expansion of range and tends to dominate others; its establishment and dominance can cause widespread harm to an ecological system by altering the species composition, susceptibility to fire and hydrology of an area. Non-indigenous species (i.e., non-native or exotic species) are those that have been introduced purposefully or accidentally to an area outside their normal range. The characteristics of some of these species (high rate of growth/reproduction, no natural predators, easily dispersed, able to out-compete native species) make them invasive. Some indigenous species (a species whose natural range included Florida at the time of European contact circa 1500 AD or a species that has naturally expanded or changed its range to include Florida) may also become invasive. Invasions by native and non-native species often follow an alteration to ecosystem function, disruption of the food web, large-scale fragmentation of an ecosystem and/or disturbance (e.g., clearing, fire, drought, etc) of an area. While some native species may become invasive, the establishment and dominance of non-native species is of particular concern. The exotic plant and animal species documented within the preserve and those that have a potential to occur within the preserve are discussed in the following sections.

2.6.1 Invasive and Problem Plant Species

The Florida Exotic Pest Plant Council (FLEPPC) maintains a list of exotic plants that have been documented to (1) have adverse effects on Florida's biodiversity and plant communities, (2) cause habitat loss due to infestations and (3) impact endangered species via habitat loss and alteration. To date, eight (8) non-indigenous plant species have been detected within Brochu Preserve (Table 6), accounting for 14% of the plant species recorded there. Of the eight exotic species, seven are listed by FLEPPC (five Category I and two Category II). FLEPPC defines Category I plants as those that alter native plant communities by displacing native species, change community structures or ecological functions, or hybridize with natives. Category II plants have increased in abundance or frequency but have not yet altered Florida plant communities to the extent shown by Category I species. These definitions do not rely on the economic severity or geographic range of the problem, but rather on the documented ecological damage caused by these plants (FLEPPC 2007).

Table 6: Invasive Plant Species within the Brochu Preserve		
Scientific Name	**Common Name(s)**	**FLEPPC[a]**
Acacia auriculiformis	earleaf acacia	I
Melaleuca quinquenervia	punk tree, melaleuca, paper bark	I
Nephrolepis multiflora	Asian sword fern	I
Schinus terebinthifolius	Brazilian pepper	I
Syzygium cumini	Java plum; jambolan	I
Terminalia catappa	West Indian almond; tropical almond	II
Urena lobata	caesarweed	II
Sporobolus indicus	smutgrass	n/a

[a]*Florida Exotic Pest Plant Council (FLEPPC) 2007 designations*

I: *Invasive, exotics that are altering native plant communities by displacing native species, changing community structures or ecological functions, or hybridizing with natives.*

II*: Invasive, exotics that have increased in abundance or frequency but have not yet altered Florida plant communities to the extent shown by Category I species.*

As of the acquisition of the Brochu Preserve by the Conservation Collier program on August 25, 2006 the most problematic exotic, invasive plant species were and continue to be melaleuca (*Melaleuca quinquenervia*) and earleaf acacia (*Acacia auriculiformis*). The control/ removal of invasive, exotic species are discussed in detail in section 4 of this document.

2.6.2 Invasive and Problem Animal Species

Although Florida does not have an official exotic, invasive animal species list, at least 400 exotic fish and wildlife animal species have been reported in Florida, and approximately 125 species are established.

Three non-indigenous, invasive animal species have been documented on the preserve: red imported fire ant (*Solenopsis invicta*), brown anole (*Anolis sagrei*) and feral pig (*Sus scrofa*). Based on the natural communities found within the preserve, proximity to residential areas and geographic location, several more species (native and non-native) have the potential to impact the Brochu Preserve to varying degrees. Brief descriptions of documented and undocumented but potentially problematic species are provided in the following paragraphs.

Red imported fire ant (*Solenopsis invicta*): documented within the Brochu Preserve

Solenopsis invicta, an invasive, non-indigenous arthropod documented within the Brochu Preserve. Photo courtesy of the USDA.

These social insects were introduced into the U.S. from Brazil into either Mobile, Alabama or Pensacola, Florida between 1933 and 1945 (Collins & Scheffrahn 2005) and have been detected in the Brochu Preserve. Red imported fire ants (RIFA) have been documented to cause harm to humans and wildlife as well as economic harm (Stimac & Alves 1994; Collins & Scheffrahn 2005; Willcox & Giuliano, 2006). RIFAs have a number of impacts on wildlife; in many areas, they have eliminated native ant populations through competition and predation and have eradicated food sources utilized by some wildlife species. Ground-nesting wildlife is especially susceptible to RIFAs.

Within the Brochu Preserve, RIFAs have the potential to affect ground-nesting birds; small mammals; reptiles, native lizard and snake species, and native invertebrates (Willcox & Giuliano 2006). Additionally, members of the public that come into contact with RIFAs may be harmed if stung. Many people have anaphylactic reactions to the toxins released from RIFA stings.

Brown Anole (*Anolis sagrei*): documented within the Brochu Preserve

Also known as the Cuban anole, the brown anole is native to Cuba, the Bahamas, and neighboring islands (Schwartz & Henderson 1991). Like other anoles from the islands, this species is a small, tropical, diurnal, arboreal, territorial, and insectivorous lizard (Campbell 2001). The brown anole was first documented in the Florida Keys in the late 1800s (Lee 1985) and has since spread throughout Florida, into Georgia and into two other southeastern states (Campbell 1996). It feeds on a wide variety of insects, amphipods, and isopods. Brown anoles also prey on other small vertebrates including the hatchlings of the native green anole (*A. carolinensiis;* Campbell 2000).

Anolis sagrei, an invasive, exotic reptile documented in the Brochu Preserve. Photo courtesy of the USGS.

Campbell (2000) showed that, in the absence of the exotic brown anoles, native green anoles occupy perches from ground to the canopy of vegetation. However, in the presence of the exotic anole, native anoles move higher in trees, occupying only the trunk and crown of trees. Dietary overlap is high between both species, but the overall affects of the brown anole on the green anole are still undetermined.

Feral pig *(Sus scrofa):* documented within the Brochu Preserve

Hogs were first brought to Florida in the mid 1500's to provision settlements of early explorers. Their high rate of reproduction and their ability to adapt to Florida's natural areas has led them to populate every county in the state. Today, Florida is second only to Texas in its feral hog population (Giuliano & Tanner 2005*a*; 2005*b*). While feral pigs are able to survive in a variety of habitats, they prefer large forested areas interspersed with marshes, hammocks, ponds, and drainages; cover in the form of dense brush; and limited human disturbance (Giuliano & Tanner 2005*b*). Dense cover is used as bedding areas and provides protection from predators and hunters. Feral pigs are omnivorous, opportunistic feeders consuming grasses, forbs, and woody plant stems, roots, tubers, leaves, seeds, fruits, fungi, and a variety of animals including worms, insects, crustaceans, mollusks, fish, small birds, mammals, reptiles, amphibians, and carrion. Their propensity for digging for foods below the surface of the ground (rooting) destabilizes the soil surface, resulting in erosion and exotic plant establishment. Additionally, this behavior uproots or weakens native vegetation (Giuliano & Tanner 2005*a*; 2005*b*). Due to the natural communities that are found within the preserve, this species has the potential to thrive within the boundaries. As these animals are highly visible outside of natural plant communities, adjoining residents of the preserve may be useful in the early detection of this nuisance animal. A dead feral pig was observed on the southeast portion of the preserve by Conservation Collier staff on February 11, 2009.

Coyote (*Canis latrans*): undocumented within the Brochu Preserve

Coyotes were introduced in very small numbers to Florida during the 1920's for sport hunting with domestic dogs. This introduction did not lead to the establishment of coyote populations in Florida. Concurrently, these canids expanded their range eastward across the United States and Canada as a result of nonspecific needs in habitat and food, decreased competition from other predators, large litter sizes and anthropogenic changes to the landscape. Since many species naturally expand or change their home ranges in response to climate and resource availability, the coyote may be considered native to Florida. This crepuscular (active mostly at dawn and dusk) species is elusive and may travel individually or in groups of two or three (Coates et al. 1998). Coyotes commonly enlarge burrows made by other animals such as armadillos or gopher tortoises to use as dens or use dense vegetation for cover. Coyotes may have a negative influence on indigenous wildlife as direct predators or as potential competitors with predators that may occur at the preserve such as foxes (*Urocyon cinereoargenteus)* or bobcats (*Lynx rufus floridanus)***;** however, this species may prove beneficial in controlling potential problem species such as feral cats.

Cuban tree frog (*Osteopilus septentrionalis*): undocumented within the Brochu Preserve

Osteopilus septentrionalis, an invasive, exotic amphibian that has the potential to occur at the Brochu Preserve. Photo courtesy of the USGS.

Like the Cuban anole, the Cuban tree frog is native to Cuba, the Bahamas, and neighboring islands. They have established breeding populations as far north as Cedar Key on Florida's Gulf Coast, Jacksonville on the Atlantic Coast, and Gainesville in north-central Florida. These hylids are the largest tree frog found in Florida and because of their ability to invade natural areas and prey on native invertebrates and small vertebrates (including native tree frogs) they are considered an invasive species. Additionally, the tadpoles of this species inhibit the growth and development of the tadpoles of the native southern toad (*Bufo terrestris*) and green tree frog (*Hyla cinerea*). Cuban tree frogs thrive in residential and natural areas such as pine forests, hardwood hammocks, and swamps. In residential settings, they are most commonly found on and around homes and buildings, and in gardens and landscape plants. Due to the natural communities that are found within the Brochu Preserve and its proximity to residential areas, this species has the potential of occurring in the preserve.

Giant Marine Toad or Cane Toad (*Bufo marinus*): undocumented within the Preserve

Bufo marinus, an **invasive, exotic** amphibian that has the potential to occur at the Brochu Preserve. Photo courtesy of the USGS.

The cane toad is a tropical species native to the Amazon basin in South America, and its range extends through Central America to extreme southern Texas along the Rio Grande River. They are used as a control agent for insects that damage sugarcane and consequently, are one of the most introduced amphibian species in the world. They have since been deemed an invasive species in Florida and are currently found in urban areas of south and central Florida, and are rapidly expanding northward (Brandt & Mazziotti 2005). Beetles, bees, ants, winged termites, crickets and bugs are

a large part of the diet of the adult marine toad. Additionally, they consume arthropods, mollusks, small vertebrates, plant matter, pet food, carrion, household scraps, marine snails, smaller toads and native frogs, small snakes, and even small mammals. Marine toads are prolific breeders and females can lay tens of thousands of eggs in a single breeding season. They prefer forested areas with semi permanent water nearby (Churchill 2003). Due to the natural communities that are found within the Brochu Preserve and its proximity to residential areas, this species has the potential of occurring within the preserve. Adjoining residents of the preserve should be encouraged to keep pet food and water containers indoors or empty at night.

Feral domestic cat *(Felis catus):* undocumented within the Brochu Preserve

Domestic cats originated from an ancestral wild species, the European and African wildcat (*Felis silvestris*). Humans facilitated the global distribution of cats due to their highly efficient predatory skills. Egyptians took cats with them on shipping vessels to keep rodent populations down, and they likely introduced domestic cats to Europe. Today, the impact of feral cats on wildlife is difficult to quantify; however, literature (FFWCC 2001; Karim 2007; Masterson 2007) strongly indicates that they are a significant factor in the mortality of small mammals, birds (including migratory birds), reptiles, and amphibians in Florida. Because free-ranging cats often receive food from humans, they may reach abnormally high numbers. An increase in the population of feral cats may lead to increased predation rates on native wildlife. While no cats have yet been observed on the Brochu Preserve, there exists a high probability of their future presence on the preserve due to the proximity of Brochu to human residential areas. Adjoining residents of the preserve should be encouraged to keep their cats indoors and staff should monitor the preserve for the presence of feral cats.

3.0 Previous Conditions of the Preserve; Current Use of the Preserve and Adjacent Land Uses

3.1 Previous Conditions of the Preserve

Aerial photographs taken in 1973 (Figure 7) and 1993 (Figure 8) accompanied by more recent visits to the site show that development has never occurred on the site. Digital images were downloaded from the Florida Department of Transportation's Aerial Photo Look Up System (2009) and georeferenced in ArcMap 9.3 by Conservation Collier Staff. The aerial image from 1973 shows that the western portion of the property and the marsh in the eastern portion did not contain as many trees as present day conditions. Additionally, this image reveals that the land contained trails on the western portion. As of 1993, that the western portion of the property contained more trees but the marsh still contained few trees.

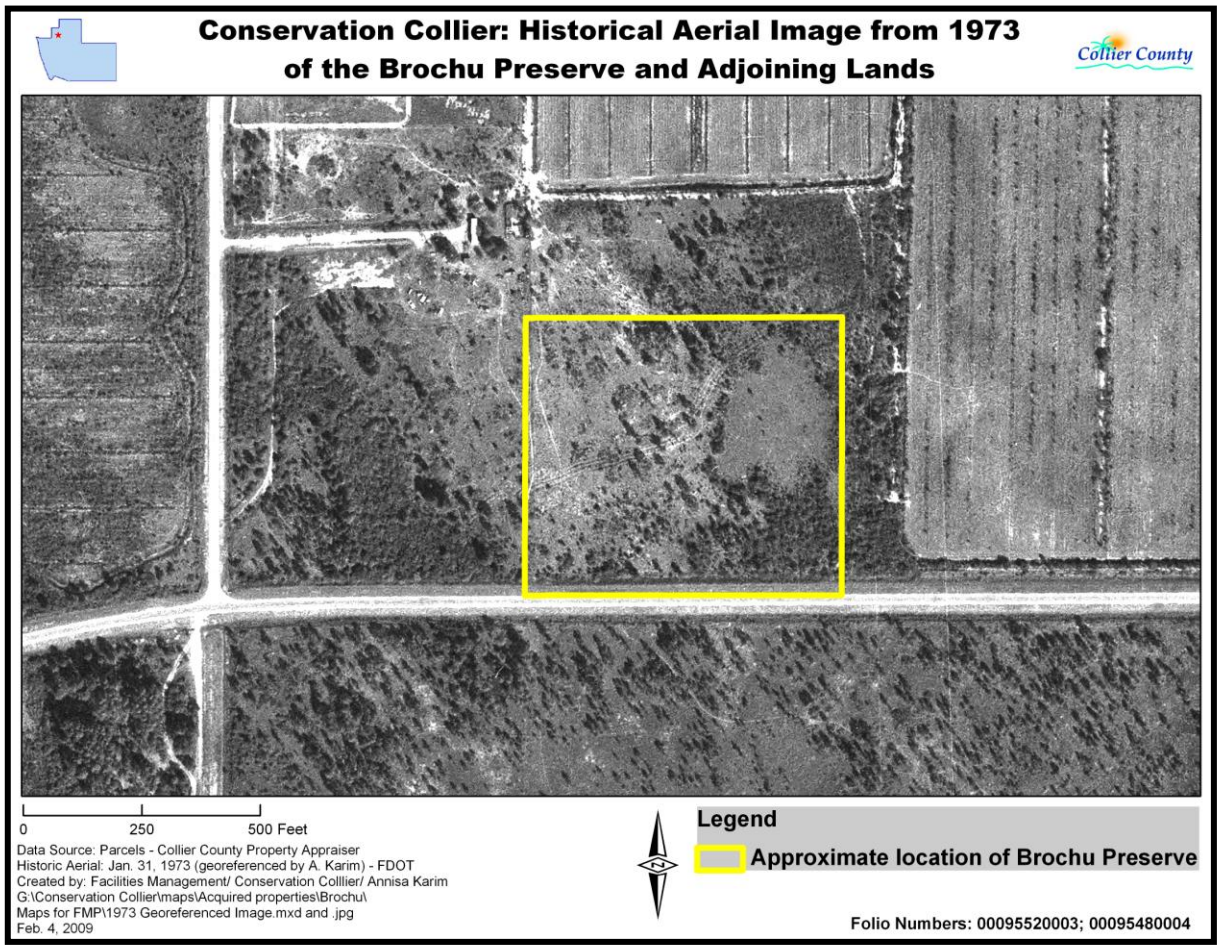


Figure 7: Historical Aerial Photograph from 1973 of the Brochu Preserve

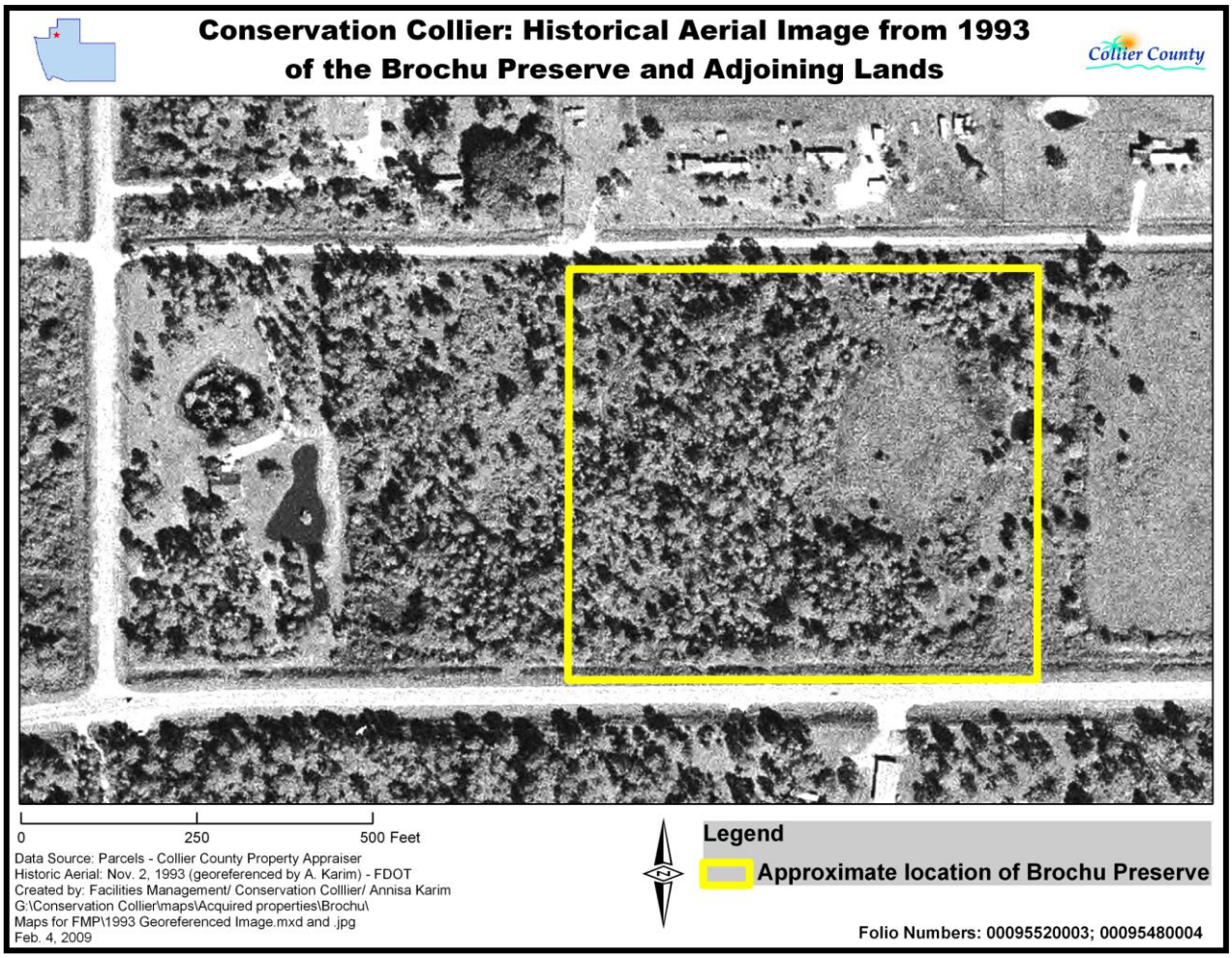


Figure 8: Historical Aerial Photograph from 1993 of the Brochu Preserve

3.2 Current Use of the Preserve and Adjacent Land Uses

Currently, there is no sanctioned public use of the Brochu Preserve. Conservation, restoration and natural resource-based recreation are the designated uses of this preserve. Management activities allowed include those necessary to preserve, restore, secure and maintain this environmentally sensitive land for the benefit of present and future generations. Public use of the site must be consistent with these management goals and will be discussed in section 4.4 of this document.

The Brochu Preserve is bordered on the north by Limpkin Road (an unpaved, private road), on the east and west by undeveloped parcels and on the south by a ditch and Immokalee Road (a paved, public road; Figure 9). All of the parcels surrounding the Brochu Preserve are zoned as Agricultural with a Mobile Home Overlay, which allows for no greater than one unit per five acres.

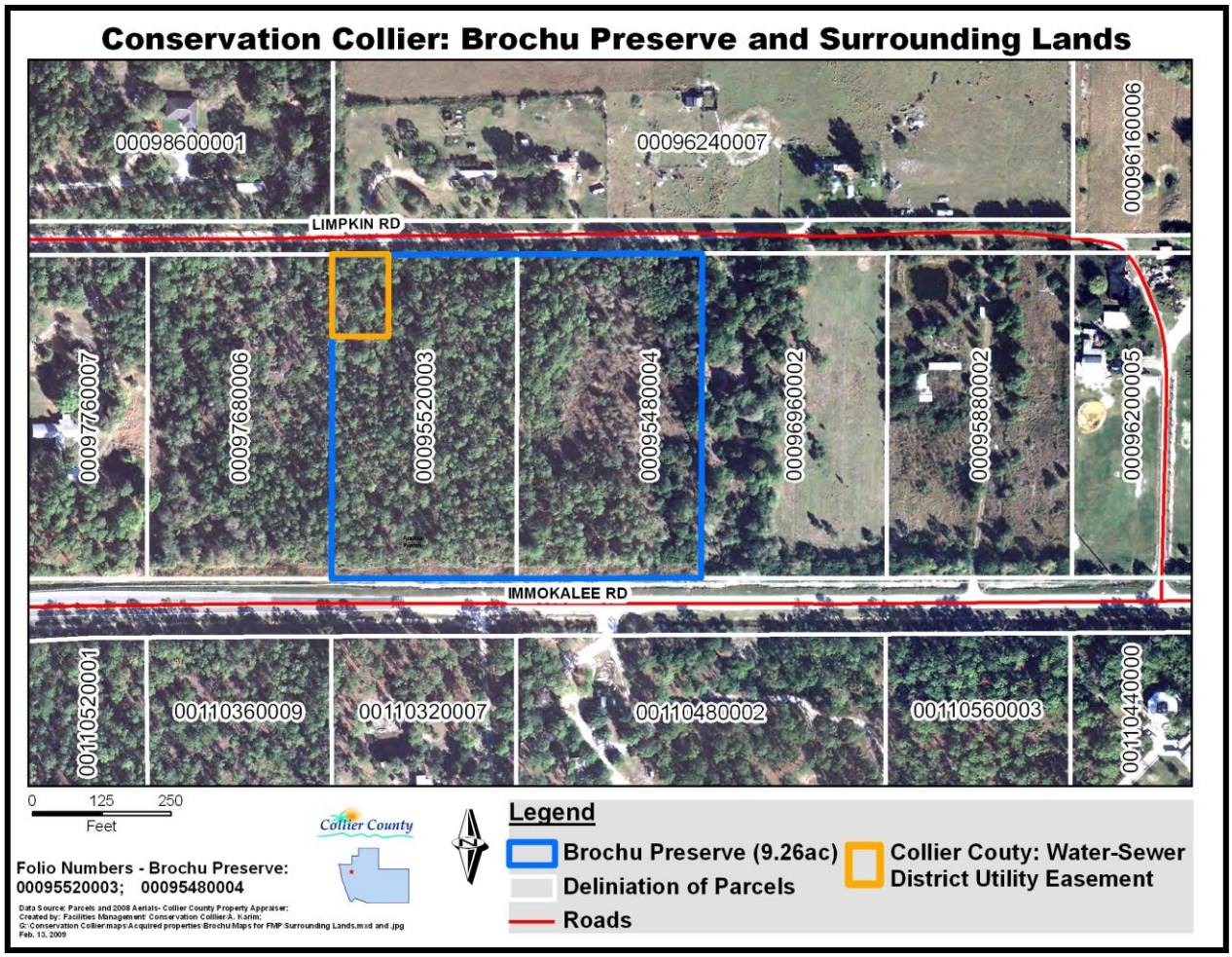


Figure 9: Areas Adjacent to the Brochu Preserve

3.3 Cultural, Historical and Archeological Resource Protection

The Brochu Preserve is not within an area of historical and archaeological probability, and no historical or archaeological sites appear to be present on the property. The County will notify the Division of Historical Resources immediately if evidence is found to suggest any archaeological or historic resources are discovered. If such resources are identified on-site, staff shall cordon off the area, and a professional survey and assessment shall be instituted. The archaeologist shall prepare a report outlining results of the assessments and issue recommendations to County staff about management of any sites discovered, per provisions of the Land Development Code Section 2.2.25. This report shall be sent to the Division of Historical Resources. The County shall cooperate fully with direction from the Division of Historical Resources on the protection and management of archaeological and historical resources. The management of these resources will comply with the provisions of Chapter 267, Florida Statutes, specifically Sections 267.061 2 (a) and (b).

3.4 Management Activities during Previous Years

Since the acquisition of the Brochu Preserve in August 2006, staff has accomplished a number of management activities aimed at creating baseline data for the preserve and identifying areas of invasive plant infestations (Table 7). Staff conducted floristic inventories and established photo monitoring points to better aid in the long-term management of the preserve. Given the discrepancy between the 1995 FLUCCS digital layers (as they pertain to the Brochu Preserve) and the plant communities within the preserve, staff created a new digital layer showing the location and extent of the native plant communities currently found on the preserve.

Table 7: Management Activities since the Acquisition of the Brochu Preserve

Accomplishment	Year(s)
Conducted floristic inventories	2005/ 2009
Established photo monitoring points	2008
Created an accurate FLUCCS Map of the Preserve	2009

4.0 Future Use of the Brochu Preserve including Management Issues, Goals and Objectives

This section describes the main management issues, goals, and objectives for the Brochu Preserve as well as the overall management framework. Central to the management of the Preserve is the mission of the Conservation Collier Program, and the goals and objectives set forth in this management plan.

4.1 Management Plan Framework

Each property purchased by Conservation Collier shall have its own management plan. At the time the Brochu Preserve was purchased, the Conservation Collier Ordinance required that an "Interim" Management Plan be developed within 60 days of closing. Interim plans include basic items such as removal of invasive, exotics and trash, establishing site security, developing management partnerships and planning for public access. The interim plan for this site was officially approved in February 2007. The ordinance then requires a "Final" ten-year management plan be developed within two years. Subsequently, the property management plan must then be reviewed every five years. Final management plans, however, are considered living documents and can be updated at any time. Review of all management plans start in the Lands Evaluation and Management subcommittee and must be approved by both the CCLAAC and the Collier County BCC.

4.1.1 Preserve Manager: Contact Information

The site manager for Brochu Preserve will be a designated Collier County Environmental Specialist who may be contacted through electronic mail: ConservationCollier@Colliergov.net.

4.2 Planned Uses and Assessment of their Impacts

Future planned use will be consistent with the primary goals of conservation, preservation, restoration and maintenance of the resource. Official public use of the site will not be possible until safe public access trails can be created. However, citizens that desire to visit the site prior to opening may do so by signing a waiver that will allow them access at their own risk and releases the liability of the County until safe access is established. Details of planned uses for the Brochu Preserve and an assessment of their potential impacts are provided in the following sections.

4.2.1 Identification of Public Uses Consistent with Preservation, Enhancement, Restoration, Conservation and Maintenance of the Resources

The Conservation Collier Ordinance 2002-63 constrains the use of this property to "primary objectives of managing and preserving natural resource values and providing appropriate natural resource-based recreational & educational opportunities." Natural resource-based recreation shall mean all forms of uses, which are consistent with the goals of this program, and are compatible with the specific parcel. Such uses may include, but are not limited to hiking, nature photography, bird watching, kayaking, canoeing, swimming, hunting and fishing (Ord. No. 02-63, as amended§ 5, 12-3-02). Additionally, no dumping, use of unauthorized vehicles, or removal or destruction of natural or historical/archaeological resources will be permitted within the preserve. The goal is to allow limited, non-destructive public access to native plant communities and animal species. Currently, the preserve rules are those identified in Collier County Ordinance 76-48 (available from www.municode.com), as amended.

The following are ***consistent*** uses for this particular site: hiking, nature photography and bird watching. ***Inconsistent*** uses include swimming, kayaking / canoeing, fishing, hunting and off road vehicle use (ORV).

A 100' X 150' Collier County Water-Sewer District utility easement exists over the northwest corner of the property. Per the Collier County Board of County Commissioners, the Water-Sewer District will provide site improvements on the easement commensurate with its own needs and will allow for shared public parking access with the Conservation Collier portion of the property. Exotics, trash, and debris on the easement will be removed in coordination with the removals done on the Conservation Collier portion of the property. Finally, any code required landscaping on the easement will be planted by the Collier County Water-Sewer District with site appropriate native plant species. At the time of purchase, Collier County's Water-Sewer District (a part of the Public Utilities Planning and Project Management Department) planned on drilling a test well on the easement. Due to the downturn in the economy, these plans have been put on hold for an indeterminate amount of time. Informal talks between Conservation Collier staff and the staff at the Water-Sewer District revealed that this test well will not even be considered as a project until after 2018. This interdepartmental agreement is included in this plan as Appendix 3.

In addition, there are no existing easements, concessions, or leases on the Brochu Preserve. In accordance with the management goals of the preserve, no future easements, concessions, or leases are appropriate in association with this site, other than conservation related easements.

Limpkin Road is a private road that extends off Sanctuary Road, which connects to Immokalee Road and is not maintained by Collier County. It is a 60 foot wide public road right-of-way

(ROW) easement. The two parcels that make up the Brochu Preserve have a 30-foot wide right-of-way access easement along Limpkin Road. All similar parcels located south of Limpkin Road also have a 30 feet ROW easement, and all properties located north contain the north 30 feet of the ROW. The Transportation planning department has indicated that they would have no opposition to the Conservation Collier Program creating 2-3 parallel parking spaces along the south side of limpkin road adjacent to the property that could be utilized by the public until the utility easement parking area is created. Permits will be obtained from the appropriate agencies to ensure this temporary parking area complies with environmental regulations and does not inhibit water flow in the area.

4.3 Desired Future Conditions

This section includes a description of the proposed future conditions for the site's natural areas. Management techniques to achieve these conditions are outlined in section 4.4.

After managers complete recommended management actions, Brochu Preserve will consist of pine flatwoods and freshwater marsh with shrub, brush & vines. These communities will have a similar structure and composition to those that existed before non-indigenous people settled the region and before the exclusion of fire. With the exception of a mulched trail, the site will be vegetated with appropriate native flora that will provide suitable cover for a variety of wildlife species.

Increasing the acreage of the preserve will greatly enhance the quality of the preserve. Efforts will continue to expand the size of the preserve to the east and west. Letters will be sent to the adjacent landowners on a yearly basis to let them know that we are interested in purchasing their property.

4.4 Goals for the 10 year period 2009-2019

A set of goals and objectives for Brochu Preserve were developed in conjunction with the drafting of this Management Plan. The goals and objectives in this plan are tailored specifically for Brochu Preserve based on the purposes for which the lands were acquired, the condition of the resources present, and the management issues for the property. On-site managers should be familiar with this entire Management Plan. Goals and objectives from the interim management plan for the Brochu Preserve were reviewed to determine whether they should be included in this plan. The goals and objectives presented here reflect programmatic goals and ideas of Conservation Collier personnel in charge of managing and protecting the area. These goals shall not be modified, but specific application of management techniques may take into consideration input by user groups and other stakeholders from outside the program, accommodating user needs and desires where practicable and where overarching management goals are not violated.

Management issues are discussed below in separate sections. Within each section, approaches for dealing with these issues are described. The ability to implement the specific goals and objectives identified in this plan is dependent upon the availability of staffing and funding sources. The following goals have been identified for Brochu Preserve:

Goal 1: Eliminate or significantly reduce human impacts to indigenous flora and fauna

Goal 2: Develop a baseline monitoring report

Goal 3: Remove or control populations of invasive, exotic or problematic flora and fauna to restore and maintain natural habitats

Goal 4: Determine if prescribed fire and/or mechanical treatments are feasible to decrease woody invasion resulting from past fire exclusion if so proceed

Goal 5: Restore native vegetation

Goal 6: Develop a plan for public use

Goal 7: Facilitate uses of the site for educational purposes

Goal 8: Provide a plan for security and disaster preparedness

GOAL 1: *ELIMINATE OR SIGNIFICANTLY REDUCE HUMAN IMPACTS TO INDIGENOUS FLORA AND FAUNA*

Action Item 1.1 Install a fence and access gate on the Brochu Preserve if needed. Currently, a fence runs along the eastern boundary of the property (installed by adjoining property owner). Staff does not recommend a fence around the remainder of the property but if trespassing, chronic dumping or other security issues arise, a field fence, four feet in height, will be installed along the northern and western boundaries of the preserve. If a fence is installed, a gate, 12 feet in width and four feet in height will be installed (if needed) along the northern fence-line to allow access to the Brochu Preserve by authorized County staff and the fire department. A fence along the southern boundary of the Brochu Preserve is not recommended due to its proximity to the ditch and Immokalee Road just south of this ditch (Figure 10). As traffic on Immokalee Road is fast-paced, the likelihood of trespass or

dumping issues from this thoroughfare is low. Additionally, the ditch that separates the preserve from Immokalee Road is filled with water during the wet season and provides a further barrier to people entering the preserve from this side.

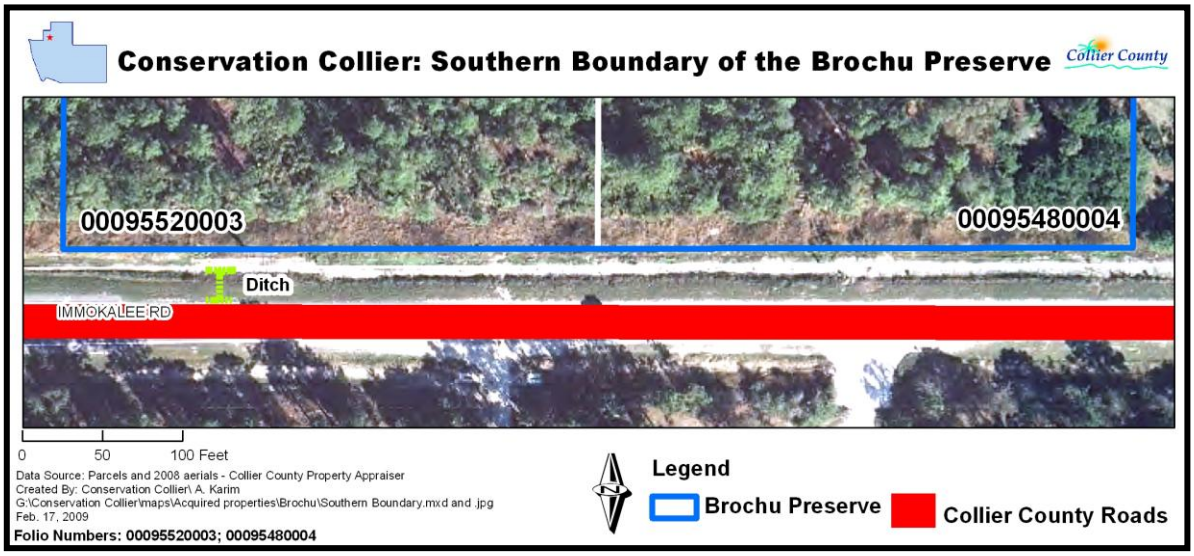


Figure 10: Southern boundary of the Brochu Preserve showing the location of the ditch and Immokalee Road

<u>Action Item 1.2</u> Install signs encouraging people to stay on any future public access trails situated on the preserve.

<u>Action Item 1.3</u> Identify locations of rare and listed native plant species.

The location of these species will be identified using a global positioning system (GPS) device and mapped to allow staff to monitor them. Public trails will be constructed to avoid areas where rare and listed species exist.

<u>Action Item 1.4</u> Enforce regulations prohibiting trash in or near the preserve.

Staff will monitor the preserve on a regular basis and if excessive dumping occurs, enforcement actions will be sought through the County Sheriff's Department.

<u>Action Item 1.5</u> Identify actual and potential locations of resident animal life and take steps such as locating visitor amenities away from animal nesting sites.

Action Item 1.6 Avoid non-target damage to native plants and animals, especially rare species, during invasive, exotic plant treatments.

If the use of herbicides is appropriate during the treatment of invasive, exotic plant species, decisions on the types of herbicides utilized will be made on the best information available at the time of exotic removal. Staff has prohibited the use of herbicides containing Imazapyr (e.g., Arsenal) due to reports that these herbicides have potentially caused a great deal of non-target damage throughout the state. Licensed County or State contractors will be monitored closely to ensure the proper herbicide applications are being utilized while treating the site. In addition, close attention will be taken to identify listed species (Table 5) that may be attached to invasive trees being cut down or removed. Individuals of these species will be relocated prior to removal. Special attention will be given to avoid damage to native species in the vicinity of exotic removal activities.

Action Item 1.7 Note, research and provide input as to all site development occurring adjacent to Brochu Preserve to determine that the proper site development permits have been obtained and that the site development complies with the permits.

Activities on adjacent lands may have an impact on the indigenous plant and animal life on the Brochu Preserve. As such, all existing local, state, and federal regulations should be strictly followed and enforced during any site development adjacent to the preserve. It shall be the responsibility of the developer to establish erosion control measures and vegetation protection measures (i.e., protective fencing or barriers). If any site developer working in areas adjacent to the preserve does not take the necessary control measures, construction shall be immediately halted until control measures are put into place and mitigation and/or remediation will be the sole responsibility of the developer.

GOAL 2: *DEVELOP A BASELINE MONITORING REPORT*

Action Item 2.1 Establish a long-term biological monitoring program and conduct additional wildlife surveys.

Long-term management of the preserve should be based on biological data. Changes following baseline conditions should be assessed as negative or positive, and management strategies changed appropriately. This section discusses information needs and long-term monitoring needs.

Conservation Collier staff has conducted a floristic inventory of the Brochu Preserve; these findings will comprise the baseline floristic data on which future actions will be based. The site should be inspected by Conservation Collier Staff at least twice a year and thoroughly inventoried at regular intervals (ca. 5-10 years) to detect new invasions (by natives or exotics) and extinctions. Areas undergoing extreme restoration should be assessed more frequently. While some wildlife data has been collected, additional baseline data should be collected, especially on invertebrates, small mammals, reptiles, and amphibians. The site manager may contract this work out or enlist the assistance of local educators to coordinate student research projects. Wildlife sampling, like plant sampling, should take place at regular intervals (ca. 5-10 years) to detect long-term trends.

Currently, four (4) photo points have been established throughout the preserve (Figure 11). Locations of photo points have been recorded with a GPS and all photographs taken at these locations have been taken at a standard height and angle of view. During photo documentations, one photo is taken in each of the cardinal directions (north, east, south and west) and a 360-degree panoramic photo is taken. These photos will help to monitor exotic removal and native plant recruitment over time. If necessary, more photo points will be established to aid in management decision activities. Future photo points will include photos taken with a vegetation profile board to aid in the determination of what (if any) changes occur over time.

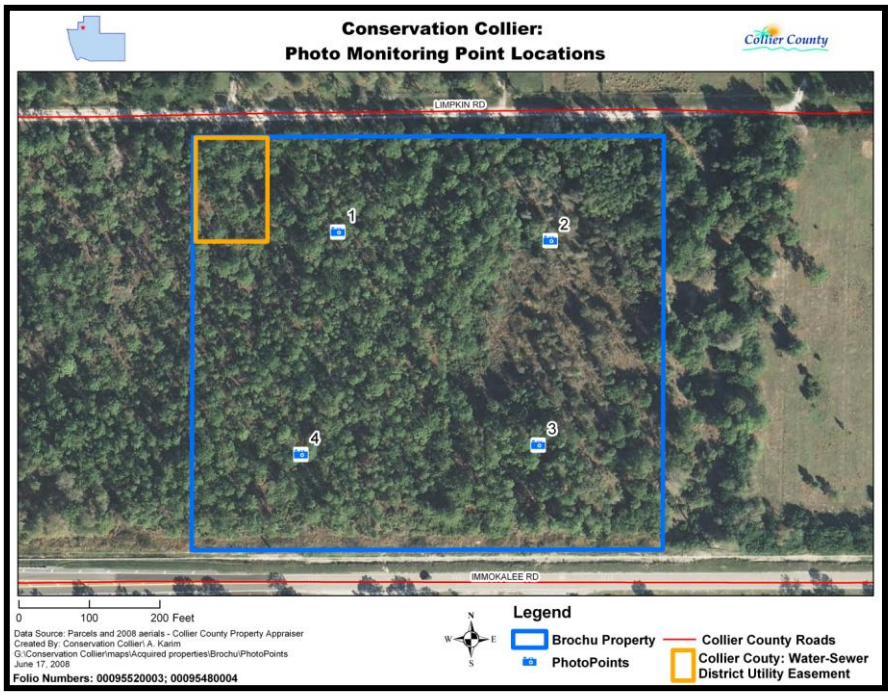


Figure 11: Photo Point Locations within the Brochu Preserve

GOAL 3: *REMOVE OR CONTROL POPULATIONS OF INVASIVE, EXOTIC OR PROBLEMATIC FLORA AND FAUNA TO RESTORE AND MAINTAIN NATURAL HABITATS*

Action Item 3.1 Acquire services of licensed and qualified contractor(s) for the removal of invasive, exotic or problematic plant species.

The following (Table 8) describes recommended controls (Langeland & Stocker 2001; Langeland 2008) of the Category I, invasive, exotic plant species recorded to date on the Brochu Preserve. These recommended control methods may be altered by site managers dependent on new information and products available on the control of these species.

Table 8: Invasive, Exotic Plant Species Control Plan for the Brochu Preserve FLEPPC Category I species [a]		
Scientific Name	**Common Name(s)**	**Recommended Control(s)[b]**
Acacia auriculiformis	earleaf acacia	Basal bark application of 10% Garlon 4 or cut-stump treatment with 50% Garlon 3A.
Melaleuca quinquenervia	melaleuca, punk tree, paper bark	For seedlings and saplings: (1) hand pull, being sure not to break plant off of root system and remove or place in piles to help reduce the chance that they will re-root or; (2) Treat with foliar, low volume spot application of 5% Rodeo. For mature trees: (1) Fell large trees with chain saw leaving a level surface, or fell small trees with machete and treat with triclopyr or glyphosate products according to frill and girdle directions on SLN. Use aquatic versions where standing water is present. Monitor for resprouting and retreat as necessary. (3) Mature trees are very difficult to control with foliar applications.
Nephrolepis multiflora	Asian sword fern	A foliar application of a product that contains 41.0% glyphosate diluted to 1.5% v/v of product provides control.
Schinus terebinthifolius	Brazilian pepper	Cut-stump treatment with 50% Garlon 3A, 10% Garlon 4 or a basal bark application of 10% Garlon 4. Foliar application of Garlon 4, Garlon 3A, Roundup Pro, Roundup Super Concentrate, or Rodeo, according label directions may be used where appropriate. Glyphosate products are less effective when used alone in spring and early summer. Use Rodeo where plants are growing in aquatic sites.
Syzygium cumini	Java plum, jambolan	Mature trees may take up to 9 months to die. Cut-stump treatment with 50% Garlon 3A or 10% Garlon 4, or use a basal bark treatment with 10% Garlon 4.

[a] FLEPPC 2007: Category I plants are those that alter native plant communities by displacing native species, change community structures or ecological functions, or hybridize with natives (FLEPPC 2007)
[b] All species except *Nephrolepis* (Langeland & Stocker 2001); *Nephrolepis* (Langeland 2008)

<u>Action Item 3.2</u> Acquire services of licensed or qualified contractor(s) for the removal of invasive, exotic or problematic animal species.

To date, three (3) introduced animal species have been documented on the Brochu Preserve, the RIFA, the brown anole and the feral hog. It is doubtful that the total eradication of these species can be achieved. However, staff and/or contractors should take measures to remove RIFA populations close to or on public access trails.

Additionally, if feral cat colonies are found near the preserve, the elements that sustain the undesirable population(s) should be identified and efforts made to ask property owners to eliminate them (i.e., refuse bins, dumpsters, and supplementary feeding by humans). If any feral cats remain, they will be trapped and taken to Collier County Domestic Animal Services.

GOAL 4: *UTILIZE PRESCRIBED FIRE AND/OR MECHANICAL TREATMENTS TO DECREASE WOODY INVASION RESULTING FROM PAST FIRE EXCLUSION.*

Action Item 4.1 Develop a prescribed fire or mechanical treatment plan to mimic natural fires within the Preserve.

Much of Collier County is comprised of plants that are dependent on fire to maintain species composition and diversity. These species are the same ones that are prone to lightning strike wildfires, and the controlled reduction of those fuels will prevent catastrophic wildfire damage. Prescribed fires: reduce fuel loads and consequently decrease the threat of wildfires; create open areas for wildlife to travel within; stimulate food and seed production; recycle nutrients; alter the composition and density of forested areas; and aid in the control of some invasive plant species.

The structure and composition of the ***mesic pine flatwood*** community is dependent on periodic fires. Fire probably occurred every 1 to 8 years during pre-Columbian times. A majority of the flora and fauna found within this community are adapted to periodic fires; several species depend on fire for their continued existence. Without relatively frequent fires, mesic pine flatwoods succeed into hardwood-dominated forests whose closed canopy can essentially eliminate herbaceous groundcover and shrubs. Additionally, the dense layer of litter that accumulates on unburned sites can eliminate the reproduction of pine trees that require a mineral soil substrate for proper germination (FFWCC 2002).

Fire is the ideal ecological tool for achieving a sustainable mesic pine flatwood community. However, due to the proximity of the Brochu Preserve to Immokalee Road and the size of the parcel, alternate manual or mechanical treatments will be investigated in lieu of managing the lands through the use of fire.

Action Item 4.2 If fire is deemed appropriate, delineate fire management and rescue access routes, and provide this information to the police department and emergency services.

If fire is deemed an appropriate management tool on the Brochu Preserve, the fire plan and access routes to and within the preserve will be provided to the police department and emergency services.

GOAL 5: *RESTORE NATIVE VEGETATION*

Action Item 5.1 Maintain a revised GIS map and description of FNAI natural communities and disturbed areas on the property.

Maintaining updated maps will help to guide restoration efforts

Action Item 5.2 Plant native plant species in their appropriate habitats

Periods following exotic removal and prescribed fire (or mechanical treatment) are essential to the recruitment of native plants. If native plant recruitment is not sufficient from the surrounding, intact seed source, efforts will be made to plant indigenous flora in appropriate habitats. Natural area restoration of Brochu Preserve should include only site-specific native

plant material that has been determined to be non-problematic at the site and whenever possible, site-specific seed sources should be utilized. In addition, hardwoods that may invade the natural areas (mesic pine flatwood area) should not be planted.

GOAL 6: *DEVELOP A PLAN FOR PUBLIC USE*

Action Item 6.1 Develop access and required facilities for intended public uses

A 100' X 150' Collier County Water-Sewer District utility easement exists over the northwest corner of the property (Figure 4). Per the Collier County Board of County Commissioners, the Water-Sewer District will provide site improvements on the easement commensurate with its own needs and will allow for shared public parking access with the Conservation Collier portion of the property. Exotics, trash, and debris on the easement will be removed in coordination with the removals done on the Conservation Collier portion of the property. Finally, any code required landscaping on the easement will be accomplished with site appropriate native plant species that will be approved by Conservation Collier Staff. At the time of purchase in 2006, Collier County's Water-Sewer District (a part of the Public Utilities Planning and Project Management Department) planned to drill a test well on the easement. Due to the recent downturn in the economy, these plans have been suspended for an indeterminate amount of time. Informal talks between Conservation Collier staff and the staff at the Water-Sewer District revealed that this test well will not be considered as a project until after 2018. A possibility exists that the Water-Sewer District may be able to participate in exotic removal activities when the Conservation Collier Program is able to treat/remove invasive, exotic plants on the Brochu Preserve. Conservation Collier staff will maintain talks with the Water-Sewer District as is applies to management and access issues on the Brochu Preserve.

The Collier County Greenway Trail (Bike Trail) has potential to extend from Naples out to the town of Immokalee. The Transportation Services Northeast Collier Transportation Study Final Alternatives Map identifies the segment of Immokalee Road immediately adjacent to the Brochu Preserve as a future alternative pathway. If this pathway is constructed within the life of this management plan, an additional connection will be made from the bike trail to the hiking trail.

Depending on funding, safety issues, site security and the availability of staff, planned public use of the Brochu Preserve is as follows. Site improvements on the Water-Sewer District easement commensurate with its own needs and will allow for shared public parking access with the Conservation Collier portion of the property. In the meantime, we may construct 2-3 pervious parallel parking spaces on the south side of Limpkin Road in our access easement area next to the trailhead. Conservation Collier staff has developed a conceptual site plan (Figure 12) incorporating the following components:

- ***The walking trail*** measures approximately 1,350 feet in length. The route of the trail represented in Figure 12 was approximated from a 2008 aerial image to take advantage of areas where impacts to the community would be minimized. The entrance to the trail will be approximately 770 feet east of the intersection of Sanctuary Lane and Limpkin Road. This distance accommodates for the width of the Water-Sewer District's easement. The trailhead will be located at the northeast corner of the Water-Sewer District's easement and run south through the pine

flatwoods. The trail will then meander east towards the southern portion of the freshwater marsh and then curve northwards. This placement along the ecotone will theoretically allow visitors the best opportunity to view the plants and animals of the pine flatwoods and freshwater marsh communities. The trail will then turn west and complete the loop. Interpretive signs near the trailhead and the freshwater marsh will give specific information about the plant communities and associated animals that may be seen. Once the trail is constructed, a bench and picnic table will be placed along the trail in areas to be determined. Small plant signs will also be placed along the trail to educate visitors about the species present on the preserve.

If the Collier County Greenway Trail (Bike Trail) is extended out to the town of Immokalee, an additional trail connection will be made from the bike trail to the hiking trail and an additional trailhead will be created along the south property boundary.

The hiking trail may be submerged during the rainy summer months. However, the cost to install a raised boardwalk at this preserve is prohibitive. We will install a small sign at the entrance referring visitors who have special access needs to consider visiting the Audubon Corkscrew Swamp Sanctuary located one mile to the northwest of the preserve which has an extensive boardwalk system and facilities. Staff will continue to monitor the amount of visitation the preserve receives over the next few years to determine if we should seek grant money to help fund a raised trail.

- ***The official parking area*** will not be constructed until the utility easement is developed which may not occur until after 2018. Until then, the County may develop two to three unpaved parallel parking spaces in the County's easement along the south side of Limpkin Road near the trailhead.

GOAL 7: *FACILITATE USES OF THE SITE FOR EDUCATIONAL PURPOSES*

Actions Item 7.1 Develop interpretive signage to educate preserve visitors.

Once a trail system is complete, site-specific signage will be developed to educate visitors on plant identification and general ecosystem information. A large sign with a map of the preserve will be installed at the trailhead and smaller, more site specific interpretive signs, will be placed along the trail.

Action Item 7.2 Provide preserve Brochures in rainproof box on site.

A brochure outlining the native plant communities and wildlife present at the preserve will be created by County staff and kept in rainproof boxes near the preserve entrance. The preserve manager will inspect these boxes monthly and refilled as necessary.

***GOAL 8**: PROVIDE A PLAN FOR SECURITY AND DISASTER PREPAREDNESS*

Action Item 8.1 Discourage any visitation to the park at night.

A sign designating park hours as sunrise to sunset will be installed at the entrance to the preserve and adjacent landowners will be given an emergency phone number if they detect human activity on the preserve after hours. If problems arise, the Collier County Sheriff's Office will be contacted to patrol the area and site on a routine basis.

Action Item 8.2 Enforce regulations prohibiting trash and landscape debris dumping in or near the preserve.

Currently, there is no vehicular access and dumping is not a problem. Monthly inspections will determine if dumping becomes a problem. Staff will work with the Collier County Sheriff's Office to address dumping if it becomes a problem.

Action Item 8.3 Survey trees along the trail and the perimeter of the property annually for damage

Staff will determine if diseased, weak, or damaged trees/limbs surrounding the trails should be removed for safety reasons. This activity is intended to reduce the risk of visitor injury.

Action Item 8.4 Visit preserve within 48 hours after a storm event to assess damage.

Staff will take photos of damage and fill out appropriate Collier County Risk Management Department forms. If damage is extensive, the preserve will be closed until public safety hazards are cleared.

Action Item 8.5 Promptly clear storm debris from preserve.

If necessary, a Collier County emergency debris removal contractor will be contracted as soon as possible after the storm to schedule clean up. Removal of debris and damaged or downed trees along the trail system may be needed. Downed trees and limbs that do not appear to be a public safety hazard will be cleared at the discretion of the Preserve Manager. As much hurricane debris as possible will be chipped and retained on-site – to be used as mulch for the trail. The preserve will be closed temporarily until the potential hazards are eliminated.

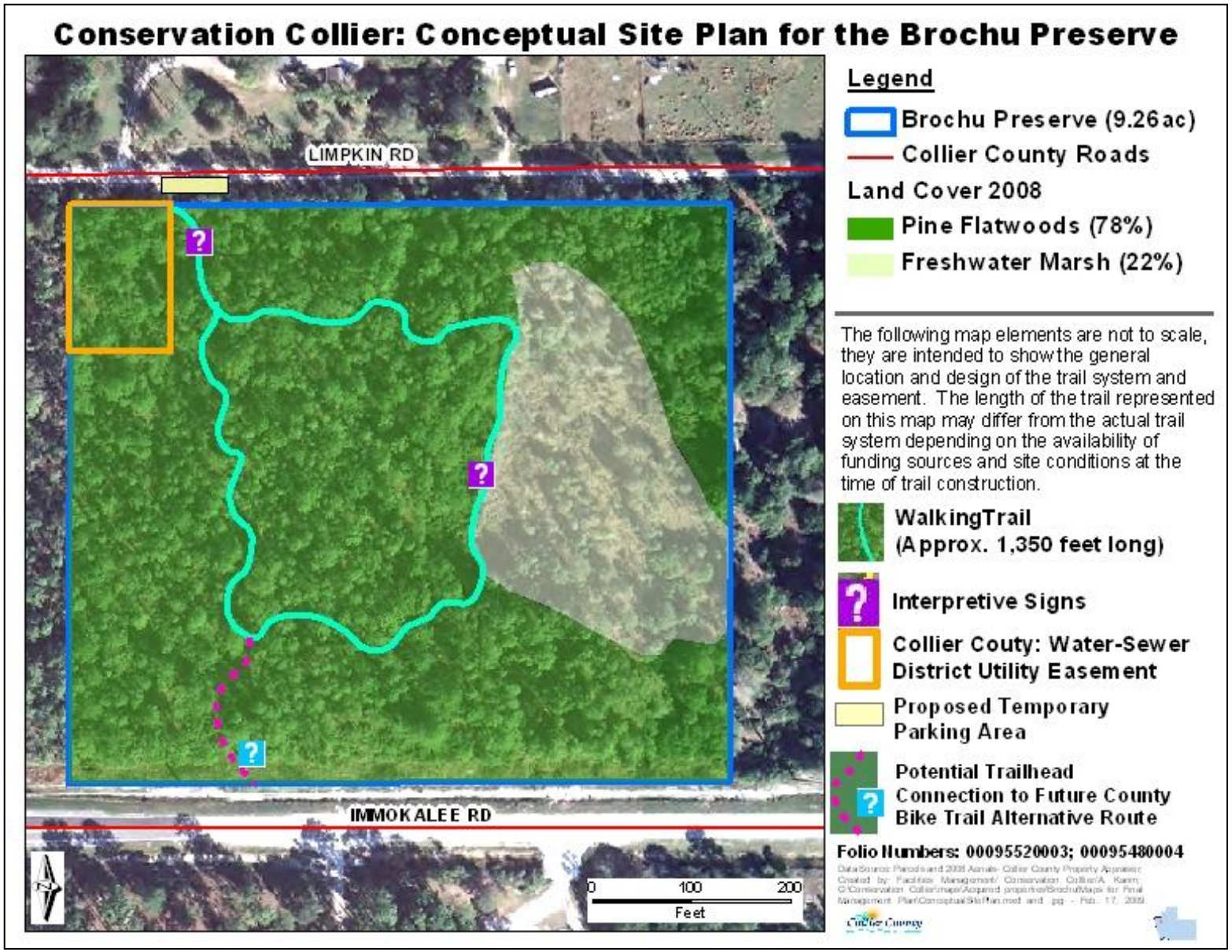


Figure 12: Brochu Preserve Conceptual Master Plan

4.5 Establish an Operational Plan for the Brochu Preserve

This section provides management recommendations for operation of the Brochu Preserve. It discusses maintenance and budgeting needs, the possibilities for contracting the restoration activities, coordination, and other management issues.

4.5.1 Maintenance

The primary maintenance activities for the preserve will include control of dumping and littering within and around the preserve and trail as needed. Particularly important are the security measures to keep intruders out and the signage and fencing (if installed) in good condition. Signs that effectively convey the desired message provide an opportunity for increasing environmental education and awareness.

4.5.2 Estimated Annual Costs and Funding Sources

Preliminary budget estimates for Brochu Preserve include cost breakdowns associated with resource restoration and management. The funding source identified for the restoration and management activities is the Conservation Collier Program Management Trust Fund. Grants will be sought to supplement existing management funds. Staff will also utilize the Collier County Sheriffs Department weekenders program for certain labor projects and may also separately involve the County Scout programs for trail creation and enhancement.

The budget in Table 9 represents the actual and unmet budgetary needs for managing the lands and resources of the preserve for the next ten years. The table shows the activities planned and the initial and annual cost estimate of each activity. This budget was developed using data from Conservation Collier and other cooperating entities, and is based on actual costs for land management activities, equipment purchase and maintenance, and for development of fixed capital facilities. The budget considers available funding and is consistent with the direction necessary to achieve the goals and objectives for Brochu Preserve.

Table 9: Estimated Annual Land Management Budget

Table 9: Estimated Annual Land Management Budget (Amounts in $; see assumptions for cost estimates on next page)													
Item	**QTY**	**Cost ($)**	**2008-09**	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**Total**
Facilities Development													
Trail mowing [1]	1,350 LF	$1,500		$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	**$13,500**
Entry Gate [2]	1	($800)											**$0**
Fence along northern and western boundaries [3]	1,200 LF	($6,435)											**$0**
Interpretive signs [4]	2	$500			$1,000								**$1,000**
Plant signs [5]	25	$10			$250								**$250**
Entry signage [6]	1	$2,000			$2,000								**$2,000**
Directional sign [6]	2	$250			$500								**$500**
Bench [7]	1	$650			$650								**$650**
Parking Area [8]	2-3 pervious spaces	$10,000			$10,000								**$10,000**
Restoration/Monitoring													**$0**
Establish photo points	recurring	n/a											
Remove exotics [9]	18.46 acres			$26,000	$1,850	$1,850	$1,850	$1,850	$1,850	$1,850	$1,850	$1,850	**$40,800**
Native Plant Restoration [10]	t.b.d.	t.b.d.											**$0**
Regular Maintenance													**$0**
Reduce Fuel Loads [11]	2	$2,000		$2,000					$2,000				**$4,000**
General Facilities Maintenance [12]	8	$100			$100	$100	$100	$100	$100	$100	$100	$100	**$800**
Brochures [13]						$300	$100	$100	$300	$100	$100	$100	**$1,100**
Grand Total				**$29,500**	**$17,850**	**$3,750**	**$3,550**	**$3,550**	**$5,750**	**$3,550**	**$3,550**	**$3,550**	**$74,600**

Assumptions for Cost Estimates:

1. **Trails:** will be mowed to maintain
2. **Entry Gates:** 1 gate at $800 each, **(Installed only if the site needs to be fenced)**
3. **Perimeter Fence: (will only be fenced if dumping or other related problems occur**) Field Fence along northern and western boundaries estimated at $5.85 per linear foot at 1,100 LF
4. **Interior signage:** 2 interpretative signs (4'x6') at $500 each;
5. **Plant signs-**small signs identifying native plants 25 @ $10 each
6. **Directional and entry signage:** 2 road signs indicating entrance to the preserve ($250 each) and 1 welcome sign (8'x6') estimated at $2,000
7. **Bench:** Bench-$650
8. **Parking Spaces along Limpkin-** Estimated cost of $10,000
9. **Removal of Exotics:** Estimated cost of $26,000 for removal from outer perimeter and kill in place in interior
10. **Native Plant Restoration in wetlands:** t.b.d
11. **Reduce fuel loads:** Estimated at $2,000 every 5 years
12. **General Facilities** Maintenance-includes garbage can maintenance approx. $60 per month
13. **Brochures:** $300 per year in printing costs

4.5.3 Potential for Contracting Restoration and Management Activities by Private Vendors

A significant number of management operations and restoration activities on the Brochu Preserve can be considered for outsourcing. Restoration and management activities that can be considered for outsourcing to private entities are listed in table 10.

Table 10: Potential Contracting for Restoration and Management Activities

Activity	Approved	Conditional	Rejected
Prescribed fire and/ or mechanical treatment application	X		
Minor fireline installation	X		
Fireline, fence, and trail maintenance	X		
Fence installation	X		
Plant and wildlife inventory and monitoring		X	
Listed species mapping and needs assessment		X	
Restore/enhance encroachment and ruderal areas		X	
Reduce exotic species	X		
Literature development and printing		X	
Interpretive signs development and installation		X	
Trail installation	X		
Parking Area construction	X		
Law enforcement and patrol	X		

5.0 Literature Cited

Abrahamson, W. G., and D. C Hartnett. 1990. Pine flatwoods and dry prairies. Pages 103-149 in R. L. Myers and J. J. Ewel editors. Ecosystems of Florida. University of Central Florida Press; Orlando, Florida.

Brandt, L. A. and F. J. Mazziotti. 2005. Marine toads (*Bufo marinus*). University of Florida Cooperative Extension Service Document WEC11. 4pp. University of Florida, UF/IFAS Extension Digital Information Source (EDIS) Database. Available from http://edis.ifas.ufl.edu/pdffiles/UW/UW04600.pdf (accessed November 2007).

Campbell K. M. 1990. Soil survey of Collier County area Florida. USDA, Natural Resources Conservation Service; Washington, D.C.

Campbell, T. 2001. The brown anole. Institute for Biological Invaders: Invader of the Month. University of Tennessee, Knoxville, TN. Available from http://invasions.bio.utk.edu/invaders/sagrei.html (accessed November 2007).

Campbell, T. S. 1996. Northern range expansion of the brown anole, *Anolis sagrei*, in Florida and Georgia. Herp. Review 27:155-157.

Campbell, T. S. 2000. Analyses of the effects of an exotic lizard (*Anolis sagrei*) on a native lizard (*Anolis carolinensis*) in Florida, using islands as experimental units. Ph.D. Dissertation, University of Tennessee, Knoxville, TN.

Churchill, M. 2003. Giant marine toad (*Bufo marinus*) - Introduced Species Summary Project. Columbia University, New York, NY. Available from http://www.columbia.edu/itc/cerc/danoff-burg/invasion_bio/inv_spp_summ/Bufo_marinus.html (accessed December 2007).

Coates, S. F., M. B. Main, J. J. Mullahey, J. M. Schaefer, G. W. Tanner, M. E. Sunquist, and M. D. Fanning. 1998. The coyote (*Canis latrans*): Florida's newest predator. University of Florida Cooperative Extension Service Document WEC124. 5pp. University of Florida, UF/IFAS Extension Digital Information Source (EDIS) Database. Available from http://edis.ifas.ufl.edu/pdffiles/UW/UW12700.pdf (accessed November 2007).

Collins, L. and R. H. Scheffrahn. 2005. Red imported fire ant, *Solenopsis invicta* Buren (Insecta: Hymenoptera: Formicidae: Myrmicinae). 9pp. Featured Creatures from the Entomology and Nematology Department, Florida Cooperative Extension Service Document EENY-195. Institute of Food and Agricultural Sciences, University of Florida. Available from http://edis.ifas.ufl.edu/IN352.

Fairbank, P. and S. Hohner. 1995. Mapping recharge (infiltration and leakage) throughout the South Florida Water Management District. Technical publication 95-20 (DRE # 327). SFWMD, West Palm Beach, Florida.

Florida Department of Transportation. 2009. Aerial Photo Look Up System. Available from http://www.dot.state.fl.us/surveyingandmapping/apac.shtm (accessed February 2009).

Florida Exotic Pest Plant Council (FLEPPC). 2007. List of Florida's invasive plant species. Florida Exotic Pest Plant Council. Available from http://www.fleppc.org/list/07list.htm (accessed August 2007).

Florida Fish and Wildlife Conservation Commission (FFWCC). 2001. Impacts of feral and free-ranging domestic cats on wildlife in Florida. Tallahassee, FL. Available from http://www.floridaconservation.org/viewing/articles/cat.pdf (accessed October 2007)

Florida Fish and Wildlife Conservation Commission (FFWCC). 2002. A conceptual management plan for Caravelle Ranch Wildlife Management Area: 2002 – 2007. Tallahassee, FL. 218 pp. Available from http://myfwc.com/wma-planning/CMP/Caravelle%20Ranch%20WMA/Caravelle%20Ranch%20CMP%202002-2007.pdf (accessed December 2007)

Florida Fish and Wildlife Conservation Commission (FFWCC). 2003, January 6. Florida's breeding bird atlas: A collaborative study of Florida's birdlife. http://www.myfwc.com/bba/ (accessed July 2008).

Florida Natural Areas Inventory (FNAI). 2008. Acres of conservation lands by county. Florida State University, Florida Natural Areas Inventory, Tallahassee. FL. Available from http://www.fnai.org/pdf/MA_acres_counties.pdf (accessed August 2008).

Florida Natural Areas Inventory (FNAI) and Florida Department of Natural Resources (FDNR) 1990. Guide to the Natural Communities of Florida. Florida Natural Areas Inventory and Florida Department of Natural Resources.

Giuliano, W. M., and G. W. Tanner. 2005. Control and management of wild hogs in Florida. Department of Wildlife Ecology and Conservation Publication WEC 192. 7pp. Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences (IFAS), University of Florida. Available from http://edis.ifas.ufl.edu/UW221 (accessed December 2007).

Giuliano, W. M., and G. W. Tanner. 2005. Ecology of wild hogs in Florida. Department of Wildlife Ecology and Conservation Publication WEC 191. 7pp. Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences (IFAS), University of Florida. Available from http://edis.ifas.ufl.edu/UW220 (accessed December 2007).

Johnson, S. 2007. The Cuban treefrog (*Osteopilus septentrionalis*) in Florida. Department of Wildlife Ecology and Conservation Publication WEC218. 8pp. Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences (IFAS), University of Florida. Available from http://edis.ifas.ufl.edu/UW259 (accessed December 2007)

Karim, A. 2007. Status and use of tropical hardwood hammocks and forested residential areas as habitat for resident and Neotropical migratory birds in the Florida Keys. Master of Science Thesis. University of Florida, Gainesville, FL. 61pp.

Kushlan, J. A. 1990. Freshwater marshes. Pages 324-363 in R. L. Myers and J. J. Ewel editors. Ecosystems of Florida. University of Central Florida Press; Orlando, Florida.

Langeland, K. A., and R. K. Stocker. 2001. Control of non-native plants in natural areas of Florida. University of Florida Cooperative Extension Service Document SP 242. 34pp. University of Florida, UF/IFAS Extension Digital Information Source (EDIS) Database. Available from http://edis.ifas.ufl.edu/pdffiles/WG/WG20900.pdf (accessed December 2007).

Langeland, K. A. 2008. Natural area weeds: distinguishing native and non-native "Boston ferns" and "sword ferns" (*Nephrolepis* spp.). University of Florida Cooperative Extension

Service Document SS-AGR-22. 7pp. University of Florida, UF/IFAS Extension Digital Information Source (EDIS) Database. Available from http://edis.ifas.ufl.edu/pdffiles/AG/AG12000.pdf (accessed February 2009).

Larson, B. C., J. H. Frank, G. M. Allen, M. B. Main. 2006. Florida's native bromeliads. University of Florida Cooperative Extension Service Circular 1466. 10pp. University of Florida, UF/IFAS Extension Digital Information Source (EDIS) Database. Available from http://edis.ifas.ufl.edu/UW205 (accessed November 2007).

Lee, J. C. 1985. *Anolis sagrei* in Florida: phenetics of a colonizing species I. Meristic characters. Copeia 1985:182-194.

Lodge, T. E. 2005. The Everglades handbook - Understanding the Ecosystem. 2nd edition. CRC Press, Boca Raton, FL.

Liudahl, K., D.J. Belz, L. Carey, R.W. Drew, S. Fisher, and R. Pate. 1990. Soil survey of Collier County area Florida. USDA, Natural Resources Conservation Service; Washington, D.C.

Masterson, J. 2007. *Felis catus*. Smithsonian Marine Station at Fort Pierce. Fort Pierce, Florida. Available from http://www.sms.si.edu/IRLspec/Felis_catus.htm (accessed November 2007).

Miller J. A. 1986. Hydrogeologic framework of the Floridan Aquifer System in Florida and in parts of Georgia, Alabama, and South Carolina. United States Geological Survey Professional Paper 1403-B. United States Government Printing Office, Washington, D.C.

Oaks, R. Q. and J. R. Dunbar. 1974. Post Miocene stratigraphy of the Central and Southern Atlantic Coastal Plain. Utah State University Press, Logan, Utah.

Schwartz, A. and R. W. Henderson. 1991. Amphibians and reptiles of the West Indies: descriptions, distributions, and natural history. University of Florida Press, Gainesville.

Scott, T. M. 1988. Lithostratigraphy of the Hawthorne Group (Miocene). Florida Geological Survey Bulletin No. 59, Tallahassee, Florida.

Stimac J. L., and S. B. Alves. 1994. Pest Management in the Subtropics: biological control a Florida perspective. (Rosen D, Bennett FD, Capinera JL, Ed.) pp. 353-380. Intercept Limited, Andover, Hants SP10 1 YG, UK.

United States Fish and Wildlife Service (USFWS). 1999. Mesic pine flatwoods. South Florida multi-species recovery plan – a species plan…an ecosystem approach. USFWS Southeast Region, Compact Disk.

Willcox, E. and W. M. Giuliano. 2006. Red imported fire ants and their impacts on wildlife. Department of Wildlife Ecology and Conservation Publication WEC 207. Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences (IFAS), University of Florida . Available http://edis.ifas.ufl.edu/UW242

Wunderlin, R. P., and B. F. Hansen. 2008. Atlas of Florida vascular plants. [S.M. Landry and K.N. Campbell (application development), Floirda Center for Community Design and Research]. Institute for Systematic Botany, University of South Florida, Tampa. Available from http.//www.plantatlas.usf.edu/.

Appendix 1. Preliminary Floristic Inventory of the Brochu Preserve.

Brochu Preserve: Preliminary Plant List			
Scientific Name	**Common Name(s)**	**State[b]**	**FLEPPC[c]**
Acacia auriculiformis[a]	earleaf acacia		I
Acer rubrum	red maple		
Ambrosia artemisiifolia	common ragweed		
Ampelopsis arborea	peppervine		
Andropogon glomeratus	bushy bluestem		
Aristida stricta var. *beyrichiana*	wiregrass		
Asimina spp.	pawpaw		
Bacopa sp.	waterhyssop		
Blechnum serrulatum	swamp fern, toothed midsorus fern		
Cephalanthus occidentalis	common buttonbush		
Ceratiola ericoides	Florida rosemary; sand heath		
Cladium jamaicense	sawgrass, Jamaica swamp sawgrass		
Diodia virginiana	Virginia buttonweed		
Dryopteris ludoviciana	southern wood fern; southern shield fern		
Erigeron sp.	fleabane		
Eriocaulon decangulare	hatpins		
Eryngium yuccifolium	button rattlesnakemaster; button eryngo		
Hypericum sp.	St. John's-wort		
Hyptis alata	clustered bushmint; musky mint		
Ilex cassine	dahoon holly, dahoon		
Ilex glabra	inkberry; gallberry		
Lachnanthes caroliniana	Carolina redroot		
Licania michauxii	gopher apple		
Lyonia ferruginea	rusty staggerbush; rusty lyonia		
Melaleuca quinquenervia[a]	punk tree, elaleuca, paper bark		I
Melochia corchorifolia	chocolateweed		
Mikania scandens	climbing hempvine		
Muhlenbergia capillaris	muhly grass		
Myrica cerifera	wax myrtle, southern bayberry		
Nephrolepis multiflora[a]	Asian sword fern		I
Nymphaea odorata	American white waterlily		
Persea borbonia	red bay		
Piloblephis rigida	wild pennyroyal; mint stuff		
Pinus elliottii	slash pine		
Pluchea baccharis	rosy camphorweed		
Polygala nana	candyroot		
Polygonum spp.	Smartweed		
Pterocaulon pycnostachyum	blackroot		
Quercus laurifolia	laurel oak; diamond oak		
Quercus elliottii	running oak		
Rapanea punctata	myrsine, colicwood		

(continued on next page)

Appendix 1 (continued). Preliminary Floristic Inventory of the Brochu Preserve.

Brochu Preserve: Preliminary Plant List (continued)			
Scientific Name	**Common Name(s)**	**State[b]**	**FLEPPC[c]**
Sabal palmetto	cabbage palm; sabal palm		
Sagittaria latifolia	broadleaf arrowhead, common arrowhead, duck potato		
Sarcostemma clausum	white twinevine		
Schinus terebinthifolius[a]	Brazilian pepper		I
Serenoa repens	saw palmetto		
Smilax auriculata	earleaf greenbrier		
Sporobolus indicus[a]	smutgrass		
Syzygium cumini[a]	Java plum; jambolan		I
Terminalia catappa[a]	West Indian almond; tropical almond		II
Tillandsia balbisiana	reflexed wild-pine, northern needleleaf	T	
Tillandsia fasciculata	stiff-leaved wild-pine, cardinal airplant	E	
Tillandsia usneoides	Spanish-moss		
Toxicodendron radicans	eastern poison-ivy		
Urena lobata[a]	caesarweed		II
Vaccinium myrsinites	shiny blueberry		
Vitis rotundifolia	muscadine, muscadine grape		
Xyris spp.	yelloweyed grass		

list revised February 2009

[a]*Non-native species that may or may not have FLEPPC designations*

[b]*State listed species: T = Threatened; E = Endangered*

[c]*Florida Exotic Pest Plant Council (FLEPPC) 2007 designations*

I: *Invasive, exotics that are altering native plant communities by displacing native species, changing community structures or ecological functions, or hybridizing with natives.*

II*: Invasive, exotics that have increased in abundance or frequency but have not yet altered Florida plant communities to the extent shown by Category I species.*

Appendix 2. Florida Natural Areas Inventory Report for the Brochu Preserve

1018 Thomasville Road
Suite 200-C
Tallahassee, FL 32303
850-224-8207
850-681-9364 fax
www.fnai.org

Florida Natural Areas Inventory
Biodiversity Matrix Query Results
UNOFFICIAL REPORT
Created 2/12/2009
(Contact FNAI Data Services Coordinator for an official **Standard Data Report**)

NOTE: The Biodiversity Matrix includes only rare species and natural communities tracked by FNAI.

Report for 1 Matrix Unit: 43523

Descriptions

DOCUMENTED - There is a documented occurrence in the FNAI database of the species or community within this Matrix Unit.

DOCUMENTED-HISTORIC - There is a documented occurrence in the FNAI database of the species or community within this Matrix Unit; however the occurrence has not been observed/reported within the last twenty years.

LIKELY - The species or community is *known* to occur in this vicinity, and is considered likely within this Matrix Unit because:

1. documented occurrence overlaps this and adjacent Matrix Units, but the documentation isn't precise enough to indicate which of those Units the species or community is actually located in; *or*
2. there is a documented occurrence in the vicinity and there is suitable habitat for that species or community within this Matrix Unit.

POTENTIAL - This Matrix Unit lies within the known or predicted range of the species or community based on expert knowledge and environmental variables such as climate, soils, topography, and landcover.

Matrix Unit ID: 43523
0 **Documented** Elements Found
0 **Documented-Historic** Elements Found

5 **Likely** Elements Found

Scientific and Common Names	Global Rank	State Rank	Federal Status	State Listing
Grus canadensis pratensis Florida Sandhill Crane	G5T2T3	S2S3	N	LT
Mesic flatwoods	G4	S4	N	N
Mycteria americana Wood Stork	G4	S2	LE	LE
Puma concolor coryi Florida Panther	G5T1	S1	LE	LE
Sciurus niger avicennia Mangrove Fox Squirrel	G5T2	S2	N	LT

Appendix 2 (continued). Florida Natural Areas Inventory Report for the Brochu Preserve

Matrix Unit ID: 43523

16 **Potential** Elements for Matrix Unit 43523

Scientific and Common Names	Global Rank	State Rank	Federal Status	State Listing
Andropogon arctatus Pine-woods Bluestem	G3	S3	N	LT
Athene cunicularia floridana Florida Burrowing Owl	G4T3	S3	N	LS
Calopogon multiflorus Many-flowered Grass-pink	G2G3	S2S3	N	LE
Drymarchon couperi Eastern Indigo Snake	G3	S3	LT	LT
Elytraria caroliniensis var. angustifolia Narrow-leaved Carolina Scalystem	G4T2	S2	N	N
Gopherus polyphemus Gopher Tortoise	G3	S3	N	LT
Lechea cernua Nodding Pinweed	G3	S3	N	LT
Linum carteri var. smallii Small's flax	G2T2	S2	N	LE
Mustela frenata peninsulae Florida Long-tailed Weasel	G5T3	S3	N	N
Nemastylis floridana Celestial Lily	G2	S2	N	LE
Nolina atopocarpa Florida Beargrass	G3	S3	N	LT
Picoides borealis Red-cockaded Woodpecker	G3	S2	LE	LS
Pteroglossaspis ecristata Giant Orchid	G2G3	S2	N	LT
Rana capito Gopher Frog	G3	S3	N	LS
Rostrhamus sociabilis plumbeus Snail Kite	G4G5T3Q	S2	LE	LE
Ursus americanus floridanus Florida Black Bear	G5T2	S2	N	LT*

Collier County

Public Utilities Division

Planning & Project Management

Interdepartmental Agreement:
Public Utilities - Conservation Collier Partnership
Brochu Property
February 26, 2009

Purpose of agreement – to delineate a partnership agreement between the Public Utilities Planning and Project Management (PUPPM) Department and Facilities Management's Conservation Collier Program regarding the purchase of the Brochu property - 2 parcels of 4.63 acres each, located along Immokalee Road in the Big Corkscrew Island Community, Folio Numbers #00095520003 and 00095480004.

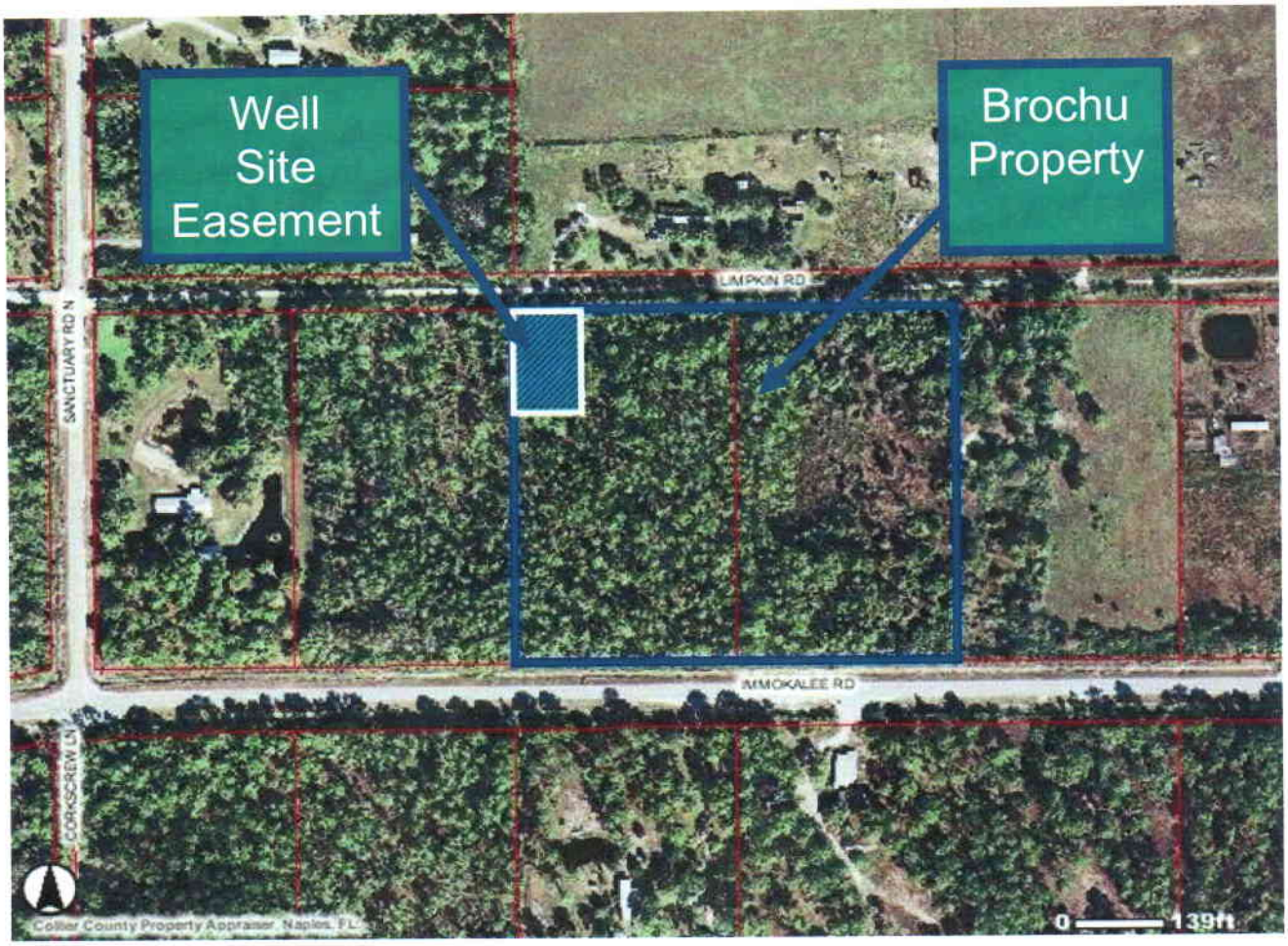
Agreement

- PUPPM will provide funding for less than fee to acquire easement interest in the property that will be needed for the well site, identified as an area in the northwest corner of the property along Limpkin Road, 100' by 150' (see attached aerial photo). (Completed and Satisfied – August 25, 2006)
- Exotic plant and debris/trash removal on the PUPPM easement portion will be coordinated with removal of exotic plants and debris/trash on the Conservation Collier portion of the parcel, which may occur in advance of well site development.
- As the utility easement is developed, PUPPM will coordinate with the Conservation Collier Program to provide shared access to the easement property for public parking and security needs.
- The Conservation Collier Program shall be responsible for development and maintenance of any necessary infrastructure for a parking area above the needs of PUPPM for easement use and maintenance.
- Any landscaping material installed by PUPPM pursuant to code requirements shall complement the objectives of the Conservation Collier Program by being site appropriate and consisting of native plant species.
- The Facilities Management Department, Conservation Collier Program, will be responsible for all management costs associated with the Conservation Collier portion of the property.

Phil Gramatges, P.E., PUPPM Department Director — Date 3/3/09

Skip Camp, Facilities Management Department Director — Date 3/24/09

Aerial Photo Attachment:


Well
Site
Easement
Brochu
Property
LIMPKIN RD
SANCTUARY RD N
IMMOKALEE RD
CORKSCREW LN
Collier County Property Appraiser, Naples, FL
0
139ft

sulecki_a

From: ashton_h
Sent: Monday, March 23, 2009 3:42 PM
To: sulecki_a
Cc: bonham_g; AlthouseTammy
Subject: Conservation Collier Brochu property--Interdepartmental Agreement RLS#09ENs00357

Alex,

The proposed interdepartmental agreement is appropriately worded as approved by the BCC on 7/25/06, and it is sufficient to maintain as an attachment to the Brochu final management plan.

Heidi Ashton-Cicko

Heidi Ashton-Cicko
Assistant County Attorney
Land Use Section Chief
Phone (239) 252-2939
Fax (239) 252-6300