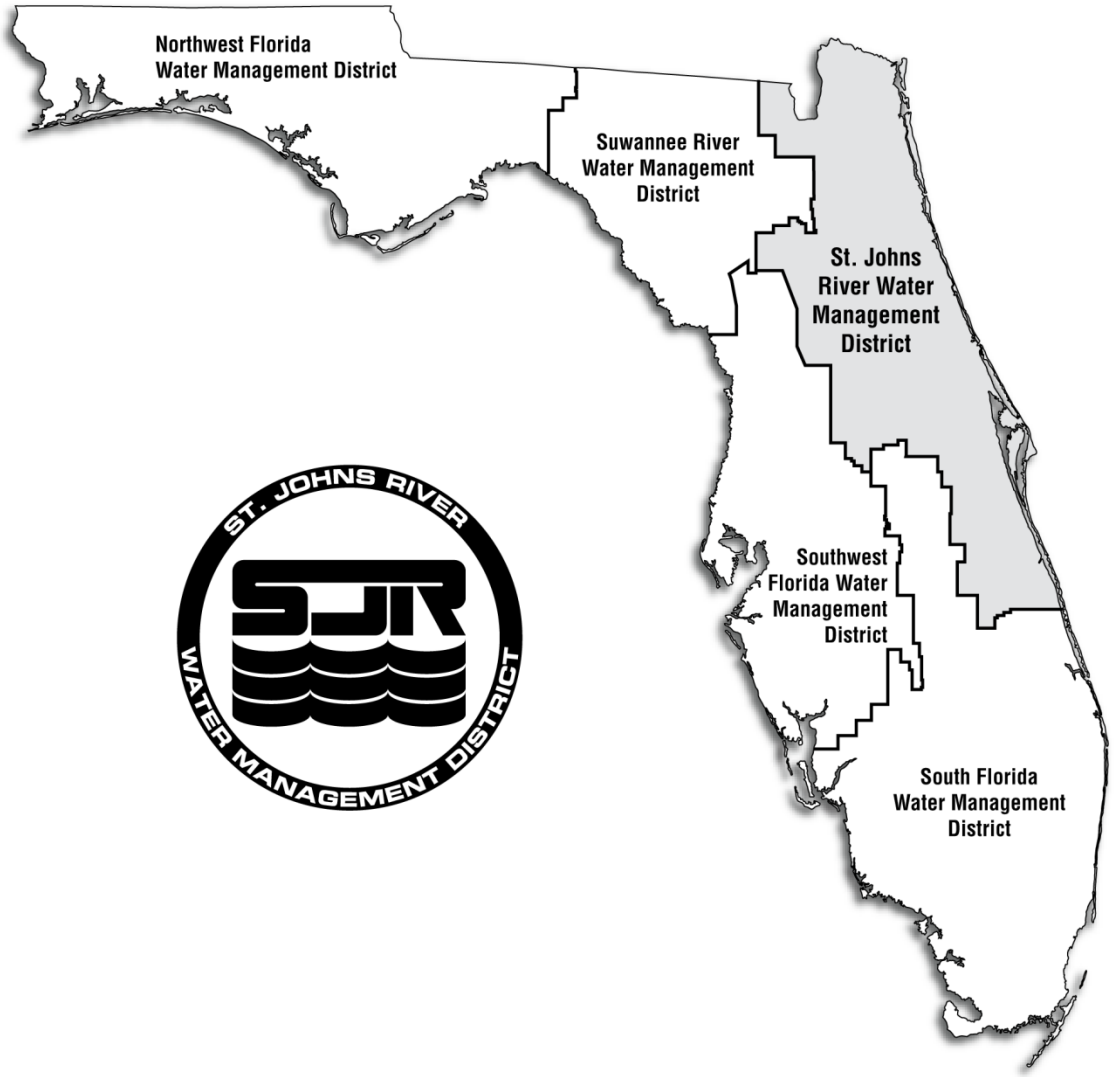
TURNBULL HAMMOCK CONSERVATION AREA
LAND MANAGEMENT PLAN

VOLUSIA COUNTY, FLORIDA

ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

SEPTEMBER 13, 2022


Northwest Florida
Water Management District
Suwannee River
Water Management
District
St. Johns
River Water
Management
District
Southwest
Florida Water
Management
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South Florida
Water Management
District
ST. JOHNS RIVER
SJR
WATER MANAGEMENT DISTRICT

EXECUTIVE SUMMARY

MANAGEMENT AREA SIZE: 2,432 acres

DATE OF ACQUISITION: Turnbull Hammock Conservation Area (Conservation Area or Property) consists of five parcels with acquisition beginning in 1980
DATE OF PLAN: xx 2022
MAJOR BASIN: Indian River Lagoon
PLANNING BASIN: North Indian River Lagoon

LOCATION: The Property is in southeast Volusia County, east of I-95, west of US 1 and the City of Oakhill. The Property is trisected by Maytown Road and Volco Road.

FUNDING SOURCE: The acquisition funding sources for the Conservation Area include Water Resource Development, Florida Department of Transportation (FDOT) Mitigation and Ad Valorem funds.

MANAGEMENT PARTNERS: The District is lead manager of Turnbull Hammock Conservation Area.

VISION STATEMENT: The management focus for Turnbull Hammock Conservation Area is the continued protection of the water resources of the Indian River Lagoon. This includes protection of more than 2,336 acres of diverse wetlands such as basin swamp, basin marsh and hydric hammock which act as a vital water quality treatment system for the Indian River Lagoon. Management activities within Turnbull Hammock will focus on the preservation of the site's hydrology, natural communities, and cultural resources to aid in the restoration of the Indian River Lagoon.

RESOURCE PROTECTION AND MANAGEMENT:

- **WATER RESOURCES** – Water resources are largely undisturbed; most protection was accomplished with acquisition. The Property was not assessed for nor has sufficient data to determine if it contains an impaired waterbody. The Conservation Area protects more than 2,336 acres of diverse wetlands such as basin swamp, basin marsh and hydric hammock.
- **FOREST MANAGEMENT AND RESTORATION** – The majority of the forested portions of the Conservation Area are wetlands. Due to this, no forest management or restoration activities are planned for the Conservation Area.
- **FIRE MANAGEMENT** – The natural communities within the Conservation Area are not fire dependent or are too small for prescribed fire to be practical; no fire management activities aside from wildfire suppression are planned.
- **FLORA AND FAUNA** – The Conservation Area provides habitat for numerous wildlife species, including the Florida black bear (*Ursus americanus floridanus*), as well as listed species including the gopher tortoise (*Gopherus Polyphemus*), wood stork (*Mycteria*

americana), roseate spoonbill (*Platalea ajaja*), and tricolored heron (*Egretta tricolor*). Invasive exotic pest plant and animal species occur on the Property. The District regularly monitors for the presence of invasive plants and animals and executes appropriate control actions. Sea level induced wetland migration has the potential to change the natural communities within the conservation area.

- **CULTURAL AND HISTORICAL RESOURCES** – There are four Florida Master File sites on the Conservation Area all classified as middens or mounds. If any additional sites are located, District staff will document and report the sites to the Division of Historical Resources.

LAND USE MANAGEMENT:

- **ACCESS** – There are no designated public access points to the Conservation Area. The District holds an access easement with a private property owner which allows staff access from Cow Creek Rd. to the northern portion of the Property for land management purposes.
- **RECREATION** – The Conservation Area is not currently open for recreation due to limited but not prohibited public access; however, the District will continue to seek opportunities to allow for recreational use.
- **SECURITY** – Maintenance of signage, gates, and locks is conducted as needed. The District maintains contact with FWC, local law enforcement, and a private security firm for any potential security needs. In addition, the cattle lessee provides an on-site presence and patrol for security issues.

ADMINISTRATION:

- **REAL ESTATE ADMINISTRATION** – The District may consider purchasing parcels near the Conservation Area that become available and that will aid in the conservation of water resources within the Indian River Lagoon Basin. The Conservation Area is within the Indian River Blueway, a Florida Forever project. The District may pursue acquisition of parcels or property exchanges with neighbors to improve and provide additional access to the conservation area. At the time of writing, Volusia County is in negotiation with several property owners adjacent to the Conservation Area to purchase over 2,600 acres within the Indian River Blueway Florida Forever project.
- **COOPERATIVE AND SPECIAL USE AGREEMENTS, LEASES, AND EASEMENTS** –The District administers one cattle lease on the Conservation Area, an access easement, and three special use authorizations (SUAs).
- **MANAGEMENT COSTS AND REVENUES** – Management costs at the Conservation Area were $43,400 from 2007–2021 and are projected at $41,800 from 2022–2032. Revenues from cattle lease were $4,769 from 2010–2022 and are projected at $7,200 from 2022–2032. Payments from the cattle lease can either be cash or in-kind services performed on the Property by the lessee.

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VISION STATEMENT

The management focus for Turnbull Hammock Conservation Area is the continued protection of the water resources of the Indian River Lagoon. This includes protection of more than 2,336 acres of diverse wetlands such as basin swamp, basin marsh and hydric hammock which act as a vital water quality treatment system for the Indian River Lagoon. Management activities within Turnbull Hammock will focus on the preservation of the site's hydrology, natural communities, and cultural resources to aid in the restoration of the Indian River Lagoon.

OVERVIEW

This document provides the goals and strategies to guide land management activities at the Turnbull Hammock Conservation Area (Conservation Area or Property) over the next 10 years. This land management plan was developed in accordance with sections 373.1391 and 373.591, Florida Statutes. This is the fourth land management plan update for the Property. Previous plans were completed in 1995, 2001 and 2007.

The St. Johns River Water Management District (District) owns or manages over 780,000 acres of land, acquired for the purposes of water management, water supply, and the conservation and protection of water resources.

LOCATION

The Conservation Area is comprised of approximately 2,432 acres and is in southeast Volusia County, between Oak Hill and Interstate 95 (Figure 1). The Property is located in Sections 43, 44, 46, Township 18 South, Range 34 East and Sections 38, 39, 40 Township 19 South, Range 35 East in the Public Lands Survey System. This area was sectioned as part of the Spanish land grants. The Property is part of a larger basin that provides an influx of freshwater to the North Indian River Lagoon and is included in the Indian River Lagoon Blueway Florida Forever project boundary for land acquisition purposes.

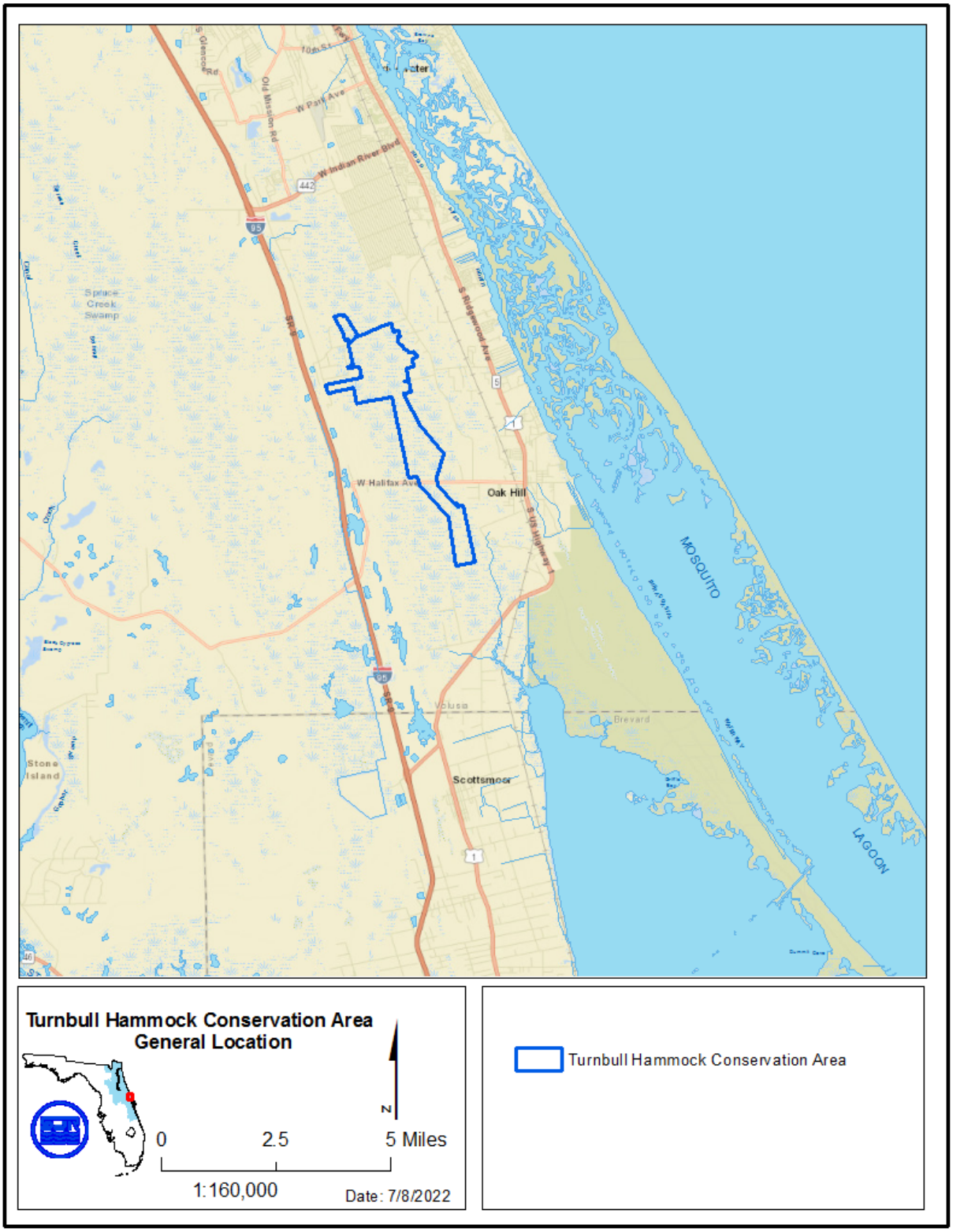

Figure 1: General Location

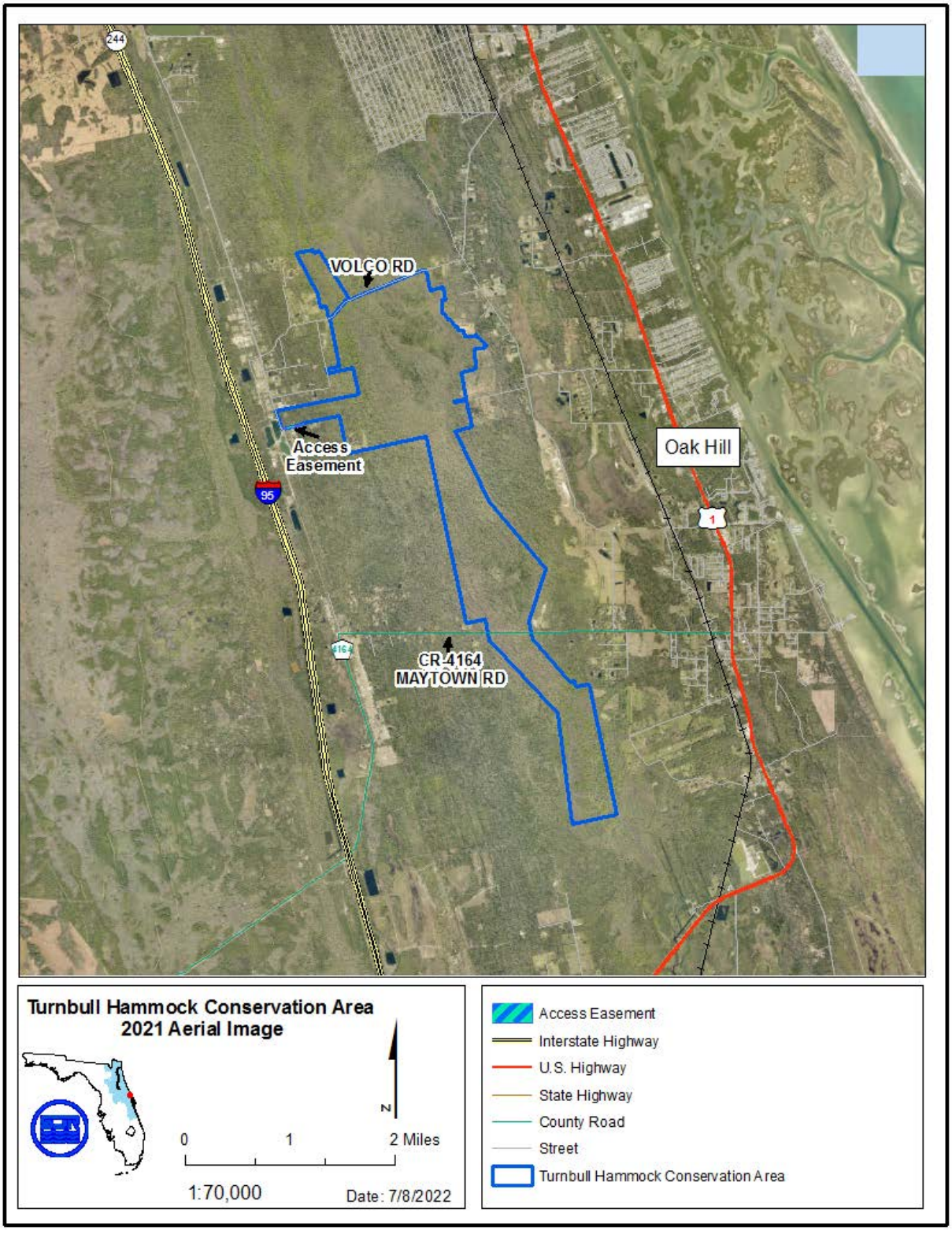

Figure 2: Aerial imagery.

REGIONAL SIGNIFICANCE

The Conservation Area lies within the Indian River Lagoon Basin, which contains the Indian River Lagoon, one of the most diverse estuaries in North America. The Property is located within a complex of conservation areas, conservation easements, and mitigation banks. The Conservation Area is an important component of the basin with its wetland habitats contributing fresh water to the north Indian River Lagoon.

The Conservation Area is adjacent to the Cape Atlantic Estates Parcels (1,808 acres) which are managed by Volusia County. The Conservation Area is also near the Canaveral National Seashore (57,662 acres) and Merritt Island National Wildlife Refuge (140,551 acres).

Lead Manager	Conservation Area
Brevard County	North Buck Lake Scrub Sanctuary
Brevard County	Scottsmoor Flatwoods Sanctuary
District	Buck Lake Conservation Area
District	Lake Monroe Conservation Area
District	Palm Bluff Conservation Area
District	Seminole Ranch Conservation Area
Florida Department of Environmental Protection	Mosquito Lagoon Aquatic Preserve
Florida Fish and Wildlife Conservation Commission	Salt Lake Wildlife Management Area
Florida Forest Service	Little-Big Econ State Forest
Miami Corporation	Farmton-Volusia Greenkey Conservation Easement
Swallowtail, LLC	Farmton-Brevard Conservation Easement
US Dept. of the Interior, Fish and Wildlife Service	Merritt Island National Wildlife Refuge
US Dept. of the Interior, National Park Service	Canaveral National Seashore
Volusia County	Cape Atlantic Estates Parcels
Volusia County	Deep Creek Preserve
Volusia County	Longleaf Pine Preserve
Volusia County	Wiregrass Prairie Preserve

Table 1: Proximate conservation areas

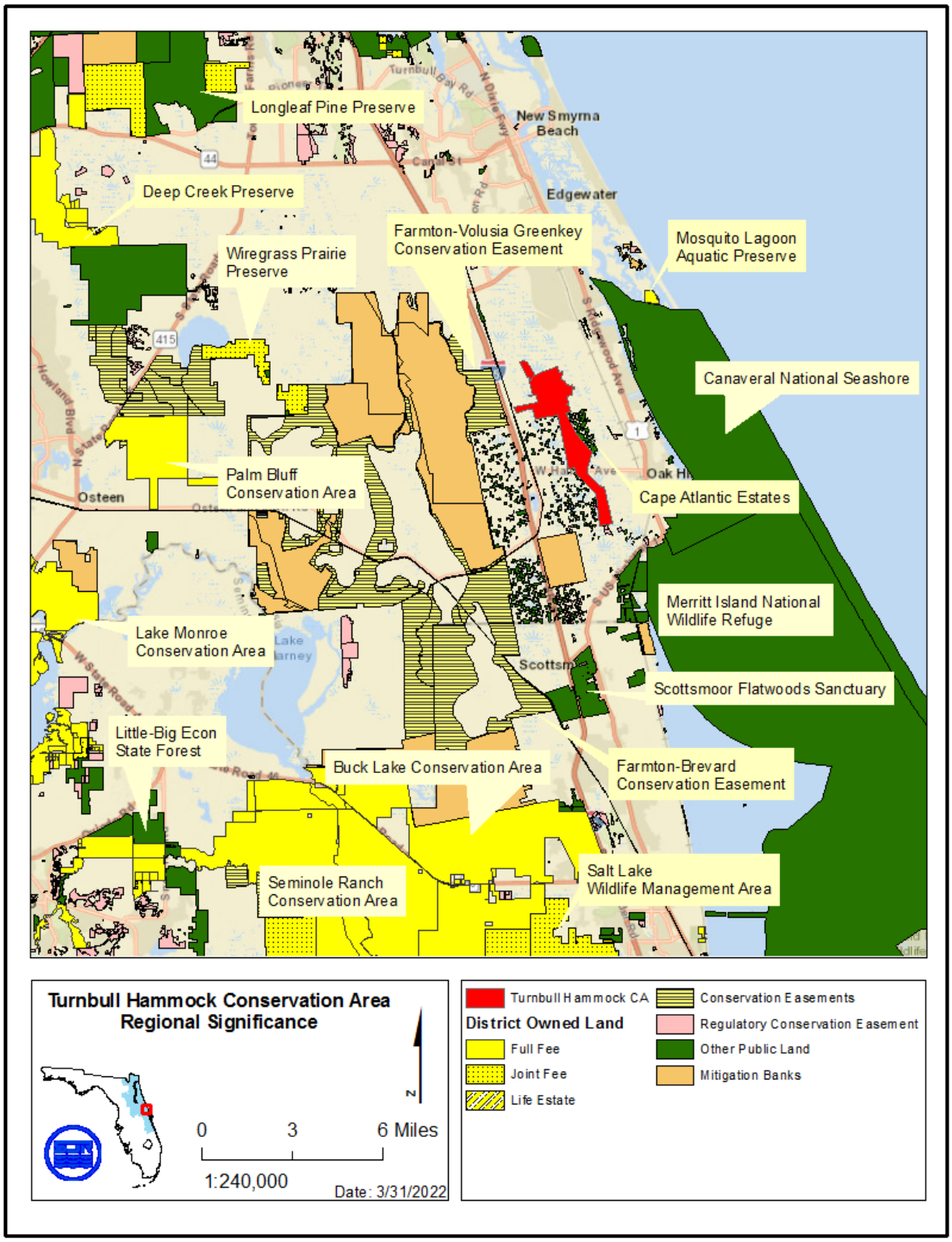

Figure 3: Regional significance.

ACQUISITION HISTORY

Acquisition of the parcels that comprise the Conservation Area provides for the protection of important water resources and ecological functions. The purchase of the parcels that comprise the Conservation Area is consistent with the goals of the Indian River Lagoon Basin projects as set forth in the District's Land Acquisition and Management Five Year Plan, the District's Surface Water Improvement and Management Plan (SWIM), the Florida Department of Environmental Protection's Basin Management Action Plan for the North Indian River Lagoon and the mitigation goals for the Florida Department of Transportation. These goals, as they apply to the Conservation Area, include:

- Improve water quality, maintain natural hydrological regimes, and maintain flood protection by preserving important wetland areas.
- Restore, maintain, and protect native natural communities and diversity.

The Conservation Area is comprised of five parcels totaling 2,432 acres (Figure 4). The parcels that currently comprise the Conservation Area are listed below, and all acreage reported is derived from GIS calculations.

Turnbull Hammock (1,167 acres) Land Acquisition number 1979-002-P1

The Turnbull Hammock parcel totals 1,167 acres and was acquired by the District on 8/13/1980 for $116,730.00 using Water Resource Development funds.

Hart Land and Cattle FPL (17 acres) Land Acquisition number 1992-026-PA

The Hart Land and Cattle FPL parcel totals 17 acres and was purchased by Florida Power and Light for $49,866.07 with the property subsequently donated to the District on 11/18/1994 for mitigation for wetland impacts associated with Florida Power and Light powerline construction.

Hart Properties (1,212 acres) Land Acquisition number 2008-022-P1

The Hart Properties parcels total 1,212 acres and were purchased by the District on 1/6/2010 for $3,918,585.00 using funds from the FDOT Mitigation Plan.

Peters (26 acres) Land Acquisition number 2010-012-P1

The Peters parcel totals 26 acres and was purchased by the District on 11/04/2010 for $51,060.00 using funds from the FDOT Mitigation Plan.

Gentry (10 acres) Land Acquisition number 2013-007-P1

The Gentry parcel totals 10 acres and was purchased by the District on 02/28/2014 for $10,000.00 using Ad Valorem funding, designated as fund balance committed to Land Management and Acquisition purposes.

LOCAL GOVERNMENT LAND USE DESIGNATION

Volusia County

According to the Volusia County Comprehensive Plan 2005-2025, August 15, 2021, update, the future land use designation for the area surrounding the Conservation Area within Volusia County is Environmental Systems Corridor. This designation consists of important ecological corridors comprised of environmentally sensitive and ecologically significant lands. Land use activities occurring within these corridors shall not degrade these natural functions and connections. The intention is to provide protected, natural pathways which connect to other protected areas such as parks, conservation lands and water bodies. This inter-connection helps maintain the ecological integrity and biodiversity of the county's vast natural resources (Volusia County Growth and Resource Management Department, 2021).

The Conservation Area is within the East Volusia Mosquito Control District (EVMCD). EVMCD does not currently have a specific Arthropod Control Program or Arthropod Management Plan for the Conservation Area. The Conservation Area would be covered under the EVMCD's area wide responsibility for arthropod control.

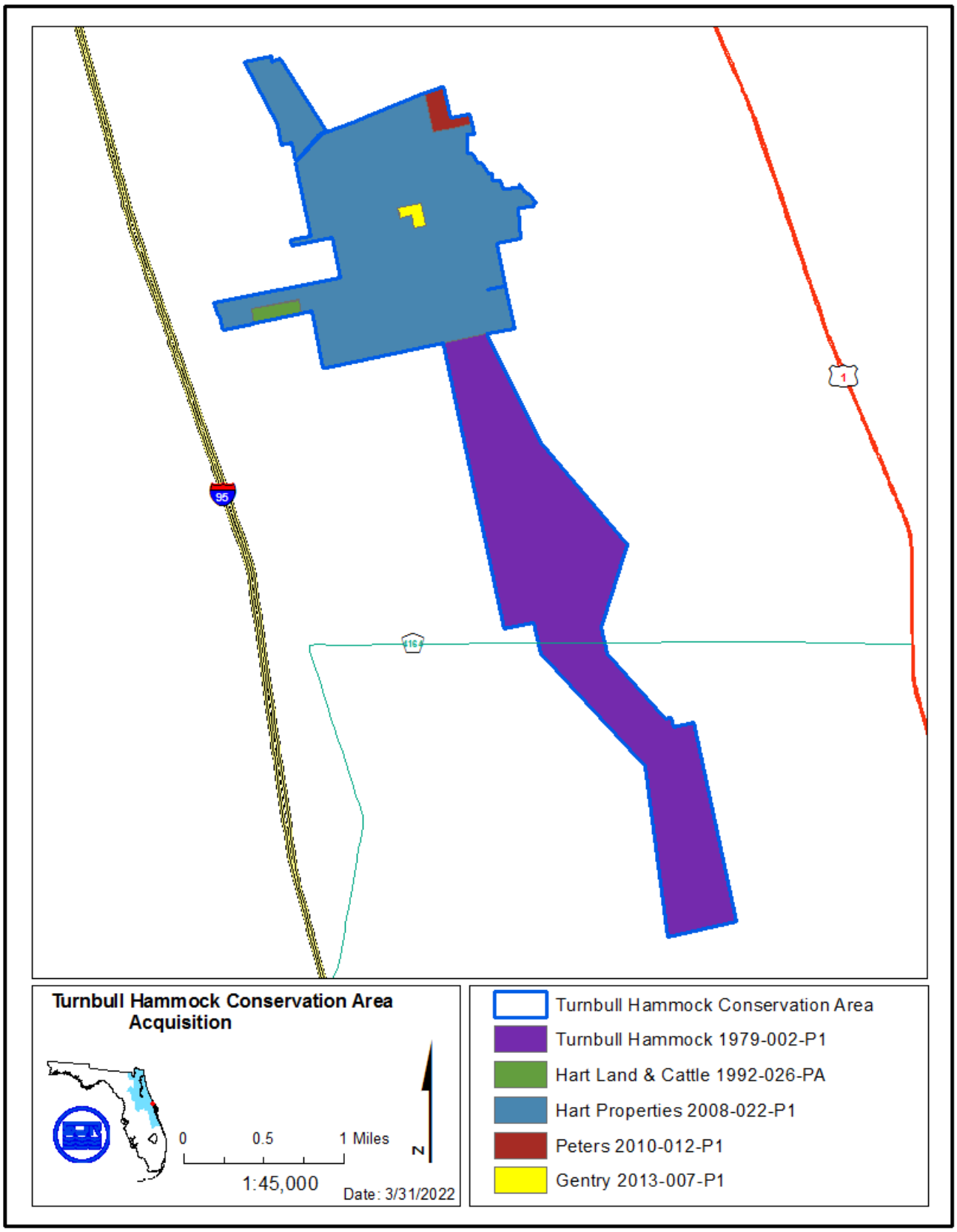

Figure 4: Acquisition History.

NATURAL RESOURCES

WATER RESOURCES

The Conservation Area is not located within an Aquatic Preserve or an Area of Critical State Concern pursuant to section 380.05, Florida Statute. The Conservation Area is a natural drainage area that flows in a southerly direction, into Turnbull Creek, and then to the Indian River Lagoon (Figure 1). This area is a contributor of freshwater to the North Indian River Lagoon and its protection is important in maintaining water quality and quantity in this area of the Lagoon. The Property lies within the north central area of the Indian River Lagoon Basin in the North Indian River Lagoon Planning Unit (Figure 5). The acquisition of the Conservation Area contributes to the goals and accomplishments included in the District's 2002 Indian River Lagoon Surface Water Improvement and Management (SWIM) Plan (Steward et al., 2003). The Property, which is wholly contained within the Turnbull Creek (freshwater segment) waterbody was not assessed for or has insufficient data to determine if that waterbody is impaired as defined by the parameters and methodologies contained within chapters 62-302 and 62-303, F.A.C.

As sea level rises, wetland ecosystems will invade low-lying uplands as well as change the structure and composition of existing wetlands. The Conservation Area is particularly susceptible to wetland migration due to its broad drainage and elevation which ranges from one to five feet above sea level.

GEOMORPHOLOGY

The Conservation Area lies within the Central Atlantic Coastal Strip of the Eastern Flatwoods District, Turnbull Hammock subdivision. Turnbull Hammock subdivision consists of two parts: the true Turnbull Hammock, which developed as a gentle eastward slope and a terrace that is accreted onto a more ancient upland. The upland generally is 25 to 35 feet in elevation (Figure 6); solution depressions occur, some of which contain lakes. The older upland is dominantly covered by flatwoods, the crest of the ridge is vegetated with longleaf pine and turkey oak. The majority of the Conservation Area is found on the lower slope of the ridge and the associated terrace, which supports a forest of cabbage palms with scattered hammocks (Brooks, 1981).

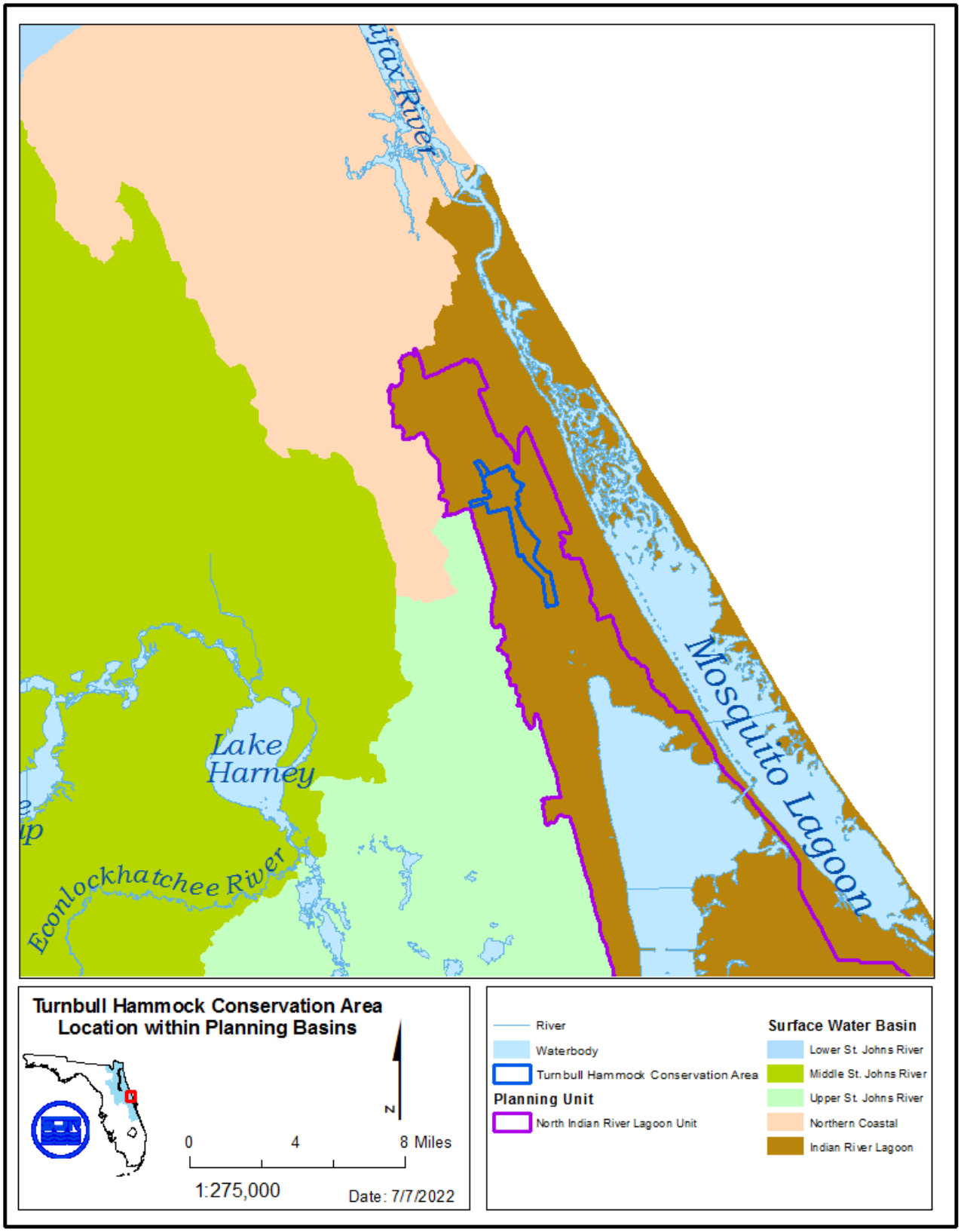

Figure 5: Location within the District's Planning Basins.

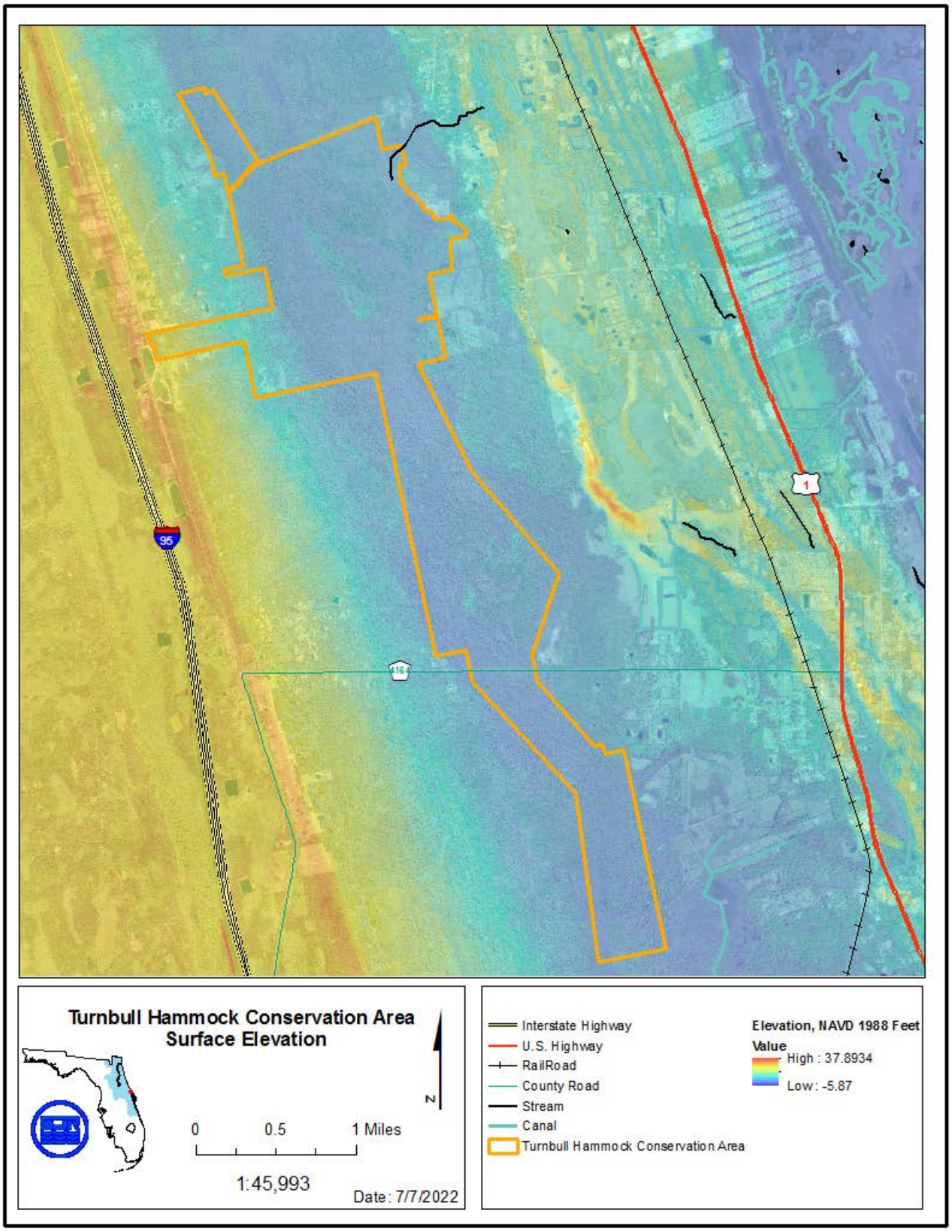

Figure 6: Land surface elevation and drainage.

WATER LEVELS

The District has active groundwater monitor well site number 3719 located on the Conservation Area. Wells are identified as V-1255 and V-1256 for Upper Floridan aquifer (UFA) monitoring and V-1257 for surficial aquifer system (SAS) monitoring. Water levels from July 19, 2017 to April 3, 2022 for both sites are depicted in Figure 7. Both the SAS and the UFA water levels are plotted together to show the elevations relative to the well site benchmark (NAVD 1988) of the water levels in each aquifer. The water elevations are higher in the SAS than in the UFA indicating downward flow from the SAS towards the UFA.

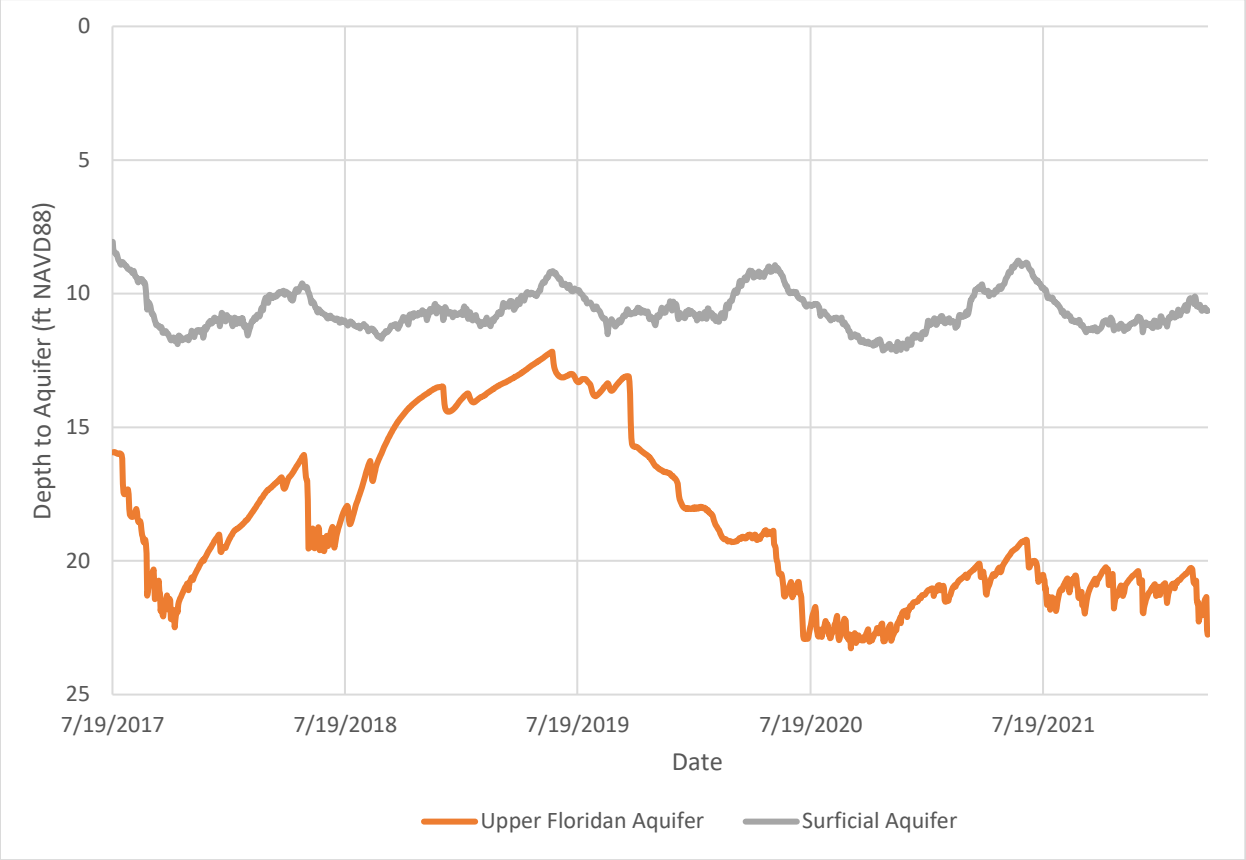

Figure 7: Hydrographs from Upper Floridan Aquifer monitor well V-1255 and Surficial Aquifer System monitor well V-1257 at Turnbull Hammock Groundwater Monitoring Well Site Number 3719

WATER CHEMISTRY

The District monitors surface water quality at over 400 long-term sampling stations at rivers, streams, lakes, canals, and estuaries throughout the 18-county service area. Water quality status is an indication of the condition of a water body. The District's 2021 Status and Trends Report is a 15-year assessment that uses data from January 1, 2006 to December 31, 2020. Water quality trends indicate whether a water quality parameter is increasing or decreasing over time. (SJRWMD, 2021 https://www.sjrwmd.com/data/water-quality/#status-trends).

Status is evaluated over the most recent five years, with the requirement that data be available for the last year and two of the other five years. For surface water, the status of a given station is

determined by the ranking of the median of its annual medians relative to similar values for all other stations (i.e., low implies below the 25th percentile, medium implies between the 25th and 75th percentiles, and high implies above the 75th percentile). Importantly, these relative rankings are not related to a standard or target for water quality. Trend is evaluated over the most recent fifteen years, with the requirement that data be available for the last year and nine of the other fifteen years. When possible, data are adjusted so that each year has the same number of samples. A statistical test was used to determine if monthly values differed significantly. If the values did, then the test for trend was adjusted to account for this variation.

Basic water chemistry data is collected at one site connected to the Conservation Area's watershed: Station IRLTBC, located downstream from the Conservation Area where Turnbull Creek flows into the Indian River Lagoon (Figure 11). Water chemistry data were typically collected on a monthly basis by Volusia County staff as an in-kind payment to the District for water quality analyses of other samples. Field data including water temperature, pH, specific conductivity, and dissolved oxygen were collected, as well as grab samples analyzed for nutrients, minerals, and metals. Water chemistry parameters discussed in this section include total nitrogen (nitrogen), total phosphorus (phosphorus), specific conductivity, salinity, dissolved oxygen (DO), potential of hydrogen (pH), color and chlorophyll-*a* (Chl-a).

The following parameters are discussed in relative terms for the past 5 years for status and 15-years for trends as described in the 2021 Status and Trends Report.

Station IRLTBC
Phosphorus is in the high-range and stable; nitrogen is in the high-range and decreasing; DO is in the low range and stable; pH is in the mid-range and stable. Specific conductivity and salinity are in the mid-range and decreasing at 5.7% and 6.4% annually, respectively. Color is in the mid-range and increasing. Chl-a is in the high-range and stable.

Surface water chemistry data do not exist within the conservation area itself as there is a lack of suitable water bodies for sampling. The above sites serve as a proxy for the Property to provide insight to water quality conditions downstream. These data could reflect the health of the ecosystem within the Conservation Area and the extensive wetlands within the Property. Acquisition and protection of the Conservation Area helps protect the wetlands associated with the headwaters of the Indian River Lagoon.

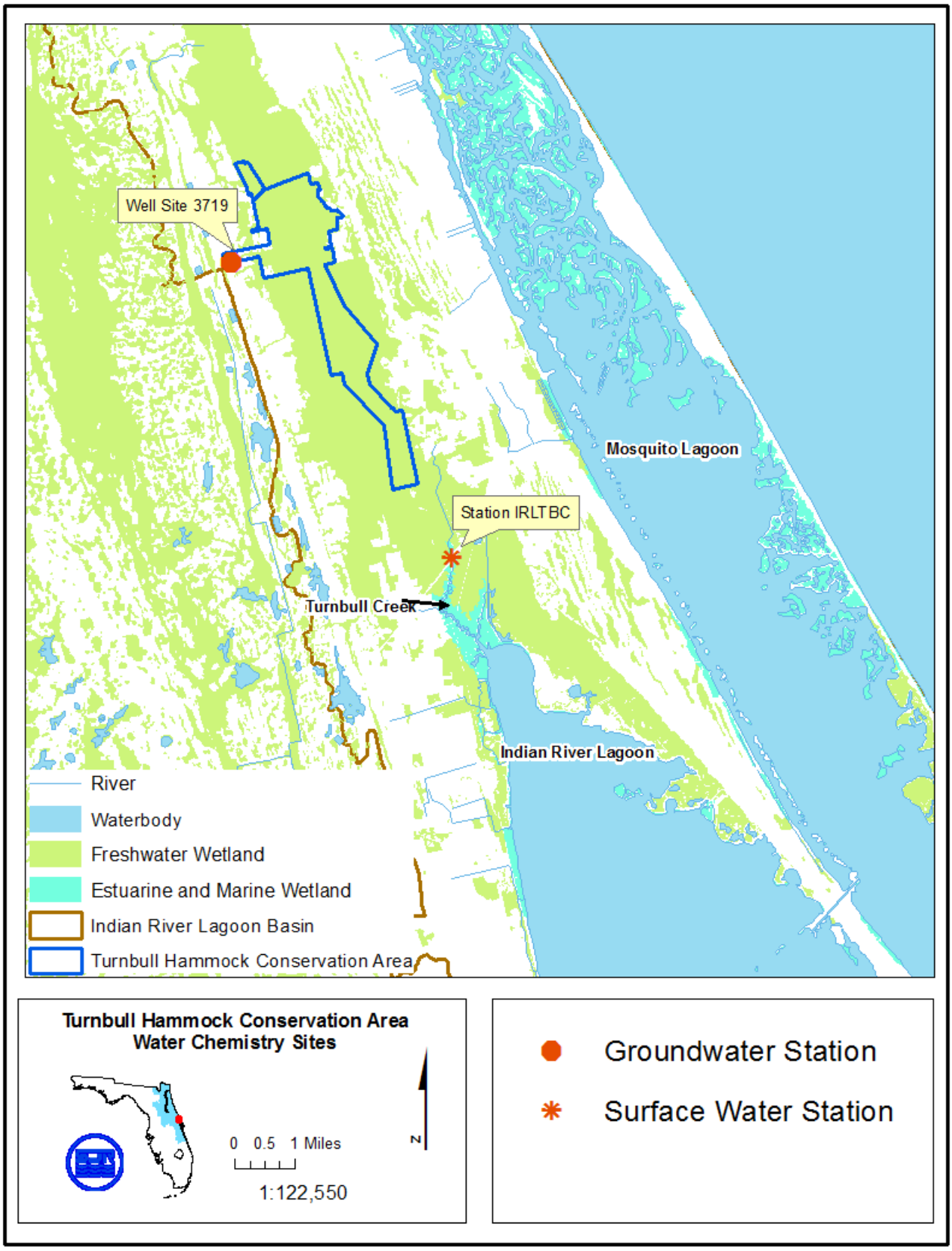

Figure 8: Water Chemistry Sites.

NATURAL COMMUNTIES

There are six natural communities contained within the Conservation Area: basin marsh (6 acres), basin swamp (1152 acres), hydric hammock (1176 acres), mesic hammock (74 acres) and pasture (14 acres), sessional hardwood forest (9 acres). The dominant community types at the Conservation Area are basin swamp, hydric hammock and mesic hammock (Figure 9). Due to the long fire return intervals or the small acreage associated with these communities, fire will not be used as a land management tool on this Property. As sea level rises, the natural communities on the Conservation Area will be affected and their management strategies will change.

Information pertaining to the natural communities at the Conservation Area was derived from personal observations by District staff combined with aerial imagery analysis as well as mapping completed by Florida Natural Areas Inventory (FNAI) in 2022. Natural communities have been characterized using descriptions provided by FNAI staff during their 2022 site visit.

Hydric Hammock (1176 acres, 48%)

Hydric hammock is a low-lying, closed-canopy forest that is periodically flooded, often occurring on shelly sands or where limestone is near the surface. The community is characterized by a mix of cabbage palm (*Sabal palmetto*) and swamp laurel oak (*Quercus laurifolia*). On the Conservation Area, hydric hammocks occupy higher elevations within the low terrace sandwiched between a sandhill ridge to the west and the St. Augustine-Edgewater coquina ridge to the east. This hammock grades up to a mesic hammock along a slope to the west and on small rises throughout the community. The two communities can be difficult to distinguish, with many areas intermediate between the two communities. Likewise, the transition to more frequently inundated basin swamp can be very gradual.

The canopy and subcanopy layers are dominated by a mix of mostly hydrophytic trees but have a consistent component of cabbage palm and swamp laurel oak. There is an unusually large amount of green ash (*Fraxinus pennsylvanica*) in the canopy. Other common occasional trees include sweetgum (*Liquidambar styraciflua*), American elm (*Ulmus americana*), sugarberry (*Celtis laevigata*), red maple (*Acer rubrum*), and water hickory (*Carya aquatica*). Slightly drier areas intermediate to mesic hammock may have live oak (*Quercus virginiana*), pignut hickory (*Carya glabra*), and southern magnolia (*Magnolia grandiflora*). The understory trees and shrubs are a mix of American hornbeam (*Carpinus caroliniana*), yaupon (*Ilex vomitoria*), needle palm (*Rhapidophyllum hystrix*), wild coffee (*Psychotria nervosa*), American beautyberry (*Callicarpa americana*), red mulberry (*Morus rubra*), eastern hophornbeam (*Ostrya virginiana*), shortleaf wild coffee (*Psychotria sulzneri*), and silverling (*Baccharis glomeruliflora*). Remnant citrus trees (*Citrus* sp.) are occasional. Epiphytes are common to abundant with oaks often draped with airplants including Spanish moss (*Tillandsia usneoides*), Spanish moss (*Tillandsia usneoides*), Bartram's air-plant (*Tillandsia bartramii*), and spreading air-plant (*Tillandsia triculate*). Cabbage palms often have golden polypody (*Phlebodium aureum*) and shoestring fern (*Vittaria lineata*) and occasionally wild Boston fern (*Nephrolepis exaltata*). Herbs are generally sparse, but slender woodoats (*Chasmanthium laxum*) and savannah panicum (*Phanopyrum gymnocarpon*) are commonly found.

Some portions of the hammock near the western boundary were converted to orange groves in the early 20th century, but these are long abandoned and have mostly reverted back to hammock vegetation, although one area was converted to a pasture. Current management considerations of the Conservation Area's hydric hammocks primarily consists of maintaining natural hydrology and controlling exotic plant invasion.

Basin Swamp (1,152 acres, 47%)

Basin swamps are forested depressions that are typically large and/or embedded in a non-pyrogenic community and thus are not heavily influenced by frequent fires in the surrounding landscape. The soils are generally acidic, nutrient-poor peats overlying an impervious soil layer. This community type is dominated by cypress and/or tupelo but may contain additional hydrophytic trees and shrubs that can withstand inundation for most or all of the year.

At the Conservation Area, a large complex of basin swamp and hydric hammock make up most of the site. Swamp and hammock are roughly equal in size with swamp forming a branched network of deeper, frequently inundated, broad channels in the low terrace sandwiched between a sandhill ridge to the west and the St. Augustine-Edgewater coquina ridge to the east. Hydric hammocks occupy the higher elevations within this terrace.

Aerial photographs from the 1940's, relic logging tram beds and stumps of large cypress within the Conservation Area provide evidence of the large-scale timbering of cypress that occurred throughout Florida in the late 19th and early 20th century. Current management considerations include monitoring and treating invasive species as well as monitoring for landscape level changes induced by sea level rise.

The dense canopy and subcanopy layers are composed of bald cypress (*Taxodium distichum*), green ash (*Fraxinus pennsylvanica*), American elm (*Ulmus americana*), red maple *(Acer rubrum*), water hickory (*Carya aquatica*), swamp laurel oak (*Quercus laurifolia*), and cabbage palm (*Sabal palmetto*). Swamp tupelo (*Nyssa biflora*) is also dominant, particularly in areas of former basin marsh. Spanish moss (*Tillandsia usneoides*) is a common epiphyte. Other species include golden polypody (*Phlebodium aureum*), resurrection fern (*Pleopeltis michauxiana*) and some larger airplants – Florida air-plant (*Tillandsia simulata*), Bartram's air-plant (*Tillandsia bartramii*), and spreading air-plant (*Tillandsia utriculata*). There is an open tall shrub layer of younger canopy species plus common buttonbush (*Cephalanthus occidentalis*).This is a deep swamp with hummocks and herb composition depends on water depth. Herbs are much more abundant in areas of former marsh where the canopy is more open. Species include savannah panicum (*Phanopyrum gymnocarpon*), angle pod (*Gonolobus suberosus*), mild waterpepper (*Persicaria hydropiperoides*), barnyardgrass (*Echinochloa crus-galli*), narrowfruit horned beaksedge (*Rhynchospora inundata*), swamp rosemallow (*Hibiscus grandiflorus*), swamp milkweed (*Asclepias perennis*), and marshpennywort (*Hydrocotyle sp*.). Deep areas usually have pickerelweed (*Pontederia cordata*), alligatorflag (*Thalia geniculata*), or broadleaf cattail (*Typha latifolia*), plus floating species such as water spangles (*Salvinia minima*).

Fire intervals in basin swamps are highly variable. The lowest portions of basin swamps rarely, if ever, burn. If hydrology has been altered (i.e., ditches/canals), normal hydroperiod should be restored if possible, since shortened hydroperiods can also allow devastating fire to enter, potentially altering the community. This community is thought to be very stable as long as hydrological conditions and water quality are maintained.

Mesic Hammock (419 acres, 3%)

Mesic hammocks are upland, closed-canopy, evergreen forests of mainly live oak and cabbage palm. They are similar to the upland hardwood forests mostly found further north, but generally have a less diverse, more evergreen canopy. At the Conservation Area, mesic hammock forms the broad, nearly 1 km wide transition area from the dry upland ridge to the west down to the low terrace of swamp and hydric hammock that makes up the majority of the site. The large hydric hammock also has several higher areas that are somewhat intermediate to mesic hammock. Large blocks of the mesic hammock were converted to orange groves in the early 20th century, but these are long abandoned and have reverted back to hammock vegetation, although one area was converted to a pasture.

The mesic hammocks on the Conservation Area have a closed canopy of mostly live oak (*Quercus virginiana*), but with other species such as southern magnolia (*Magnolia grandiflora*), water oak (*Quercus nigra*), pignut hickory (*Carya glabra*), cabbage palm (*Sabal palmetto*), sweetgum (*Liquidambar styraciflua*), swamp laurel oak (*Quercus laurifolia*), and sugarberry (*Celtis laevigata*) mixed throughout. Areas cleared for citrus production have a similar composition, but the trees are markedly smaller. Epiphytes are common throughout, mostly Spanish moss (*Tillandsia usneoides*), shoestring fern (*Vittaria lineata*), and golden polypody (*Phlebodium aureum*). The understory is fairly open with many younger canopy species throughout plus southern bayberry (*Morella cerifera*), saw palmetto (*Serenoa repens*), rusty staggerbush (*Lyonia ferruginea*), yaupon (*Ilex vomitoria*), St. Andrew's cross (*Hypericum hypericoides*), and false indigobush (*Amorpha fruticosa*). Herbs are sparse and include Elliott's milkpea (*Galactia elliottii*), dogfennel (*Eupatorium capillifolium*), witchgrass (*Dichanthelium* sp.), and Carolina ponysfoot (*Dichondra carolinensis*). The non-native invasive Caesar's weed (*Urena lobata*) is occasional along roads through this community.

Current management considerations of the Conservation Area’s mesic hammocks primarily consists of maintaining natural hydrology and controlling exotic plant invasion.

Pasture (14 acres, 0.5%)

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; Agro-Ecology Grazing Issues Working Group 2009). 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 Conservation Area has two improved pastures that are actively grazed by cattle through a lease on the Property. The pastures have a ground cover of bahiagrass (*Paspalum notatum*) mixed with weeds such as dogfennel (*Eupatorium capillifolium*) and turkey tangle fogfruit (*Phyla nodiflora*). Hammock vegetation occurs in clumps of live oak (*Quercus virginiana*), sand

live oak (*Quercus geminata*), cabbage palm (*Sabal palmetto*), and American beautyberry (*Callicarpa americana*) with an open, disturbed understory.

The pasture at the Conservation Area encompasses the entire of the cattle lease. Gopher tortoise burrows can also be found on this area of the Conservation Area. There are no plans for restoration within the scope of this plan due to the cattle lease that runs until 2030.

Successional Hardwood Forest (9 acres, 0.4%)

Closed-canopied forest dominated by fast growing hardwoods such as laurel oak (*Quercus hemisphaerica*), water oak (*Quercus nigra*), and/or sweetgum (*Liquidambar styraciflua*), often with remnant pines. These forests are either invaded natural habitat (i.e., mesic flatwoods, sandhill, upland pine, upland mixed woodland) due to lengthy fire-suppression or old fields that have succeeded to forest. The subcanopy and shrub layers of these forests are often dense and dominated by smaller individuals of the canopy species. Successional hardwood forests can contain remnant species of the former natural community. Restoration of these forests includes mechanical tree removal and reintroduction of fire. Where characteristic herbaceous species (e.g., wiregrass) have been lost, reintroduction via seed or plants may be necessary to restore natural species composition and community function.

There is a small area of former pine flatwoods on the far western boundary of the Conservation Area is now primarily a successional hardwood forest. This community has a short canopy dominated by water oak (*Quercus nigra*), sand live oak (*Quercus geminata*), and cabbage palm (*Sabal palmetto*), with an overstory of slash pine (*Pinus elliottii*). Shrubs are dense and include a mix of species including wild olive (*Cartrema americanum*), red bay (*Persea borbonia*), sand live oak, rusty staggerbush (*Lyonia ferruginea*), saw palmetto (*Serenoa repens*), myrtle oak (*Quercus myrtifolia*), shiny blueberry (*Vaccinium myrsinites*), gallberry (*Ilex glabra*), American beautyberry (*Callicarpa americana*), pricklypear (*Opuntia humifusa*), gopher apple (*Geobalanus oblongifolius*) and dwarf huckleberry (*Gaylussacia dumosa*). Vines of earleaf greenbrier (*Smilax auriculata*) and muscadine (*Vitis rotundifolia*) are abundant. Herbs are sparse and include bracken fern (*Pteridium aquilinum*), witchgrass (*Dichanthelium* sp.), and vanillaleaf (*Carphephorus odoratissimus*). The area of successional hardwood forest on the Conservation Area is considered too small for fire to be an effective management tool.

Basin Marsh (6 acres, 0.2%)

Basin marshes are depressional, non-forested wetlands. They are typically large and/or embedded in a non-pyrogenic community and thus are not heavily influenced by frequent fires in the surrounding landscape. This community type is dominated by herbs or occasionally shrubs that can withstand inundation for most or all of the year. On the Conservation Area, large areas within the swamp matrix appear to be non-forested on the 1940s aerial photographs. Most of this former marsh now has a developed canopy and is currently included within the basin swamp. Additional areas of marsh vegetation occupy depressions in hammocks. The marsh near the western boundary at the interface between historic flatwoods and mesic hammock is highly disturbed by cattle grazing and old linear clearings that bisect the community. Red maples (*Acer rubrum*) and cabbage palms (*Sabal palmetto*) form a scattered short canopy. Large patches of common buttonbush (*Cephalanthus occidentalis*) and coastalplain willow (*Salix caroliniana*) are frequent. Typical marsh graminoids and herbs such as sawgrass (*Cladium jamaicense*), spikerush

(*Eleocharis* sp.), and dotted duckweed (*Landoltia punctata*) are found throughout. Weedy and invasive species such asclimbing hempvine (*Mikania scandens*), turkey tangle fogfruit (*Phyla nodiflora*), and dogfennel (*Eupatorium capillifolium*) exploit areas of disturbance.

Although not considered a pyrogenic community, occasional fires can be beneficial for restoring an herb-dominated vegetation structure. Removing feral hogs (*Sus scrofa*) is desirable in areas where these animals are impacting basin marshes and other wetlands.

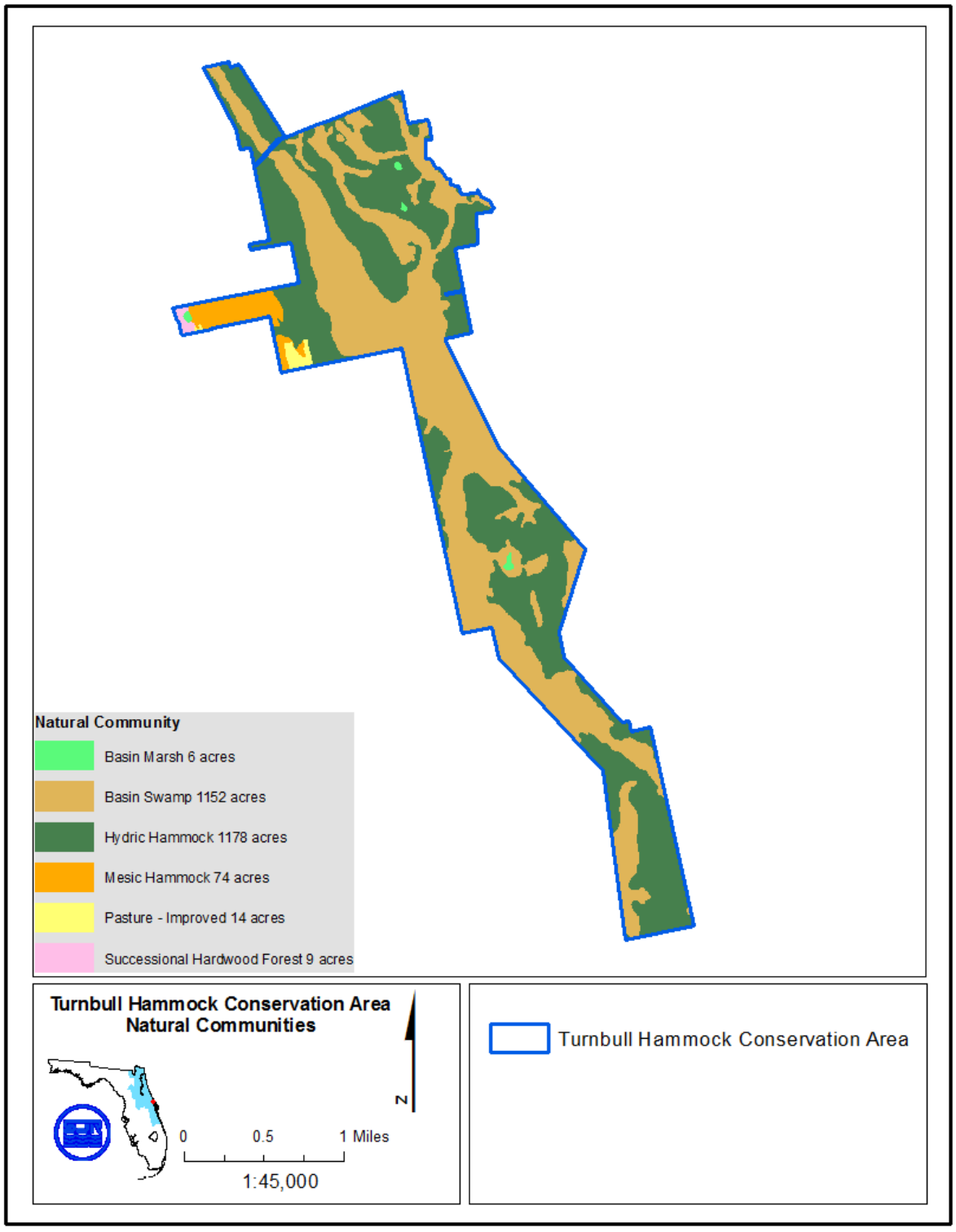

Figure 9: Natural Communities

SOILS
According to the USDA Soil and Conservation Service, 12 different soil types are within the Conservation Area. The Volusia County Soil Survey provided information used to develop descriptions of the predominant soil series found within the Conservation Area. The soil descriptions are located in Appendix 2.

CULTURAL AND HISTORICAL RESOURCES
A review of the Department of State, Division of Historical Resources indicates the presence of four registered cultural sites within the boundaries of the conservation area. These sites are classified as prehistoric mounds or middens. A thorough survey of these areas will be conducted before undertaking any management actions near these resources. If any new sites are located, District staff will document and report the sites to the Division of Historical Resources.

IMPLEMENTATION

The following sections outline land management strategies for resource protection, land use, and administration on the Conservation Area for the next ten years.

RESOURCE PROTECTION AND MANAGEMENT

Water Resources

Goal:

This Conservation Area protects forested wetland habitat that inputs freshwater into the North Indian River Lagoon. Land acquisition has been the principal form of protection at this Property. The District will continue to manage this Property for its water quality filtering and flood protection functions.

Strategy:

- Continue to manage the Property in a manner that will assist in the protection of the water quality of the Indian River Lagoon consistent with the Indian River Lagoon SWIM and BMAP plans.

Fire Management

The Conservation Area's natural communities are not dependent on frequent fire. Prescribed burning will not be utilized at this site. The area of successional hardwood forest on the Conservation Area is considered too small for fire to be an effective management tool.

Forest Management

Goal: Maintain forest resources for water quality, water supply, flood protection and natural resource benefit.

Strategy:

- Monitor forest health and take forest management actions as necessary and where practicable.

Chapter 253.036, Florida Statutes, requires the lead agency of state lands to prepare a forest resource analysis, "…which shall contain a component or section…which assesses the feasibility of managing timber resources on the parcel for resource conservation and revenue generation purposes through a stewardship ethic that embraces sustainable forest management practices if the lead management agency determines that the timber resource management is not in conflict with the primary management objectives of the parcel."

The natural communities as well as the access challenges of the Conservation Area make most forest management activities not practicable. The forested natural communities of the Conservation Area shall be monitored for structural and biotic changes. Where these changes occur, appropriate actions shall be undertaken in consultation with the District forester.

Flora and Fauna

Goal: Maintain, improve or restore native and listed species populations.

Strategies:

- Conduct plant and wildlife surveys and develop species lists.
- Monitor for the presence of listed species and adjust management actions appropriately.
- Monitor health of known needle palm populations
- Monitor for sea level induced wetland migration

Goal: Remove invasive plants and animals.

Strategies:

- Assess the need for a feral hog removal agent.
- Locate, map, and treat any infestations of invasive species.

Native Species

The Conservation Area has a diverse assemblage of natural communities providing significant habitat for a variety of floral and faunal species. There are historic occurrences of a wading bird rookery being active in the 1970s as well as indigo snake (*Drymarchon couperi*) observations in the late 1960s, but neither have been observed contemporarily.

Florida Black Bear

The Florida black bear (*Ursus americanus floridanus*) has been documented near the Conservation Area. The conservation area lies within a critical movement corridor for the Central (Ocala/St. Johns) subpopulation of the black bear. The Conservation Area is a significant acquisition in providing connectivity to other conservation lands and provides an optimal range of desirable habitat and seasonal food sources for bears, as well as cover for denning and protection from humans.

Gopher Tortoise

The gopher tortoise (*Gopherus polyphemus*) is a federal candidate species for listing as a threatened species and a state-listed threatened species which occurs within the Conservation Area. This species is typically found in dry upland habitats, such as sandhill, scrub, and pine flatwoods. Gopher tortoises excavate deep burrows and are considered a keystone species because their burrows provide refuge for more than 300 animal species. Management activities within the Conservation Area will focus on minimizing impacts to the gopher tortoise. The majority of the gopher tortoise occurrences on the Conservation Area are located near the access easement off of Cow Creek Rd.

Needle Palm

Needle palm (*Rhapidophyllum hystrix*), a shrublike, clumping palm, has been observed in the hydric hammocks of the Conservation Area. Beginning in 2020, numerous specimens on site were observed in a state of decline. This decline preceded a noticeable die off of this plant at the Conservation Area. In the spring of 2022, scientists with the Florida Department of Agriculture and Consumers Services made several visits to the Conservation Area to determine the reason for the decline and die off. Research is still ongoing, and no conclusion has been determined as of the time of writing. A variety of causal agents including nematodes, foliar fungus and soil salinity have been discussed. Staff will continue to monitor the populations for any continuing changes.

Wetland Migration

As sea level rises, wetland ecosystems will invade low-lying uplands as well as change the structure and composition of existing wetlands (Miller, 2021). The Conservation Area is particularly susceptible to wetland migration due to its broad drainage and low elevation (one to five feet above sea level). To track these changes, the District will remap natural communities during the subsequent ten-year updates to the Conservation Area management plans. Through its acquisition, the Conservation Area acts as a buffer to the impacts of sea level rise on the surrounding land uses and additional acquisitions should be considered in the area to mitigate these impacts (Linhoss et al., 2015).

Invasive Species

The most common invasive plants that occur within the Conservation Area include cogongrass (*Imperata cylindrica*) Caesar-weed (*Urena lobata*) and tropical soda apple (*Solanum viarum*). Small population of Chinese tallow (*Triadica sebifera*), Japanese climbing fern (*Lygodium japonicum*) and *Bamboo* sp. are also present at the Conservation Area. These invasive plants are managed by District staff as well as contractors. Invasive species control is necessary to inhibit the continued proliferation of invasive plants and integral in the maintenance and restoration of natural plant communities. District staff apply various US EPA approved herbicides per label rates using the most appropriate method of application for the target species. The cattle lessee is required to treat tropical soda apple within the lease area.

While it is unlikely that the District will entirely eradicate invasive plants within the Property, depending on species and level of infestation, maintaining control or achieving maintenance control of such species is targeted within the scope of this plan. Invasive plant infestations are minimal across the Property, and the Property is regularly monitored and treated, as necessary.

Invasive wildlife species known to occur within the conservation area include feral hogs (*Sus scrofa*). Soil disturbance from feral hog activity on the Property is minimal. The current cattle lessee conducts hog removal efforts. From 2012 to 2021, 379 hogs have been removed from the Conservation Area by the cattle lessees. If necessary, the District will explore the option of issuing a special use agreement (SUA) for feral hog removal to an approved agent if damage becomes extensive.

Cultural Resource Protection
Goal: Identify, protect, and maintain any cultural resources found on the Property.

Strategies:
- Maintain security on existing sites.
- Identify and report sites to the Florida Division of Historical Resources (DHR).
- Identify and report any detrimental activities to the sites to the DHR and law enforcement.

A review of the Department of State, Division of Historical Resources indicates four (4) registered cultural sites within the Conservation Area. If any additional sites are located, District staff will document and report the sites to the Division of Historical Resources. District land management activities that may impact these resources will be evaluated and modified to eliminate disturbance. To further protect the cultural resources, the location of the sites is not identified on public maps.

LAND USE MANAGEMENT

Access
Goal: Evaluate opportunities to provide public access**.**

Strategies:
- Evaluate potential future acquisitions to provide for improved access to the Conservation Area.

There is currently no designated public access to the Conservation Area. The District has an access easement from the neighboring landowner to access the Conservation Area from Cow Creek Rd. The District will continue to assess opportunities to provide a designated public access point for this Property.

Recreation
The Conservation Area does not offer developed recreation amenities at this time due to limited but not prohibited access. The limited trails and roads which exist on the Conservation Area are often inundated and impassable. The District will continue to seek opportunities to allow for recreational opportunities via future acquisitions.

Security

Goal: Provide and maintain security.

Strategies:

- Maintain signage, gates and locks.
- Continue coordination with cattle lessee (in-kind service), private security firm, FWC, and local law enforcement.

Security concerns within the Conservation Area include illegal motorized vehicle access, poaching and refuse dumping. Most onsite security is performed by the cattle lessee who provides an on-site presence and patrol. Volusia County Sheriff's Department patrols and enforces refuse dumping issues which are mainly focused on Volco Rd.

ADMINISTRATION

Real Estate Administration

Goal: Explore opportunities and partner with other agencies for acquisition of adjacent Property.

Strategy: Evaluate adjacent properties for potential acquisition.

At the time of writing of this Plan, Volusia County is in negotiation with several property owners adjacent to the Conservation Area to purchase over 2,600 acres within the Indian River Blueway Florida Forever Project. This includes property north of Volco Rd. as well a property on the east side of the Conservation Area along Deharo Rd. These properties comprise the current optimal boundary for the Conservation Area (Figure 10).

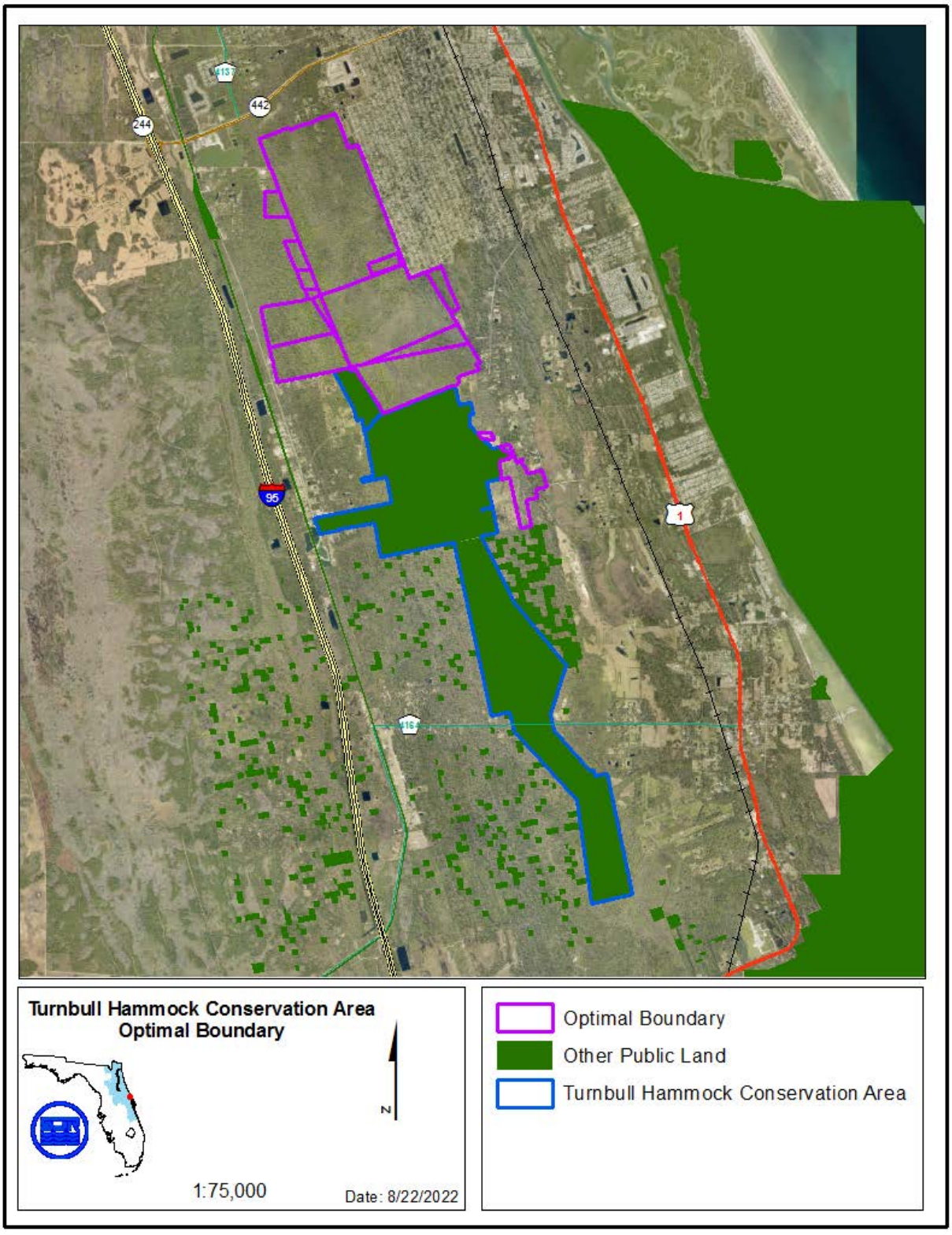

Figure 10: Optimal Boundary

Cooperative Agreements, Leases, Easements, and SUAs

Goal: Maintain a cattle lease as well as evaluate and pursue cooperative opportunities.

Strategies:

- Continue to evaluate and administer leases and SUAs with lessees, researchers, universities and local governments as appropriate.

The District is authorized to enter into Cooperative Agreements, Cooperative Management Leases, Leases, Easements and Special Use Authorizations. According to section 373.1391, Florida Statutes, the District is authorized and encouraged to enter into cooperative land management agreements with state agencies or local governments to provide for the coordinated and cost-effective management of lands to which the water management districts, the Board of Trustees of the Internal Improvement Trust Fund, or local governments hold title. In addition to Florida Statutes, District Policy #820, promotes the District entering into agreements with other agencies and private parties for cooperation and coordination of management of the District's lands. These cooperative agreements serve to protect the District's water management interests and to enhance the management and public value of the land. Leasing can be a useful tool in accomplishing land management objectives and will be evaluated and implemented where appropriate. Table 2 details the agreements, leases, and SUAs in effect during the writing of this Plan.

The Conservation Area is subject to a District administered cattle lease on 32 acres of the Property. It is a 10-year lease expiring in 2030. A maximum of 16 animal units (cow and calf or single bull) are authorized under the lease at a rate of $100 per animal unit. The annual lease fee is pro-rated to $800 because the cattle graze on District land half of the year until the lease area becomes inundate. During the other half of the year, the cattle graze on adjacent private property for which lessee holds a private cattle lease. Figure 9 depicts the extent of the cattle lease area.

The District is the grantee of a 50-foot-wide perpetual access easement (LA# 1992-026-PB) as a part of the Hart Land and Cattle Company purchase LA# 1992-026-PA. This easement allows the District to access the Conservation Area from Cow Creek Rd.

Table 2: Cooperative Agreements, Leases, and Special Use Authorizations

Agreement Number	Type/Purpose	Agreement Name	Term
1111	Intergovernmental Agreement/Fire Management Mutual Aid	Cooperative Fire Management Agreement - SJRWMD & Volusia County 2020	Renewed April 2020, 20-year term
1854	Cattle Lease/Revenue; In-Kind Allowed	Dean, James Bruce Jr. - Turnbull Hammock	April 2020-April 2030
2243	SUA/Research-Sampling	University of Central Florida Kelly Invertebrate Sampling	July 2021-July 2026
2268	SUA/Research-Sampling	Kansas State University District Wide Lobelia & Soil Sampling	September 2021-September 2026

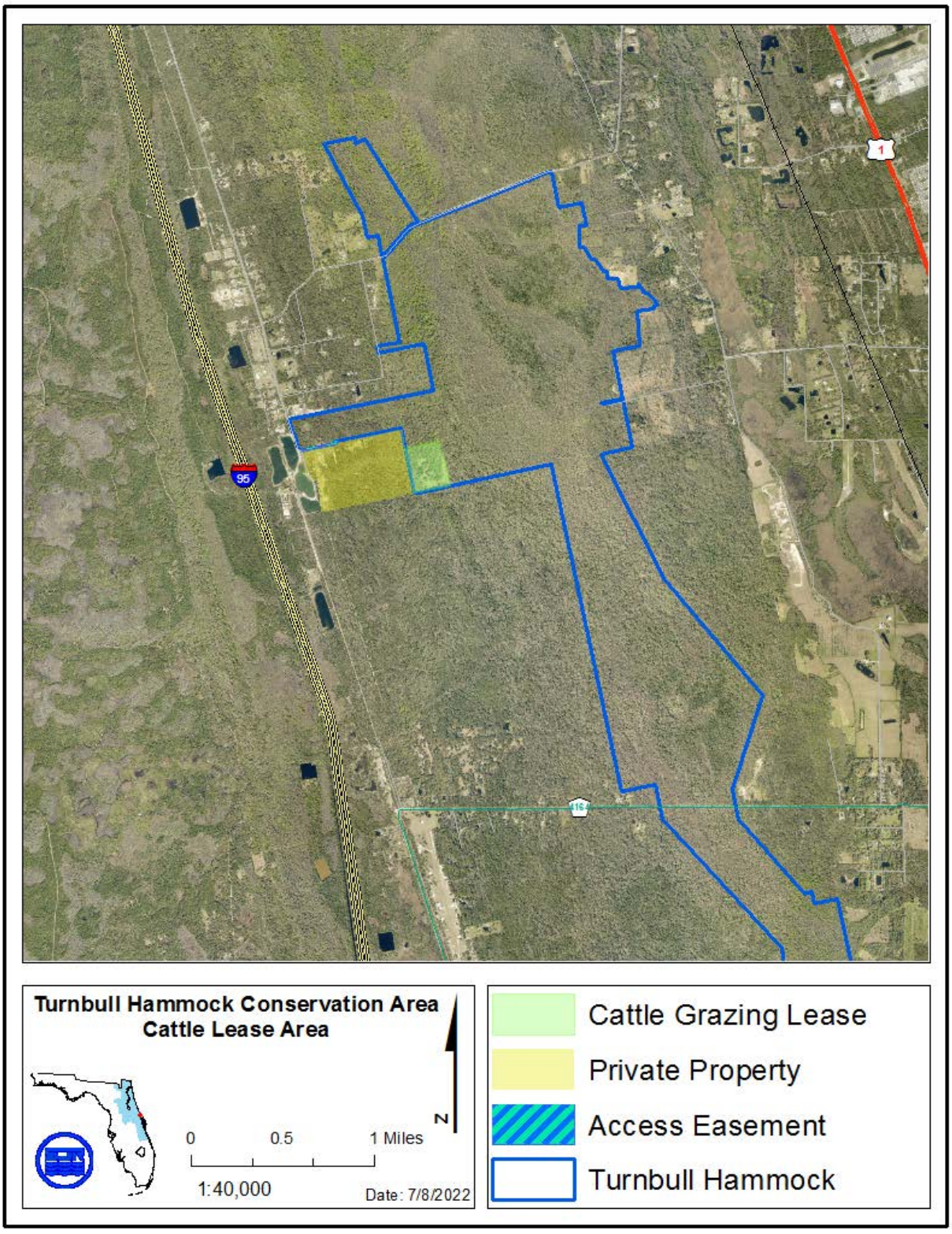

Figure 11: Cattle Lease Area

Management Revenues and Costs
Goal: Analyze and report projected and actual costs and revenues.

Strategies:
- Analyze and report cattle lease revenue.
- Analyze and report land management costs.

All revenue generated through the cattle lease is applied towards the District's land management budget to offset management costs for the Property.

Costs and revenues are projected into the future.

Revenues Since Purchase of Property
Revenues since the last LMP update in 2007 are solely from the cattle lease (Table 3). Cattle lease payments can be cash or in-kind service credits. Credits are determined by activity (security patrol, mowing outside of the lease area, invasive species control) with a per hour dollar amount assigned.

Table 3: Management Revenues from 2007 to 2021

Activity	**Year**	**Revenue**
Cattle Lease	2015	$ 569
Cattle Lease	2016	$ 520*
Cattle Lease	2017	$ 520*
Cattle Lease	2018	$ 520*
Cattle Lease	2019	$ 520*
Cattle Lease	2020	$800 ($595*, $205 check)
Cattle Lease	2021	$800 ($595*, $205 check)
Total (*= Payment by In-Kind Services)		**$ 4,249**

Costs Since Purchase of Property
Since the last land management update of the Property in 2007, costs have totaled $33,880 (Table 4).

Table 4: Management Costs from 2007 to 2021

Annual Costs				
Activity	**Annual Number of Units**	**Units**	**Annual Cost**	**Total Cost (Since 2007)**
Invasive plant control	5	Acres	$900	$12,600
Staff Time	80	Hours	$2200	$30,800
Total Cost Since 2007				**$ 43,400**

Projected Revenues

The projected revenues the cattle lease at the Conservation Area between 2022 and 2030 (the end of the current cattle lease) are $7,200 (Table 5). All revenue generated from the cattle lease during this time-period will be applied towards the District's land management budget to offset management costs for the Property. Any in-kind services will be conducted on the Conservation Area and approved by the Land Manager.

In addition to cattle lease revenues, ecosystem services are provided by the protection of the Conservation Area. Ecosystem services are the combination of the goods and services provided by the functions (habitat, biological properties or processes) of an ecosystem. Ecosystem goods (such as raw materials) and services (such as water supply protection) represent the benefits human populations derive, directly or indirectly, from ecosystem functions. Using metrics developed Costanza et al. (1997) and Blair et al. (2015), the ecosystem services provided by the 2,336 acres of wetlands within the Conservation Area can be valued at over $10 million annually. These benefits are produced by disturbance regulation, water supply protection, and water quality improvements amongst many others.

Table 5: Projected revenues between 2022 to 2032

Activity	Year	Revenue
Cattle Lease	2022	$800
Cattle Lease	2023	$800
Cattle Lease	2024	$800
Cattle Lease	2025	$800
Cattle Lease	2026	$800
Cattle Lease	2027	$800
Cattle Lease	2028	$800
Cattle Lease	2029	$800
Cattle Lease	2030	$800
Total		**$7,200**

Projected Management Costs

Projected management costs for the Conservation Area from 2022-2032 are $97,900.

Table 6: Projected Management costs from 2020-2032

Activity	Number of Units (annual)	Units	Annual Cost	10 Year Total Cost
Invasive plant control	11	Acres	$1,980	$19,800
Staff Time	80	Hours	$2,200	$22,000
Total cost over 10 years			**$4,180**	**$41,800**

RESOURCE PROTECTION AND MANAGEMENT

Water Resources			
Goal	**Protect water quality and quantity, restore hydrology to the extent feasible, and maintain the restored condition**	**Measure**	**Planning Period**
Strategy A	Continue to manage the Property in a manner that will assist in the protection of the water quality of the Indian River Lagoon consistent with the Indian River Lagoon SWIM and BMAP plans.		Ongoing
Forest Management and Restoration			
Goal	**Maintain forest resources for water quality, water supply, flood protection and natural resource benefit.**	**Measure**	**Planning Period**
Strategy A	Monitor forest health and take forest management actions as necessary and where practicable.	Number of site visits	Ongoing
Flora and Fauna			
Goal	**Maintain, improve, or restore native and listed species populations**	**Measure**	**Planning Period**
Strategy A	Conduct plant and wildlife surveys and develop species lists.	Updates to species list	Ongoing
Strategy B	Monitor for the presence of listed species and adjust management actions appropriately.	Updates to species list and adjusted management actions	Ongoing
Strategy C	Monitor known populations of needle palm and coordinate with FDACS on their health evaluations	Perceived population health	Ongoing
Strategy D	Monitor for sea level induced wetland migration	Natural Community Mapping	Every 10 years
Goal	**Remove invasive plants and animals**	**Measure**	**Planning Period**
Strategy A	Assess the need for a feral hog removal agent.	Needs assessment	Annually by Sept.
Strategy B	Locate, map, and treat any new infestations.	Mapping and treatment of new infestations	Ongoing
Cultural Resource Protection			

Goal	Identify, protect, and maintain any cultural resources found on the Property	Measure	Planning Period
Strategy A	Maintain security on existing sites.	Existing sites visited and evaluated	Ongoing
Strategy B	Identify and report sites to the Florida Department of Historical Resources (DHR).	Sites identified and reported	Ongoing
Strategy C	Identify and report any detrimental activities to the sites to the DHR and law enforcement.	Sites identified and reported	Ongoing

LAND USE MANAGEMENT

Access

Goal	Evaluate opportunities to provide public access	Measure	Planning Period
Strategy A	Evaluate future acquisitions to provide for improved access to the Conservation Area.	Site identified	Ongoing

Goal	Provide and maintain security	Measure	Planning Period
Strategy A	Maintain signage, gates, and locks.	Signs, fences, gates, and locks maintained	Ongoing
Strategy B	Continue coordination with private security firm, FWC, and local law enforcement.	Secure Property	Ongoing

ADMINISTRATION

Real Estate Administration

Goal	Explore opportunities for adjacent property acquisition	Measure	Planning Period
Strategy A	Evaluate adjacent properties for potential acquisition.	Properties evaluated	Annually by Sept.

Cooperative Agreements, Leases, Easements, and Special Use Authorizations

Goal	Evaluate and pursue cooperative opportunities	Measure	Planning Period
Strategy A	Administer easements, agreements, leases, and SUAs	Agreements administered	Ongoing
Management Revenues and Costs			
Goal	**Analyze and report projected and actual costs and revenues**	**Measure**	**Planning Period**
Strategy A	Analyze and report cattle lease revenues.	Annual report	Annually by Nov.
Strategy B	Analyze and report land management costs.	Annual report	Annually by Nov.

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APPENDIX 1: TURNBULL HAMMOCK CONSERVATION AREA SOILS

Below is a description of the soils and an accompanying map (Figure 1) at Turnbull Hammock Conservation Area.

Basinger
The Basinger series consists of very deep, poorly drained and very poorly drained, rapidly permeable soils in sloughs, depressions, low flats, and poorly defined drainageways. They formed in sandy marine sediments. The natural vegetation may consist of wax myrtle, St. Johns wort, maidencane, pineland threeawn, cypress, slash pine, longleaf pine, pond pine, and other water tolerant plants.

EauGallie
The EauGallie series consists of deep or very deep, poorly or very poorly drained, slowly permeable soils in flats, sloughs and depressional areas. They formed in sandy and loamy marine sediments in Peninsula Florida. Natural vegetation may consist of longleaf pine, South Florida slash pine, and saw palmetto, with understory vegetation possibly including inkberry, southern bayberry, and pineland threeawn.

Gator
The Gator series consists of very poorly drained organic soils that formed in moderately thick beds of hydrophytic plant remains overlying beds of loamy and sandy marine sediments. They are in depressions and on flood plains. Native vegetation includes mostly cordgrass or saw grass, maidencane, willow, dogwood, or swamp vegetation including bald cypress, sweet gum, red maple, and American hornbeam.

Hicoria
The Hicoria series consists of very deep, very poorly and poorly drained, moderately slowly to slowly permeable soils in seasonally ponded depressions and broad low flats. They formed in thick beds of sandy and loamy marine sediments. Natural vegetation may include cypress, willow, sweet bay, red bay, pickerel weed, arrowhead, maidencane, saw grass, chalky bluestem, bushy beard bluestem, sand cordgrass, wax myrtle, and other water tolerant plants. Some areas have slash pine and scattered cabbage palms.

Hontoon
The Hontoon series consists of deep, very poorly drained, rapidly permeable organic soils formed in hydrophytic non-woody plant remains. These soils occur in fresh water swamps and marshes. Native vegetation is loblolly, bay, maple, gum, and scattered cypress trees with a ground cover of greenbriers, ferns, and other aquatic plants. In a few areas there are slash pines with a ground cover of fern.

Malabar
The Malabar series consists of very deep, poorly to very poorly drained soils in sloughs, shallow depressions, and along flood plains. They formed in sandy and loamy marine sediments. Native vegetation consists of scattered slash pine, cypress wax myrtle, cabbage palm, pineland

threeawn, and maidencane. In depressions, the vegetation is dominantly St. Johns wort or maidencane.

Pineda
The Pineda series consists of deep and very deep, poorly and very poorly drained, very slowly permeable soils in depressions, low hammocks, poorly defined drainageways, broad low flats, and flood plains. They formed in thick beds of sandy and loamy marine sediments on the lower coastal plain. Natural vegetation consists of slash pine, cypress, myrtle, cabbage palm, blue maidencane, chalky bluestem, bluepoint panicum, sedges, pineland threeawn, and sand cordgrass.

Placid
The Placid series consists of very deep, very poorly drained, rapidly permeable soils on low flats, depressions, poorly defined drainageways on uplands, and flood plains on the Lower Coastal Plain. They formed in sandy marine sediments. Natural vegetation consists of pond pine, bay, cypress, gum, pickerel weed, and coarse grasses.

Pomona
The Pomona series consists of very deep, poorly and very poorly drained, moderate to moderately slowly permeable soils on broad low ridges on the Lower Coastal Plain. They formed in sandy and loamy marine sediments. The native vegetation consists of slash pine, longleaf pine with an understory of saw palmetto, wax myrtle, gallberry, creeping bluestem, chalky bluestem, indiangrass, and pineland threeawn.

Riviera
The Riviera series consists of very deep, poorly drained, very slowly permeable soils on broad, low flats and in depressions in the Lower Coastal Plain. They formed in stratified sandy and loamy marine sediments on the Lower Coastal Plain. Native vegetation may consist of slash pine, cabbage, and saw palmetto, scattered cypress, maidencane, and pineland threeawn.

Samsula
The Samsula series consists of very deep, very poorly drained, rapidly permeable soils that formed in moderately thick beds of hydrophytic plant remains and are underlain by sandy marine sediments. These soils are in swamps, poorly defined drainageways and flood plains. Natural vegetation is loblolly bay with scattered cypress, maple, gum, and pine trees with a ground cover of greenbriers, ferns, and other aquatic plants.

Smyrna
The Smyrna series consists of very deep, poorly to very poorly drained soils formed in thick deposits of sandy marine materials. Natural vegetation consists of longleaf and slash pines with an undergrowth of saw palmetto, running oak, gallberry, wax myrtle, and pineland three awn.

St. Johns
The St. Johns series consists of very deep, very poorly or poorly drained, moderately permeable soils on broad flats and depressional areas of the lower Coastal Plain. They formed in sandy

marine sediments. Principal vegetation of the forested areas is longleaf pine, slash pine, and pond pine with an undergrowth of saw palmetto, gallberry, wax myrtle, huckleberry, and pineland threeawn.

Valkaria
The Valkaria series consists of deep, rapidly permeable soils that formed in thick beds of marine sands. These soils occur in broad, poorly defined, low gradient drainageways, depressions and low nearly level areas. Natural vegetation is palms, cabbage palmettos, St. Johnswort, wax myrtle, blue maidencane, chalky bluestem, pineland threeawn, and widely spaced pine and cypress. Maidencane is the most common plant in depressions.

Wabasso
The Wabasso series consists of deep or very deep, very poorly and poorly drained, very slowly and slowly permeable soils on flatwoods, flood plains, and depressions in Peninsula Florida. They formed in sandy and loamy marine sediments. The natural vegetation consists of longleaf pine, slash pine, cabbage palm, live oak, with an understory of saw palmetto, laurel oak, wax myrtle, chalky bluestem, and pineland threeawn.

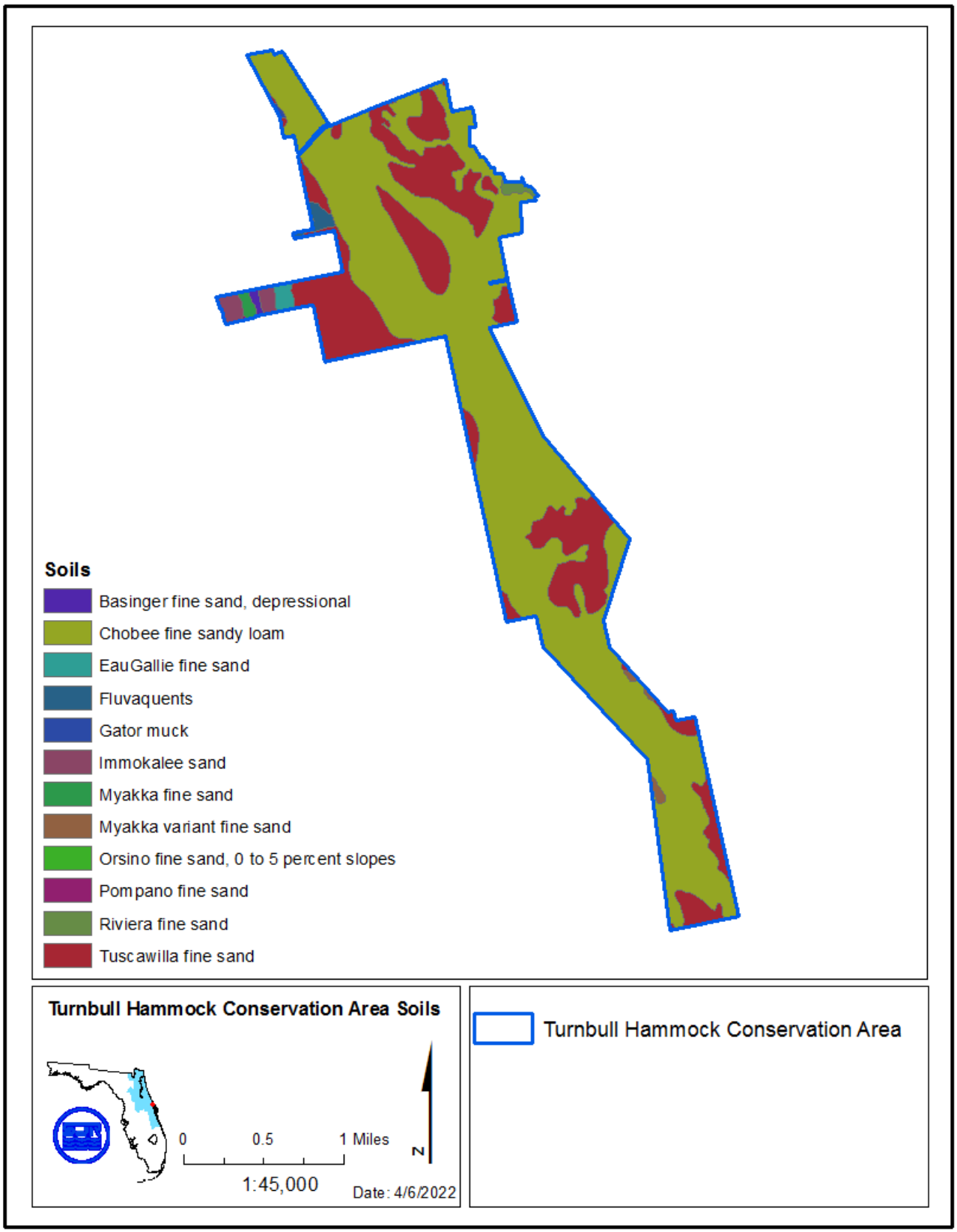

Figure 1: Soil types at Turnbull Hammock Conservation Area.

Appendix 2: TURNBULL HAMMOCK CONSERVATION AREA SPECIES LIST

Plants

Scientific name	**Common Name (Conservation Status)**
Acer rubrum	red maple
Ambrosia artemisiifolia	common ragweed
Amorpha fruticosa	false indigobush
Andropogon virginicus var *glaucus*	chalky bluestem
Aristida stricta	wiregrass
Asclepias perennis	swamp milkweed
Baccharis glomeruliflora	silverling
Bacopa caroliniana	lemon bacopa
Bidens alba	beggarticks
Callicarpa americana	beautyberry
Carpinus caroliniana	American hornbeam
Carphephorus odoratissimus	vanillaleaf
Cartrema americanum	wild olive
Carya aquatica	water hickory
Carya glabra	pignut hickory
Celtis laevigata	sugarberry
Cephalanthus occidentalis	buttonbush
Chamaecrista fasciculata	partridge pea
Chasmanthium laxum	slender woodoats
Citrus sp.	citrus tree*
Cladium jamaicense	sawgrass
Dichanthelium sp.	witchgrass
Dichondra carolinensis	Carolina ponysfoot
Dioscorea bulbifera	air potato*
Echinochloa crus-galli	barnyardgrass
Eleocharis sp	spikerush
Eupatorium capilifolium	dogfennel
Fraxinus caroliniana	pop ash
Fraxinus pennsylvanica	green ash
Galactia elliottii	elliott's milkpea
Gaylussacia dumosa	dwarf huckleberry
Gelsemium sempervirens	yellow jessamine
Geobalanus oblongifolius	gopher apple
Gonolobus suberosus	angle pod (ST)
Gordonia lasianthus	loblolly bay
Guzmania monostachia	west indian tufted airplant
Hibiscus grandiflorus	swamp rosemallow

Hydrocotyle umbellata	manyflower marshpennywort
Hypericum sp.	St. Johns wort
Ilex glabra	gallberry
Ilex vomitoria	yaupon
Ipomoea cordatotriloba	morning glory
Iris savannarum	savanna iris
Landoltia punctata	dotted duckweed
Liatris sp.	blazing-star
Licania michauxii	gopher apple
Liquidambar styraciflua	sweetgum
Lyonia ferruginea	rusty staggerbush
Lyonia lucida	fetterbush
Magnolia virginiana	sweetbay
Magnolia grandiflora	southern magnolia
Melia azedarach	Chinaberrytree*
Melinis repens	rose natalgrass*
Mikania scandens	climbing hempvine
Monarda punctata	spotted beebalm
Morella cerifera	wax myrtle
Morus rubra	red mulberry
Nephrolepis exaltata	wild Boston fern
Nyssa aquatica	water tupelo
Nyssa biflora	swamp tupelo
Opuntia humifusa	devil's tongue
Osmunda regalis	royal fern
Ostrya virginiana	eastern hophornbeam
Panicum hemitomon	maidencane
Parthenocissus quinquefolia	virginia creeper
Paspalum notatum	bahia grass
Persea borbonia	red bay
Persicaria hydropiperoides	mild waterpepper
Phanopyrum gymnocarpon	savannah panicum
Phlebodium aureum	golden polypody fern
Phyla nodiflora	turkey tangle fogfruit
Pinus elliottii	slash pine
Pinus clausa	sand pine
Pityopsis graminifolia	narrowleaf silkgrass
Pleopeltis polypodioides var. michauxiana	resurrection fern
Polygonum sp.	smartweed
Pontederia cordata	pickerelweed
Pseudognaphalium obtusifolium	rabbit tobacco

Psychotria nervosa	wild coffee
Psychotria sulzneri	shortleaf wild coffee
Pteridium aquilinum	bracken fern
Quercus geminata	sand live oak
Quercus laurifolia	laurel oak
Quercus myrtifolia	myrtle oak
Quercus nigra	water oak
Quercus shumardii	shumard's oak
Quercus virginiana	live oak
Rhapidophyllum hystrix	needle palm
Rhus copallinum	winged sumac
Rhynchospora inundata	narrowfruit horned beaksedge
Rubus cuneifolius	sand blackberry
Sabal palmetto	cabbage palm
Salix carolinana	carolina willow
Salvinia minima	water spangles
Schinus terebinthifolius	brazilian pepper*
Serenoa repens	saw palmetto
Setaria sp.	foxtail
Smilax auriculata	earleaf greenbrier
Smilax bona-nox	saw greenbrier
Solanum viarum	tropical soda apple*
Solidagoodora var. chapmanii	chapman's goldenrod
Taxodium ascendens	pond cypress
Taxodium distichum	bald cypress
Thalia geniculata	alligatorflag
Tilia americana	carolina basswood
Tillandsia bartramii	Bartram's air-plant
Tillandsia simulata	Florida air-plant
Tillandsia usneoides	Spanish moss
Tillandsia utriculata	giant airplant (SE)
Typha latifolia	broadleaf cattail
Ulmus americana	american elm
Urena lobata	caesar weed*
Vaccinium myrsinites	shiny blueberry
Viola sororia	common blue violet
Vitis rotundifolia	grapevine
Vittaria lineata	Shoestring fern
Zanthoxylum clava-herculis	toothache tree

Birds

Specific Name	Common Name (Conservation Status)
Cardinals, Grosbeaks, and Allies	
Cardinalis	Northern Cardinal
Catbirds, Mockingbirds, and Thrashers	
Dumetella carolinensis	Gray Catbird
Mimus polyglottos	Northern Mockingbird
Cormorants and Anhingas	
Gnatcatchers	
Polioptila caerulea	Blue-gray Gnatcatcher
Grouse, Quail, and Allies	
Colinus virginianus	Northern Bobwhite
Meleagris gallopavo	Wild Turkey
Herons, Ibis, and Allies	
Bubulcus ibis	Cattle Egret
Butorides virescens	Green heron
Egretta thula	Snowy egret
*Egretta caerulea***	Little Blue Heron (G5, S4, ST, FN)
Egretta tricolor	Tricolored heron (G5, S4, ST, FN)
*Eudocimus albus***	White Ibis (G5, S4, SN, FN)
Platalea ajaja	Roseate spoonbill (G5, S2, ST, FN)
Jays, Magpies, Crows, and Ravens	
Corvus brachyrhynchos	American Crow
Kingfishers	
Megaceryle alcyon	Belted kingfisher
Owls	
Bubo virginianus	Great Horned Owl
Strix varia	Barred Owl
Pigeons and Doves	
Zenaida macroura	Mourning Dove
Storks	
*Mycteria americana***	Wood Stork (G4, S2, ST, FT)
Thrushes	
Turdus migratorius	American Robin
Tits, Chickadees, and Titmice	

Poecile carolinensis	Carolina Chickadee
Baeolophus bicolor	Tufted Titmouse
Mniotilta varia	Black-and-white Warbler
Parula americana	Northern Parula
Dendroica palmarum	Palm Warbler
Dendroica pinus	Pine Warbler
Dendroica discolor	Prairie Warbler
Dendroica coronata	Yellow-rumped Warbler

Turkey

Melaeagris gallopavo Osceola	Osceola turkey

Tyrant Flycatchers: Pewees, Kingbirds, and Allies

Sayornis phoebe	Eastern Phoebe
Myiarchus crinitus	Great Crested Flycatcher

Vireos

Vireo olivaceus	Red-eyed Vireo
Vireo griseus	White-eyed Vireo

Vultures, Hawks, and Allies

Buteo lineatus	Red-shouldered Hawk
Buteo jamaicensis	Red-tailed Hawk
Coragyps atratus	Black Vulture
Cathartes aura	Turkey Vulture
*Elanoides forficatus***	Swallow-tailed Kite (G5, S2, SN, FN)
Haliaeetus leucocephalus	Bald eagle
Pandion haliaetus	Osprey (G5, S3S4, SN, FN)

Waterfowl

Aix sponsa	Wood Duck

Woodpeckers

Picoides pubescens	Downy Woodpecker
Dryocopus pileatus	Pileated Woodpecker

Wrens

Thryothorus ludovicianus	Carolina Wren

Amphibians

Specific Name	**Common Name (Conservation Status)**
Acris gryllus dorsalis	Florida cricket frog
Anaxyrus quercicus	Oak toad
Anaxyrus terrestris	Southern toad
Arcis gryllus	Southern cricket frog
Hyla femoralis	Pinewoods Treefrog
Lithobates grylio	Pig frog

Lithobates sphenocephalus	Southern leopard frog
Pseudacris nigrita	Southern chorus frog
Pseudacris ocularis	Little grass frog

Mammals

Scientific name	Common Name
Odocoileus virginianus	White-tailed deer
Procyon lotor	Racoon
Sciurus carolinensis	Eastern gray squirrel
Sus scrofa	Feral hog
Ursus americanus floridanus	Florida black bear
Didelphis virginiana	Virgina opossum
Sylvilagus floridanus	cottontail rabbit
Canis latrans	coyote

Reptiles

Specific Name	Common Name (Conservation Status)
Alligator mississippiensis	American alligator
Agkistrodon conanti	Florida cottonmouth
Anolis carolinensis carolinensis	Green anole
*Anolis sagrei**	Brown anole
Aspidoscelis sexlineata	Six-lined racerunner
Coluber constrictor priapus	Southern black racer
Crotalus adamanteus	Eastern diamondback rattlesnake
Deirochelys reticularia	Chicken turtle
Gopherus polyphemus	Gopher tortoise
Masticophis flagellum flagellum	Eastern Coachwhip
Nerodia fasciata pictiventris	Florida watersnake
Kinosternon baurri	Three striped mup turtle
Sternotherus odoratus	Common musk turtle
Terrapene carolina	Florida box turtle

Fish

Specific Name	Common Name
Elassoma evergladei	Everglades pygmy sunfish
Esox americanus	Redfin pickerel
Gambusia holbrooki	Mosquito fish

Invertebrates

Order	Specific Name	Common Name

Coleoptera	*Phanaeus vindex*	Green Dung beetle
Diplopoda	*Anadenobolus monilicornis*	Yellow-banded millipede
Hemiptera	*Ranatra Sp*	Water Scorpion
Heteroptera	*Lethocerus Sp*	Giant Water Bug
Hymenoptera	*Camponotus floridanus*	Carpenter ant
Hymenoptera	*Dasymutilla occidentalis*	Velvet ant
Lepidoptera	*Danaus gilippus*	Zebra Swallowtail
Lepidoptera	*Thyridopteryx ephemeraeformis*	Bagworm
Lepidoptera	*Thorybes sp.*	Skippers
Odonata	*Libellula axilena*	Bar-winged skimmer

***Exotic**
**** Listed – Status descriptions below**

FNAI GLOBAL RANKING

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).

FNAI STATE RANKING

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.

STATE and FEDERAL LEGAL STATUS

C = Candidate for listing at the Federal level by the U. S. Fish and Wildlife Service
FE = Listed as Endangered Species at the Federal level by the U. S. Fish and Wildlife Service
FT = Listed as Threatened Species at the Federal level by the U. S. Fish and Wildlife Service
FXN = Federal listed as an experimental population in Florida
FT(S/A) = Federal Threatened due to similarity of appearance
ST = State population listed as Threatened by the FFWCC. Defined as a species, subspecies, or isolated population which is acutely vulnerable to environmental alteration, declining in number at a rapid rate, or whose range or habitat is decreasing in area at a rapid rate and as a consequence is destined or very likely to become an endangered species within the foreseeable future.
SSC = Listed as Species of Special Concern by the FFWCC. Defined as a population which warrants special protection, recognition, or consideration because it has an inherent significant vulnerability to habitat

modification, environmental alteration, human disturbance, or substantial human exploitation which, in the foreseeable future, may result in its becoming a threatened species.