DEEP CREEK PRESERVE

MANAGEMENT PLAN

PREPARED FOR:
COUNTY OF VOLUSIA
COMMUNITY SERVICES DEPARTMENT
RESOURCE STEWARDSHIP DIVISION

PREPARED BY:
RESOURCE STEWARDSHIP DIVISION
&
YOUNG BEAR ENVIRONMENTAL CONSULTING

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FDEP OES Draft: September 4, 2026 (pending version)

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I. GENERAL INFORMATION

The Deep Creek Preserve Management Plan (Plan), presented here, includes three tracts with different ownerships, the State Tract (formerly known as the Carter Quail Ranch property) owned by the State of Florida, Board of Trustees (BOT), the WMD Tract (formerly known as the Kemcho Investment Group property) owned by the St. Johns River Water Management District (SJRWMD), and the County Tract (formerly known as the Leffler property) owned by Volusia County (Figure 1). Volusia County is the designated lead management agency for all three tracts, collectively known as Deep Creek Preserve (Preserve). As such, Volusia County intends to manage the Preserve in a holistic manner, and this Plan incorporates all three tracts into a single, holistic management plan.

The incorporation of the State Tract into this Plan requires that it follow certain Florida statutes, and be submitted for review and approval to the Acquisition and Restoration Council (ARC) on behalf of the Board of Trustees of the Internal Improvement Trust Fund (BOT) of the State of Florida through the Department of Environmental Protection, Division of State Lands (DSL), in compliance with paragraph eight (8) of Lease No. 4890 (Appendix A). This Plan is intended to meet the requirements of Sections 253.034 and 259.032, Florida Statutes, Chapter 18-2, Florida Administrative Code, and intended to be consistent with the State Lands Management Plan. All development and resource alterations encompassed in this plan are subject to the granting of appropriate permits, easements, licenses, and other required legal instruments. Approval of the Plan does not constitute an exemption from complying with the appropriate local, state or federal agencies. The Plan's format and content were drafted in accordance with ARC requirements for management plans and the model plan outline provided by the staff of DSL.

The total Preserve area under public ownership and managed by Volusia County is 9,873 acres. The reader of this Plan should note that the intended (and required) purpose is to show that the County is appropriately managing the State Tract which is 1,339.66 acres in size. The requirements noted in the above paragraph apply specifically to the State Tract. Therefore, when quantifying resources, the quantities will be presented for each tract and for the Preserve as a whole.

A. Land Acquisition

1. Purchase

The acquisition of the Preserve began in the early 2010's. The County of Volusia acquired the County Tract by purchasing approximately 4,771 acres in December of 2010 and acquiring an additional 35 acres, consisting of multiple parcels within antiquated plat (University Highlands) located in the northwestern quadrant of the County Tract, which were acquired over an extended period. Volusia County's acquisition funding sources include the "Volusia Forever" program, County Utilities, and General Fund monies. Small lots may also have been acquired through donations and tax sales. Volusia County retains sole ownership of the County Tract.

The SJRWMD acquired approximately 3,200 acres (WMD Tract) in the northern portion of the Preserve in May of 2011 and has acquired multiple adjacent parcels totaling 491 acres between 2020 and 2025. SJRWMD's acquisition funding sources include the Florida Department of Transportation mitigation program and "Florida Forever" funds. SJRWMD retains sole ownership of the WMD Tract.

Volusia Forever partnered with Florida Forever to acquire the State Tract in March of 2025. The State of Florida, Board of Trustees retains sole ownership of the State Tract.

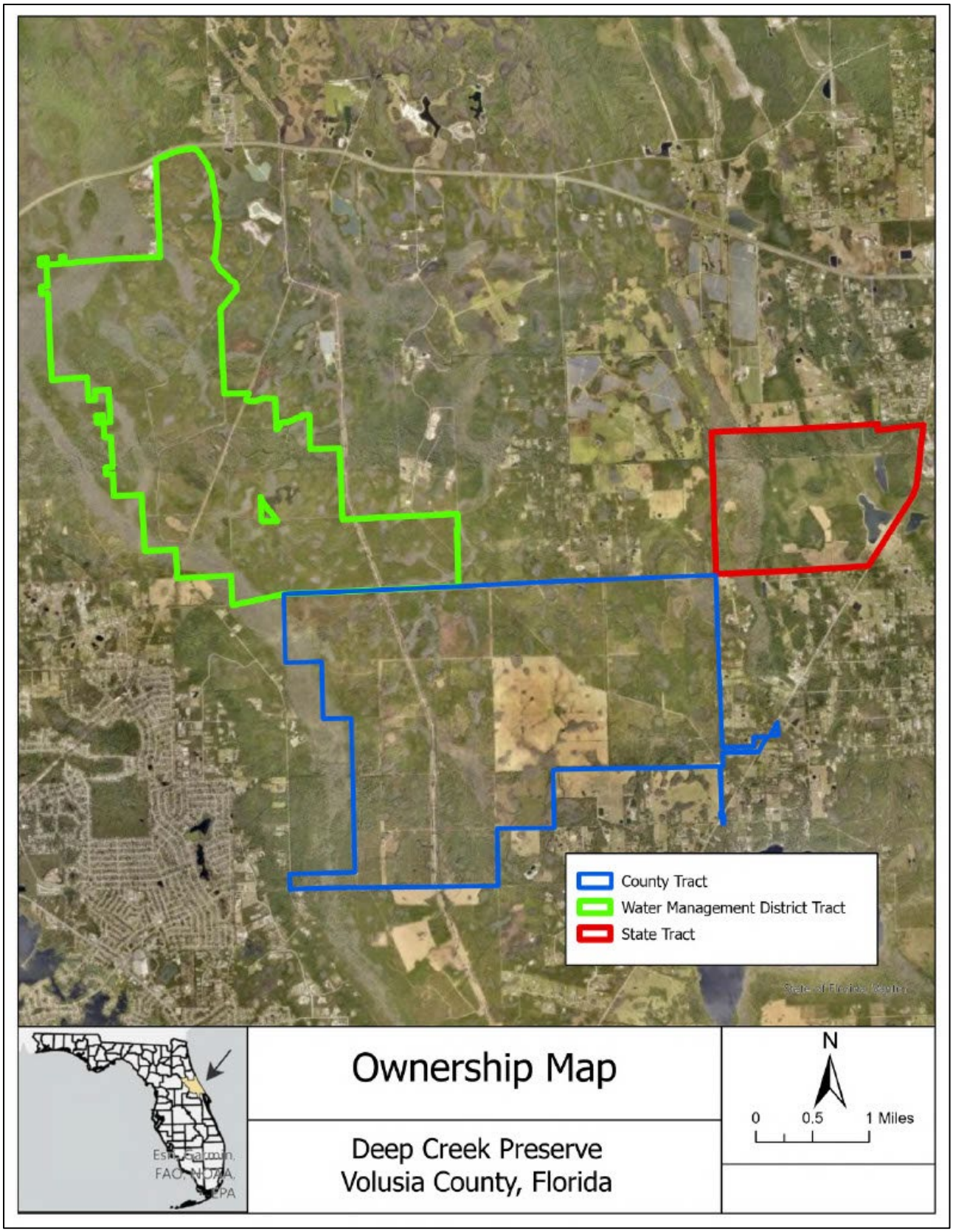


Figure 1. Ownership Map

The Preserve is located within the Volusia Conservation Corridor, a Florida Forever project. The purpose of acquisition of properties in this corridor is described in DEP's Volusia Conservation Corridor Florida Forever Plan (Appendix B):

> The Volusia Conservation Corridor project will provide a continuous corridor of environmentally significant land from Tiger Bay State Forest, through the central wetlands and flatwoods of Volusia County, to the marshes of the St. Johns River. This project will also increase natural resource-based public recreation and education opportunities. This project will help ensure that enough water is available to meet the current and future needs of natural systems and the citizens of the state.

The specific purpose of acquisition of the State Tract is described in DEP's Florida Forever Project Evaluation Report: Carter Quail Ranch (Appendix C):

> The Carter Quail Ranch project will contribute to a corridor of conservation lands that will support and provide crucial habitat protection and connectivity for rare and endangered plant and animal species. The project will provide critical water quality and quantity protection for Deep Creek and the St. Johns River while expanding public access to resource-based recreational opportunities in a rapidly growing region of the state.

Acquisition of this project would serve to:

- increase the protection of Florida's biodiversity at the species, natural community, and landscape levels
- increase natural resource-based public recreation or educational opportunities
- provide and enhance wildlife corridors and valuable habitat for rare and imperiled species
- provide surface and groundwater protection and protect natural floodplain functions
- increase the amount of forestland available for sustainable management of natural resources
- protect, restore, and maintain the quality and natural functions of land, water and wetland systems

2. Location

The Preserve is located in central Volusia County, generally south of State Road 44, west of State Road 415, and east of the municipalities of Deltona and Lake Helen. Deep Creek is partially included within some portions of the County and WMD Tracts and generally forms the western boundary. The total area managed by Volusia County within the Preserve is 9,873 acres.

State Tract

The State Tract is in the unincorporated area of New Smyrna Beach (Sections 33 and 34, Township 17 South, Range 32 East). The State Tract is east of the WMD Tract and northeast of the County Tract. The State Tract's southwest corner and County Tract's northeast corner meet but do not overlap. The main entrance to the State Tract is located on State Road 415, approximately 2 miles south of the intersection of State Road 44 and 415. There are 7 contiguous parcels that make up the State Tract, totaling 1,339.66 acres (Appendix A3).

County Tract

The County Tract is located in the southwestern portion of the Preserve, south of State Road 44 and west of State Road 415, east of the municipalities of Deltona and Lake Helen, in unincorporated Volusia County. The County Tract is southwest of the State Tract and south of the WMD Tract. The primary entrance to the County Tract is located on State Road 415 at Leffler Landing Road. The County Tract encompasses approximately 4,806 acres and was acquired by Volusia County in December of 2010. The County Tract contains the primary, existing public trailhead, parking area, and the majority of the existing multi-use trail system. Deep Creek generally forms the western boundary of the County Tract. The improved pasture and associated agricultural infrastructure are located in the south-central portion of the County Tract.

WMD Tract

The WMD Tract is located in the northern portion of the Preserve, south of State Road 44 and generally west of State Road 415 and Pioneer Trail (County Road 4113), in unincorporated Volusia County. The WMD Tract is north of the County Tract and is west of the State Tract. The WMD Tract encompasses approximately 3,691 acres and was acquired by the SJRWMD in May of 2011, and smaller adjacent parcels were added between 2020-2025. The WMD Tract is bounded to the south by the County Tract and to the north by Longleaf Pine Preserve. Vehicular access to the WMD Tract is currently limited to land managers and those authorized under the active hunting lease that encompasses the WMD Tract. However, the WMD Tract is open to public access. Volusia County serves as the lead management entity for the WMD Tract under a Cooperative Management Agreement with the SJRWMD (Appendix D)

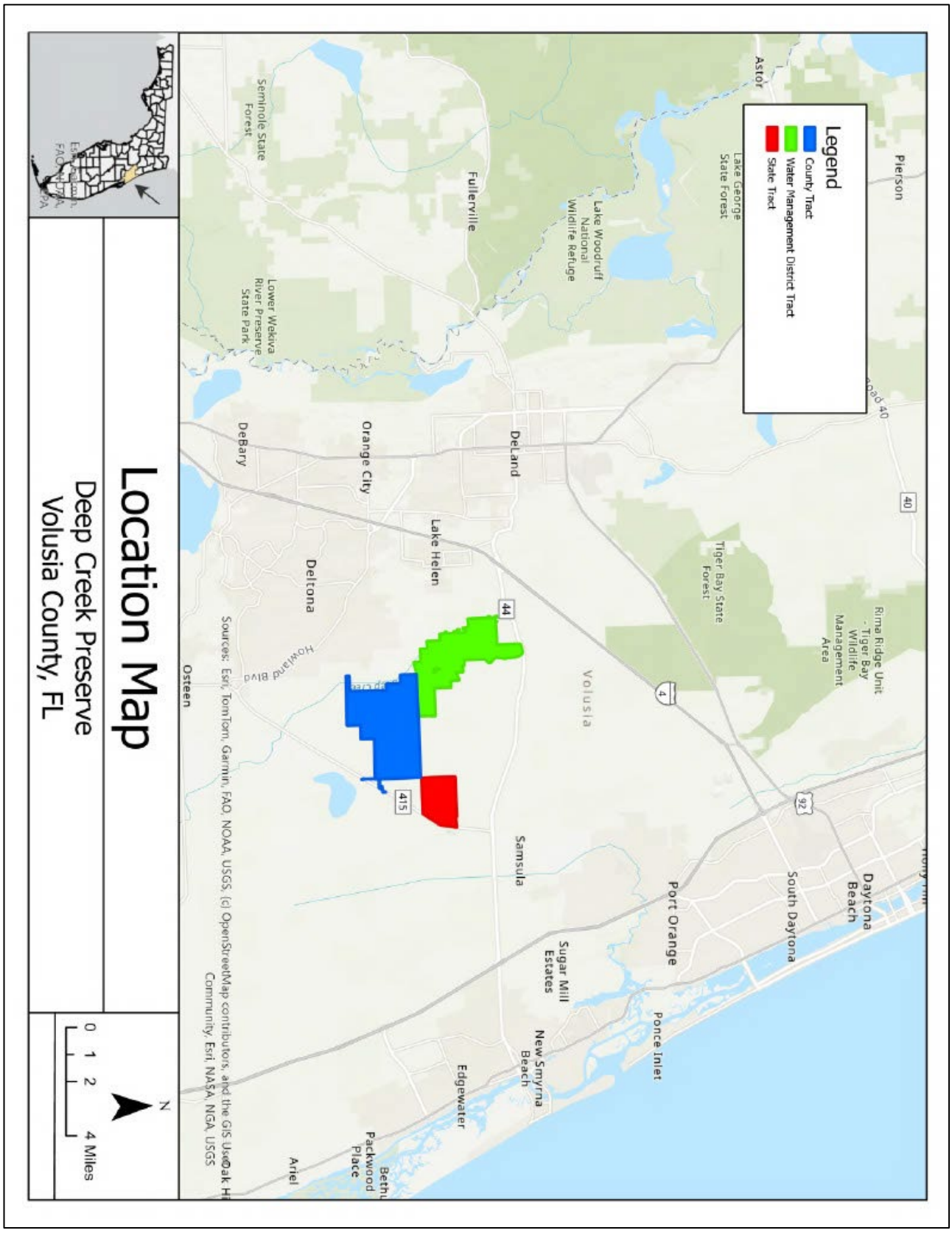


Figure 2. Location Map

3. Management Authority

Volusia County is the designated lead managing agency for the State Tract under the authority granted by Lease Number 4890 for the purposes of conservation, protection, and stewardship of natural and cultural resources (Appendix A). Under this lease, Volusia County is responsible for implementing land management activities consistent with state guidelines, including habitat restoration, invasive species control, and the provision of resource-based outdoor recreation. The lease allows for public access and compatible uses as outlined in the agreement, while ensuring the long-term preservation of the property's ecological value. The term of the lease is for a period of twenty-five years.

The County, through a "Cooperative Management Agreement" (Appendix D) with the SJRWMD, has been designated as the lead management entity for the conservation, protection, management, and enhancement of natural and cultural resources of the WMD Tract property within the Preserve. This Agreement also encompasses the development and management of resource-based outdoor recreation and other uses as provided for by the document. The term of the Agreement is for a period of twenty years with automatic renewal in twenty-year increments.

4. Management Directives

This Management Plan is to guide the appropriate development of facilities that will provide access to the Preserve, while preserving the integrity of its natural and cultural resources. The Plan identifies the objectives, criteria and standards that guide preserve development, administration and management and is intended to meet the requirements of Section 253.034, Section 259.032, Florida Statutes and Chapter 18-2, Florida Administrative Code (Appendix M).

Florida Statutes, subsection 253.023(11) directs the County to manage the leased premises only for the conservation and protection of natural and historical resources and resource-based, public outdoor recreation which is compatible with the conservation and protection of these public lands.

Thus, the fundamental goal of the County as the managing agency is the protection and preservation of the natural and cultural historic resources of the Preserve and serves as the goal guiding management of the Preserve and its associated uses.

The Florida Forever Report provided the Management Prospectus (Appendix M) that provided the framework to develop this Plan. Excerpts of the Prospectus are provided here. As described in that section, the land will be managed as a holistic system under the same guidelines as the County of Volusia's Deep Creek Preserve General Management Plan. This is due to the adjacency/proximity to the State Tract and the similar types of habitats. Management goals include implementation of an "Objective-based Management" program in furtherance of the "Desired Future Conditions", reintroduce prescribed burning, harvesting and other silvicultural activities, maintenance and restoration of surface hydrology protection and enhancement of listed species, and control of non-native invasive species.

5. Title Interest and Encumbrances

State Tract

Title to the State Tract, as State-owned lands, is held by the Board of Trustees of the Internal Improvement Trust Fund of the State of Florida (Lessor). In December 2025, the Lessor entered into a lease agreement with Volusia County as lessee and lead manager of the Preserve (Appendix A). The term of this lease is 25 years.

On the State Tract, a 6.94-acre tree preservation easement is located within a baygall swamp on the east side of the property (Appendix O2).

Reservation of One Half of all oil, gas and sulfur and the right of ingress and egress for locating, producing and removing as set forth and reserved in that certain Special Warranty Deed recorded June 25, 1951 in Deed Book 442, page 579; as partially released by Warranty Deed recorded December 27, 1972 in Official Records Book 1519, page 394, all of the Public Records Volusia County, Florida. Note: Without Right of Entry.

Right of Way Agreement by and between Santona Land Corporation and Florida Power & Light Company recorded in Official Records Book 637, page 246, Public Records Volusia County, Florida.

Easement in favor of Florida Power & Light Company recorded September 4, 1987, in Official Records Book 3030, page 1989, Public Records Volusia County, Florida (Appendix O3).

Resolution vacating a portion of Howe & Currier Plat as recorded in Official Records Book 3496, Page 1114, of the Public Records of Volusia County, Florida (Appendix O4).

Easement in favor of Florida Power Corporation recorded January 22, 1991 in Official Records Book 3578, page 1369; as affected by Easement Deed in favor of the Utilities Commission, City of New Smyrna Beach, Florida, recorded July 12,1993 in Official Records Book 3841, page 1643, all of the Public Records Volusia County, Florida (Appendix O5).

Environmental Resource Permit recorded in Official Records Book 7217, Page 4739, of the Public Records of Volusia (Appendix O6).

Covenant and Restriction recorded in Official Records Book 7149, Page 1894, of the Public Records of Volusia (Appendix O7).

County Tract

Title to the County Tract is held by the County of Volusia. The County Tract was acquired in December of 2010 and Volusia County retains sole ownership of the Tract.

Two utility easements bisect the County Tract in a north to south direction. Regional electrical transmission lines are sited within both of these easements, which are held by Florida Power and Light Corporation. The easterly easement is approximately 300 feet in width and the westerly easement is approximately 175 feet wide.

At the time of the 2013 Deep Creek Preserve General Management Plan, no other restrictions or encumbrances were identified on the County Tract beyond the aforementioned utility easements. Subsequent to the 2013 plan, additional encumbrances have been recorded on the County Tract including a Natural Vegetation Easement, an Environmental Resource Permit recorded in the public records of Volusia County, and a Covenant and Restriction. These instruments are provided in the Appendices to this Plan and should be consulted prior to undertaking any ground disturbing or development activities on the County Tract.

WMD Tract

Title to the WMD Tract is held by the SJRWMD. The WMD Tract was acquired by the SJRWMD in May of 2011 and retains sole ownership of the WMD Tract. Volusia County serves as the lead management entity for the WMD Tract under a Cooperative Management Agreement with the SJRWMD, as described in Section I.A.3 of this Plan.

Two utility easements bisect the WMD Tract in a north to south direction. Regional electrical transmission lines are sited within both of these easements, which are held by Florida Power and Light Corporation. The easterly easement is approximately 300 feet in width and the westerly easement is approximately 175 feet wide.

Two non-exclusive perpetual access easements were granted by the Kemcho Investment Group to the SJRWMD concurrent with their acquisition of the property. The first of these easements provides access to the WMD Tract from State Road 44 across property retained by Kemcho. The second easement provides for use by the SJRWMD of certain roads located upon property retained by Kemcho that generally parallel the boundary between the two ownerships. The SJRWMD has subsequently granted the County permission to use these easements for management purposes.

A non-exclusive easement for remediation and access and right of way purposes was granted by the SJRWMD to the Kemcho Investment Group, located in the southeastern portion of the WMD Tract, providing access to adjoining lands owned by Kemcho. This easement was identified in the 2013 Deep Creek Preserve General Management Plan as non-perpetual, with a stated lapse date of 2016 unless terminated earlier by either party.

B. Proximity to Other Public Properties

The Preserve is contiguous with several publicly owned conservation areas that are managed by Volusia County. The Preserve is located adjacent to the south of Longleaf Pine Preserve and to the north of Palm Bluff Conservation Area. These public lands connect to additional publicly owned lands within the Volusia Corridor. In addition to fee-simple public lands, numerous parcels that have been placed under Conservation Easements granted to regulatory agencies (primarily the SJRWMD) have hydrologic connections via swamps and other watercourses that connect to Deep Creek. The Preserve is not within and/or adjacent to an aquatic preserve or a designated area of critical state concern or an area under study for such designation.

A map of conservation lands within a 10-mile radius of the Preserve is displayed below in the Adjacent Conservation Lands Map. Some of the notable lands in the region include:

State Owned Properties (BOT):

- Tiger Bay State Forest (includes Rima Ridge Wildlife Management Area)

SJRWMD Properties:

- Clark Bay Conservation Area
- Palm Bluff Conservation Area
- Turnbull Hammock Conservation Area

County Owned Properties:

- Longleaf Pine Preserve
- Doris Leeper Spruce Creek Preserve
- Wiregrass Prairie Preserve

City Owned Properties:

- Port Orange City Forest
- Ponce Preserve

Less Than Fee Simple/Privately Owned Properties

- Lefils Conservation Easement
- Double T Ranch Conservation Easement
- Gamble Place
- Farmton Mitigation Bank

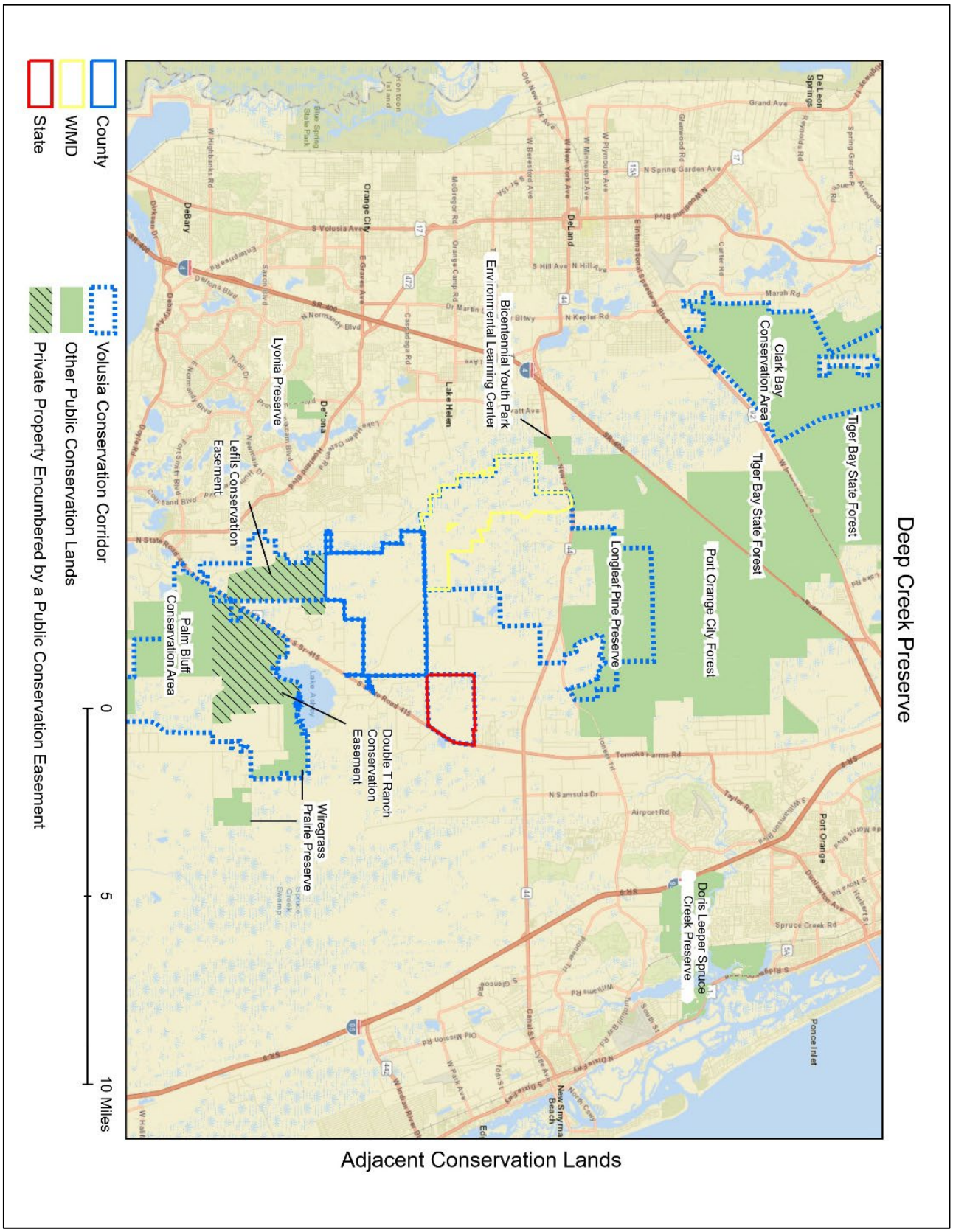


Figure 3. Adjacent Conservation Lands

C. Optimal Boundary

The optimal boundary is identified in Figure 4. The purpose of the optimal boundary is to guide acquisition of parcels towards those parcels that would promote the Florida Forever goals and the goals listed within this Plan. Adjustments to the boundary may add or remove parcels depending upon current conditions. If parcels that were formerly within an optimum boundary are developed, they may be removed from essential parcels list. Note that inclusion within this boundary does not equate to ownership. It is a guide to acquiring additional lands for public ownership and management.

The County, in partnership with others, has been able to acquire a significant portion of the properties within the Optimal Boundary. The acquisition of these lands is a significant focus of Volusia County's Resource Stewardship Division. The acquisition of these properties directly promotes the primary objective of the management directive noted above. The remaining properties include lands adjacent to the exterior boundaries of the overall publicly owned lands. As part of the management strategy, adjacent and contiguous lands are continuously reviewed and evaluated for potential incorporation into the Preserve's Florida Forever boundary.

The Preserve has been one of the several priority areas of the county's land acquisition programs, including Volusia Forever. The Volusia Forever program provides for the acquisition and management of environmentally sensitive and outdoor recreation lands. The program, created by the county's voters in 2000 and renewed in 2020, is funded through annual ad valorem assessment for a period of twenty years. Potential future acquisitions through this program, which is for willing sellers only, are dependent upon available funding.

The Volusia Forever program is administered by the County's Resource Stewardship Division. The responsibility for final decisions regarding property acquisition resides with the County Council.

The optimal boundary was developed, and parcels selected based, on the Florida Forever Volusia Conservation Corridor and the Florida Wildlife Corridor.

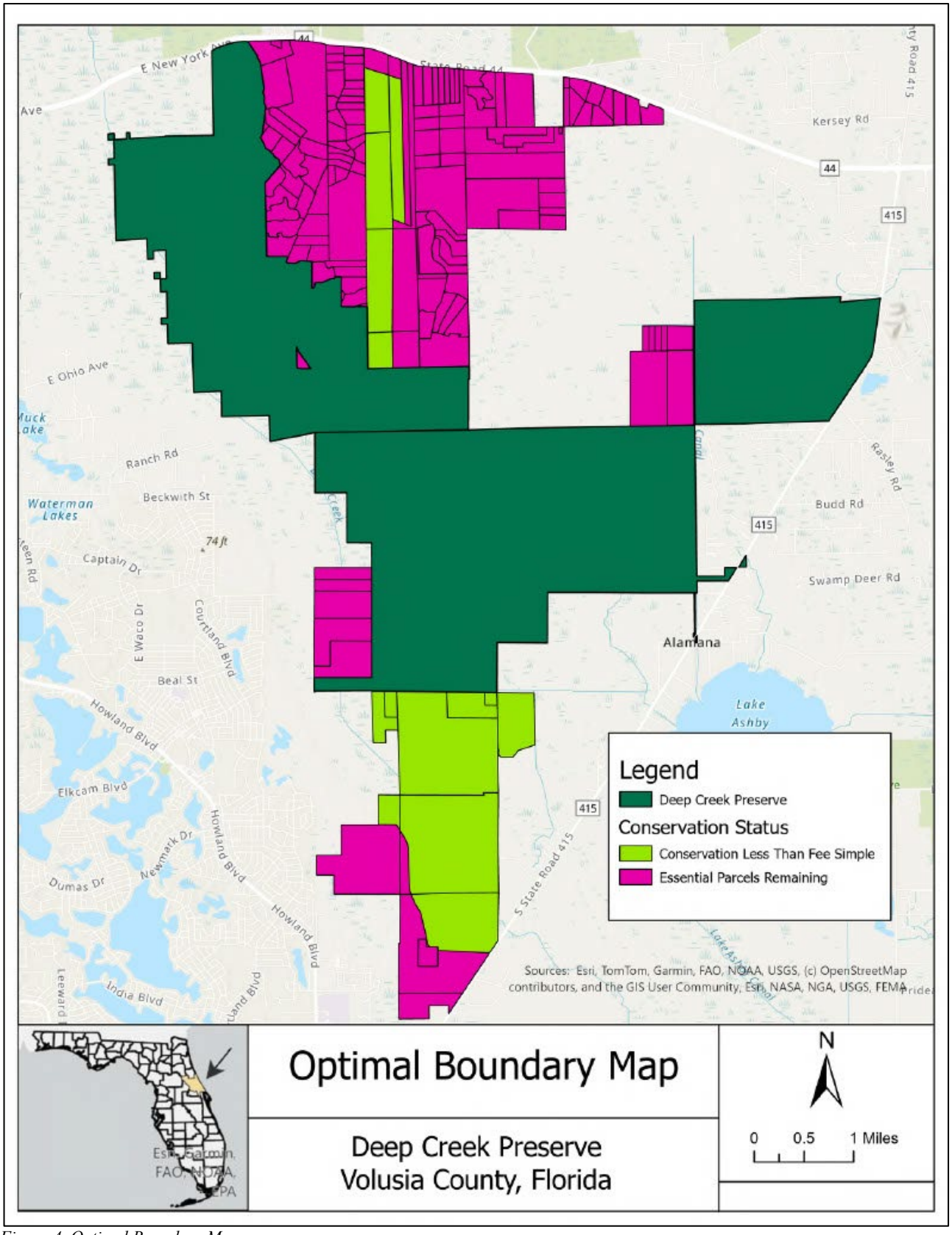


Figure 4. Optimal Boundary Map

D. Public Involvement

Prior to the State's acquisition of Carter Quail Ranch (the State Tract), the County's 2013 Deep Creek Preserve General Management Plan was available to the public on Volusia County's website, under the Land Management Plans webpage.

Following acquisition and execution of the lease, Volusia County, in accordance with Section 259.032, Florida Statutes, established an advisory group that provided input for development of this current Plan. The Management Plan Advisory Group (MPAG) meeting was held on April 28, 2026 at the County's Thomas C. Kelly Administration Center. The advisory group members consisted of representatives from the lead and co-managing agency, a local property owner, the soil and water conservation district, a local conservation organization, Florida Fish and Wildlife Commission, Florida Forest Service, and a local elected official.

The MPAG members were provided FDEP's Management Prospectus (Appendix M), and an initial draft management plan (the MPAG draft) on April 21, 2026. The County considered input from the MPAG meeting, conducted on April 28, 2026, and provided an updated draft management plan (the public hearing draft) to the public via public notice, on May 7, 2026. The plan was noticed via FDEP's website, the County's website and signage posted at the State Tract.

The MPAG conducted a public hearing at the Volusia County UF IFAS Extension Office on June 11, 2026. The County provided the public the ability to provide comments via email, written letters, and in person at the public hearing.

Volusia County, as the lead managing agency, considered this public input in the final version of this Plan (Appendix N).

II. NATURAL AND CULTURAL RESOURCES

A. Physiography

The following section provides a description and assessment of existing natural and cultural resources found in the Preserve. An Aerial Map (Figure 5) and other supporting figures are provided in this section.

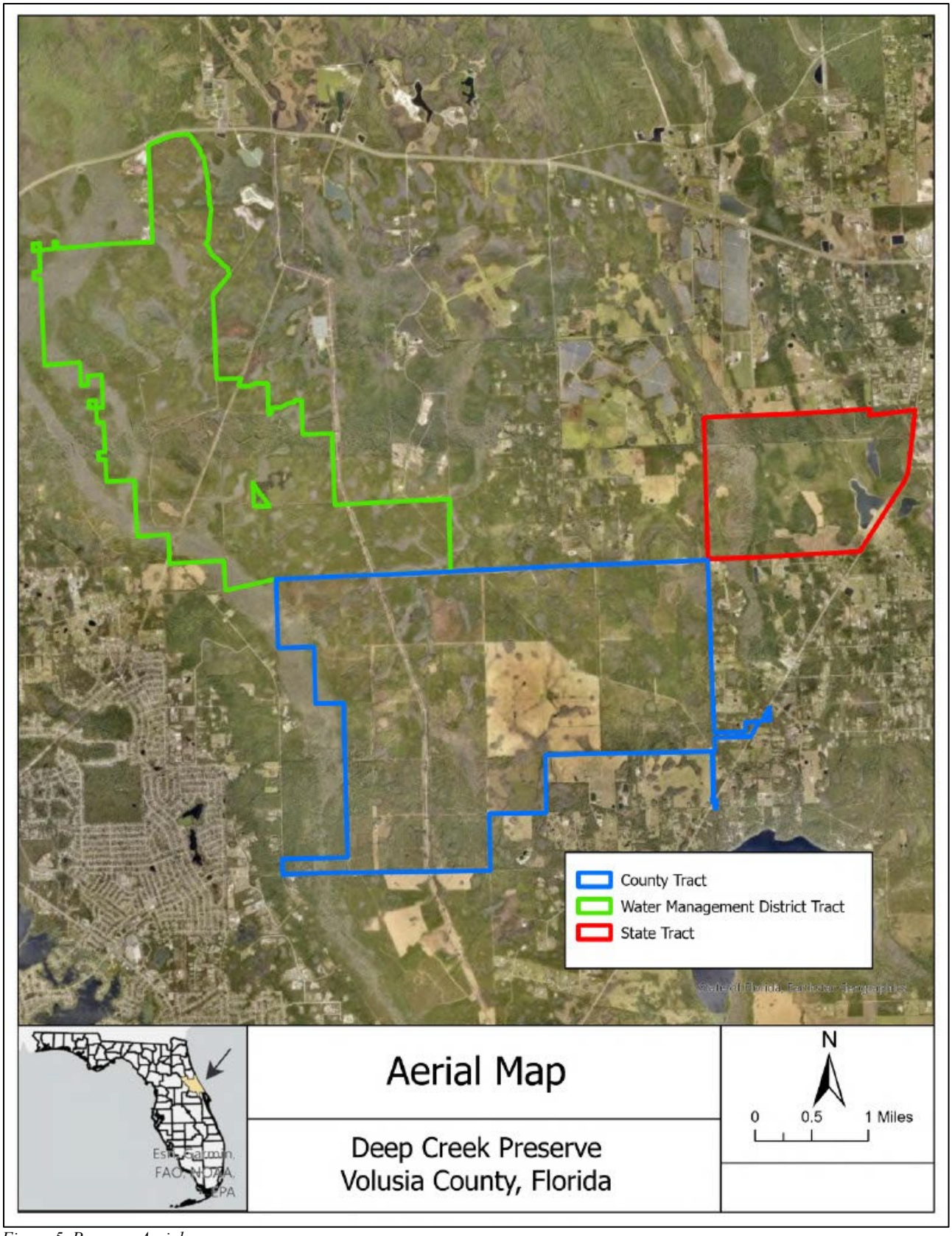


Figure 5. Preserve Aerial

1. Topography

Topographic relief across the Preserve is minimal, as is typical in this physiographic region. Elevations range from 24 NAVD in the basin and floodplain swamps to 50 feet NAVD in the northern central portion of the State Tract, representing the southern extent of the Volusia Ridge Sets region, a series of ridges and terraces resulting from ancient sea level fluctuations (Figure 6).

The Preserve is situated within the Deep Creek sub-basin of the middle St. Johns River basin. This sub-basin includes portions of southern Volusia and northeastern Seminole counties, covering approximately 274 square miles. Deep Creek, Lake Ashby Canal and Lake Ashby are waterbodies located on and near the Preserve that interact with waters coming from the Preserve and eventually discharging into Lake Harney and the St. John's River.

Portions of Deep Creek (the waterbody) are located within the County and WMD Tracts and are found along the western boundary of the Preserve. Significant segments of this watercourse, including those in the general vicinity of the Preserve, have previously been altered and channelized. This watercourse originates in the vast area of wetlands north of State Road 44, within and adjacent to Longleaf Pine Preserve. From its origins, it flows generally south and east and eventually empties into the St. Johns River, north of Lake Harney. Flows within the waterway typically fluctuate. During dry periods volume may be minimal and increase during wet periods or heavy rainfall.

In addition to seasonal variation, the natural surface hydrology of the Preserve is affected, to an undetermined degree, by the aforementioned systems of ditches (of varying depths) and roads established by the prior owners.

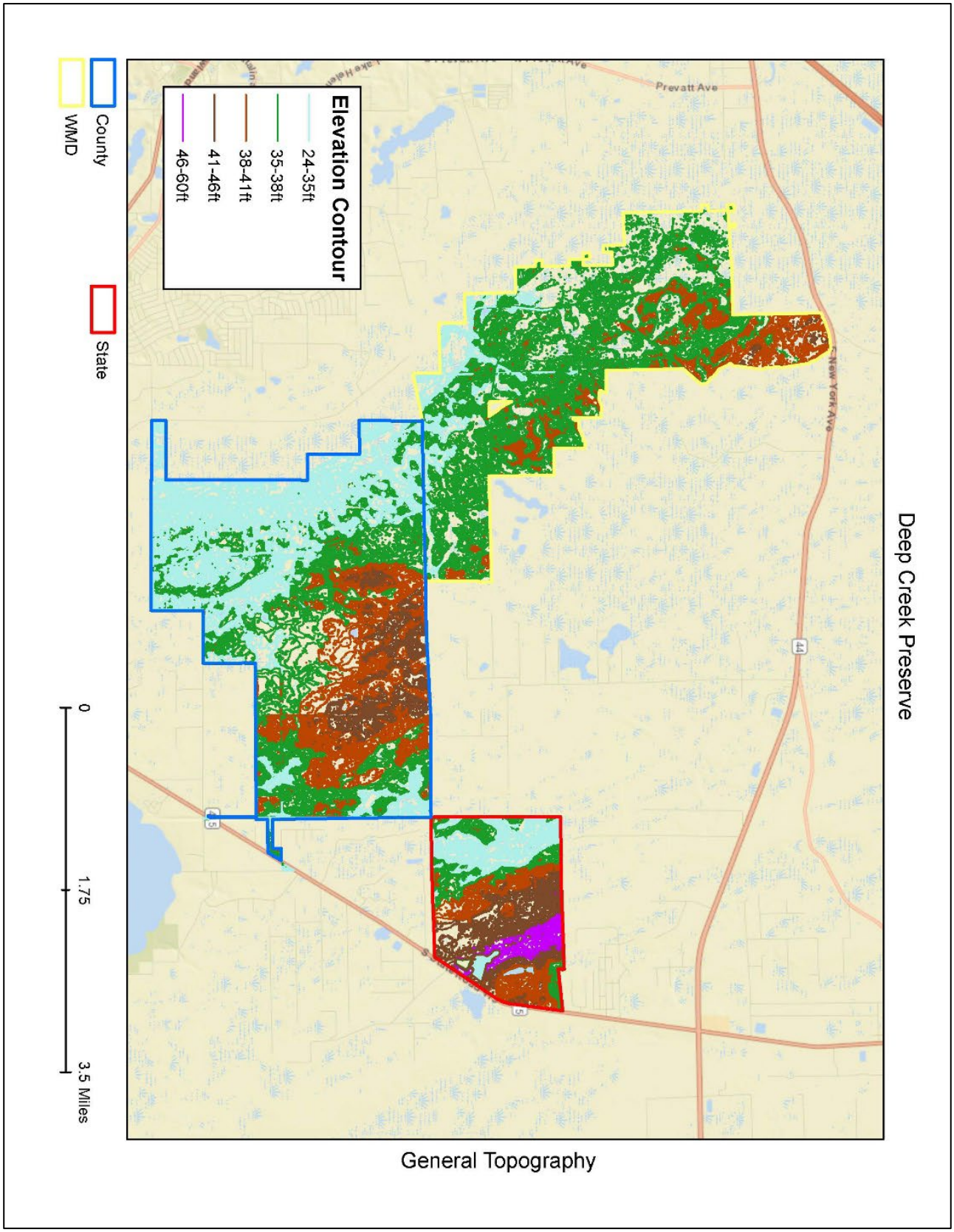


Figure 6. Topography Map

2. Soils

Specific soil map unit data were obtained from the United States Department of Agriculture (USDA) Soil Conservation Service Soil Survey of Volusia County (1980) (now the Natural Resource Conservation Service – NRCS). These soil map units, along with brief descriptions relating to natural communities and hydrology are listed in Table 1 below and displayed on the Soils Map (Figure 8). The categorization of soils as either *Hydric* or *Non-Hydric* was determined using the *Hydric Soils of Florida Handbook, 4th Edition*. Historic vegetation is per the Soil Survey of Volusia County (1980).

Soil map units provide insight into historic vegetation patterns, potential land uses, and appropriate plant selections for restoration areas. Revenue-generating mineral resources, such as oil, gas and phosphate, are not known to occur within the Preserve. However, mineral sands have been extracted from the State Tract, prior to State acquisition, which has resulted in the two reservoirs that now exist on that tract. Future mineral sands extraction is not considered a compatible use within the Preserve.

The dominant soil types in each of the three parcels as follows: the County Tract dominant soil types are Myakka-Myakka, Pomona fine sand and Wauchula fine sand soils, the WMD Tract dominant soil types are Tomoka muck, Wabasso-Wabasso and Wauchula fine sand soils, and the State Tract dominant soil types are Immokalee sand and Hontoon muck, frequently ponded, 0 to 1 percent slopes soils. This shows that the WMD and County Tracts are generally “wetter” overall and the State Tract has considerable hydrologic variation relative to the other two.

Table 1. Soil Types and Descriptions occurring within the Preserve

Soil Name and Map Symbol	Hydrologic Setting and Land Position	Seasonal High Water Table		Historic Vegetation	Hydric Status
		Depth (in)	Duration (mo)		
Basinger fine sand, frequently ponded, 0 to 1 percent slopes (8)	Poorly drained; nearly level	Above surface	4-7	St. John's wort. Maidencane, pond pine	Hydric
Daytona sand, 0 to 5 percent slopes (17)	Moderately well drained; nearly level to gently sloping	40-50	1-4	Sand pine, scrub oak, longleaf pine, rosemary, turkey oak, fetterbush, saw palmetto	Non-Hydric
EauGallie fine sand (20)	Poorly drained; nearly level	Within 10	1-4	Sand pine, longleaf pine, gallberry, wiregrass, saw palmetto	Hydric
Farmton fine sand (23)	Poorly drained; nearly level	Greater than 10	1-3	Saw pine, saw palmetto, runner oak, gallberry, fetterbush, waxmyrtle	Hydric
Hontoon muck, frequently ponded, 0 to 1 percent slopes (27)	Very poorly drained, nearly level	At or above the surface	6-9	Red maple, sweetgum, bald cypress, waxmyrtle, sawgrass, maidencane	Hydric
Immokalee sand (29)	Poorly drained; nearly level	Greater than 10	1-2	Slash pine, longleaf pine, saw palmetto, wiregrass, runner oak	Non-Hydric
Malabar fine sand (31)	Poorly drained; nearly level	Within 10	2-6	Cabbage palm, water oak, slash pine, laurel oak, waxmyrtle, gallberry, saw palmetto, fetterbush	Hydric
Myakka-Myakka, wet, fine sands, 0 to 2 percent slopes (32)	Poorly drained; nearly level	Less than 12	6	Slash pine, longleaf pine, saw palmetto, wiregrass	Non-Hydric
Myakka fine sand, frequently ponded, 0 to 1 percent slopes (33)	Very poorly drained; nearly level	Within 10	3-6	Slash pine, longleaf pine, saw palmetto, maidencane, wiregrass, pineland threeawn	Hydric

Soil Name and Map Symbol	Brief Soil Description	Seasonal High Water Table		Historic Vegetation	Hydric Status
		Depth (in)	Duration (mo)		
Myakka-St. Johns complex (34)	Very poorly drained; nearly level	10 above surface, to within 10	9	Bald cypress, pond pine, sweetgum, bay, slash pine, waxmyrtle, gallberry, St. John's wort, saw palmetto, maidencane	Hydric
Paisley fine sand, 0 to 1 percent slopes, rarely flooded (38)	Poorly drained; nearly level	10	2-6	Cabbage palm, live oak, slash pine, longleaf pine	Hydric
Pineda-Pineda, wet, fine sand, 0 to 2 percent slopes (45)	Poorly drained; nearly level	10	1-6	Longleaf pine, slash pine, saw palmetto, wiregrass, cabbage palm	
Pomona fine sand (49)	Poorly drained; nearly level	6 above surface to within 10	4-8	Slash pine, sweetgum, pond pine, gallberry, waxmyrtle, St. John's wort, fetterbush, saw palmetto, wiregrass	Hydric
Pomona fine sand, depressional, 0 to 2 percent slopes (50)	Very poorly drained; nearly level	6 above surface to within 10	4-8	Slash pine, sweetgum, pond pine, gallberry, waxmyrtle, St. John's wort, fetterbush, saw palmetto, wiregrass	Hydric
Pomona-St. Johns complex (51)	Very poorly drained; nearly level	10 above surface to within 10	9	Bald cypress, pond pine, sweetgum, slash pine, gallberry, St, John's wort, saw palmetto, waxmyrtle, maidencane	Hydric

Soil Name and Map Symbol	Brief Soil Description	Seasonal High Water Table		Historic Vegetation	Hydric Status
		Depth (in)	Duration (mo)		
Riviera fine sand (55)	Poorly drained; nearly level	Within 10	2-6	Cabbage palm, water oak, laurel oak, southern magnolia, slash pine, waxmyrtle, gallberry, fetterbush, maidencane	Hydric
Samsula muck, frequently ponded, 0 to 1 percent slopes (56)	Very poorly drained; nearly level	At or above surface	12	Red maple, cypress, sweetgum, cabbage palm, sedges	Hydric
Satellite sand, 0 to 2 percent slopes (57)	Somewhat poorly drained; nearly level	10-40	2-6	Longleaf pine, saw palmetto, scrub oak, sand pine	Non-Hydric
Scoggin sand (59)	Very poorly drained; nearly level	At or above surface	6	Slash pine, bald cypress, maidencane, gallberry, saw palmetto, wiregrass	Hydric
St. Johns fine sand (61)	Poorly drained; nearly level	Within 10	2-6	Pond pine, longleaf pine, slash pine, bay, saw palmetto, gallberry	Hydric
Smyrna-Smyrna, wet, fine sand, 0 to 2 percent slopes (60)	Very poorly drained; nearly level	Within 10	1-4	Slash pine, saw palmetto, running oak, wiregrass	Hydric
St. Lucie fine sand, 0 to 5 percent slopes (62)	Excessively drained; nearly level to moderately sloping	Greater than 72	12	Sand pine, sand live oak, saw palmetto, fetterbush, rosemary	Non-Hydric
Tequesta muck, frequently ponded, 0 to 1 percent slopes (64)	Very poorly drained; nearly level	Within 10	9	Red maple, bald cypress, sweet gum, cabbage palm, waxmyrtle, fetterbush, and gallberry, maidencane	Hydric
Tomoka muck, frequently ponded, 0 to 1 percent slopes (66)	Very poorly drained; nearly level	At or above the surface	6-9	Red maple, bald cypress, cordgrass	Hydric

Soil Name and Map Symbol	Brief Soil Description	Seasonal High Water Table		Historic Vegetation	Hydric Status
		Depth (in)	Duration (mo)		
Valkaria fine sand, 0 to 2 percent slopes (72)	Poorly drained; nearly level	At or above the surface	6	St. John's wort, waxmyrtle, wiregrass, slash pine, cabbage palm	Hydric
Wabasso-Wabasso, wet, fine sand, 0 to 2 percent slopes (73)	Poorly drained; nearly level	Within 10	1-4	Slash palm, cabbage palm, saw palmetto, gallberry, runner oak, fetterbush, maidencane, wiregrass	Hydric
Wauchula fine sand (75)	Poorly drained; nearly level	Within 10	1-4	Longleaf pine, slash pine, saw palmetto, gallberry, wiregrass	Non-Hydric
Winder fine sand, 0 to 2 percent slopes (77)	Poorly drained; nearly level	Within 10	2-6	Live oak, laurel oak, red maple, cabbage palm	Hydric

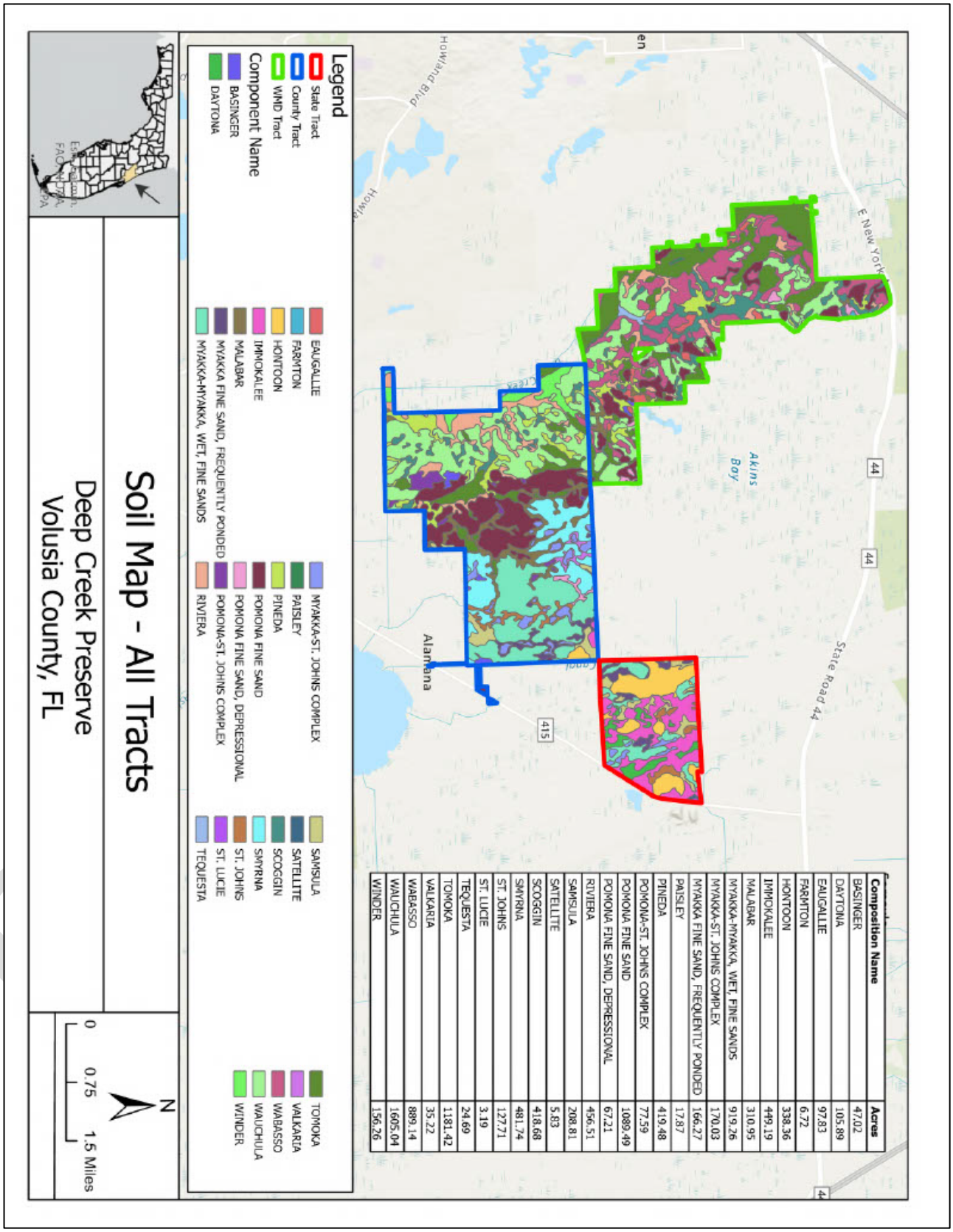


Figure 7. Overall Soils Map

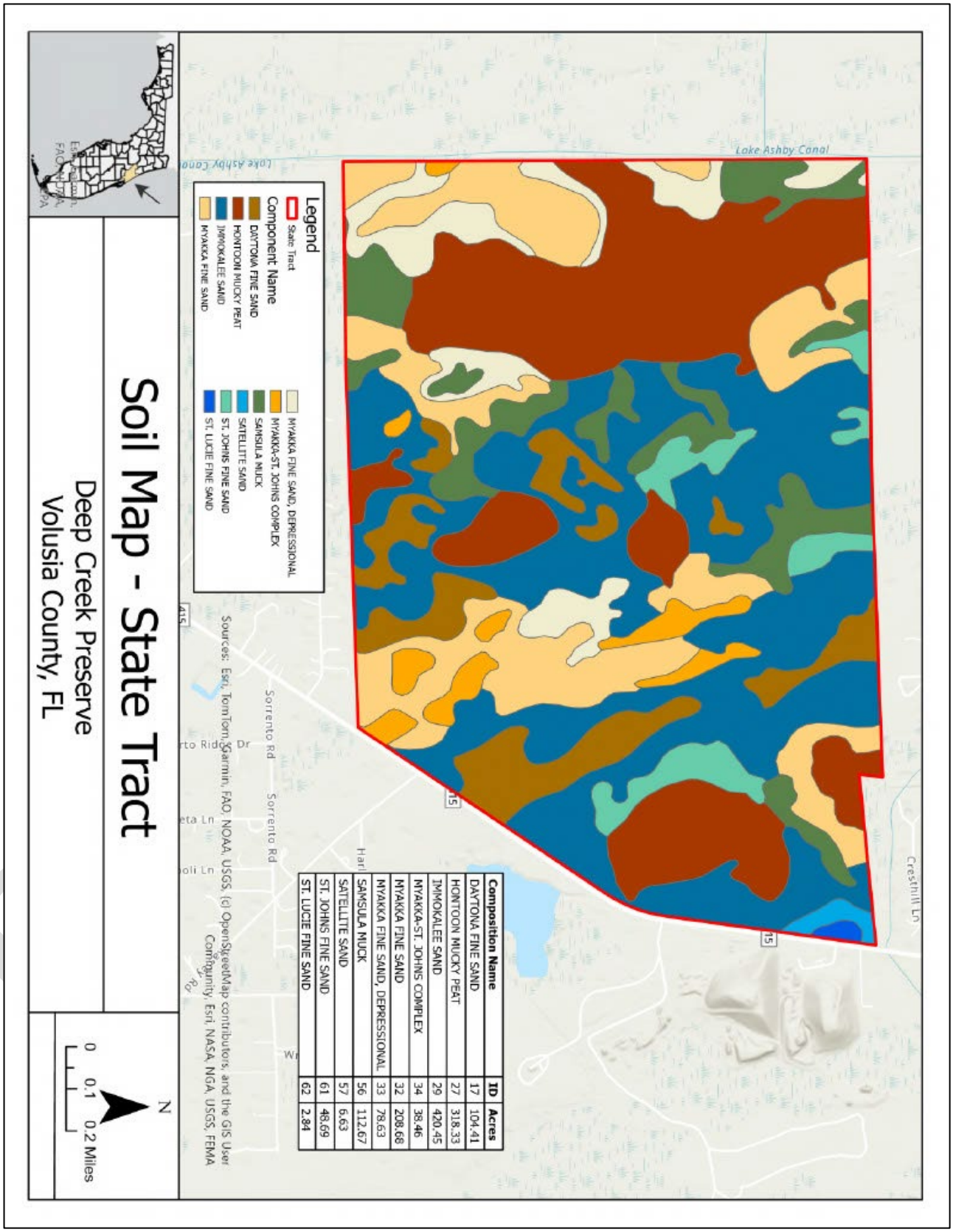


Figure 8. State Tract Soils Map

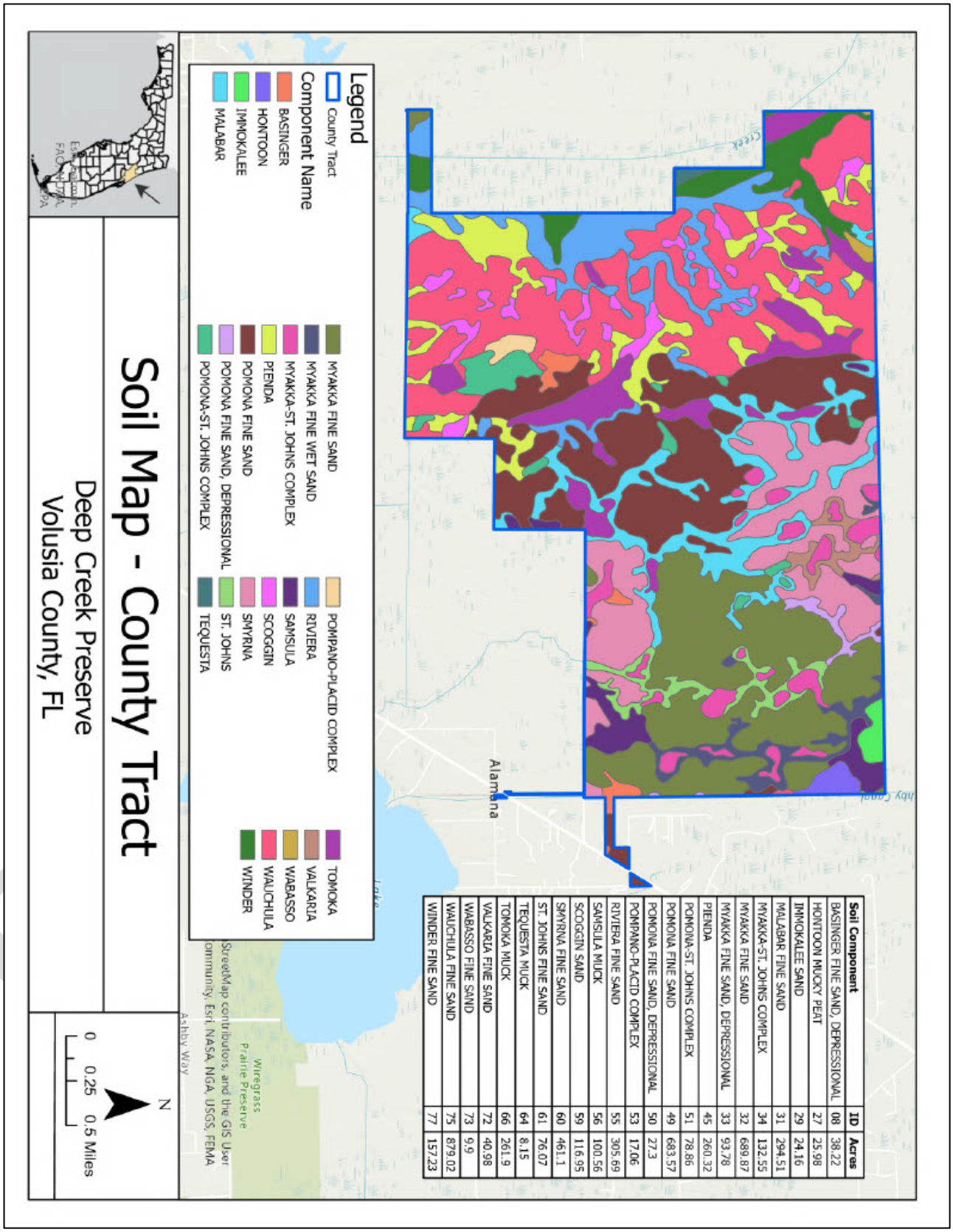
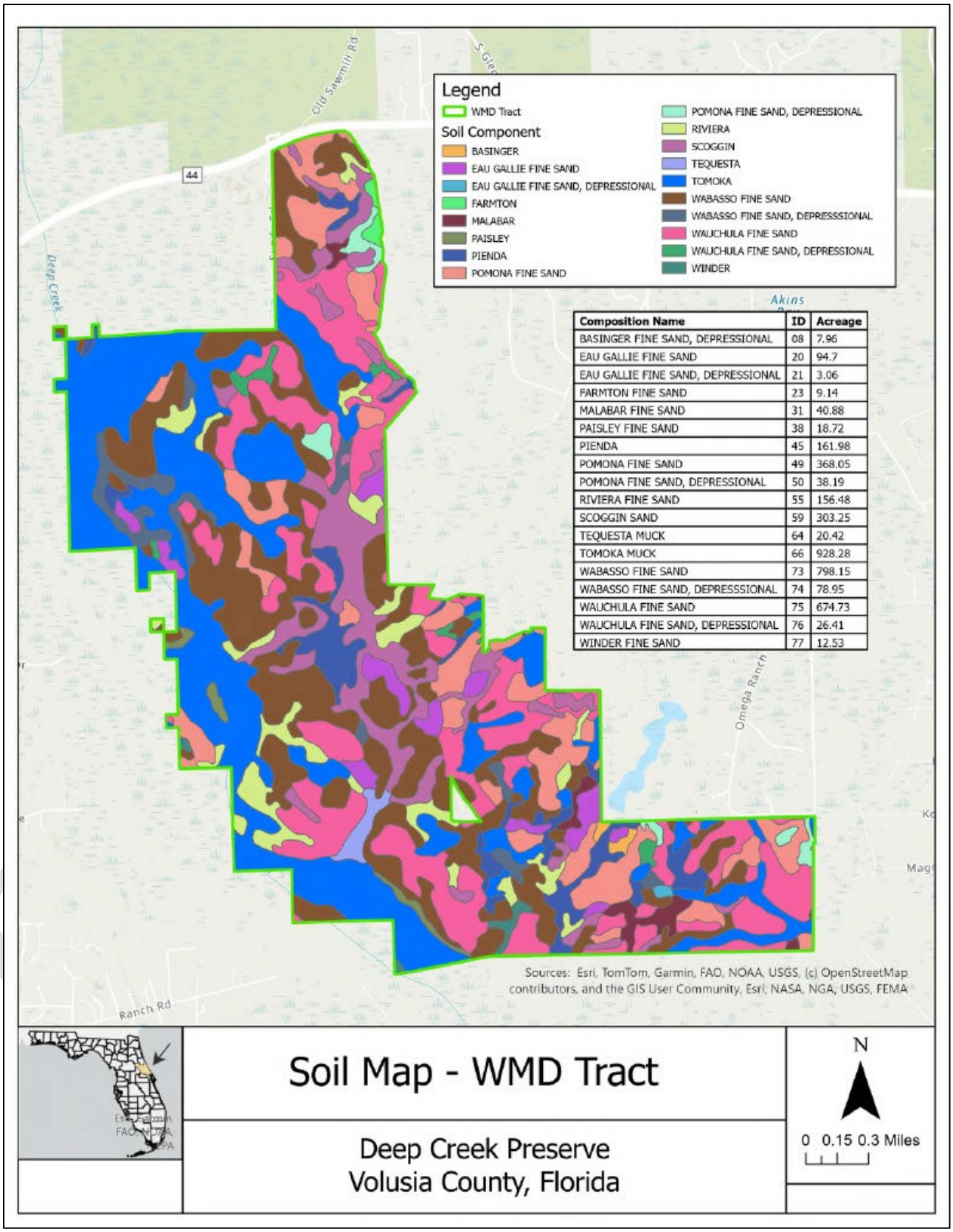


Figure 9. County Tract Soils Map



Composition Name	ID	Acreage
BASINGER FINE SAND, DEPRESSIONAL	08	7.96
EAU GALLIE FINE SAND	20	94.7
EAU GALLIE FINE SAND, DEPRESSIONAL	21	3.06
FARMTON FINE SAND	23	9.14
MALABAR FINE SAND	31	40.88
PAISLEY FINE SAND	38	18.72
PIENDA	45	161.98
POMONA FINE SAND	49	368.05
POMONA FINE SAND, DEPRESSIONAL	50	38.19
RIVIERA FINE SAND	55	156.48
SCOGGIN SAND	59	303.25
TEQUESTA MUCK	64	20.42
TOMOKA MUCK	66	928.28
WABASSO FINE SAND	73	798.15
WABASSO FINE SAND, DEPRESSSIONAL	74	78.95
WAUCHULA FINE SAND	75	674.73
WAUCHULA FINE SAND, DEPRESSIONAL	76	26.41
WINDER FINE SAND	77	12.53

Figure 10. WMD Tract Soils Map

B. Natural Communities

The system of classifying natural communities employed in this plan was developed in accordance with the Florida Natural Areas Inventory (FNAI) Guide to the Natural Communities of Florida – 2010 Edition. The premise of this system is that physical factors, such as climate, geology, soil, hydrology and fire frequency generally determine the species composition of an area, and that areas which are similar with respect to these factors will tend to have natural communities with similar species compositions.

Obvious differences in species composition can occur, despite similar physical conditions. In other instances, physical factors are substantially different, yet the species compositions are quite similar. An example of this in the Preserve is the distinction between baygall and wet flatwoods. In the State Tract, fire has been suppressed for decades, and as a result both baygall and wet flatwoods exhibit abundant loblolly bay in the canopy. However, baygall will typically only experience fire along its boundary when it is embedded within a pyrogenic community, whereas wet flatwoods require a frequent fire return interval to maintain proper species composition and habitat structure. In this example, the underlying soil map unit was utilized to establish the boundaries between these often-adjacent natural communities. Baygall is situated upon component hydric soils map units with a significant organic surface layer (e.g., Hontoon muck) while wet flatwoods are situated upon hydric soil map units lacking an organic surface layer (e.g., Myakka and St. Johns fine sands).

The Preserve contains fourteen (14) communities (Figure 12, below) including altered cover types. Preserve-specific assessments of the existing natural communities are provided in the narrative below and a summary of the communities and their relative cover and acreages is provided in Table 2 below. The descriptions below summarize the generalized condition of the community, followed by details of the specific community occurring within the Preserve. Details such as fire return intervals, timber thinning, and other specific restoration details are provided in separate plans within the Appendices.

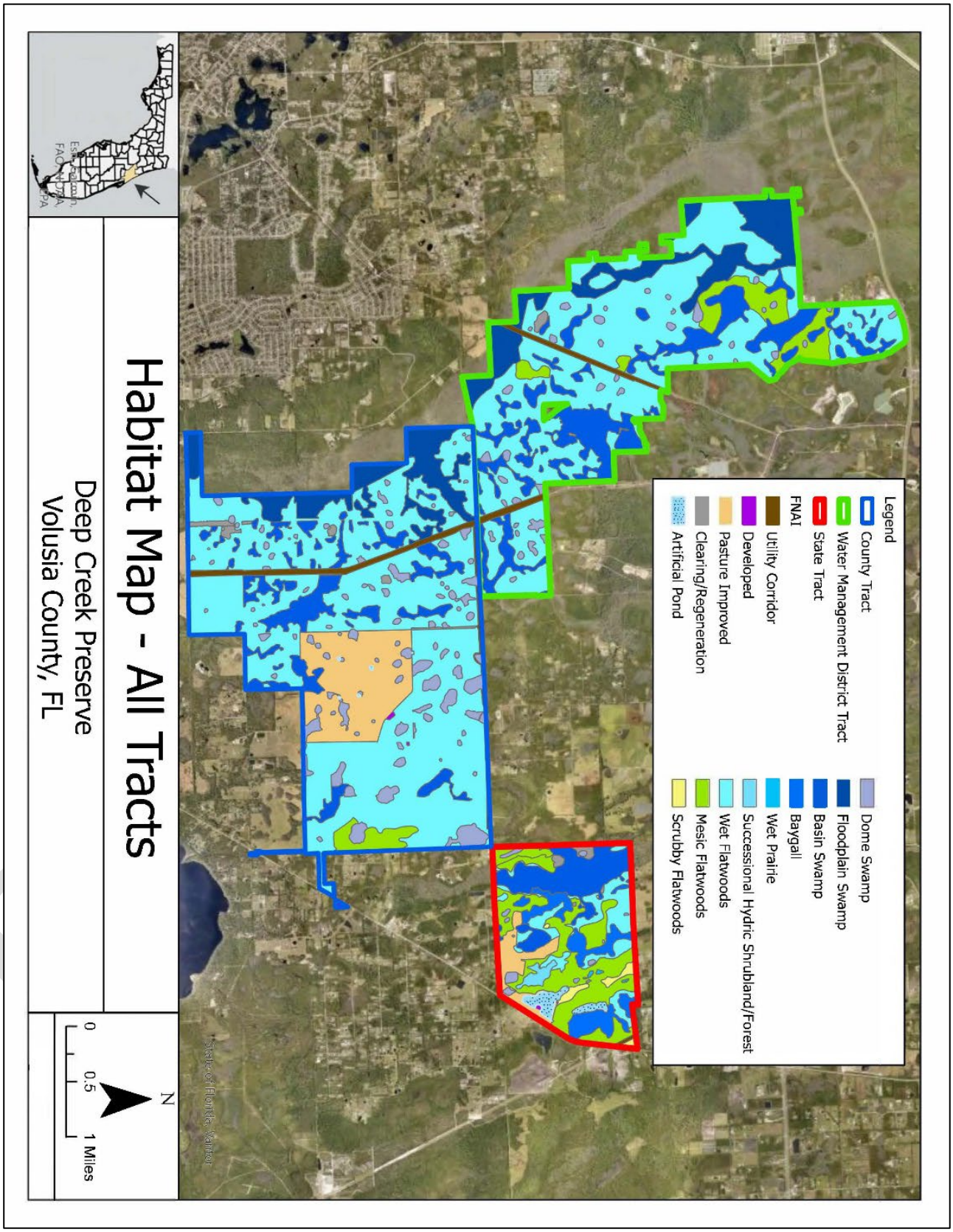


Figure 11. Overall Preserve Habitat Map

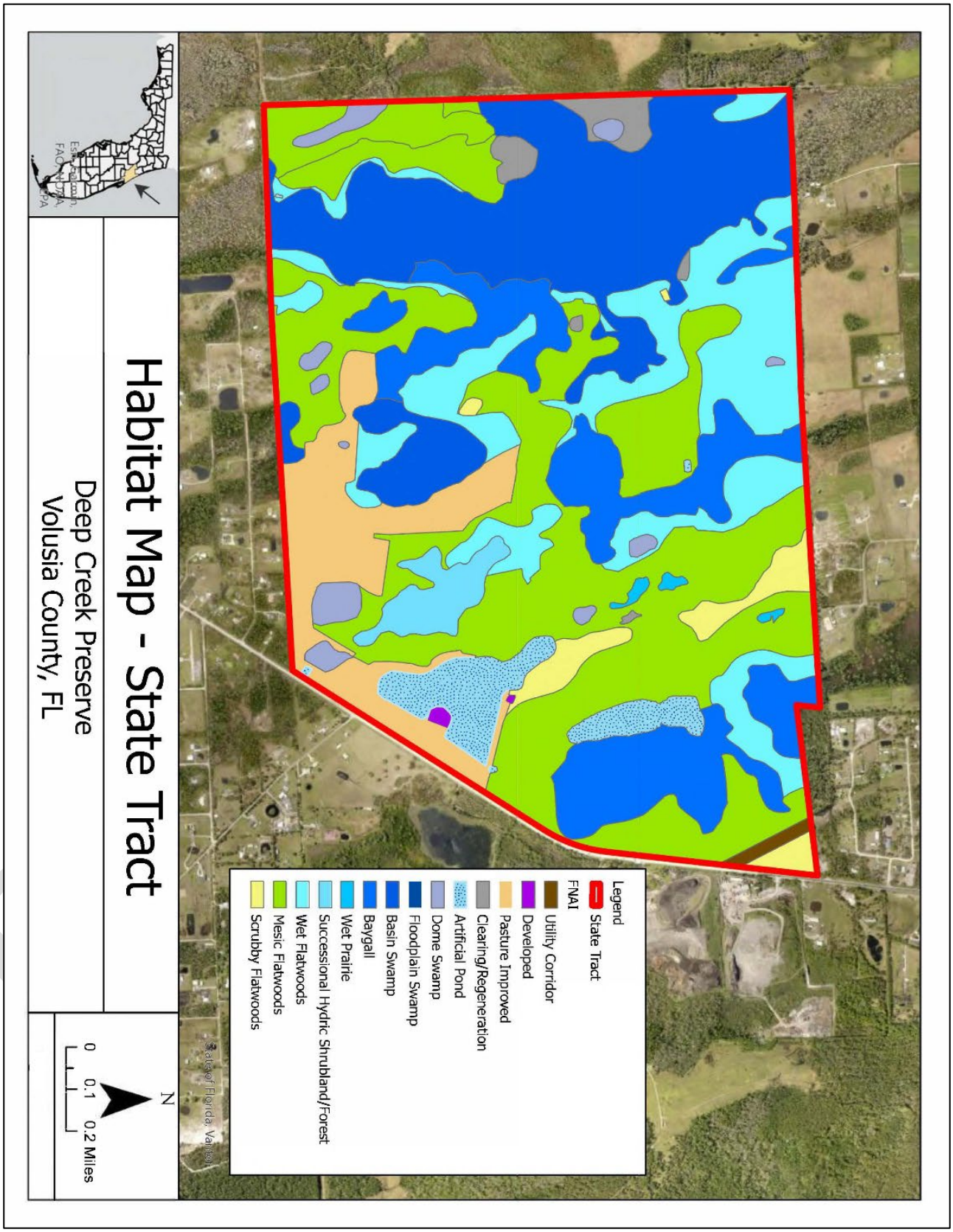


Figure 12. State Tract Habitat Map

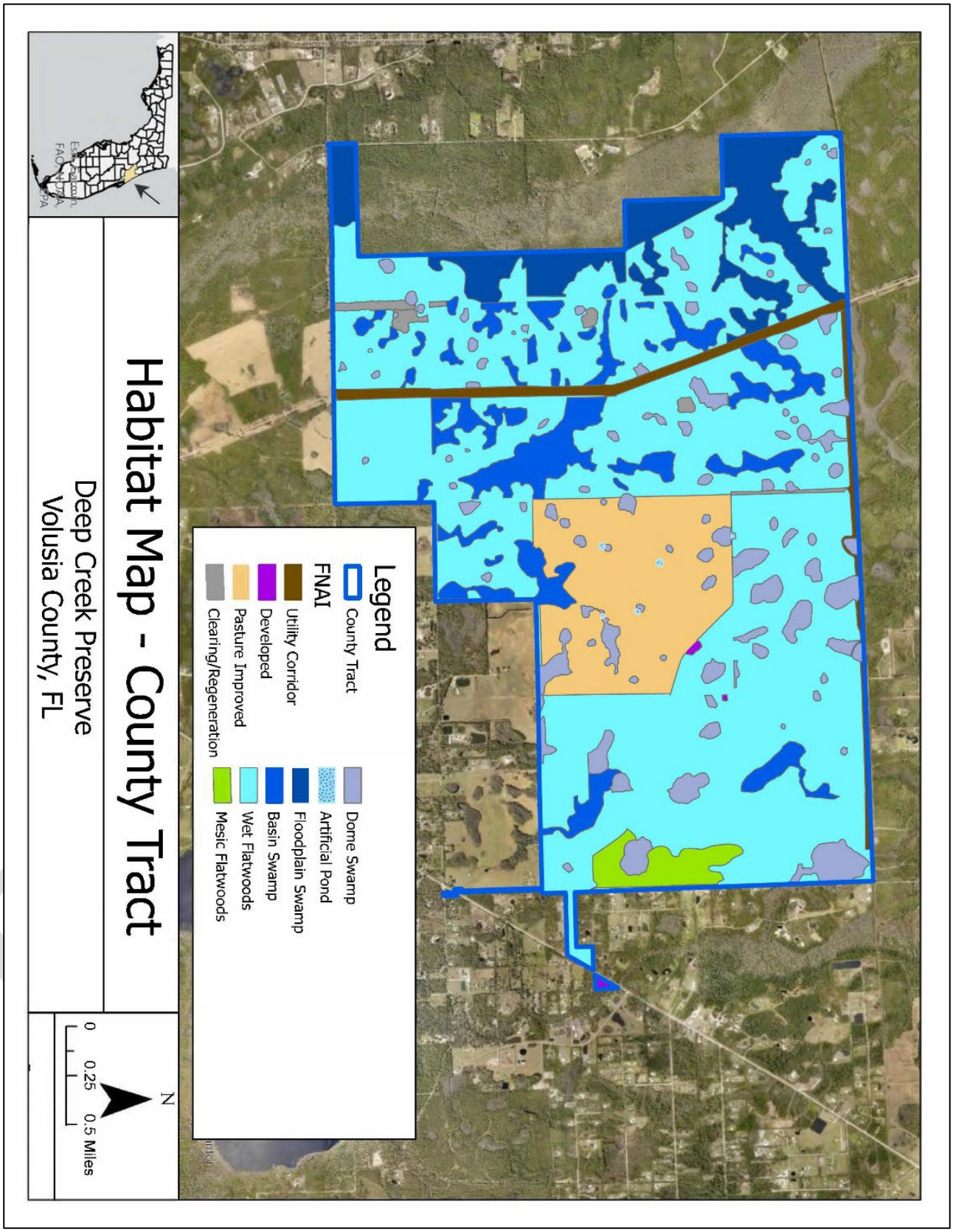


Figure 13. County Tract Habitat Map

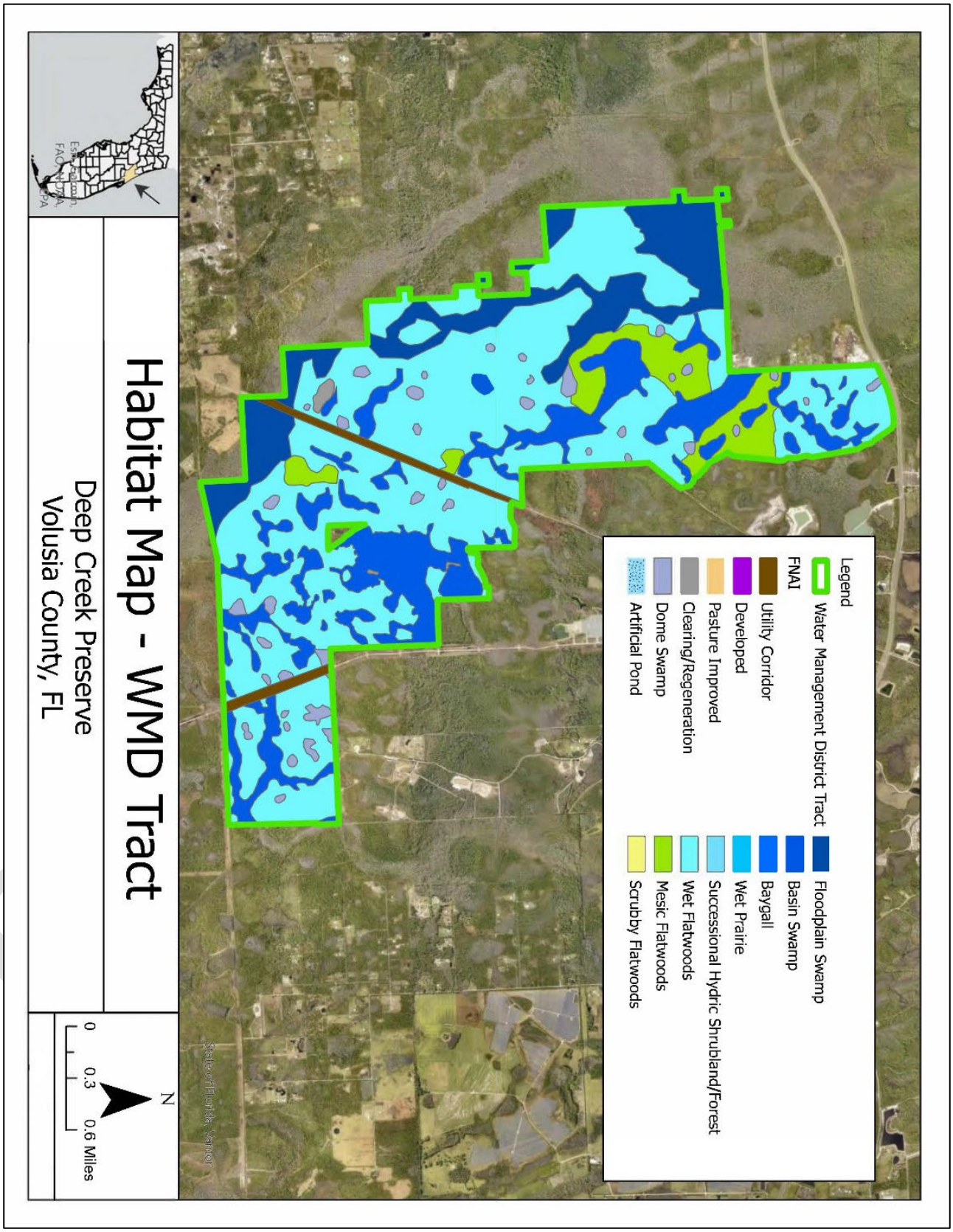


Figure 14. WMD Tract Habitat Map

The overall condition of the natural communities within the Preserve has been significantly influenced by prior management practices, including the planting of extensive areas of slash pine (*Pinus elliottii*), logging within the basin swamps, conversion to pasture, mineral (sand) extraction, fire suppression and various hydrologic alterations including drainage ditches and creek channelization. Pine plantations encompass a large percentage of the total area in flatwoods. The plantations within this portion of the Preserve generally range from 20 to 65 years in age, with the majority of the acreage being planted since 1980.

A significant portion of the Preserve was impacted by the regional wildfires of 1998, one of the most destructive wildfire seasons in Florida history. The fires burned extensively through the northern portion of the Preserve, encompassing what is now the WMD Tract, and resulted in the loss of a substantial amount of the existing timber stand. In the years following the fires, much of the affected acreage was replanted in slash pine plantation, with stands generally established within one to two years of the wildfire event. The legacy of the 1998 wildfires is still evident across the Preserve today in the form of these younger, more even-aged pine stands, and informs the restoration approach and fire management objectives described in this Plan.

Long-term ecological viability of the natural communities of the Preserve will require a combination of initial restoration and long-term land management strategies, including sustainable forestry practices, implementation of a prescribed fire program, invasive species treatments and hydrologic restoration and maintenance. The use of these various techniques and general program of implementation is described in the sections following the communities descriptions.

Wet flatwoods are the most abundant natural community, occupying multiple large areas throughout each tract, punctuated with more poorly drained areas occupied by other natural communities. Wet flatwoods are described in the application as containing mostly slash pine in the canopy, with some longleaf and some pond pine. The shrub and groundcover layers consist of nearly impenetrable thickets of saw palmetto, gallberry, blackberry and greenbrier in the shrub layer due to fire suppression. Flood plain swamps near the west edge of both the County and WMD Tracts extend from the north boundaries to the south boundaries, and smaller areas of basin swamps occur in the center of these tracts. The State Tract has basin swamps along the western border, extending from the northern to southern border, as well in the northeast corner of the Tract. Several relatively large swamps that appear to be baygalls based on aerial photography occur in a discontinuous band in the mesic flatwoods. Wet flatwoods are found at intergrades between mesic flatwoods or more disturbed uplands and adjacent wetlands. A dozen dome swamps less than an acre to 3 acres in size are found scattered throughout the property in flatwoods, pine plantation, and pasture.

Fingers of improved pasture extend between other landcover types from the southeast corner of the State Tract. Two large artificial ponds make up a substantial portion of the eastern third of the State Tract. Two smaller artificial ponds occur as well; these are near roads and may be borrow pits from road construction. One utility corridor crosses the property near the northeastern corner of the State Tract and is surrounded by scrubby flatwoods and disturbed areas that are likely to be successional hardwood forest resulting from fire exclusion of pyrogenic habitats. The other utility corridor on the State Tract runs from east to west along the southern border of the Tract.

Table 2. Preserve Land Cover and Associated Fire Return Interval

Land Cover Classification	State Tract (BOT)		County Tract (non-BOT)		WMD Tract (non-BOT)		Fire Return Interval (yrs) Per FNAI (2010)
	Acres	% Area	Acres	% Area	Acres	% Area	
Artificial Pond	46.9	3.5	2	0.04	--	--	-
Basin Swamp	273.6	20.4	434.6	9.1	753.4	20.1	-
Baygall	176.9	13.2	--	--	--	--	-
Clearing/Regeneration	19.2	1.4	33.8	0.7	10.4	0.3	TBD
Developed	1.5	0.1	5.8	0.1	--	--	-
Dome Swamp	23.4	1.7	313.7	6.6	91.3	2.4	3 - 5*
Floodplain Swamp	--	--	378.8	7.9	514.7	13.8	3 - 5*
Improved Pasture	108.3	8.1	506.8	10.6	--	--	-
Mesic Flatwoods	421.1	31.4	76.6	1.6	231.5	6.2	1 - 3
Scrubby Flatwoods	34.1	2.5	--	--	--	--	5 to 10**
Successional Hydric Forest	24.8	1.9	--	--	--	--	2-7
Utility Corridor	4.2	0.3	126.8	2.6	66.1	1.8	-
Wet Flatwoods	202.6	15.1	2910.3	60.8	2074	55.4	1 - 3
Wet Prairie	3.4	0.3	--	--	--	--	1 - 3
Total***	1,339.6	100	4789.2	100	3741.4	100	

* Along outer edge/ecotone, interior fire cycle may be as long as 100 to 150 years
** Along outer edge may be 3-5 years
*** Acres are GIS derived from parcel data and may not reflect survey acres

The natural communities described below are presented in the following order, the General FNAI Community Description, which describes the habitats according to the FNAI 2010 Guide, including the subsections within which they are described in the Guide, the Existing Site Conditions on the Preserve, which describes the current conditions, restoration needs, as well as restoration activities that have taken place for the habitats existing throughout the Preserve. The species listed in the generalized description of the community are limited to species occurring in the central peninsula.

PINE FLATWOODS AND DRY PRAIRIE

1. Wet Flatwoods

Figure 15. Wet flatwoods existing conditions

General FNAI Community Description:

Wet flatwoods are pine forests with a moderate to open canopy, sparse or absent midstory and a dense groundcover of hydrophytic grasses, herbs, and low shrubs.

The canopy typically consists of slash pine (*Pinus elliottii*), longleaf pine (*Pinus palustris*) and/or pond pine (*Pinus serotina*), though the latter is generally a component of a seepage slope forest. Historically, longleaf pine was the most common flatwoods canopy species throughout the southeastern U.S. Other species which may be present include cabbage palm (*Sabal palmetto*), sweetbay (*Magnolia virginiana*), loblolly bay (*Gordonia lasianthus*), dahoon (*Ilex cassine*), and pond cypress (*Taxodium ascendens*). Common shrub species include gallberry (*Ilex glabra*), wax myrtle (*Myrica cerifera*), and saw palmetto (*Serenoa repens*). Typical groundcover species include wiregrass *(Aristida stricta*), blue maidencane (*Amphicarpum muehlenbergianum*), various witch and panic grasses (*Dichanthelium* spp. and *Panicum* spp.), beaksedges (*Rhynchospora* spp.), various terrestrial orchids (*Calopogon*, *Platanthera, Spiranthes*) and numerous insectivorous species (*Sarracenia minor, Pinguicula* spp.,

Utricularia subulata).

Typically found on relatively poorly-drained, sandy soils lacking an organic surface horizon. They are generally situated in areas of minimal topographic relief, hence the name "flatwoods."

Fire return intervals are generally every 1 to 3 years. If the interval is too long, 7 to 10 years, it can lead to an increase in palmetto and woody species cover in the shrub layer, resulting in a decline in grasses and forb cover and diversity. Fire suppression increases the abundance of bay trees in the canopy and can create an organic surface layer. Many factors other than frequency of fire, such as season of fire, pre- and post-fire soil moistures, groundwater levels, weather, plant size or age at the time of fire, can greatly influence tree mortality and vegetation response to fire. Fire in the growing season can reduce the composition of woody vegetation, particularly hardwoods and prevent increases in shrub densities, as well as promote diversity and flowering of herbaceous groundcover.

Wet flatwoods often occur in the ecotones between mesic flatwoods and shrub bogs, wet prairies, dome swamps, or strand swamps. Wet flatwoods also occur in broad, low flatlands, often in a mosaic with these communities.

Existing Site Conditions on the Preserve

Wet flatwoods are found throughout the Preserve and are the most common habitat by acreage. Prior silvicultural practices, particularly artificial regeneration activities dominated by slash pine, have been conducted across much of the area encompassed by this community.

Under previous ownerships, these plantations were treated as industrial silviculture and highly stocked with offsite slash pine. In addition to the artificially high stocking rate, fire suppression has led to much of these areas consisting of nearly impenetrable thickets of saw palmetto, gallberry, blackberry and greenbrier in the shrub layer. Fire exclusion has also led to an artificially abundant cover of loblolly bay in the canopy, making it difficult to visually distinguish between wet flatwoods and baygalls in the field. Open patches do exist within the community, along with the commencement of restoration in the County Tract. In these areas, species such as wiregrass, redroot, St. John's worts, cinnamon fern, witch and panic grasses and hooded pitcher plants are present.

The need for restoration is significant, and the general exclusion of fire/disturbance has significantly impacted this community's structure and species composition. Restoration activities which may be employed include, but may not be limited to, harvesting, chopping, prescribed fire, and reforestation (which may include species other than slash pine). Examples of these efforts may include removal / harvesting of the loblolly bay, thinning and / or clear cutting of the slash pine (or other) canopy, restoring with longleaf pine where feasible. The prescribed fire practices will include such practices as mechanical fuel reduction, dormant season fires for continued fuel reduction, and eventually growing season prescribed fires. Note that the initial fire/mechanical disturbance interval will likely be 2-5 years until maintenance conditions are met to return to the targeted 1-3 year interval. The implementation of these practices is described in the forestry and prescribed fire operational plans, appended to this Plan.

Significant acreage of wet flatwoods restoration has commenced in the County Tract, including canopy thinning through timber sales, and dormant season fires for fuel reduction.

2. Mesic Flatwoods

Figure 16. Mesic flatwoods existing conditions

General FNAI Community Description:

Mesic flatwoods are generally characterized by an open canopy of tall pines and dense groundcover including shrubs, grasses, and forbs.

Historically this community's canopy was dominated by longleaf pine (*Pinus palustris*). Today the majority of mesic flatwoods found throughout central and northeastern Florida are dominated by dense stands of slash pine due to the pine silviculture industry and furthermore by prolonged periods of fire exclusion. Characteristic shrubs include saw palmetto (*Serenoa repens*), gallberry (*Ilex glabra*), and many species of Ericaceae such as fetterbush (*Lyonia fruticosa*), shiny lyonia (*Lyonia lucida*), shiny blueberry (*Vaccinium myrsinites*), Darrow's blueberry (*V. darrowii*), and dwarf huckleberry (*Gaylussacia dumosa*). Rhizomatous oaks (dwarf live oak (*Quercus minima*), runner oak (*Q. elliottii*)) are common and have the majority of their biomass underground, a common adaptation to frequent fire. The herbaceous layer is predominantly grasses, including wiregrass (*Aristida stricta*), dropseeds (*Sporobolus floridanus*), witch and panicgrasses (*Dichanthelium* and *Panicum* spp.), and broomsedges *(Andropogon* spp.), plus a large number of showy forbs.

As indicated by the name, mesic flatwoods sit between wet and xeric (scrubby) flatwoods and often

are underlain by a spodic horizon (hardpan). This hardpan is nearly impermeable which occasionally results in short-term ponding following heavy rains. The water is rapidly shed off the landscape so that hydric soils do not develop. In contrast, the soils become excessively dry during periods of drought. The soils in flatwoods are acidic and likely the reason for the abundance of species in the Ericaceae within this habitat.

Mesic flatwoods require frequent fire with fire return intervals of 1 to 3 years. Many of the species in this habitat are fire dependent. Longleaf pines have thick bark to protect them from fire, and their seeds need the mineral soil and open sunlight that fire provides to germinate. Longleaf pine during the grass stage is fire resistant. Several species require fire to reproduce. Wiregrass requires growing (lightning) season fire to produce viable seeds. The need for growing (lightning) season, frequent fire to control hardwoods, stimulate flowering in many flatwoods herbs and increase (or maintain) species richness and abundance. Fire return interval and seasonal variability are an important aspect of returning fire to these systems in the form of prescribed fire. Prescribed burns in mesic flatwoods also indirectly determine the fire frequency and season for all the adjacent natural communities. Statistics from lightning caused fires and numerous other studies show that most areas in Florida naturally burned at the beginning of the lightning season. The exclusion of fire in the twentieth century has significantly impacted this community throughout the southeastern U.S.

Mesic flatwoods is the most common habitat in Florida and lies on the broad, flat, sandy plains with little elevation change.

Existing Site Conditions on the Preserve

The canopy found within the mesic flatwoods within the Preserve is comprised primarily of slash pine; however, longleaf pine does occur throughout this habitat. Prior silvicultural practices, particularly artificial regeneration activities, have been conducted across much of the area encompassed by this community. Pine plantations represent the majority of total acreage of this community. These plantations are generally moderate to highly stocked and are typically characterized by a dense shrub stratum with species including gallberry, wax myrtle and saw palmetto. In openings within the shrub stratum, groundcover species includes wiregrass, bluestem, witch and panic grasses along with some woody species such as pawpaws (*Asimina* spp. *s.l.*) that often get crowded out in heavy shrub layers.

The need for restoration is significant, and the general exclusion of fire has significantly impacted this community's structure and species composition. Restoration activities which may be employed include, but may not be limited to, harvesting, chopping, prescribed fire, and artificial regeneration (which may include species other than slash pine). Examples of these efforts may include removal / harvesting of the loblolly bay, thinning and / or clear cutting of the slash pine canopy, and re-stocking with longleaf pine where feasible. The prescribed fire practices will include such practices as mechanical fuel reduction, dormant season fires for continued fuel reduction, and eventually growing season prescribed fires. Note that the initial fire/mechanical disturbance interval will likely be 2-5 years until maintenance conditions are met to return to the targeted 1-3 year interval. The implementation of these practices is described in the forestry and prescribed fire operational plans, appended to this Plan.

Significant acreage of mesic flatwoods restoration has commenced in the County and State Tracts, including, Longleaf pine restoration, canopy thinning through timber sales, dormant season fires for fuel reduction and roller chopping to reduce shrub layers and lower fuel heights. Some growing season

fires have occurred on the County Tract. The County will focus on disturbance (fire and mechanical) return intervals, rather than strictly considering fire along as the disturbance regime.

Figure 17. Mesic flatwoods post-restoration activities

Mesic flatwoods on the County and State Tracts, are known to be occupied by the federally endangered, Volusia endemic, Rugel's pawpaw (*Deeringothamnus rugelii*, syn. *Asimina rugelii*). This species is typically found in the Immokalee (29) soil map unit, though it is also found in similar sandy soils.

3. Scrubby Flatwoods

Figure 18. Scrubby flatwoods existing conditions

General FNAI Community Description:

Areas of open canopy of widely spaced pine trees and a low, shrubby understory dominated by scrub oaks and saw palmetto, often interspersed with areas of barren white sand.

Principal canopy species are longleaf pine (*Pinus palustris*) and slash pine (*P. elliottii*) in northern and Central Florida, and South Florida slash pine (*P. elliottii* var. *densa*) south of Lake Okeechobee. The shrub layer consists of one or more of the four scrub oaks, sand live oak (*Quercus geminata*), myrtle oak (*Q. myrtifolia*), Chapman's oak (*Q. chapmanii*), and scrub oak (*Q. inopina*), and typical shrubs of mesic flatwoods including saw palmetto (*Serenoa repens*), gallberry (*Ilex glabra*), rusty staggerbush (*Lyonia ferruginea*), fetterbush (*L. lucida*), coastalplain staggerbush *(L. fruticosa*), and deerberry (*Vaccinium stamineum*). The shrub layer of scrubby flatwoods is not solely comprised of oaks; grasses and dwarf shrubs make up a substantial portion of the cover. Grasses include wiregrass (*Aristida stricta*), broomsedge bluestem (*Andropogon virginicus*), and little bluestem (*Schizachyrium scoparium*); dwarf shrubs include dwarf live oak (*Quercus minima*), runner oak (*Q. elliottii*), dwarf huckleberry (*Gaylussacia dumosa*), gopher apple (*Licania michauxii*), and shiny blueberry (*Vaccinium myrsinites*). A variety of forbs, many typical of drier types of mesic flatwoods, are present including coastalplain honeycomb-head (*Balduina angustifolia*), narrowleaf silkgrass (*Pityopsis graminifolia*),

October flower (*Polygonella polygama*), and sweet goldenrod (*Solidago odora*).

Soils of scrubby flatwoods are moderately well-drained sands with or without a spodic horizon (hardpan). Examples of soil types include Pomello and Satellite sands.

The fire regime of scrubby flatwoods is intermediate between mesic flatwoods (very frequent) to scrub (less frequent) with a wide-ranging fire return interval. The fire return interval may be as frequent as 1-3 years along an edge bordering mesic flatwoods, and much less frequent across the entire habitat (5-10 years). Fire intensity follows the return interval, with lower, less intense fires along the edge and higher, more intense fires across the entire habitat.

Scrubby flatwoods occur on slight rises within mesic flatwoods and in transitional areas between scrub and mesic flatwoods.

Existing Site Conditions on the Preserve

This habitat occurs only on the State Tract and is limited to relatively small pockets embedded within the mesic flatwoods. Many of these occur on typically mesic flatwoods soil types (e.g., Immokalee). Only one xeric soil type (Daytona sand) occurs on the Preserve and is occupied by scrubby flatwoods on the State Tract. This is an area that should be evaluated for a potential gopher tortoise recipient site.

The canopy is moderate in cover, and consists primarily of slash pine, along with some sand pine and longleaf pine. The sub-canopy/ shrub layer consists of sand live oak, myrtle oak, Chapman's oak, rusty lyonia and saw palmetto. The shrub layer is patchy and dense, interspersed with open sandy patches.

The primary restoration need in the scrubby flatwoods is for fuel reduction in the shrub layer to allow the introduction of prescribed fire. Some areas will require canopy and subcanopy thinning as well. The portion of scrubby flatwoods located adjacent to SR 415 presents challenges for prescribed fire and will likely receive mechanical disturbances more than fire as a disturbance event.

FRESHWATER NON-FORESTED WETLANDS

4. Wet Prairie

Figure 19. Wet prairie existing conditions

General FNAI Community Description:

Wet prairie is an herbaceous community found on continuously wet, but not inundated, soils on somewhat flat or gentle slopes between lower lying depression marshes, shrub bogs, or dome swamps and slightly higher wet or mesic flatwoods, or dry prairie.

It is typically dominated by dense wiregrass (*Aristida stricta*) in the drier portions, along with foxtail club-moss (*Lycopodiella alopecuroides*), cutover muhly (*Muhlenbergia expansa*), yellow butterwort (*Pinguicula lutea*), and savannah meadowbeauty (*Rhexia alifanus*). In the wetter portions, wiregrass may occur with, or be replaced by, species in the sedge family, such as plumed beaksedge (*Rhynchospora plumosa*), featherbristle beaksedge (*R. oligantha*), Baldwin's nutrush (*Scleria baldwinii*), or slenderfruit nutrush (*S. georgiana*), plus longleaved threeawn (*Aristida palustris*). Also common in wetter areas are carnivorous species, such as pitcher plants (*Sarracenia* spp.), sundews (*Drosera* spp.), butterworts (*Pinguicula* spp.), and bladderworts (*Utricularia spp*.). Other characteristic species in this community include toothache grass (*Ctenium aromaticum*), pineland rayless goldenrod (*Bigelowia nudata*), flattened pipewort (*Eriocaulon compressum*), water cowbane (*Tiedemannia*

filiformis), and coastalplain yellow-eyed grass (*Xyris ambigua*).

Wet prairie usually occurs on acidic, nutrient-deficient, saturated soils. Soil series associated with wet prairies in the Panhandle include Plummer fine sands, Rutledge sandy loams, and Bladen sandy loams with clay subsoils. In the Florida peninsula, wet prairies, including those dominated by cutthroat grass, are often found on poorly drained Basinger fine sands. Calcareous wet prairies are found in Central and south-central Florida on circum-neutral Felda or Wabasso fine sands with sandy loam subsoil.

Natural fires likely entered wet prairie from surrounding pinelands and burned through them when they were dry enough to carry fire. Estimated natural fire return is an interval of 2-3 years where wet prairie vegetation is adjacent to mesic/wet flatwoods or sandhill in the Apalachicola National Forest. A similar fire interval was also determined for mesic flatwoods near the Panhandle coast from an analysis of fire scars on pine stumps. In the absence of fire, shrubs and trees invade wet prairie and shade out the light-loving herbaceous species. A further indication of their dependence on fire is the requirement for fire to stimulate flowering in many wet prairie herbs, including two of the dominant grasses, wiregrass and cutthroat grass.

Wet prairie occurs throughout Florida except for extreme South Florida where limestone soils predominate. Outside Florida, wet prairies (also known as pitcher plant bogs) are found in the southeastern coastal plain from eastern Texas to North Carolina. Wet prairies in the Panhandle are closest floristically to other areas in the East Gulf Coastal Plain, i.e. pitcher plant bogs in Mississippi, Alabama, and southwestern Georgia.

Existing Site Conditions on the Preserve

This habitat occurs exclusively on the north and central portions of the State Tract and northeast of the out parcel within the WMD Tract and is limited to relatively small pockets embedded within the mesic and wet flatwoods. Many of these occur on typically mesic flatwoods soil types (e.g., Immokalee). These communities may be artificially created but function as wet prairies.

The sub-canopy/ shrub layer consists of some slash pine regeneration. The groundcover layer consists of purple bluestem (*Andropogon glaucopsis*), giant plumegrass (*Saccharum giganteum*), and *Ludwigia repens*.

The wet prairies are in relatively good ecological condition and do not require any specific restoration activities. Application of prescribed fire will be a necessary management tool and will likely increase the biodiversity within the system. The fire return intervals of the wet prairies are a direct factor of the fire return intervals of the community within which the prairie is embedded.

The primary restoration need of the wet prairie community is the reintroduction of fire, which will be accomplished through prescribed burning of the pyrogenic communities within which the prairies are embedded.

FRESHWATER FORESTED WETLANDS

5. Dome Swamp

Figure 20. Dome swamp existing conditions

General FNAI Community Description:

Dome swamp is an isolated, forested, depression wetland occurring within a fire-maintained community such as mesic flatwoods. These swamps are generally small, but may also be large and shallow. The characteristic dome shape is created by smaller trees that grow in the shallower waters of the outer edge, while taller trees grow in the deeper water in the interior of the swamp.

Pond cypress (*Taxodium ascendens*) often dominates, but swamp tupelo (*Nyssa biflora*), may also form pure stands or occur as a co-dominant. Other canopy or subcanopy species include red maple (*Acer rubrum*), dahoon (*Ilex cassine*), swamp bay (*Persea palustris*), slash pine (*Pinus elliottii*), sweetbay (*Magnolia virginiana*), loblolly bay (*Gordonia lasianthus*), and, in South Florida, coco plum (*Chrysobalanus icaco*) and pond apple (*Annona glabra*). Shrubs are typically sparse to moderate, but often are absent in dome swamps with a high fire frequency or dense in swamps where fire has long been absent. Shrubs common in dome swamps include Virginia willow (*Itea virginica*), fetterbush (*Lyonia lucida*), common buttonbush (*Cephalanthus occidentalis*), coastalplain willow (*Salix caroliniana*), wax myrtle (*Myrica cerifera*), titi (*Cyrilla racemiflora*), and St. John's wort (*Hypericum*

spp.). Herbaceous species can be dense or absent and include a wide variety of ferns, graminoids, and herbs including Virginia chain fern (*Woodwardia virginica*), royal fern (*Osmunda spectabilis*), cinnamon fern (*Osmunda cinnamomea*), toothed midsorus fern (*Blechnum serrulatum*), maidencane (*Panicum hemitomon*), sawgrass (*Cladium jamaicense*), various species of beaksedge (*Rhynchospora* spp.), lizard's tail (*Saururus cernuus*), Carolina redroot (*Lachnanthes caroliana*), taperleaf waterhorehound (*Lycopus rubellus*), false nettle (*Boehmeria cylindrica*), and knotweeds (*Polygonum* spp.). Sphagnum moss (*Sphagnum* spp.) often occurs in patches where the soil is saturated but not flooded. Vines such as eastern poison ivy (*Toxicodendron radicans*), white twinevine (*Sarcostemma clausum*), laurel greenbrier (*Smilax laurifolia*), epiphytes such as Spanish moss (*Tillandsia usneoides*), several species of wild pine (*Tillandsia* spp.), and orchids can be common in dome swamps. The center of the dome swamp contains the largest cypress trees and the understory can be open with deeper water and floating and emergent species such as alligatorflag (*Thalia geniculata*), big floatingheart (*Nymphoides aquatica*), floating water spangles (*Salvinia minima*), duckweeds (*Lemna*, *Spirodela*, and/or *Landoltia*), and bulltongue arrowhead (*Sagittaria lancifolia*).

Dome swamps are most often found on flat terraces, where they develop when the overlying sand has slumped into a depression in the underlying limestone, creating a rounded depression connected to a shallow water table. In uplands with clay subsoils, dome swamps may occupy depressions over a perched water table. Soils in dome swamps are variable but are most often composed of a layer of peat, which may be thin or absent at the periphery, becoming thicker toward the center of the dome. This peat layer is generally underlain with acidic sands or marl and then limestone or a clay lens. In South Florida, dome swamps also occur on peat directly overlying limestone. Common soil types include Bladen, Coxville, and Bayboro.

Fire is essential for maintaining the structure and the species composition of a dome swamp community. Without periodic fires cypress may become less dominant as hardwood or bay canopy species increase and peat accumulates. Cypress have fairly thick, fire-resistant bark and are tolerant of light surface fires, but catastrophic fires burning into the peat can kill cypress trees, especially when fire has long been absent. The consumption of muck fuels from such a catastrophic wildfire can lower the ground surface and transform a dome swamp into a pond, wet prairie, or shrub bog. Fire frequency is generally greatest at the periphery of the dome and least in the interior, where long hydroperiods and deeper peat, and/or water, maintain high moisture levels. The normal fire cycle might be as short as three to five years along the outer edge and as long as 100 to 150 years towards the center. The domed profile of these swamps may be partly attributable to this frequent, peripheral fire regime. Fire in a long-unburned dome swamp may result in higher cypress mortality in the center of the dome where fire burns through a deeper layer of accumulated peat and kills the cypress roots. Emergent marshes can develop in the center of such dome swamps.

Dome swamps are most common in Central Florida but occur throughout the state, except in the Florida Keys. Similar cypress swamps in shallow depressions also occur throughout the southeastern coastal plain.

<u>Existing Site Conditions on the Preserve</u>

This habitat occurs throughout all three tracts and occurs mostly within wet flatwoods and basin swamps. Many of these occur on typically hydric soil types (e.g., Pineda-Pineda, Myakka-St. Johns complex).

The canopy is moderate in cover and consists primarily of pond cypress (*Taxodium ascendens*), loblolly bay (*Gordonia lasianthus*) along with some mixed pine. The sub-canopy/ shrub layer consists of dahoon holly (*Ilex cassine*) and loblolly bay (*Gordonia lasianthus*). The groundcover layer consists of Virginia chain fern (*Woodwardia virginica*), purple bluestem (*Andropogon glaucopsis*), Sphagnum moss (*Sphagnum* spp.).

The primary restoration need in the dome swamps is the recovery of the ecotone that should occur at the interface between the dome swamp and the community within which it is embedded. Fuel reduction, canopy thinning and introduction of prescribed fire are key in restoring these ecotonal edges. Fire breaks should be placed outside of the ecotone to allow fire to enter the edges of the dome swamp and naturally extinguish as it enters the wetter, interior portions.

No restoration activities have occurred within the dome swamps. Some of the dome swamps may have been harvested for cypress, but natural regeneration is apparent and supplemental planting is not necessary.

6. Basin Swamp

Figure 21. Basin swamp existing conditions

General FNAI Community Description:

Basin swamp is a basin wetland vegetated with hydrophytic trees and shrubs that can withstand an extended hydroperiod. Basin swamps are highly variable in size, shape, and species composition.

While mixed species canopies are common, the dominant trees are pond cypress (*Taxodium ascendens*) and swamp tupelo (*Nyssa biflora*). Other typical canopy and subcanopy trees include slash pine (*Pinus elliottii*), red maple (*Acer rubrum*), dahoon (*Ilex cassine*), swamp bay (*Persea palustris*), sweetbay (*Magnolia virginiana*), loblolly bay (*Gordonia lasianthus*), swamp laurel oak (*Quercus laurifolia*), sweetgum (*Liquidambar styraciflua*), water oak (*Quercus nigra*), green ash (*Fraxinus pennsylvanica*), American hornbeam (*Carpinus caroliniana*), and American elm (*Ulmus americana*). Depending on the hydrology and fire history, shrubs may be found throughout a basin swamp or they may be concentrated around the perimeter. Common species include Virginia willow (*Itea virginica*), swamp dogwood (*Cornus foemina*), swamp doghobble (*Leucothoe racemosa*), coastal sweetpepperbush (*Clethra alnifolia*), myrtle dahoon (*Ilex cassine* var. *myrtifolia*), fetterbush (*Lyonia lucida*), wax myrtle (*Myrica cerifera*), titi (*Cyrilla racemiflora*), black titi (*Cliftonia monophylla*), and common buttonbush (*Cephalanthus occidentalis*). The herbaceous layer is also variable and includes a wide array of species including maidencane (*Hymenachne hemitomon*), Virginia chain fern (*Woodwardia virginica*),

arrowheads (*Sagittaria* spp.), lizard's tail (*Saururus cernuus*), false nettle (*Boehmeria cylindrica*), beaksedges (*Rhynchospora* spp.), bladderworts (*Utricularia* spp.), and royal fern (*Osmunda spectabilis*). Sphagnum moss (*Sphagnum* spp.) often occurs in patches where the soil is saturated but not flooded. Vines may be present, particularly coral greenbrier (*Smilax walteri*), laurel greenbrier (*Smilax laurifolia*), and eastern poison ivy (*Toxicodendron radicans*). Epiphytic species such as resurrection fern (*Pleopeltis michauxiana*), Spanish moss (*Tillandsia usneoides*), and Bartram's air-plant (*Tillandsia bartramii*) are common, especially in older, more mature examples of basin swamp.

This natural community typically occurs in any type of large landscape depression such as old lake beds or river basins, or ancient coastal swales and lagoons that existed during higher sea levels. Basin swamps exist around lakes and are sometimes headwater sources for major rivers, such as the Suwannee. Soils are generally acidic, nutrient-poor peats often overlying a clay lens or other impervious layer.

Fire intervals are variable and depend on such factors as dominant vegetation, fire exposure, and drought. The interior of basin swamps may go without fire for decades or even centuries while the exposed outer edges can be more susceptible to frequent fire. Basin swamps that are situated within the matrix of a pyrogenic community, such as mesic flatwoods, will likely burn more frequently than basin swamps positioned within a matrix of mesic or hydric hammock. Without fire, bays and hardwoods increase in density and peat accumulates more rapidly. Cypress and pines are tolerant of light surface fires, but muck fires burning into the peat can kill the trees, lower the ground surface, and transform a swamp into a pond, lake, marsh, or shrub bog.

Basin swamps occur throughout the Florida Panhandle and peninsula south to the Lake Okeechobee area. Similar cypress swamps also occur in large basins throughout the southeastern coastal plain.

Existing Site Conditions on the Preserve

This habitat occurs throughout all three tracts and occurs mostly adjacent to wet flatwoods and dome swamps. Many of these occur on typically hydric soil types (e.g., Samsula muck, Hontoon muck).

The canopy is generally closed and consists primarily of bald cypress (*Taxodium distichum*), swamp tupelo (*Nyssa biflora*), red maple (*Acer rubrum*), and slash pine (*Pinus elliottii*) on hummocks. The sub-canopy/ shrub layer consists of bald cypress (*Taxodium distichum*), swamp tupelo (*Nyssa biflora*), red maple (*Acer rubrum*), and sweetgum (*Liquidambar styraciflua*). The groundcover layer consists of royal fern (*Osmunda spectabilis*), cinnamon fern (*Osmunda cinnamomea*), and fall panicgrass (*Panicum dichotomum)*.

Limited restoration is required within the basin swamps. The primary adverse effects that result from human disturbances are related to hydrology and non-native, invasive species. The County will be evaluating potential hydrological impacts and restoration. Invasive species management is already employed throughout the Preserve. Prescribed fire is not a management tool to be utilized in the basin swamps, other than within the ecotonal boundary between the swamp and an adjacent pyrogenic community.

No hydrologic restoration projects have occurred within the basin swamps. Invasive species treatments have occurred.

7. Floodplain Swamp

General FNAI Community Description:

Floodplain swamp is a closed-canopy forest of hydrophytic trees occurring on frequently or permanently flooded hydric soils adjacent to stream and river channels and in depressions and oxbows within floodplains. Trees are often buttressed, and the understory and groundcover are sparse.

The canopy is sometimes a pure stand of bald cypress (*Taxodium distichum*), but more commonly bald cypress shares dominance with one or more of the following tupelo species: water tupelo *(Nyssa aquatica*), swamp tupelo (*N. biflora*), or ogeechee tupelo (*N. ogeche*). The "knees" arising from the root systems of both cypress and tupelo are common features in floodplain swamp. Other canopy trees capable of withstanding frequent inundation may be present but rarely dominant, including water hickory (*Carya aquatica*), overcup oak (*Quercus lyrata*), red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*), American elm (*Ulmus americana*), and swamp laurel oak (*Q. laurifolia*). Pond cypress (*T. ascendens*) is sometimes present in backswamps and depressions of the more hydrologically isolated areas of the floodplain. Floodplain swamp can often occur within a complex mixture of communities including alluvial forest, bottomland forest, and baygall. This produces a variable assemblage of canopy and subcanopy species, with less flood tolerant trees and shrubs found on small hummocks and ridges within the swamp. Shrubs and smaller trees such as Carolina ash (*Fraxinus caroliniana*), planer tree (*Planera aquatica*), black willow (*Salix nigra*), titi (*Cyrilla racemiflora*), Virginia willow (*Itea virginica*), common buttonbush (C*ephalanthus occidentalis*), cabbage palm (*Sabal palmetto*), and dahoon (*Ilex cassine*) may be present. A groundcover of flood tolerant ferns and herbs are found in some floodplain swamps, including lizard's tail (*Saururus cernuus*), false nettle (*Boehmeria cylindrica*), creeping primrosewillow (*Ludwigia repens*), savannah panicum (*Phanopyrum gymnocarpon*), royal fern (*Osmunda spectabilis*), dotted smartweed (*Polygonum punctatum*), climbing aster (*Symphyotrichum carolinianum*), and string lily (*Crinum americanum*). Swamps with stagnant water typically have a mixture of floating aquatics such as duckweeds (*Lemna* spp.) and Florida mudmidget (*Wolffiella gladiata*). Eastern poison ivy (*Toxicodendron radicans*) is a frequent vine.

Soils are variable mixtures of alluvial and organic materials, sometimes with layers of sand in the subsoil. Inundation is seasonal and usually prolonged, restricting the growth of most shrubs and herbs and leaving most of the ground surface open or thinly mantled with leaf litter.

Floodplain swamp is usually too wet to support fire; however, large cypress trees are somewhat fire-resistant, and thus infrequent fires during very dry conditions may contribute to cypress dominance. Fires may greatly damage the understory.

Floodplain swamp is located within floodplains of any permanently moving stream or river. It ranges from narrow strips of cypress along primary and secondary streams to expansive stands along large rivers to tidally influenced freshwater swamps near river mouths. Often, floodplain swamps immediately border the stream or river channel. In many cases, however, floodplain swamps are isolated from the main channel by riverbank levees and restricted to oxbows, overflow channels, old stream beds, and expansive flats commonly called backswamps.

Existing Site Conditions on the Preserve

This habitat type exists along the western borders of the County and the WMD Tracts, following Deep Creek.

The canopy is generally closed and appropriate in cover and consists primarily of bald cypress (*Taxodium distichum*), swamp tupelo (*Nyssa biflora*), red maple (*Acer rubrum*), and slash pine (*Pinus elliottii*) on hummocks. The sub-canopy/ shrub layer consists of bald cypress (*Taxodium distichum*), swamp tupelo (*Nyssa biflora*), red maple (*Acer rubrum*), and sweetgum (*Liquidambar styraciflua*). The groundcover layer consists of royal fern (*Osmunda spectabilis*), cinnamon fern (*Osmunda cinnamomea*), and fall panicgrass (*Panicum dichotomum*).

Floodplain swamps are managed similar to the basin swamps discussed above and limited restoration is required. The primary adverse effects that result from human disturbances are related to hydrology and non-native, invasive species. The County will be evaluating potential hydrological impacts and restoration. Invasive species management is already employed throughout the Preserve. Prescribed fire is not a management tool to be utilized in the basin swamps, other than within the ecotonal boundary between the swamp and an adjacent pyrogenic community.

No hydrologic restoration projects have occurred within the floodplain swamps. Invasive species treatments have occurred.

HARDWOOD

8. Baygall

Figure 22. Baygall existing conditions

General FNAI Community Description:

Baygall is an evergreen forested wetland of bay species situated at the base of a slope or in a depression.

Loblolly bay (*Gordonia lasianthus*), sweetbay (*Magnolia virginiana*), and/or swamp bay (*Persea palustris*) form an open to dense tree canopy and are also dominant in the understory along with fetterbush (*Lyonia lucida*), large gallberry (*Ilex coriacea*), dahoon (*I. cassine*), myrtle dahoon (*I. cassine* var. *myrtifolia*), titi (*Cyrilla racemiflora*), black titi (*Cliftonia monophylla*), wax myrtle (*Myrica cerifera*), coastal doghobble (*Leucothoe axillaris*), swamp doghobble (*L. racemosa*), red maple (*Acer rubrum*), Florida anisetree (*Illicium floridanum*), coco plum (*Chrysobalanus icaco*), and/or Virginia willow (*Itea virginica*). Composition of the understory varies regionally; coco plum is restricted to South Florida, Florida anisetree to the central and western Panhandle. Black titi is a dominant component of baygall in the Florida Panhandle, but uncommon in other areas. Loblolly pine (*Pinus taeda*), slash pine (*P. elliottii*), and/or pond pine (*P. serotina*) are often found in the canopy, as well as sweetgum (*Liquidambar styraciflua*), and in the Panhandle, Atlantic white cedar (*Chamaecyparis thyoides*). Wetter baygalls may also contain swamp tupelo (*Nyssa biflora*) and/or

pond cypress (*Taxodium ascendens*). The canopy and understory do not generally form distinct strata but may appear as a dense, tall thicket (Clewell 1986). Vines, especially laurel greenbrier (*Smilax laurifolia*), coral greenbrier (*S. walteri*), and muscadine (Vitis rotundifolia), may be abundant and contribute to the often impenetrable nature of the understory. Herbs are absent or few, and typically consist of ferns such as cinnamon fern (*Osmunda cinnamomea*), netted chain fern (*Woodwardia areolata*), and Virginia chain fern (*W. virginica*). Sphagnum mosses (*Sphagnum* spp.) are common.

Baygall typically develops on wet soils at the bases of slopes, edges of floodplains, in depressions, and in stagnant drainages. The soils are generally composed of peat with an acidic pH (3.5 - 4.5). Seepage from uplands, rainfall, and/or capillary action from adjacent wetlands maintains a saturated peat substrate. While baygalls are not generally influenced by flowing water, they are often drained by small blackwater streams. Within the slough and glades marsh communities of the Everglades in South Florida, baygall may develop on elevated islands of peat (often called "bayheads"). Although most baygalls are small in acreage, some form large, mature forests, often called "bay swamps."

The dominant baygall species are fire-intolerant, and a mature canopy indicates the lack of destructive fire for many years (Clewell 1986). Although the saturated soils and humid conditions within baygalls typically inhibit fire, droughts may create conditions that allow them to burn catastrophically. These fires not only destroy the canopy, but also may ignite the deep peat layers that can smolder for weeks, or even months. This occurs perhaps only a few times each century in the deepest baygalls.

Baygall occurs throughout mainland Florida and much of the southeastern coastal plain. The largest examples occur near the Georgia border in the Pinhook Swamp area south of Okefenokee Swamp.

Existing Site Conditions on the Preserve

This habitat occurs exclusively and throughout the State Tract. The habitat is found adjacent to wet flatwoods, mesic flatwoods, and basin swamps. Many of these occur on typically hydric soil types (e.g., Samsula muck, Hontoon muck).

The canopy is moderate in cover and consists primarily of loblolly bay (*Gordonia lasianthus*), with some pond cypress (*Taxodium ascendens*) and slash pine (*Pinus elliottii*). The sub-canopy layer consists of loblolly bay (*Gordonia lasianthus*), (*Taxodium ascendens*), and slash pine (*Pinus elliottii*). The shrub layer consists of loblolly bay (*Gordonia lasianthus*), *Smilax* spp., swamp bay (*Tamala palustris*), and blackberry (*Rubus* spp.).

The need for restoration is significant, and the general exclusion of fire and artificial hydrologic modification has significantly impacted this community's structure and species composition. To varying degrees, the community has been affected by prior harvesting activities and/or modification of the natural hydrology resultant from establishment of the network of ditches found across the parcel. It is unknown if these communities are natural or established due to human interference and/or the 1998 wildfires. Restoration activities which may be employed include, but may not be limited to, harvesting, chopping, prescribed fire, artificial regeneration, and hydrologic restoration. Examples of these efforts may include removal / harvesting of the loblolly bay, thinning and / or clear cutting of the slash pine canopy, and re-stocking with cypress where feasible. The prescribed fire practices will include such practices as mechanical fuel reduction, dormant season fires for continued fuel reduction, and eventually growing season prescribed fires up to the edges of the community to establish ecotone.

The implementation of these practices is described in the forestry and prescribed fire operational plans, appended to this Plan. It is recommended that these communities are revisited eight years post fire reintroduction and restoration activities.

No restoration activities have been performed.

ALTERED LANDCOVER TYPES

9. Improved Pasture

Figure 23. Improved pasture existing conditions

General FNAI Community Description:

Improved pasture is defined as an area dominated by planted non-native or domesticated native forage species and evidence of current or recent pasture activity and/or cultural treatments (mowing, grazing, burning, fertilizing).

Improved pastures have been cleared of their native vegetation. Most improved pastures in Florida are planted with bahiagrass (*Paspalum notatum*) and to a lesser extent with Bermudagrass (*Cynodon dactylon*) or pangolagrass (*Digitaria eriantha*). Weedy native species are often common in improved pastures in Florida and include dogfennel (*Eupatorium capillifolium*), many species of flatsedge (*Cyperus* spp.), carpetgrasses (*Axonopus* spp.), crabgrasses (*Digitaria* spp.), and rustweed (*Polypremum procumbens*) among many others.

The hydrology of improved pasture is altered in the conversion process from a natural community to an altered community. These areas hydrology differ but should be generally similar to surrounding natural communities and the communities that they were converted from.

As with the hydrology of these altered communities, the fire interval of these areas is altered. The fire regime of these areas depends on the surrounding communities and species composition of the altered community.

Existing Site Conditions on the Preserve

This habitat occurs on the south and southeastern portions of the State Tract and central portion of the County Tract. The habitat is found adjacent to wet flatwoods, mesic flatwoods, and basin swamps. Many of these occur on typically flatwoods soil types (e.g., Immokalee sand, Daytona sand).

These communities have historically, and continue to be, utilized for cattle grazing.

The canopy layer is very sparse with some live oak (*Quercus virginiana*), slash pine (*Pinus elliottii*), and sabal palm (*Sabal palmetto*). The shrub layer includes very sparse Rugel's false pawpaw (*Deeringothamnus rugelii*). Groundcover includes primarily bahiagrass (*Paspalum notatum*).

There is no immediate need for restoration. If the cattle lease expires, consideration of restoration to dry prairie or mesic flatwoods.

Areas of improved pastures along the eastern edge of the State Tract are known to be occupied by the federally endangered, Volusia endemic, Rugel's pawpaw (*Deeringothamnus rugelii*, syn. *Asimina rugelii*). This species is typically found in the Immokalee (29) soil map unit, though it is also found in similar sandy soils. The occupied areas are near the existing (and proposed future) entrance. Survey and rescue / replanting of Rugel's pawpaws should occur prior to any future development of these areas.

10. Hydric Successional Shrubland/Forest

Figure 24. Hydric successional shrubland/forest existing conditions

General FNAI Community Description:

Hydric successional shrubland/forest is described as shrubland or closed canopied forest occupying disturbed areas and dominated by fast growing hydrophilic hardwoods. These shrubland/forests may invade herbaceous habitats (i.e., wet prairie, wet flatwoods, seepage slope, depression marsh, basin marsh, floodplain marsh) due to lengthy fire suppression and/or hydrological alterations OR forested wetlands (dome swamp, basin swamp, strand swamp) that have been cleared and are not succeeding to swamp but to highly disturbed shrubland or forest dominated by hydrophilic hardwoods. Successional hydric shrubland/forests are often shrub thickets with few of the characteristic herbaceous or canopy (e.g. *Taxodium* spp.) species from the former community remaining. They can resemble naturally occurring shrub bogs and can be distinguished from them by occurring in areas of historically herbaceous communities, where fire suppression and/or hydrological alterations have taken place or in former forested swamps that have been logged or undergone severe hydroperiod disruptions. Although some shifts in community type may be better described with a natural community designation, the use of "successional hydric shrubland/forest" is suitable to label areas that are known to be highly disturbed and altered, and where restoration efforts of hydrology restoration and/or re-introduction of fire would be particularly beneficial.

Hydric successional shrubland/forest in Florida are often consisting of titi (*Cyrilla racemiflora*), black titi (*Cliftonia monophylla*), sweet gallberry (*Ilex coriacea*), sweet gum (*Liquidambar styraciflua*), red maple (*Acer rubrum*), water oak (*Quercus nigra*), swamp laurel oak (*Quercus laurifolia*), wax myrtle (*Morella cerifera*), blackberry (*Rubus argutus*), and groundsel tree (*Baccharis halimifolia*). Weedy vines such as smilax (*Smilax* spp.) and muscadine (*Vitis rotundifolia*), and non-native invasive plants including Peruvian primrosewillow (*Ludwigia peruviana*) and Brazilian pepper (*Schinus terebinthifolius*) may be common in the subcanopy and shrub layers.

The hydrology of hydric successional shrubland/forest is altered in the conversion process from a natural community to an altered community. These areas hydrology differ but should be generally similar to surrounding natural communities and the communities that they were converted from.

As with the hydrology of these altered communities, the fire interval of these areas is altered. The fire regime of these areas depends on the surrounding communities and species composition of the altered community.

Existing Site Conditions on the Preserve

This habitat occurs on the southeastern corner of the State Tract, west of the southern artificial pond (borrow pit). The habitat is found adjacent to mesic flatwoods. The soils of this community include Myakka fine sand, Myakka-Myakka, and Myakka-St. Johns complex.

These community was logged extensively in 2005.

There is canopy layer containing pond cypress (*Taxodium ascendens)*, slash pine (*Pinus elliottii*), and loblolly bay (*Gordonia lasianthus*). The sub-canopy/shrub layer is fairly open, containing pond cypress (*Taxodium ascendens)*, slash pine (*Pinus elliottii*), and loblolly bay (*Gordonia lasianthus*). Groundcover includes purple bluestem (*Andropogon glaucopsis*), Sphagnum moss (*Sphagnum* spp.) blue maidencane (*Amphicarpum muehlenbergianum*), and *Rhynchospora* spp.

The need for restoration is significant, and the general exclusion of fire and artificial hydrologic modification has significantly impacted this community's structure and species composition. The community has been affected by prior harvesting activities and modification of the natural hydrology resulting from establishment of the network of ditches found across the parcel. Restoration activities which may be employed include, but may not be limited to, harvesting, chopping, prescribed fire, and hydrologic restoration. Examples of these efforts may include removal / harvesting of the loblolly bay, thinning and / or clear cutting of the slash pine canopy, and re-stocking with cypress where feasible. The prescribed fire practices will include such practices as mechanical fuel reduction, dormant season fires for continued fuel reduction, and eventually growing season prescribed fires. In the community's current condition, it is not possible to determine its original state. The area was not logged and / or cleared in the 1967 aerial (Figure 30). This community will be visited after hydrologic and fire restoration activities have been conducted to reevaluate. The implementation of these practices is described in the forestry and prescribed fire operational plans, appended to this Plan.

11. Developed

General FNAI Community Description:

Developed areas can be described in numerous ways but ultimately is defined as parking lots, buildings, maintained lawns (as part of recreational, business, or residential areas), campgrounds, recreational, industrial, and residential areas.

The hydrology of developed land is altered in the conversion process from a natural community to an altered community. These areas hydrology differ but should be generally similar to surrounding natural communities and the communities that they were converted from.

As with the hydrology of these altered communities, the fire interval of these areas is altered.

Existing Site Conditions on the Preserve

There are developed areas on the State Tract and the County Tract. The State Tract has two single family homes on the east side of the Tract next to the borrow pit (reservoir). The County Tract has a storage barn along with another small section with silos in the eastern section of that Tract.

There is no immediate need for restoration.

12. Utility Corridor

Figure 25. Utility corridor existing conditions

General FNAI Community Description:

Utility corridors are electric, gas, or telephone rights-of-way.

The hydrology of utility corridors is altered in the conversion process from a natural community to an altered community. These areas hydrology differ but should be generally similar to surrounding natural communities and the communities that they were converted from.

As with the hydrology of these altered communities, the fire interval of these areas is altered in the conversion process. Fire regime could be same or similar as the adjacent communities and/or the original natural community prior to conversion.

Existing Site Conditions on the Preserve

This habitat occurs only on the State Tract and is limited to a relatively small stretch in the northeast corner. Many of these occur on typically mesic flatwoods soil types (e.g., Immokalee and Satellite). The adjacent community is scrubby flatwoods and this utility corridor should be managed as such.

There is no canopy. The sub-canopy/ shrub layer consists of sand live oak, myrtle oak, Chapman's oak, rusty lyonia and saw palmetto. The shrub layer is patchy and dense, interspersed with open sandy patches.

There is no immediate need for restoration.

13. Artificial Pond

Figure 26. Artificial pond existing conditions

General FNAI Community Description:

Artificial ponds are water retention ponds, cattle ponds, etc.

Existing Site Conditions on the Preserve

This habitat occurs on the both the County Tract within the improved pasture, and on the State Tract in two abandoned borrow areas within the improved pasture.

Groundcover consists of blue maidencane (*Amphicarpum muehlenbergianum*) and *Rhynchospora* spp.

The past and/or current usage for the ponds are for cattle as well as borrow pits.

Restoration opportunities are available for the southern artificial pond within the State Tract. There is a large berm around the bank of this pond that should be evaluated for littoral zone restoration. This restoration could consist of utilizing the berm material to form littoral shelf, pending permitting and cost estimation.

14. Clearing/Regeneration

Figure 27. Clearing/regeneration existing conditions

General FNAI Community Description:

Clearing/regenerations are described as recent or historic clearings that have significantly altered the groundcover and/or overstory of the original natural community (old homesites, etc.); clearings of unknown origin.

The hydrology of clearing/regeneration is altered in the conversion process from a natural community to an altered community. These areas hydrology differ but should be generally similar to surrounding natural communities and the communities that they were converted from.

As with the hydrology of these altered communities, the fire interval of these areas is altered. The fire regime of these areas depends on the surrounding communities and species composition of the altered community.

Existing Site Conditions on the Preserve

This habitat occurs on all three tracts, with one each on the County and WMD Tracts as well as three on the State Tract.

The canopy layer is sparse with some slash pine (*Pinus elliottii*). Groundcover includes primarily bahiagrass (*Paspalum notatum*) with some pockets of cogongrass (*Imperata cylindrica*).

At least some restoration is necessary depending on final land use. The non-native, invasive cogongrass should be treated to limit spread. Fire-return intervals will be based on the adjacent natural communities within which this community is embedded.

C. Fish and Wildlife

Wildlife observations, both direct and indirect (indirect observations of their presence include remnants, tracks, burrows, calls, scat, etc.), are made by management staff during regular visit. A list of species observed is provided in Table 3 below. This list is comprised of observations from iNaturalist, County staff, and user groups. All scientific names are derived from iNaturalist.

Table 3. Wildlife species observed on the Preserve

Taxa	Scientific Name	Common Name
Reptiles/Amphibians		
	Anaxyrus quercicus	Oak Toad
	Anaxyrus terrestris	Southern Toad
	Alligator mississippiensis	American Alligator
Birds		
	Falco sparverius	American Kestrel
	Anhinga anhinga	Anhinga
	Haliaeetus leucocephalus	Bald Eagle
	Polioptila caerulea	Blue-gray Gnatcatcher
	Poecile carolinensis	Carolina Chickadee
	Sialia sialis	Eastern Bluebird
	Ardea herodias	Great Blue Heron
	Setophaga americana	Northern Parula
	Podilymbus podiceps	Pied-billed Grebe
	Dryocopus pileatus	Pileated Woodpecker
	Columbina	Small Ground Doves
	Ardea ibis	Western Cattle-Egret
	Eudocimus albus	White Ibis
	Vireo griseus	White-eyed Vireo
	Meleagris gallopavo	Wild Turkey
	Mycteria americana	Wood Stork
	Sphyrapicus varius	Yellow-bellied Sapsucker
	Dendrocygna autumnalis	Black-Bellied Whistling-Duck
	Colinus virginianus	Northern Bobwhite
	Zenaida macroura	Mourning Dove
	Coccyzus americanus	Yellow-billed Cuckoo
	Archilochus colubris	Ruby-throated Hummingbird
	Aramus guarauna	Limpkin
	Antigone canadensis	Sandhill Crane
	Gallinago delicata	Wilson's Snipe
	Nannopterum auritum	Double-crested Cormorant
	Plegadis falcinellus	Glossy Ibis
	Egretta caerulea	Little Blue Heron
	Ardea alba	Great Egret
	Cathartes aura	Turkey Vulture

	Coragyps atratus	Black Vulture
	Pandion haliaetus	Osprey
	Elanoides forficatus	Swallow-tailed Kite
	Astur cooperii	Cooper's Hawk
	Circus hudsonius	Northern Harrier
	Buteo lineatus	Red-shouldered Hawk
	Buteo jamaicensis	Red-tailed Hawk
	Strix varia	Barred Owl
	Megaceryle alcyon	Belted Kingfisher
	Melanerpes erythrocephalus	Red-headed Woodpecker
	Melanerpes carolinus	Red-bellied Woodpecker
	Dryobates pubescens	Downy Woodpecker
	Leuconotopicus villosus	Hairy Woodpecker
	Colaptes auratus	Northern Flicker
	Caracara plancus	Crested Caracara
	Falco peregrinus	Peregrine Falcon
	Contopus Virens	Eastern Wood-Pewee
	Sayornis phoebe	Eastern Phoebe
	Myiarchus crinitus	Great Crested Flycatcher
	Vireo solitaris	Blue-headed Vireo
	Vireo olivaceus	Red-eyed Vireo
	Cyanocitta cristata	Blue Jay
	Corvus brachyrhynchos	American Crow
	Corvus ossifragus	Fish Crow
	Baeolophus bicolor	Tufted Titmouse
	Tachycineta bicolor	Tree Swallow
	Hirundo rustica	Barn Swallow
	Corthylio calendula	Ruby-crowned Kinglet
	Sitta pusilla	Brown-headed Nuthatch
	Troglodytes aedon	Northern House Wren
	Thryothorus ludovicianus	Carolina Wren
	Sturnus vulgaris	European Starling
	Dumetella carolinensis	Gray Catbird
	Toxostoma rufum	Brown Thrasher
	Mimus polyglottos	Northern Mockingbird
	Catharus ustulatus	Swainson's Thrush
	Catharus guttatus	Hermit Thrush
	Turdus migratorius	American Robin
	Bombycilla cedrorum	Cedar Waxwing
	Haemorhous mexicanus	House Finch
	Spinus tristis	American Goldfinch
	Peucaea aestivalis	Bachman's Sparrow
	Spizella passerina	Chipping Sparrow
	Passerculus sandwichensis	Savannah Sparrow

	Melospiza georgiana	Swamp Sparrow
	Pipilo erythrophthalmus	Eastern Towhee
	Sturnella magna	Eastern Meadowlark
	Agelaius phoeniceus	Red-winged Blackbird
	Quiscalus quiscala	Common Grackle
	Quiscalus major	Boat-tailed Grackle
	Seiurus aurocapilla	Ovenbird
	Mniotilta varia	Black-and-white Warbler
	Geothlypis trichas	Common Yellowthroat
	Leiothlypis celata	Orange-crowned Warbler
	Setophaga citrina	Hooded Warbler
	Setophaga ruticilla	American Redstart
	Setophaga pensylvanica	Chestnut-sided Warbler
	Setophaga caerulescens	Black-throated Blue Warbler
	Setophaga palmarum	Palm Warbler
	Setophaga pinus	Pine Warbler
	Setophaga coronata	Yellow-rumped Warbler
	Setophaga dominica	Yellow-throated Warbler
	Setophaga discolor	Prairie Warbler
	Piranga rubra	Summer Tanager
	Piranga olivacea	Scarlet Tanager
	Cardinalis cardinalis	Northern Cardinal
Mammals		
	Ursus americanus	American Black Bear
	Lynx rufus	Bobcat
	Dasypus mexicanus mexicanus	East Mexican Nine-banded Armadillo
	Sciurus carolinensis	Eastern Gray Squirrel
	Dasypus mexicanus	Mexican Long-nosed Armadillo
	Odocoileus virginianus	White-tailed Deer
	Sus scrofa	Wild Boar
	Canis latrans	Coyote
	Sciurus niger niger	Southern Fox Squirrel

*Feral hog is a common local nuisance species throughout the region. While acorns are their favorite food, they will eat almost anything, including dead animals. When natural foods are scarce or inaccessible, hogs will forage on tree seeds, seedlings, and herbaceous vegetation, causing significant damage in forests and marsh systems. In Florida and the Southeast, this may be a problem in regenerating long-leaf pine forests. In addition to the effects of consuming, knocking down and trampling large amounts of native vegetation, the rooting behavior of wild hogs causes significant damage. Rooting, digging for foods below the surface of the ground, destabilizes the soil surface, uprooting or weakening native vegetation, damaging systems and causing erosion. Wallowing destroys pond and stream banks, which may affect water quality.

The hog population on the Preserve is low, and they are not causing major harm in any known locations. Because hogs are prolific breeders, having up to 3 litters per year and due to the extent of forests, dense vegetation, and abundant water in the area, there is no way to completely eliminate them. Therefore, regular efforts to monitor and trap hogs will be performed, in a manner similar to that of monitoring and removal of non-native invasive plant species.

3. Endangered, Threatened and Species of Special Concern

A background literature search was conducted to compile a list of state and federally protected animal and plant species that could occur on-site. The four primary sources of literature reviewed include the Florida Fish and Wildlife Conservation Commission's (FWC) Florida's Endangered Species, Threatened Species, And Species of Special Concern, the United States Fish and Wildlife Service's (FWS) database, the Florida Natural Areas Inventory (FNAI), and the Florida Department of Agriculture and Consumer Services (FDACS), Division of Plant Industry's (DPI) Notes on Florida's Endangered and Threatened Plants. During regular maintenance and monitoring activity staff notes occurrences of listed species.

Florida Natural Areas Inventory, FWC's IPaC, and citizen science websites (iNaturalist and eBird) was queried for a list of elemental occurrences on or near the Preserve. FNAI's provided their findings in a letter report which is provided in Appendix E. IPaC and iNaturalist findings are provided in Appendix L.

Table 4. Listed wildlife species known to occur on the Preserve

Species Name	Common Name	Status	Ranking
Alligator mississippiensis	American alligator	FT(S/A)	G5/S4
Antigone canadensis pratensis	Florida sandhill crane	ST	G5T2/S2
Danaus plexippus	Monarch butterfly	FT-PDL	G4/S4
Drymarchon couperi	Eastern indigo snake	ST/FT	G4T3/S3
Egretta caerulea	Little blue heron	ST	G5/S4
Egretta tricolor	Tricolored heron	ST	G5/S4
Falco sparverius paulus	Southeastern American kestrel	ST	G5T4/S3
Gopherus polyphemus	Gopher tortoise	ST	G3/S3
Haliaeetus leucocephalus	Bald Eagle	BGPA	G5/S3
Mycteria americana	Wood stork	S-P	G4/S2
Platalea ajaja	Roseate spoonbill	ST	G5/S2
Caracara plancus syn. *Polyborus plancus audubonii*	Crested caracara syn. Audubon's crested caracara	FT	G5/S2
Sciurus niger niger	Southern fox squirrel	-	G5T5/S3

Abbreviations:
BGPA: Bald and Golden Eagle Protection Act
FE: Federally-designated Endangered
FT: Federally-designated Threatened
FXN: Federally-designated Threatened Nonessential Experimental Population
FT(S/A): Federally-designated Threatened species due to similarity of appearance
FT-PDL: Proposed Federally-designated Threatened species
ST: State-designated Threatened
SSC: State Species of Special Concern
SP: State-pending status. Recently removed from federal listing. State status currently refers to the federal listing.

FNAI Rank Definitions:
G1: Critically imperiled globally because of extreme rarity (5 or fewer occurrences or less than 1000 individuals) or because of extreme vulnerability to extinction due to some natural or man-made factor.
G2: Imperiled globally because of rarity (6 to 20 occurrences or less than 3000 individuals) or because of vulnerability to extinction due to some natural or man-made factor.
G3: Either very rare and local throughout its range (21-100 occurrences or less than 10,000 individuals) or found locally in a restricted range or vulnerable to extinction from other factors.
G4: Apparently secure globally (may be rare in parts of range).
G5: Demonstrably secure globally
G#T#: Rank of a taxonomic subgroup such as a subspecies or variety; the G portion of the rank refers to the entire species and the T portion refers to the specific subgroup; numbers have same definition as above (e.g., G3T1).
S1: Critically imperiled in Florida because of extreme rarity (5 or fewer occurrences or less than 1000 individuals) or because of extreme vulnerability to extinction due to some natural or man-made factor.
S2: Imperiled in Florida because of rarity (6 to 20 occurrences or less than 3000 individuals) or because of vulnerability to extinction due to some natural or man-made factor.
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S4: Apparently secure in Florida (may be rare in parts of range).
S5: Demonstrably secure in Florida.

Species that are documented onsite and historical are considered as factors in land management decisions. Species considered likely to occur are to increase awareness of staff and user groups during surveys and inventories.

Based on the results of the database search described above, there were twelve (12) ESA listed animal species that have been documented to occur. These listed species as well as some documented species that are listed as imperiled by FNAI discussed below.

The American kestrel (*Falco sparverius*) was observed over the pasture during a site investigation. However, the protected subspecies, the Southeastern American kestrel (*F. s. paulus*) is not discernible from the migratory non-protected subspecies (F. s. sparverius). Suitable snags within the Preserve could provide nesting areas for kestrel. No nests or nesting activities were observed. It should be noted that the migratory northern subspecies generally departs Florida by March; however, there are recorded observations of the migrant subspecies beyond that date. Any kestrels observed on the Preserve during the breeding season (April – early September) would be considered to be the protected southern subspecies (*F. sparverius paulus*).

Gopher tortoise (*Gopherus polyphemus*) and their burrows are documented when witnessed in the field. The density of gopher tortoises within the Preserve appears to be minimal. The gopher tortoise requires uplands that have a high enough elevation to allow for the construction of underground burrows that would not be below the groundwater table. Eastern indigo snake (*Drymarchon couperi*), Florida pine snake (*Pituophis melanoleucus mugitus*) and the Florida mouse (*Podomys floridanus*) are considered gopher tortoise commensal species and have potential to occur onsite.

The two species of reptiles that have some likelihood to occur on the Preserve are the American alligator (*Alligator mississippiensis*) and the Eastern indigo snake (*Drymarchon couperi*). The alligator has been observed to utilize the artificial ponds on-site for foraging. Eastern indigo snakes utilize a wide variety of habitats.

Five of the listed bird species (refer to Table 4) that are known to occur consist of long-legged waders or similar species such as storks and cranes. These species are primarily expected to utilize the site for foraging. No long-legged rookeries are known on or near the Preserve. The sandhill crane (*Grus canadensis*) has some limited potential to nest on the Preserve in wetter pockets within the improved pastures.

A crested caracara (*Caracara plancus*) has been observed on the Preserve according to iNaturalist data. Crested caracara are known to utilize improved pastures consisting of open grassland and scattered cabbage palm and cypress.

Monarch butterfly (*Danaus plexippus*) has been observed on the preserve according to iNaturalist data.

The nearest recorded bald eagle (*Haliaeetus leucocephalus*) nest is reported to be located approximately 2.5 miles northeast of the subject property outside the limits of the Preserve. The eagle nest, located west of SR-415, north of SR-44, and has been recorded as active in 2025.

The southern fox squirrel (*Sciurus niger niger*), previously known as Sherman's fox squirrel, has been observed near the Preserve. This species was removed as a Species of Special Concern in 2018.

Listed Plant Species

The listed plant species known to occur on the Preserve are listed in Table 5, below.

Table 5. Listed plant species known to occur on the Preserve

Scientific Name	Common Name	Family	Status	Ranking	Likelihood of Occurrence
Sarracenia minor	HOODED PITCHER PLANT	SARRACENIACEAE	ST	G4T4/S4	Documented
Nolina atopocarpa	FLORIDA BEARGRASS	RUSCACEAE	ST	G3/S3	Documented
Deeringothamnus rugelii	RUGEL'S FALSE PAWPAW; YELLOW SQUIRREL-BANANA	ANNONACEAE	FE	G1/S1	Documented

Abbreviations:
FE: Federally-designated Endangered
FT: Federally-designated Threatened
FXN: Federally-designated Threatened Nonessential Experimental Population
FT(S/A): Federally-designated Threatened species due to similarity of appearance
FT-PDL: Proposed Federally-designated Threatened species
ST: State-designated Threatened
SSC: State Species of Special Concern

FNAI Rank Definitions:
G1: Critically imperiled globally because of extreme rarity (5 or fewer occurrences or less than 1000 individuals) or because of extreme vulnerability to extinction due to some natural or man-made factor.
G2: Imperiled globally because of rarity (6 to 20 occurrences or less than 3000 individuals) or because of vulnerability to extinction due to some natural or man-made factor.
G3: Either very rare and local throughout its range (21-100 occurrences or less than 10,000 individuals) or found locally in a restricted range or vulnerable to extinction from other factors.
G4: Apparently secure globally (may be rare in parts of range).
G5: Demonstrably secure globally
G#T#: Rank of a taxonomic subgroup such as a subspecies or variety; the G portion of the rank refers to the entire species and the T portion refers to the specific subgroup; numbers have same definition as above (e.g., G3T1).
S1: Critically imperiled in Florida because of extreme rarity (5 or fewer occurrences or less than 1000 individuals) or because of extreme vulnerability to extinction due to some natural or man-made factor.
S2: Imperiled in Florida because of rarity (6 to 20 occurrences or less than 3000 individuals) or because of vulnerability to extinction due to some natural or man-made factor.
S3: Either very rare and local in Florida (21-100 occurrences or less than 10,000 individuals) or found locally in a restricted range or vulnerable to extinction from other factors.
S4: Apparently secure in Florida (may be rare in parts of range).
S5: Demonstrably secure in Florida.

Rugel's pawpaw (*Deeringothamnus rugelii*, syn. *Asimina rugelii*) is a federally endangered species endemic to eastern Volusia County. This species occurs primarily in mesic flatwoods and is generally associated with the Immokalee sand (29) soil map unit. The Pawpaw Chapter of the Florida Native Plant Society along with Young Bear Environmental Consulting and Volusia County Land Management staff, have documented this species on the County and State Tracts in several locations. For the protection of the species, specific data locations are not provided within this Plan. More survey work is needed to confirm the extent of occupied habitat. It should be considered to occur in all Immokalee mapped areas, as well as adjacent areas and potentially within Myakka-complex soils (Figure 33). The species is tolerant of some land disturbance (e.g., roller chopping) but generally will be extirpated from a site if repeated pine bedding silviculture practices are employed. The mesic flatwoods in the County and State Tracts should be considered priority for restoration, including mechanical fuel reduction and introduction of fire, eventually leading to growing season burns. Surveys for Rugel's pawpaw will be performed in areas of compatible soils (Figure 29) and in areas within or adjacent to documented occurrence prior to any infrastructure development.

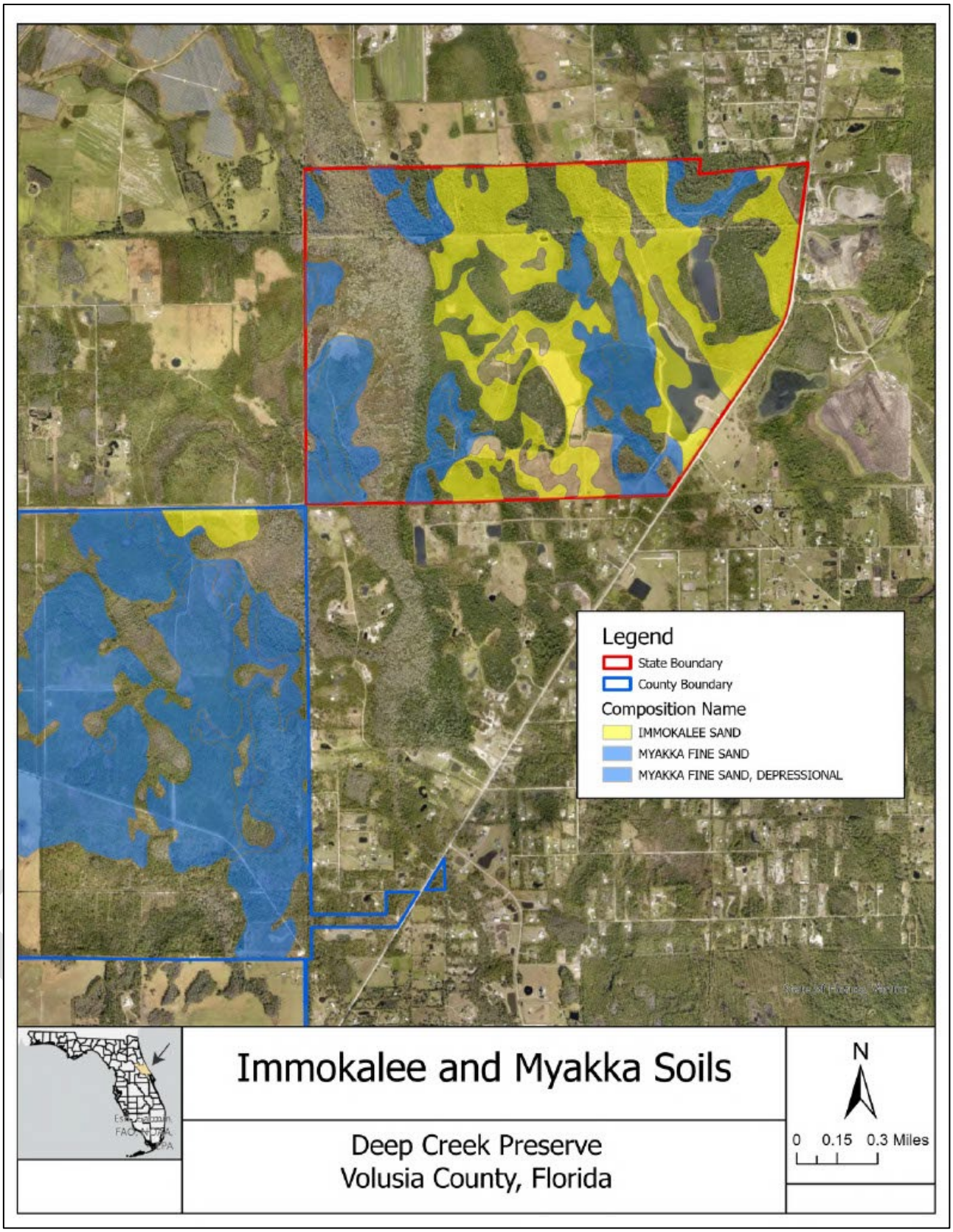

Figure 28. Immokalee and Myakka Soils Map

The xeric uplands that occur in the Preserve make it a potential site for numerous listed plant species. Much of the upland areas on the project site have been fire-suppressed for many years, leading to a closed canopy structure and overgrown conditions. Several listed plant species may occur within the scrubby flatwoods, such as the large-flowered rosemary (*Conradina grandiflora*), garberia (*Garberia heterophylla*), pinweeds (*Lechea cernua* and *L. divaricata*), sand butterfly pea (*Centrosema arenicola*), sand dune spurge (*Chamaesyce cumulicola*), wild coco (giant orchid - *Orthochilus ecristatus*) and shellmound pricklypear (*Opuntia stricta*) are species that are likely to occur in the xeric habitats following disturbance (such as fire or clearing) and along existing breaks such as trails and powerlines. Florida beargrass (*Nolina atopocarpa*) was documented according to the iNaturalist project data.

Several species are common in the county, in high acid wet flatwoods, but will occur along borders of any of the wetlands on the Preserve. These include Catesby's lily *(Lilium catesbaei*), hooded pitcher plant *(Sarracenia minor),* and fall-flowering ixia (*Nemastylis floridana*). Managing the wet flatwoods for open mid-story and shrub layers, including reducing and preventing woody thickets are successful measures in managing for these species.

The occurrence or potential occurrence of listed plant and wildlife species does not directly preclude public use of this site. The presence of listed species provides environmental education opportunities for the general public. However, user group management is an important component of these species continued existence or restoration efforts. Several species occur in habitats in need of restoration efforts. Where and when feasible, surveys for listed species will occur following management activities, including any land clearing or fires (prescribed or otherwise). These surveys may be conducted by County staff or coordinated with local volunteer groups such as the FNPS.

4. Imperiled Natural Communities

One (1) natural community on the Preserve is listed by FNAI as Imperiled Natural Communities. Scrubby flatwoods are considered imperiled (G2/S2) in Florida because of rarity (6 to 20 occurrences or less than 3,000 individuals) or because of vulnerability to extinction due to some natural or manmade factor. The Preserve includes 34.1 acres of scrubby flatwoods, occurring exclusively on the State Tract.

Current conditions of scrubby flatwoods were discussed in the Natural Communities section. This habitat has not been as severely impacted by past land management activities, as compared with the adjacent flatwoods communities. Mechanical fuel reduction may be required for some of the habitat within the Preserve. Some of the scrubby flatwoods occur as small pockets within a flatwoods matrix and it may be possible to introduce fire as part of the fire reintroduction in the adjacent flatwoods without mechanical fuel reduction. This area represents the most likely habitat for gopher tortoises. Gopher tortoise burrow surveys should be conducted before and after restoration activities to show any improvement in habitat to support this species.

Management activities include protection from illegal access related to dumping and off-highway vehicle (OHV) use and prevention of invasion by non-native invasive species.

D. Archaeological and Historic Resources

The sole recorded site (#VO7236) within the Florida Master Site File, maintained by the Florida Division of Historical Resources, occurring on the Preserve is a segment of the historic Blue Spring, Orange City and Atlantic Railroad (circa 1880). This route, which was later part of the Florida East Coast Railway system, traverses the central portion of the Preserve generally coinciding with the extension of Ohio Avenue east of Lake Helen. The railway was abandoned in the mid-1900s and all rails and appurtenances have been removed.

Maps from the period and information obtained from local descendants of earlier residents suggests that a small community, designated as the town of Rodgers, associated with the railway and a cemetery, the Deep Creek Cemetery, may be sited in this area. Staff has been unable to verify the presence of either of these features.

This section of abandoned railway is a segment of the proposed "Cross-Volusia Trail." This proposed trail is one component of a planned county-wide network of multi-use trails.

There is an existing cinder block single-family residence that was built in 1960. The home is approximately 470 feet northwest of State Road 415.

The managing agency will consult with the Division of Historical Resources, Department of State before taking any action that may adversely affect archeological or historical resources.

III. USEAGE OF THE PROPERTY

A. Previous Use and Development

Several areas within the Preserve have been converted to pasture for livestock, with evidence of improved pasture dating back to at least 1967 (Figure 30) As noted in the Natural Communities section, nearly all of the pine flatwoods have been actively managed for timber production under traditional silvicultural practices, including site preparation, planting of slash pine plantations, and periodic harvesting. These practices reflect the property's long history of working forest management prior to public acquisition. Timber harvesting has also occurred within portions of the forested wetlands, including basin swamps and baygalls, with harvest activities occurring as recently as 2016 on the State Tract.

State Tract

Prior to purchase by Maury L. Carter and Associates in 2007, the State Tract was owned by the Akers family. Under the Akers' stewardship, the property was managed primarily for quail hunting. Additionally, the property has been managed for silviculture, cattle grazing and hay production.

County Tract

Information regarding activities undertaken by the previous private landowners prior to purchase by the County in 2010 is limited. However, certain assumptions and conclusions may be reasonably drawn based upon existing features and conditions.

As evidenced by the large pasture and significant areas of pine plantation, lands within the County Tract have been actively managed for agricultural and silvicultural purposes. The previous private landowner was awarded Florida Tree Farmer of the year in 2000.

The grazing of cattle has apparently been confined to the southern portion of the County Tract. This activity, which encompassed both the large area of improved pasture and adjacent native rangeland / woodland, has been established through a lease between the user and the prior owner.

As previously discussed, pine plantations have been established across an extensive portion of the County Tract.

The stewardship practices of the prior owners may have also included the limited and probably intermittent, use of prescribed fire.

Hunting was also a use undertaken by the prior owners of the County Tract. In the southern portion of the property this is evidenced by the existing camps. The previous owner of the northern portion of the Preserve leased this area to a private hunting club.

The prior owners also sought to control surface hydrology by establishing numerous internal ditches.

Immediately prior to, and part of transferring ownership of the County Tract to the County, areas of soil contaminated by agricultural chemicals and mechanical fluids were removed from beneath the pole barn and adjacent to a small structure (which was simultaneously demolished and removed from the property) located north of the pasture.

WMD Tract

Prior to purchase by the SJRWMD in 2011 the WMD Tract was used for timber management and hunting. It was heavily impacted by the historic 1998 wildfires, therefore, much of the property was replanted in pine. A hunting lease was in place during the acquisition of the property and has been continued under the County management.

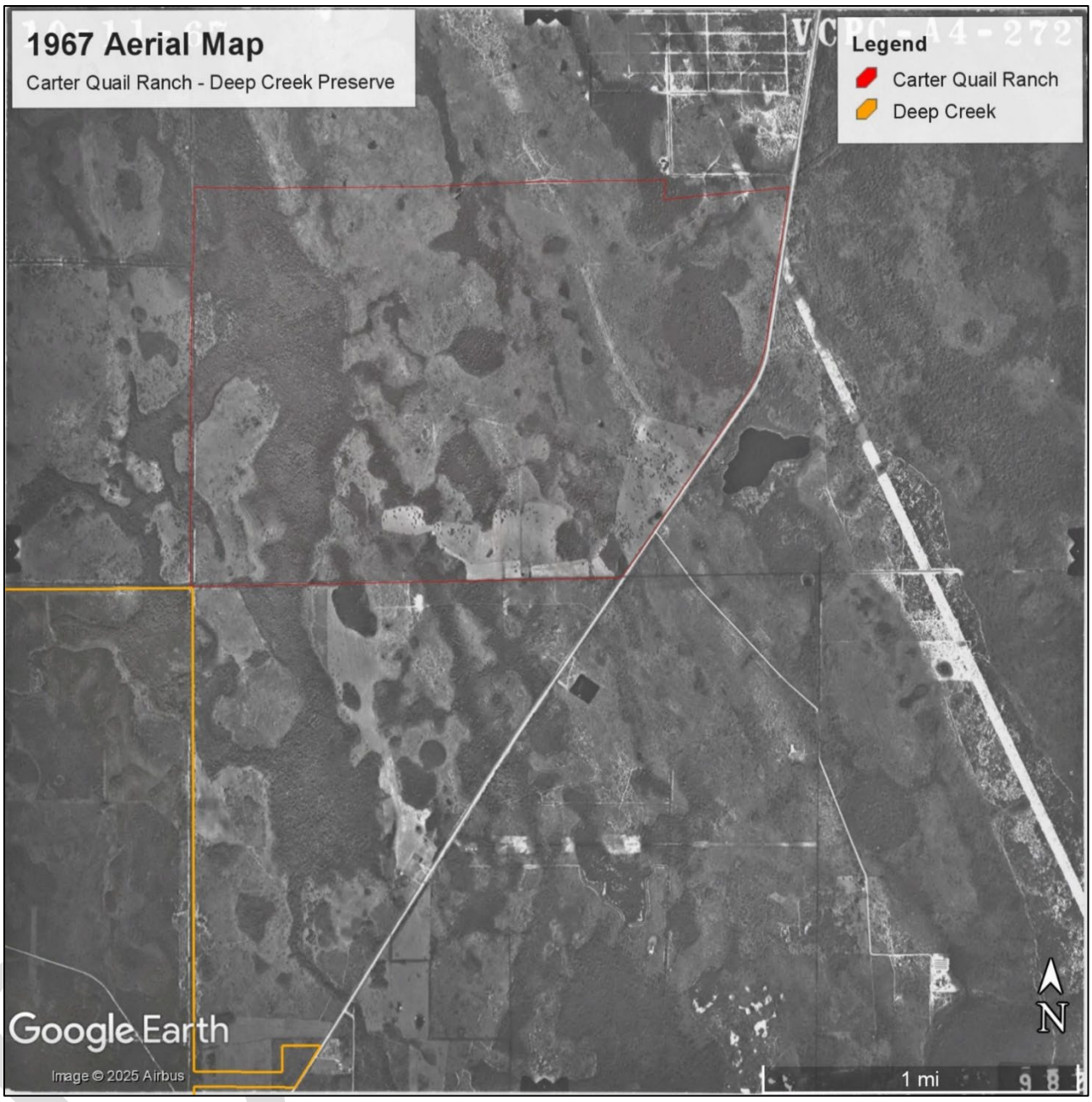

Figure 29. State Tract Historic Aerial

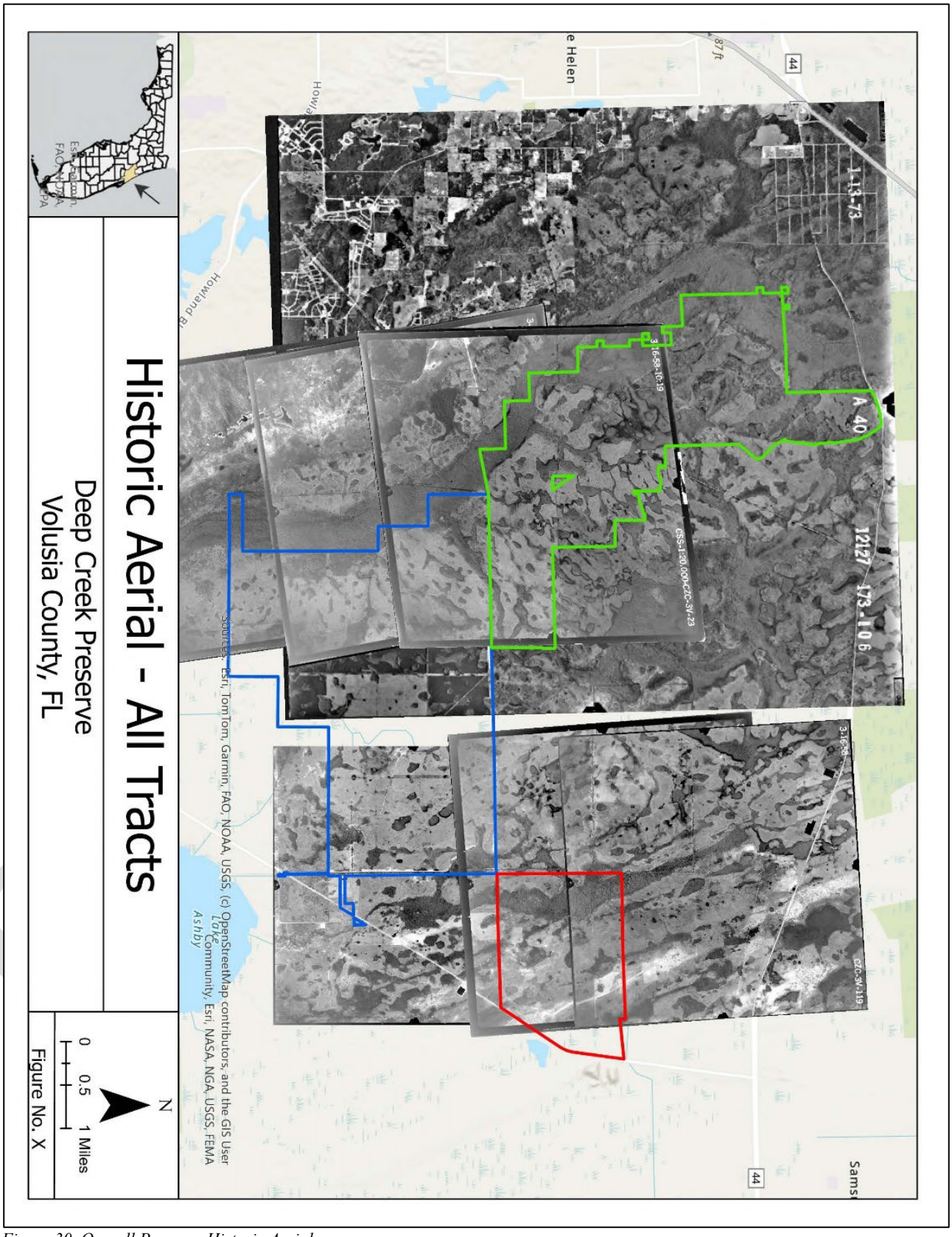

Figure 30. Overall Preserve Historic Aerial

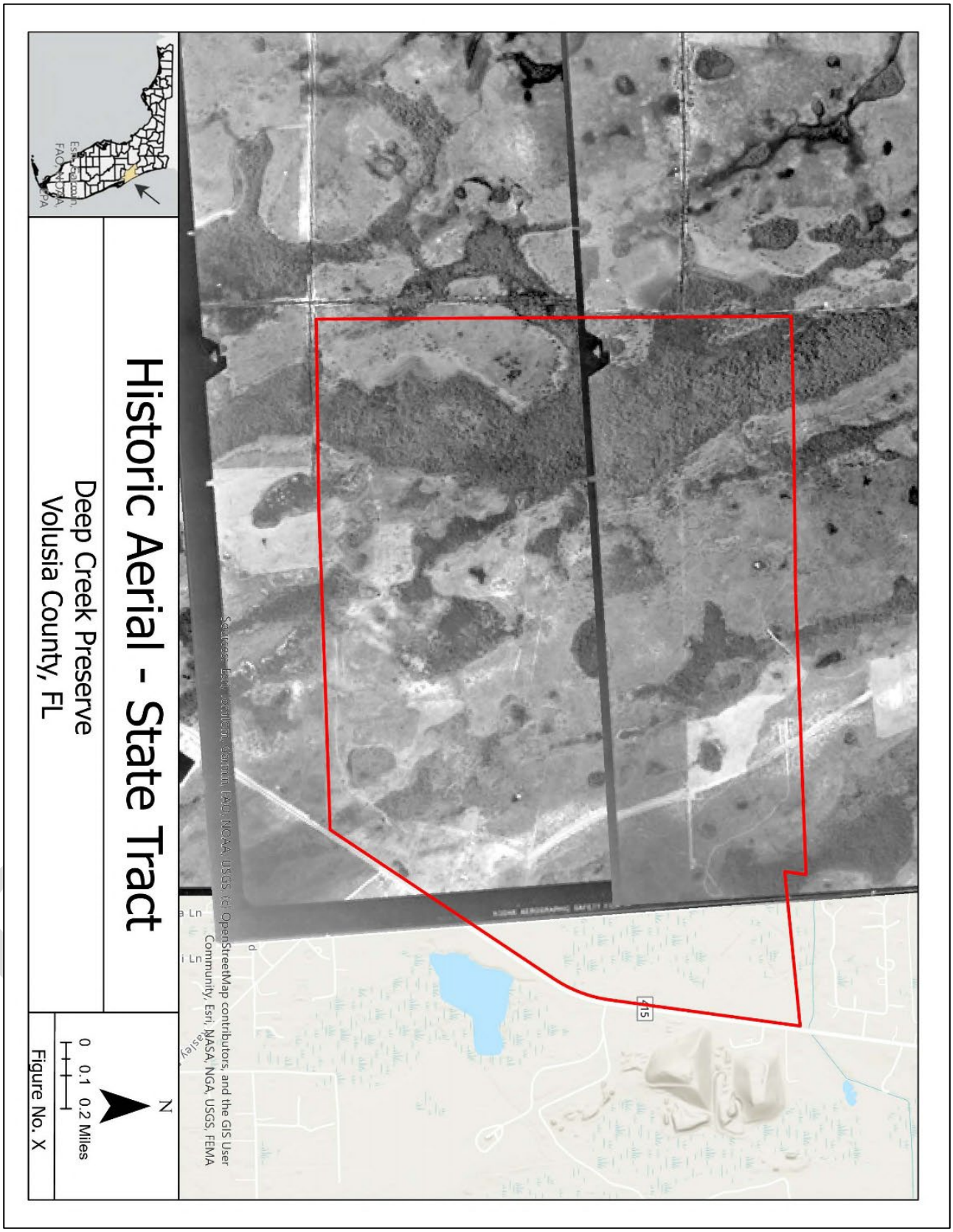

Figure 31. State Tract Historic Aerial

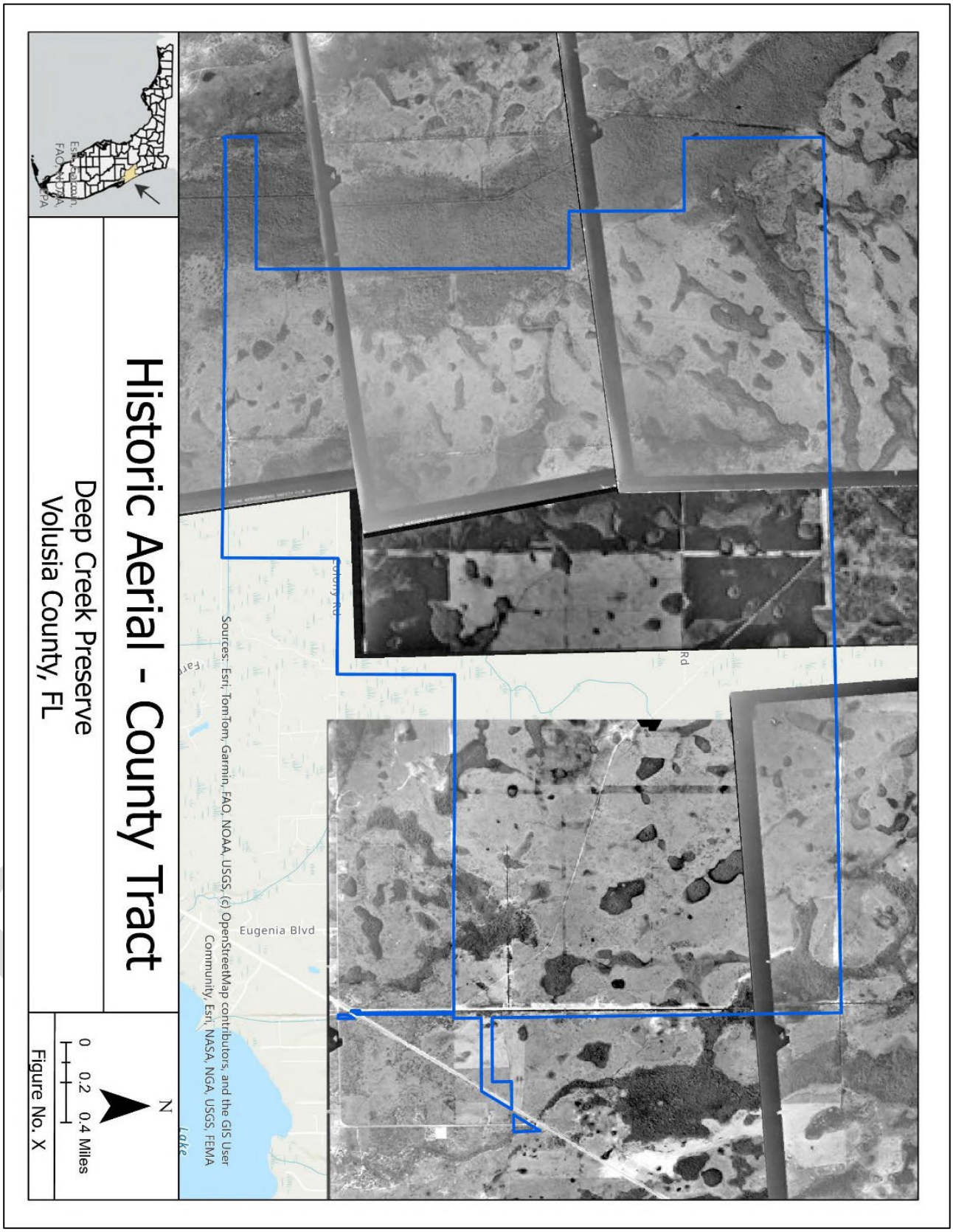

Figure 32. County Tract Historic Aerial

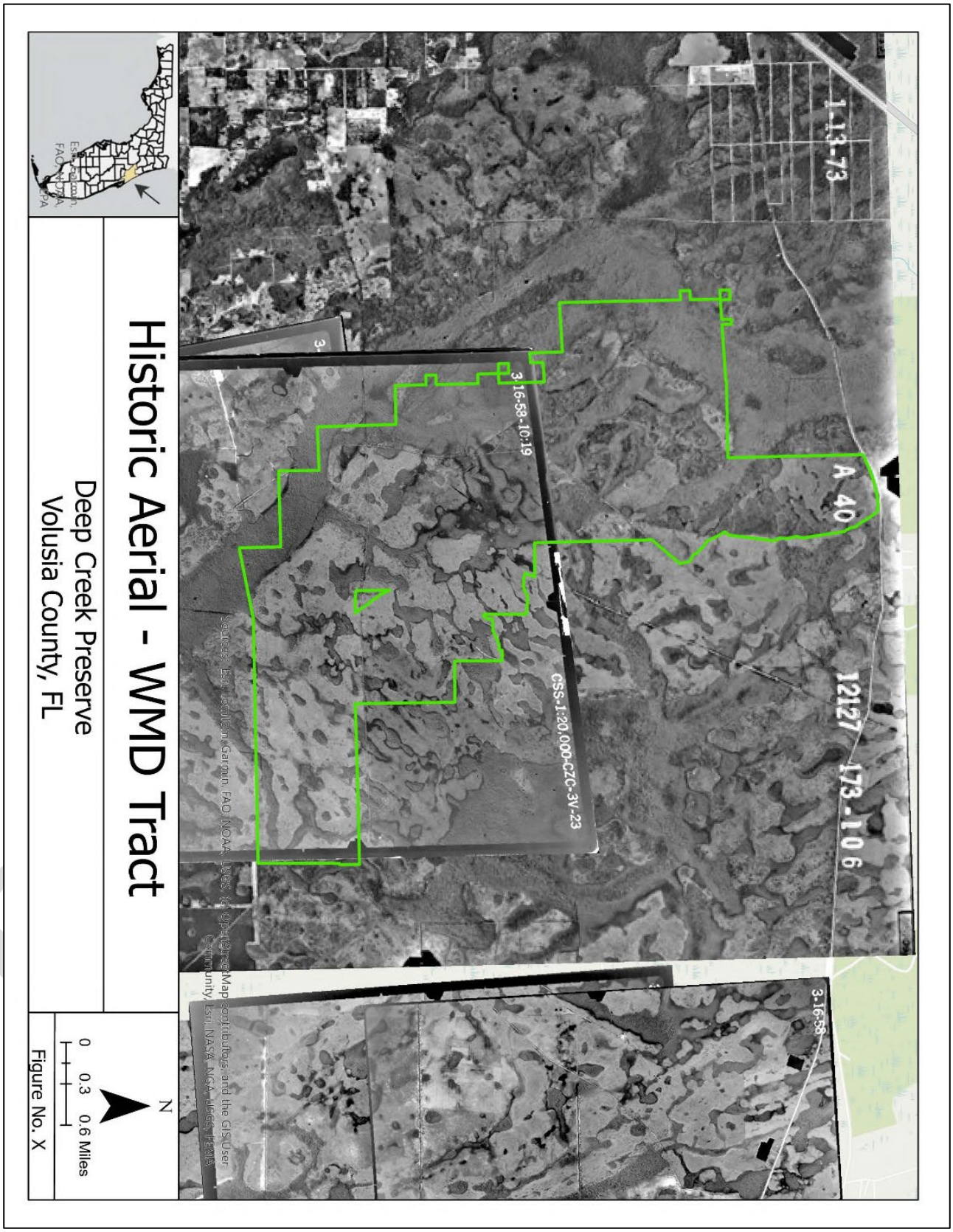

Figure 33. WMD Tract Historic Aerial

B. Current Use and Development

Since the Preserve has been in public ownership by the SJRWMD and Volusia County, it has been used by residents for passive recreation activities. Current uses are related to public access, outdoor recreation, cattle grazing (through leases) and hunting (through leases). Multiple use, unpaved trails and primitive camping sites have been developed on the County Tract. At the time of the State Tract acquisition, public access to the Preserve was provided via the County Tract. The WMD Tract access to the general public is from the connection to the County Tract. Vehicular access to the WMD Tract is limited to land managers and hunt club lessees. Additional uses, access points and infrastructure are proposed for the State Tract. Table 6 below provides a list of existing uses and infrastructure within each tract. Analysis of proposed uses is provided in the following section. A conceptual recreational plan is provided in Appendix F. This table is intended to list existing infrastructure related to uses and development. Additional conceptual uses and related infrastructure that do not yet exist on the Preserve are evaluated in the following sections and shown on the Conceptual Recreation Plan.

Table 6. Inventory of existing recreational and access facilities, at the time of acquisition of the State Tract.

Current Use / Infrastructure	Tract Existing		
	State (BOT)	County	WMD
Public Access Point	0	1	0
Hunting Access Points	0	1	1
Parking Area	0	1	0
Information Kiosk	0	2	0
Trails (H, B, E, OHV, V)*	H, B, E, OHV, V	H B E V	V
Trails (H, B, E, OHV combined) Miles	0	11.5	12
Pavilion/ Picnic Area	0	1	0
Observation Tower	0	0	0
Camp Sites (Special use – permit required) Incl. hike, car, cabin, RV	0	1	0
Canoe/Kayak Landing/ Launch	0	0	0
Restroom/Port-O-Let	0	1	0
Pasture / Cattle Grazing Acres	X	X	0
Hunting Acres	0	2,617	3,200

*H, B, E, OHV, V = Hiking, Biking, Equestrian, Off highway vehicle, Vehicle.

The public access points are generally open during daylight hours. The parking at the County Tract is

not gated, but the entrance to the Preserve beyond the parking area is gated to preclude vehicular access. There is a permanent opening for pedestrian and equestrian access at the gate location. Primitive group camping is allowed with a permit from the County. Vehicular parking will be provided at least one location on the State Tract. The Conceptual Recreation Plan in Appendix F provides the various uses and infrastructure conceptually proposed for the State Tract.

C. Purposes for Acquisition of the Property

The Florida Forever Project Evaluation Report for Carter Quail Ranch (FDEP, 2023) provides the purpose for acquisition:

> The Carter Quail Ranch project will contribute to a corridor of conservation lands that will support and provide crucial habitat protection and connectivity for rare and endangered plant and animal species. The project will provide critical water quality and quantity protection for Deep Creek and the St. Johns expanding public access to resource-based recreational opportunities in a rapidly growing region of the state.
>
> Acquisition of this project would serve to:
> - increase the protection of Florida's biodiversity at the species, natural community, and landscape levels.
> - increase natural resource-based public recreation or educational opportunities.
> - provide and enhance wildlife corridors and valuable habitat for rare and imperiled species.
> - provide surface and groundwater protection and protect natural floodplain functions.
> - increase the amount of forestland available for sustainable management of natural resources.
> - protect, restore, and maintain the quality and natural functions of land, water and wetland systems.

<u>The Goals of Volusia Forever</u>
Conserve, maintain and restore the natural environment and provide access for the enjoyment and education of the public; provide resources to ensure that sufficient quantities of water are available to meet current and future needs; meet the need for high-quality resource based outdoor opportunities, greenways, trails, and open space; preserve the habitat and water recharge; ensure that the natural resource values of such lands are protected and that the public has the opportunity to enjoy the lands to their fullest potential.

<u>Water Resource Facilities</u>
A portion of the County Tract was acquired using County Utilities funding, reflecting the Preserve's identified potential to support future regional water supply needs. The SJRWMD has indicated that the County's existing raw water wells are projected to impact the flow of Blue Spring, a first-magnitude spring located adjacent to the St. Johns River. In order to mitigate the potential impacts to Blue Spring, the County has proposed to evaluate the potential for locating several water resource facilities within the County Tract of the Preserve. These water resource facilities, which may be implemented in conjunction with the west Volusia cities of DeBary, DeLand, Deltona, Lake Helen, and Orange City, may provide an opportunity for a regional water supply solution that serves the public's basic daily health and safety needs in an environmentally responsible manner. Any water resource facilities considered would be limited to the County Tract and would not be established on the State or WMD Tracts.

Should water resource development be pursued on the County Tract, the following components have been identified as potential strategies:

Raw Water Collection

Raw water may be collected through a series of small, low-yield wells distributed across the County Tract. Each well would be housed in a small building designed to blend with the surrounding environment and withstand wildfire and periodic prescribed fire events. Should wells be established, they would be sited within or adjacent to existing internal roads and clearings within the County Tract to minimize disturbance to the surrounding natural environment and would be spaced to minimize potential drawdown impacts to on-site wetlands.

Water Treatment

A water treatment facility, which may encompass twenty or more acres, may be established within an existing disturbed or altered area of the County Tract to treat raw water pumped from on-site wells as well as potential off-site well fields. A paved road and electrical service would be necessary to support such a facility. Should a treatment facility be established, it would be sited within the County Tract only, in an area that minimizes impacts to the surrounding natural communities.

Potable Water Distribution

Should a treatment facility be established, a finished water main may be provided from the facility through the County Tract to service centers in western Volusia County. The main would be sited within or adjacent to existing easements, roadways, and clearings within the County Tract where practicable to minimize potential impacts to the surrounding natural environment.

Stormwater Augmentation

A stormwater augmentation reservoir may be constructed within an existing disturbed area of the County Tract, potentially encompassing 200 or more acres, to offset impacts to natural wetland systems that may be caused by groundwater pumping. Should such a reservoir be constructed, stormwater stored in the reservoir may be used to augment on-site wetland systems within the County Tract in a manner that mimics the natural hydroperiod of each wetland community, and may supplement the reclaimed water supply used by the County and the west Volusia cities of DeBary, DeLand, Deltona, Lake Helen, and Orange City for irrigation. Stormwater may be harvested from Deep Creek and the Lake Ashby Canal and conveyed via pump station to the reservoir for storage. Distribution piping would be located along existing power line corridors and roadways to the extent practicable, with smaller piping systems constructed via horizontal directional drilling where necessary to deliver augmentation water to individual wetland systems while minimizing damage to natural communities.

Any water resource facility development would be limited to the County Tract and would be contingent upon completion of a hydrogeological evaluation of that Tract, which would assess current ground and surface water conditions and determine the number, location, and capacities of raw water wells that may be suitable for siting within the County Tract. Any construction beyond exploratory or test wells would require completion and evaluation of that study and the availability of funding. Development of water resource facilities within the County Tract is a long-term county objective that extends beyond the horizon of this management plan, and no water resource facility construction beyond exploratory evaluation is anticipated within the 10-year life of this Plan. This use is acknowledged here given the role of County Utilities funding in the acquisition of the County Tract, and any future development of

water resource facilities will be addressed in a subsequent management plan update.

A storm debris collection site may be utilized within the County Tract within an existing disturbed area as needed.

The purpose for acquisition is repeated here as it has direct bearing on the assessment of the impact of planned uses, discussed in the following sections.

D. Proposed Single or Multiple-Use Potential

The Preserve will be managed under the multiple-use concept. The Preserve will allow for natural resource-based recreation and educational opportunities, while keeping protection of the natural and historical resources found in the area as the primary goal and objective.

E. Analysis of Multiple-Use Potential

It is Volusia County's goal to manage the Preserve in such a way as to protect the natural and historical resources, while also providing opportunities for compatible, resource-based recreation and education. During the development of this Plan, likely outdoor recreation uses typical of the region were considered. Those found appropriate are discussed within this plan. Some uses that were rejected are included as the uses may have been requested by the public, local leadership, or are uses provided at other conservation lands in the region.

The potential of generating revenue to fund management was also analyzed. Some revenues may be generated by user and concession fees within the Preserve. Such revenue generation is most compatible within the State Tract.

Revenue generation may also come from mitigation, resource sales or leases. Mitigation may consist of wetland restoration and recipient sites for listed species. Some wetland restoration through hydrologic improvements is likely to occur. The County will evaluate the potential for use of hydrologic restoration as potential mitigation on a case-by-case basis.

The primary species to consider for recipient site is the state-listed gopher tortoise within the State Tract. The FWC Guidelines provide parameters that must be met to be considered as a long-term recipient site (Permitting Guidelines in Appendix G1).

Revenues may be generated through sale of forest products generated during management. Any revenues generated through the sale of these timber products will be used directly for management of County conservation lands.

There are active hunting lease agreements for the County and the WMD Tracts, as well as a cattle lease for the County Tract (Appendix H).

The use of private land managers to facilitate restoration and management of the Preserve was also analyzed. Decisions regarding this type of management (such as mitigation projects, removal of timber for resource protection or restoration, implementation of prescribed fire, non-native invasive species treatments, etc.) will be made on case-by-case basis as necessity dictates.

F. Assessment of the Impact of Planned Use

Determination of public uses that are consistent with acquisition purposes follows the parameters outlined below. The parameters are a summary of the objectives and goals for management of the Preserve as they relate to purpose for acquisitions and as outlined in the Florida Statutes.

1. To conserve and protect environmentally unique and irreplaceable lands that contain native, relatively unaltered flora and fauna representing a natural area unique to, or scarce within, a region of Florida or a larger geographic area, including FNAI listed imperiled habitats;

2. To conserve and protect native species habitats that support or could support with appropriate management techniques state and federally listed species or species considered imperiled by FNAI;

3. To conserve, protect, manage, or restore important ecosystems, landscapes, and forests, if the protection and conservation of such lands are necessary to enhance or protect significant surface water, ground water, coastal, recreational, timber, or fish or wildlife resources which cannot otherwise be accomplished through local and state regulatory programs.

4. To provide areas, including recreational trails, for natural resource-based recreation and other outdoor recreation on any part of any site compatible with conservation purposes.

The primary goal is to provide a diversity of outdoor recreational opportunities that are environmentally, culturally, outdoor or educationally oriented where such activities are compatible with the long-term well-being of the natural and cultural resources for which the property was acquired or for which it is being managed. Public needs and desires, as well as assessment of the impact of planned activities on natural and cultural resources, are considered in the development of recreational opportunities and represent “balanced public utilization.” Uses planned for the Preserve are in compliance with the Conceptual State Lands Management Plan.

Table 7. Summary of activities and uses that were analyzed for compliance with the goals and objectives of the Plan.

Activity	Status of Use*		
	Approved	**Conditional**	**Rejected**
Protection of listed species	✓		
Preservation of cultural sites	✓		
Preservation of historical sites	✓		
Ecosystem maintenance	✓		
Soil and water conservation	✓		
Hunting		✓	
Fishing		✓	
Wildlife Observation (incl. birding)	✓		
Hiking		✓	
Jogging		✓	
Bicycling		✓	
Equestrian use (Horseback riding)		✓	
Model hobbyist activities		✓	
Mining			✓
Silviculture		✓	
Cattle grazing / range management		✓	
Apiaries		✓	
Bat House Construction		✓	
Observation Tower / Dark Sky Viewing		✓	
Camping		✓	
Cabin Rentals		✓	
RV Camping		✓	
Canoe / kayak landings & use		✓	
Ecotourism		✓	
Vehicular Access and Parking		✓	
New Linear Facilities			✓
Water Resource Facilities		✓	
Off Highway Vehicle Use		✓	
Survey and Mapping	✓		
Environmental Education (Nature Study)		✓	
Cultivation of native species for seed banks or propagation		✓	
Citriculture or other agriculture / row crops			✓
Swimming / Diving			✓
Boating (power)/ Sailing			✓
Disc Golf		✓	

Approved = A use considered to be in compliance with goals and objectives with the Plan.
Conditional = A use that is considered in compliance with Plan goals and objectives given certain conditions are met (e.g., timing, location of use, intensity, etc.)
Rejected = A use considered not in compliance with goals and objectives of the Plan.

The majority of uses and decisions on acceptability are clear. Those worth further discussions are explained in further detail here. It is important to note that the list is primarily geared towards user groups; however, activities performed by the lead agency may appear contradictory and thus are discussed below.

Ecosystem maintenance includes the eradication of nuisance wildlife species, namely feral hog, through trapping and removal. This activity is not considered hunting and is performed by County staff or licensed trappers contracted by the County. Access to all parts of the Preserve by management equipment, including off-highway vehicles (OHVs), is also a necessary component of ecosystem maintenance and is distinct from recreational OHV use discussed below.

Hunting is an existing, established use on the County and WMD Tracts, currently conducted under active lease agreements consistent with FWC rules and preserve-specific regulations. As additional lands are incorporated into the Preserve, each tract will be evaluated individually for hunting compatibility based on habitat type, proximity to other user groups, listed species considerations, and existing use patterns. Where hunting is determined to be appropriate, it will be designated as a conditional use, regulated pursuant to FWC rules and preserve-specific guidelines, and conducted in a manner consistent with how hunting is managed on comparable publicly owned conservation lands in Florida. Hunting access points and designated hunting areas will be identified in the Conceptual Recreation Plan.

OHV use by the general public is proposed as a conditional recreational use on designated roads and trails within appropriate portions of the State Tract. Unlike the management vehicle access described above, recreational OHV use would be limited to specifically designated routes, mostly existing roads and firelines. The routes are identified in the Conceptual Recreation Plan and would not be permitted in areas containing documented populations of listed species, imperiled natural communities. OHV use would be closely monitored by the County and subject to modification, relocation, or discontinuation if determined to adversely impact natural resources, listed species, or other user groups. It is acknowledged that the 2013 Deep Creek Preserve General Management Plan prohibited public OHV use. The conditional approval of this use in the current Plan reflects the expanded Preserve boundary, the availability of suitable upland areas on the State Tract, and the County's commitment to managing OHV use within defined parameters. Given that the State Tract is managed under a BOT lease subject to ARC oversight, any implementation of recreational OHV use on that Tract will be subject to the conditions and approval of the applicable state agencies prior to establishment.

Silviculture is identified as an approved use solely in support of natural resource restoration, management, and maintenance objectives. This designation enables the lead agency to conduct timber harvests, prescribed burns, and other associated activities that may require silvicultural classification to obtain permits or approvals from local municipalities and regulatory agencies. Revenue generation is not the purpose of this designation; however, incidental revenue derived from these activities is encouraged as a means of offsetting restoration and management costs.

Hiking, equestrian use and biking are limited to use on trails and are currently allowed in designated areas on the Preserve with equestrian use and biking primarily limited to the County Tract. These are on-going and popular activities and result in the greatest daily use of the Preserve. These activities have been designated as a Conditional Use as these are active uses and do result in some impacts to natural resources and historical sites. They are controlled by trail and access management.

Linear facilities, including gas and power lines, already occur within the limits of the Preserve and were in place prior to acquisition. The approval of this use is limited to existing linear projects.

Camping on all tracts will be considered primitive in nature, including the proposed RV and drive-to campsites. All proposed campsites will not have water or utility hookups.

The Conceptual Recreation Plan, provided in Appendix F, discusses the implementation of these uses, and provides for guidance of public use management in the context of the two-prong approach to natural resource protection and public access. The Conceptual Recreational Plan provides a framework for the types, quantities and general locations of recreational uses. It is not a mandate that all such uses and related infrastructure be completed in the span of this 10-year management plan or be sited exactly as shown. It is anticipated that flexibility in layout will be required in development of use infrastructure to avoid impacts to imperiled species and communities, wetlands, etc.

G. Cooperating Agencies Responsibilities

No other agencies are directed by the lease or other agreements as a cooperating partner in the management of the Preserve. This does not preclude the County from partnering with other agencies to accomplish the Plan's goals. This may include other state agencies for wildlife management, prescribed fire, suppression of wildfires, etc. The County may also utilize non-governmental organizations for aiding in citizen science projects to aid in documenting and monitoring organisms within the Preserve.

H. Acreage that Should be Declared Surplus

On State-owned conservation lands where Volusia County is the lead manager, the County is required to assess and identify areas for potential surplus land. This assessment consists of an examination of resource and operational management needs, public access and recreational use, and GIS modeling and analysis. The evaluation of the entire Preserve by the County has determined that all portions of the area are being managed and operated for the original purposes of acquisition, and continue to center on the multiple-use concept, as defined in sections 589.04(3) and 253.034(2)(a) F.S. Implementation of this concept will utilize and conserve state natural resources and provide public outdoor recreational opportunities in a harmonious and coordinated combination that will best serve the people of the state of Florida. Therefore, no portion of the Preserve is recommended for potential surplus.

IV. MANAGEMENT GOALS AND OBJECTIVES

Volusia County has implemented resource and user group management programs for the purpose of preserving the significant natural resources under its directive as the lead agency. The goals and objectives presented in this Plan have been developed for the Preserve to meet the purpose for which the property was acquired. These have been developed cooperatively by County staff with input from professional consultation, an advisory group, a public hearing, and user group and other stakeholder surveys.

The goals presented here provide the ultimate, desired outcomes and the objectives provide specific, measurable actions taken to achieve the stated goals. Target dates for completion of objectives are classified as short-term (0-2 years) or long-term (up to 10 years). Corresponding goal numbers for each

objective are listed in parenthesis following the goal. Successful completion of each objective is contingent upon obtaining necessary permits and adequate funding. The goals and objectives will be reviewed, revised and updated in each subsequent ten-year management plan update.

The Resource Management Goals for the Preserve are identified as the following:

A. Restore and maintain natural communities with a trend towards maintenance conditions as defined by the Desired Future Conditions
B. Continuation and introduction of prescribed fire to pyrogenic natural communities trending towards appropriate return intervals and seasonality
C. Protect water quality and quantity, evaluate hydrologic restoration needs, restore hydrology as needed and where feasible, and maintain optimal hydrologic conditions given existing site constraints
D. Manage timber resources for resource conservation and habitat restoration, enhancement, and maintenance with a trend towards maintenance of Desired Future Conditions
E. Monitor and treat non-native, invasive species to the maximum extent practicable
F. Document and monitor listed and imperiled species and manage, through restoration and maintenance activities, listed and imperiled species habitats
G. Document, protect, restore and maintain imperiled natural communities
H. Identify, protect, preserve, and maintain cultural and historic resources
I. Develop, improve and maintain capital facilities and infrastructure necessary to meet the goals and objectives of this management plan
J. Provide public access, recreational and educational opportunities with a focus on high quality trails, hunting, camping and regionally unique opportunities
K. Enhance resources and management through development of an optimal boundary that identifies important habitats, landscape-scale linkages, wildlife corridors, operational and resource management and access needs; continue to identify acquisition needs, and pursue acquisitions through existing County programs and conservation stewardship partnerships
L. Goal: Develop stewardship partners to achieve management objectives

A. Habitat Restoration and Improvement

Land management and restoration require clear ecological goals with Desired Future Conditions (DFCs) which were determined using FNAI's recommended ranges for each natural community. These goals are essential to successful ecosystem management and restoration. It is essential to provide a clear vision of future conditions that can be communicated to the management staff and the public, establish a guide for conservation and management actions, establish priorities for proposed activities, and integrate proper monitoring criteria that can evaluate resource management.

Within the Preserve, there are several natural communities that require land management activities to maintain their appropriate ecological functions. Land management activities include manipulation of abiotic (e.g., fire, hydrology, infrastructure, etc.) and biotic factors (e.g., invasive species, forestry, supplemental plantings, herbicide application for habitat maintenance, etc.). Goals related to habitat restoration and improvement are listed below. Objectives to achieve one or more specific goal are provided under the goals.

Along with mechanical treatments, herbicide application is another widely used method in habitat management such as pine tree seed release treatments and control of woody vegetation. As a specific example, broadcast herbicide application is often used in various types of flatwoods (from sandhills to hydric pine savannahs) restoration projects when hardwoods such as laurel oaks or sweetgums have become dominant shrub and subcanopy species and preclude the use of fire.

Goal 1: Restore / improve native habitats trending away from optimal conditions

Goal 2: Implement management techniques that result in a trend towards Desired Future Conditions (DFCs) / habitat maintenance condition

Objectives:

1. Quantify the number of
   a. artificial land uses that will remain through the long-term of this plan (G1)
   b. artificial land uses where restoration activities will occur (G1)
   c. natural communities (G1)
2. Map the extent of, and quantify the acreage of each artificial land use and natural community (G1)
3. Identify, map, and quantify the acreage of management units that will be created to implement restoration and maintenance management activities (G1, G2)
4. Update the extent and acreage of natural communities after restoration activities have been implemented (G1, G2)

B. Fire Management

All of the upland natural communities on the Preserve, and many of the successional and natural community wetlands within the Preserve are considered fire dependent or pyrogenic communities. A properly developed and implemented fire management program provides ecological, economical and public safety benefits such as: The following statements summarize the general benefits of:

- Reduction of fuels which reduces wildfire hazards;
- Improves accessibility for fire fighters, public and wildfire mitigation;
- Reduces competition within all vegetative strata, reduces forest disease pathogens and vectors, and generally provides for a more healthy and productive forest;
- Improves forage for wildlife;
- Increases carrying capacity for many wildlife species;
- Increase biodiversity, especially within the plant and insect communities;
- Aids in consumption of dead organic materials and returns nutrients to soils;
- Improves aesthetics by improving habitat structure, generally creating a more open habitat

Fire is a historically important disturbance within several plant communities and can be very important for reproduction and production of species endemic to the vegetation communities found on the project site. Fire return intervals, prior to colonization, may have been as low as 1-2 years in some flatwoods and hyperseasonal wet prairies (the latter does not occur within the Preserve). Historically, fire occurred primarily in the early growing season (Noss 2018). Due to myriad logistical and safety constraints, a modern-day fire program focuses on variability of the fire return intervals, percent of areas burned within a management unit, seasonality, duration and intensity. Variability amongst all of these parameters, with a continual trend towards growing season burns (yet maintenance of variability within that season) are important aspects included in the fire management plan to maintain diversity and promote "patchiness" within habitats.

The ultimate goal in a typical burn program is to allow for growing season burns to occur within the fire-dependent communities and to reach a stage where fire is being utilized as a habitat maintenance tool, rather than a restoration tool.

Not all natural communities within the Preserve are fire-dependent. The floodplain swamps and basin swamps may have rarely experienced fire historically, within extremely long and variable return intervals. The occurrence of some bay swamps may have originated entirely due to fire exclusion. The presence of thick organic layers in these wetland communities require that fire generally continues to be excluded. However, it is imperative that the edges of these systems, the ecotones between them and adjacent pyrogenic communities, experience regular fire. Thus, fire breaks should not be located within the ecotone between wetlands and the pyrogenic communities. In the case of bay swamps, fire can continue to be pushed further into the system as the potentially artificial build up of organics is consumed during cool, wet season fires. Some of the natural communities, such as the wet prairies, are so small that their fire management is based solely on the fire management of the surrounding pyrogenic communities.

Several constraints exist on any given site that influence how and when fire can be introduced. These constraints are discussed in more detail in Section V, below. The constraints surrounding prescribed fire implementation at the Preserve are generally related to fire exclusion by previous landowners and

land use activities. These constraints typically include a build of fuels and / or organic layers that would result in catastrophic, unsafe fires. Where/when these circumstances occur, other management activities will be implemented. Such management strategies include a combination of roller chopping and forestry mowing that directly reduce fuel loads and heights. Reduction of the canopy, through various forestry practices also reduces fire intensity. These mechanical methods are considered "fire surrogates" as they replace the role of fire in situations where fire is, at least temporally, an unsuitable restoration tool. While several methods are available as fire surrogates, none have proven to be as ecologically effective as fire. However, many of these fire surrogate activities are necessary prior to safe fire implementation. In these cases, mechanical and other fire surrogate activities are crucial in the eventual re-introduction of fire.

There are several listed species whose occurrence and population health are directly related to fire / fire surrogate activities. Where the specifics of a particular species are well known, they are discussed in the imperiled species section below. Goals related to fire management are listed below. Objectives to achieve one or more specific goal are provided under the goals.

Goal 1: Maintain disturbance intervals in appropriate habitats

Goal 2: Develop a Prescribed Burn Plan

Goal 3: Improve site conditions that will foster increased use of prescribed fire

Goal 4: Implement a plan that will result in a trend toward use of prescribed fire in the growing season

Objectives:

1. Identify the artificial and natural communities where fire management may be applied (G1, G2)
2. Create a management unit map, and for each unit, identify the Management Unit (MU) number, total acreage, habitat type, and whether fire, or a fire surrogate is to be implemented (G1, G2, G3, G4)
3. Develop an operational Fire Management Plan (G2)
4. Develop a monitoring program that tracks:
    a. Acres receiving fire surrogate treatments (by habitat, and year) (G1, G3)
    b. Acres burned (incl. wild and prescribed fires) (G1)
    c. Post-burn analysis (G3)
5. Implement Fire Management Plan (incl. fire or surrogate techniques as appropriate) (G1, G4)
6. Utilize fire monitoring program (G1, G2, G3, G4)

C. Hydrological Preservation and Restoration

Existing or historic field road crossings through wetland areas should be evaluated to determine if they should be removed or retrofitted with culverts for use in the trail system of the project to restore natural water movement within impacted wetland areas. In areas that the trail system is proposed to cross over wetland areas, consideration will be given to placing the alignment over the retrofitted road crossings and/or using elevated walkways. Goals related to hydrologic preservation and restoration are listed below. Objectives to achieve one or more specific goal are provided under the goals.

Goal 1: Protect water quality and quantity, restore hydrology to the extent feasible, and maintain the restored condition

Objectives:

1. Locate, quantify the size of, and evaluate condition of all culvert crossings (G1)
2. Replace failing culverts with low-water crossings or new culverts (G1)
3. Evaluate the feasibility and cost of creating an expanded littoral shelf in the largest artificial pond, located on the State Tract (G1)
4. List of acreages of wetland habitats onsite (G1)
5. Evaluate feasibility and cost of canoe / kayak launch, etc. (G1)
6. Research potential hydrological restoration projects where feasible / necessary (G1)
7. Evaluate feasibility and cost of boardwalks or similar for wetland / water crossings (G1)

D. Sustainable Forest Management

The Preserve has multiple forested habitats. The ability to use sustainable forestry management practices to assist in habitat management is an invaluable tool. The timber stands that exist on the Preserve will be assessed in a timber inventory. Goals related to sustainable forest management are listed below. Objectives to achieve one or more specific goal are provided under the goals.

Goal 1: Manage timber resources for resource conservation and habitat restoration, enhancement, and maintenance

Goal 2: Practice a stewardship ethic that embraces sustainable forest management practices

Goal 3: Generate revenue through sustainable forest management

Goal 4: Reestablish longleaf pine as the dominant overstory species in appropriate communities through the use of sustainable forestry and prescribed fire

Objective

1. Conduct a timber inventory (G1, G3, G4)
2. Develop a Forestry Plan (G1, G2, G3, G4)
3. Utilize revenue generation to offset management expenses (G3)
4. Utilize sustainable forestry practices to restore longleaf pine (G1, G2, G4)
5. Implement Forestry Plan (G1, G2, G3, G4)

E. Non-Native Invasive Species Maintenance and Control

Non-native invasive species are a significant threat to the ecological integrity of conservation lands managed for long-term habitat protection. These species often establish rapidly in disturbed or natural areas because they lack the predators, pathogens, and ecological controls present in their native ranges. This enables non-native invasives to outcompete native vegetation, resulting in reduced plant diversity and altered habitat structure. Non-native invasive plants may form dense monocultures that displace native groundcover and prevent natural regeneration, while non-native animals can prey upon or compete with native wildlife. These changes can disrupt ecosystem processes such as fire regimes, hydrology, and nutrient cycling, ultimately degrading habitat quality for native species, including imperiled species. Effective management of non-native invasive species is essential to maintaining biodiversity and preserving the natural ecological functions of conservation lands.

Several invasive plant species have been identified throughout the Preserve. Initial acreage estimates of non-native invasive plants that occur on the project site are as follows

- Cogongrass (*Imperata cylindrica*) - approx. one (1) acre
- Brazilian pepper (*Schinus terebinthifolius*) - approx. one (1) acre
- Old world climbing fern (*Lygodium microphyllum*) - approx. one-quarter (1/4) acre
- Chinese tallow (*Triadica sebifera*) - approx. five (5) acres
- Torpedograss (*Panicum repens*) - approx. two (2) acres
- Caesarweed (*Urena lobata*) - approx. ten (10) acres (low density)

Because of these species' invasive nature and potential to disrupt natural communities by dominating wetland and upland communities, these plants are targeted for removal using chemical and/or mechanical control methods. As populations of these plants are found, regular maintenance events are scheduled to eliminate or reduce invasive species. Where feasible, volunteer organizations can be used to monitor the preserve for non-native invasive species and could perform some of the control of these species in cooperation with regularly scheduled maintenance events.

Because of the opportunistic nature of invasive species to spread via human use and the known natural history of the invasive species in the area, it is a reality that invasive species will continue to invade all habitats. Those areas easily accessed such as property boundaries marked by clearing or fencing, field roads, trails and natural breaks are the most likely to be invaded by such species and will be regularly monitored for any invasive species. The species of primary importance during monitoring include species listed as Level I or II non-native invasive by the Florida Invasive Species Council (FISC). Monitoring will consist of visual reconnaissance during all other onsite activities. Discovery of new species or locations will be recorded by species, location and size of infestation and regularly monitored until eradiated or in a maintenance level condition. The County utilizes a GPS / GIS based software for tracking location and management of invasive species.

Of the non-native invasive animal species, feral hogs (*Sus scrofa*) create the greatest visible impact to the onsite natural communities and create large, disturbed areas that disrupt natural vegetative processes and promote the introduction of invasive / weedy species. The hog population is relatively low at this time and impacts from this species are minor. Numerous other non-native invasive animals may be present, from terrestrial to aquatic. Species such as Cuban tree frog (*Osteopilus septentrionalis*) are outcompeting local native treefrogs. However, these smaller, more inconspicuous species are not readily or easily controlled through land management practices. Education of such species, including

proper disposal, may be a potential tool to assist in identification and control of less visible species.

The County has developed an Arthropod Control Plan to evaluate the necessity of control. This is provided in Appendix P.

Goals related to non-native invasive species maintenance and control are listed below. Objectives to achieve one or more specific goal are provided under the goals.

Goal 1: Control non-native invasive species utilizing Integrated Pest Management strategies

Objectives:

1. Identify species, locations and extent of invasive species (G1)
2. Utilize ArcGIS for monitoring of invasive species locations and treatments (G1)
3. Track area treated per year and document treatment method (G1)
4. Document number of hogs trapped / removed per year (G1)

F. Imperiled Species Habitat Management

The Preserve supports numerous listed wildlife and plant species. Where a particular species occurrence has an implication to resource management, it is discussed below. Those that occur due to existence of high-quality habitat, or that are benefited by existing proposed management goals and objectives, are not discussed specifically in this section.

Proper management of the project site for listed wildlife and plant species is based on locations of known populations (extant or otherwise) on the property. Therefore, inventory to determine presence / absence of species with specific management objectives is necessary. Surveys will be focused in areas that have the highest likelihood of occurrence for listed species, based on habitat requirements of the species, and should follow events creating disturbances within the communities, including controlled (roller chopping, prescribed fires) and uncontrolled (wildfires, tornadoes) events.

With the addition of GIS mapping tools, gopher tortoise(s) and their burrows are documented when witnessed in the field. The density of gopher tortoises (*Gopherus polyphemus*) within the Preserve appears to be minimal. It appears that this species is lower than carrying capacities set by the Florida Fish and Wildlife Conservation Commission (FWC) in determining whether a site would be a suitable recipient site for tortoises relocated from to-be-developed lands. The County does operate a gopher tortoise recipient site at Longleaf Pine Preserve. The State Tract is being evaluated by FWC as a potential recipient site. The results are provided in Appendix G.

The use of the Preserve as a tortoise-recipient site can be a source of revenue, and can be utilized by other County development projects that may occur within occupied tortoise habitat. Therefore, tortoise relocation to the Preserve is identified as suitable management tool, but is not a mandated objective by this Plan. As noted elsewhere, vegetation reduction, preferably through prescribed fire is essential to increase suitability of gopher tortoise habitats and therefore increase density and total population, which meets the goal stated above. Those habitats that are too overgrown to successfully carry a safe fire will be thinned mechanically. Any activity promoting thinning of woody vegetation and thereby an increase in open space and herbaceous vegetation in the upland habitats will be critical to the stated goal for this species.

Cox et. al. stated that fire used as a management tool on gopher tortoise habitat is more beneficial than other techniques because it reduces the amount of ground litter, quickly reduces nutrients bound in plant materials, and does not disturb soil conditions and wildlife to the same extent as other management techniques. Furthermore, there is strong evidence to suggest that burning, particularly during the growing season, has several other beneficial effects on gopher tortoise populations. Prescribed burning during this period reduces the growth of deciduous shrubs and trees, thereby reducing canopy cover and stimulating herbaceous groundcover. Fire during this period also removes dead litter and tall standing plant stems at a time when hatchling tortoises are first ready to disperse from their nests and establish their first burrows. Summer burns expose mineral soil which may be necessary for burrow excavation by hatchlings. Since this species is adapted to upland plant communities in which fire is a natural and recurring feature, it is reasonable to assume applying a “natural” fire regime with respect to frequency and season will result in a habitat matrix suited to the needs of this species.

The southeastern American kestrel (*Falco sparverius paulus*) utilizes nest sites that include tall dead trees or utility poles generally with an unobstructed view of surroundings. Although the species has

not been observed, snags should be left standing where feasible.

Rugel's pawpaw (*Deeringothamnus rugelii*), a federally endangered small woody shrub endemic to Volusia County, has been documented as present onsite of both the State and County Tracts.

Other imperiled species not listed under the ESA that have been documented onsite include the Southeastern fox squirrel (*Sciurus niger niger*), and the Florida black bear (*Ursus americanus floridanus*).

Bat boxes could be utilized by the imperiled species Rafinesque Big-eared Bat (*Corynorhinus rafinesquii*) with potential of occurrence.

Goals related to imperiled species habitat management are listed below. Objectives to achieve one or more specific goal are provided under the goals.

Goal 1: Document listed and imperiled species occurring on the preserve
Goal 2: Provide optimal site conditions to aid in the recovery of listed and imperiled species
Goal 3: Provide opportunities to receive listed and imperiled species that would increase the health of the population
Goal 4: Partner with institutions / agencies / conservation groups to accomplish inventories for imperiled / listed species
Goal 5: Educate visitors and public of presence and importance of listed species

Objectives:

1. Estimate gopher tortoise populations (G1)
2. Determine feasibility of creating a gopher tortoise recipient site (G2, G3, G4)
3. Conduct survey for *Deeringothamnus rugelii* through partnership with the Pawpaw Chapter, FNPS and USFWS (G1, G4)
4. Document all listed and imperiled species occurrences. To include:
    a. Species, location and approximate population size, where feasible (G1)
    b. Date and type of land management activities conducted in the MU containing the species (G1, G2)
5. Utilize game cameras, or similar, to document imperiled wildlife species (G1)
6. Set up photo stations for monitoring (G1)
7. Conduct inventories as needed for listed species (G1)
8. Confirm presence / absence of species documented in citizen science projects, i.e. iNaturalist, that have not been documented by the County staff or FNAI (G1, G4)
9. Report new, confirmed findings to Florida Natural Areas Inventory (G1, G4, G5)
10. Install two (2) kiosks with educational information regarding listed and imperiled species onsite and their habitat management needs (G5)

G. Imperiled Natural Communities

One (1) natural community, scrubby flatwoods, is located on the Preserve. Scrubby flatwoods are considered G2/S2 by FNAI. This community was not included in the FNAI report but has been documented by the County. This community occurs entirely within the State Tract, which contains 34.1 acres of scrubby flatwoods. Management activities include protection from illegal access related to dumping, unauthorized off-highway vehicle (OHV) use and prevention and maintenance of invasion by non-native invasive species. Goals related to imperiled natural communities are listed below. Objectives to achieve one or more specific goal are provided under the goals.

Goal 1: Restore, protect and maintain imperiled natural communities

Objectives:

1. Determine current natural community conditions (G1)
2. Determine restoration / management needs to trend the community towards DFCs (G1)
3. Introduce prescribed fire to the scrubby flatwoods within the Preserve (G1)
4. Document the extent of scrubby flatwoods after restoration activities (G1)
5. Conduct surveys in the scrubby flatwoods for listed imperiled species (G1)

H. Cultural and Historical Resources

There are no historic buildings located within the boundaries of the Preserve. Cultural resource management activities focus on archaeological resources in accordance with *Best Management Practices: An Owners Guide to Protecting Archaeological Sites and Management Procedures for Archaeological and Historical Sites and Properties on State-owned or Controlled Lands (revised August, 1995)*. Historical, cultural and archaeological sites are limited in scope within the Preserve and do not face threats of destruction by any proposed uses or activities in this Plan. County staff will continue to make opportunistic observations of any undocumented, unknown such resources. Goals related to cultural and historic resources are listed below. Objectives to achieve one or more specific goal are provided under the goals.

Goal 1: Identify, protect, preserve, and maintain the cultural resources of the Preserve

Objectives:

1. Continue to monitor, and protect and preserve resources (G1)
2. Submit new finds to SHPO for inclusion on the Florida Master Site File (G1)

I. Facilities and Infrastructure

For the purpose of the Preserve's facility and infrastructure management, the County considers the entire managed area, regardless of ownership, as one complete unit. Goals related to facilities and infrastructure are listed below. Objectives to achieve one or more specific goal are provided under the goals.

Goal 1: Maintain, improve and develop capital facilities and infrastructure necessary to meet the goals and objectives of this management plan

Goal 2: Generate revenue through recreational opportunities

Objectives:

1. Track infrastructure
    a. Quantify each type and summarize by Tract (G1)
    b. Annual revenue / expenditures directly related to facilities / infrastructure (G1, G2)
    c. Date of construction completion of new projects; dates of maintenance events (G1)
2. Create two (2) new access points, one with public parking and one for specific user group access (G1)
3. Determine if existing gates are sufficient to control public access (G1)
4. Identify infrastructure needs, estimate costs for implementation and create priority list for implementation (G1, G2)
5. Evaluate revenue generation through development of recreational facilities (G2)
6. Evaluate the following specific infrastructure items:
    a. Water resource development projects, water supply development projects, storm-water management projects (G1)
    b. Linear activities (G1)
    c. Forestry (G1, G2)
7. Construct educational kiosks (G1)

J. Public Access, Recreational and Educational Opportunities

Much of the infrastructure and facilities discussed above are provided to support the goal established in this subsection. Public access, recreational and educational facilities and uses will be developed in a manner that is consistent with the purpose of acquisition.

The County intends to provide an improved experience for users by creating specific trails for user groups, developing regionally unique opportunities and maximizing types of use available within the Preserve. The County has developed a Conceptual Recreational Plan that has determined myriad uses and the carrying capacity of each. This Plan will guide construction and implementation of facilities to support the intended uses. Several new uses will be developed on the State Tract that are not feasible on the existing County and WMD Tracts. All objectives are dependent on sufficient funding. Goals related to public access, recreational and educational opportunities are listed below. Objectives to achieve one or more specific goal are provided under the goals.

Goal 1: Provide public access, recreational and educational opportunities.

Objectives:

1. Develop a Recreation Plan (G1)
2. Develop a day use / picnic area
3. Develop new trails for hiking, biking, equestrian and OHV use (G1)
4. Designate a Wildlife Management Area or Public Small Game Hunting Area (G1)
5. Develop camping facilities (G1)
6. Construct a fishing pier with canoe / kayak launch (G1)
7. Provide road access for conditionally approved recreational uses (G1)
8. Maintain existing trails for hiking, biking, off highway vehicle (OHV; on State Tract) and equestrian use (G1)
9. Utilize a web-based platform for camping reservations (G1)
10. Conduct bio-blitzes (G1)
11. Provide eco-buggy tours (G1)

K. Conservation Acquisition and Stewardship Partnerships

Beginning with the initial land acquisition program from the mid-2000's, the County, in conjunction with its partners, has been successful in identifying and acquiring additional lands to protect critical habitats and to increase the availability of resources. These partnerships have included municipalities, state agencies, and the SJRWMD.

The County's current program, *Volusia Forever*, provides for the acquisition and management of environmentally sensitive and outdoor recreation lands. The program, created in 2000 reinstated in 2020. *Volusia Forever* is funded through annual ad valorem assessment for a period of twenty years. A portion of this annual revenue is set aside for the management of conservation lands located across the county.

Where feasible, volunteer organizations are utilized to conduct and/or assist the County in the above stated objectives. Objectives that are being accomplished include volunteer efforts by the local Pawpaw Chapter of the Florida Native Plant Society to inventory the plant species occurring on the Preserve. Goals related to conservation acquisition and stewardship partnerships are listed below. Objectives to achieve one or more specific goal are provided under the goals.

Goal 1: Enhance resources and management through development of an optimal boundary that identifies potential important habitats, landscape-scale linkages, wildlife corridors, operational/resource management and access needs by continuing to identify and pursue acquisition needs and conservation stewardship partnerships.

Goal 2: Develop stewardship partners to achieve management objectives

Objectives:

1. Create an Optimal Boundary (G1)
2. Acquire essential parcels within the Optimal Boundary, as funding allows (G1)
3. Identify potential non-governmental organization partnerships and grant program opportunities (G2)
4. Develop partnerships with other agencies, municipalities, institutions and conservation organizations to achieve stated goals and objectives (G2)

Table 8. Summarizing Goals and Objectives for the Preserve

Goals / Objectives		**Term***	**Priority**
No.	**Description**		
A	**Habitat Restoration and Improvement**		
G1	**Restore / improve native habitats trending away from optimal conditions**		
G2	**Implement management techniques that result in a trend towards Desired Future Conditions (DFCs) / habitat maintenance condition**		
O1	Quantify the number of		
O1.a	artificial land uses that will remain through the long-term of this plan	Short	High
O1.b	artificial land uses where restoration activities will occur	Short	High
O1.c	natural communities	Short	High
O2	Map the extent of, and quantify the acreage of each artificial land use and natural community	Short	High
O3	Identify, map, and quantify the acreage of management units that will be created to implement restoration and maintenance management activities	Short	Low
O4	Update the extent and acreage of natural communities after restoration activities have been implemented	Long	Low
B	**Fire Management**		
G1	**Maintain disturbance intervals in appropriate habitats**		
G2	**Develop a Prescribed Burn Plan**		
G3	**Improve site conditions that will foster increased use of prescribed fire**		
G4	**Implement a plan that will result in a trend toward use of prescribed fire in the growing season**		
O1	Identify the artificial and natural communities where fire management will be applied	Short	High
O2	Create a management unit map, and for each unit, identify the Management Unit (MU) number, total acreage, habitat type, and whether fire, or a fire surrogate is to be implemented	Short	High
O3	Develop an operational Fire Management Plan	Short	Low
O4	Develop a fire monitoring program that tracks:		
O4.a	Acres receiving fire surrogate treatments (by habitat, and year)	Short	Low
O4.b	Acres burned (incl. wild and prescribed fires)	Short	Low
O4.c	Post-burn analysis	Short	Low
O5	Implement Fire Management Plan (incl. fire or surrogate techniques as appropriate)	Long	Low
O6	Utilize fire monitoring program	Long	Low

C	**Hydrological Preservation and Restoration**		
G1	**Protect water quality and quantity, restore hydrology to the extent feasible, and maintain the restored condition**		
O1	Locate, quantify the size of, and evaluate condition of all culvert crossings	Short	High
O2	Replace failing culverts with low-water crossings or new culverts	Short	High
O3	Evaluate the feasibility and cost of creating an expanded littoral shelf in the largest artificial pond, located on the State Tract	Short	High
O4	List of acreages of wetland habitats onsite	Short	Low
O5	Evaluate the feasibility and cost of canoe/ kayak launch, etc.	Short	Low
O6	Research potential hydrological restoration projects where feasible / necessary	Long	Low
O7	Evaluate the feasibility and cost of boardwalks or similar for wetland / water crossings	Long	Low
D	**Sustainable Forest Management**		
G1	**Manage timber resources for resource conservation and habitat restoration, enhancement, and maintenance**		
G2	**Practice a stewardship ethic that embraces sustainable forest management practices**		
G3	**Generate revenue through sustainable forest management**		
G4	**Reestablish longleaf pine as the dominant overstory species in appropriate communities through the use of sustainable forestry and prescribed fire**		
O1	Conduct a timber inventory	Short	High
O2	Develop a Forestry Plan	Short	Low
O3	Utilize revenue generation to offset management expenses	Long	Low
O4	Utilize sustainable forestry practices to restore longleaf pine	Long	Low
O5	Implement Forestry Plan	Long	Low
E	**Non-Native Invasive Species Maintenance and Control**		
G1	**Control non-native species**		

G2	**Implement an Integrated Pest Management program**		
O1	Identify species, locations, and extent of invasive species	Long	High
O2	Utilize ArcGIS for monitoring of invasive species locations and treatments	Long	High
O3	Track area treated per year and document treatment method	Long	High
O4	Document number of hogs trapped / removed per year	Long	High
F	**Imperiled Species Habitat Management**		
G1	**Document listed and imperiled species occurring on the preserve**		
G2	**Provide optimal site conditions to aid in the recovery of listed and imperiled species**		
G3	**Provide opportunities to receive listed and imperiled species that would increase the health of the population**		
G4	**Partner with institutions / agencies / conservation groups to accomplish inventories for imperiled / listed species**		
G5	**Educate visitors and public of presence and importance of listed species**		
O1	Estimate gopher tortoise populations	Short	High
O2	Determine feasibility of creating a gopher tortoise recipient site	Short	High
O3	Conduct survey for *Deeringothamnus rugelii* through partnership with the Pawpaw Chapter, FNPS and USFWS	Short	Low
O4	Document all listed and imperiled species occurrences. To include:		
O4.a	Species, location and approximate population size, where feasible	Long	Low
O4.b	Date and type of land management activities conducted in the MU containing the species	Long	Low
O5	Utilize game cameras to document imperiled wildlife species	Long	Low
O6	Set up photo stations for monitoring	Long	Low
O7	Conduct inventories as needed for listed species	Long	Low
O8	Confirm presence / absence of species documented in citizen science projects, i.e. iNaturalist, that have not been documented by	Long	Low

	the County staff or FNAI		
O9	Report new, confirmed findings to Florida Natural Areas Inventory	Long	Low
O10	Install two (2) kiosks with educational information regarding listed and imperiled species onsite and their habitat management needs	Long	Low
G	**Imperiled Natural Communities**		
G1	**Restore, protect and maintain imperiled natural communities**		
O1	Determine current natural community condition	Short	Low
O2	Determine restoration / management needs to trend the community towards DFCs	Short	Low
O3	Introduce prescribed fire to the scrubby flatwoods within the Preserve	Long	High
O4	Document the extent of scrubby flatwoods after restoration activities	Long	Low
O5	Conduct surveys for listed imperiled species in the scrubby flatwoods	Long	Low
H	**Cultural and Historical Resources**		
G1	**Identify, protect, preserve, and maintain the cultural resources of the Preserve**		
O1	Continue to monitor, and protect and preserve resources	Long	Low
O2	Submit new finds to SHPO for inclusion on the Florida Master Site File	Long	Low
I	**Facilities and Infrastructure**		
G1	**Develop and Maintain/Improve the capital facilities and infrastructure necessary to meet the goals and objectives of this management plan**		
G2	**Generate revenue through recreational opportunities**		
O1	Track infrastructure		
O1.a	Quantify each type and summarize by Tract	Short	High
O1.b	Annual revenue / expenditures directly related to facilities / infrastructure	Long	Low
O1.c	Date of construction completion of new projects; dates of maintenance events	Long	Low
O2	Create two (2) new access points, one with public parking and one for specific user group	Short	High

	access		
O3	Determine if existing gates are sufficient to control public access	Short	High
O4	Identify infrastructure needs, estimate costs for implementation and create priority list for implementation	Long	Low
O5	Evaluate revenue generation through development of recreational facilities	Long	Low
O6.a	Water resource development projects, water supply development projects, storm-water management projects	Long	Low
O6.b	Linear activities	Long	Low
O6.c	Forestry	Long	Low
O7	Construct educational kiosks		
J	**Public Access, Recreational and Educational Opportunities**		
G1	**Provide public access, recreational and educational opportunities**		
O1	Develop a Recreation Plan	Short	High
O2	Develop a day use / picnic area	Short	High
O3	Develop new trails for hiking, biking, equestrian and OHV use	Long	High
O4	Designate a Wildlife Management Area or Public Small Game Hunting Area	Long	High
O5	Develop camping facilities	Long	High
O6	Construct a fishing pier with canoe / kayak launch	Long	High
O7	Provide road access for conditionally approved recreational uses	Long	High
O8	Maintain trails for hiking, biking, off highway vehicle (OHV; on State Tract), and equestrian use	Long	Low
O9	Utilize a web-based platform for camping reservations	Long	Low
O10	Conduct bio-blitzes	Long	Low
O11	Provide eco-buggy tours	Long	Low
K	**Conservation Acquisition and Stewardship Partnerships**		

G1	**Enhance resources and management through development of an optimal boundary that identifies potential important habitats, landscape-scale linkages, wildlife corridors, operational / resource management and access needs by continuing to identify and pursue acquisition needs and conservation stewardship partnerships.**		
G2	**Develop stewardship partners to achieve management objectives**		
O1	Create an Optimal Boundary	Short	High
O2	Acquire essential parcels within the Optimal Boundary, as funding allows	Long	High
O3	Identify potential non-governmental organization partnerships and grant program opportunities	Long	High
O4	Develop partnerships with other agencies, municipalities, institutions and conservation organizations to achieve stated goals and objectives	Long	High

***Short-term = 0-2 years; Long-term = 3-10 years**

V. MANAGEMENT CHALLENGES AND STRATEGIES

A. Law Enforcement / Historic Resources

Challenge: Potential for adverse impacts to resources due to public use.

Situated amid a rural area, there presently exists a significant demand for access and use by the public to the Preserve. As the adjacent region continues to grow, it is anticipated that the demand by the public for access to the Preserve will dramatically increase. Addressing this demand in a responsible manner that ensures proper stewardship of the Preserves' resources will be a continuing challenge. The County intends to provide the public with appropriate opportunities to use and enjoy the Preserve. However, these activities are to be offered in a way that is compatible with and furthers the over-arching strategy of providing proper protection of the Preserves' natural resources.

Strategy:

1) Construct / maintain gates, parking, trails at appropriate locations
2) Monitor for potential impacts related to specific uses

B. Habitat Management

Challenge: Many years of fire suppression has altered the strata of the fire dependent communities and reduced the potential suitability of the site for upland listed wildlife species.
Challenge: Non-native invasive species occur on the Preserve and will continue to invade and disrupt natural communities
Challenge: Recreational uses have the potential to result in unanticipated adverse impacts to natural resources

Management issues related to natural communities create a challenge. The mosaic of natural communities within the Preserve is comprised of a wide variety of habitats, including several that are rare. These communities are of varying quality and stages of maturity/succession. Several of the communities also present challenging management opportunities, especially given the location of the Preserve. For example, several communities are dependent upon a comparably frequent fire interval.

Given concerns for ecological values and mitigation of hazard to adjacent developments, a prescribed fire plan will be implemented subsequent to final approval. Due to smoke sensitive areas, such as State Road 44 and State Road 415 the plan will address challenges such as the substantial difficulty in sustaining a sufficient fire frequency to maintain healthy ecosystems and the protection of historical and / or archaeological resources, and possible solutions such as mechanical alternatives to prescribed fire. The Preserve is situated amid a rural / residential area. Aside from adjacent residential land use, the Preserve is also bounded or traversed by the regional thoroughfares of State Road 44 and State Road 415. In addition to being adjacent to the aforementioned "smoke-sensitive areas", the wind pattern of this region also complicates the use of prescribed fire. Wind conditions will be considered for burn prescriptions to avoid smoke issues.

As discussed in detail in the Goals and Objectives section, non-native invasive species are a significant threat to the ecological integrity of conservation lands managed for long-term habitat protection. These species often establish rapidly in disturbed or natural areas because they lack the predators, pathogens,

and ecological controls present in their native ranges. These species require a wide array of treatment types and careful monitoring.

Recreational uses proposed for the Preserve have been evaluated and determined to be in concert with the restoration and protection of natural resources for which the properties have been acquired. However, if not monitored, such uses may extend beyond the conditional parameters and result in adverse impacts, such as unauthorized trails, uses occurring in areas not designated for such use, etc.

Strategy:

1) Implement the Prescribed Fire Plan
2) Conduct mechanical and other fire surrogate activities where necessary
3) Utilize the principals of Integrated Pest Management (IPM) and Early Detection, Rapid Response (EDRR) in the management of non-native, invasive species
4) Monitor recreational uses for potential adverse impacts and limit, revise or remove such uses as deemed necessary

C. Prescribed Fire

Challenge: The use of prescribed fire as a management tool at the Preserve is hindered by several outside variables.

Several constraints exist that influence how and when prescribed fire can be implemented at the Preserve. These constraints include residential housing to the north, west, and south, State Road 415 to the east and State Road 44 to the north. These surrounding land uses have implications for smoke management in association with prescribed burning. Smoke management must be considered for the major highway areas to maintain safe driving conditions for these thoroughfares. Attention to weather conditions, proper management techniques, and education of surrounding residents can reduce some of these conflicts.

Other management issues related to prescribed fire is the establishment of fire lines and reducing fuel loads. The fire lines must be built to allow fire to enter ecotones between pyrogenic communities and adjacent wetland areas while preventing potential muck fires that could arise from fire reaching the interior of these communities. In some areas, fuel loads have built up due to fire exclusion and will need to be mechanically reduced prior to conducting prescribed fire.

Strategy:

1) In association with the prescribed burn plan, awareness and education may be provided to the public and users of the project site. This is accomplished by public announcements and targeted programming. This could include elements such as smoke management, the scheduling of prescribed fires, aesthetic value of the burn, the long-term protection of adjacent properties, and the importance of fire for wildlife and plants.
2) Map existing firelines, identify those that occur within ecotones and alter their location. This shall be accomplished over a number of years and will become easier to identify and rectify as fire is applied throughout the Preserve
3) Implement fuel reduction techniques (forestry mowing, roller chopping, canopy thinning)

throughout the pyrogenic communities

D. Management Costs

Challenge: Securing adequate funding for habitat management planning and the implementation of land management activities.

Strategy:

1) Utilize dedicated revenue from Volusia Forever and revenue generated from the Preserve
2) Seek cost sharing opportunities

VI. PRIORITY SCHEDULING, COST ESTIMATES AND FUNDING SOURCES FOR CONDUCTING MANAGEMENT ACTIVITIES

A. Priority Scheduling

The short and long term goals established in Section IV above, along with their designated priority levels were used to develop a Priority Schedule. The schedule is divided into three chronological sections; 1-2 years, 2-10 years. The schedule will be used to develop cost estimates for land management activities.

Table 9. Schedule of Events

Years 1 -2:

Section / Objectives		Status
A	**Habitat Restoration and Improvement**	
O1.a	Quantify the number of artificial land uses that will remain through the long-term of this plan	Completed with development of the Plan
O1.b	Quantify the number of artificial land uses where restoration activities will occur	Completed with development of the Plan
O1.c	Quantify the number of natural communities	Completed with development of the Plan
O2	Map the extent of, and quantify the acreage of each artificial land use and natural community	Completed with development of the Plan; update after implementation of restoration activities for the subsequent 10-year management plan
O3	Identify, map, and quantify the acreage of management units that will be created to implement restoration and maintenance management activities	In development
B	**Fire Management**	
O1	Identify the artificial and natural communities where fire management will be applied	Completed with development of the Plan
O2	Create a management unit map, and for each unit, identify the Management Unit (MU) number, total acreage, habitat type, and whether fire, or a fire surrogate is to be implemented	In development
O3	Develop an operational Fire Management Plan	In development
O4.a	Develop a fire monitoring program that tracks acres receiving fire surrogate treatments (by habitat, and year)	In development
O4.b	Develop a fire monitoring program that tracks acres burned (incl. wild and prescribed fires)	In development
O4.c	Develop a fire monitoring program that tracks post-burn analysis	In development
C	**Hydrological Preservation and Restoration**	
O1	Locate, quantify the size of, and evaluate condition of all culvert crossings	In progress
O2	Replace failing culverts with low-water crossings or new culverts	In progress
O3	Evaluate the feasibility and cost of creating an expanded littoral shelf in the largest artificial pond, located on the State Tract	Pending
O4	List of acreages of wetland habitats onsite	Completed with development of the Plan
O5	Evaluate the feasibility and cost of canoe/ kayak launch, etc.	Pending

D	**Sustainable Forest Management**	
O1	Conduct a timber inventory	Pending
O2	Develop a Forestry Plan	Pending
F	**Imperiled Species Habitat Management**	
O1	Estimate gopher tortoise populations	In development
O2	Determine feasibility of creating a gopher tortoise recipient site	Completed with development of the Plan (Pending as of MPAG meeting)
O3	Conduct survey for *Deeringothamnus rugelii* through partnership with the Pawpaw Chapter, FNPS and USFWS	Ongoing task
G	**Imperiled Natural Communities**	
O1	Determine current natural community condition	Completed with development of the Plan
O2	Determine restoration / management needs to trend the community towards DFCs	Completed with development of the Plan
I	**Facilities and Infrastructure**	
O1.a	Quantify each infrastructure type and summarize by Tract	Ongoing task
O2	Create two (2) new access points, one with public parking and one for specific user group access	Pending
O3	Determine if existing gates are sufficient to control public access	Pending
J	**Public Access, Recreational and Educational Opportunities**	
O1	Develop a Recreation Plan	Completed with development of the Plan
O2	Develop a day use / picnic area	Pending
K	**Conservation Acquisition and Stewardship Partnerships**	
O1	Create an Optimal Boundary	Completed with development of the Plan

Years 2-10

Goals / Objectives		Status
A	**Habitat Restoration and Improvement**	
O4	Update the extent and acreage of natural communities after restoration activities have been implemented	
B	**Fire Management**	
O5	Implement Fire Management Plan (incl. fire or surrogate techniques as appropriate)	Ongoing
O6	Utilize fire monitoring program	Ongoing
C	**Hydrological Preservation and Restoration**	
O6	Research potential hydrological restoration projects where feasible / necessary	Pending
O7	Evaluate the feasibility and cost of boardwalks or similar for wetland / water crossings	Pending
D	**Sustainable Forest Management**	
O3	Utilize revenue generation to offset management expenses	Ongoing
O4	Utilize sustainable forestry practices to restore longleaf pine	Ongoing
O5	Implement Forestry Plan	Ongoing County, WMD Tracts; Pending on State Tract
E	**Non-Native Invasive Species Maintenance and Control**	
O1	Identify species, locations, and extent of invasive species	Ongoing
O2	Utilize ArcGIS for monitoring of invasive species locations and treatments	Ongoing
O3	Track area treated per year and document treatment method	Ongoing
O4	Document number of hogs trapped / removed per year	Ongoing
F	**Imperiled Species Habitat Management**	
O4.a	Document imperiled species, location and approximate population size, where feasible	Ongoing
O4.b	Document date and type of land management activities conducted in the MU containing imperiled species	Ongoing
O5	Utilize game cameras to document imperiled wildlife species	Pending

O6	Set up photo stations for monitoring	Pending
O7	Conduct inventories as needed for listed species	Ongoing
O8	Confirm presence / absence of species documented in citizen science projects, i.e. iNaturalist, that have not been documented by the County staff or FNAI	Completed with development of the Plan
O9	Report new, confirmed findings to Florida Natural Areas Inventory	Ongoing
O10	Install two (2) kiosks with educational information regarding listed and imperiled species onsite and their habitat management needs	Pending
G	**Imperiled Natural Communities**	
O3	Introduce prescribed fire to the scrubby flatwoods within the Preserve	Pending mechanical fuel reduction
O4	Document the extent of scrubby flatwoods after restoration activities	Completed with development of the Plan; to be updated with next 10-year management plan
O5	Conduct surveys for listed imperiled species in the scrubby flatwoods	Ongoing
H	**Cultural and Historical Resources**	
O1	Continue to monitor, protect, and preserve resources	Ongoing
O2	Submit new finds to SHPO for inclusion on the Florida Master Site File	Ongoing
I	**Facilities and Infrastructure**	
O1.b	Track annual revenue / expenditures directly related to facilities / infrastructure	Ongoing
O1.c	Track date of construction completion of new projects; dates of maintenance events	Ongoing
O4	Identify infrastructure needs, estimate costs for implementation and create priority list for implementation	Ongoing
O5	Evaluate revenue generation through development of recreational facilities	Ongoing
O6.a	Evaluate water resource development projects, water supply development projects, storm-water management projects	Pending
O6.b	Linear activities	Ongoing
O6.c	Forestry	Ongoing
O7	Construct educational kiosks	Pending
J	**Public Access, Recreational and Educational Opportunities**	
O3	Develop trails for hiking, biking, and	Pending for State Tract

	equestrian use	
O4	Designate a Wildlife Management Area or Small Game Hunting Area	In development
O5	Develop camping facilities	Pending
O6	Construct a fishing pier with canoe / kayak launch	Pending
O7	Provide road access for conditionally approved recreational uses	Pending
O8	Maintain trails for hiking, biking, off highway vehicle (OHV; on State Tract), and equestrian use	Ongoing
O9	Utilize a web-based platform for camping reservations	Ongoing
O10	Conduct bio-blitzes	Ongoing
O11	Provide eco-buggy tours	Ongoing
K	**Conservation Acquisition and Stewardship Partnerships**	
O2	Acquire additional land within the Optimal Boundary as funding allows	As funding allows
O3	Identify potential non-governmental organization partnerships and grant program opportunities	Ongoing
O4	Develop partnerships with other agencies, municipalities, institutions and conservation organizations to achieve stated goals and objectives	Ongoing

B. Cost Estimates

The cost estimates provided here reflect the costs necessary to achieve the goals stated above and organized in a manner consistent with the Land Management Uniform Accounting Council, Chapter 259.037(3)(a) as provided below. Specific management activities and costs must initially be grouped, at a minimum, within the following categories: 1) Resource management, 2) administration, 3) support, 4) capital improvements, 5) recreation and visitor services, 6) law enforcement activities.

Table 10. Short Term Annual Expenditure Estimate (Years 1 - 2):

1. Resource management	**Annual Cost**
Habitat restoration	
Prescribed burning	
Non-native invasive species control	
Listed species survey and protection	
Cultural resource management	
Timber Management	
Hydrological Management	
Other	
Subtotal	$85,500
2. Administration	
General Administration	$8,000
3. Support	
Resource Management Planning	
Land Management Review	
Training / Staff Development	
Vehicle / Equipment Operation & Maintenance	
Other	
Subtotal	$16,000
4. Capital improvements	
New construction	
Facility/ infrastructure maintenance	
Subtotal	$50,000
5. Recreation visitor services	
Signage; operations; programs	
Public meetings	
Subtotal	$25,000
6. Law enforcement activities	
Resource protection	$3,000
TOTAL	**$187,500**

Table 11. Long Term Annual Expenditure Estimate (Years 3 - 10):

1. Resource management	**Annual Cost**
Habitat restoration	
Prescribed burning	
Non-native invasive species control	
Listed species survey and protection	
Cultural resource management	
Timber Management	
Hydrological Management	
Other	
Subtotal	$20,500
2. Administration	
General Administration	$5,000
3. Support	
Resource Management Planning	
Land Management Review	
Training / Staff Development	
Vehicle / Equipment Operation & Maintenance	
Other	
Subtotal	$14,500
4. Capital improvements	
New construction	
Facility/ infrastructure maintenance	
Subtotal	$90,000
5. Recreation visitor services	
Signage; operations; programs	
Public meetings	
Subtotal	$3,000
6. Law enforcement activities	
Resource protection	$2,000
TOTAL	**$135,000**

C. Estimated Revenue Sources

Revenue resources for accomplishing the above goals come from user group fees, sustainable forestry revenue, and land leases, and represents only a small fraction of the costs associated with management of the property. The majority of the management objectives are primarily funded through Volusia Forever funds, cost share opportunities grants.

Additional funding sources may come from the development of a gopher tortoise recipient site located on the State Tract.

VII. ANALYSIS FOR CONTRACTING PRIVATE VENDORS FOR RESTORATION AND MANAGEMENT

The following management and restoration activities have been considered for outsourcing to private entities. It has been determined that items selected as "approved" below are those that Volusia County either does not have in-house expertise to accomplish or which can be done at less cost by an outside provider of services. Those items selected as "rejected" represent those for which Volusia County has in-house expertise and/or which the agency has found it can accomplish at less expense than through contracting with outside sources. "Conditional" items are those that could be done either by an outside provider or by the agency at virtually the same cost or with the same level of competence:

Table 12. Analysis for contracting private vendors for restoration and management

Activity	Approved	Conditional	Rejected
Road/Trail Development and Maintenance		**X**	
Herbicide Application for Habitat Maintenance		**X**	
Prescribed Burning		X	
Vegetation Inventories		**X**	
Timber Harvest Activities		**X**	
Mechanical Restoration Activities		**X**	
Public Contact and Educational Facilities Development		**X**	
Non-Native Invasive Species Control		**X**	
Management Plan Development		**X**	
Imperiled Species Survey / Monitoring		**X**	
Habitat Restoration Plan Development		**X**	

VIII. LAND MANAGEMENT REVIEW

In compliance with Chapter 259.036, F. S. the Department of Environmental Protection (DEP) Division of State Lands (DSL) will conduct reviews of the Preserve to determine whether conservation, preservation, and recreation lands owned by the state Board of Trustees of the Internal Improvement Trust Fund (Board) are being managed properly. These reviews are conducted on a five-year cycle. The first land management review should occur in 2031.

SJRWMD conducted a public review of the 2013 Deep Creek Preserve General Management Plan in 2023 (Appendix R).

IX. COMPLIANCE WITH STATE, FEDERAL AND LOCAL GOVERNMENT REQUIREMENTS

The proposed activities within this Plan are in accordance with state, federal and local government requirements and regulations. Some activities proposed may require permits from these agencies prior to implementation. This is primarily related to infrastructure and facility construction. Any such proposed construction activities will be reviewed with the appropriate agencies. This will include, but not necessarily limited to, FDEP, SJRWMD, Army Corps of Engineers, Volusia County, Florida Department of Transportation, etc.

Where practicable, all facilities are designed and constructed to comply with the American Disabilities Act (Public Law 101-336). The universal access requirements of this law are followed in all cases except where the law allows for reasonable exceptions, such as when handicap access is structurally impractical or when providing access fundamentally changes the purpose / character of the facility.

Uses planned for the Preserve are in compliance with the Conceptual State Lands Management Plan and its requirement for "balanced public utilization," and are in compliance with the eight Florida Forever goals, as well as the guidance and directives of Chapters 372, 253, 259, 327, 370, 403, 870, 373, 375, 378, 487, and 597 FS. This plan is also in conformance with the Local Government Comprehensive Plan for Volusia County, Florida, as approved and adopted. The letter confirming compliance is contained in Appendix Q.

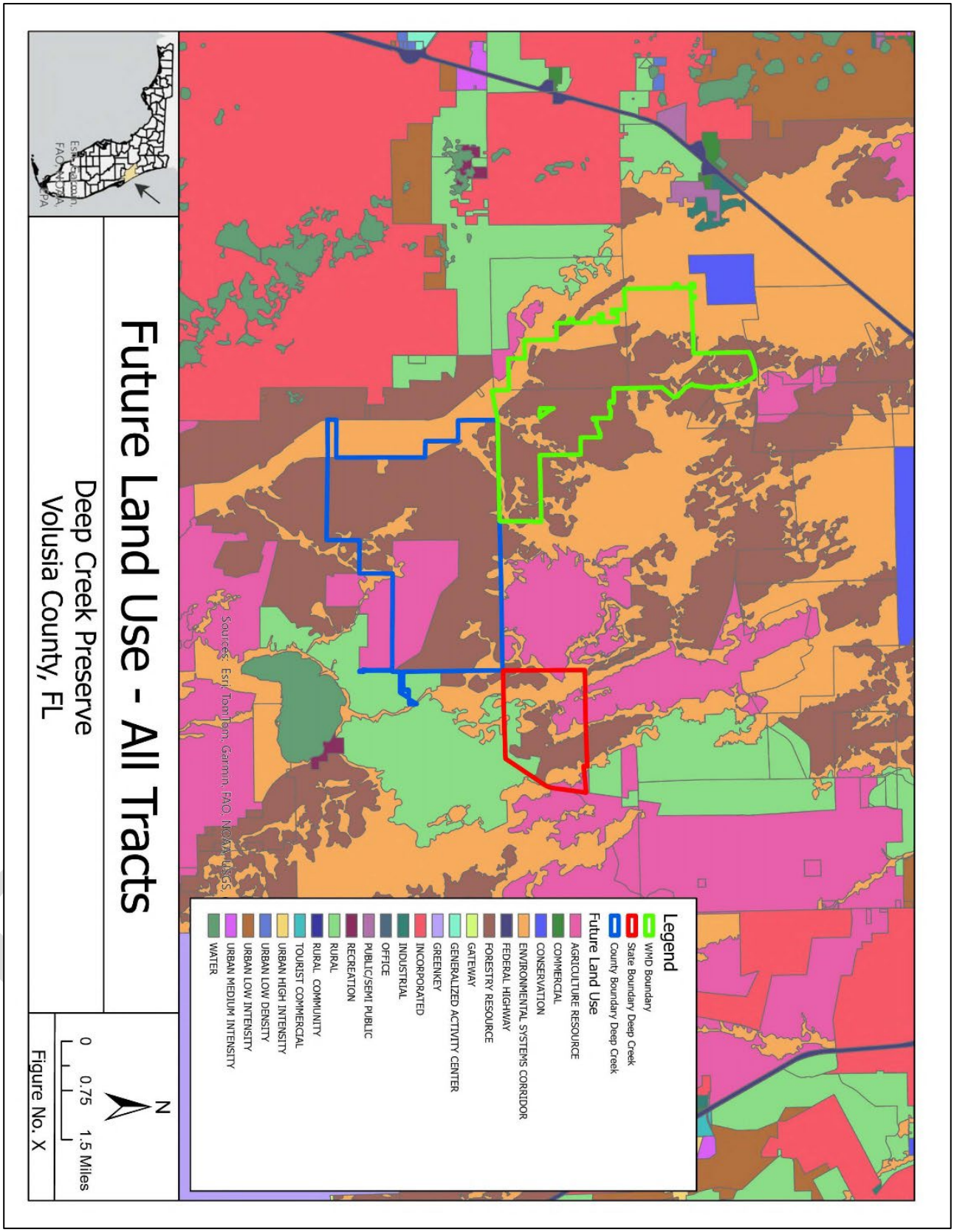

Figure 34. Future Land Use Map

X. SOIL AND WATER RESOURCE CONSERVATION

The County will continue to employ best management practices for activities and projects which potentially impact soil and water in order to minimize soil erosion and protect water quality. Soil disturbing activities will be conducted only in areas that present the least likelihood of causing erosion problems, avoiding the steepest slopes, streamside management units and impacts to cultural resources. Soil disturbing activities will follow landform contours to the extent practicable and will not occur without assessment against potential impacts to cultural resources and supervision during such activities by trained staff (ARM training). On areas that have been discovered that may prevent erosion problems, an assessment will be made to determine if soil erosion is occurring, and if so, appropriate measures will be implemented to stop or control the effects of this erosion.

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