# Leon County Lakes Ecology Project, Leon County, Florida

## Ecological Monitoring

**Start / End Dates:** 1998 – 2006

**Key Project Personnel Involved in this Project:**

S. McGlynn, PhD
S. Rupp, BS
K. McGlynn, BA
J. Stanley, BS
A. Kubes
M. Jones
N. Curtis
B. McGlynn

**Project 1**

**Brief Description of Work Performed:**

Funded by the Leon County Commission, this lake protection program monitors the nutrients, physical properties, macrophytes and phytoplankton in the numerous lakes of Leon County, Florida. The major goal of the study is to assess the trophic status and identify sources of pollution of these lakes. Over 11,000 measurements were performed. The data generated was entered into the FLORIDA STORET database with data attributes equalling over 86,000 data entries. McGlynn Labs became the top data provider for state through the data entered into the Storet Program. The data generated by McGlynn Labs was used by the FDEPs TMDL and was found to be acceptable for verified list of impaired waters (303D). McGlynn Labs is NELAC certified. This data has been used to generate TMDLs for Lakes Munson, Lake Lafayette and the Ochlockonee River. The data generated by McGlynn Labs for the TMDL for Upper Lake Lafayette comprised over 90% of the data. In 2001 and 2008 Dr. McGlynn brought, as Conference Chair, the Annual Convention for the Florida Lake Management Society to the Florida Panhandle to showcase our lakes. Approximately a million dollars of grants were obtained using the results of this program, including the Lafayette Watershed Study and the Killearn Lakes Restoration.

Monitoring was performed from 1998 to 2006 at monthly intervals. During 9 years of monitoring no stations was missed. Lakes monitored were Carr (1 station); Jackson (6 stations); Hall (2 stations); Munson (3 stations); McBride (3 stations); Lafayette (6 stations); Iamonia (6 stations); Miccosukee (1 station); Talquin (4 stations); Weeks (2 stations) and the Ochlockonee River (2 stations).

The following parameters were monitored monthly at each station: Field Parameters (time, cloud cover, wind speed, depth, stage, secchi, temperature, turbidity, dissolved oxygen, percent oxygen saturation, pH and specific conductivity); Laboratory Parameters (turbidity, true color, alkalinity, chloride, TSS, TDS, ortho-phosphorus, total phosphorus, total inorganic phosphorus, nitrite, nitrate + nitrite, nitrate, total inorganic nitrogen, TIN/TIP, ammonia, total kjeldahl nitrogen, total nitrogen, TN/TP ratio, chlorophyll, pheophytin, corrected chlorophyll, enterococcus, E coli, fecal and total coliforms.

Sediments, Aquatic plants and plankton were sampled and analyzed (sediment type/grain size; depth from sediment/water interface to underlying hard pan; moisture content of sediment; organic content of sediment; inorganic content of sediment; total nitrogen; total phosphorus). Aquatic plant populations were sampled quarterly for percent coverage of the surface and bottom; percent total volume of the water column occupied; and the taxonomic identification of the dominant species and two subdominant species of macrophytes at each station. Every year, up to 5 algal toxicity assays were run (as needed) with complete taxonomy.

# Beatty Bayou, Lynn Haven, Florida

## Trophic State Analysis & Hydrological Modeling

**Start / End Dates:** 2004

**Key Project Personnel Involved in this Project:**

S. McGlynn, PhD
S. Rupp
K McGlynn, BA
A. Kubes

**Project 2**

### Brief Description of Work Performed:

Beatty Bayou was being evaluated for restoration, including sediment removal, which was hoped to improve water quality and habitat. Parts of Beatty Bayou were very shallow. Distinct sand bars had developed at the mouth and terminus of the Beatty Bayou. The water was less than 0.5 meters deep at the mouth of Beatty Bayou. Algal mats were growing on the shallow sediments, *Lyngbya spp*. These algal mats were breaking loose in small 5 – 10 cm clumps, and were floating down the Bayou towards the Bay.

Beatty Bayou was monitored and modeled by McGlynn Labs. The following parameters were sampled and analyzed: Physical-Chemical Parameters (depth, stage, secchi, temperature, turbidity, dissolved oxygen, pH and specific conductivity); Laboratory Parameters (turbidity, true color, TSS, TDS, ortho-phosphorus, total phosphorus, nitrite, nitrate, ammonia, total nitrogen, chlorophyll, pheophytin, corrected chlorophyll, metals, petroleum hydrocarbons, and bacteria). Sediments were sampled and analyzed for: sediment type/grain size; moisture content of sediment; organic content of sediment; inorganic content of sediment; metals, petroleum hydrocarbons.

Hydrological models showed that physical dynamics account for zones of high sediment deposition at both the head and mouth of Beatty Bayou where sediment removal would be beneficial for both ecological and recreational concerns. The middle portion of Beatty Bayou should also be considered a zone of deposition. Overall there was not enough flow through Beatty Bayou to scour and keep the passes open. Sediment removal was recommended. Thus the major problem or impairment of Beatty Bayou was found to be due to sedimentation build up and nutrient enrichment, not toxins. It was recommended that they also reduce nutrient inputs through reduced usage of fertilizers, increased septic tank maintenance, and erosion control in the watershed as well as shoreline protection (buffers).

# Joint Public Notice Coordinator for the State of Louisiana

Natural features identification and evaluation concerning coastal zone permit applications

**Start / End Dates:** 2002 – PRESENT

**Key Project Personnel Involved in this Project:**

Kathleen McGlynn, BA
Sheila Starling, MS

**Project 3**

**Brief Description of Work Performed:**

The Joint Public Notice Coordinator office (JPN), funded by State of Louisiana, Department of Natural Resources, processes permitting in the coastal zone of Southern Louisiana as an embedded contractor. This area includes the nations most extensive fresh and saline marsh systems as well as a fragile subsiding shoreline. This area includes extensive petroleum production areas, the largest refineries in the world, shipping and a burgeoning seafood industry. To protect Louisiana's natural resources and facilitate land use, our primary function is to locate and identify sensitive areas and natural resources potentially impacted by proposed permits. The JPN office was privatized and McGlynn Labs has won the contract and run this office through two successive 3-year contracts.

Our JPN office is located across the street from the Mississippi River on Main Street in downtown Baton Rouge. We have staffed the office with professional geographers and planners who coordinate the receipt of all new permit applications and correspondence, assign new permit numbers, follow-up on incomplete applications, prepare ArcView habitat maps and technical reports, plot projects to scale on the USGS Quad sheets, assign permits to analysts, collect application and processing fees, coordinate with the U.S. Army Corps of Engineers (COE), the Department of Environmental Quality Office of Environmental Services (DEQ) and representatives from the local coastal zone programs, and maintain the CMD Data Base and Map Room for DNR, perform QA/QC checks on the permit process and prepare all permit applications for review to ensure that all runs smoothly and according to protocol for the daily permit process.

# Woodville Recharge Basin Aquifer Protection Study, Leon County, FL

## Ecological Monitoring and modeling

**Start / End Dates:** 2003 – 2006

**Key Project Personnel Involved in this Project:**

S. McGlynn, PhD
S. Rupp, BS
K. McGlynn, BA
J. Stanley, BS
A. Kubes
M. Jones
N. Curtis
B. McGlynn

**Project 4**

### Brief Description of Work Performed:

The purpose of this study is to assess sources of nutrient loading to the aquifer within the Woodville Recharge Basin, a critical recharge area for Wakulla Springs where most of the inhabitants are on septic tanks and private wells for drinking water. The Leon County Board of County Commissioners, through an EPA Grant, funds this study. The Woodville Recharge Basin (WRB) is located in southeastern Leon County. The Floridan Aquifer, as it passes through the Karst Topography under the WRB is unconfined. Increasing concentrations of nutrients at discharge points, like Wakulla Springs and the St. Marks Rise (both 1st order magnitude springs), are becoming problematic. There are concerns as to the portability of drinking water in the future.

This study developed recommendations to guide the inevitable development of the basin so that impacts to the aquifer will be minimized. With the Leon County GIS Department we used the WAMview model, a geospacial **W**atershed **A**nalysis and **M**anagement model to incorporate groundwater flow (both diffuse and conduit flows) and predict water quality (surface and groundwater) under different development scenarios. Water quality monitoring included: surface and groundwater; septic tanks; atmospheric deposition; and laboratory experiments. Parameters monitored include nutrients, metals, hydrocarbons and bacteria. We developed GIS layers for the application of septic systems, land use, agriculture, a wastewater sprayfield surviving the City of Tallahassee and associated residuals, karst features, groundwater flow, rainfall, atmospheric deposition, diffuse groundwater flow and conduit groundwater flow.

The direction of diffuse groundwater flow was determined using piezometric surfaces and LIDAR data (water levels in Karst windows during a dry period). The different approaches validated each other. Conduit flow was determined using rhodamine dye and insitu Hydrolab Minisonde 5 Multiprobes equipped to measure and store insitu fluorescence measurements.

Recommendations of this study included: restricting the use of septic tanks in aquifer-vulnerable areas; modifications to the CoT Sprayfield; proposing sewer systems; regulating stormwater runoff; stormwater retrofit projects; restricting certain land uses; purchasing vulnerable lands; offering tax incentives for placing conservation easements on aquifer-vulnerable areas; etc.

# Huckleberry Creek, Apalachicola, Florida

## Ecological Monitoring and Flow Study

**Start / End Dates:** 2004

**Key Project Personnel Involved in this Project:**

S. McGlynn, PhD
S. Rupp, BS
K. McGlynn, BA
A. Kubes
N. Curtis

**Project 5**

**Brief Description of Work Performed:**

McGlynn Laboratories Inc, monitored water quality performed a hydrographic dye study as a consultant to BRA in this WQBEL study. Huckleberry Creek flows north and Clark Creek flows south into the Jackson River, which, in turn flows into the Apalachicola River. McGlynn labs performed two monitoring runs under different flow conditions at high tide and low tide and performed dye studies under similar conditions to measure the effects of the Apalachicola WWTP which discharges through a marsh at the headwaters of Huckleberry Creek. Clark Creek was a control. McGlynn Labs utilized its own boats, field crews and NELAC certified laboratory for this study.

Six stations were sampled at 0.5 meters from the top and 0.5 meters from the bottom of the water column in each creek for: Field Parameters (time of day, cloud cover, wind speed and direction); Physical-Chemical Parameters (depth, stage, secchi, temperature, turbidity, dissolved oxygen, percent oxygen saturation, pH and specific conductivity); Laboratory Parameters (turbidity, true color, alkalinity, chloride, TSS, TDS, ortho-phosphorus, total phosphorus, total inorganic phosphorus, nitrite, nitrate + nitrite, nitrate, total inorganic nitrogen, TIN/TIP, ammonia, total kjeldahl nitrogen, total nitrogen, TN/TP ratio, chlorophyll, pheophytin, corrected chlorophyll, enterococcus, E coli, fecal and total coliforms).

Dye studies were run with Rhodamine wt, a fluorescent dye and insitu hydrolab fluorometers. Three Hydrolab Minisonde 5 Multiprobes with 108,000 KB of internal memory equipped with Rhodamine WT sensors by Turner Designs were used to measure insitu fluorescence. The dye study was difficult and had to be repeated several times because the flow was slow and vegetative mats in Huckleberry Creek, growing off the excess nutrients discharged from the WWTP, provided a lot of hydrologic resistance.

USGS data indicated that discharge in the Apalachicola River was quite variable during this time, from April 12 to April 19 the flow dropped from 80,000 cfs to less than 30,000 cfs. In June the dye was traced from HC0 at Moses Road to the railroad tracks at HC1 despite the extensive vegetation. The total flow time from HC0 (Moses Road) to HC5 (Huckleberry Creek at the Jackson River) was found to be 22.84 hours. The slow but steady discharge from Huckleberry Creek allows the mats of floating vegetation, mostly *Hydrocotyle* species, to proliferate and provides considerable treatment for the waste water. The vegetation is a nuisance for those living and navigating the upper reaches of Huckleberry Creek but monitoring data indicate that the water quality continues to improve as it flows downstream. Water quality, in terms of bacteria and nutrient levels were quite good by the time the water reached the Apalachicola River, similar in quality to the control, Clark Creek. The amount of vegetation in the two creeks was not similar.

# Pensacola I-10 Bridge Reconstruction Environmental Assessment

## Ecological Monitoring

**Start / End Dates:** 2005

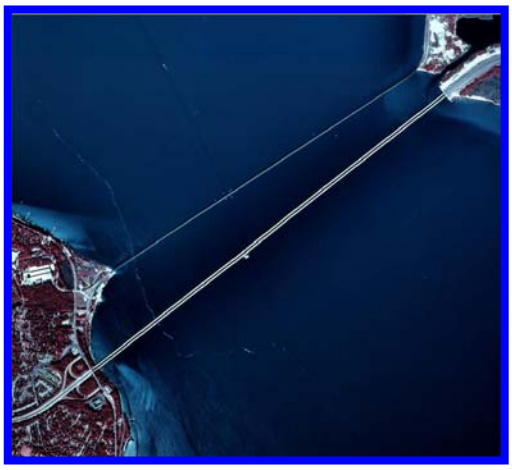
**Key Project Personnel Involved in this Project:**

S. McGlynn, PhD
S. Rupp, BS
K. McGlynn, BA
N. Curtis
B. McGlynn

**Project 6**

### Brief Description of Work Performed:

Hurricane Ivan devastated Pensacola in August 2005 and damaged the I-10 Bridge over Escambia Bay to such an extent that it must be rebuilt. This study determined the extent of marine habitat disruption, mostly seagrass beds, and evaluated potential toxins that might be resuspended re-suspended by the I-10 Bridge reconstruction. This study had national security implications since the I-10 corridor connects vital military bases and municipalities. McGlynn Labs expedited this project. The sediments of Escambia Bay, at the site of the I-10 Bridge replacement, were sampled at 15 sites by McGlynn Labs from our 17 ft Boston Whaler with a stainless steel gravity corer. Sampling sites were spaced at regular intervals, encompassing the span of the new bridge. Sites were identified by GPS. Samples were cored to a depth of 30 cm with a stainless steel corer. The core was homogenized and a representative sub-sample was placed in analyte free containers. Samples were preserved according to NELAC protocol and NELAC holding times were followed. Sediment samples were analyzed at for Volatile Organics (EPA 8260B), Semivolatile Organics (EPA 8270C), Total Recoverable Petroleum Hydrocarbons (FLO-PRO) and metals (Ag, As, Al, Ba, Cd, Cr, Pb and Se by EPA 6010B and Hg by EPA 7471A). 2190 separate and distinct sediment contaminants were assayed.



Results were first evaluated using the *Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C., Table II, Soil Cleanup Target Levels, 2005 edition*. Sediment Arsenic concentrations found exceeded the SCTL. The sediment contaminants were then evaluated using the *Approach to the Assessment of Sediment Quality in Florida Coastal Waters, McDonald, 1994*. All contaminants, including Arsenic, were below the Probable Effects Level (PEL). *A Guide to the Interpretation of Metal Concentrations in Estuarine Sediments, Schropp and Windom, 1988*, revealed that when Arsenic concentrations are normalized to Aluminum concentrations, the Arsenic concentrations are natural, not elevated. The results of this analysis reveal that none of the contaminants assayed pose a real or potential threat to the biota of Escambia Bay based on existing studies and state/federal guidelines.

Seagrasses were surveyed by aerial photography. McGlynn Labs SCUBA divers investigated all the 15 sites. The entire span of the bridge was sampled by FROTUS. No seagrasses were found; the loose unconsolidated sediments are inhospitable to vegetative colonization. The bridge reconstruction represents little threat to the ecosystem.

# The Choctawhatchee Bay Watershed Water Quality Assessment

## Watershed Management and Ecological Monitoring

**Start / End Dates:** 2004

**Key Project Personnel Involved in this Project:**

S. McGlynn, PhD
A. Kubes
K. McGlynn, BA
S. Rupp

**Project 7**

### Brief Description of Work Performed:

This study was funded by the Choctawhatchee Basin Alliance with a grant from the NWFWMD to examine nutrient loading in this Outstanding Florida Waterbody (OFW) as development pressures increase in its rapidly developing basin. McGlynn Labs was a consultant on this study. McGlynn Labs performed the laboratory analysis, data crunching and statistical analysis. Chemical Parameters include, Chlorophylls, True Color, Inorganic Matter (Particulate and Dissolved), Nutrients (TN, NH3, NO2 and NO3), Oxygen Demand (Biochemical), Organic Carbon (Particulate and Dissolved), Organic Matter (Particulate and Dissolved), Phosphorous (total, organic and reactive), Solids (TSS) and Turbidity. McGlynn Labs wrote most of the Final Report.

Phase I was to determine the current condition of the bay utilizing data from the numerous studies and monitoring programs in the Choctawhatchee Bay area. This data then was loaded into a single database for trend analysis. Phase II completed an intensive/event-related water quality study of Boggy and Hogtown Bayous. Periodic sampling was conducted to establish background water quality and assess water quality changes. This sampling effort was coordinated with weather related events and ambient conditions. McGlynn Labs also conducted a review of historical and current data on atmospheric deposition for the study. The data was to be used to aid in the development of the proportionate nutrient loading rate.

The database generated for this study was used by FDEP's TMDL program to assess the ecological staus of the Choctawhatchee Basin. The project recommended the establishment of a Florida-Alabama Watershed Improvement District, stormwater management projects in Niceville for the Boggy Bayou watershed, shoreline restoration at Cessna Park on Hogtown Bayou, the paving project for dirt roads in the Hogtown Bayou watershed and a Septic tank abatement program for the Hogtown Bayou watershed.

# Lillearn Lakes Restoration, Leon County, Florida

## Ecological Restoration

**Start / End Dates:** 2006 – 2008

**Key Project Personnel Involved in this Project:**

S. McGlynn, PhD
S. Rupp, BS
K. McGlynn, BA
J. Stanley, BS
A. Kubes
M. Jones
N. Curtis
B. McGlynn

**Project 8**

### Brief Description of Work Performed:


Phase 1: Muck removal. The unconsolidated accumulated in Lake Blue Heron during was removed and four in-lake sediment sumps were constructed to catch future erosion and runoff. Temporary haul road were constructed in the dry lakebed. Pre and post excavation bathymetries showed that 50,000 cubic yards of sediment were removed.

Phase II: BMP Implementation. The inflows leading to the Lake and the constructed sumps were reconstructed with the lime rock; a long unpaved access road to the dam on Lake Blue Heron was paved with granitic gravel to decrease erosion and dust. Berms and swales were built along the sides of the road to stop erosion; an educational outreach program was implemented to decrease pointless personal pollution and promote best management practices that won the American Waterworks Associations The 2007 Water Conservation Award for Excellence in Public Education; storm drain plaques were installed, designed by local schoolchildren, throughout the community; diseased and beaver damaged shoreline trees were removing. Exotic vegetation was eradicated, this included: Primrose, Alligator Week and Chinese Tallow. We also performed stream restoration, artificial marsh creation and rain garden installations.

Phase II: Restoration. Herbaceous emergent aquatic vegetation, was planted on the shoreline of lake Blue Heron and Arrowhead to enhance nutrient uptake from sheet flow runoff: 300 Lizard's Tail; 1,000 Sand Cordgrass; 2,000 Blue Flag Iris and 1,000 Soft Rush. The re-vegetation of Lake Blue Heron included artificial marsh construction and Raingarden construction. Shoreline trees were also planted: 150 Pond Cypress; 50 Water Tupelo; 30 Chestnut Oaks; 50 Red Cedar; 45 Dogwoods and 45 Red Buds.

# Bay Point Marriott, Panama City, Florida

## Ecological Monitoring

**Start / End Dates:** 2005

**Key Project Personnel Involved in this Project:**

S. McGlynn, PhD
S. Rupp, BS
K. McGlynn, BA
A. Kubes

**Project 9**

### Brief Description of Work Performed:

The Bay Point Marriott expanded its FDEP permit, which requires a healthy aquatic system. To determine the ecological and hydrographic status of the system, Garlick Environmental Associates hired McGlynn Labs.

This assessment required field sampling, ecological monitoring and hydrological modeling all according to FDEP protocol. Hydrological models were used to estimate the time needed to reduce an initial concentration of hypothetical pollutant to 10% of its initial concentration. The model was field verified to determine the flushing and the advective/dispersive nature of the waterway using a tracer dye, Rhodamine, measured in the field with a Hydrolab Minisonde equipped with fluorescence sensors. Flow measurements were performed with both drogues and a Marsh McBurney 201D portable current flow meter, according to FDEP protocols (DEP-SOP-001/02, FT 1800, Field Measurement of Water Flow and Velocity).

McGlynn Labs provided a detailed and specific description of: the system; changes in dimension; the longest path to open water; the mean tidal range, amplitude and periodity; flow amplitude at mid tide for ebb and flood at selected locations within the basin and the location of the entrances to the basin; the phase lag in the tide between the entrance and the center of the system and to the head of the system.

Laboratory Services included triplicate sampling and analysis according to Chapter 62-312, of the Florida Administrative Code. Sampling included: Fecal and Total Coliforms (10 samples over a 30 day period); Oil and Grease; Arsenic; Cadmium; Chromium; Copper; Lead and Zinc. Diel oxygen was measured at 4 hour intervals at all three stations for a 24 hour period. The final report detailing: dates; sampling methods; Chain of Custody; accuracy; precision; NELAC certified; MDL; PQL; water temperature; salinity; depth; weather; tidal stage; the appropriate Rule 62-302, F.A.C., standard for the parameter being measured; and QA/QC data available on request. McGlynn Labs performs many similar studies throughout Florida.

# Control of Invasive Exotic Island Apple Snails (Pomacea insularum) Regional Stormwater Facility #1, Leon County, FL.

**Start / End Dates:** 2008

**Key Project Personnel Involved in this Project:**

S. McGlynn, PhD
J. Van Dyke, Retired FDEP (working for himself)
F. Roosevelt

**Project 10**

**Brief Description of Work Performed: Control of Invasive Exotic Island Apple Snails (Pomacea insularum), Regional Stormwater Facility #1, Leon County, FL., by McGlynn Laboratories Inc and Van Dyke Environmental. Funded by Blueprint 2000.**

6800 pounds of live adult invasive exotic Island Apple Snails were removed to stabilize a half million dollars of planted aquatics in this regional stormwater treatment facility. Immediately after planting approximately $400,000 of these plants were eaten by the snails. During the following winter few snails were observed in the pond as the snails were estivating in the sediments. Blueprint 2000 contracted with Van Dyke Environmental and McGlynn Laboratories Inc, in the spring of 2008 to control the snail population. Using a combination of trapping, baiting and predator release (Redear Sunfish or Shell Crackers, stocked by Michael Hill, FFWCC) the snail population has been brought under control and there has been no subsequent loss of plants in the pond to date. The surviving plants, approximately 25% of the originals are growing and reproducing. In addition, the entire shoreline has been colonized by volunteers like Smartweed, through natural recruitment.

Island Apple Snails have been removed from the 15 acre Regional Stormwater Facility #1 in Leon County, Florida. The littoral shelf of the Regional Stormwater Facility #1 in Leon County was planted with approximately $565,000 worth of aquatic plants. This 15-acre pond was designed with a long Sheet Pile Wall to funnel the stormwater through a planted marsh system of aquatic plants, designed to cleanse stormwater before discharge. This pond was also designed to become a public park. Of the original planting, approximately 75% of the plants have disappeared. Of the original species planted Soft Rush (142,124 planted) and Duck Potato (51,227 planted) have survived. All of the Arrowhead (22,673 planted) and Pickerel Weed (27,468 planted) have vanished. Herbivorous invasive exotic island apple snails appeared in the pond after construction and consumed these plants.

Throughout the project all of the egg clutches laid by these snails have been collected weekly to prevent re-colonization of the pond. Theoretically, the snail population could be successfully managed indefinitely in this manner. We have patented traps and baits designed for use for low-level infestations.