

## Executive Summary

A local citizens advocacy group, Withlacoochee Aquatic Restoration (W.A.R., Inc.) contracted with Wetland Solutions, Inc. (WSI) to conduct a three-phase environmental assessment and restoration planning effort in response to perceived ecosystem changes and environmental degradation in the Lower Withlacoochee River. The study area included the Withlacoochee River from just upstream of Dunnellon and the Rainbow River confluence, downstream through Lake Rousseau and the historic river channel to the Gulf of Mexico, and proceeded in three phases:

- Phase 1 was a review of existing environmental conditions and data relevant to the health of the Lower Withlacoochee River. Key among the preliminary conclusions was that the Lower Withlacoochee River has been significantly altered by human activities over the past 100+ years. Major impacts include historic timber extraction, dredging, ditching, current and historic phosphate and limerock mining, construction of dams and spillways, construction of the Cross-Florida Barge Canal, regional groundwater extractions, aquatic weed management in Lake Rousseau, and agricultural and urban development in the surface and groundwater basin that supplies water to the river.
- Phase 2 was conducted to update environmental information through current conditions and to fill existing data gaps, including collection of environmental data over a four-year period from November 2015 through October 2020. Monthly monitoring took place from November 2015 through October 2017; and supplemental quarterly monitoring was conducted from October 2019 through October 2020. For Phase 2 the Southwest Florida Water Management District (SWFWMD) provided staff support and the Florida Department of Environmental Protection (FDEP) provided all analytical chemical analyses. Sampling of fish populations in the Lower Withlacoochee River was conducted by the Florida Fish & Wildlife Conservation Commission (FWC) staff.
- Phase 3 is the conclusion of this study, including preparation and publication of this report. This report describes the existing environmental impairments that negatively affect the environmental health of the Lower Withlacoochee River Study Area and recommends practical management and capital improvement actions that will reduce or eliminate impairments and increase overall environmental, economic, and aesthetic vitality to the project study area.

### *Phase 3 Key Findings and Recommendations*

#### **Key Findings**

Urban, commercial, and agricultural development have replaced natural land cover in large areas of the surface and groundwater basins that contribute water to the Lower Withlacoochee River Study Area. These intensive human activities occupy a combined 25% of the contributing surface water basin affecting this portion of the river and 60% of the groundwater basin feeding water to the Rainbow River. These land use changes have resulted in both direct and indirect impacts to the Lower Withlacoochee River, including reduced water inflows and impaired water quality that have contributed to altered river conditions.

Since the construction of the Cross-Florida Barge Canal in the late 1960s, the Lower Withlacoochee River has been deprived of peak flows in excess of approximately 1,450 cfs. Before the late 1960s

periodic higher flows in the Lower Withlacoochee River had the potential to flush out accumulated sediment and filamentous algae and contributed to a productive aquatic food chain supporting a healthy recreational fishery.

Historically, baseflows in the Lower Withlacoochee River were dominated by upstream springs, including the Gum Slough spring system, Blue Spring in Citrus County, and most importantly the spring-fed Rainbow River. Historic discharge data document significant long-term reductions in average and low flows in these springs and in the Lower Withlacoochee River, on the order of 20 to 40%.

Upstream of the confluence with the Rainbow River, the Withlacoochee River is characterized as a blend of surface runoff and spring inflows, with low turbidity and suspended solids, some tannic color, and relatively low concentrations of nitrogen and phosphorus nutrients. The low concentrations of nitrogen in the Withlacoochee River increase downstream of the river's confluence with the Rainbow River. Rainbow Springs has experienced a significant increase in nitrate-nitrogen concentrations over the past four decades due to increasing fertilizer use and wastewater discharges throughout the groundwater basin. Nitrate-nitrogen concentrations in the Rainbow River increased from 0.08 mg/L in March 1927 to consistently above 2.2 mg/L currently, a more than 25-fold increase.

The Lower Withlacoochee River water quality, downstream of the confluence with the Rainbow River, reflects the blending of these two rivers. During periods with low water levels in the Withlacoochee River, water quality conditions downstream of the confluence are similar to conditions in the Rainbow River. Increased water clarity and nitrogen entering Lake Rousseau fuel growth of invasive aquatic plants and planktonic algae, increasing concentrations of chlorophyll-a, and requiring annual herbicide treatments to maintain boating access. This cultural eutrophication of Lake Rousseau likely contributes to water quality degradation in the downstream segment of the Lower Withlacoochee River when water is discharged from the lake to the river.

Historic herbicide treatments in Lake Rousseau may be partially or wholly responsible for the near eradication of aquatic plants that formerly grew in the Lower Withlacoochee River. Continuing herbicide treatments in Lake Rousseau contribute periodic elevated herbicide concentrations to the lower river. The potential chronic toxicity of these residual herbicides, combined with the documented reduction in water clarity due to reduced spring-fed base flows and increased incoming particulates from Lake Rousseau, may have limited the recovery of the former native plant communities in the Lower Withlacoochee River.

With few exceptions, aquatic habitat in the Lower Withlacoochee River is considered "marginal" or "suboptimal" and macroinvertebrate populations are indicative of polluted water conditions. These small organisms are a critical link in the aquatic food web that supports healthy fish and wildlife populations. Existing fish populations in the Lower Withlacoochee River are dominated by non-game species indicative of impaired water quality conditions. Due to the apparent absence of submerged aquatic vegetation in the Lower Withlacoochee River, primary productivity is low and wildlife habitat is largely dependent on organic inputs from Lake Rousseau.

Human recreational use of the Lower Withlacoochee River also appears to be low. Although more than 200 boats were typically moored to docks along the river, only 134 individuals and 12 fishermen were documented during the 28 Phase 2 sampling trips.

### Restoration Recommendations

A plan for restoration of the Lower Withlacoochee River must mitigate many of the impacts that have occurred to-date and must also include measures to offset inevitable future impacts resulting from additional development activities.

Partial restoration of the original river flows may be possible by decreasing consumptive uses in the groundwater basin feeding the Rainbow and Lower Withlacoochee Rivers, while increasing recharge of high-quality water to the Floridan Aquifer. Regulatory minimum flows and minimum levels (MFLs) for the Rainbow River and Gum Slough and the upcoming MFL for the Lower Withlacoochee River must be set at levels that provide adequate flows needed to support healthy environmental systems.

A direct and achievable alternative for environmental enhancement of the Lower Withlacoochee River is restoration of historic peak flows from Lake Rousseau to the lower river. This could be accomplished in one of two ways: either by increasing the flow capacity of the Inglis Bypass Channel and the control gate to between 2,500 and 4,500 cfs, or by reconnecting the dam to the historic channel of the lower river by installing a new lock in the Cross-Florida Barge Canal, downstream of a restored connection between the two natural sections of the Lower Withlacoochee River. The proposed new lock connecting the lower river to upstream Lake Rousseau could also be designed to allow facilitated passage of fish and manatees into the upstream springs and river.

An additional recommended structural improvement is elimination of the approximately 105-167 cfs leakage that currently occurs under or around the Inglis Dam to the Barge Canal. This repair is expected to measurably increase flows to the Lower Withlacoochee River. This additional inflow is particularly critical during droughts when it constitutes 20% or more of the total flow in the Lower Withlacoochee River.

Reducing water quality problems in the Lower Withlacoochee River will require efforts to eliminate both direct and indirect sources of nitrogen to surface and groundwaters. Indirect pollution impacts from thousands of septic tanks affecting the lower river requires septic-to-sewer conversion for most residences and businesses with a new wastewater treatment plant. This new wastewater treatment system should include advanced wastewater treatment with nitrogen removal and groundwater recharge within the springsheds to recycle highly-treated effluent to the Floridan Aquifer.

Other indirect sources of nitrogen pollution affecting the Rainbow River and ultimately Lake Rousseau and the Lower Withlacoochee River need to be reduced by more than 80% as identified by the state's Rainbow River Basin Management Action Plan (BMAP). Achieving this level of nutrient load reduction is expected to require the replacement of thousands of single-family septic systems throughout the 737 square mile Rainbow Springshed and nutrient reduction on tens of thousands of acres of intensive farmland. These efforts are expected to require significant state and federal funding support.

Use of fertilizers and pesticides on urban and commercial properties should be regulated within a riverine buffer zone through a city, county, or state ordinance. Herbicide use on Lake Rousseau should be limited lake wide and eliminated within close proximity to outflow structures to reduce downstream acute and chronic impacts. Periodic drawdowns of water levels in the lake should

be considered in conjunction with limited mechanical harvesting as an alternative approach for lake management.

Finally, limits should be considered for further shoreline development along the Lower Withlacoochee River, including docks and seawalls, that allow a maximum length of hard, vertical seawall combined with a more environmentally-friendly option such as living shorelines or natural shorelines for the remaining shoreline length.

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# Restoration Implementation Plan

## *Responsible Parties*

Relocating the east terminus of the Cross-Florida Barge Canal and enhancing the Lower Withlacoochee River is a worthy goal for the residents of Florida. This goal will only be realized through a partnership between the affected public and local governments on one hand, and the Governor, cabinet, legislature, and state agency heads on the other. Federal monetary support should also be sought to modify the Cross-Florida Barge Canal and to achieve the water quality improvement goals of the Clean Water Act.

## *Stakeholder Engagement*

All affected parties will need to be involved in this proposed restoration project. This includes all landowners on the Lower Withlacoochee River and all landowners within the Rainbow Springshed. Other stakeholders will include city and county governments, local businesses, SWFWMD, FDEP, FWC, USFWS, Florida Legislature, United States Coast Guard, and United States Army Corps of Engineers.

## *Regulatory Enforcement*

The existing water quantity and quality impairments noted at Rainbow Springs and the Rainbow River need to be fully and expeditiously addressed by state governmental agencies. This includes full implementation of the Rainbow River BMAP, completion of the Lower Withlacoochee River MFL, and development of a TMDL and BMAP for Lake Rousseau and the Lower Withlacoochee River.

Given FDEP's Rainbow River BMAP, a fertilizer ordinance should be developed for both urban and agricultural inputs and implemented throughout the 737 square mile Rainbow Springshed. In addition, sewerage all septic systems on parcels of one acre or less throughout the springshed should be prioritized. Marion County Utilities has already prepared a public-private partnership concept to make these connections at no public expense (Mellinger, 2015).

Based on the observed decreases in baseflows documented in this study, efforts should be made to prioritize groundwater recharge in both the Rainbow Springshed and Withlacoochee groundwater basin. This recharge will bolster aquifer levels and increase baseflows in the Rainbow and Withlacoochee Rivers. Recharge can be provided in both existing projects and in new projects designed to recharge treated wastewater and/or stormwater.

## **Structural Modifications**

A variety of alternatives exist to provide structural improvement and environmental enhancement on the Lower Withlacoochee River. Two primary options are discussed with a variety of sub-projects that could be a part of each. Additionally, a variety of separate projects exist that would apply in the case of either alternative. Expected conceptual cost ranges for each alternative are also defined below. Some of the restoration components were previously evaluated for the SWFWMD (URS, 2004). Where applicable, component costs for Alternative 1 and 2 were extrapolated and escalated from 2003 costs to present day values using a cost

multiplier of 1.74 (Hale & R.S. Means Company, 2018). 'Other Projects' expected conceptual cost sources are identified below.

#### Alternative 1: Bypass Channel Modifications

- Reconstruction of the Inglis Bypass Channel to allow passage of flood flows to the lower river (an increased capacity to between 2,500 and 4,500 cfs<sup>7</sup>) and conversion from the existing underflow gate to an overflow gate. [\$20-30 M]
- Restoration of the Inglis Lock to allow controlled passage of manatees and fish between the Gulf and the river. [\$5-10 M]

#### Alternative 2: Re-Connection of the Lower Withlacoochee River

- Reconnection of the Inglis Dam overflow to the Lower Withlacoochee River segment by closing the Cross-Florida Barge Canal and installing a lock at or upstream of the FWC ramp and facility, and removing the earthen fill blocking the historic channel of the lower river. [\$50-75 M]
- The Barge Canal channel from the new Inglis Lock to the Gulf of Mexico can be maintained as a protected inland boat harbor and boat ramp and landing for the general public, FWC, and the Florida Marine Patrol. This channel could also serve to provide flood protection under extreme events. [maintain as-is]

#### Other Projects

- Repair of the existing leak around the Inglis Dam. [\$1-5 M]
- Provide central sewer to all homes located in the springshed. [\$15,000 - 40,000/home]<sup>8</sup>
- Establish a fertilizer ordinance for the springshed. [\$250,000 - 500,000]<sup>9</sup>
- Provide improved wastewater management and recharge throughout the springshed. [\$50-75 M]
- Discontinue herbicide application within a minimum of 500' of structures that discharge to downstream waterbodies except in the immediate vicinity of structures. [minor cost savings]

<sup>7</sup> A detailed hydrologic modeling of the lower river's flow capacity range should be evaluated before any improvements are made.

<sup>8</sup> approximate costs of septic-to-sewer projects in FDEP Springs Funding requests (<https://floridadep.gov/springs/restoration-funding>), accessed 5/18/2021

<sup>9</sup> Florida Department of Environmental Protection, 2020