MADISON BLUE SPRINGS STATE PARK

Park Chapter

SUWANNEE RIVER PLANNING REGION

Withlacoochee

TO JASPER

6

PARK FEATURES
- Park Boundary
- Structures
- Unpaved Park Roads
- Walkways

SINKHOLE
Entrance Station
Bathhouse
Spring Monitoring Tower
Pumphouse
Swimming Platform
SINKHOLE
Storage
Madison Blue Spring
SINKHOLE
Pavilions
Cave Entry
BOTTOMLAND FOREST
UPLAND HARDWOOD FOREST
ALLUVIAL FOREST
UPLAND HARDWOOD FOREST
UPLAND MIXED WOODLAND
ALLUVIAL FOREST

TWIN RIVERS STATE FOREST

River

TO MADISON

NE BLUE SPRINGS CHURCH RD

6

SURROUNDING LAND COVER
- Agriculture
- Silviculture
- Forests
- Wetlands

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MADISON BLUE SPRING STATE PARK

MADISON COUNTY, FLORIDA

0 250 500 Feet

INTRODUCTION

LOCATION AND ACQUISITION HISTORY

Madison Blue Spring State Park is located in Madison County (see Vicinity Map). Access to the park is from State Road 6. The Vicinity Map also reflects significant land and water resources existing near the park.

Madison Blue Spring State Park was initially acquired by The Board of Trustees of the Internal Improvement Trust Fund (Trustees) on Oct. 26, 2002, with funds from the Land Acquisition Trust Fund (LATF). Currently, the park comprises 49.73 acres. The Trustees hold fee simple title to the park and on April 14, 2014, the Trustees leased (Lease No. 4762) the property to the Division of Recreation and Parks (DRP) under a 50-year lease. The current lease will expire on April 13, 2064.

Madison Blue Spring State Park is designated single-use to provide public outdoor recreation and conservation. There are no legislative or executive directives that constrain the use of this property (see Addendum 1). A legal description of the park property can be made available upon request to the Florida Department of Environmental Protection (DEP).

SECONDARY AND INCOMPATIBLE USES

In accordance with 253.034(5) F.S., the potential of the park to accommodate secondary management purposes was analyzed. These secondary purposes were considered within the context of DRP's statutory responsibilities and resource values. This analysis considered the park's natural and cultural resources, management needs, aesthetic values, visitation and visitor experiences. It was determined that no secondary purposes could be accommodated in a manner that would not interfere with the primary purposes of resource-based outdoor recreation and conservation.

DRP has determined that uses such as water resource development projects, water supply projects, stormwater management projects, linear facilities and sustainable agriculture and forestry (other than those management activities specifically identified in this plan) would not be consistent with the management purposes of the park.

In accordance with 253.034(5) F.S., the potential for generating revenue to enhance management was also analyzed. Visitor fees and charges are the principal source of revenue generated by the park. It was determined that no additional revenue generating activities are appropriate during this planning cycle. Generating revenue from consumptive uses or from activities that are not expressly related to resource management and conservation is not under consideration.

PURPOSE AND SIGNIFICANCE OF THE PARK

Park Purpose

The purpose of Madison Blue Spring State Park is to provide opportunities for resource-based outdoor recreation for Florida residents and visitors while ensuring conservation and protection of valuable natural resources, including a representative example of natural karst topography, aquatic cave environments and water resources with direct linkages to the Withlacoochee River and Floridan aquifer.

Park Significance

- The park protects one of Florida's 33 first-magnitude springs, which discharges into a karst bowl and yields a 150-foot spring-run stream before merging with the Withlacoochee River.

- The park protects significant examples of karst topography, including limestone outcroppings and an array of unique sinkhole types.

- The park provides habitat for three imperiled species of cave-dwelling invertebrates.

- The park is an internationally known cave diving destination in which cave systems provide recreational opportunities and spectacular underwater scenery.

Central Park Theme

A first magnitude spring along the Withlacoochee River, Madison Blue Spring is a renowned swimming hole shaped by ancient limestone.

Madison Blue Spring State Park is classified as a state recreation area in the DRP unit classification system. In the management of a state recreation area, major emphasis is placed on maximizing the recreational potential of the unit. Preservation of the park's natural and cultural resources, however, remains important. Depletion of a resource by any recreational activity is not permitted. In order to realize the park's recreational potential, the development of appropriate park facilities is undertaken with the goal of providing facilities that are accessible, convenient and safe to support public recreational use or appreciation of the park's natural, aesthetic and educational attributes.

OTHER DESIGNATIONS

The unit is not within an Area of Critical State Concern as defined in section 380.05; Florida Statutes and is not presently under study for such designation. The park is a component of the Florida Greenways and Trails System, administered by the DEP Office of Greenways and Trails.

All waters within the park have been designated as Outstanding Florida Waters, pursuant to Chapter 62-302, Florida Administrative Code. Surface waters in this park are also classified as Class III waters by DEP. The park is not adjacent to an aquatic preserve as designated under the Florida Aquatic Preserve Act of 1975 (Section 258.35, Florida Statutes).

PARK ACCOMPLISHMENTS

- Removed invasive bamboo.
- Installed fencing to delineate parking area and visitor picnic areas.
- Erosion control measures were taken underneath the stairs leading from the main day use area.
- Added new administrative building in 2020.
- Park management zones were put into fire rotation.

RESOURCE MANAGEMENT COMPONENT

Madison Blue Springs State Park Management Zones			
Management Zone	**Acreage**	**Managed with Prescribed Fire**	**Contains Known Cultural Resources**
MBS-1A	11.32	N	Y
MBS-1B	2.29	N	N
MBS-1C	0.64	N	N
MBS-2	35.48	N	N

TOPOGRAPHY

The physiographic province in which Madison Blue Spring State Park is located is called the Withlacoochee River Valley Lowlands, a narrow extension of the Gulf Coastal Lowlands that follows the Withlacoochee River corridor northward into Georgia (Ceryak et al. 1983). The lowlands along the Withlacoochee are typically below 80 feet mean sea level (msl) in elevation, with many areas less than 60 feet msl (Hoenstine et al. 1990). The Gulf Coastal Lowlands as a whole are described as a low karst plain with elevations typically less than 100 feet msl (White 1970). Complete and rapid infiltration of surface water runoff is characteristic of the drainage within the lowlands. Exposed limestone features are numerous, and the many well-developed sinkholes in the area provide a high degree of interconnection between surface water and groundwater systems. West and east of the Withlacoochee River Valley Lowlands is the Northern Highlands region, consisting of uplands capped by relatively impermeable, clay-rich sediments. East of the Withlacoochee River, the Northern Highlands are relatively flat and elevations are typically greater than 150 feet above msl. Karst development is minor. A high degree of surface runoff and a more extensive development of lakes and wetlands characterize the drainage in this region (Champion and Upchurch 2003). West of the Withlacoochee River is a sub-unit of the Northern Highlands that was formerly included within the Tallahassee Hills subunit, but later received its own designation as the Madison Hills (Scott 2005). This sub-unit extends from central Jefferson County east to the west side of the Withlacoochee River Valley, and actually encompasses the extreme western edge of Madison Blue Spring State Park. Elevations within the Madison Hills area range from 70 feet above msl to 200 feet above msl. Karst features are evident in the eastern portion where Suwannee Limestone occurs near the surface (Scott 2005). The transitional zone between the Gulf Coastal Lowlands and the Northern Highlands is a distinctive karst feature known as the Cody Escarpment, familiarly known as the Cody Scarp (Puri and Vernon 1964). Ancient marine shoreline processes have significantly shaped this visible landscape feature, where topographic relief can vary up to 80 feet. The scarp area has an abundance of sinkholes, sinkhole lakes and sinking streams, known as swallets, that profoundly influence the hydrology of the region. A large portion of the surface runoff from the Northern Highlands drains across the Cody Scarp and becomes groundwater as it rapidly infiltrates subsurface limestone conduits of the upper Floridan aquifer. While the transitional edge of the Cody Scarp is readily distinguishable in the field along much of its route, in the Madison Hills region it is less apparent. In referencing USGS topographic maps, however, geologists have discerned a noticeable break at the 100-foot contour that they now use to define the edge of the Cody Scarp in the

Madison Hills area (Hoenstine 1990). The Cody Scarp appears to intersect the Withlacoochee River Valley Lowlands in the vicinity of Madison Blue Spring State Park. The aquifer is unconfined in the immediate area, having become exposed through processes of surface erosion and geologic dissolution (Wetland Solutions 2010). Considering the small size of the unit (49.73 acres), topographic relief within Madison Blue Spring State Park is quite variable. While many areas are nearly level, others are gently rolling. The western side of the park is defined by a low broad floodway that cuts through the length of the park, roughly in a north-south line, and by a steep slope that rises from the floodway into uplands along the west boundary. Elevations range from approximately 114 feet above msl in the southwest corner of the park to below 40 feet msl in the head spring area. Only about 5% of the park (2.52 acres) is above the 100-year floodplain, while 90% lies within the 10-year floodplain. Among the numerous karst features in the park are aquatic caves, spring vents, sinkholes, and sinkhole lakes. Another notable topographic feature is the steep limestone bank along the west side of the Withlacoochee River. Approximately one acre of earthmoving occurred several decades ago at the very northern edge of the park within the floodway, probably during construction of the western span of the two State Road 6 bridges across the Withlacoochee drainage. The alluvial forest in this area contains trees that are considerably younger than those further south in the floodway.

SOILS

Soils within Madison Blue Spring State Park range from the frequently flooded soils of floodplains near the Withlacoochee River to the well-drained sandy soils of the uplands (see Soils Map). There are seven mapped soil types in the park. Detailed descriptions of these soils are included in Addendum 4 of this plan (Howell and Williams 1990)

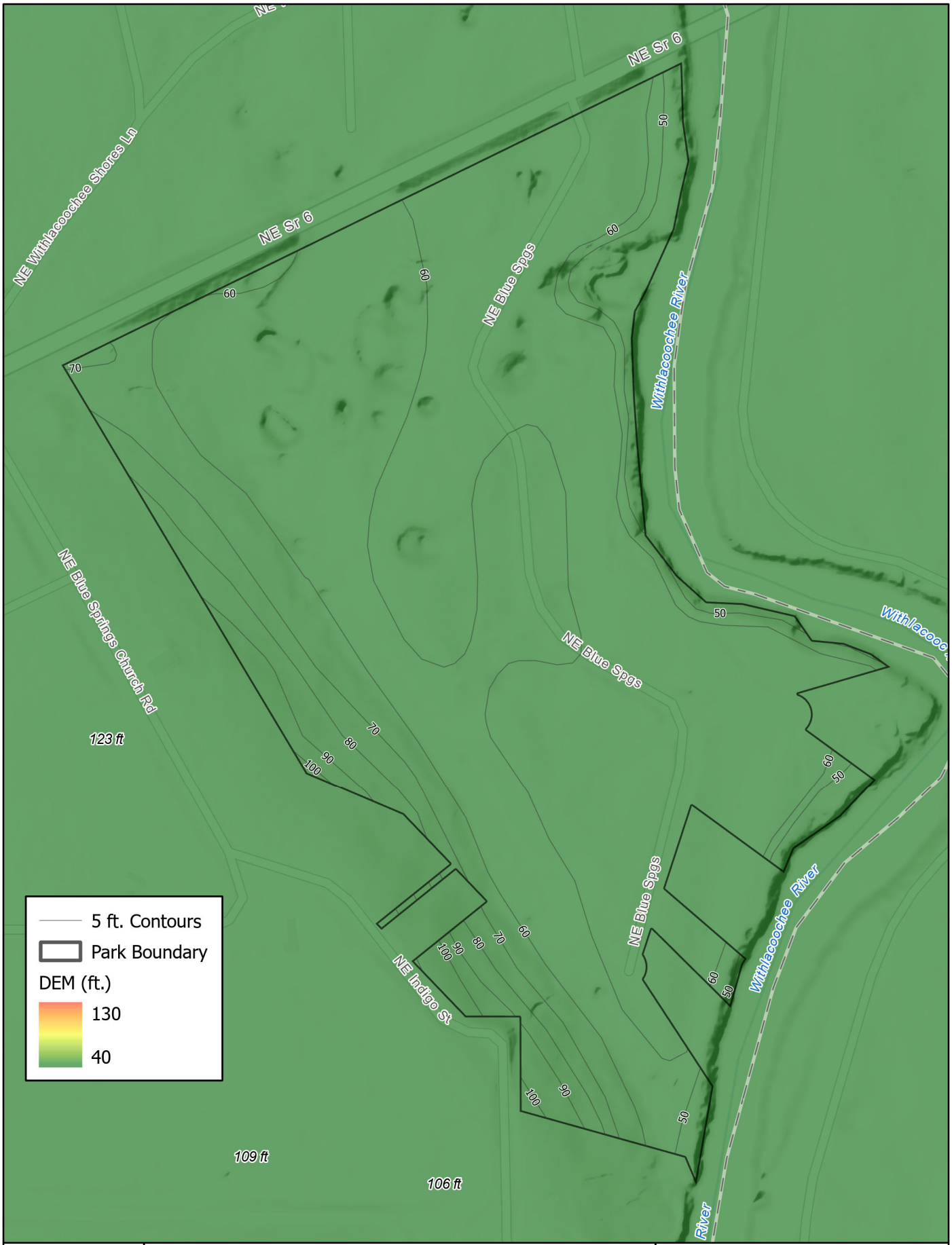
Soil disturbance and erosion from surface water runoff can be highly detrimental to the erosion prone, steep-sided banks of the Withlacoochee River and to sensitive karst features in the park. Areas of the park that are most vulnerable to soil erosion include footpaths along the riverbanks and intensively used slopes around major karst features such as the head spring and Martz Sink. Large karst openings into the Floridan aquifer are particularly vulnerable to possible contamination from runoff, especially during strong storm events. Runoff that lacks ample opportunity to filter through underlying soils may flow directly into these openings, causing increased turbidity and sedimentation and decreased water quality in the aquifer. The DRP needs to develop an erosion control plan for the park that provides guidelines for mitigating critical areas of erosion. At present, the park staff routinely monitors erosion prone areas to detect changes in the extent and pattern of erosion, particularly along pathways that provide public access to the head spring swimming area. Mitigation of eroding areas along existing pathways, or possibly even relocation of some access routes, are among the actions being considered to resolve the erosion issue. Management activities will continue to follow accepted best management practices to minimize or prevent additional soil erosion and to protect the park's soil and water resources.

MADISON BLUE SPRING STATE PARK
Management Zones

N

0 200 400 Feet

This graphical representation is provided for informational purposes and should not be considered authoritative for navigational, engineering, legal, and other uses.

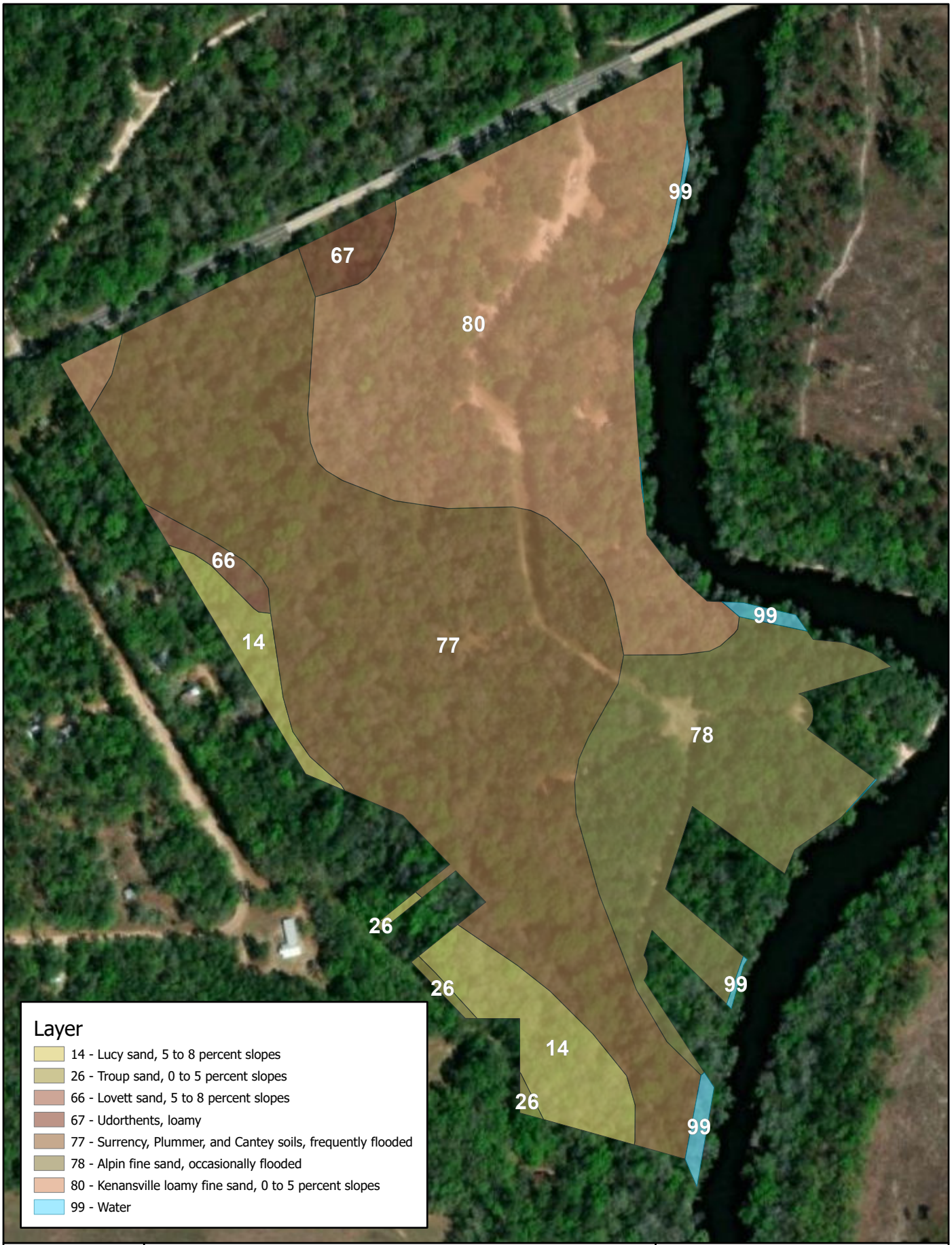


MADISON BLUE SPRING STATE PARK
Topography

N

0 0.05 0.1 Miles

This graphical representation is provided for informational purposes and should not be considered authoritative for navigational, engineering, legal, and other uses.



MADISON BLUE SPRING STATE PARK
Soils

N

0 200 400 Feet

This graphical representation is provided for informational purposes and should not be considered authoritative for navigational, engineering, legal, and other uses.

HYDROLOGY

Madison Blue Spring and the Withlacoochee River are the two most significant hydrologic features of the park. Madison Blue is a first-magnitude spring located on the west side of the Withlacoochee River approximately 12 miles upstream from its confluence with the Suwannee River. The spring discharges into an 80-foot diameter circular pool which forms the head of a 150-foot spring-run stream that flows easterly into the Withlacoochee River (Scott et al. 2004). About 30 feet below the pool surface is a large opening to a cave which serves as the main entrance to a very extensive aquatic cave system. Over 26,000 feet of underground passages have been explored to date (Gulden and Coke 2014).

The Withlacoochee River is a major tributary of the Suwannee River and is part of the Upper Suwannee River basin, which encompasses a surface watershed of 7,056 square miles (Hornsby et al. 2003). Over 50% of that watershed lies in Georgia, including the headwaters of the Withlacoochee River located north of Valdosta (Farrell and Upchurch 2005). The mean annual flow rate for the Withlacoochee, measured at the Pinetta gage about 10 miles upstream from Madison Blue Spring State Park, is 1,718 cubic feet per second (Farrell and Upchurch 2004; USGS 2014). In the upper Withlacoochee River, flow is primarily dependent on surface water inputs, while further downstream the river is increasingly fed by groundwater. In fact, Madison Blue Spring is the major source of base flow in the lower Withlacoochee River (Giese and Franklin 1996a). When the river experiences low water levels, a greater proportion of flow is contributed by springs, and this can trigger significant changes in water chemistry and clarity.

During flood stage of the Withlacoochee, however, the opposite occurs. As river levels rise, Madison Blue begins to act as a "siphon" or inflow point into the Upper Floridan aquifer (Giese and Franklin 1996b; Gulley et al. 2011). This inflow, as surface waters and groundwater mix, can cause substantial changes in groundwater quality, including the input of significant loads of nutrients into the aquifer (Katz et al. 1999; Katz and Hornsby 1998; Berndt et al. 1998). The marked changes in water clarity that are observable within the Madison Blue system are dependent on factors such as flow velocity, clarity of the Withlacoochee River (i.e., tannic or clear), and height of the river stage. Partial or complete "brownouts" of the Madison Blue system may occur. A complete brownout is considered to have happened when tannic river water covers the entire spring run and headspring and water clarity is reduced to less than 4 feet of visibility. Park staff has sporadically documented brownouts and monitored water clarity at Madison Blue Spring since 2009.

When surface water and groundwater mixing occur, the result can be a rather rapid and potentially large-scale change within the usually stable aquatic cave environment. One consequence of such events may be a notable die-off of cave-dwelling fauna, i.e., troglobites, as has been documented several times at Wes Skiles Peacock Springs State Park (Streever 1991, 1992a, and 1992b). Whether invertebrate populations in aquatic caves at Madison Blue Spring State Park experience similar episodes is currently unknown (Franz et al. 1994), but the monitoring program now underway in the aquatic cave system should eventually provide some answers. This monitoring of troglobites at Madison Blue Spring has been taking place since 2005 as part of an Environmental Monitoring Plan (EMP) required by the Suwannee River Water Management District (SRWMD) as a condition for issuing a consumptive use permit for a water bottling plant near the park (SRWMD 2003). High troglobite diversity and abundance are considered strong indicators of a healthy spring ecosystem.

Water Quantity

The period of record for measuring Madison Blue Spring discharge is from 1932 to the present (U.S. Geological Survey (USGS) 2014). Only seven instantaneous measurements of flow rate are available from 1932 to 2001, but a continuous discharge record was initiated in 2002 and continues to this day

(Scott et al. 2004; USGS 2014). The minimum flow ever recorded for the spring was negative 893 cubic feet per second on March 2, 2013, while the maximum discharge was 752 cubic feet per second on July 23, 2005. The average total discharge of Madison Blue Spring from 1932 to 2008 was reported as 85.9 cubic feet per second (Wetland Solutions 2010).

The Madison Blue springshed was partially delineated when it was mapped north to the Georgia line in the early 2000s. It was found to encompass over 100 square miles (Farrell and Upchurch 2004). The Georgia portion of the springshed still needs to be delineated. For DEP to accomplish this, it will be necessary to solicit the assistance and cooperation of comparable agencies in Georgia.

One potential threat to water resources within Madison Blue Spring State Park is the large-scale withdrawal of groundwater from systems that are hydraulically connected to groundwater resources within the park. Under a water use permit issued by the SRWMD in December 2003, groundwater extraction for the retail sale of bottled spring water was initiated at a new facility near the west boundary of the park (SRWMD 2003). Two 10-inch diameter production wells with a capacity of 400 gallons per minute were permitted, at least one of which was located only a quarter-mile from the Madison Blue spring bowl. The total groundwater withdrawal allocation amounted to 588.8 million gallons per year. The maximum permitted withdrawal rate for all wells combined was 2.088 million gallons per day. According to a permit modification issued by the SRWMD in June 2014 (SRWMD Permit 2-98- 00025.007), the bottling plant is now allowed to extract an average of 1.6132 million gallons per day.

The long-term impact of withdrawals of this magnitude on the water budget of Madison Blue Spring remains to be determined. Among the requirements of the Nestle permit is that the company must develop a dataset illustrating the correlation between bottling plant withdrawals and local groundwater levels and Madison Blue discharge. To that end, the permit holder constructed four wells for the purpose of monitoring groundwater levels near Madison Blue Spring. For the duration of the permit, the permit holder must conduct the array of environmental monitoring procedures outlined in the EMP described above. The permit holder is required to stop or reduce its water withdrawals if aquifer levels fall below the minimum established by regulation. A compliance report is to be produced every five years.

An additional impact to water resources at Madison Blue Spring State Park is recent land use changes in the area which have resulted in the conversion of hundreds of acres of timberland to irrigated cropland. The multiple new wells required for these agricultural operations are putting additional strains on groundwater resources. The SRWMD is the agency responsible for issuing water use permits in the region, and in doing so must balance competing demands and ensure that proposed uses are in the public interest, which includes the conservation of fish and wildlife habitat and the protection of recreational values. Additionally, the SRWMD is responsible for prioritizing and establishing Minimum Flows and Levels (MFLs) for water bodies within its boundaries (SRWMD 2004).

The SRWMD established an MFL for Madison Blue Spring in 2004. The MFL limit was set at a point below which additional groundwater withdrawals would cause significant harm to the water resources or ecology of the Madison Blue system (Chapter 40B-8.031 F.A.C. Minimum Surface water Levels and Flows for Madison Blue Spring). Two modeling boundary conditions formed the basis for the MFL - a minimum Withlacoochee River stage of 55.0 feet (NGVD) at the Pinetta gauge (Site No. 02319000) and a minimum discharge of 70 cubic feet per second at Madison Blue Spring (Site No. 02319302) (USGS 2014). Water managers are required to determine the impacts of existing and proposed groundwater withdrawals in

the region based on the above two criteria. The MFL rule states that if both conditions are surpassed more than 10% of the time, when summarizing the entire period of record, continued groundwater withdrawals at the current rate will be significantly harmful to the area's water resources.

Many water management experts acknowledge that the past two significant drought periods in Florida (1998-2001 and 2010-12), as well as the increased consumptive use of groundwater, have cumulatively caused a significant lowering of water tables and decreased spring flows throughout north Florida (Copeland et al. 2011; Swihart 2011; Still 2010). In October 2011, the St. Johns River Water Management District (SJRWMD), SRWMD and DEP signed an interagency agreement that outlined closer coordination in the management of north Florida water supplies. The two water management districts are now required to address the issue of decreased groundwater resources in their district water supply planning efforts (SRWMD 2010; SJRWMD 2011). In October 2011, the SRWMD designated several areas within its regulatory boundary as "Water Resources Caution Areas", including the Upper Suwannee River region. This designation means that groundwater sources in those areas are not adequate to meet future needs over a 20-year planning period.

Water Quality

The factors that most influence water quality in Madison Blue Spring State Park include erosion/sedimentation along the banks of Madison Blue Spring and regional groundwater contamination. Erosion and sedimentation in the park is occurring at various locations around the springhead and its spring run. Surface water runoff originating from upland areas around the springhead can significantly contribute to deteriorating water quality. Since the Floridan aquifer in the area is unconfined, park staff should remain vigilant about possible pollution sources that could contribute to contamination of the springhead.

Highly vulnerable karst features within the park also have potential to funnel contaminated surface waters into high quality groundwater resources (Cichon et al. 2004). Martz Sink, for example, located in the floodway in the western part of the park, has a direct connection to the Madison Blue cave system.

Outside the park, there are potential sources of groundwater pollution as well. Seasonal flooding has necessitated periodic closures to public use because of high fecal bacterial counts attributable to contaminated runoff from upstream wastewater treatment systems. Agricultural operations within the Madison Blue springshed may pose a threat to the quality of groundwater and surface water resources within the springshed. Additionally, groundwater extraction is occurring at a bottled water plant within the springshed immediately west of the park, and the influence of this operation on the ecology of the spring is unknown. As a requirement of the Water Use Permit (iNo. 2-98-0025M4) issued by the SRWMD, extensive ecosystem monitoring is being conducted and Madison Blue Spring biological monitoring reports are produced annually (Geosyntec Consultants 2010).

State water managers have monitored groundwater quality in numerous types of wells over the past 25 years. DEP monitors over 276 different wells within the general area of Madison Blue Spring alone (Farrell and Upchurch 2004; DEP 2014a). Monitoring has revealed that nitrogen enrichment has contaminated most of the Upper Floridan aquifer in the northern region of the state. Nitrates specifically have increased by an order of magnitude or more over the past 50 years (Cohen et al. 2007). Human activity, especially the use of inorganic fertilizers, has long been the leading cause of this enrichment, and it may be particularly detrimental to the Madison Blue springshed.

Groundwater contamination from high nutrient loading has significantly influenced the ecological health of several spring ecosystems across the state (Cohen et al. 2007; Wetland Solutions 2010). Studies suggest that one of the primary water quality issues within these systems is unhealthy levels of nitrate-nitrogen (Jones et al. 1996). Nitrate concentrations measured at the Madison Blue springhead have ranged from 0.97 milligrams per liter to nearly 2.0 milligrams per liter (Harrington et al. 2010). According to Harrington, these levels are below the concentrations found at other springs in the state. However, naturally occurring background levels for nitrates should be less than 0.01 milligrams per liter (Cohen et al. 2007).

There is a large set of water quality data available for Madison Blue Spring, as well as for its receiving water body, the Withlacoochee River (Hornsby and Ceryak 1998; Scott et al. 2004). Much of the hydrological information that has been collected, stored and managed by state water management agencies can now be accessed through a variety of web-based filters (USGS 2014; SRWMD 2014; DEP 2014b).

The SRWMD maintains three surface water quality monitoring stations along the Withlacoochee River (Jenkins et al. 2010). The water quality measured at these stations generally falls in the good to fair range, although inputs from episodic rainfall and runoff events may influence them variably (Hand et al. 1996).

As of 2014, DEP's Total Maximum Daily Load (TMDL) program, which outlines the surface water quality improvements needed in water bodies throughout the state, had not assigned any TMDL requirements for Madison Blue Spring or the Withlacoochee River (DEP 2001; DEP 2003; DEP 2014c; Silvanima 2008).

Objective A: Assess the park's hydrological restoration needs.

- Action 1 - Continue to cooperate with entities involved in hydrological research and monitoring programs in the Withlacoochee basin.
- Action 2 - Continue to monitor water quality at Madison Blue Spring and track changes, particularly during brownout events.
- Action 3 - Continue to coordinate with the SRWMD in protecting historic flows at Madison Blue Spring during implementation of the MFL.
- Action 4 - Continue to monitor land-use or zoning changes in the Madison Blue Spring region and provide comments as appropriate.
- Action 5 - Determine if remnants of an apparent limestone rock dam are impeding flow in the spring run.

DRP will continue its tradition of close cooperation with state and federal agencies and independent researchers engaged in hydrological research and monitoring programs in the park and along the adjacent Withlacoochee River. Additional cooperative efforts may include facilitating the review and approval of research permits and providing researchers with assistance in the field, including orientation to park resources. DRP will continue to work with other state agencies, local governments and property owners within the park's vicinity to promote best management practices for the park's springshed.

Agencies such as the SRWMD, USGS, and DEP will be relied upon to keep DRP apprised of any declines in surface water quality or any suspected contamination of groundwater in the region. DRP staff will closely monitor incidents of contamination of the Withlacoochee River upstream from the park, such as that stemming from repeated malfunctions of the Valdosta wastewater treatment system. DRP will also

continue to monitor the springhead for ecological impacts of recurring brownout events and flow reversals.

District 2 staff will monitor Environmental Resource Permit (ERP) and Water Use Permit (WUP) requests for the region in order to provide timely and constructive comments that promote protection of the park's water resources. Staff will also continue to review annual biological monitoring reports produced by ENTRIX, an environmental consultant for Nestle Waters North America, which operates the water bottling plant just west of the park. In addition, DRP will continue to work closely with the SRWMD in evaluating the existing Madison Blue Spring MFL for its effectiveness in restoring historic flows to the spring.

Groundwater sources for Madison Blue Spring are still incompletely known. To trace those sources and provide adequate protection to the spring and potentially restore historic flows, water managers will need to have a better understanding of the true extent of the Madison Blue Springshed. Accordingly, DRP will seek funding for dye trace studies to delineate the springshed more thoroughly and to pinpoint the groundwater sources for the spring. Previous dye trace studies in other managed springsheds in Florida have provided DRP with invaluable information about spring sources and about the timing of surface to groundwater interactions that potentially affect important water bodies.

DRP staff will continue to monitor land-use or zoning changes within lands bordering the park. Major ground disturbances on neighboring properties or inadequate treatment of runoff into local streams could ultimately cause significant degradation of park resources. When appropriate, District 2 staff will provide comments to other agencies regarding proposed changes in land use or zoning that may affect the park.

Objective B: Evaluate and mitigate impacts of soil erosion in the park.

- Action 1 - Develop and implement protocols for monitoring erosion on slopes above the springhead and along the Withlacoochee River.
- Action 2 - Develop and implement erosion control measures for public access points to the spring, river and Martz Sink.

DRP staff will develop an erosion monitoring protocol and regularly monitor areas in the park that are prone to erosion. To maintain surface water and groundwater quality in the park, DRP will adopt best management practices for mitigating erosion, not only at public access points to the springhead and the Withlacoochee River shoreline, but also at significant karst features such as Martz Sink. It may be necessary to exclude visitors from some areas, at least temporarily, to allow healing of erosion scars. Certain areas along the drainage slope around the springhead may require installation of water bars to reduce the velocity of stormwater flow, encourage natural infiltration and minimize movement of sediments into the spring. Some access paths to the spring or river may require rerouting.

Objective C: Monitor the aquatic cave system for impacts from visitor use.

- Action 1 - Continue to consult with cave diving experts regarding potential resource disturbance issues attributable to increased visitor use of the cave system.
- Action 2 - Continue to develop and implement procedures for conducting baseline biological and physical surveys in the aquatic cave system and institute a long-term monitoring program.

DRP staff will continue to coordinate with cave diving experts in assessing the physical condition of the Madison Blue caves, in particular recording instances of possible degradation of cave surfaces attributable to increased diving pressure.

Cave experts, including certified cave divers who have volunteered significant time and resources in studying the cave systems of the park, have already provided numerous recommendations regarding appropriate use and management of the Madison Blue cave system. The ability of DRP to continue to make sound decisions about cave management in the future will depend on additional recommendations from those experts, as well as adaptive management and detailed knowledge of the resources. If cave resources show signs of unacceptable levels of disturbance from visitor use, appropriate science-based carrying capacities may need to be instituted.

DRP will continue to develop and implement monitoring programs that assess biological and physical conditions in the Madison Blue cave system. Monitoring of troglobite populations in the cave system will be of particular importance since cave fauna are very sensitive to changes in their environment. Both natural and human influences will need to be assessed, including hydrologic events such as brownouts and visitor use parameters such as intensity of recreational pressure. The potential impacts of these factors on cave fauna within the Madison Blue Spring system are still unknown. Survey data will be used to generate future recommendations for protection of troglobites. DRP staff will work with the North Florida Springs Alliance, the National Association of Cave Divers and the National Speleological Society Cave Diving Section in developing interpretive programs that educate cave divers about cave preservation and proper behavior within caves.

NATURAL COMMUNITIES

Upland hardwood forest

More than half the natural area at Madison Blue Spring State Park consists of upland hardwood forest, most of it in good condition. Within the park, the more floristically diverse associations of this community tend to occur in areas of limestone outcropping near sinkholes and just upslope from the band of alluvial forest that occupies the floodway in the western third of the park. Characteristic canopy species in the upland hardwood forest at the park include pignut hickory, southern magnolia, sweetgum, Florida maple, live oak, water oak (*Quercus nigra*) and laurel oak. Typical understory vegetation includes American holly, American hornbeam, basswood (*Tilia americana*), red buckeye (*Aesculus pavia*), beautyberry, white fringetree (*Chionanthus virginicus*) and horse sugar. Partridgeberry (*Mitchella repens*) is the most common groundcover species. Private property owners along the west boundary of the park once maintained an old woods road that descended to the west edge of the broad floodway in the park, in effect fragmenting the strip of upland hardwood forest that occurs there. This practice has been discontinued.

The main management strategy for this community is to protect it from disturbance and fragmentation. If erosion becomes problematic, park staff will need to implement corrective measures such as stabilization of disturbed areas. The neighbors' maintenance of the old woods road on the western side of the floodway must not be resumed.

Upland mixed woodland

The upland mixed woodland community often serves as a transition zone between upland pine or sandhill and adjacent upland hardwood forest or mesic hammock. It is similar to upland pine in that it is fire-adapted, has longleaf pine as the dominant pine species, and has a strong presence of southern red

oak and mockernut hickory in the canopy, along with scattered sand post oaks. Unlike the upland pine community, however, upland mixed woodland typically lacks wiregrass as a dominant groundcover, and the oaks and hickories may be co- dominant with the longleaf pines. Being a transitional community, upland mixed woodland is very susceptible to succession to upland hardwood forest when there is a lack of fire. As a result, very few intact examples of this community remain in north Florida.

Remnant patches of upland mixed woodland at Madison Blue Spring State Park still contain a few typical canopy species such as longleaf pine, southern red oak and mockernut hickory, plus some characteristic sub-canopy species including sparkleberry and hawthorn (*Crataegus* sp.) and groundcover species such as wiregrass (*Aristida stricta* var. *beyrichiana*) and blackseed needlegrass (*Piptochaetium avenaceum*).

However, a decades-long exclusion of fire from this community has hastened its decline from relatively open woodland to dense forest dominated by invasive off-site hardwoods such as laurel oak, water oak and sweetgum. Those hardwoods have shaded out most of the herbaceous species. The integrity of the upland mixed woodland is also compromised by the presence of numerous woods roads and trails that provide access to private outparcels within the park.

Because the upland mixed woodland sites at Madison Blue have deteriorated to such an extent, they are considered to be in poor condition. Nevertheless, these sites are restorable. Initiation of the restoration process in those areas will require the application of prescribed fire. Some selective girdling or herbiciding of off-site canopy and mid-story hardwoods will also be needed. These efforts will increase the effectiveness of initial burns by thinning out invasive species and releasing seed banks in overgrown sites. Initial girdling/herbiciding efforts should concentrate on upland mixed woodland sites that are considered to be in marginally better condition because they have a lower density of invasive hardwoods. Fires in the upland mixed woodlands should be allowed to creep into adjacent upland hardwood forests and gradually die out, thereby maintaining natural ecotones between communities.

Restoration and improvement of the upland mixed woodland community will entail the reintroduction of frequent fire (return interval of two to five years) and the removal of off-site hardwood species. Before restoration efforts can begin in much of the community, survey lines delineating the boundaries between outparcels and park property will need to be re-established and firebreaks will have to be constructed along those lines. The park will postpone the planting of longleaf pines and groundcover species until the canopy is sufficiently open to allow seedlings to survive. DRP should conduct additional field surveys to verify the historic extent of this community. Documentation of the distribution of remnant species will be necessary as well.

Sinkhole

The karst topography in the Madison Blue Spring area makes it susceptible to sinkhole formation, particularly in the northern third of the park. The sinkholes range from those that are relatively young and steep-sided, with exposed limestone walls, to those which slope more gradually and form depressions containing vegetation typical of the surrounding natural communities. Some of the sinkholes remain dry year-round, while others may hold water for a period of time after floods or heavy rainfall events. Sinkholes embedded within the upland hardwood forest tend to be in good to excellent condition, but others near or within public use areas are in poor condition due to heavy foot traffic or infestations of invasive exotic plants.

Sinkhole management must emphasize protection of resources. For sinkholes outside the developed areas of the park, staff will protect edges and slopes from disturbance, particularly that caused by foot

traffic which could accelerate erosion and cause sedimentation issues. There should be no authorized public access to the more sensitive sinkhole sites. Park staff will regularly monitor sinkholes for the presence of invasive plants and animals. Staff will also promptly treat invasive plants as needed.

The desired future condition for sinkholes can be attained by limiting unnatural erosion and protecting the microclimate from disturbance.

Limestone outcrop

As might be expected given the karst nature of the area, several limestone outcrops occur in Madison Blue Spring State Park. These outcrops are found along the sides of sinkholes and sinkhole lakes. Only one is large enough to be delineated on the Natural Communities Map. The only outcrop that is relatively accessible to the public is at Martz Sink, which is an access point for cave divers entering the Madison Blue aquatic cave system.

The limestone outcrops in the park are considered to be in good condition. Most are located well away from trails. Some may be susceptible to colonization by highly invasive plants such as Japanese climbing fern (*Lygodium japonicum*) or hedge bamboo (*Bambusa multiplex*). No surveys for rare or imperiled plant species have been conducted at the park's limestone outcrops.

The limestone outcrops must be protected from disturbance. Most of the outcrops are within sinkholes where public access is already restricted. Still, park staff should take measures to prevent unauthorized access to sinkholes that contain limestone outcrops, particularly those that may be situated relatively close to existing trails or roadways. Personnel involved in treating invasive plants in sinkholes should consider it likely that there may be limestone outcrops nearby that harbor rare plants and should minimize ground disturbance and overspray of herbicide as much as possible. Mapping of significant limestone outcrops, accompanied by surveys for imperiled plant species, will be necessary to ensure their long-term protection.

Bottomland forest

At Madison Blue Spring State Park, this community occurs within lowlands either slightly elevated above the adjacent alluvial forest or slightly lower than adjacent upland hardwood forest. Bottomland forests flood less frequently than alluvial forests (Florida Natural Areas Inventory (FNAI) 2010). In some areas, bottomland forest may act as a transition zone between floodplain and upland community types. These transition zones may be too narrow to map depending on the relative slope of the terrain.

Characteristic canopy species in the bottomland forest at Madison Blue Spring State Park include laurel oak (formerly diamondleaf oak), live oak, red maple and loblolly pine. The bottomland forest also contains parsley hawthorn (*Crataegus marshallii*), dwarf palmetto, American hornbeam and highbush blueberry (*Vaccinium corymbosum*). The understory tends to be somewhat open and may be relatively grassy compared to adjacent alluvial forest. The bottomland forest at Madison Blue Spring State Park is considered to be in fair to good condition.

Bottomland forest requires little active management other than protection from excessive erosion and control of invasive species. Park staff will continue regular monitoring of the bottomland forest for signs of invasive plants and feral hogs.

Alluvial forest

Alluvial forest at the park occurs in low areas adjacent to the springhead and along the west bank of the Withlacoochee River, as well as within the long linear floodway that cuts through the western half of the park. Bottomland forest and upland hardwood forest are typically the adjacent natural communities within the park. Distinctions among floodplain communities are often blurred, making accurate categorization difficult. However, the nature of alluvial forest's hydroperiod does distinguish it from similar lowland communities such as bottomland forest. Alluvial forests tend to flood frequently, usually on an annual basis, and they are found at slightly lower elevations than bottomland forests, which typically have at least several years pass between flood events. A huge old-growth water hickory occurs at the ecotone between the alluvial forest and a sinkhole lake in the northwestern part of the park. The alluvial forest at Madison Blue Spring State Park is generally in good condition.

Alluvial forest requires little active management other than protection from excessive erosion and control of invasive species. Park staff will periodically monitor the alluvial forest, checking for signs of erosion or feral hog rooting, and will address sources of impacts on a case-by-case basis.

Sinkhole lake

Because of the extent of underlying limestone, the northern half of Madison Blue Spring State Park is dotted with sinkholes and depressions characteristic of karst topography. Several very small sinkhole lakes (karst windows) occur in the northwestern part of the park, including Martz Sink. The smallest karst windows only cover a few square feet and are mere microcosms of a typical sinkhole lake. Most sinkhole lakes maintain a direct connection to underground water sources, the Floridan and surficial aquifers, and remain continuously flooded.

The more inaccessible sinkhole lakes in the park are nearly pristine in appearance. The lakes that are closer to hiking trails, however, are more subject to littering, soil compaction and disturbance of vegetation. In general, the sinkhole lakes at Madison Blue Spring State Park are in good condition.

In managing sinkhole lakes, the emphasis should be on protection. The edges of sinkhole lakes need to be protected from impacts that could accelerate erosion and sedimentation. Increased erosion can cause a decline in water quality, especially if there is a direct connection to the aquifer.

Access to sinkhole lakes in the park is restricted, except for Martz Sink, although legitimate research and park management activities may be permitted. An additional management consideration is protection of the quality and quantity of groundwater and surface waters that feed the sinkhole lakes.

Alluvial stream

The Withlacoochee River, whose course forms the boundary between Madison and Hamilton counties, is one of the relatively few alluvial streams in Florida, most of which occur in the Florida Panhandle. The majority of Florida's alluvial streams originate in the clayey uplands of Georgia and then follow a long, meandering southerly course until they reach the Gulf of Mexico. The Withlacoochee River, however, only flows 84 miles south from its headwaters near Tifton, Georgia, before it empties into the Suwannee River near Ellaville, Florida.

None of the Withlacoochee River channel actually falls within the boundaries of Madison Blue Spring State Park, although the park has about half a mile of frontage on the river. Consequently, alluvial stream is not depicted on the Natural Communities Map for the park. However, where the Withlacoochee River borders the park, DRP has management authority over resources within a 400-foot

zone in which sovereign submerged lands extend out from the edge of mean high water along the west bank of the river. In places where there is emergent wetland vegetation, the zone extends waterward 400 feet beyond the vegetation. Within this zone, park regulations will be enforced. All wildlife within this zone, with the exception of fish, is protected from harvest. In addition, pre-cut timber harvesting (deadhead logging) is prohibited within this zone.

Although land use within the Withlacoochee River basin is predominantly agricultural, the stream has several substantial point sources of domestic or industrial wastewater discharge along its course. Of these sources, five are municipal sewage treatment plants. The Withlacoochee Pollution Control Plant (WPCP) in Valdosta, Georgia, has had several sewage spills into the Withlacoochee River in recent years, some of them major. Apparently the WPCP facility has been unable to cope when severe rainfall events in the area have caused stormwaters to overwhelm the city's sanitary sewer collection system (WALB.com 2013). Another significant source of pollution has been a pulp mill that operates in Georgia but discharges its wastewater directly into Jumping Gully Creek, a minor tributary of the Withlacoochee River at the state line. State agencies in both Florida and Georgia have made a concerted effort in recent years to monitor this situation.
Despite these potentially significant upstream sources of pollution, water quality in the Withlacoochee River in vicinity of the park remains relatively good.

Periodic monitoring of water quality in the Withlacoochee River near Madison Blue Spring State Park will be an important management measure. Monitoring will be accomplished primarily in cooperation with DEP, the SRWMD and the Florida Department of Health in Madison County. Another priority will be regular monitoring of riverbanks for signs of erosion and prompt mitigation of any significant erosion discovered.

Spring-run stream

There is one known spring in the park, Madison Blue Spring. Its spring run is very short, flowing easterly for 150 feet before emptying into the Withlacoochee River. It appears that a previous owner of the Madison Blue property may have dammed at least part of the spring run with limestone rocks sometime in the 1990s. Remnants of the dam persist today. The extent to which the dam has modified flow in the spring run, if at all, is unknown.

The volume of flow in a spring-run stream fluctuates dramatically with groundwater levels and is largely dependent on the relationship between river stage and the potentiometric surface of the aquifer. When the Withlacoochee River stage increases, there is a corresponding rise in the waters of the spring-run stream, and when the river stage exceeds the potentiometric surface of the aquifer, backflow of river water into the spring occurs. The spring-run stream in the park is in fair to good condition.

The park will also monitor and mitigate any erosion occurring adjacent to the spring. Possible effects of the dam remnants will be evaluated and consideration given to removal of the rocks if necessary.

Aquatic cave

An extensive aquatic cave system underlies Madison Blue Spring State Park. This system extends well outside the park and even passes under the Withlacoochee River into Hamilton County just south of the State Road 6 Bridge.

The aquatic cave system at the park is considered to be in excellent condition. This assessment is derived from communications with expert cave divers who have conducted research explorations in this

system and collected data for many years. By 2014, certified cave divers had already mapped nearly 5 miles of passageways in the Madison Blue system, making it the sixth-longest in the state at the time (Gulden and Coke 2014). Divers access the system through the springhead and Martz Sink. Current research projects include mapping to determine the extent of the underground passages and identification of troglobitic species in the caves. DRP should continue to promote such research activities and will encourage development of a cave monitoring plan that will allow comparison of Madison Blue data with information gathered at caves in other state parks. Monitoring should include documentation of any degradation of cave surfaces observed, particularly that attributable to increased recreational diving pressure in the cave system.

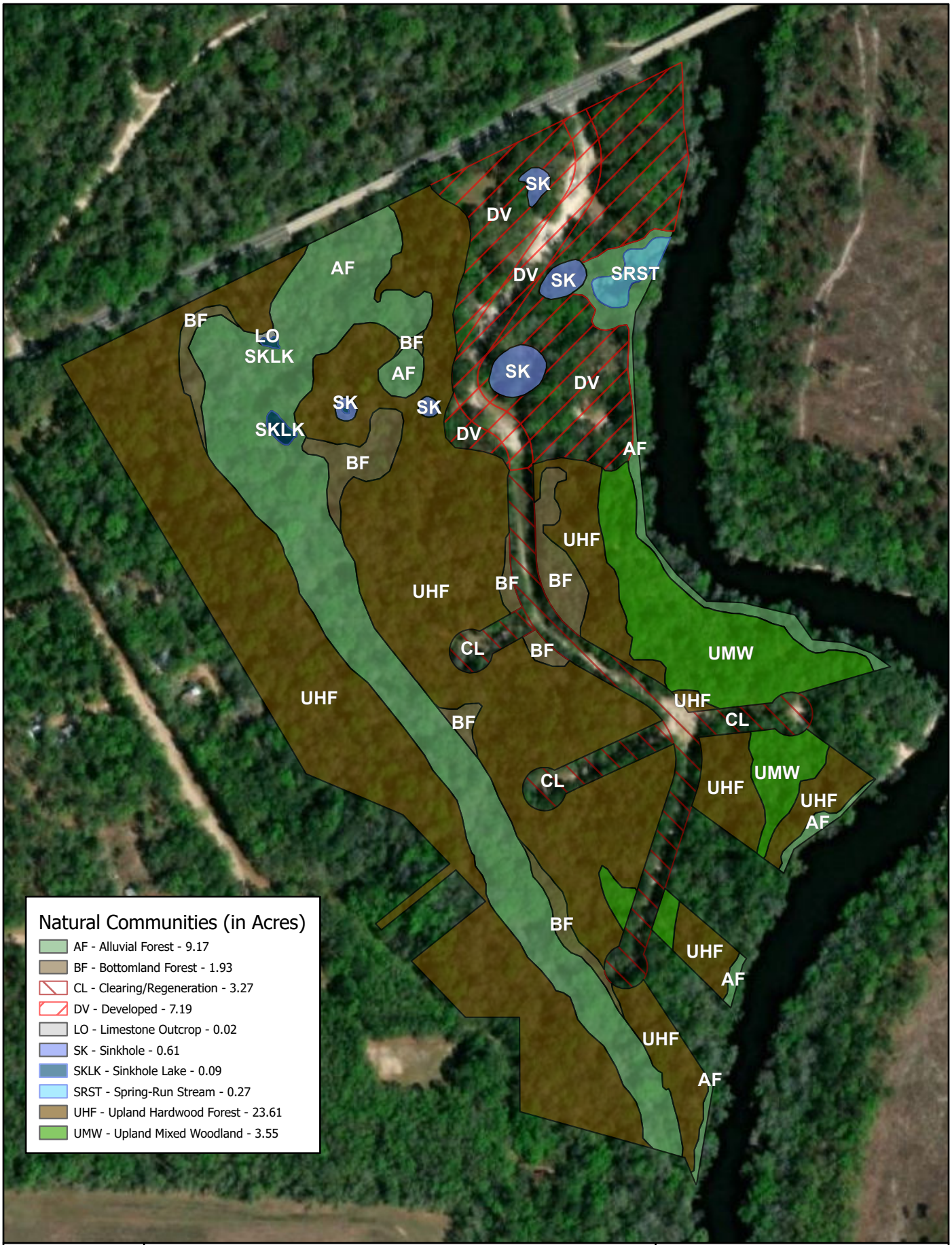
Researchers who have sampled the Madison Blue cave system (Franz et al. 1994) have positively identified three troglobitic invertebrate species there, the pallid cave crayfish (*Procambarus pallidus*), Florida cave amphipod (*Crangonyx grandimanus*) and Hobbs' cave amphipod (*Crangonyx hobbsi*). During recent biological monitoring conducted by Nestle as part of the required Environmental Monitoring Plan, no amphipods have been collected due to their status as imperiled species. Relatively little information is available about the population dynamics or ecology of these organisms. However, population densities apparently can vary greatly over time and space. Contamination of subsurface waters via sinkholes is always a threat to aquatic caves, and small changes in water quality can significantly influence cave resources, especially troglobitic organisms.

The most important consideration in managing aquatic caves at Madison Blue Spring State Park is to protect the quality and quantity of groundwater and surface water entering the system. This will entail protecting the Madison Blue springshed from excessive groundwater withdrawals and from contamination by pollutants. Diver explorations have shown that the cave system extends well beyond the park's boundary, and thus outside the jurisdictional authority of DRP, so protection of aquatic cave resources will continue to be a challenge. Erosion monitoring and mitigation on slopes above the spring and around the sinkhole lakes should also be an integral part of cave management in order to protect the aquatic cave system from excessive siltation. Continuation of the diver check-in system is recommended in order to monitor intensity of cave usage and ensure that only certified cave divers enter the system.

<u>Developed</u>

Developed areas in the park include an entrance station, restroom facilities, maintenance sheds, access roads and recreational facilities such as picnic areas and a swimming area. A complete list of all the developed areas may be found in the *Land Use Component*.

Priority invasive plant species (Florida Invasive Species Council (FISC) Category I and II species) will be removed from all developed areas. In uplands around the swimming area, however, removal of some invasives may need to be done gradually as certain species that are now established there provide effective erosion control on slopes above the spring, and finding and replanting suitable native substitutes may be a lengthy process. Other management measures will include the use of proper stormwater management techniques in developed areas and the designing of future development so that it is compatible with prescribed fire management in adjacent natural areas. To provide better erosion control and increase natural buffering around the Madison Blue springhead, some alterations to walkways and the existing picnic area along the north side of the spring may be desirable. Information about possible changes planned for the park's developed areas can be found in the *Land Use Component*.

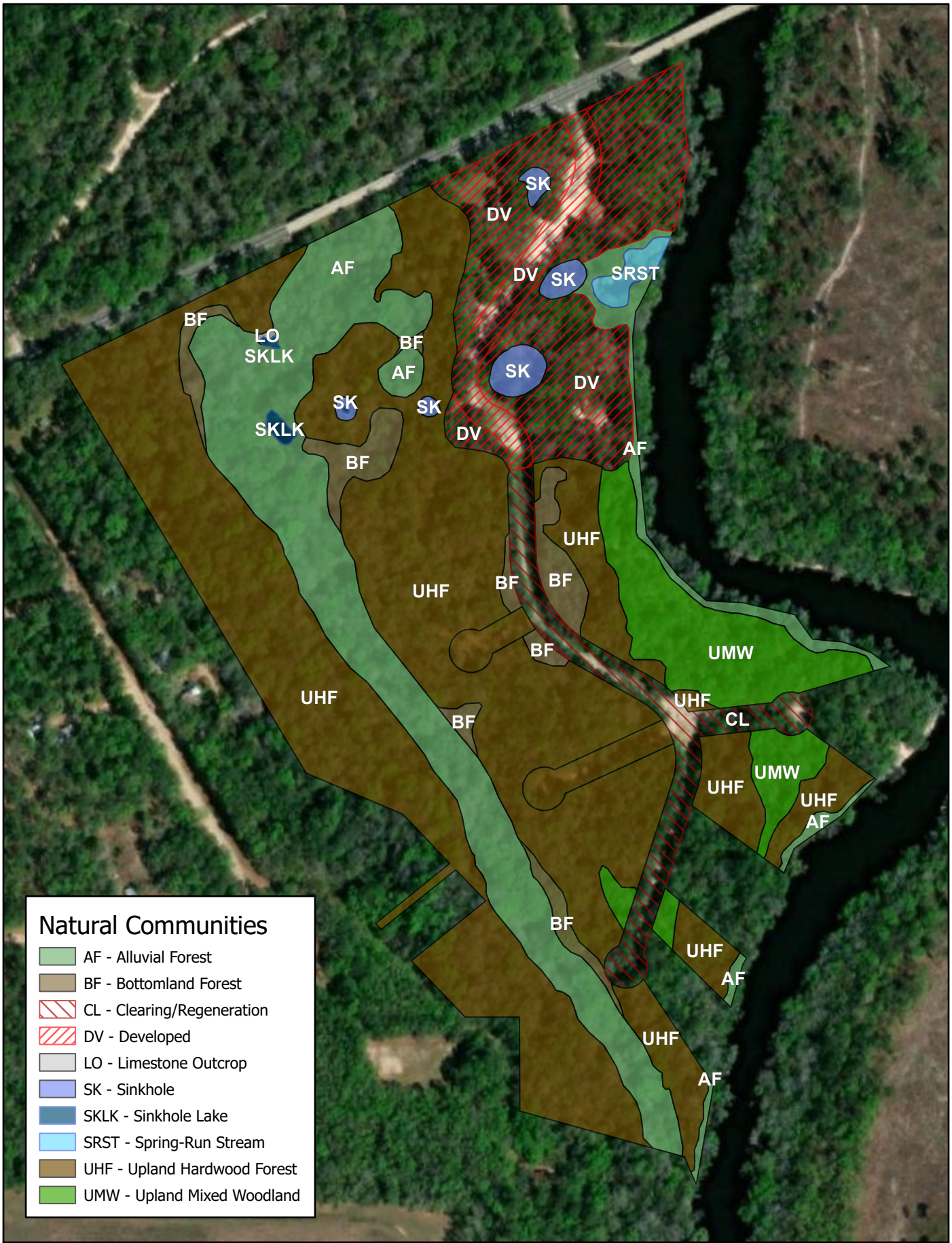


MADISON BLUE SPRING STATE PARK
Natural Communities - Existing Conditions

N

0 200 400 Feet

This graphical representation is provided for informational purposes and should not be considered authoritative for navigational, engineering, legal, and other uses.



MADISON BLUE SPRING STATE PARK
Natural Communities - Desired Future Conditions

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0 200 400 Feet

This graphical representation is provided for informational purposes and should not be considered authoritative for navigational, engineering, legal, and other uses.

Clearing

Clearings in the park consist of narrow linear corridors associated with an unimproved road system that provides legal access to small private outparcels along the Withlacoochee River. The main road in the system extends about two-thirds the length of the park. It also functions as a firebreak. Several short spur roads that end in cul-de-sacs diverge from the main road. Groundcover in the clearings consists mainly of exotic grasses such as bahiagrass (*Paspalum notatum*) and centipedegrass (*Eremochloa ophiuroides*). Two of the spurs head west through upland hardwood forest, and another cuts eastward through upland mixed woodland to a private parcel. Given the need for continued functioning of the main road and the eastward spur, little restoration of the altered landcover there will likely occur other than allowing the roads to become narrower through gradual encroachment by woody species from adjacent natural communities. The two westerly spurs, however, should eventually revert to upland hardwood forest as mowing there is discontinued and canopy species colonize the open space. The transition should be gradual enough to allow the Florida mountainmint (*Pycnanthemum floridanum*) that is currently growing in the spurs to recolonize nearby upland mixed woodland sites as they undergo restoration to a more open state.

Objective A: Within 10 years, maintain 3.56 acres within the optimum fire return interval.

- Action 1 - Develop/update annual burn prescribed fire plan.
- Action 2 - Conduct prescribed fire on between 0.7 and 1.8 acres annually.
- Action 3 - Construct approximately 0.25 miles of new firebreaks.

Prescribed fire is planned for each fire zone on the appropriate interval. The park's prescribed fire plan is updated annually because fire management is a dynamic process. To provide adaptive responses to changing conditions, fire management requires careful planning based on annual and very specific fire objectives. Each annual plan is developed to support and implement the broader objectives and actions outlined in this 10-year management plan.

Madison Blue Spring State Park contains less than 4 acres of fire-dependent habitat and only one fire-type natural community, upland mixed woodland. There is no known fire history for the park property. Long-term fire exclusion has transformed this community from a relatively open woodland with a diverse groundcover to a comparatively dense forest with a sparse, shaded-out groundcover. Other than the gopher tortoise, no fire-dependent wildlife species have yet been observed in the park. However, at least one imperiled plant species, Florida mountainmint, should benefit from the initiation of a prescribed fire program.

Currently, the use of prescribed fire to manage upland mixed woodlands in the park is significantly hampered by the lack of established firebreaks, which in turn cannot be constructed until the exact boundaries of the outparcels embedded in the park are resurveyed and delineated in the field. Unfortunately, most of the roads that pass through the park to access outparcels are not oriented such that they could also serve as firebreaks.

The effectiveness of initial fires at overgrown sites will be significantly increased if invasive off-site hardwoods are first thinned to some degree through selective girdling or herbiciding. Hardwood removal should enhance the movement of air currents through the zone, increasing the likelihood that fires will burn all the way through, and should also facilitate the release of dormant seed banks. Fires in the upland mixed woodlands should be allowed to creep into adjacent upland hardwood forest and gradually die out, thereby maintaining natural ecotones between communities.

The table below contains a list of all fire-dependent natural communities found within the park, their associated acreage and optimal fire return interval, and the annual average target for acres to be treated with prescribed fire.

Prescribed Fire Management		
Natural Community	**Acres**	**Optimal Fire Return Interval (Years)**
Upland Mixed Woodland	3.56	2-5
Annual Target Acreage	1-2	

Objective B: Conduct natural community restoration activities on 3.56 acres of upland mixed woodland.

- Action 1 - Develop/update site specific restoration plan.
- Action 2 - Implement restoration plan.
- Action 3 - Conduct offsite hardwood removal on 3.56 acres of upland mixed woodland.

Before restoration can actually begin in much of the community, survey lines delineating the boundaries between outparcels and park property will need to be reestablished. Off-site hardwoods in remnant patches of upland mixed woodland in the park will need to be treated mechanically, chemically or both. Restoration efforts should first target sites that are in marginally better condition than others in that they have a lower density of invasive hardwoods. Prescribed fire will be an important tool for encouraging the re-establishment of suppressed remnant groundcover species on the sites and discouraging the re-emergence of off-site species.

A post-burn survey for remnant species in the restoration sites will indicate if there is a need to restock longleaf pines and appropriate hardwood species such as southern red oak. Groundcover species will likely need to be planted as well. The park will postpone the planting of longleaf pines and groundcover species until the canopy is sufficiently open to allow seedlings to survive. Maintenance activities for the restoration sites will consist of follow-up treatments of off-site hardwood sprouts and the regular application of prescribed fire. DRP will need to conduct additional field surveys to verify the historic extent of this community in the park.

Park staff should cease mowing the two western road spurs to encourage re-establishment of upland hardwood forest species in the open corridors. The restoration process should be very gradual in order to allow imperiled Florida mountainmint plants that are currently scattered along road edges to successfully colonize nearby upland mixed woodland sites.

IMPERILED SPECIES

Imperiled plants at Madison Blue Spring State Park include Florida mountainmint (*Pycnanthemum floridanum*) and angle pod (*Gonolobus suberosus)*). Florida mountainmint appears to prosper in areas of disturbed uplands along edges of service roads and trails, while angle pod is sporadically distributed within bottomland forest in the floodway in the western third of the park. Additional surveys for

imperiled plant species are needed at Madison Blue Springs State Park, particularly in limestone outcrop areas.

Imperiled animals recorded to date at the park include troglobitic species such as the pallid cave crayfish, Florida cave amphipod and Hobbs' cave amphipod, stream dwellers such as the Gulf sturgeon (*Acipenser oxyrinchus desotoi*), Suwannee moccasinshell (*Medionidus walkeri*), Suwannee cooter (*Pseudemys concinna suwanniensis*) and American alligator (*Alligator mississippiensis*), and the gopher tortoise (*Gopherus polyphemus*).

The troglobitic species are adapted to relatively stable aquatic cave environments. When insurgence events occur, there may be die-offs of troglobitic fauna due to rapid and potentially large-scale changes within the system (Streever 1991).

Previously documented flow reversals at Wes Skiles Peacock Springs State Park have indicated that there is a clear pattern of die-off and recovery episodes radically affecting populations of cave invertebrates (Streever 1991, 1992a, and 1992b). Currently, it is unknown if invertebrate populations in aquatic caves at Madison Blue Spring State Park experience similar episodes. Given the lack of information, DRP should monitor flow reversals at the springhead and coordinate with cave divers to watch for corresponding die-offs of troglobites.

The gopher tortoise and Suwannee cooter were historically harvested in the region for meat. Both are currently protected from harvest and possession is prohibited without a permit from the Florida Fish and Wildlife Conservation Commission (FWC). Recent regulation changes have also prohibited the sale of all freshwater turtles taken from the wild. The harvest of all wildlife, with the exception of fish, is prohibited along the part of the Withlacoochee River that passes by the boundary of Madison Blue Spring State Park.

Although suitable habitat for the gopher tortoise exists in the park, most of it lies within the 10-year floodplain and is frequently inundated. Nevertheless, tortoises have been sighted in the park. The restricted size of available habitat makes it likely that such individuals wander outside the park on a regular basis. Tortoises are vulnerable to vehicular traffic, not only on State Road 6 but also on interior park roads that provide access to public use areas in the park or to private outparcels.

The Withlacoochee River, from its confluence with the Suwannee River upstream to the State Road 6 Bridge, has been designated by the USFWS as critical habitat for Gulf sturgeon. The critical habitat stretches bank-to-bank between ordinary high-water lines but excludes developed sites such as bridges and designated swimming areas (Federal Register 2003). The river adjacent to Madison Blue Spring, however, is included. Gulf sturgeon spend their summer months in freshwater systems such as the Suwannee and Withlacoochee rivers where they spawn, preferably in areas with hard rocky bottoms and steep banks such as that available in the lower Withlacoochee River at Madison Blue Spring State Park. In fact, FWC biologists have documented juvenile and adult sturgeon in the area just below the State Road 6 Bridge (Tucker 2005). Maintenance of good water quality and natural flow regimes at spawning sites will be a critical contributor to the long-term success of the Gulf sturgeon recovery efforts.

The table below contains a list of all known imperiled species within the park and identifies their status as defined by various entities. It also identifies the types of management actions that are currently being taken by DRP staff or others and identifies the current level of monitoring effort. The codes used under

the column headings for management actions and monitoring level are defined following the table. Explanations for federal and state status as well as FNAI global and state rank are provided in the appendix.

Imperiled Species Inventory						
Common and Scientific Name	**Imperiled Species Status**				**Management Actions**	**Monitoring Level**
	FWC	**USFWS**	**FDACS**	**FNAI**		
PLANTS						
Angle Pod *Gonolobus suberosus*			LT		10	Tier 1
Florida Mountainmint *Pycnanthemum floridanum*			LT	G3,S3	1, 6, 9	Tier 1
INVERTEBRATES						
Florida Cave Amphipod *Crangonyx grandimanus*		UR		G2G3,S2S3	4, 10, 13	Tier 2
Hobbs' Cave Amphipod *Crangonyx hobbsi*		UR		G2G3,S2S3	4, 10, 13	Tier 2
Suwannee Moccasinshell *Medionidus walkeri*	FT	T		G1,S1	4, 10	Tier 1
Pallid Cave Crayfish *Procambarus pallidus*		UR		G1G2,S1S2	4, 10, 13	Tier 2
FISH						
Gulf Sturgeon *Acipenser oxyrinchus desotoi*	FT	T		G3T2T3, S2?	4, 9, 13	Tier 1
REPTILES						
American Alligator *Alligator mississippiensis*	FT (S/A)	T(S/A)		G5,S4	4, 10	Tier 1
Gopher Tortoise *Gopherus polyphemus*	ST			G3,S3	1, 6, 7, 10, 12	Tier 1

Management Actions:

1. Prescribed Fire
2. Exotic Plant Removal
3. Population Translocation/Augmentation/Restocking
4. Hydrological Maintenance/Restoration
5. Nest Boxes/Artificial Cavities
6. Hardwood Removal
7. Mechanical Treatment
8. Predator Control

9. Erosion Control
10. Protection from visitor impacts (establish buffers)/law enforcement
11. Decoys (shorebirds)
12. Vegetation planting
13. Outreach and Education
14. Other

Monitoring Level:
Tier 1.
Non-Targeted Observation/Documentation: includes documentation of species presence through casual/passive observation during routine park activities (i.e. not conducting species-specific searches). Documentation may be in the form of Wildlife Observation Forms, or other district specific methods used to communicate observations.
Tier 2.
Targeted Presence/Absence: includes monitoring methods/activities that are specifically intended to document presence/absence of a particular species or suite of species.
Tier 3.
Population Estimate/Index: an approximation of the true population size or population index based on a widely accepted method of sampling.
Tier 4.
Population Census: A complete count of an entire population with demographic analysis, including mortality, reproduction, emigration, and immigration.
Tier 5.
Other: may include habitat assessments for a particular species or suite of species or any other specific methods used as indicators to gather information about a particular species.

Objective A: Update baseline imperiled species occurrence list.

- Action 1 - Conduct additional surveys for imperiled animal and plant species.
- Action 2 - Enlist the assistance of academic researchers and staff from other agencies.

Objective B: Continue existing monitoring protocols for four imperiled animal species.

- Action 1 - Develop monitoring protocols for three selected imperiled troglobitic animal species, the pallid cave crayfish, Florida cave amphipod and Hobbs' cave amphipod.
- Action 2 - Implement monitoring protocols for the three imperiled animal species listed in Action 1 above, and for the gopher tortoise.
- Action 3 - Conduct an informal survey for tortoise burrows in suitable habitat in the park and GPS in burrow locations if any are found.

The aquatic cave system at Madison Blue Spring State Park provides essential habitat for several imperiled cave-dwelling invertebrates, including the pallid cave crayfish. The troglobitic fauna associated with aquatic cave systems is dependent upon a stable environment that experiences few fluctuations in water temperature or quality. According to some observers, the drastic decreases in troglobite populations that have been recorded periodically in other parks are attributable to the sudden flooding of cave systems by river waters. Very little research has actually been conducted to confirm this hypothesis, however.

Analysis of data from future faunal inventories in the Madison Blue cave system may help identify fluctuation trends in cave arthropod populations. DRP staff will continue to coordinate with certified cave divers and researchers in the routine Tier 2 monitoring of imperiled troglobitic species.

The gopher tortoises that have been previously observed in the park may not be permanent residents.

Objective C: Monitor and document two selected imperiled plant species in the park.

- Action 1 - Develop and implement monitoring protocols for two selected imperiled species, Florida mountainmint and angle pod.

DRP staff will conduct additional surveys for Florida mountainmint and angle pod. Timing of the surveys will consider flowering phenology of the two species to ensure proper identification.

INVASIVE SPECIES

Most of the undeveloped areas at Madison Blue Spring State Park are apparently free of invasive plants, but one particularly aggressive species has become well established: the Japanese climbing fern (*Lygodium japonicum*), which the Florida Invasive Species Council (FISC) rates as a Category I invasive (FISC 2013). At present, it is concentrated around the spring, along the riverbank at the south end of the property, within the hardwood forest east of the floodway, along State Road 6, and in the extreme northwest corner of zone 2 along the park's west boundary. However, considering that the park contains a relatively large disturbed area and is almost entirely within the 10-year floodplain, the climbing fern has the potential to spread elsewhere rapidly. Another FISC-listed species, mimosa (*Albizia julibrissin*), while not really pervasive in the park, is remarkably persistent. A small population of Japanese honeysuckle (*Lonicera japonica*), also a Category I species, is present in zone 2 in upland hardwood forest at the base of the steep slope along the park's west boundary. Perhaps it was relocated there during disposal of debris from the clearing of adjacent private lots.

Another invasive species that is well established at Madison Blue is hedge bamboo (*Bambusa multiplex*), which has formed dense colonies in several sinkholes in the public use area of the park and has proven difficult to control. Switchcane (*Arundinaria gigantea*), a tall native grass that resembles bamboo, may well be intermixed with the hedge bamboo. Park staff needs to avoid spreading the exotic bamboo and begin reducing its footprint. To do so, staff must be able to distinguish switchcane from invasive bamboos so that only the invasives are treated and the native switchcane is not affected. All invasive bamboo infestations should be mapped.

Three other invasives, the ornamental plants Confederate jasmine (*Trachelospermum jasminoides*), climbing fig (*Ficus pumila*) and lilyturf (*Liriope* sp.), have been used in the past to control erosion on slopes around the spring bowl and swimming area. Of the three, Confederate jasmine is the most widespread. All three plants should be considered invasive. Confederate jasmine in particular can be an aggressive runner and climber of trees and may be very tenacious. Staff should avoid mowing the jasmine and the climbing fig, as both can be dispersed via cuttings. Lilyturf produces berries that are spread by animals, and it has shown a tendency to become invasive in several state parks in north Florida. Staff should ensure that no expansion of the footprint of any of these three species occurs. In fact, all three need to be totally removed from the park, but gradually so that their erosion control function can continue while DRP searches for suitable native groundcover replacements.

The invasive tree podocarpus (*Podocarpus macrophyllus*) also occurs in the park. While FISC does not list it as a Category I or II invasive, it nevertheless produces fertile fruits and self-seeds, and it has the potential to spread. Therefore, its removal from the park is desirable.

In the period from 2009-14, DRP staff treated 85.22 gross acres of invasive plants in the park, which represents a total of about 2.88 infested acres. DRP staff regularly surveys all areas of the park for occurrences of invasive plant species, particularly those that are the most invasive.

Invasive (non-indigenous) animals and nuisance animals are removed from the park as necessary to protect native wildlife populations and preserve the integrity of natural communities. The nine-banded armadillo (*Dasypus novemcinctus*) is among the species occasionally removed. Armadillos may cause extensive ground disturbance and are a threat to ground nesting birds, small reptiles and amphibians. Feral cats and dogs are removed from the park on an as-needed basis.

Invasive Plants Inventory			
Species Name *Scientific Name* - Common Name	FLEPPC Category	Distribution	Zone ID
Broussonetia papyrifera - Paper mulberry	II	Single Plant or Clump	MBS-2
Broussonetia papyrifera - Paper mulberry	II	Scattered Plants or Clumps	MBS-2
Lygodium japonicum - Japanese climbing fern	I	Scattered Plants or Clumps	MBS-1A, MBS-2
Sapium sebiferum - Chinese tallow tree	I	Scattered Dense Patches	MBS-2

Objective A: Annually treat 0.5 acres of invasive plant species.

- Action 1 - Annually develop/update an invasive plant management work plan.
- Action 2 - Implement annual work plan by treating at least 0.5 acres in the park annually and by continuing maintenance and follow-up treatments as needed.
- Action 3 - Gradually replace invasive groundcover species on slopes around the spring with suitable native species.

The park will treat all known populations of Japanese climbing fern at least annually. Climbing fern spores often become waterborne and most of the park lies within the 10-year floodplain, so this pest can easily translocate to other sites in the park during periods of high water. As river levels drop, the ferns tend to colonize newly exposed soil and limestone. It is therefore imperative for the park to keep all known populations of climbing fern under strict control, which will require annual inspection and thorough treatment as needed, possibly several times a year.

All mimosa in the park should be treated every three years to break the reproductive cycle. With diligent follow-up, staff may eventually be able to eliminate this species from the park. All the lilyturf and podocarpus should gradually be removed from park landscaping and replaced with appropriate native plants. Lilyturf can be treated by uprooting plants if care is taken to include the entire root structure. Larger specimens of podocarpus will require mechanical and possibly herbicide treatment. Staff will need to completely eradicate Confederate jasmine and climbing fig from the park and immediately replace them with native species so that the stabilization of slopes above the spring continues uninterrupted. This process may have to occur in stages to allow patches of native groundcover to become firmly established before additional jasmine or climbing fig is uprooted.

It will be important for staff to know what invasive species occur in the park, where they are located and how severe the infestations are. It will be equally important to know which areas are free of invasives so

that staff can continue to keep them that way. This is particularly true for high quality or ecologically important habitats.

To prevent new populations of invasive plants from becoming established and expanding, park staff will need to survey every zone for the occurrence of new invasives at least twice within the next 10 years and map any infestations discovered. By regularly surveying invasives-free zones, staff can discover new infestations at an early stage and eliminate them before they have a chance to significantly increase in size. Areas that serve as sources of particularly aggressive species, or of species that can dramatically change ecosystem function, may need to be scouted more frequently. The focus should be on FISC Category I and II species, while at the same time watching for new species that exhibit aggressive tendencies.

The further spread of invasives already established in the park may be avoided by making sure that staff and contractors do not move equipment, landscaping debris or soil from a contaminated area to an invasives-free area. Particular care will be needed when mowing. As an added precaution, staff should thoroughly clean equipment before moving it from one location to another.

Objective B: Implement control measures on one nuisance species.

- Action 1 - Remove nine-banded armadillos from the park when they pose a threat to ground nesting birds or small reptiles and amphibians.

Park staff will occasionally remove armadillos that are judged to be negatively affecting small herpetofauna and ground nesting birds. Feral cats and dogs will also be removed as they are encountered.

CULTURAL RESOURCES

Prehistoric and Historic Archaeological Sites

According to Florida Master Site File (FMSF) records from 1981 and 2007, the only recorded site actually within Madison Blue Spring State Park is MD33, an archaeological site containing a low-density artifact scatter consisting of lithic debitage and finished tools. The scatter is now inundated by the spring run and Withlacoochee River but likely was dry during the Pleistocene. The main quarry area seems to have been at the mouth of the spring run and extended out into the river. Based on evidence from the land portion of the site, some archaeologists surmise that MD33 may also contain a habitation site. Erosion within the spring and spring run and on the slopes above them are potential threats to the integrity of MD33. Another possible concern may be the occasional, casual removal of artifacts from the site.

Sites recorded with the FMSF that are near but not actually within Madison Blue Spring State Park include MD207, MD208 and MD209 just west of the park and HA407 and HA408 across the Withlacoochee River in Hamilton County. It is likely that both MD208, a late 19th-century cemetery, and MD209, an early 20th -century church, are confined within site limits as described in the FMSF. MD207 is a prehistoric site containing sparse lithic artifact scatter. There is a slight possibility that the site could extend onto park property. There is also a chance that fringes of the Hamilton County sites could extend across the Withlacoochee River into the park. Consequently, an additional archaeological survey in the park beyond the limits of MD33 is warranted. The full extent of this site is not known and the drawn boundaries of the site may be expanded, pending results of a terrestrial archaeological survey.

A predictive model for Madison Blue Spring State Park was completed in 2010 (Collins et al. 2012). The model delineated about 5% of the park in two disjoint areas as highly sensitive for archaeological resources. One of these areas surrounds the springhead (MD33), while the other is located in the southwest corner of the park near the historic cemetery. According to the predictive model, much of the remaining property along the west boundary of the park, as well as a broad swath along the west bank of the Withlacoochee River, is of medium sensitivity for archaeological resources. The floodway in the western third of the park was found to be of low sensitivity.

Although MD33 has been partially altered by spring and river currents and by artifact collecting, Jim Dunbar, the underwater archaeologist who submitted the first record to the FMSF in 1981, considered the site to be in good condition. Use of the site as a swimming area has exacerbated the erosion issues over time. That factor, plus chronic erosion on trails leading down to the spring, may necessitate a reassessment of the site's condition in the future.

Site MD33 requires additional preservation and stabilization measures. The park should develop and adopt a formal monitoring plan that includes regularly scheduled site visits and a protocol for recording concerns and needed actions at the time of each visit. Site MD33 should be checked regularly to enable early detection of adverse impacts from erosion, vegetation intrusion, and looting so that resources do not suffer significant additional damage. Plantings of exotic groundcover species used to control erosion on steep slopes above the spring and river should gradually be replaced with equivalently effective native species.

Additionally, DRP should seek funding for supplemental archaeological research at MD33. The site warrants much more thorough investigation to clarify details about the Pleistocene aboriginal presence, determine the actual extent of the site and verify the age of the various components. Additional cultural resource survey along the western edge of the park and along the west bank of the Withlacoochee River would be helpful in determining whether any of the adjacent archaeological sites extend into the park.

Collections

A Scope of Collections Statement for the park has already been written. The park staff should develop a Statement of Interpretation to complement the Scope of Collections Statement. These two documents will serve to guide the park's interpretive and collections management programs. Items should only be accepted for any future park collection if they fit within the goals of the Scope of Collection and the park's interpretive themes.

Cultural Sites Listed in the Florida Master Site File					
Site Name and FMSF #	**Culture/Period**	**Description**	**Significance**	**Condition**	**Treatment**
MD33 Madison Blue Springs	Archaic/Unspecified, possible Paleoindian	Archaeological Site	NE	G	P

Objective A: Assess/evaluate one of one recorded cultural resources in the park.

- Action 1 - Complete one assessment/evaluation of archaeological sites.

The fact that MD33 is located within the springhead swimming area, which visitors reach via steep pathways that descend from uplands above the spring, makes the site vulnerable to erosion and chronic deterioration from pedestrian traffic. Those factors and occasional looting may make an archaeological reassessment of the site's condition necessary in the future. In the meantime, DRP staff need to check MD33 regularly to enable early detection of possible adverse impacts from erosion, vegetation intrusion and looting before resources experience significant damage. Site assessors should consider all possible measures for mitigating erosion at the site, including possible relocation of some access routes if necessary.

The species composition and effectiveness of groundcover plantings used to control erosion on slopes above the spring should be evaluated often. Trees on slopes above the spring whose roots have become exposed need to be frequently monitored for stability. Protective measures will be implemented as necessary. Periodic monitoring of MD33 that utilizes photographs for comparison purposes would be best for the site. There are no historic structures in the park.

Objective B: Compile reliable documentation for all recorded historic and archaeological resources.

- Action 1 - Ensure all known sites are recorded or updated in the Florida Master Site File.
- Action 2 - Conduct a Level 1 archaeological survey of one priority area identified by the predictive model.
- Action 3 - Seek the assistance of BAR archaeologists in conducting an archaeological survey of the park.
- Action 4 - Delineate the boundaries of MD33 more accurately and determine the age of the site's components.

A predictive model for the park was completed in 2010. This model will be consulted whenever ground disturbing activities or archaeological studies are planned for the park. Madison Blue Spring State Park has never had a thorough archaeological survey. It warrants at least a Level 1 survey of MD33 to supplement the limited information available about the Pleistocene aboriginal presence there. A Level 1 survey might also help determine the age and maximum extent of MD33. An archaeological survey of

the park that covers more than just the high probability areas indicated by the predictive model would also be warranted. Such a survey might be helpful in determining if any of the adjacent archaeological sites extend into the park.

Objective C: Bring one of one recorded cultural resources into good condition.

- Action 1 - Design and implement regular monitoring programs for one cultural site.
- Action 2 - Create and implement a cyclical maintenance program for each cultural resource.

Although MD33 was considered by underwater archaeologists in 1981 to be in good condition, a professional re-evaluation of the site would be desirable and might arrive at a different conclusion. Park personnel currently visit site MD33 at the springhead on a regular basis. Establishment of a more formal monitoring process, however, would generate baseline information that could be used as a standard of comparison in future assessments. To that end, park staff will develop a simple, repeatable protocol for tracking changes at the archaeological site, including a procedure for recording concerns and needed actions. Baseline photographs to be used for comparison purposes should be part of the protocol. Photographs would only need to be retaken if it became apparent that site conditions had changed.

Site MD33 needs additional protective measures. Accordingly, DRP will develop and implement a cyclical maintenance program designed to protect resources at the site. DRP will also improve erosion control measures at MD33 along the pathways that provide access to the swimming area.

LAND USE COMPONENT

VISITATION

Home to a first-magnitude spring and crystal-clear water, Madison Blue Spring State Park is a popular location for year-round swimming and cave diving due to the year-round water temperature of 72 degrees and karst features. The springhead provides scenic views of a rich forest of mixed hardwoods and pines bordered by the Withlacoochee River. Visitors travel to this park for remarkable swimming and cave diving opportunities.

Trends

The steady water temperature of the spring encourages year-round visitation. However, the summer season attracts the largest crowds, particularly on hot, dry days.

EXISTING FACILITIES AND INFRASTRUCTURE

One main public use area and one support area make up the developed zones of Madison Blue Spring State Park. A portable ranger station and visitor parking are located on the north side of the park at the State Road 6 entrance. A half-mile long stabilized park road essentially bisects the park into east and west portions. The park's day-use activities are focused in the east portion within the springhead swimming area and an adjacent picnic area. Access to the spring is facilitated by a series of staircases, a swimming platform and a pathway around the basin. Two large pavilions and one small pavilion are in the picnic area. A short trail extending south from the picnic area offers nature walking opportunities with scenic vantage points over the Withlacoochee River. The trail terminates at a moderately sloped sandy embankment of the river, which is a popular access point for swimming. The west portion of the park contains a low-lying floodway of alluvial forest and is generally less developed. Existing facilities within the west portion of the park include the bathhouse and one storage unit for support. A short trail from the park drive leads to Martz Sink. A staircase descends the sinkhole to provide access for certified cave divers.

Facilities Inventory

Park Entrance	
Portable Ranger Station	1
Honor Box	1
Springhead Swimming Area	
Swimming Platform	1
Dive Staging Benches	1
Parking Area	1
Bathhouse	1
Picnic Area	
Picnic Pavilion	3
Martz Sink Cave Diving Area	
Dive Staging Bench	1
Access stairs	1
Support Area	
Maintenance shed	1
Pumphouse/Well	1

CONCEPTUAL LAND USE PLAN

Detailed Conceptual Land Use Plan Objectives

Five use areas at Madison Blue Spring State Park are listed below for improvements to be implemented within the 10-year planning cycle. Specific plan details are available in the next section.

Park Entrance
Objective: Establish revegetation within park.
Actions:

- *Relocate park entrance.*
- *Remove and relocate support area and restroom.*
- *Once relocated, revegetate the original park entrance footprint.*

Relocation of the existing park entrance is recommended. The existing entrance extends from a bridged segment of State Road 6. Entry and exit to and from the steep park road pose a recurring traffic hazard. Additionally, during peak visitation, vehicles frequently back up from the ranger station, causing traffic congestion on the highway. An additional study will be conducted to determine the appropriate location for the new entrance. The new park entrance will include a park sign, gate and ranger station. The new ranger station should be located on high ground and constructed as a permanent structure. Design of the new entrance will consider provision of 78 space for vehicles to stack within the park to reduce traffic congestion on adjoining roads. When the new entrance is developed, the existing entrance and parking will be closed, and the site included within the adjacent restoration area. Parking may be provided south of the existing parking area along the side of the park road within the wide clearing of the park road corridor. Stabilization or surfacing of the park road and parking area should be sensitive to the karst geology and flood-prone topography of the park. Options for the location and route of the new park entrance will be evaluated during the next 10-year planning period.

One of the issues of the park entrances is its interface with the support area and restroom. For this planning period, the restroom and support are to be relocated. The restroom will be relocated to the picnic area and the support area will be relocated to an already disturbed area at the southern end of the park. Once relocated, the former sites will be restored with natural vegetation. This will also aid in developing a buffer between the park and the adjacent highway.

Springhead Swimming Area
Objective: Improve walkways.
Actions:

- *Stabilize pathways around springhead.*

Improvements are needed to the walkways and access paths around the springhead. The lower section of the access path to the spring run has become stripped of shoreline vegetation, resulting in sedimentation. The exposed tree roots and cypress knees pose a safety hazard for visitors. This existing path should be stabilized to improve access, reduce erosion and allow for protection and restoration of the shoreline.

Picnic Area

Objective: Update infrastructure.

Actions:

- *Replace pavilions as needed.*
- *Develop new nature trail along with interpretation.*
- *Construct one off-grade restroom.*

The park's picnic area contains three large picnic pavilions just off the parking lot. Improvements include replacing the current pavilions on an as-needed basis within their existing footprint and installing an off-grade restroom.

River Access Area

Objective: Build additional park facilities

Actions:

- *Construct paddling launch.*

The park is a popular launch and landing site for paddlers. Paddlers currently use the narrow path around the springhead for access. However, the site is not suited for this purpose and generates recreational user conflicts. A designated canoe and kayak launch/landing should be constructed on the riverbank south of the spring and picnic area near the terminus of the nature trails. Vehicle access to the proposed paddling launch should be facilitated by a stabilized road extending from the new park entrance. Development of this river access area will promote use of the park as a paddling destination within the Withlacoochee and Suwannee River basin.

Nature Trail

Objective: Develop nature trail.

Actions:

A nature trail with multiple spur paths extends south from the picnic area. These trails should be improved with wayfinding. Interpretive elements may be considered. . A single designated trail should be clearly marked, and use of spur paths should be discontinued. The trail should provide access to the sandy river shoreline of the Withlacoochee River**.**

Support Area

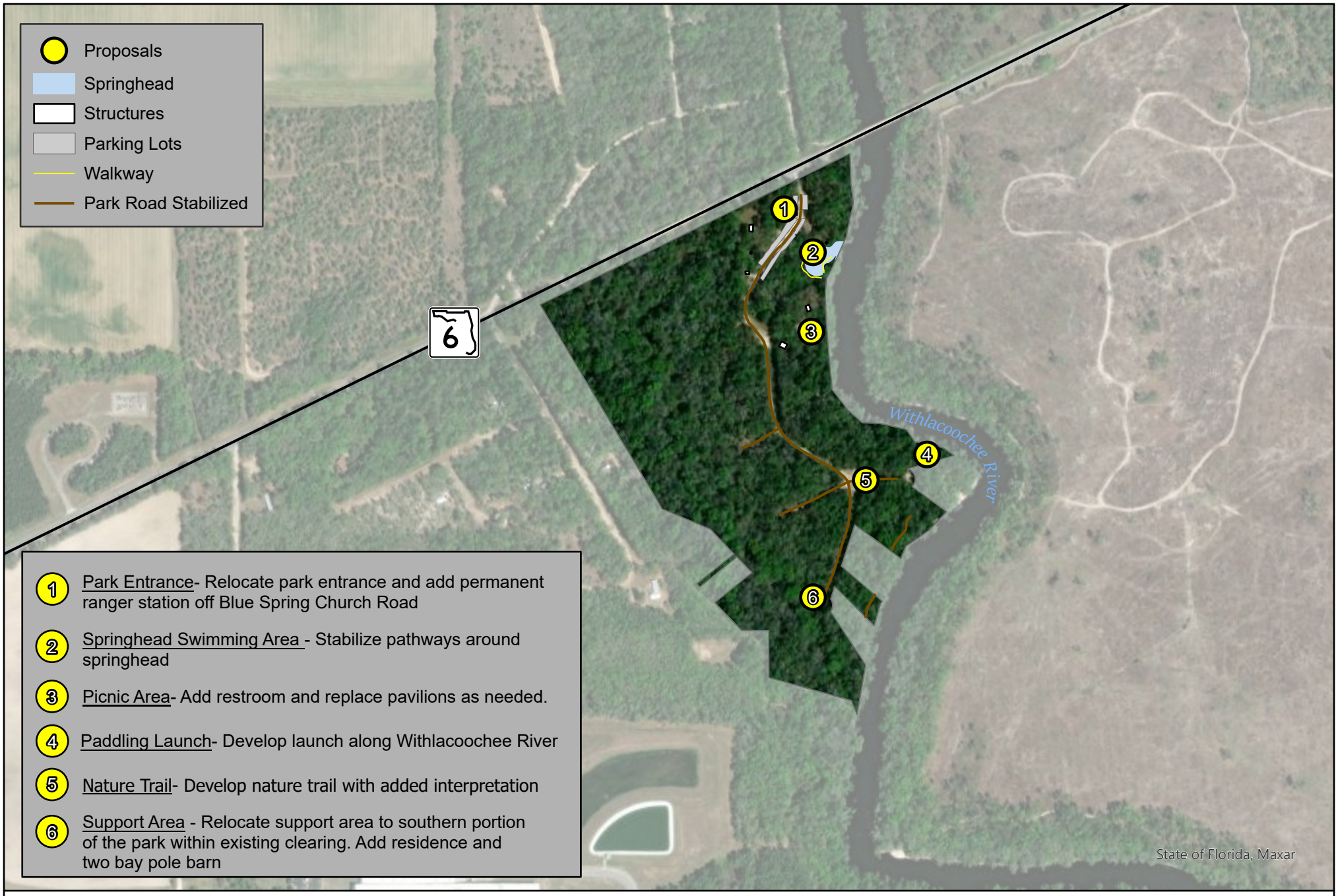
Objective: Relocate support structures

Actions:

- *Relocate support area.*
- *Add ranger residence and two-bay pole barn.*

Relocation of the support area is a priority for the park. Currently, the support area is located near the park entrance with several structures needed for park operations. All support structures should be relocated to an existing clearing within the southern portion of the park. Additional needed structures to the support area include a ranger residence and a two-bay pole barn.

Once relocated, the former footprint will be revegetated with native plants to create a buffer from the parking lot to the adjacent highway. Structures at the new location should include a site-built ranger residence and two-bay pole barn.



Madison Blue Spring State Park

Conceptual Land Use Plan

0 500 1,000 Feet

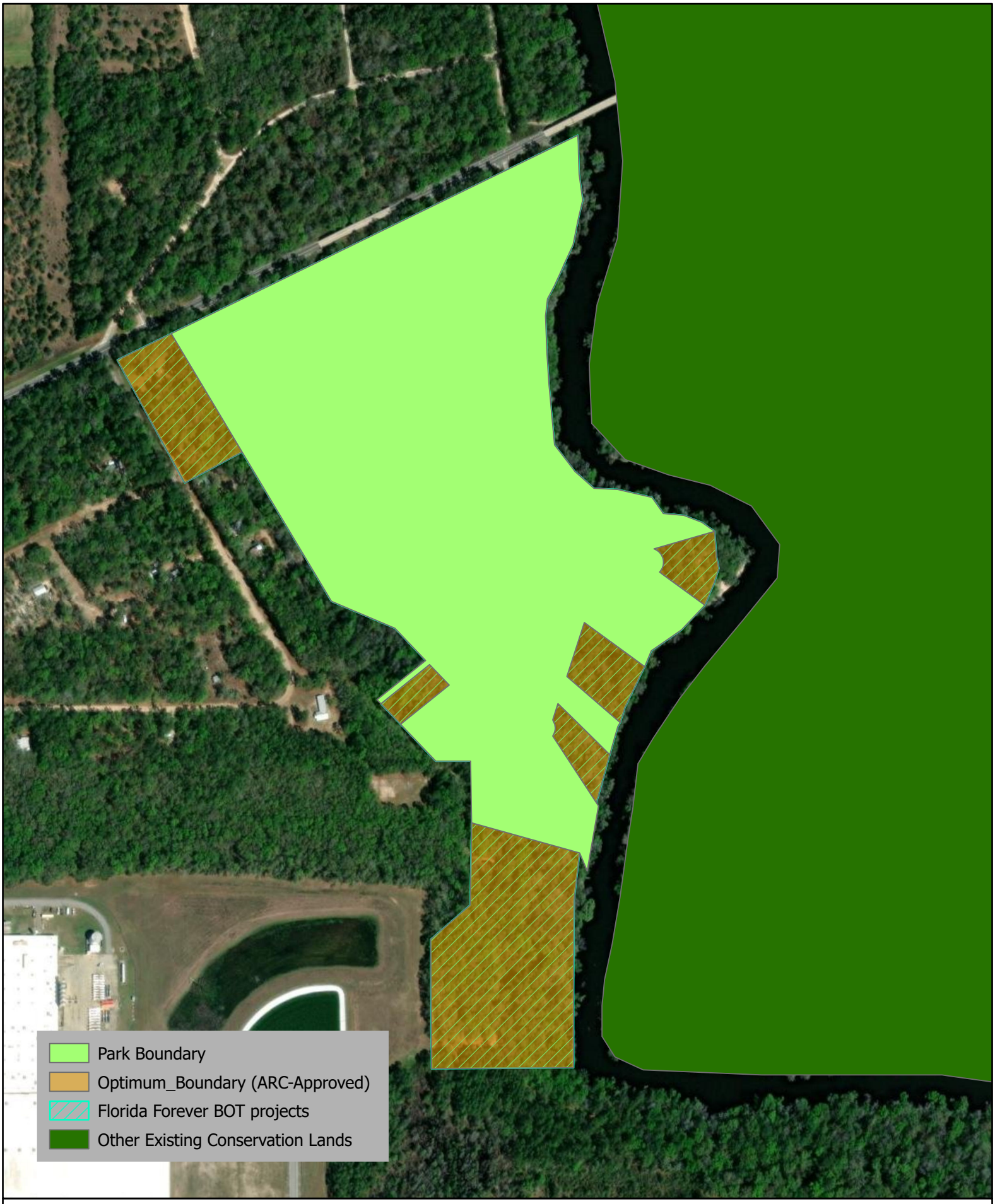
N

OPTIMUM BOUNDARY

Three undeveloped private parcels are located at the southeast boundary of the park along the Withlacoochee River. Acquisition of these parcels would alleviate operational and resource protection challenges for the park, especially concerning hydrological and natural communities restoration. Management of these parcels would also provide opportunities for expanded recreational access by lengthening the distance of the park's existing nature trail and providing access to the sandy shoreline of the Withlacoochee River. Potential management of these parcels would facilitate the addition of the access road to the park lease.

Acquisition of undeveloped parcels along Blue Spring Church Road could provide alternative options for the location of a new park entrance or support area.

Currently, no lands are considered surplus to the needs of the park.



Madison Blue Spring State Park

Optimum Boundary

0 250 500 Feet

N