

Final Report FY97 Section 319 Grant Program

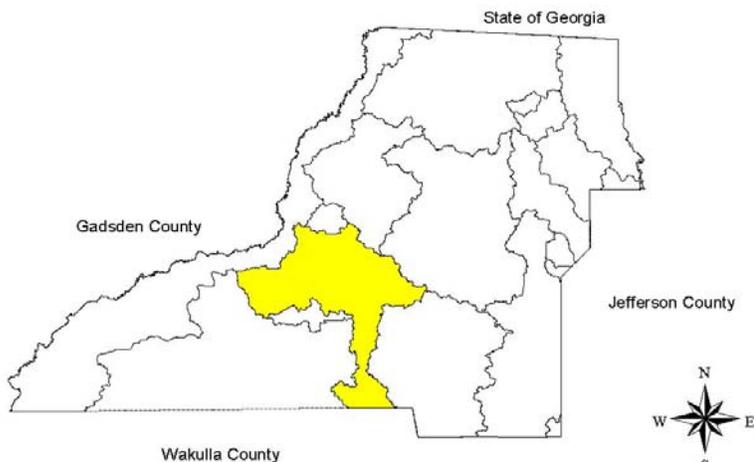
DEP Contract WM682: Lake Munson Restoration

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PROJECT SUMMARY:

Background: Lake Munson is an impounded water body receiving surface flow from approximately 32,000 acres. Decades of development in the Tallahassee Red-Clay Hills, wastewater treatment facilities discharging to the tributary system, and drainage activities focused on flood reduction contributed to Lake Munson's decline, resulting in the lake ranking as Florida's 7th most degraded water body in 1982. Federal grant funds allowed the City of Tallahassee to construct advanced wastewater treatment with spray irrigation discharge by 1984, removing this impact from the surface water system. The Lake Munson Restoration project and the preparation of this report was funded in part by a Section 319 Nonpoint Source Management Program grant from the U.S. Environmental Protection Agency (US EPA) through a contract with the Stormwater/Nonpoint Source Management Section of the Florida Department of Environmental Protection. The total cost of the project was \$13.4 million, of which \$366,000 (or 2.7%) was provided by the USEPA.

LEON COUNTY, FLORIDA Lake Munson Drainage Basin Limits

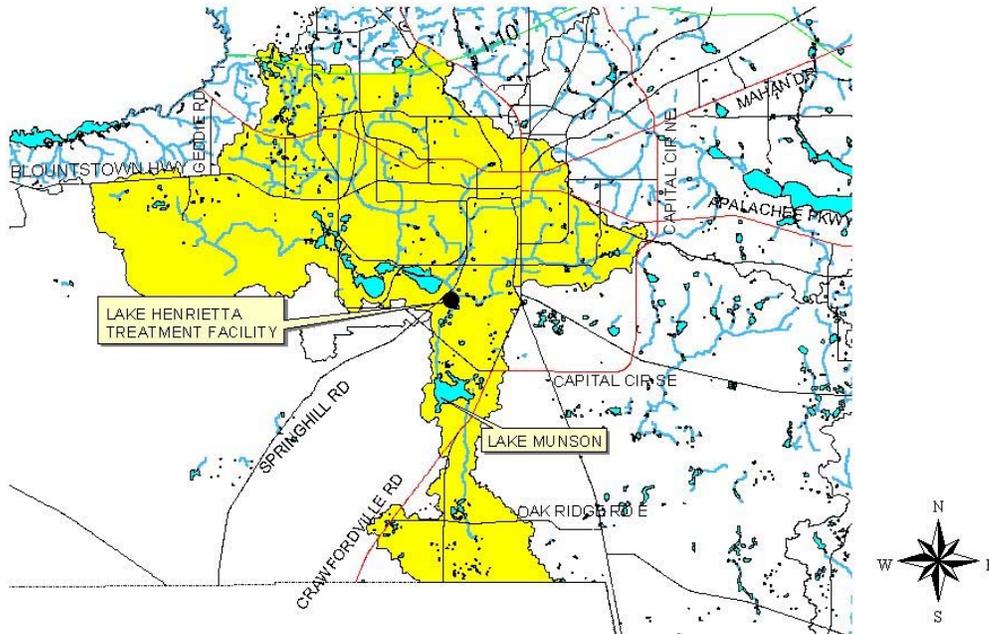


Objectives: The Lake Munson Restoration Project focused on the reduction of stormwater runoff impacts to the tributary system and the receiving waters. The ultimate goals are to enhance the lake water quality and restore adjacent habitat, reduce flooding, reduce groundwater impacts at Ames Sink (ultimate discharge point), and increase recreation opportunities.

PROJECT DESIGN:

This project initiated the lake restoration efforts by focusing on opportunities to capture and treat storm flows ahead of Lake Munson. Preliminary meetings with the various resource agencies highlighted the importance of constructing treatment prior to attempting in-lake restoration in order to protect the natural system. Following design contract award in March 1997, the engineering firm of Camp Dresser & McKee, Inc. immediately began collecting surface and ground water level information to correlate to rainfall data. Topographic and boundary surveys identified the existing features and acquisition targets for both flood-reduction and habitat enhancement. The biological field surveys verified the extents of the former Lake Henrietta, the quality of the existing natural systems, and the jurisdictional limits of the wetlands for state and

Lake Munson Tributary System



local permitting purposes. Soil testing identified petroleum-contaminated areas and characterized the site conditions for design purposes. Calibration of the surface water model to site conditions recorded during peak flow events refined the design efforts. The map above illustrates the location of the treatment facility at the confluence of the three major tributaries to Munson Slough.

The design team and County representatives met regularly to ensure that project goals and maintenance concerns were addressed in the final design. Community meetings were held at the beginning, midpoint, and final design stages to both inform and involve the affected neighborhoods and interested citizens. Local, state and federal permitting and resource agencies were approached throughout the design to ensure issues were identified and resolved at the earliest opportunity. Permitting review included the Federal Aviation Administration, due to the project proximity to the Tallahassee Regional Airport; the US Army Corps of Engineers; the US Forest Service Special Use Permit for activities in the Apalachicola National Forest; the Florida Department of Environmental Protection for stormwater, wetland resources, and land clearing debris disposal; the Florida Department of Transportation; and the City of Tallahassee Environmental Management permitting section.

Land acquisition involved both the fee-simple purchase of 34 residential and vacant lands (with relocation of owners and tenants) and the execution of inter-local agreements for use of City properties and federal forest lands. The properties were acquired with federal Community Development Block Grant (CDBG) flood hazard mitigation funds awarded in response to the 1994 flooding events, as well as Leon County Capital Improvement Bonds.

The construction project was advertised for bid in February 1999. Final contract award to Phoenix Construction Services, Inc. was authorized in September 1999 following contract negotiations due to bids exceeding project budget. The engineer, County and contractor were able to identify cost-savings which would not adversely affect the project goals, and established a working relationship which was crucial to the ultimate success of the project.

CONSTRUCTION:

Phase 1: Sediment Disposal Sites

Excavated sediments were dewatered at material handling sites adjacent to Munson Slough and the lake excavation areas. The sites were used under agreement with the City of Tallahassee and the US Forest Service which continue ownership of the sites. The trash was separated and hauled to the County Solid Waste Facility. Once the sediments were dry enough to be transported over the public roads, they were trucked to the disposal sites.



The primary sediment disposal site was designated as the County's Eisenhower Clay Pits, approximately five miles from Lake Munson and four miles from Lake Henrietta. The site is a former clay borrow pit and an active municipal fill pit with 600,000 cubic yards of storage capacity. A site plan was developed to ensure that no stormwater runoff left the site. This assisted in addressing concerns from adjacent residents regarding impacts from the fill activity.

In order to prepare the site for accepting materials from the restoration project, the site was regraded by Leon County Public Works in February 1997. Funds for the grading were provided by a grant from the Florida Game and Fresh Water Fish Commission (now the Florida Fish and Wildlife Conservation Commission - FWCC). Additional work to prepare the Eisenhower site involved site surveys, soil borings and geotechnical evaluations, including groundwater monitoring wells. The portion of the site formerly used as a firing range by local law enforcement was confirmed as lead contaminated, but no impact to groundwater was identified. However, the Total Contaminant Leaching Potential (TCLP) levels required special disposal of all affected soil and remaining lead pellets at a cost exceeding \$97,000.



The Florida Department of Environmental Protection (FDEP) determined that any project soils with a Total Recoverable Petroleum Hydrocarbon (TRPH) value of 2500 ppm or more required disposal at the County's landfill. Two areas along Munson Slough were determined to have soils exceeding 2500 ppm of TRPH during the design phase of the project. The contractor reevaluated the sites

immediately prior to excavation, with the results confirming bioremediation had resolved the contamination and no special handling or disposal was required. The bioremediation may have resulted from the repeated flooding of the sites since the design testing approximately three (3) years prior to construction. However, the contractor uncovered isolated contamination in the Lake Henrietta construction area during excavation, which was first identified by the equipment operators due to the odor of the material. This material was handled in accordance with contract documents and placed at the Leon County Solid Waste Facility lined landfill cell.

The County Solid Waste Division agreed to "purchase" suitable spoil materials for use as daily cover at the landfill. Almost 164,000 cubic yards was disposed in this manner, adding \$600,000 to the construction budget. The County also negotiated with the City Aviation Department to haul soils not exceeding 2500 ppm of TRPH to the City's airport lands adjacent to the project site. However, after bidding, City staff became concerned that the material would attract nuisance animals to the runways and withdrew from the agreement.

The materials handling sites were regraded as part of the final construction effort. The City of Tallahassee directed replanting of long-leaf pines on the 5.9-acre site owned by the Regional Airport. The US Forest Service accepted the responsibility to revegetate the 13.7-acre site in the National Forest, if a future use is not developed for the area.

Phase 2: Lake Henrietta Restoration

The goal of the restoration of the Lake Henrietta area, which includes a stormwater attenuation pond and wetland restoration, was to provide peak flow attenuation and water quality treatment for Lake Munson. A key design consideration was that the runoff stages and flows resulting from design storms (25-year and 100-year, 8-hour events) could not increase above existing levels without flooding additional residences. In addition, the existing altered wetland hydrology was to be improved to offset the construction impacts to the slough and Lake Munson delta. The project



accomplishes flood attenuation with the stormwater facility known as Lake Henrietta. The pond is designed with approximately 25 acres of surface area at a normal pool depth of 8 feet. The pond collects inflow from Munson Slough downstream of West Ditch and Central Ditch confluence, and from the East Drainage Ditch downstream of Northridge Road. The original channel bed remains around the pond perimeter to allow peak flows to bypass Lake Henrietta. The pond discharges through bleed-down piping and equalization pipes into the main slough channel and a spillway directed to the wetlands south of Lake Henrietta. The pond design takes full advantage of existing disturbed and filled wetland areas for the detention area. The existing 100-year floodway is utilized, with drawdown through pipes and spillways to provide the greatest detention time for sediment drop to occur.

The concept plan was refined based on site investigations to exclude an area of substantially undisturbed wetland between the Munson Slough channel and Northridge Road and to avoid the disturbance of petroleum contaminated soils. Sediment and water quality sampling demonstrated that the petroleum was adequately bound to the soils with no migration south to Lake Munson. However, isolated pockets of soil contamination were uncovered by the contractor during excavation. These areas were delineated, evaluated by the geotechnical firm for appropriate disposal handling, and soil was moved to the County lined landfill as needed.

The pond design criteria focused on sediment and floatables capture. The detention time achieved during most storms will result in the capture of sediment in forebay areas of the proposed pond, removing approximately 80% of the average sediment load. Lake Henrietta can receive flows from up to an annual storm event without bypass, assuming normal pool elevation at the initiation of the storm. Maintenance to remove sediment from the forebay areas will be performed as necessary, with initial expectations that removal will not be necessary for 5-7 years. The entrance channels to the pond incorporate floating booms and trash cages to intercept floatable debris.



The delta at Lake Munson contained a tremendous quantity of floatables. A community "Lake Munson Clean-Up" held in September 2000 removed 24 tons of debris from the lake edge. In addition, the construction firm removed approximately 8 tons of debris captured in sediment barriers across the slough during the project, as seen in the adjacent photo.

A small karst feature developed in the east pond embankment after Lake Henrietta experienced a high water level in August 2000. The extent of the cavity could not be readily determined by the geotechnical firm. Since stabilization with fill material was not a viable corrective action, the throat was capped with a concrete slab, supported on concrete pilings set in the bedrock below the cavity. The perimeter of the concrete slab was turned down into the weathered limestone overlying the cavity to prevent seepage from further eroding the confining layer.



Ground-penetrating radar (GPR) was used along the embankment length to evaluate the possibility of additional karst features in the project area. An area roughly 100 feet south of the failure was identified as a potential concern in the future. The GPR also revealed areas of concern in the vicinity of the proposed diversion structures and bridges. Soil borings confirmed the presence of voids at the proposed piling locations. The piling locations were adjusted and the construction method was changed to auger-cast pilings rather than driven piles, to reduce potential collapse of the subgrade. Also, the sheet piling was vibrated into the surface sands rather than driven. The increased construction costs at the diversion structures were approximately \$62,000.

The sediment and floatables capture in Lake Henrietta proper are supplemented by the nutrient removal occurring in the adjacent wetlands downstream from the lake. Historic channelization of the slough for flood control and mosquito control created extreme water level fluctuations, increasing scour and degrading the habitat. A weir was constructed across the slough south of the wetlands, creating a backwater condition which extends the recovery time and mimics a natural wetland hydroperiod. The USACOE required that stage recorders verify the enhanced hydroperiod through the project length for a period of five years following construction.

Phase 3: Munson Slough Stabilization

Prior to construction, the stream velocity in Munson Slough during intense storm events eroded the vertical banks, scoured the channel bottom, and undermined trees along the banks. Historic channel maintenance practice was to place the soils dredged from the slough on the banks to eliminate the need for haul-out. This poor soil contributed to the slough bank instabilities and increased the sediment load to Lake Munson. Review of the soils data and the slough velocities revealed that the primary sediment load to Lake Munson came from the unstable channel itself rather than upstream development activities as commonly believed.

Improvements to Munson Slough included realignment, regrading and stabilization of channel banks for erosion control between Springhill Road (including the slough adjacent to Lake Henrietta) and Lake Munson. Stormwater flows were evaluated with a basin-wide model to determine peak flow rates and timing. The information was crucial in determining the appropriate measures to reduce scour and deposition throughout the length from Springhill Road to Lake Munson. Limited change to the channel alignment was needed to achieve velocities acceptable for grassed channels, allowing the slough to retain a natural meander along its length from Lake Henrietta to Lake Munson. The velocity also determined which areas required geotextile stabilization and which areas could be addressed by regrading the banks to a 5:1 (H:V) slope. The berm for Lake Henrietta separating the slough from the facility was stabilized with Mirafi geogrid lifts to ensure the berm would resist peak flow scour velocities.



The view on the left (above) shows the soil lifts and Mirafi Geogrid which wrapped the lifts. The right photo shows the area at final project acceptance, with gabion baskets adjacent to the flow diversion structure into Lake Henrietta.

Soil sampling along the slough length during design identified sporadic petroleum contaminated sites. Further testing established the limits of special handling and the method of removal and disposal. The contamination was not unexpected, due to the Superfund cleanup occurring approximately one mile upstream at the former Davis Oil Recycling plant. Areas along the slough which could remain undisturbed to allow bioremediation to continue were avoided in the design. Followup sampling during construction documented that special handling was no longer required, possibly due to the flooding of the site during construction by Tropical Storms Helene, Allison, and Barry. It is also possible that the clearing and construction activity provided aeration of the soils during the three years following design sampling.

The undisturbed wetlands east of Lake Henrietta caused concern during slough stabilization for two reasons. The soils were highly organic, requiring a field change to increase the slough bottom elevation and decrease the bank slope in order to achieve a stable slough bank with vegetation rather than hardened surface materials such as concrete. In addition, the discharge from the wetland to the slough at various points continued to undermine the banks, resulting in the need for gravel stabilization. The east bank was initially graded 3:1 (H:V) but experienced severe slippage due to groundwater movement from the adjacent wetland. A defined clay layer could be seen in the cut slopes which directed the water to the slough from the wetland. The

slough was redesigned with an increased bottom elevation to accommodate the wetland confining layer and the eastern bank slopes were revised to 5:1 (H:V) to decrease the shearing tendencies.

Initial design included a gravel roadbed for the maintenance access on the west slough bank. This was to provide a stable surface for heavy maintenance equipment such as dump trucks to work the length of the project. The slough historically required frequent dredging of sediments, removal of large trees following storm events, and regular removal of beaver dams which supported the critical need to include maintenance access in the design. Unfortunately, the access road was controversial in the environmental community due to the impact to the adjacent treeline. The road width was held to provide maintenance access as originally envisioned. The gravel was deleted in the initial contract negotiations with Phoenix Construction in order to meet budget constraints. The road bed is compacted soils, blended with off-site clay from the Eisenhower pit to achieve a stable surface.



The geotextile materials specified for the slough banks were intended to withstand the anticipated peak velocities during saturated conditions, assuming two years of normal flow conditions following the construction. The slough meander was incorporated into the design as shown in the photo to the left. Although the construction began during record drought conditions, three named storms (TS Helene in September 2000, TS Allison in June 2001, TS Barry in August 2001) and an unnamed winter storm (March 2002) exceeded the 100-year rainfall intensity at the project site

during the project period. The photograph below shows the effects of the March 2002 storm on the slough south of Capital Circle.

The final access road configuration balances the environmental concerns and the funds remaining at the end of the project. In order to avoid the expense and time required to rebuild the slough banks the third time, the road width south of Capital Circle was reduced in order to complete the project before the 2002 storm season. (The estimated costs to reconstruct the affected areas with a hardened surface



exceeded \$750,000.) The photograph to the left shows how the slough banks were regraded to correct the vertical erosion. Areas which were most affected by the scour were reinforced with gabion rock and basket material. The access road was reconstructed as a single lane in the locations where the maintenance activity could be accommodated in some other manner, such as truck turn arounds or short distance backing maneuvers.



A diversion channel to bypass low flows during the sediment delta removal was originally designed and permitted to bisect an adjacent City of Tallahassee borrow pit and enter the northernmost portion of Lake Munson. Representatives of the Florida Fish and Wildlife Commission (FWCC) and the FDEP Aquatic Plant Management section were concerned that the proposed channel required removal of the cypress fringe at the connection point. Record drought conditions at the outset of construction motivated the construction firm to offer a unique alternative: Phoenix Construction agreed to accept the initial risk of attempting the sediment delta removal without the low-flow bypass, so long as the contract price was not reduced and the contractor retained the right to construct the channel if conditions became unworkable. The Board of County Commissioners accepted the offer, and the diversion channel was not constructed.

The survey, engineering design and permitting, and construction of the Munson Slough stabilization were funded by County capital improvement revenue bonds.

Phase 4: Excavation of the Delta in Lake Munson

The “delta” formed at the confluence of Munson Slough and Lake Munson, encompassing an area of approximately 29 acres. The “delta” was excavated to restore the channel inflow to a more natural state while removing trash and debris from the lake. The trash included stoves, refrigerators, tires, and



automotive parts which were taken to the Solid Waste Facility. The significant amount of tree debris in the upper reaches of the delta were taken to the Eisenhower site. The northernmost portion of the delta was estimated to contain 12 percent trash and 7 percent tree debris by volume. An amphibious vehicle was used by the land surveyor and geotechnical firm to access the delta for soil borings and topographic survey. The soils were determined to be primarily very soft organic plastic silts. The extent of the cypress fringe was surveyed, and a setback of 15 feet was included in the design to reduce construction impacts to the trees.

Phoenix Construction did not utilize the diversion ditch included in the design for flow diversion during construction and for increased flushing in the north arm of Lake Munson after construction was completed. The contractor purchased two amphibious excavators after confirming that standard wetland construction methods were not adequate for the extremely soft, fluid organic soils in the delta. Excavation in the delta continued 24 hours a day, 7 days a week, for over 10 weeks to remove the material to higher ground for handling and disposal. The original handling sites were quickly overwhelmed. The contractor negotiated with the Forest Service, the City permitting staff and the City's Wastewater Treatment Facility staff to expand the handling sites to receive the delta material. The off-road dump trucks were modified to retain the fluid soils on their trip to the handling sites. An operator worked each site to continuously turn the material in order to dry the soil sufficiently to be hauled off-site. Several months were required to complete the removal of the delta material to the designated disposal site from the handling areas.

The first excavation of the delta was complete June 2000. The channel erosion due to Tropical Storm



Helene in September 2000 required a second excavation of deposited material. The adjacent photograph shows some of the sediment at the transition between the slough and Lake Munson. The third excavation following the back-to-back tropical storms Allison and Barry in the summer of 2001 included an extra “sump” depth as a precaution. The unnamed winter storm of March 2002 again damaged the slough and deposited material in the delta vicinity. The lake bottom was surveyed and determined to be substantially in compliance with the original design, so no further excavation was performed.

The original transition from Munson Slough to Lake Munson as designed and permitted would have affected approximately 35 cypress trees on the eastern bank of the slough. The Board of County Commissioners accepted a revised plan to address the concerns raised in the environmental community about this construction. A reduced maintenance access width and realignment of the transition to the west allowed the larger trees to be avoided with minimal impact to the western fringe.

Leon County capital bonds funded the design, permitting and construction of the delta removal, with supplemental construction funds provided by the USEPA Section 319(h) grant and a FWCC grant.

Phase 5: Hydraulic Dredging of Lake Munson/Fishery Enhancements

The final phase of the restoration project will be to hydraulically dredge the lake and to improve the recreational value and fishery quality of Lake Munson. This work will proceed when funds for design, permitting and construction can be obtained. The US Forest Service has expressed a willingness to participate in the construction, including the consideration of material disposal on forest lands, stabilization of forest roads for public access, and the construction of recreation facilities on federal lands along the west shore. Leon County was designated to receive FWCC funding in 2001 which was redirected to another FWCC priority. Funding requests to the state and federal agencies and legislature have not been successful in the past years, but will be pursued in the future.

Phase 6: Monitoring

Monitoring of the slough hydroperiod is required by the USACOE permit, with annual reports to be provided. In addition, water quality sampling is proposed to confirm the actual efficiency of pollutant removal by the BMP's implemented in the project. Paired autosamplers could be located at the primary influent and the bleed-down from Lake Henrietta, or at the discharge point to Lake Munson, and may be included in the future.