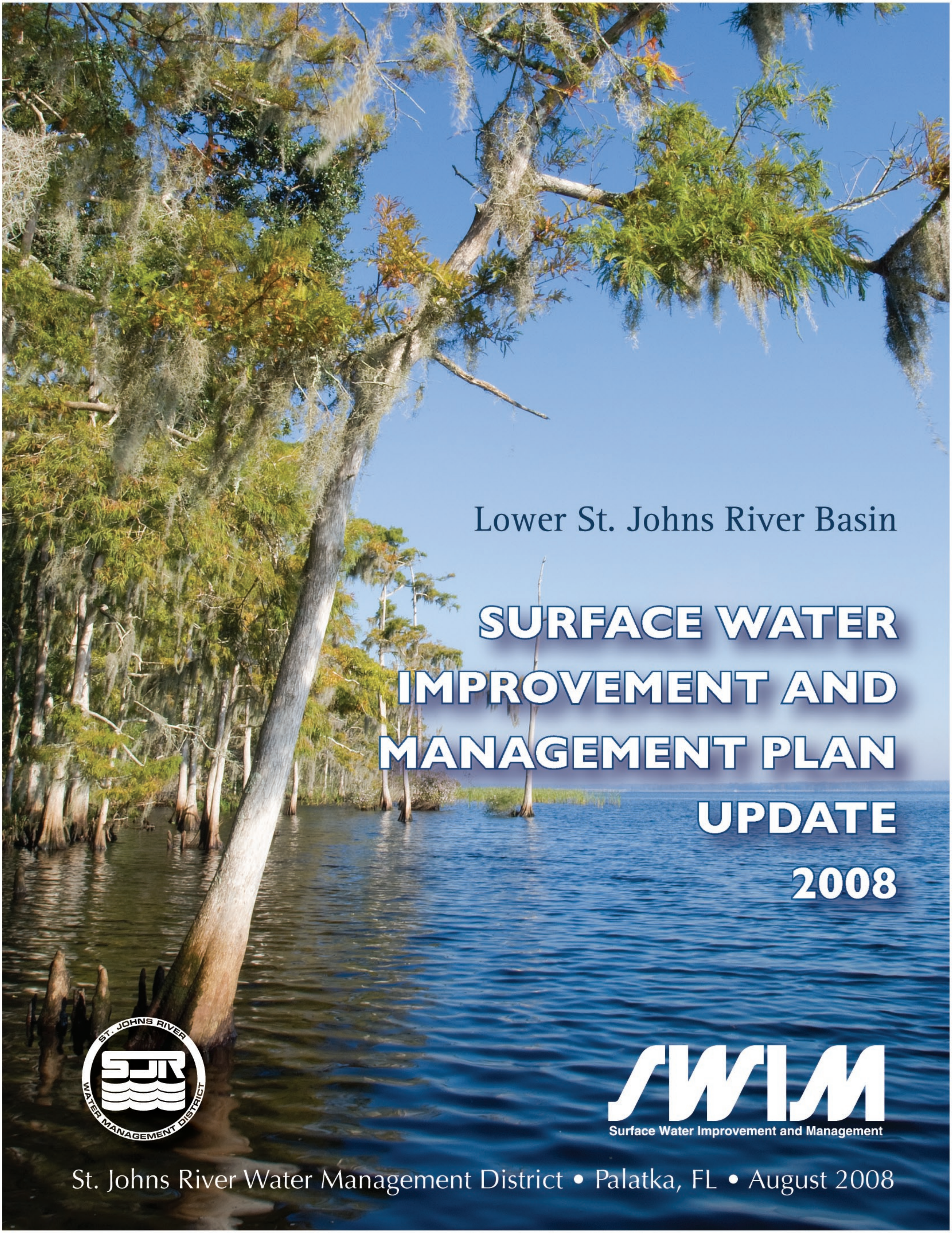

Lower St. Johns River Basin

SURFACE WATER IMPROVEMENT AND MANAGEMENT PLAN UPDATE 2008

SWIM

Surface Water Improvement and Management

St. Johns River Water Management District • Palatka, FL • August 2008

Lower St. Johns River Basin
SWIM Plan Update
2008

August 2008

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EXECUTIVE SUMMARY

INTRODUCTION

The lower St. Johns River and Lake George have documented impairments and degraded surface water quality. Significant scientific understanding has been made in the past 20 years and improvement through project development has continued, although surface waters remain in a degraded state. With the initiation of the surface water management planning cycle, known as the total maximum daily load (TMDL) effort, the Lower St. Johns River Basin (LSJRB) has received funding necessary to complete state-of-the-art water quality modeling resulting in a nutrient pollutant load reduction goal (PLRG). This goal has been used to establish the LSJRB nutrient TMDL, which has initiated major restoration efforts. Through collaborative efforts, the St. Johns River Water Management District (SJRWMD), state, local governments, utilities, and private entities are making unprecedented strides to reduce nutrient discharges ahead of the implementation plan, the Basin Management Action Plan (BMAP). Examples of projects include wastewater treatment facility upgrades, reuse of reclaimed wastewater, stormwater retrofits, and agricultural best management practices.

SWIM PLAN ACT

The Florida Legislature enacted the Surface Water Improvement and Management (SWIM) Act (Chapter 373.451-373.4595, *Florida Statutes* [F.S.]) in 1987 and revised it in 1991. This Act declares that many natural surface water systems in Florida, including the LSJRB, have been or are becoming degraded. The SWIM Act directed SJRWMD, with the cooperation of state agencies and local governments, to design and implement a plan for the improvement of LSJRB surface waters and habitats. The SJRWMD complied with this mandate in the development of the 1989 LSJRB SWIM Plan and subsequent 1993 update. This 2008 plan document serves as an update to that 1993 plan and includes a status report on the state of the LSJRB, a summary of progress on projects undertaken since the 1993 SWIM Plan, and recommendations for future projects and implementation efforts for the next five years.

LOWER ST. JOHNS RIVER 2008 SWIM PLAN UPDATE

The main purpose of this document is to provide an update of the 1993 SWIM Plan and its programs and projects since 1993. This update also includes a reorganized format and additional information to address the U.S. Environmental Protection Agency's (EPA's) nine elements of a comprehensive watershed plan. Although including these elements is not essential for a SWIM plan, having these elements incorporated into the plan helps to make the projects that are detailed in this update eligible for federal Section 319 funding. In addition, information on the Lake George Basin was added, as described in greater detail below.

The management issues have not changed substantially since the 1993 LSJRB SWIM Plan, although many of the issues have been further refined through scientific investigation, new management techniques, and remediation efforts. The four main issues identified in the 1993 LSJRB SWIM Plan were:

- Point and nonpoint sources of pollution
- Destruction of natural systems
- Public awareness and environmental education
- Interagency coordination and management

Since 1993, two additional management issues have been identified: sediment management and toxic contaminants remediation. These issues were previously included with the water quality and natural systems goals; however, the technical community now felt that these topics warranted their own specific goals, objectives, and strategies. This 2008 SWIM Plan Update includes goals for each of the above management issues as follows:

1. Restore and protect the basin’s surface water quality to meet state-designated use classifications.
2. Restore and protect natural systems associated with the basin’s surface waters.
3. Increase public awareness of water resource problems in the basin to generate public support for restoration and protection efforts.
4. Enhance interagency coordination and management of water resources throughout the basin.
5. Implement erosion and sediment management to protect and improve living resources and water quality in the LSJRB.
6. Protect living resources in the LSJRB from toxic pollution to ensure protection and propagation of healthy and well-balanced communities.

This updated plan is organized based on SJRWMD’s programs and initiatives, which correspond to the six SWIM Plan goals. These initiatives are

1. Water quality
2. Biological health
3. Sediment management
4. Toxic contaminants remediation
5. Public education
6. Intergovernmental coordination

Milestones, strategies, and objectives were developed to meet the SWIM Plan goals for each of these initiatives. Projects that have been implemented since 1993 to meet the goals of each initiative are listed as well as projects that are projected to occur during the next five years (2008–2012). Estimated budgets for the future projects are also provided.

Water Quality Initiative

At the time of the publication of the LSJRB SWIM Plan in 1993, water quality was significantly degraded in many of the tributaries within the LSJRB as well as in considerable portions of the river itself. Agricultural and urban runoff had been identified as significant sources of nutrient, bacterial, and toxic contaminant pollution. Wastewater had also been identified as a significant source of pollution from both domestic and industrial sources. Since 1993, several major wastewater sources in the LSJRB began efforts to improve treatment levels to reduce the impacts to the river and its tributaries. These efforts included the elimination of many small wastewater package plants that had low levels of treatment and redirecting that wastewater to larger regional plants with higher treatment levels. The goal of these changes was to improve the quality of wastewater effluent discharged to both tributaries and the mainstem of the river and to reduce overall pollutant loads. Due to these water quality problems, public agencies involved with issues of river water quality worked together to perform a comprehensive examination of the LSJRB to determine the sustainable limits of river pollution.

As part of this examination of river water quality, PLRGs and TMDLs were established. The TMDL process focuses on the assimilative capacity of a water body, which is defined using biological health metrics. PLRGs were also established to estimate loading reductions needed to meet applicable state water quality standards. Once the TMDL/PLRG was established, nutrient reductions were assigned to reduce inputs to the river to no more than its assimilative capacity. These reductions and the projects and programs to achieve them, are outlined in a BMAP. The BMAP process is currently ongoing for both the mainstem and tributaries of the LSJRB. These BMAPs are expected to be completed in 2008.

Since 1993, many water quality related research projects have been conducted. Future research efforts will focus on marine reach and near-coast ecology, freshwater river reach ecology, discharges from the Ocklawaha River, nonpoint source water quality, and regulation associated with the TMDL program.

The Water Quality Initiative includes the following seven strategies to address the issues noted above related to water quality in the LSJRB:

1. Reduction of urban nonpoint source pollution
2. Reduction of agricultural nonpoint source pollution
3. Point-source reductions and reuse
4. Increase understanding of ocean dynamics
5. Reduction of algal blooms
6. Evaluation of the effects of surface water withdrawals
7. Protection of aquifer recharge areas

Water Quality Projects

This plan includes descriptions of 58 water quality related projects that occurred between 1993 and 2007. In addition, 47 projects are expected to continue or be initiated in the next five years (2008–2012). Of these, estimated budgets were provided for 32 projects, with a total cost of more than $17 million.

Biological Health Initiative

The current biological condition of the LSJRB is an important consideration but is difficult to assess because it references an historical condition, before many of the current system stressors occurred. In the LSJRB, comprehensive historical biological data is essentially absent for many areas and for many biological groups. However, it is known that there have been many changes within the watershed that have likely caused changes within the biota of the river (e.g., channel dredging and increased pollutant discharge).

Studies have been conducted on plankton, macroinvertebrates, submerged aquatic vegetation, and fisheries to determine any trends and changes in the biological health of the LSJRB. Historical data does indicate that development in the basin has caused detrimental changes to biota. Evidence includes increased phytoplankton biomass and bloom frequency, and invertebrate deformities in areas of elevated pollutant concentrations. It has also been shown that many pollutants can and do affect fish reproductive function. Therefore, it is reasonable to assume that many of the biological components in the river have changed and/or declined and general ecological health has been negatively impacted as a result of land use changes. The next important step is determining the extent of the impact, which can be accomplished by additional comparative analyses between historical data sets and current data. The collection of additional data is also warranted.

To address these issues and to learn more about the biological health of the river, the following strategies were developed for the Biological Health Initiative:

1. Develop biological indicators.
2. Assess and monitoring submerged aquatic vegetation (SAV).
3. Develop biological management and restoration tools.
4. Assess and monitor algal populations and respond to harmful algal blooms.
5. Assessment, monitoring, and recommendations of fisheries management.
6. Acquire upland buffers.

Biological Health Projects

This plan includes descriptions of 24 projects occurring between 1993 and 2007 that address the Biological Health Initiative. Future efforts include 14 continuing or new projects that will occur from 2008 through 2012. Of these, estimated budgets were provided for 12 projects, with a total cost of more than $3 million.

Sediment Management Initiative

Sedimentation in Jacksonville's urban tributaries affects the aquatic resources and impacts human activities. Impacts from sedimentation and turbidity may include covering SAV, decreasing light penetration, and reducing photosynthesis; smothering macroinvertebrates and harming organisms; impacting fish health and spawning; reducing aquatic habitat; and filling in streams, impacting human enjoyment, boating, and recreation.

The projects and programs associated with sediment management are concerned with reducing the adverse impacts from construction sites and maintenance dredging of major waterways to maintain required navigation depths. Restoration projects also occur in some areas where ecosystems have been impacted by past construction activities. A major focus of this initiative and an important component of the sediment management projects is public education.

The strategies to meet the goal of the Sediment Management Initiative are to

1. Investigate causes and sources of sedimentation and implement projects, programs, and regulations to control sediments.
2. Provide additional education and outreach to the construction industry and citizens.
3. Review current requirements for improving compliance and simplifying processes, while maintaining environmental controls.
4. Encourage the use of polyacrylamide and other flocculants to control turbidity from dewatering operations.
5. Develop incentives for innovative solutions.

Sediment Management Projects

In the period from 1993 through 2007, four sediment projects were completed or started and descriptions of these projects are provided in this update. During 2008 through 2012, five projects are expected to occur. Estimated budgets were provided for three of these projects, at a total cost of more than $20 million.

Toxic Contaminants Remediation Initiative

Protecting water quality and natural systems are among the top priorities of the management organizations in the basin. With the help of many partners, SJRWMD is leading work to improve stormwater treatment, remove harmful sediment deposits, buy environmentally sensitive lands, and execute projects designed to reverse negative trends in water quality and to preserve the areas still in good health.

SJRWMD has conducted several sediment quality assessments since 1993 and these studies found trace organic and metal contaminants in the sediments. In the LSJRB, sediment data indicated good environmental quality, except in the northernmost part of the river in Jacksonville; the Cedar-Ortega river basin in Jacksonville; Rice Creek; and river sediments in the Palatka area. Of the LSJRB sites, sediments in the Cedar-Ortega river basin were of greatest concern due to elevated levels of contamination from PCBs, organic solvents, pesticides, lead, copper, silver, zinc, and chlordane. Sources of the contamination were not identified in the study but will be addressed in later studies.

Future studies will focus on addressing the following two strategies for the Toxic Contaminants Remediation Initiative:

1. Toxic contaminant sediment assessment and diagnostics
2. Toxic contaminant sediment remediation planning

Toxic Contaminants Remediation Projects

This plan includes descriptions of 19 toxic contaminants remediation projects that occurred between 1993 and 2007. In the next five years, seven projects will continue or be initiated, with a total estimated budget of more than $900,000.

Public Education Initiative

Public education is supported by numerous entities in the basin. SJRWMD is the most active source of public information and programs directed at improving the health of the LSJRB. The goal of SJRWMD's Office of Communications and Governmental Affairs and the Outreach Program is to educate the public, media, and governmental entities about water resources, to involve the public in protecting these resources, and to develop partnerships needed to advance the mission of the St. Johns District.

Since the last update of the LSJRB SWIM Plan, SJRWMD has been one of the leaders in the development of two notable partnership initiatives to restore the LSJRB to health: the 1998–2003 River Agenda and the 2006 River Accord. In addition, District staff have given numerous educational presentations to homeowners, civic and school groups, and elected officials on the river's water quality and media tours of the river resulting in hundreds of articles aired or published.

The Public Education Initiative consists of the following two main objectives:

1. Increase public awareness of the importance of water resources, problems affecting these resources, and restoration/protection efforts in the LSJRB.
2. Increase the public's knowledge and understanding of the St. Johns River ecosystem and actions needed to address its problems.

Public Education Projects

During the period of 1993 through 2007, multiple outreach and educational efforts were undertaken to meet the objectives of the Public Education Initiative. The paid media campaign and other outreach efforts are expected to continue in the future, with an estimated budget of $5 million.

Intergovernmental Coordination Initiative

The goal of this initiative is to encourage and enhance interagency coordination efforts and water resource management throughout the basin. Agencies at the federal, state, and local levels have and continue to work cooperatively to achieve the goals for the LSJRB.

The major objectives of the Intergovernmental Coordination Initiative include

1. Establishing administrative frameworks, interagency agreements, and technical linkages required to improve interagency coordination and management of the basin's surface waters and associated natural systems.
2. Establishing priorities for action based on political, governmental, and public input; addressing the needs of the LSJRB as a whole and specific needs related to the three planning regions and individual management units (subbasins)
3. Providing technical support for regulatory and management programs affecting the basin's natural systems

Intergovernmental Coordination Projects

Descriptions are provided for 10 intergovernmental coordination efforts that occurred from 1993 through 2007. For the period of 2008 through 2012, nine coordination projects are expected to occur. These projects have an estimated total budget of more than $79 million, with the majority of the funding ($75 million) going to the River Accord efforts.

LAKE GEORGE BASIN

Historically, the Lake George Basin has been considered as a basin separate from both the Middle and Lower St. Johns River basins and has, therefore, not been considered a SWIM water body. This update of the LSJRB SWIM Plan identifies the Lake George Basin as a SWIM water body. Inclusion of the lake and its watershed is justified because water quality has been shown to be impaired. In addition, recent hydrodynamic and natural resource assessment efforts have shown the importance of improving and maintaining water quality within the Lake George Basin to the subsequent health of both the Middle and Lower St. Johns River basins.

It should be noted that the Lake George program is not as developed as the programs for the Lower and Middle St. Johns River basins. Currently, the Lake George program is in the planning stage, which includes reconnaissance and assessment efforts to further identify the most critical issues facing the lake and to help develop potential strategies to address them. Similar to the development of the LSJRB program, initial planning efforts are currently focused on five key initiatives: water quality, biological health, sediment management, public education, and intergovernmental coordination. As the program becomes more developed, future plan updates will include additional information about this basin.

There are four major groups of water resource issues that are addressed in the Lake George portion of the LSJRB SWIM Plan:

1. Point- and nonpoint source pollution, including
    - Deteriorating surface and sediment quality
2. Deterioration of natural systems, including
    - Alteration of wetlands, nursery areas, and special habitats
    - Alteration of benthic habitat
    - Riverine shoreline erosion
3. Insufficient interagency coordination and management, including
    - Regulation and management of surface waters

- Total maximum daily loads (TMDLs)
- Wetlands policies and regulations

4. Limited public awareness and environmental education programs

Currently, very little data exists to fully analyze the five initiatives in the Lake George Basin. In response to increased discussions about the potential of waters within the Lake George Basin for consumptive purposes, SJRWMD is considering ways to more fully incorporate the Lake George Basin into its future management efforts. There is currently not a Lake George program at SJRWMD similar to the lower, middle, and upper basins; however, SJRWMD has begun planning efforts in the basin and is proposing the assessments outlined in this 2008 LSJRB SWIM Plan.

Water Quality Initiative
There are currently four strategies to address the goal of the Water Quality Initiative:

1. Review and strengthen water quality policies and regulations.
2. Support the state's water policy guidelines for reuse.
3. Evaluate impacts of agricultural and silvicultural operations and implement BMPs to address those impacts.
4. Compile and analyze available water and sediment quality data in conjunction with biological/bioassessment, data to evaluate the extent causes, and effects of pollution on the basin's surface waters.

In the Lake George Basin, five projects have been identified for the period 1993–2007. There are 12 projects that will continue or begin in the next five years (2008–2012). Of these, estimated budget is provided for four projects with a total of approximately $600,000.

Biological Health Initiative
The strategies for the Biological Health Initiative in the Lake George Basin include the following:

1. Protect existing habitat through enforcement of regulations for land development and alteration.
2. Acquire environmentally sensitive land within the Lake George Basin, including buffer zones and wildlife corridors.
3. Inventory existing natural systems, fisheries, and wildlife in the basin and determine their condition, monitor their condition, and identify wildlife habitat needs.

There are two projects related to biological health that were completed in the Lake George Basin. In addition, one project has been identified to occur in the future, with an estimated budget of $45,000.

Sediment Management Initiative
The Sediment Management Initiative currently consists of the strategy to focus on upstream reductions for sediments. One project has already been started related to this initiative in the Lake George Basin and is expected to continue in the next five years (2008–2012) with an estimated budget of $112,000.

Public Education Initiative
The main strategy for this initiative in the Lake George Basin is to heighten public awareness and understanding of problems with the basin's surface waters and associated

natural systems, the cultural impacts contributing to their deterioration, and protection and restoration efforts in the basin. Public education efforts in this basin will be related to outreach efforts in the LSJRB.

Intergovernmental Coordination Initiative

There are two strategies in the Lake George Basin for the Intergovernmental Coordination Initiative:

1. Improve GIS data used for regulation and management decision making.
2. Enhance interagency coordination and management of surface waters and natural systems in the Lake George Basin.

Intergovernmental coordination efforts in this basin will be related to efforts in the LSJRB.

THE FUTURE

This updated plan brings the cataloging of efforts since 1993 up-to-date and forecasts future efforts through 2012. Although the SWIM Program has not been funded in recent years, SJRWMD believes that the SWIM Program has provided significant benefits to the lower St. Johns River and other SWIM water bodies and, therefore, feels it is important to revisit and update these plans periodically. SWIM plans such as this one serve to record technical findings, describe the near-term vision for basin restoration, as well as document progress made and the challenges to restoration. Since the formulation of initiatives and strategies in this plan, the funding environment, both at the state and federal levels, has changed, becoming even more challenging than in the past. With the inclusion of the EPA's nine planning elements, the linkages to potential funding sources are strengthened and increase the possibility of the projects described in this plan to carry forward.

LIST OF ACRONYMS

BMAP	Basin Management Action Plan
BMP	Best Management Practice
BOD	Biological Oxygen Demand
CAMA	Coastal and Aquatic Managed Areas
cfs	Cubic Feet per Second
COJ	City of Jacksonville
CRF	Controlled Release Fertilizer
D&F	Dredge and Fill
DO	Dissolved Oxygen
DRI	Development of Regional Impact
EA	Environmental Assessment
EFDC	Environmental Fluid Dynamics Code
EMAP	Environmental Monitoring and Assessment Program
EPA	U.S. Environmental Protection Agency
EQD	City of Jacksonville Environmental Quality Division
ERM	Effects Range-Medium or Middle
ERP	Environmental Resource Permit
F.A.C.	*Florida Administrative Code*
FDACS	Florida Department of Agriculture and Consumer Services
FDEP	Florida Department of Environmental Protection
FDOH	Florida Department of Health
FDOT	Florida Department of Transportation
FIM	Fisheries-Independent Monitoring
FIND	Florida Inland Navigation District
F.S.	Florida Statutes
FWC	Florida Fish and Wildlife Conservation Commission
FWRI	Fish and Wildlife Research Institute
FY	Fiscal Year
GIS	Geographic Information System
HAB	Hazardous Algal Bloom
IOA	Indices of Relative Abundance
LBR	Local Budget Requests
LID	Low Impact Development
LSJR	Lower St. Johns River
LSJRB	Lower St. Johns River Basin
MERHAB	Monitoring and Event Response for Harmful Algal Blooms
mgd	Million Gallons per Day
MOU	Memorandum of Understanding
MS4	Municipal Separate Storm Sewer System
MSSW	Management and Storage of Surface Water
NAS	Naval Air Station
NPDES	National Pollution Discharge Elimination System
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NOS	National Ocean Service
NPS	National Park Service
NRCS	National Resources Conservation Service
O&M	Operation and Maintenance
OCGA	Office of Communications and Governmental Affairs
OFW	Outstanding Florida Water

PAH	Polycyclic aromatic hydrocarbons
PAR	Photosynthetically Active Radiation
PCB	Polychlorinated Biphenyl
PCU	Platinum Cobalt Units
PEC	Probable Effect Concentration
PLRG	Pollutant Load Reduction Goal
PMN	Permanent Monitoring Network
PWRCA	Priority Water Resource Caution Area
RST	Regional Stormwater Treatment
SAB	South Atlantic Bight
SAV	Submerged Aquatic Vegetation
SJRWMD	St. Johns River Water Management District
SRS	Stratified Random Sampling
STA	Stormwater Treatment Area
SWG	State Wildlife Grant
SWIM	Surface Water Improvement and Management
TAC	Technical Advisory Committee
TCAA	Tri-County Agricultural Area
TMDL	Total Maximum Daily Load
TSI	Trophic State Index
UF-IFAS	University of Florida-Institute of Food and Agricultural Services
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VCUD	Volusia County Utilities Department
WAM	Watershed Assessment Model
WAV	Watershed Action Volunteers
WBID	Water Body Identification
WWTF	Wastewater Treatment Facility

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1.0 INTRODUCTION TO THE SWIM PLAN AND PROGRAMS IN THE LOWER ST. JOHNS RIVER BASIN

1.1 SWIM Act Summary

The Florida Legislature enacted the Surface Water Improvement and Management (SWIM) Act (Chapter 373.451-373.4595, *Florida Statutes* [F.S.]) in 1987 and revised it in 1991. This Act declares that many natural surface water systems in Florida, including the lower St. Johns River (LSJR), have been or are becoming degraded. Factors contributing to this degradation include point and nonpoint sources of pollution and the destruction of natural habitats. The SWIM Act directed the St. Johns River Water Management District (SJRWMD), with the cooperation of state agencies and local governments, to design and implement a plan for the improvement of Lower St. Johns River Basin (LSJRB) surface waters and habitats.

SJRWMD complied with this mandate in the development of the 1989 LSJRB SWIM Plan and subsequent 1993 update. This 2008 plan document serves as an update to that 1993 plan. This update includes a status report on the state of the LSJRB, a summary of progress on projects undertaken since the 1993 LSJRB SWIM Plan, and recommendations for future projects and implementation efforts for the next five years. This plan update was reviewed by the general public (via public workshops) and by appropriate state, federal, and local agencies, many of which have been active partners with SJRWMD in implementing the 1993 LSJRB SWIM Plan. Additional detail on the formal plan review process is provided in the 1993 LSJRB SWIM Plan (chapter 1, pp. 4–6).

Since the 1993 LSJRB SWIM Plan update, the total maximum daily load (TMDL) process has been active in the LSJRB. TMDLs are established for water body sections that are verified as “impaired;” that is, they do not meet their designated water quality standards (refer to Appendix G for a list of verified impaired waters in the LSJRB and projected dates for TMDL development). The water body identification (WBID) numbers in the basin are all classified as Class III water bodies by the state of Florida, which requires the water quality to meet the “fishable and swimmable” criterion. Using this standard, many of the WBIDs in the lower St. Johns River are impaired for nutrients (nitrogen and phosphorus), dissolved oxygen, and fecal coliform bacteria. Other impairments that are less common include heavy metal concentrations such as mercury.

Since 1993, many of the water bodies have been verified as impaired based on recent water quality monitoring data. Other water bodies will remain on the state’s planning list until more samples can be taken to determine whether water quality standards are being met. For water bodies that are verified as impaired, TMDLs will be developed based on the statewide schedule. Several TMDLs have been adopted in the LSJRB; in particular, TMDLs for nitrogen and phosphorus in the river’s mainstem and TMDLs for fecal coliforms in the tributaries. Additional TMDLs are scheduled for adoption in the next few years.

In those areas where TMDLs have been adopted, basin management action plans (BMAPs) are being developed. BMAPs are the implementation plan for meeting the TMDLs and include the list of projects to reduce loads, a monitoring plan, and reporting process. The nutrient TMDLs in the mainstem have had an active allocation and BMAP development process for several years, which includes input from local stakeholders. The mainstem nutrient BMAP is projected to be complete in 2008. The tributary BMAP process for fecal coliform impairments began in 2006 and is expected to be complete in 2009. BMAPs are adopted by Florida Department of Environmental Protection Secretarial Order and are legally enforceable; they are also linked to permits, such as wastewater treatment facility and municipal separate storm sewer system (MS4) permits, where applicable.

The TMDLs and BMAPs are revised in a five-year cycle and will be updated based on the river's response and state water quality standards. This SWIM plan update and the projects described support the implementation of these BMAPs through the promotion of scientific knowledge about the river and its processes, ecological restoration efforts, and training local stakeholders about best management practices (BMPs) and load reductions that are needed to achieve the TMDLs. This SWIM plan and its projects are linked to the TMDLs as the TMDL efforts help to focus management efforts on load reductions.

1.2 Evolution of the Lower St. Johns River Basin SWIM Plan

The main purpose of this document is to provide an update of the 1993 LSJRB SWIM Plan and its programs and projects since 1993. As such, the content is focused on progress since 1993, any programmatic changes that have occurred, and what is planned for the next five years.

The reader is advised to have a copy of the 1993 LSJRB SWIM Plan as a reference. There are frequent references to the 1993 LSJRB SWIM Plan throughout this update. Other documents useful as technical references include the 2003 Florida Department of Environmental Protection (FDEP) Lower St. Johns River Basin Status Report, the 2003 FDEP Middle St. Johns River Basin Status Report, and the St. Johns River Water Management District's individual reconnaissance reports specific to the Lower and Middle St. Johns River basins on biology, hydrology, and sediments.

The most obvious change from the 1993 LSJRB SWIM Plan is the layout of the plan. This update has an initiative-based organization versus a focus on the geographic subbasins of the previous plan. The original 1993 LSJRB SWIM Plan was organized by subbasin and then by subprogram. This document, however, is organized by SJRWMD's programs and initiatives: Water Quality; Biological Health; Sediment Management; Toxic Contaminants Remediation; Public Education; and Intergovernmental Coordination.

The Water Quality Initiative was previously referred to as the Point/Nonpoint Source Subprogram. The Biological Health Initiative was referred to as the Natural Systems Subprogram. The Sediment Management and Toxic Contaminants Remediation initiatives were previously part of the Point/Nonpoint Source and Natural Systems Subprograms. The Public Education Initiative was called the Public Awareness/Environmental Education Subprogram. The Intergovernmental Coordination Initiative was referred to as the Interagency Coordination Subprogram.

This document also addresses the U.S. Environmental Protection Agency's (EPA's) nine elements of a comprehensive watershed plan, which are

1. Identification of causes of impairment and pollutant sources or groups of similar sources that need to be controlled to achieve needed load reductions, and any other goals identified in the watershed plan [See Appendix A for permitted discharges and chapter 2 for land use changes.]

2. An estimate of the load reductions expected from management measures [See Appendix C, Allocation Table for the Lower St. Johns River Mainstem Nutrient TMDL, and descriptions of completed and future projects in chapter 3.]
3. A description of the management measures that will need to be implemented to achieve load reductions in paragraph 2, and a description of the critical areas in which those measures will be needed to implement this plan [See chapter 3 for complete descriptions of management programs in the LSJRB and chapter 5 for management programs in Lake George.]
4. Estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement this plan [See chapter 4 for estimated project budgets for the LSJRB and chapter 5 for estimated budgets for Lake George projects.]
5. An information and education component used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the nonpoint source management measures that will be implemented [See chapter 3 for LSJRB public education program description and chapter 5 for a description of public education efforts related to Lake George.]
6. Schedule for implementing the management measures identified in this plan that is reasonably expeditious [See chapters 4 and 5 for a description of the projects and funding that are necessary. See milestone schedules in chapter 3 for the LSJRB and chapter 5 for Lake George.]
7. A description of interim measurable milestones for determining whether management measures or other control actions are being implemented [See chapters 4 and 5 for a description of the projects and funding that are necessary. See project dates and descriptions in chapter 3 for the LSJRB and chapter 5 for Lake George.]
8. A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made toward attaining water quality standards [See Appendix B for a description of the state's TMDL program and Appendix C for the LSJRB mainstem nutrient TMDL allocation table.]
9. A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under item 8 immediately above [See program initiative descriptions contained in chapters 3 and 5 for the LSJRB and Lake George respectively. Also, see project summary tables in Appendix F.]

Although including these elements is not essential for a SWIM plan, having all these elements incorporated into the watershed plan helps to make the projects detailed in this update eligible for federal Section 319 funding. As funding availability is often the major limitation to project implementation, this update is structured to ensure the maximum eligibility of funding from federal sources. Appendix D details which entities in the LSJRB and Lake George Basin have stormwater master plans and whether these plans meet the EPA criteria to receive Section 319 funding.

1.3 Issues, Goals, and Objectives

The management issues have not changed substantially since the 1993 LSJRB SWIM Plan. Please refer to chapter 3 of the 1993 LSJRB SWIM Plan, pp. 43–62, for a discussion of the issues. Since 1993, many of the issues have been further refined through scientific investigation, new management techniques, and remediation efforts. These advances will be apparent to the reader upon further review of this 2008 LSJRB SWIM Plan Update.

Of the four major goals in the 1993 LSJRB SWIM Plan (chapter 1, pp. 6–7), only Goal 1 was revised to clarify the designated use classifications to be met. The four goals are as follows:

> **Previous Goal 1 (1993 LSJRB SWIM Plan):** Restore and protect the basin's surface water quality Class III or better (Chapter 373.451, F.S.).
>
> **New Goal 1:** Restore and protect the basin's surface water quality to meet state designated use classifications.
>
> **Goal 2:** Restore and protect natural systems associated with the basin's surface waters.
>
> **Goal 3:** Increase public awareness of water resource problems in the basin to generate public support for restoration and protection efforts.
>
> **Goal 4:** Enhance interagency coordination and management of water resources throughout the basin.

In addition to the previous goals, the two management issues of sediments and toxic contaminants were determined to be important enough to warrant their own goals. Previously, these issues were included with the water quality and natural systems goals. Although all of these resources and their management are interrelated, the technical community felt that these topics warranted their own specific goals, objectives, and strategies. Therefore, this 2008 LSJRB SWIM Plan Update includes separate sections on sediment management and toxic contaminants, which have the following goals associated with them:

> **New Goal 5:** Implement erosion and sediment management to protect and improve living resources and water quality in the LSJRB.
>
> **New Goal 6:** Protect living resources in the LSJRB from toxic pollution to ensure protection and propagation of healthy and well-balanced communities.

Once the goals were updated, the original set of objectives (1993 LSJRB SWIM Plan, chapter 4, pp. 64–95) were reviewed and updated as well. The revised objectives reflect how the programs have evolved since 1993 and are now organized to highlight the sediment management and toxic contaminants remediation objectives as well. The revised set of objectives is presented in Table 1-1 along with their corresponding goals.

Table 1-1: SWIM Plan Goals and Objectives

1993 SWIM Objectives	2008 SWIM Objectives
Water Quality Initiative	
Goal 1. Restore and protect the basin's surface water quality to meet state designated use classifications.	
• Develop basin-specific limitations for discharges regulated by the St. Johns River Water Management District. Through scientific investigations, determine the adequacy of existing water quality standards and	• Support development and implementation of PLRGs and TMDLs. • Conserve freshwater resources and protect surface waters.

1993 SWIM Objectives	2008 SWIM Objectives
criteria and water management programs for restoring and protecting the health of the lower St. Johns River system. Recommend changes in the rules of other agencies as appropriate. Develop interim pollution load reduction goals (PLRGs) for priority subbasins by 1994. Develop a schedule for basinwide numeric PLRGs for inclusion in the 1996 revision of the LSJRB SWIM Plan. • Conserve freshwater resources and protect surface waters. • Increase compliance with existing resource protection regulations. Bring all sources into compliance by 1995. • Develop a better understanding of specific basin management needs. Develop management improvements for specific geographic areas. Provide ongoing technical support for resolution of specific policy issues. Implement restoration and protection plans for surface water quality, sediments, and aquatic populations in the LSJRB. • Evaluate historical water chemistry data to describe trends in point- and nonpoint source pollution and effects on surface waters. • Provide an up-to-date description of the water chemistry characteristics of the LSJRB. • Determine the causes and effects of point- and nonpoint source pollution on water quality. • Select or modify the water quality assessment methods that will be used for water quality data collection and analysis.	• Increase compliance with existing resource protection regulations. Bring all sources into compliance by 2012. • Provide ongoing technical support for resolution of specific policy issues. Implement restoration and protection plans for surface water quality, sediments, and aquatic populations in the LSJR B. • Continue to evaluate historical water chemistry data to describe trends in ambient water quality as well as point-source and nonpoint source pollution to evaluate effects and interrelationships. • Select or modify the water quality assessment methods that will be used for water quality data collection and analysis.
Biological Health Initiative	
Goal 2. Restore and protect natural systems associated with the basin's surface waters.	
• Evaluate historical biological data to describe aquatic communities in the basin and their responses to point- and nonpoint source pollution. • Provide biological data that will be used to evaluate the effects of point and nonpoint source pollution on the basin's aquatic communities. • Select and/or modify the bioassessment methods that will be used for evaluating the effects of point- and nonpoint source pollution on aquatic communities. • Determine the cause-effect relationships of point- and nonpoint source pollution on aquatic communities. Use this information in restoration and protection plans. • Develop a database on landscape characteristics for SJRWMD's geographic information system. Provide resource managers with easily accessible information. *(This objective has been accomplished since 1993).* • Provide revised performance standards and Management and Storage of Surface Water (MSSW) and Dredge and Fill (D&F) rule criteria as necessary	• Provide biological data to perform trend analysis and evaluate responses to point and nonpoint pollution on the basin's living resources. • Select and/or modify the bioassessment methods that will be used for evaluating the effects of point- and nonpoint source pollution on the basin's living resources. • Establish benchmark restoration goals for the restoration of living resources in the basin. • Establish critical habitat requirements to restore and support living resources within the basin. • Investigate the causes of hazardous algal blooms (HAB) and the effects of HABs on other living resources. • Protect and restore natural systems through acquisition and management of protected lands.

1993 SWIM Objectives	2008 SWIM Objectives
to protect natural systems. *(This objective has been accomplished since 1993).* • Protect natural systems through the purchase and management of wetlands and adjacent uplands. • Describe the extent of wetlands, nursery areas, and special habitats throughout the basin. *(This objective is superseded by new or revised objectives)*. • Provide an evaluation of losses related to wetlands, nursery areas, and special habitats. Assess the effectiveness of existing regulatory and management policies for the protection and restoration of natural systems. *(This objective is superseded by new or revised objectives)* • Provide technical support for regulatory and management programs affecting the basin's natural systems. *(Moved to Intergovernmental Coordination)*.	
Public Education Initiative	
Goal 3. Increase public awareness of water resource problems in the basin to generate public support for restoration and protection efforts.	
• Increase public awareness of [the] importance [of] water resources, problems affecting these resources, and restoration/protection efforts in the lower basin. • Increase the public's knowledge and understanding of the St. Johns River ecosystem and actions needed to address its problems.	• Increase public awareness of the importance of water resources, problems affecting these resources, and restoration/protection efforts in the lower basin. • Increase the public's knowledge and understanding of the St. Johns River ecosystem and actions needed to address its problems.
Intergovernmental Coordination Initiative	
Goal 4. Enhance interagency coordination and management of water resources throughout the basin.	
• Establish administrative frameworks, interagency agreements, and technical linkages required to improve interagency coordination and management of the basin's surface waters and associated natural systems. • Establish priorities for action based on political, governmental, and public input. Address the needs of the lower basin as a whole and specific needs related to the three planning regions and individual management units (subbasins). • Provide technical support for regulatory and management programs affecting the basin's natural systems. *(Previously listed in Natural Systems section)*	• Establish administrative frameworks, interagency agreements, and technical linkages required to improve interagency coordination and management of the basin's surface waters and associated natural systems. • Establish priorities for action based on political, governmental, and public input. Address the needs of the lower basin as a whole and specific needs related to the three planning regions and individual management units (subbasins). • Provide technical support for regulatory and management programs affecting the basin's natural systems.
Sediment Management Initiative	
Goal 5. Erosion and sediment management to protect and improve living resources and water quality in the LSJRB.	
• Evaluate historical sediment data to describe the effects of point- and nonpoint source pollution on sediment quality. • Select or modify the sediment evaluation methods that will be used for sediment data collection and analysis.	• Identify the primary causes and sources of sedimentation in the LSJRB. • Reduce the primary causes and sources of sedimentation in the LSJRB. • Encourage the development and implementation of new and better technology and BMPs to reduce

1993 SWIM Objectives	2008 SWIM Objectives
• Provide an up-to-date description of sediment conditions as they are related to point- and nonpoint source pollution problems. • Determine the causes and effects of point- and nonpoint source pollution problems [on sediment conditions].	sedimentation at the source. • Improve compliance with existing regulations and requirements regarding BMPs at construction sites, and NPDES regulations, such as adherence to the stormwater pollution prevention plan. • Reduce adverse impacts from dewatering operations (pumping muddy water into drainage systems, streams, and surface waters)
Toxic Contaminants Remediation Initiative	
Goal 6. Protect living resources in the Lower St. Johns River Basin from toxic pollution to ensure protection and propagation of healthy and well-balanced communities.	
No objectives specific to toxic contaminants were included in the 1993 LSJRB SWIM Plan.	• Identify and reduce point- and nonpoint sources of toxic contamination in the LSJRB to levels that will ensure protection and propagation of aquatic living resources. • Determine the fate and effects of toxic contaminants on natural systems and living resources in the LSJRB. • Remediate toxic contamination in LSJRB sediments to Florida Sediment Quality Guidelines, or to levels that will ensure protection and proliferation of living resources. • Select or modify the toxic contaminant evaluation methods that will be used for toxic contaminant data collection and analysis. • Evaluate contaminant data and describe conditions of natural habitats and living resources to guide contaminant assessment and planning.

1.4 Relationship to Other Programs and Plans

1.4.1 State Programs

FDEP/SJRWMD Partnership — The Florida Water Resources Act, Chapter 373, F.S., established a permit system regulating consumptive use of water based on reasonable-beneficial use. The law provided a two-tiered administrative structure headed at the state level by the Department of Natural Resources and at the regional level by five water management districts mainly based on hydrologic rather than political boundaries. The law required each water management district to formulate a water shortage plan and to establish minimum flows and levels for groundwater. In 1993, the Florida Legislature combined the Departments of Natural Resources and Environmental Regulation into a single agency, the FDEP, and empowered this new department to focus its resources on managing entire ecosystems. FDEP and the water management districts jointly implement a broad range of interrelated planning, regulatory, and management programs pertaining to water supply, flood protection, water quality, and protection of natural systems. Pursuant to the legislative intent expressed in Chapter 373, F.S., FDEP regulatory functions increasingly have been delegated to the water management districts, but regulation of point-source pollution discharges remains primarily at the state level.

State Comprehensive Plan — The 1972 Comprehensive Planning Act required the development and legislative adoption of a state comprehensive plan. In 1985, the Legislature adopted the plan as Chapter 187, F.S., containing a Water Resources Policy statement that "Florida shall assure the availability of an adequate supply of water for all competing uses deemed reasonable and beneficial and shall maintain the functions of natural systems and the overall present level of surface and groundwater quality. Florida shall improve and restore the quality of waters not presently meeting water quality standards."

Aquatic Preserve Offices — The 1975 Legislature passed the Aquatic Preserves Act, beginning a statewide system of aquatic areas to receive special state protection and management.

State Water Policy — The Department of Environmental Regulation (now FDEP) adopted the State Water Policy Rule in 1981, which for the first time provided water policy goals, objectives, and guidance for the development and review of programs, rules, and plans related to water resources.

District Water Management Plans and Florida Water Plan — In 1988, FDEP and the water management districts began a coordinated statewide water resource planning initiative involving broad participation by federal, state, and local agencies and private interests. In 1994, comprehensive District Water Management Plans were completed for each region of the state. These plans provided for the first time a regional view of each district's water resources, focusing on bringing together programs relating to water supply, flood protection, water quality, and natural systems.

In 1995, FDEP adopted the Florida Water Plan, which builds upon the regional plans and provides intergovernmental strategies for addressing priority statewide issues. The legal basis for these efforts was strengthened in 1995 when, after two years of administrative challenges, major revisions became effective for the Water Resources Implementation Rule, Chapter 62-40, *F.A.C.* The purpose of this rule is "… to provide water policy goals, objectives, and guidance for the development of programs, rules, and plans relating to water resources, as expressed in Chapter 187, 373, and 403, F.S." Collectively, these planning and rule advancements established the practical administrative and program management tools needed to ensure consistent statewide implementation of Florida's water laws along with the flexibility needed to address regional problems.

1.4.2 Federal Plans and Programs

EPA National Pollution Discharge Elimination System Program — Water pollution degrades surface waters making them unsafe for drinking, fishing, swimming, and other activities. As authorized by the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Point sources are discrete conveyances such as pipes or man-made ditches. Individual homes that are connected to a municipal system, use a septic system, or do not have a surface discharge do not need an NPDES permit; however, industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters. In Florida, the NPDES permit program is administered by the FDEP. Since its introduction in 1972, the NPDES permit program is responsible for significant improvements to our nation's water quality.

In the LSJRB, most NPDES permits are administered by the FDEP-Northeast District Office based in Jacksonville. This office issues permits for industrial and wastewater discharges and wetland mitigation requirements, including the uniform mitigation assessment method. As the administrator, the FDEP conducts compliance inspections and handles enforcement for permit holders in its region. MS4 permits are administered through the Tallahassee office of FDEP and its contractors.

The NPDES permit program is essential to the management of pollutant loads to the LSJRB. It is also essential to protect wetlands for their habitat, flood control, and water quality benefits. The NPDES program controls the flows and concentrations of discharges to the lower St. Johns River and provides a legal mechanism to directly implement new TMDL-based discharge limits directed by the BMAPs. Monitoring and enforcement of discharges is essential to meeting the TMDLs for many types of impairments. If the science and restoration projects details in this 2008 LSJRB SWIM plan are to be effective, pollution sources to the river must be controlled to safe levels and to restore the health of the LSJRB.

The Timucuan Ecological and Historic Preserve — In 1988 Congress created Timucuan Ecological and Historic Preserve as part of the National Park System. TIMU was created to "preserve certain wetlands and historic and prehistoric sites in the St. Johns River Valley" and to protect the many cultural resources present at the park.

Approximately three-quarters of the park consist of inland waterways and wetlands that form an estuarine system of salt marsh, coastal hammock, and marine and brackish waters. The park is bounded by the Atlantic Ocean and Little Talbot Island to the east, the Nassau River in the north, and the St. John's River in the south. Pearson Island, Fanning Island, and the northern portion of Black Hammock Island are three small areas in the park that are heavily developed. These areas within the park boundary are not considered part of the preserve.

Timucuan Preserve encompasses approximately 46,000 acres that include the seaward confluence of the Nassau and St. Johns rivers. These rivers form an extensive estuarine system dominated by salt marsh and coastal hammock habitat, and marine and brackish open waters. These wetlands and waterways are notable for several reasons: both rivers are unusual in that they discharge directly into the Atlantic Ocean rather than into an embayment as is typical of most estuaries; the St. Johns River flows northward through one of the most heavily industrialized areas of Florida; the Nassau River is the only major drainage on the east coast of Florida not channelized or stabilized by engineering structures (except for a recent jetty at the south end of Amelia Island). The estuary is the largest marsh-estuarine system on the east coast of Florida and is the only example of an Atlantic Sea Island estuarine system in Florida. The estuary is one of the most productive in Florida, based on commercial landings of fin-fish and the area provides habitat for several state and federally-listed rare, threatened, or endangered species. Lands and waters in the preserve are owned by the federal government, the state of Florida, the city of Jacksonville, non-profit organizations, and private individuals.

Because the preserve is largely a hydrological phenomenon (75% wetlands and open waters), water-related issues naturally predominate. For that reason, land use with and adjacent to the preserve, as well as land use anywhere in the watersheds, connected by either groundwater or surface water has the potential to affect the preserve. For example, varied land use results in: (1) severe water pollution in many St. Johns tributaries upstream of the preserve; (2) elevated metal concentrations in upstream sediments of the St. Johns River; (3) industrial effluent (especially from pulp and paper mills) input upstream of the preserve; (4) the propensity of malfunctioning septic systems within and upstream of the preserve.

The National Park Service (NPS) is a cooperative partner of the Three Rivers Conservation Coalition. Other partners include FDEP State Parks system, FDEP Coastal and Aquatic Managed Areas (CAMA), and the Nature Conservancy. This partnership was established with the purpose of preserving water quality, providing assistance and coordination of data collection within and adjacent to the Timucuan Preserve. An ongoing priority of the Three Rivers Conservation Coalition is to be more proactive in reviewing plans and interacting with local governments to ensure that planning efforts help protect water quality.

NPS is also an active player in collecting water quality data with the city of Jacksonville and the Nassau-St. Johns River Aquatic Preserve. Every two months, the city of Jacksonville monitors ambient water quality at 12 stations within the preserve. The NPS provides field support as needed, as well as funding for the monitoring of chlorophyll *a*.

Finally, as one of the landowners/managers in the LSJRB, the NPS is proactive in reviewing all zoning changes and reviewing dock permits, general development plans, and the management plans of other agencies to ensure water quality protection standards.

American Heritage River Program — The entire St. Johns River, including the LSJRB , was officially designated an American Heritage River by President Clinton on July 30, 1998, in recognition of its ecological, historic, economic, and cultural significance. This designation resulted in a formal agreement that the signatory partners (federal agencies, state agencies, and the river community) would work together to preserve and enhance the water quality, and ecological and cultural resources along the St. Johns River, to stimulate economic revitalization, and to cooperate with other state, local, and federal agencies to serve their common interest in the St. Johns River. Federal agencies entered into this agreement for all the purposes stated above, to the extent allowed by law and agency policy, including staffing and funding.

The American Heritage Rivers initiative is intended to help river communities seek federal assistance and other resources to meet challenges related to river restoration. Without any new regulations on private property owners, state, local, and tribal governments, the American Heritage Rivers initiative is about making more efficient and effective use of existing federal resources, cutting red-tape, and lending a helping hand.

Through this agreement and implementation efforts, a steering committee was formed to guide river-wide efforts and improve coordination among local stakeholders. In support of these efforts a 2003 River Summit was held to discuss economic and environmental issues that affect the entire river. As a result of the community input at the River Summit, a high-level working group was formed that included local government officials, nonprofits organizations, civic leaders, and key agencies. The working group endorsed a report called the “St. Johns River Restoration Strategy” in May 2003. Among other recommendations, the report called for the creation of a river-wide nonprofit organization that supported the goals of the American Heritage River Initiative and the objectives identified at the River Summit. Based on this report and recommendations, the St. Johns River Alliance was formed.

As of 2007, the St. Johns River Alliance has an active Board of Directors and a list of projects that promote river restoration, public awareness, public access, and economic links to river health. The St. Johns River Alliance is supported by funding from the municipalities in the St. Johns River watershed and through some private support. The Alliance has created a unique forum for the key stakeholders such as citizens groups, local governments, and natural resource management agencies to share information and to promote efforts along the entire river.

1.4.3 Other Agencies and Local Governments

The following table provides a list of the types of agencies involved in water management at all levels of government and the responsibilities of each entity.

Table 1-2: Agencies Responsible for Water Management

FEDERAL
Department of Commerce National Oceanic and Atmospheric Administration • Weather forecasting and climate change • Coastal ecosystems • Fisheries
Environmental Protection Agency • Implementation of programs under the Clean Water Act and the Safe Drinking Water Act, Superfund, and the Resource Conservation and Recovery Act
Department of the Interior U.S. Geological Survey • Assessment of quantity and quality of the nation's water resources, includes National Water-Quality Assessment Program • Biological Resources Division, includes National Wetlands Research Center U.S. Fish and Wildlife Service • Endangered species, migratory birds, certain marine mammals, and freshwater and anadromous fish
U.S. Army Corps of Engineers • River and harbor navigation • Flood control • Hydroelectric power • Environmental restoration • Wetland permitting
Department of Agriculture Natural Resources Conservation Service • Programs to reduce erosion and to conserve and protect water • National Resources Inventory • Wetlands Reserve Program
Federal Emergency Management Agency • Flood zone mapping • National Flood Insurance Program • Disaster relief
STATE
Executive Office of the Governor • Coordination of interagency review of development projects and grant applications • Review of water management district budgets • Appointment of water management district Governing Board members

Department of Environmental Protection • Water Resources Implementation Rule • Florida Water Plan • Pollution control permitting and monitoring • Ecosystem management and restoration • Water quality standards • Solid and hazardous waste management • Aquatic weed control • Administration of SWIM and Preservation 2000 funds • Mine reclamation management • Marine resources
Department of Community Affairs • Areas of Critical State Concern • Developments of Regional Impact review • Coastal management • Emergency management coordination and disaster relief
Florida Fish and Wildlife Conservation Commission • Research and manage habitats to maintain the long-term well-being of fish and wildlife resources • Assess development impacts on habitats
Department of Health • Protect public health, related to solid waste disposal, septic tanks, and drinking water
Public Service Commission • Private water and sewage utility rate structures and approval
Department of Agriculture and Consumer Services • Development of agricultural and silvicultural BMPs for protection of water resources • Regulation of pesticide and fertilizer use
REGIONAL
Water Management Districts • District water management plans • Regional water supply plans • Water resources development • Water supply assistance to local governments • Flood protection and emergency response • Stormwater management • Natural system protection and restoration • Consumptive use permitting • Water well construction • Environmental Resource Permitting (ERP) Program • SWIM plans • Land acquisition for conservation and recreation • Water shortage orders
Regional Planning Councils • Developments of Regional Impact review • Growth management coordination • Surface water quality planning and studies • Development of regional policy plans that provide guidelines for local comprehensive plans • Hurricane evacuation planning and mapping
Water Supply Authorities • Water distribution • Development of regional sources

LOCAL
City and County Governments • Water supply development • Local environmental controls and monitoring • Building codes, zoning, and land use • Drinking water and wastewater services • Growth management and comprehensive planning • Land acquisition and management • Emergency preparedness • Public utility protection (water, sewer, solid waste) • Stormwater management • Water conservation programs • Emergency water restrictions
Special Districts • Operation, maintenance of local surface water management systems (chapter 298 districts, others)

Source: *Water Resources Atlas of Florida*, 1998

2.0 DESCRIPTION OF THE LOWER ST. JOHNS RIVER BASIN

2.1 Lower Basin Planning Units

The LSJRB is made up of 11 smaller subbasins, also termed planning units (Figure 2-1). A planning unit is either an individual, usually large, primary tributary basin or a group of small adjacent primary tributary basins with similar characteristics. Since the 1993 LSJRB SWIM Plan, changes to subbasin delineations have occurred resulting in a decrease in the total number of planning units from 13 to 11. An explanation of why and how each planning unit was created can be found in Appendix B of SJRWMD technical report SJ97-1. Each of the basin's planning units, according to the 1993 basin delineation, is described in the 1993 LSJRB SWIM Plan, and includes discussions for the region's hydrology, geology and groundwater resources, soils and related land uses, and water quality problems as they are related to historical and current land uses.

2.2 The Lower Basin and How It Relates to the Lake George, Middle and Upper Basins

The LSJRB is that portion of the St. Johns River that extends from the confluence of the St. Johns and Ocklawaha rivers near Welaka, north to the mouth of the St. Johns River at Mayport in Jacksonville (see Figure 2-2). It is an area of approximately 2,777 square miles and represents approximately 22 percent of the area within SJRWMD. The counties that largely occur within the basin boundary are Duval, Clay, St. Johns, Putnam, Flagler, and Volusia.

Upstream of the LSJRB is the Lake George Basin. This area is the portion of the St. Johns River that begins at its confluence with the Wekiva River downstream of Lake Monroe and ends at its confluence with the Ocklawaha River and the beginning of the lower basin. The Lake George Basin includes the subbasins of Lake Woodruff, Alexander Springs, Lake Kerr, and Lake George itself. The entire Lake George Basin drainage area is 816 square miles and includes portions of Volusia, Marion, Lake and Putnam counties. Also upstream is the Ocklawaha Basin, which contributes flows into both the Lake George Basin and the LSJRB. Water flows from the Ocklawaha are affected by rainfall, land use changes, as well as by a large water control structure (the Rodman Dam). Water quality and hydrodynamics downstream in the Lake George Basin and the LSJRB are affected by the Ocklawaha's water quality and the timing and quantity of water releases from the Rodman Dam.

The Middle St. Johns River Basin extends from the inflow of the Econlockhatchee River upstream of Lake Harney northward to the confluence with the Wekiva River, just south of DeLand. The basin area encompasses over 1,200 square miles and sizable portions of Lake, Volusia, Seminole, and Orange counties, and much smaller parts of Marion and Brevard counties. The middle basin is comprised of a variety of landscapes, including highly urbanized areas such as the northeastern portion of Orlando, rapidly urbanizing areas such as Winter Park, as well as largely undeveloped areas such as the Deep Creek Basin. Lakes Jesup, Monroe, and Harney are the three major lakes in the basin.

The Upper St. Johns River Basin extends from the headwaters of the St. Johns River in Indian River and Okeechobee counties to the confluence of the St. Johns and Econlockhatchee rivers in Seminole County. The 2,000-square-mile basin originally contained over 400,000 acres of floodplain marsh but has undergone significant changes during the 20th century that necessitated a massive flood control and wetland restoration project, which is nearly complete.

Upstream sources of pollutants are a major concern in the lower basin. Substantial loads of nutrients and other contaminants originate in the middle basin and the Ocklawaha, and Lake George basins and then flow into the LSJRB. The St. Johns River from Lake George to the mouth exhibits a regular annual spike in nitrate–nitrite concentration starting in late summer and lasting through much of the winter. This increase could be due to several occurrences including (1) remineralization of phytoplankton organic matter; and (2) wet-season rehydration of riparian areas and the flushing of remineralized nitrogen from those areas. In spring and summer, competition for nitrogen by phytoplankton keeps nitrate–nitrite concentrations low. The river's flow rate is highly variable and river water coming from the upstream basins can have long residence times and therefore be substantial sources of nutrients and sources for nutrient cycling. The Lake George Basin is considered a potential source of additional nutrients because of its own hydrodynamics, potential sediment sources and long residence time, and may add to the nutrient loads from the middle basin flows. Therefore, the upstream basins have a strong influence on the water quantity and quality coming into the lower basin and have a substantial influence on biological resources and human uses in the LSJRB. Management of resources in the lower basin needs to be related to the upstream inputs and consideration of changes occurring upstream.

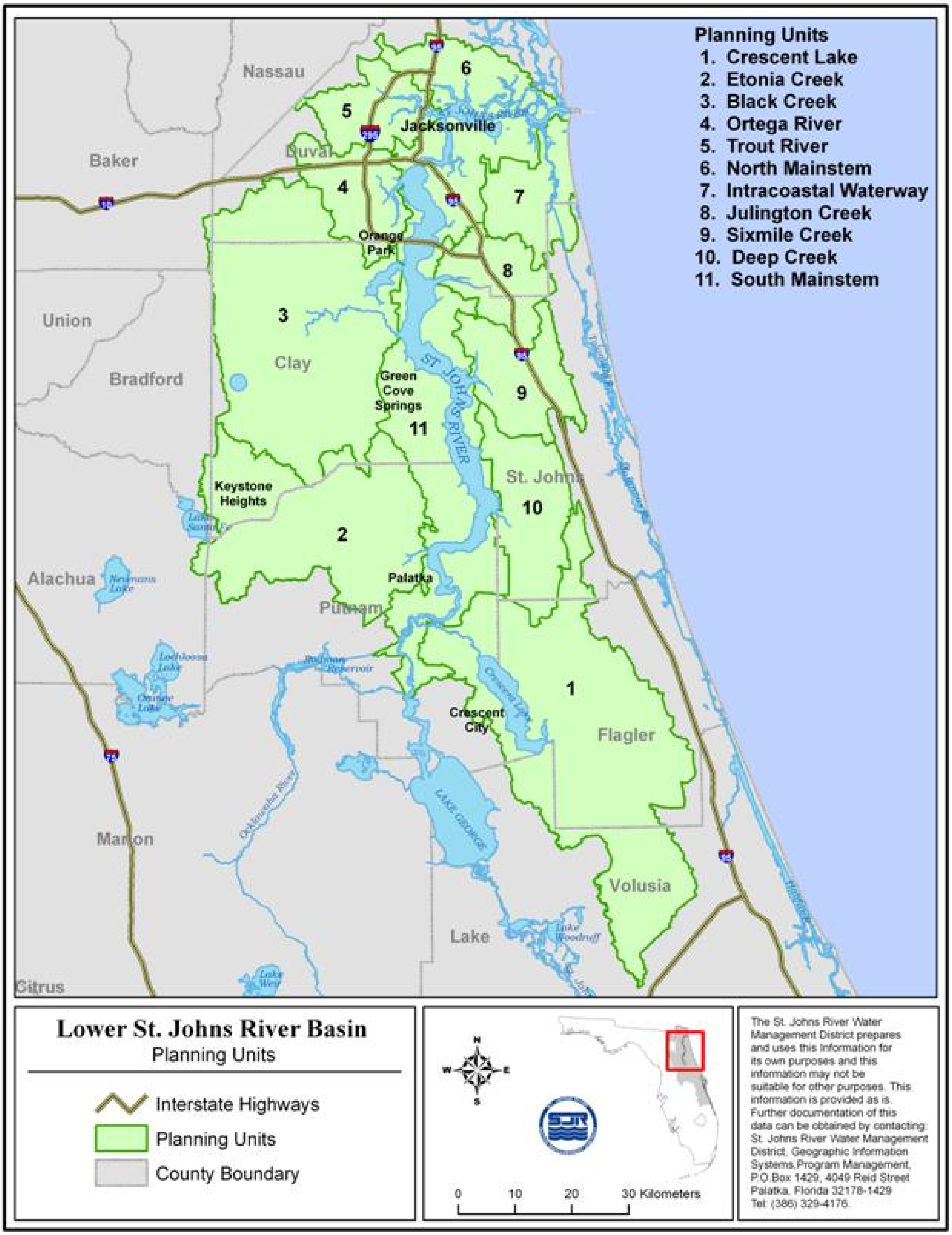

Figure 2-1: Planning Units of the Lower St. Johns River Basin

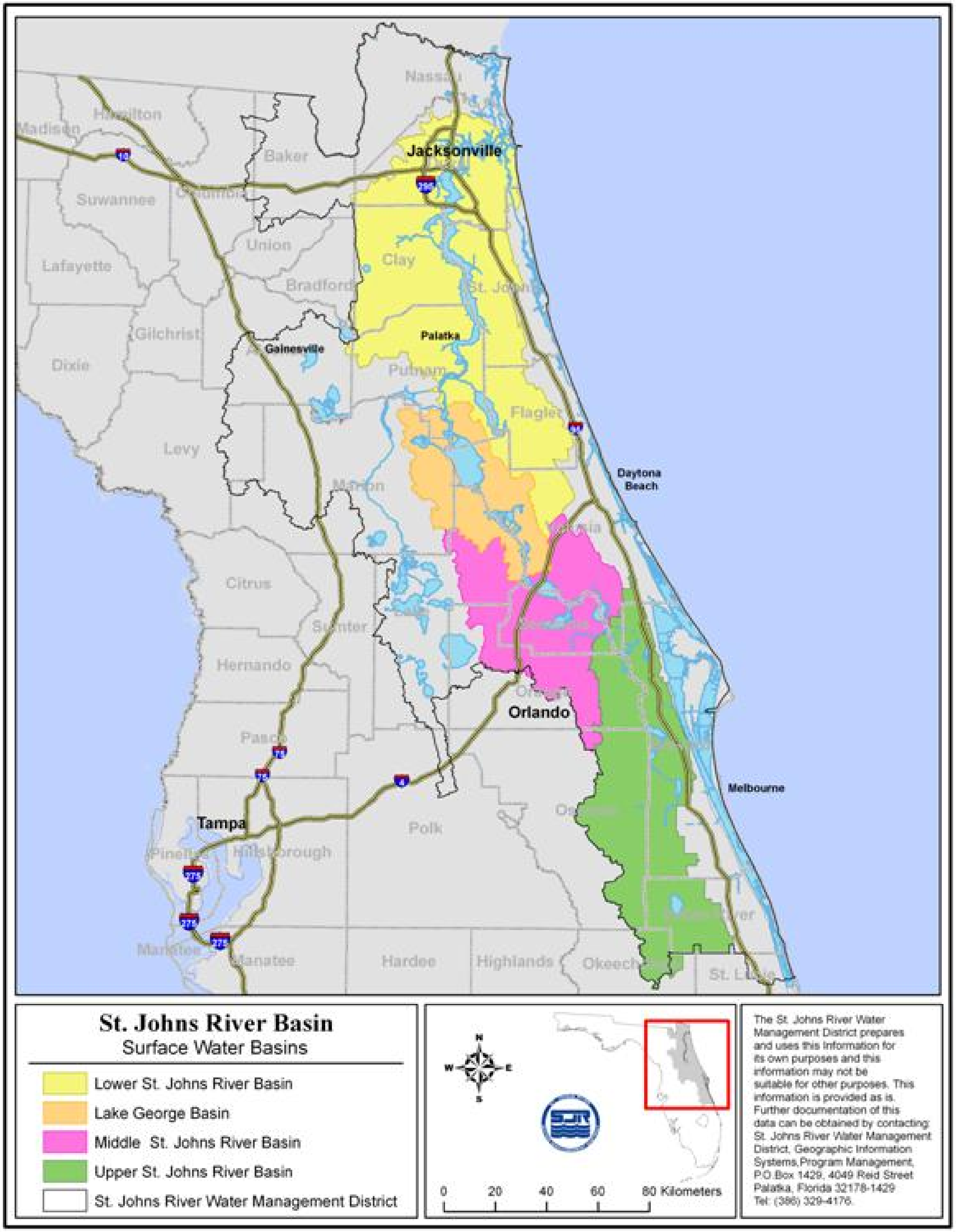

Figure 2-2: The Lower, Middle, and Upper St. Johns River Basins

2.3 Population Trends

Table 2-1 lists historical, current, and projected population figures for the basin's counties and major cities. Duval is the most densely populated county in the basin, with the majority of the population associated with the city of Jacksonville. The city of Jacksonville together with northern portions of Clay and St. Johns counties comprise the greater metropolitan Jacksonville area and have a combined population of close to 1 million. Flagler, Clay, and St. Johns counties have experienced the greatest population growth in the basin since the 1950s, with a fivefold to tenfold increase. Flagler continues to be the state's fastest-growing county, although growth in the 1990s (73.6 percent) was slower than in the preceding decades (145 percent in the 1970s and 165 percent in the 1980s). Since 1990, St. Johns County has ranked as the seventh fastest-growing county in Florida.

Table 2-1: Lower St. Johns River Basin Population Statistics

County	1950 Census Population	1990 Census Population	2000 Census Population	2020 Projected Population
Duval County	304,029	672,971	778,879	972,675
St. Johns County	24,998	83,829	123,135	200,629
Clay County	14,323	105,986	140,814	208,212
Putnam County	23,614	65,070	70,423	80,614
Volusia County	74,229	370,712	443,343	583,387
Flagler County	3,367	28,701	49,832	92,340
Total	**444,560**	**1,327,269**	**1,606,426**	**2,137,857**
Source data: FDEP 2003 Lower St. Johns Basin Status Report				

The Northeast Florida Regional Planning Council identified census tracts in the region with the highest and lowest rates of population change. In the LSJRB, the areas with the greatest population increase include all of Flagler County, Kingsley Lake to Lake Lowery, south of Doctors Lake, south of Julington/Durbin Creeks, Clay County west of the town of Orange Park, and southeast Jacksonville/Duval County (south and east of the St. Johns River). The greatest declines in population have occurred west of the St. Johns River in the city of Jacksonville.

2.4 Land Use

Prominent types of land use in the basin are urban and built-up, upland forest, wetlands, and agriculture. Most urban and built-up land is concentrated in Jacksonville/Duval County and Palatka. Continued residential expansion is projected in southeast Duval, northern St. Johns, and Clay counties. With the widening of State Road (SR) 207 and the addition of central sewer and water, increased residential and commercial development is expected in East Palatka. Most upland forest consists of pine plantation or silviculture (23 percent) and is distributed fairly evenly throughout the basin. A breakout of basinwide land uses can be found in Appendix F of the FDEP 2003 Lower St. Johns Basin Status Report.

The Trail Ridge along the basin's northwestern boundary is the site of heavy mineral mining, primarily for titanium. Other heavy mineral deposits can be found in ancient beach ridges in southeastern Clay and northeastern Putnam counties. Sand and gravel are also mined on the sandy ridges in Clay and western Putnam counties. Additional tracts of land are designated for mining in Putnam and Clay counties.

Agriculture land use is concentrated in Flagler, St. Johns, and Putnam counties, known as the Tri-County Agricultural Area (TCAA). This region is located along the eastern shoreline of the lower St. Johns River and covers a total area of 376,000 acres, of which 32,000 acres are irrigated row cropland (primarily potatoes, cabbage, and sod) and 8,200 acres are pastureland. Ferneries and other nurseries are concentrated just south of Crescent Lake and are largely outside the basin.

Various types of publicly owned lands in the basin include state parks, preserves, wildlife management areas, and state forests (Figure 2-3). The better known areas include Haw Creek State Preserve, Gold Head Branch State Park, Ravine State Gardens, Timucuan Ecological and Historic Preserve, Jennings State Forest, Fort Caroline National Memorial, Camp Blanding Military Reservation, and Camp Blanding Wildlife Management Area.

2.4.1 Projected Future Land Use Changes

Silviculture has historically dominated the LSJRB. However, agricultural, industrial, and urban development has been increasing throughout the basin. Rapid urbanization has been occurring in the northern portion of the basin, which includes Jacksonville, Orange Park, and Middleburg. Land use in this area is characterized by development, including residential dwellings and high-intensity commercial and industrial activity. The majority (64 to 82 percent) of this land use drains to the oligohaline and meso-polyhaline reaches of the LSJRB. In contrast, the southern portion of the basin is largely rural, with forestry and row crop agriculture predominating. The majority (62 to 98 percent) of land use in this area drains to the fresh tidal, lacustrine reach of the LSJRB.

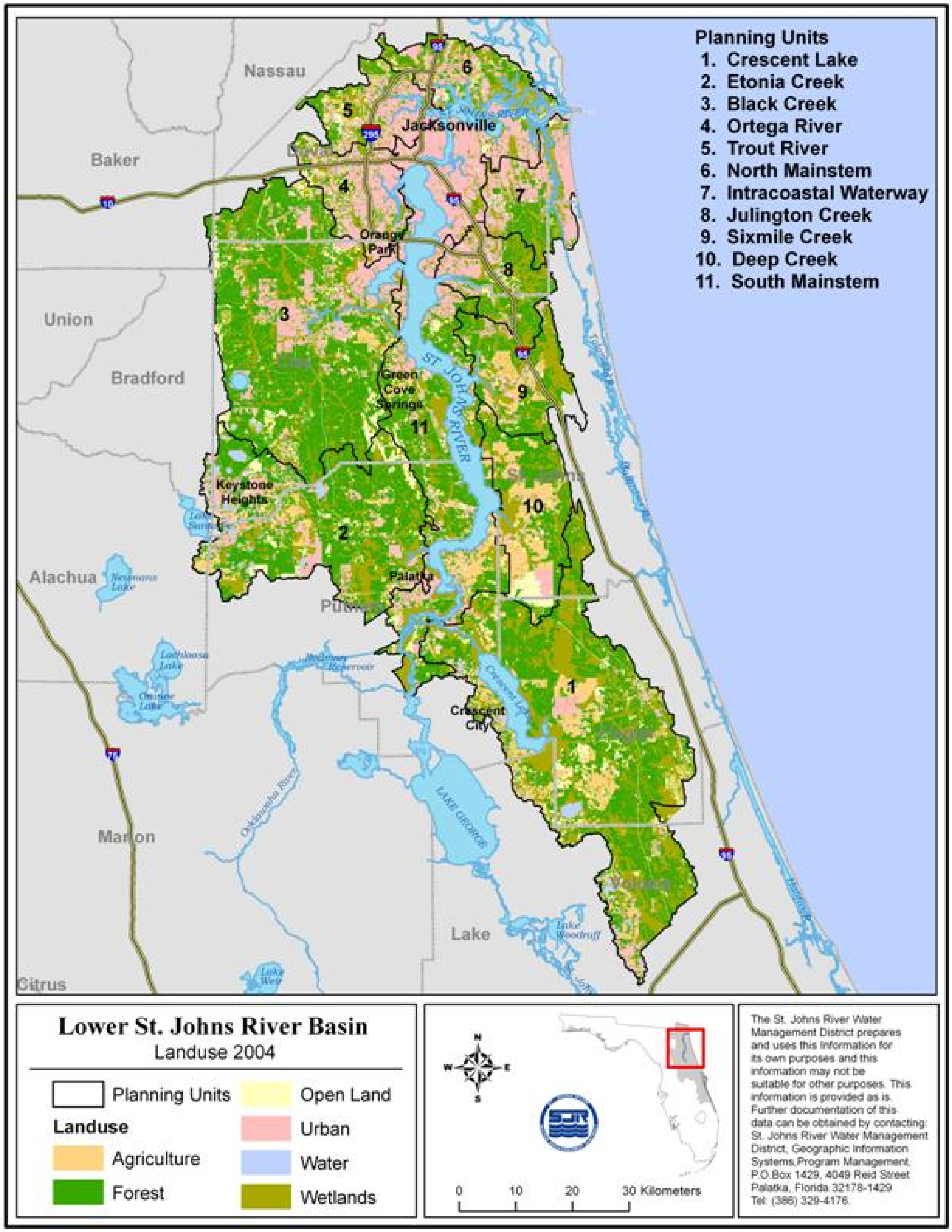

Figure 2-3: Land Use in the Lower St. Johns River Basin

2.5 Geology and Groundwater Resources

The geology and groundwater resources of the LSJRB are fully described in chapter 2 of the 1993 LSJRB SWIM Plan on a planning region basis. For a detailed discussion of these resources please refer to that document.

SJRWMD identified priority water resource caution areas (PWRCA), which are those areas where existing and reasonably anticipated sources of water and conservation efforts may not be adequate to (1) supply water for all existing legal uses and reasonably anticipated future needs, and (2) sustain the water resources and related natural systems. SJRWMD identified the PWRCAs based on the water resource constraints and the results of water use, groundwater, and surface water assessments. The PWRCAs comprise approximately 39 percent of SJRWMD.

Figure 2-4 illustrates PWRCAs within SJRWMD. In the LSJRB, the PWRCAs extend along the eastern shore of Crescent Lake.

2.6 Hydrology

Chapter 2 of the 1993 LSJRB SWIM Plan includes a discussion of monitoring stations from which hydrologic data was collected within the LSJRB. Several of these stations have become inactive since 1993 and are no longer generating hydrologic data. Similarly, other hydrologic stations have since become active providing new sources of data within the basin. A list of currently active hydrologic stations in the LSJRB is presented in Appendix E. Stations are grouped according to the planning unit in which they are located and characterized by the type of event it monitors (rainfall, stream flow/discharge, or stage/water level). Data from these stations will be used in water quality and hydrological evaluations. A more detailed overview of the surface water system and the existing rainfall and stream flow monitoring networks in the LSJRB can be found within the various hydrologic reports published electronically at the following Web link: http://www.sjrwmd.com/hydroconditionsreport/otherhydroreports.html.

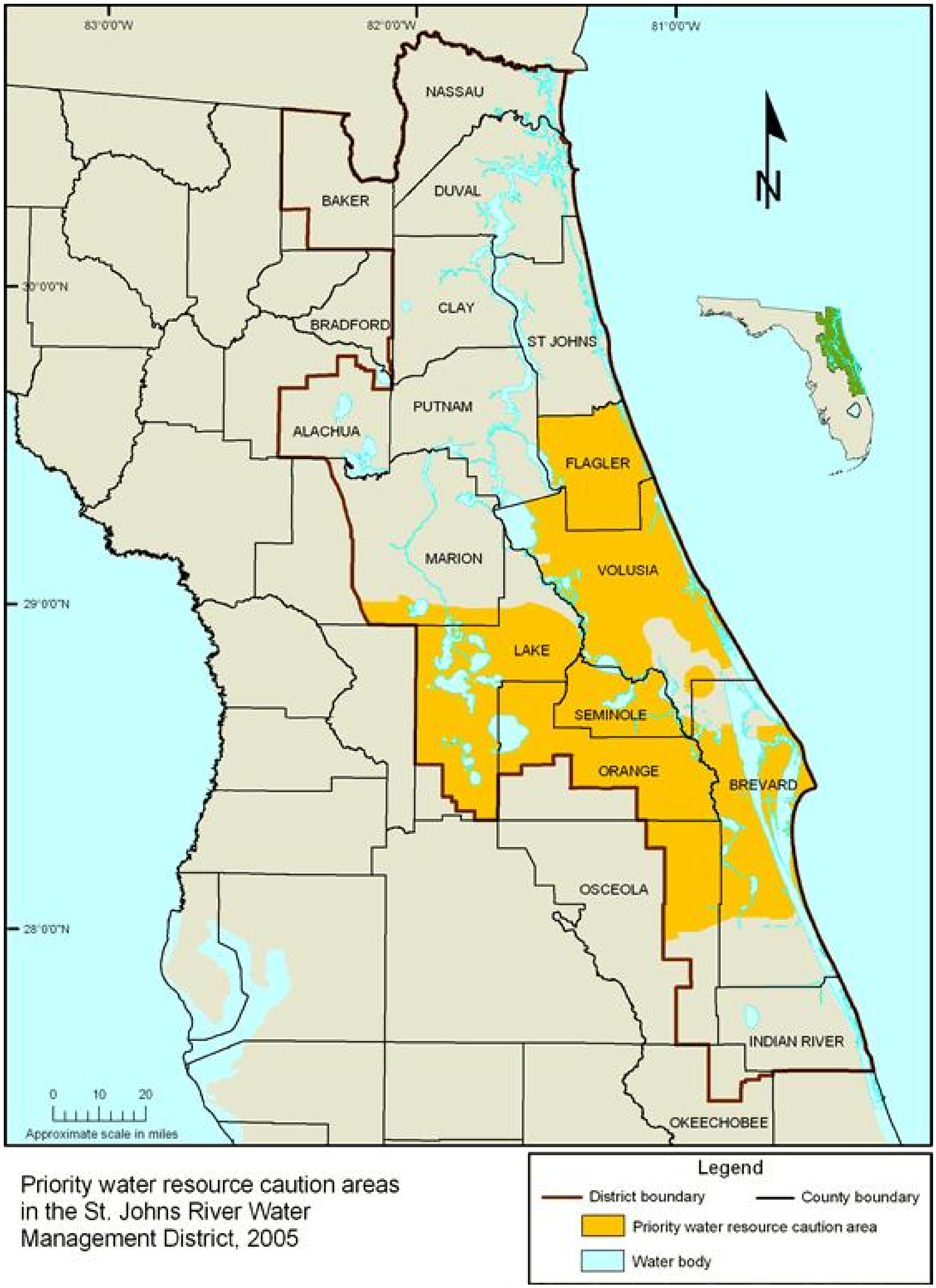

Figure 2-4: Priority Water Resource Caution Areas in SJRWMD

3.0 MANAGEMENT PROGRAMS IN THE LOWER ST. JOHNS RIVER BASIN

The management programs described in this section are organized by SJRWMD's programs and initiatives: Water Quality; Biological Health; Sediment Management; Toxic Contaminants Remediation; Public Education; and Intergovernmental Coordination. Within each section are a number of strategies and objectives that direct the associated management projects toward the accomplishment of the initiative's goals (see chapter 1).

A list of management projects and descriptions is included in section 3.7: Past/Current Projects and Section 3.8: Future Projects. These projects are considered in terms of the strategy and management activity which they are designed to accomplish. Management activities include resource assessment, development of management tools, and implementation efforts. Appendix F contains a summary table of all management projects within the LSJRB.

3.1 Water Quality Initiative

At the time of the publication for the LSJRB SWIM Plan in 1993, water quality in many of the tributaries within the LSJRB, as well as considerable portions of the river itself, was significantly degraded. Agricultural and urban runoff had been identified as significant sources of nutrient, bacterial, and toxic contaminant pollution. Wastewater had also been identified as a significant source of pollution from both domestic and industrial sources. Since 1993, several major wastewater sources in the LSJRB began efforts to improve treatment levels to reduce the impacts to the river and its tributaries. These efforts included the elimination of many small wastewater package plants that had low levels of treatment and redirecting that wastewater to larger regional plants with higher treatment levels. The goal of these changes was to improve the quality of wastewater effluent discharged to both tributaries and the mainstem of the river and to reduce overall pollutant loads.

The myriad of water quality problems that affected the LSJRB could be generalized into three categories in terms of their impacts and recovery strategies: (1) physical alteration of habitats through dredging, sedimentation, bulk-heading/shoreline hardening, and wetland riparian area destruction; (2) contamination from toxic metals and synthetic organic compounds from industrial point sources, urban runoff, illicit landfills and other sources; and (3) a degradation of the river and estuary symptomatic of excessive nutrient enrichment and eutrophication. Approaches to reversing habitat destruction and toxic contamination, discussed elsewhere in this plan, focus primarily on identification of problems areas and remediation. However, the approach to reversal of eutrophication had to be fundamentally different, as unlike the legacy problems of toxic contamination and physical habitat destruction, the causal factors of eutrophication were essentially poorly understood and unabated by permit limits. And while evidence of eutrophication was apparent based on correlated, indirect measures, no direct, defensible criteria existed for unique river estuaries such as the St. Johns River to identify impairment. Such scientifically-defensible targets, and the quantitative characterization of relationships between causal pollutants and these targets, are necessary components of restoration.

By 1995, public agencies involved with issues of river water quality; Duval County Department of Bio-Environmental Services, U.S. Army Corps of Engineers, the U.S. Geological Survey, SJRWMD, and the FDEP; came to the general conclusion that a comprehensive examination of the LSJRB was necessary in order to define the sustainable limits of river pollution as it pertains to eutrophication. This effort evolved into three interrelated branches of investigation to determine: (1) the magnitude, timing, and spatial distribution of pollutants entering the river (including its tributary mouths below the head of tide), or the external pollutant load; (2) the hydrodynamic, or water circulation and salinity patterns of the river, that could be linked to a water quality model to assess the effect of this external pollutant load on the river; and (3) the nature of ecosystem alteration brought about by increased nutrient enrichment. Investigations under this latter category were essential to quantify specific, defensible water quality targets to protect the vital aquatic plant, animal, and ultimately human components of this river ecosystem.

The effort to establish nutrient load limits for the St. Johns River gained considerable momentum during the second half of the 1990s, owing to several significant events. In 1998, the environmental group Earthjustice successfully sued the EPA over its failure to establish TMDLs, with the resulting consent agreement establishing a strict schedule to promulgate the nitrogen and phosphorus TMDLs for the lower St. Johns River. An upsurge in river resource protection interest by local environmental groups, such as the Stewards of the St. Johns River, the Putnam County Environmental Leaders Council, and later, the Riverkeeper organization, fueled intense scrutiny over impending permits and compliance infractions for surface water discharges. Also during this time, the specter of potable water shortages merged water quality and consumptive use concerns, as water managers began to endorse the complimentary goals of reducing surface water discharges and conserving treated wastewater to offset potable uses.

This merger of ideas precipitated several strong political and agency alliances to define a path to recovery for the river, and the will and financial commitment to move forward with this plan was demonstrated at the first River Summit in October of 1997. The regular meetings of the LSJRB Water Quality Technical Advisory Committee at this time served a vital role for coordination of interagency activities, dissemination of research findings, and as a forum for industry, utility, and private citizen concerns. In large part, due to the resources applied through the St. Johns River initiative, the understanding of the hydrodynamics, water quality, and ecology of the LSJRB has advanced greatly since 1993.

The TMDL, PLRG, and BMAP Processes

The Federal Clean Water Act's TMDL process has emerged as the framework for defining both the quantitative approach to river recovery and the paradigm for future reasonable and beneficial use determinations. Unlike the discharge and runoff permitting that preceded it, which allows for progressive increase in nutrient pollution, the TMDL approach embodies a sustainability concept that caps all loads at the assimilative capacity, defined by metrics of biological health. Once a TMDL is established, all reasonable and beneficial uses that lead to a nutrient load increase must somehow be offset to remain under this limit.

Pollutant load reduction goals (PLRGs) have also been established to estimate the numerical reductions in pollutant loadings needed to preserve or restore designated uses of receiving water bodies consistent with applicable state water quality standards. TMDLs and PLRGs are closely linked in that TMDLs identify how much loading of a pollutant a water body can assimilate without exceeding water quality standards, while PLRGs identify how much existing loading must be reduced to reach that loading. Once the TMDL/PLRG is established, nutrient reductions are assigned to reduce inputs to the river to no more than its assimilative capacity. These reductions and the projects and programs to achieve them are outlined in a basin management action plan (BMAP). The purpose of the BMAP is to reduce and prevent pollutant discharges through various cost-effective projects and programs. Once the BMAP is adopted, the projects associated with load reductions are required either through permit or through the enforceability of the BMAP itself, which is adopted by the Secretary of the FDEP.

Staff of the FDEP Division of Environmental Assessment and Restoration (previously the Division of Water Resource Management) and SJRWMD's Department of Water Resources formally joined efforts to establish TMDLs and PLRGs for the LSJRB, and their joint plan of study identified the following needed research areas: (1) investigations into the internal cycling of nutrients and carbon in the river, including examinations of sediment and water column interactions, algal community composition, and the unique features of specific algal community nutrient assimilation, salinity tolerances, etc.; (2) an updated external load assessment, that would better differentiate anthropogenic loads from natural loads, would differentiate labile and refractory organic nutrients and carbon, and examine atmospheric deposition more closely; (3) coupled hydrodynamic and water quality modeling to enhance the understanding of river nutrient and organic carbon processing and transport and make possible scenario modeling to assess optimal nutrient reduction strategies; and (4) the development of specific water quality criteria for the lower St. Johns River, built around algal biomass limits for the river's freshwater section, and dissolved oxygen targets for the marine reach.

Research Findings

The LSJRB Nutrient Pollution Load

Examinations of the external nutrient load to the lower St. Johns River were performed twice from 1993 to 2006. The "external" nutrient load refers to the mass load of water quality constituents relevant to eutrophication (nitrogen, phosphorus, and organic carbon forms) that enter the river from point sources, watershed runoff, upstream flow, and atmospheric deposition. The external load is a necessary first step in any examination of eutrophication, and can identify the spatial and temporal aspects of the major load contributors, and possible processes in the receiving water regarding the fate of this load. The first examination relied upon a comprehensive water quality sampling program for major domestic and industrial waste and a simple watershed model to estimate nonpoint source loads. This assessment revealed that point sources were categorically the largest source of nutrient load, a rather surprising finding that could be attributed to the fact that most domestic waste facilities treated only to secondary level, which, while exhibiting low levels of biochemical oxygen demand and high levels of disinfection, contained very high concentrations of inorganic nitrogen and phosphorus, forms readily available to algae. This first external load assessment also found that direct wet atmospheric deposition supplied a lower relative amount of nitrogen to the lower St. Johns River, roughly only 10 percent, than had been determined for other long-residence-time lagoonal estuaries of Florida, such as the Indian River Lagoon and Tampa Bay.

The investigation of the external load was improved as part of the TMDL process to differentiate labile and refractory organic nitrogen and carbon forms, expand the temporal coverage, improve the responsiveness to long-term changes in rainfall patterns, and estimate natural background loads. The differentiation of labile and refractory organic nitrogen and carbon loads was a significant enhancement, as refractory forms that dominate natural sources in blackwater river systems are only slowly utilized within the receiving water and, hence, contribute only minimally to eutrophication. In this enhanced external load assessment, it was found that bioavailable (inorganic and labile nutrient forms that are readily assimilated for primary production) nitrogen and phosphorus loads had increased approximately seven-fold over background, pre-development loads. Dairy and urban land development was found to greatly increase the relative proportions of labile organic nitrogen in nonpoint source runoff. Point sources were confirmed as significant contributors of nutrient load (and in the case of pulp mill effluent, organic carbon load also), particularly in the more densely populated marine reach. Urban and agricultural stormwater runoff was also confirmed as significant nutrient load contributors, but its relative impact was dependent upon the amount and timing of rainfall.

A closer examination of the atmospheric deposition load to the lower St. Johns River was also performed at this time. Based on measured data from regional National Atmospheric Deposition monitoring stations, and ratios of wet to dry deposition observed for Tampa Bay, a mean wet and dry deposition for nitrogen of 6.13 kilograms per hectare per year (kg/ha/yr) was estimated for the LSJRB for 1995 through 1999. This exceeds the mean terrestrial biome deposition of 2.34 kg/ha (range: 0.29–15.6 kg/ha) reported by a 1999 study. Relying on data collected from towers (to minimize surface interference) an average annual rate of phosphorus deposition of 0.0825 kg/ha (dry deposition only) was estimated. These direct deposition rates were found to comprise 4 percent of the river's bioavailable nitrogen load, and less than five-tenths of a percent of the phosphorus load. These very low relative rates were due to the relatively high flow of the St. Johns River when compared to lagoonal estuarine systems, where atmospheric deposition has been found to be a significant contributor, and to the magnitude of other anthropogenic sources.

The LSJRB is differentiated into three ecological zones based on salinity (Figure 3-1): a tidally influenced, freshwater lacustrine zone that extends from the city of Palatka north to the city of Orange Park; a predominately oligohaline lacustrine zone extending from Orange Park northward to the Fuller Warren Bridge in Jacksonville; and a meso-polyhaline riverine zone from the Fuller Warren Bridge downstream to the mouth.

<u>LSJRB Hydrodynamics</u>

Hydrodynamic and salinity modeling, along with the associated bathymetric, discharge, and tidal measurements in support of this, led to some of the most significant revelations regarding eutrophication in the lower St. Johns River. It was found that nontidal, meteorological events significantly affected the transport and migration of pollutants within the river. Net reverse flow from such events was found to persist often for many days and, at times, in excess of a week. This work also revealed that river residence times varied considerably but could, at times, be quite long, rendering the river like a lake and providing sufficient time for algal primary production to exploit nutrient pollution and form nuisance blooms. Also, because of the extreme tide range characteristic of the South Atlantic Bight (SAB), pollutants were rapidly mixed and transported from multiple sources, dispelling the downstream, one-dimensional flow concept typically invoked for rivers. This tidal mixing, coupled with the relatively long residence times of the inner shelf of the SAB, meant that the river, tide marsh, and shelf processes of the St. Johns River estuary were highly interrelated.

The dramatic effect of river hydrodynamics and circulation patterns were demonstrated in the first two applications of the Sucsy and Morris model. In April 1997, a large rainfall episode led to the breach of an extremely dark, turbid 20-acre holding pond owned by the RGC Minerals and Mining Company in the upper reaches of Simms Creek (within the Etonia/Rice watershed). The flocculent, colloidal nature of the organic matter contained within the pond resulted in a massive, 6,400-acre opaque slick in the St. Johns River that stretched 10 miles from the mouth of Rice Creek to Deep Creek. In the ensuing eight weeks, this massive plug advanced and retreated with several sustained tide reversals driven by episodic changes in ocean water level. In 1998, the Environmental Fluid Dynamics Code (EFDC) model was employed to examine the spread of the Jacksonville Buckman Wastewater Treatment Facility effluent plume in association with a dye study. The continuous, dynamic simulations from this application demonstrated that low levels of effluent (one one-thousandth of the initial concentration) were transported as much as 25 miles upstream in the St. Johns River through diffusion and advection. The hydrodynamic simulations of these events with EFDC became the quintessential heuristic tools demonstrating the limited pollutant dilution and conveyance capabilities of the lower St. Johns River.

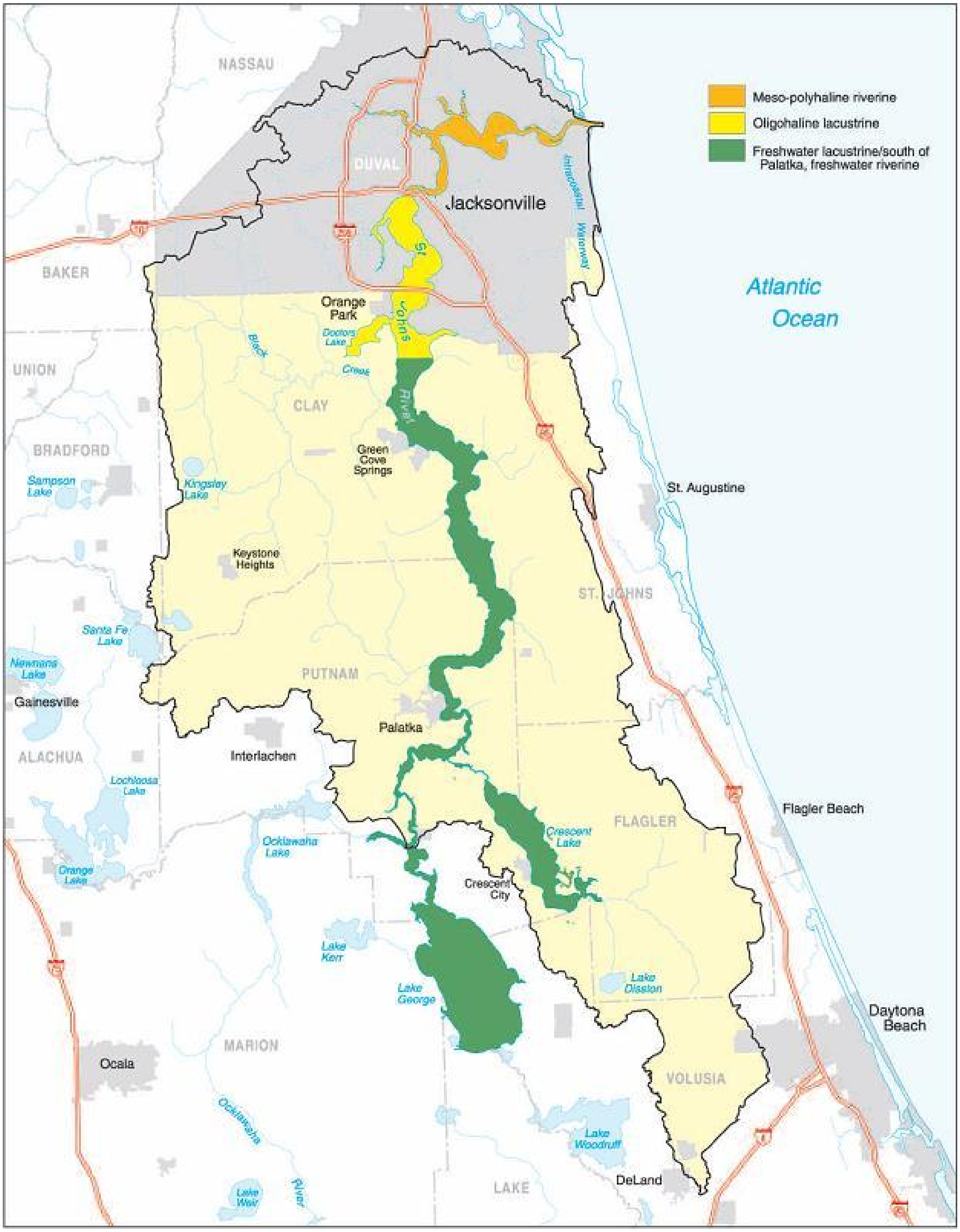

Figure 3-1: Salinity Reaches in the Lower St. Johns River Basin

Plankton Ecology and Water Quality

Investigations conducted between 1993 and 2006 into the ways in which nutrient loads enhance algal primary production were an integral part of the case for nutrient load reduction and are based on water quality, sediment-water column interactions, plankton identification, and various assays relating algal growth to nutrient supply, water quality characteristics and phytoplankton and zooplankton composition. The backbone to this effort was the interagency river water quality monitoring program executed by SJRWMD, FDEP, and the city of Jacksonville. Also indispensable in this monitoring program was the creation by the U.S. Geological Survey (USGS) of several continuous, real-time stations that have provided great detail in short-term water quality fluctuations. Data collected in this monitoring has revealed (1) patterns in total nutrient concentrations associated with the inputs of significant external source loads; (2) patterns in significant, within-river nitrogen loss (denitrification) and gain (nitrogen fixation); (3) patterns of nutrient assimilation and re-mineralization coincident with the expansion and decline in algal blooms; (4) the factors such as light, temperature and salinity, and the interplay of these with river reach, that controls phytoplankton abundance; and (5) the secondary water quality effects of dissolved oxygen, turbidity, organic carbon, etc., resulting from eutrophication.

Regular ambient plankton identification and enumeration was initiated in the mid-1990s and this work has identified several fundamental trends in the progression and composition of algal blooms, particularly for nuisance cyanobacterial (i.e., blue-green) blooms in the river's freshwater reach. While diatom algae dominates the lower St. Johns River phytoplankton in the winter and early spring, cyanobacterial biomass dominated in the late spring and summer months, with the severity of blooms depending primarily on antecedent flow and rainfall. The decline in diatom algal dominance is triggered by both a poor competitive ability relative to cyanobacteria at high temperatures and low nitrogen and phosphorus concentrations, but is believed to be primarily due the depletion of bioavailable silica.

As cyanobacteria are salinity intolerant, blooms of these species are generally confined to the fresh reaches of the river, the areal extent of which is dependent upon river flow. Specific nutrient enrichment and limitation experiments have revealed that while nitrogen is, in most cases, the first limiting nutrient for algal growth, the tendency for the formation of nitrogen-fixing blue-green algal blooms ultimately renders phosphorus the controlling nutrient. During dry years, river residence time is sufficient for cyanobacteria to fully exploit the available nitrogen supply, and blooms of the principal atmospheric nitrogen-fixing genera *Anabaena, Cylindrospermopsis*, and *Aphanizomenon* take advantage of excess phosphorus and dominate the phytoplankton. During the dry years from 1999 through 2001, freshwater blooms regularly reached biomass levels well in excess of 100 micrograms per liter (µg/L) as chlorophyll *a*. Precipitous bloom crashes were seen to occur in these years, and these crashes were associated with extreme low dissolved oxygen levels. During wet years, high levels of nitrogen relative to phosphorus favor blooms of non-nitrogen-fixing blue-greens such as *Microcystis.* During these years, fresh conditions can extend far downstream into the nutrient-rich reach of the river in Jacksonville, enhancing bloom expansion and resulting in dense surface sums of algae. At times, high levels of the algal toxin microcystin are associated with these blooms. In 2005, high discharge associated with the 2004 hurricane season resulted in an extensive bloom of *Microcystis aeruginosa* that stretched from Lake George to Jacksonville. High levels of the algal toxin microcystin were observed in association with this bloom as well as a number of secondary effects, including a fish fill and allergic reactions.

The ultimate control by phosphorus of maximum algal growth appears to diminish as the river progresses toward the ocean, owing to the low salinity tolerance of nitrogen-fixing blue-green algae. Hence, while phosphorus loads and concentrations are high in the river's marine reach, nitrogen control emerges as the most reasonable and cost-effective approach to reducing marine reach algal growth. The emphasis of nitrogen control was also supported by research in other major river estuaries on the Atlantic coast, such as Chesapeake Bay, Pamlico Sound, and Narragansett Bay.

Sediments and Sediment-Water Column Interactions

River sediment-water column exchange was examined in two investigations. The long-term rate of historic vertical sedimentation and sediment composition was examined first in 20 river cores extracted from Palatka to south Jacksonville from December 1995 to November 1996. This investigation revealed that sediments of the lower St. Johns River are highly organic in comparison to other estuarine sediments, with very low bulk density and relatively high sedimentation rates, ranging from 4 to 6 millimeters per year (mm/yr) for the river's freshwater reach and from 10 to as high as 39 mm/yr in the oligohaline reach. Sediment organic matter, based on 13C isotope composition and alkane chain length appears to be primarily terrestrial in origin. Lead-210 dating indicated that sediment mass accumulation rates have increased over the last half of the last century. The estuarine sedimentation can be viewed in context with the general pattern of sea level rise over the past 18,000 years, which is resulting in the infilling of the St. Johns River channel at a background sedimentation rate of 1.9 mm/yr. Borehole data at the Buckman Bridge indicate that there is between 40 and 50 feet (ft) of organic sediment overlying unconsolidated sand. This investigation concluded that anthropogenic development has increased the rate of river sedimentation and that internally-produced (autochthonous) river organic matter, because it is rapidly decomposed, does not contribute greatly to the increased sedimentation rate.

The investigation of sediment-water column interactions continued from 2001 to 2005 to determine the spatial distribution and timing of nutrient recycling. The survey of sediment composition found phosphorus increased in the northern portion of the river and indicated that calcium binding was an important means for phosphorus immobilization, particularly in the southern portion of the river. Low water column concentrations of nitrate and relatively high water column concentrations of sulfate, coupled with steep declines in vertical profiles of surficial sediment sulfate concentration, suggest that sulfate reduction is an important electron acceptor for sediment organic carbon metabolism. Sharp downward increases in ammonia and soluble reactive phosphorus indicated that upward fluxes of these constituents are likely an important source of water column resupply. Anaerobic soluble reactive phosphorus upward flux was found to be 40 times greater than aerobic flux, indicating that during times of high labile organic carbon sedimentation and decomposition, such as would occur during algal blooms, soluble reactive phosphorus upward flux may increase significantly. Sediment resuspension in high flows and maximum tidal flow was found to be sufficient to re-entrain surficial (top 2 centimeters [cm]) sediment on short time scales, and under such resuspension events, advective flux of nutrients most likely exceeds diffusive flux.

Water Quality Modeling

Perhaps the most recognizable and influential element of the research efforts from 1993 through 2006 was the adaptation of the U.S. Army Corps of Engineers water quality model, CE-QUAL-ICM, to the St. Johns River. This three-dimensional eutrophication model, originally developed for and applied in Chesapeake Bay, is unique among such models as it relies upon the organic carbon budget to compartmentalize the assimilation of nutrient pollution loads, allowing for the assessment of nutrient pollution effect. As the model is built upon the fundamental relationships among light, temperature, and nutrient supply that govern algal growth, it is flexible and usually quite accurate if boundary input data can be correctly quantified. The model is particularly well suited to blackwater river estuaries, such as the St. Johns River that have high loads of refractory organic nitrogen and carbon (the model distinguishes between labile and refractory organic forms), and color (the model has a light attenuation algorithm that accounts for color).

The river's CE-QUAL-ICM adaptation provided two powerful enhancements to the investigation of eutrophication and assessment of control measures. First, the model requires thorough understanding of and, therefore, investigation into the relevant elements of the multifaceted problem of eutrophication, which makes it extremely useful in organizing eutrophication related data. Second, once model coefficients and input data are correctly quantified and verified through calibration, the model input data can be modified (within reason) to provide insight into water quality outcomes from alternative nutrient pollution load scenarios. It was in the evaluation of various load reduction scenarios that the water quality model was instrumental in the LSJRB TMDL analysis.

The TMDL/PLRG process has been instrumental in the development of limits on coliform and nutrient pollution in urban stormwater. Coliform limits have been based on state water quality criteria for urban tributaries in Jacksonville, and nutrient loads have been allocated to NPDES MS4 permittees to achieve nutrient reductions necessary to achieve designated uses for the St. Johns River.

Continuing Challenges — Areas of Investigation in the Next Five Years

The enactment of nitrogen and phosphorus load limits for the lower St. Johns River redefines pollutant discharge permitting and the approach to watershed development. Because the lower St. Johns River is the most downstream hydrologic unit of the LSJRB watershed, the TMDL has bearing on water management activities in the middle and upper basins and the Ocklawaha River Basin. The establishment of nitrogen and phosphorus load limits redirects the investigation of nutrient pollution to tributary nonpoint sources, and refocuses the river monitoring efforts on compliance with TMDL load reductions and verification of ecosystem rebound. Still, challenges to river water quality remain due to threats outside the TMDL realm, brought about by reduced flow arising from upstream consumptive use and large-scale phenomena such as sea level rise and climate change.

The assessment of urban nonpoint source pollution has emphasized the following areas: (1) evaluation of the effectiveness of stormwater retention facilities; (2) retrofit of older, pre-environmental resource permit (ERP) urban areas with regional stormwater treatment facilities; (3) identification of failing septic tank areas for prioritization of sanitary sewer service extension; (4) evaluation of sources of fecal coliform contamination in urban tributaries; (5) evaluation of shallow groundwater contamination from urban land use practices such as landscape fertilization and wastewater disposal; and (6) evaluation of the water quality and effectiveness of prescribed stormwater treatment under ERP in developments of regional impact.

Marine Reach and Near Coast Ecology

Alternating riverine and lacustrine, freshwater and marine environments of the St. Johns River system leads to a succession of optimal habitats for aquatic primary producers and organisms. The Atlantic inner shelf in the vicinity of the St. Johns River mouth can be thought of as the terminal productivity zone for this alternating lake and river system.

Because of the relatively long residence time of the inner shelf (two to three months), the nutrient and carbon load of the St. Johns River can exert a significant influence over the productivity of this region. While this load is vital to the nutritional requirements of the shelf community, large, nutrient-rich rivers that discharge into long-residence-time shelf environments can accelerate organic matter production and manifest in zones of hypoxic water. The upward trends in nitrogen concentration seen for rivers of the South Atlantic Bight (Figure 3-2) presumably will tend to exacerbate this condition. And while the regular occurrence of low dissolved oxygen in the marine reach (generally occurring between river miles 4 to 16) of the St. Johns has been documented, the sources of labile organic matter and mechanisms that drive these events are poorly understood. Because dissolved oxygen is the fundamental measure of TMDL achievement, it is critical that the phenomena driving low dissolved occurrences in the river be elucidated.

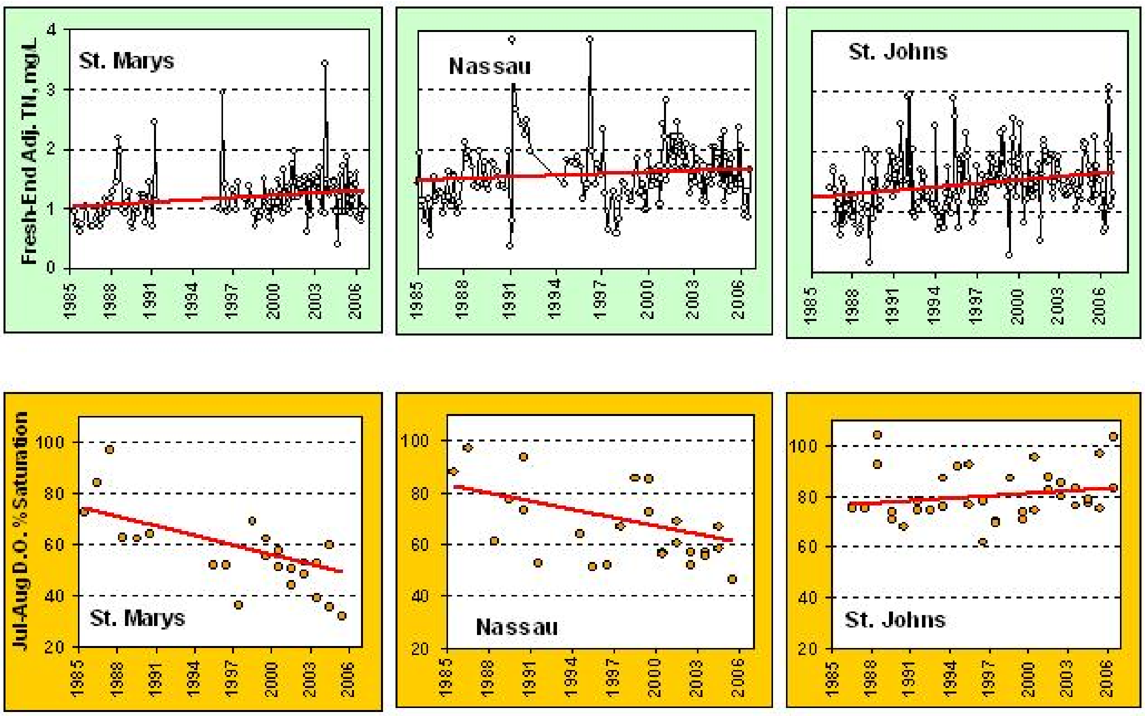

Figure 3-2: Long-Term Trends in Total Nitrogen and Summer DO Percent Saturation for the Three Rivers that Discharge to the SAB

The nitrogen concentrations in Figure 3-2 have been proportionally adjusted to estimate the fresh-end concentration based on the salinity at the time of collection and an assumed seawater total nitrogen concentration of 0.325 mg/L. Significant upward trends in total nitrogen are apparent for all three rivers. Significant downward trends in dissolved oxygen percent saturation exist for the Nassau and St. Marys Rivers, but the St. Johns River, presumed due to its long history of untreated effluent discharge, shows a stable or slightly upward trend for the monitoring stations near river mile 17.

SJRWMD in 2007 reinstituted an off-shore water quality monitoring program to identify annual-temporal and spatial trends in the Atlantic inner shelf at the mouth of the St. Johns River. This effort will expand in 2008 with the establishment of an automated sensor platform funded by FDEP as part of the Florida Coastal Ocean Observing System. The University of North Florida is the grantee for this platform, which will monitor meteorology, hydrodynamics and water quality. This platform is the initial effort in the establishment of a department of coastal ocean resources at the university, which should greatly expand opportunities for research of the Atlantic inner shelf. The research emphasis in this area is also a priority for the National Park Service Timucuan Preserve, the FDEP Coastal and Managed Areas program, and the Florida Fish and Wildlife Conservation Commission Fish and Wildlife Research Institute (FWRI). Interest by FWRI has been driven by episodic blooms of red tide in the North Florida Atlantic inner shelf. A red tide bloom in 2007 resulted in fish kills and the posting of swimmers' advisories in Jacksonville and St. Augustine.

Another research priority for the lower St. Johns River marine reach is the improved characterization of plankton as it transitions from the freshwater community south of Green Cove Springs to the predominantly marine community that typifies the river downstream of Jacksonville. While this reach of the river is nutrient-rich, phytoplankton blooms are episodic and much more variable in composition. At this time, the environmental triggers for nuisance blooms in this reach are poorly understood.

Freshwater River Reach Ecology

Monitoring has shown that there are nuances to the phytoplankton and zooplankton community composition within freshwater reach blooms that have relevance to internal nitrogen and organic carbon loading, toxin production, and food chain disruption. There also appears to be important relationships between the antecedent and contemporary hydrologic setting as it relates to reach residence time, freshwater reach extent, nutrient supply and nutrient ratios. These factors have bearing on the phytoplankton community composition, and the propensity for bloom crashes that lead to extreme low dissolved oxygen events. Several proposed management and restoration proposals upstream of and within this reach will alter the residence time, nutrient supply, and relative nutrient ratios in ways that may have unintended consequences without further investigation of these relationships. Further investigation will also be necessary to better characterize the exchange between the water column and sediments in order to improve modeling capabilities and predictions of restoration time scales. Also, fisheries monitoring should continue with the objective of identifying the possible changes in fish communities resulting from undesirable food chain effects from the perpetuation of a phytoplankton dominated community, the presence of threatened or endangered fish species, and the viability of restoration approaches such as rough fish harvesting.

Ocklawaha River

Twenty-five percent of the mean annual discharge in the lower St. Johns River comes from the Ocklawaha River, and the mean relative contribution increases to 47 percent in the typically dry month of May (Figure 3-3 and Figure 3-4). Because of its relatively large contribution to the lower St. Johns River during April through June (on average 37 percent), when nuisance algal blooms are the most severe, agency officials are examining possible affects on the lower St. Johns River from proposed restoration projects for the Ocklawaha River. Monthly stream flow data from January 1993 to September 2006 were obtained through the middle St. Johns River monitoring station at Buffalo Bluff (USGS 02244040), the Dunns Creek monitoring station near Satsuma (USGS 02244440), and the Ocklawaha River monitoring station at Rodman Dam (USGS 02243960).

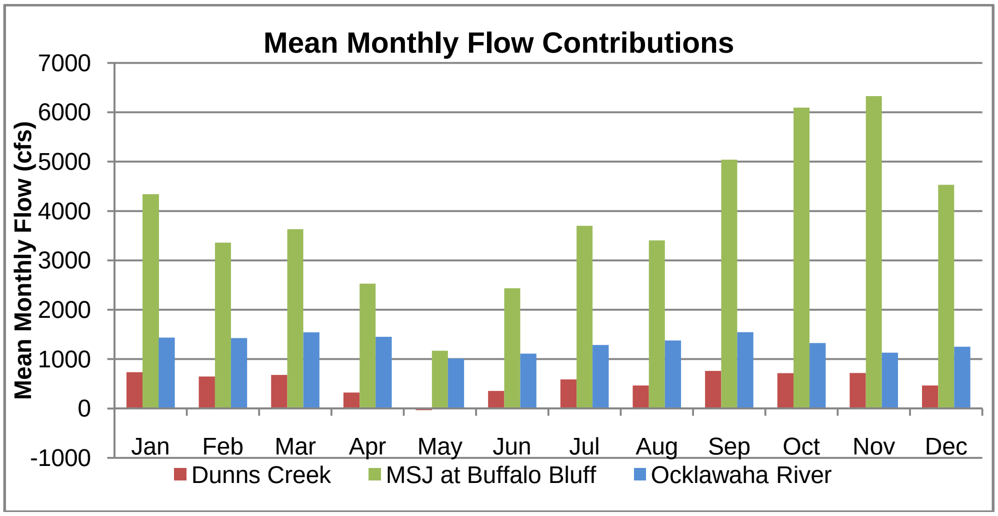

Figure 3-3: Mean Monthly Flow Contributions to the LSJR (1993–2006)

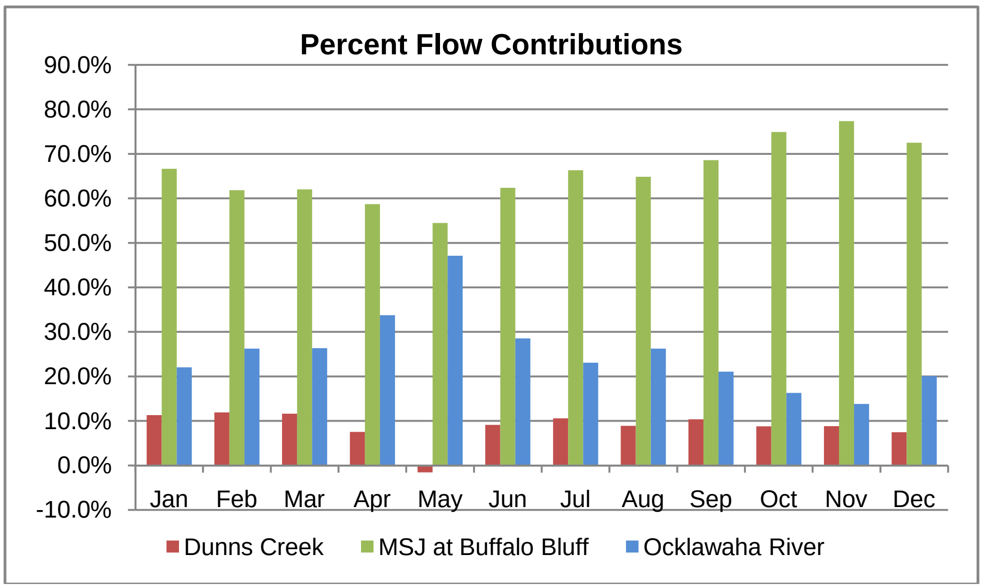

Figure 3-4: Percent Flow Contributions to the LSJR (1993–2006)

Nonpoint Source Water Quality

While advances have been made in the characterization of urban and agricultural nonpoint source pollution, numerous challenges remain in the quantification of loads, the performance of stormwater BMPs, and the migration and fate of pollutants and wastes applied to or intercepted by the land surface. Since the mid-1990s, impressive amounts of spatial geographic information systems (GIS) data have been collated that can be applied to resource assessments, but computational tools are underdeveloped to utilize this information. And, as governmental entities strive to achieve the pollutant load reductions called for by the TMDL, significant obstacles exist with regard to assessing alternatives for waste disposal and the promulgation of ordinances to achieve desired targets.

Regulatory

The creation of the TMDL establishes regulatory precedent in NPDES and ERP. While the concept of load limits is not foreign to point-source permitting under the NPDES program, it is a radical revision to MS4 stormwater permitting. Discussions have only begun on the redesign of ERP to achieve TMDL goals. The concept of zero net change, or offset of increased nutrient load from new development, faces not only conceptual obstacles but also significant quantitative deficiencies with regard to system performance, load quantification to judge mitigation, and questions related to load reduction responsibility and jurisdiction.

Another important regulatory requirement with bearing on the pursuit of SWIM goals involves the effects of probable reductions in discharge related to the withdrawal of upstream water to fulfill consumptive use demands. Such withdrawals have the potential to increase hydraulic residence time and the upstream migration of salinity, resulting in stress to rooted submerged aquatic vegetation and benthic fauna, and increasing the severity of nuisance algal blooms and the amount of internal nitrogen load through nitrogen-fixation. A concerted effort is under way in fiscal year (FY) 2008 and FY 2009 that will focus on these possible effects, with the goal of identifying thresholds for environmental harm, sustainable withdrawal scenarios, and potential mitigation strategies.

Goal for the Water Quality Initiative

Restore and protect the basin's surface water quality to meet state designated use classifications.

Identified Milestones for the Accomplishment of the Water Quality Initiative

FY 2008
• Long-range reuse partners and projects identified. • Required monitoring partners identified; memoranda of understanding and grants in place for implementation of cooperative monitoring program. • Western Atlantic ocean-tide model extended and connected to Northern Coastal Basin. • Basin Management Action Plan (BMAP) adopted. • BMAP Monitoring Plan complete. • TCAA subbasins reprioritized for implementation of nonpoint projects and BMPs. • Optimization of regional reuse options complete. • Conceptual design complete for Masters Regional Stormwater Treatment (RST) facility complete. • Phase II of GIS tracking project for agricultural producers BMPs complete. • Biennial TCAA land use update complete. • PLRG Model – land use update complete.
FY 2009
• Enhancement of modeling tools for TMDL/BMAP verification complete. • Tidal dynamics module of water quality model extended into Nassau and St. Marys rivers. • Technical paper describing tide marsh interaction module of water quality models complete. • Technical paper identifying factors causing low dissolved oxygen complete. • Current phase of water quality model delivered. • Identification of management options to offset nitrification in Lake George complete. • Hastings Agricultural Research Farm re-engineering recommendations received. • GIS tracking project for implementation of BMPs per the growers NOI complete (FDACS). • Growers NOI program formalized (FDACS).
FY 2010
• Decision made regarding use of near-shelf or full-shelf model. • Hastings Agricultural Research Farm re-engineering design complete. • Biennial TCAA land use update complete. • Watershed Assessment Model enhancements with BMP and RST scenarios complete. • Reuse and treatment projects in place or under way (1.6 million lbs/yr N removed and 31 mgd reuse occurring).

FY 2011
• Revision of BMP cost-share program handbook complete. • Hastings Agricultural Research Farm construction complete. • 90% compliance with TCAA growers Notice of Intent (NOI) reached for currently adopted BMPs (FDACS and growers).
FY 2012
• Documentation associated with basin water quality model complete. • Near-shore/full-shelf model complete. • SWIM Plan Update Complete. • Final BMP cost-share contracts closed out. • Biennial TCAA land use update complete.

3.1.1 Strategy: Reduction of Urban Nonpoint Source Pollution

Objectives:

- Support development and implementation of PLRGs and TMDLs.
- Conserve freshwater resources and protect surface waters.
- Increase compliance with existing resource protection regulations. Bring all sources into compliance by 2012.
- Provide ongoing technical support for resolution of specific policy issues. Implement restoration and protection plans for surface water quality, sediments, and aquatic populations in the LSJRB.
- Continue to evaluate historical water chemistry data to describe trends in ambient water quality as well as point-source and nonpoint source pollution to evaluate effects and interrelationships.
- Select or modify the water quality assessment methods that will be used for water quality data collection and analysis.

Urban Nonpoint Source Pollution Coordination with Other Agency Plans

Nonpoint source reductions have been coordinated through the BMAP processes sponsored by FDEP. Stakeholder committees and working groups have been formed to address sources of nutrients for the mainstem of the river and sources of fecal coliform bacteria for the tributaries. Nonpoint source representatives as well as local, state, and federal agencies have been very involved in these committees and will continue to be involved throughout BMAP implementation. If additional BMAPs are needed to address additional TMDLs, nonpoint source stakeholders will be invited to participate if they are considered to be a likely source.

3.1.2 Strategy: Reduction of Agricultural Nonpoint Source Pollution

Objectives:

- Support development and implementation of PLRGs and TMDLs.
- Conserve freshwater resources and protect surface waters.
- Increase compliance with existing resource protection regulations. Bring all sources into compliance by 2012.
- Provide ongoing technical support for resolution of specific policy issues. Implement restoration and protection plans for surface water quality, sediments, and aquatic populations in the LSJRB.
- Continue to evaluate historical water chemistry data to describe trends in ambient water quality as well as point-source and nonpoint source pollution to evaluate effects and interrelationships.

- Select or modify the water quality assessment methods that will be used for water quality data collection and analysis.

Agricultural Nonpoint Source Pollution — Coordination with Other Agency Plans

- SJRWMD regularly coordinates its agricultural projects with the University of Florida-Institute of Food and Agricultural Services (UF-IFAS) and Florida Department of Agriculture and Consumer Services (FDACS). Projects are planned in collaboration with these agencies and grower input and many projects are co-funded.
- The St. Johns River Nutrient Discharge Reduction (Algal) Initiative is a coordinated effort among several agencies (SJRWMD, UF-IFAS, and FDACS) to reduce algal blooms in the lower St. Johns River.
- Implementation of BMPs at the grower level is coordinated with FDEP as part of the implementation of the TMDLs and compliance with BMAP requirements.
- The BMP cost-share program is coordinated between SJRWMD, FDACS, UF-IFAS, Florida Farm Bureau, Florida Fruit and Vegetable Association, FDEP, North Florida Growers Exchange, and the U.S. Department of Agriculture/ National Resources Conservation Service (USDA/NRCS) Equip program.

3.1.3 Strategy: Point Source Reductions and Reuse

Objectives:

- Support development and implementation of PLRGs and TMDLs.
- Conserve freshwater resources and protect surface waters.
- Increase compliance with existing resource protection regulations. Bring all sources into compliance by 2012.
- Provide ongoing technical support for resolution of specific policy issues. Implement restoration and protection plans for surface water quality, sediments, and aquatic populations in the LSJRB.
- Continue to evaluate historical water chemistry data to describe trends in ambient water quality as well as point-source and nonpoint source pollution to evaluate effects and interrelationships.
- Select or modify the water quality assessment methods that will be used for water quality data collection and analysis.

Point-Source Reductions and Reuse — Coordination with Other Agency Plans

Point-source reductions have been coordinated through the BMAP processes sponsored by FDEP. Stakeholder committees and working groups have been formed to address sources of nutrients for the mainstem of the river and sources of fecal coliform bacteria for the tributaries. Point-source representatives as well as local, state, and federal agencies have been very involved in these committees and will continue to be involved throughout BMAP implementation. If additional BMAPs are needed to address additional TMDLs, point-source stakeholders will be invited to participate if they are considered to be a likely source. Related to these efforts is the River Accord goal to remove wastewater discharge to reuse. This will be accomplished through funding from the partnership of up to $300 million.

In addition to the BMAP committees, SJRWMD has sponsored the Northeast Florida Utility Managers Group to evaluate the costs and logistics of reducing point sources and increasing reuse water availability in the LSJRB. This group meets regularly to share information, develop projects for funding requests, and to evaluate the projects that provide the lowest cost load reductions. The group includes participation from local governments, utilities, FDEP, and other agencies when appropriate.

3.1.4 Strategy: Increase Understanding of Ocean Dynamics

Objectives:

- Support development and implementation of PLRGs and TMDLs.
- Provide ongoing technical support for resolution of specific policy issues. Implement restoration and protection plans for surface water quality, sediments, and aquatic populations in the LSJRB.
- Continue to evaluate historical water chemistry data to describe trends in ambient water quality as well as point-source and nonpoint source pollution to evaluate effects and interrelationships.
- Select or modify the water quality assessment methods that will be used for water quality data collection and analysis.

Increase Understanding of Ocean Dynamics — Coordination with Other Agency Plans

- The SJRWMD and FDEP will work together to implement the dissolved oxygen monitoring program described in the lower St. Johns River mainstem nutrient BMAP. These agencies will also coordinate on updating and expanding the boundaries of the models to be used in future TMDL efforts.
- SJRWMD encourages partnerships with government agencies and universities directed toward monitoring of Atlantic inner shelf hydrodynamics and water quality.
- SJRWMD is planning to work with other agencies and universities to design and implement investigations of near-coastal eutrophication, hypoxia, and plankton characteristics on the inner shelf in the vicinity of the St. Johns River's mouth. Through these partnerships, investigations of the nature of the interaction between the coastal marshes of the Timucuan and the St. Johns River can also be conducted.

3.1.5 Strategy: Reduction of Algal Blooms

Objectives:

- Support development and implementation of PLRGs and TMDLs.
- Select or modify the water quality assessment methods that will be used for water quality data collection and analysis.
- Continue to evaluate historical water chemistry data to describe trends in ambient water quality as well as point-source and nonpoint source pollution to evaluate effects and interrelationships.

Reduction of Algal Blooms — Coordination with Other Agency Plans

The St. Johns River Nutrient Discharge Reduction project (Algal Initiative) is a coordinated effort among several agencies including SJRWMD, UF-IFAS, FDACS, and local governments to reduce algal blooms in the river. As part of this initiative, support will be provided for funding and projects necessary to reduce phosphorus loadings. These agencies will continue this initiative to reduce algal blooms in the LSJRB.

3.1.6 Strategy: Evaluation of the Effects of Surface Water Withdrawals

Objectives:

- Conserve freshwater resources and protect surface waters.
- Continue to evaluate historical water chemistry data to describe trends in ambient water quality as well as point-source and nonpoint source pollution to evaluate effects and interrelationships.

Effects of Surface Water Withdrawals – Coordination with Other Agency Plans
SJRWMD is planning additional assessment of the potential cumulative effects of the proposed water supply withdrawals. Staff located in both the Lower and Middle St. Johns River basins will coordinate on these efforts and will also coordinate with any ongoing projects and investigations (e.g., contracted evaluations of concentrate discharge). Any additional investigations or research needs that are identified will be the responsibility of either SJRWMD or one or more regional water utilities. In addition, SJRWMD staff are monitoring several alternative water source projects. Coordination with other agencies, including FDEP, will be required as environmental, permitting, and design work proceed.

3.1.7 Strategy: Protection of Aquifer Recharge Areas

Objectives:

- Conserve freshwater resources and protect surface waters.
- Continue to evaluate historical water chemistry data to describe trends in ambient water quality as well as point-source and nonpoint source pollution to evaluate effects and interrelationships.

Protection of Aquifer Recharge Areas — Coordination with Other Agency Plans
A draft Aquifer Protection Plan was developed cooperatively with SJRWMD, FDEP, and local governments. The plan identifies strategies to protect surficial aquifers, the Floridan aquifer in areas where confining beds are thin or absent, and associated recharge areas. The strategies in the plan will be implemented through coordination of governmental agencies to ensure that the plan elements of natural area preservation, artificial recharge projects, groundwater quality protection, and data collection and analysis are carried out to achieve the goals of the plan.

3.2 Biological Health Initiative

The current biological condition of the lower St. Johns River is an important consideration but is difficult to ascertain. Assessing the current condition usually involves referencing an antecedent condition, before many of the current system stressors occurred. This time frame differs by region according to when urban and/or industrial development occurred. Unfortunately, comprehensive historical biological data is essentially absent for many areas of the river and for many biological groups. Yet it is known that there have been many changes within the watershed that have likely caused changes within the biota of the river (e.g., channel dredging, increased pollutant discharge). This section will review the major biological groups with reference to historical information, current information, and any discernible trends.

<u>Plankton</u>
Plankton sampling was not considered important or widely performed until the past several decades. Fortunately, there is one data set that gives a glimpse of pre-development conditions. It is apparent from these data that cyanophytes have always been an important part of the phytoplankton community. Likewise, the cyanophytes demonstrated large increases (i.e., blooms) during the summer months. However, total biomass (measured as mg chlorophyll *a* liter-1) during the 1940 bloom was only around 10 percent of contemporary biomass. It also appears that the proportion of rotifer biomass in the zooplankton community is greater now than in the 1939–1940 data. Thus it appears that both the magnitude and composition of the plankton community has been affected by development. Bloom frequency and magnitude have also increased, compared to historic levels, most likely due to anthropogenic nutrient loading and removal of floating macrophytes.

Macroinvertebrate

The earliest reliable macroinvertebrate data for the LSJRB began in 1973. Historical data were compared to contemporary data (1993–1995) at three sites: Georgetown (Little Lake George), Palatka, and Green Cove Springs. The only significant change appeared to be lower current invertebrate diversity at the Palatka site compared to historical diversity. Sampling in 2000 showed no change in diversity at the Green Cove Springs region, and even suggested a marginal increase. However, these results must be viewed cautiously given the extreme variability in invertebrate community composition even over small temporal and spatial scales. It was also demonstrated that higher rates of deformities in some taxa occur in areas of the river known to be contaminated. Therefore, there may be more subtle effects on the invertebrate community than broad community changes. Sampling continues and current data will be used to assess changes in the macroinvertebrate community.

Submerged Aquatic Vegetation

Submerged aquatic vegetation (SAV) is a critical habitat in the St. Johns River. Historical information is largely anecdotal and describes the SAV and floating macrophytes as quite extensive as early as 1773; however, this was prior to the dredging and channelization work that occurred in the lower St. Johns River. Water hyacinth was introduced in the late 19th century and eventually displaced much of the native vegetation. By 1948, hyacinth covered 9,500 acres in the river. Chemical control began in 1949 and reduced or eliminated most floating macrophytes. Contemporary SAV sampling began in 1995. These data show that the SAV community is highly variable and subject to the complex interactive effects of salinity, temperature, water transparency, and nutrient concentration. For example, during the recent drought, SAV was largely extirpated from downstream reaches due to increased salinity while it remained stable or expanded in more upstream reaches as color declined and transparency increased. Against this backdrop of environmentally induced variability, assessing the effects of anthropogenic stressors will require long-term sampling. Apart from drought-induced changes, there have not been obvious changes in the SAV community.

Fisheries

The St. Johns River has long been used for sport and commercial fisheries. Anecdotal reports suggest a decline in fish abundance in the river since the 1950s. The Florida Marine Research Institute began an independent fisheries monitoring program in the river in 2001. While the data are rigorous and thorough, there has been insufficient time to gauge whether the fish community has been historically affected. However, these data should be an excellent resource to be used in the assessment of future changes.

The Florida Fish and Wildlife Conservation Commission (FWC) FWRI Fisheries-Independent Monitoring (FIM) program in northeast Florida completed its sixth year of stratified random sampling (SRS) during 2006. Monthly sampling continued in the three major estuarine systems in northeast Florida: St. Marys River, Nassau River, and the lower St. Johns River. In July 2005, two new sampling zones were added to the northeast Florida FIM sampling universe as the result of a three-year cooperative grant agreement with SJRWMD. These new zones expand monthly SRS FIM sampling upstream in the lower St. Johns River to the city of Palatka and represent the tidal freshwater habitats of the LSJRB.

A total of 881,757 fish and selected invertebrates from 4,522 net deployments have been collected in northeast Florida FIM sampling from May 2001 through December 2005. Over 220 different taxa of fish and selected invertebrates have been identified during this time period. The most abundant taxa seen during sampling have consistently been small bait and forage fishes. Preliminary analysis of 2006 data show that the bay anchovy, *Anchoa mitchilli*, as in all previous years, was the most abundant taxa collected comprising 31 percent of the total 2006 catch. Other dominant taxa collected during 2006 included menhaden (*Brevoortia* spp.), silversides (*Menidia* spp.), and Atlantic silversides (*Menidia menidia*). Together, these four species represented 57 percent of the total 2006 catch.

Recreationally important species such as croaker (*Micropogonias undulatus*), spot (*Leiostomus xanthurus*), striped mullet (*Mugil cephalus*), and white shrimp (*Litopenaeus setiferus*) have consistently been in the top 10 most abundant species collected during FIM sampling for the last three years. Indices of relative abundance (IOAs) have been calculated for several recreationally important species that occur in northeast Florida. The relative abundance of juvenile red drum (*Sciaenops ocellatus*) remained stable between 2001 and 2003, declined slightly between 2003 and 2005, but returned to previously observed levels in 2006. The relative abundances of legal-size red drum (374-565 mm SL) increased between 2003 and 2004 and have remained at these higher levels through 2006. Juvenile spotted sea trout (*Cynoscion nebulous*) relative abundances remained stable from 2001 to 2004 and have shown a steady increase since, peaking during 2006. Adult spotted sea trout abundances have remained stable in northeast Florida except for a marked decline seen in 2004. Pre-fishery (131–267 mm SL) sheepshead (*Archosargus probatocephalus*) relative abundances peaked in 2002 and have shown a steady decline through 2006. Adult (> 268 mm SL) relative abundances increased in 2002 and remained at these higher levels through 2005, but have returned to the low levels seen in 2001.

Catches from the two new upriver zones in the lower St. Johns River during 2006 were dominated by silversides (n= 15,755) and bay anchovy (n=10,024). Several freshwater associated species such as rainwater killifish (*Lucania parva)* (n=4,388), Seminole killifish (*Fundulus seminolis)* (n=1,308), bluegill (*Lepomis macrochirus)* (n=936), white catfish (*Ameiurus catus)* (n=873), and mosquitofish (*Gambusia holbrooki)* (n=725) were also collected in high abundances. Three recreationally important species (Atlantic Croaker (*Micropogonias undulatus)*, n=5,098; striped mullet *(Mugil cephalus)*, n=1,000 and white shrimp (*Litopenaeus setiferus)*, n=677), were also among the 10 most abundant species collected in this new sampling area of the lower St. Johns River. Since many of the recreationally important species seen in northeast Florida, as well as many other areas, have been documented to utilize lower salinity areas during certain life history stages, the addition of these sampling areas will allow the FIM program to evaluate the importance of these habitats to specific species as well as gain a better understanding of the entire fish community structure over a broad salinity range.

As with macroinvertebrates, there is evidence that past and current pollutant loading are introducing substances into the water that are adversely affecting fish health. So far, these effects have been identified for paper mill effluents; although, there are many other pollutants and sediments in the river that could potentially affect various aspects of fish physiology. There is the potential that fish populations in the river have been and continue to be affected by myriad legacy pollutants. Both census and laboratory studies are needed to gauge the effects of these pollutants.

In summary, historical data indicates that development in the LSJRB has caused detrimental changes to biota. Evidence includes increased phytoplankton biomass and bloom frequency, and invertebrate deformities in areas of elevated pollutant concentrations. It has also been shown that many pollutants can and do affect fish reproductive function.

Therefore, it is reasonable to assume that many of the biological components in the river have changed and/or declined and general ecological health has been negatively impacted as a result of land use changes. The next important step is determining the extent of the impact. This can be accomplished by additional comparative analyses between historical data sets and current data. In other cases, especially those lacking historic data, additional sampling will have to be performed to separate out normal variability and to identify any trends.

Goal for Biological Health Initiative

Restore and protect natural systems associated with the basin's surface waters.

Identified Milestones for the Accomplishment of the Biological Health Initiative

FY 2008
• Potential indicator species identified.
FY 2009
• Suite of long-term indicators agreed upon.
FY 2010
• Restoration thresholds identified.
FY 2011
• Critical habitat requirements identified. • Monitoring programs in place adequate to support ongoing resource assessment needs.
FY 2012
• BMPs to maintain critical habitat developed and initiated.

3.2.1 Strategy: Develop Biological Indicators

Objectives:

- Select and/or modify the bioassessment methods that will be used for evaluating the effects of point- and nonpoint source pollution on the basin's living resources.

Biological Indicators — Coordination with Other Agency Plans

The foremost agency effort to develop and use biological indicators has been the EPA's Environmental Monitoring and Assessment Program (EMAP). The LSJRB Technical Advisory Committee Biological Monitoring Subcommittee has advocated the EMAP work as a model for developing biological indicators within the basin. State agency staff are investigating opportunities to partner with and utilize the expertise of EPA to develop biological indicators of ecosystem health.

3.2.2 Strategy: Assess and Monitor Submerged Aquatic Vegetation

Objectives:

- Provide biological data to perform trend analysis and evaluate responses to point and nonpoint pollution on the basin's living resources.
- Select and/or modify the bioassessment methods that will be used for evaluating the effects of point- and nonpoint source pollution on the basin's living resources.
- Establish benchmark goals for the restoration of living resources in the basin.
- Establish critical habitat requirements to restore and support living resources within the basin.
- Provide technical support for regulatory and management programs affecting the basin's natural resources.

Assess and Monitor SAV — Coordination with Other Agency Plans
SJRWMD performs comprehensive SAV sampling in the LSJRB. These data are shared with other agencies for a variety of uses. For example, Jacksonville University, under contract with U.S. Fish and Wildlife Service (USFWS), uses SAV data for preparing the Manatee Protection Plan. Similarly, FDEP uses these data to assess dock permits and SAV mitigation plans. SJRWMD will work with all interested parties to provide the most useful SAV monitoring data.

3.2.3 Strategy: Develop Biological Management and Restoration Tools

Objectives:

- Establish benchmark restoration goals for the restoration of living resources in the basin.
- Establish critical habitat requirements to restore and support living resources within the basin.
- Protect and restore natural systems through acquisition and management of protected lands.

Biological Management and Restoration Tools — Coordination with Other Agency Plans
SJRWMD is working on restoration projects with a number of agency partners. For example, SJRWMD has partnered with the U.S. Army Corps of Engineers (USACE) on restoration plans for Chicopitt Bay, Mill Cove, and Big Fishweir Creek in Jacksonville. SJRWMD also participates in a multi-agency and citizen consortium planning the Hogan Creek Restoration. Finally, SJRWMD has consulted with USFWS regarding other federally funded projects, such as McGirts Creek restoration. SJRWMD will continue to provide reciprocal data and expertise to restoration projects occurring with the LSJRB.

3.2.4 Strategy: Assess and Monitor Algal Populations and Respond to Harmful Algal Blooms (HABs)

Objectives:

- Investigate the causes of HABs and the effects of HABs on other living resources.

Assess and Monitor Algal Populations and Response to HABs — Coordination with Other Agency Plans
SJRWMD will continue to monitor phytoplankton populations in the LSJRB and will sample surficial algal scums and blooms for species identification and, if funding is available, for algal toxins when needed. Data regarding phytoplankton toxins will be provided to the Florida Department of Health (FDOH) for public dissemination and public health planning and response. SJRWMD will continue to participate in Florida’s Harmful Algal Bloom Task Force and support its mission and goals whenever possible.

3.2.5 Strategy: Assessment, Monitoring, and Recommendations of Fisheries Management

Objectives:

- Provide biological data to perform trend analysis and evaluate responses to point and nonpoint pollution on the basin’s living resources.
- Select and/or modify the bioassessment methods that will be used for evaluating the effects of point- and nonpoint source pollution on the basin’s living resources.
- Establish benchmark goals for the restoration of living resources in the basin.

- Establish critical habitat requirements to restore and support living resources within the basin.
- Investigate the causes of HABs and the effects of HABs on other living resources.
- Provide technical support for regulatory and management programs affecting the basin's natural resources.

Assessment, Monitoring, and Recommendations of Fisheries Management — Coordination with Other Agency Plans

The FIM Program is currently funded through recurring state money. Through FWRI, the results are integrated with other Florida fisheries assessment programs. In addition, FIM staff provide regular reports and updates to the LSJRB Technical Advisory Committee and the Biological Monitoring Subcommittee to coordinate and share information with regional scientists and managers.

Additional FIM sampling zones further upstream in the lower St. Johns River (Doctors Lake to Palatka) were established through a three-year grant from SJRWMD in July 2005 and will continue to be monitored monthly through 2008. The data collected from this project is compatible with all other SRS fisheries sampling conducted in northeast Florida and adjacent water basins. The goal is to make this expanded sampling in the St. Johns River continuous and a regular part of the monthly FIM sampling regime, thus providing a long-term fisheries monitoring data set for the entire lower basin. The projected budget is listed in chapter 4.

3.2.6 Strategy: Acquire Upland Buffer Areas

Objectives:

- Protect and restore natural systems through acquisition and management of protected lands.

Acquire Upland Buffer Areas — Coordination with Other Agency Plans

SJRWMD continues to pursue land acquisition opportunities both solely and in concert with other agencies. Those agencies may include FWC, FDEP, NRCS, and state and local governments. Land acquisitions will continue to be assessed according to their strategic value with respect to water resource protection and restoration.

3.3 Sediment Management Initiative

Sedimentation in Jacksonville's urban tributaries affects the aquatic resources and impacts human activities. Citizens often complain about excessive sedimentation and filling-in of stream channels. Impacts from sedimentation and turbidity may include:

1. Covering SAV, decreasing light penetration, and reducing photosynthesis
2. Smothering macroinvertebrates and harming organisms
3. Impacting fish health and spawning
4. Reducing aquatic habitat
5. Filling in streams, impacting human enjoyment, boating, and recreation

Projects and programs associated with this initiative are concerned with reducing the adverse impacts from construction sites and disturbed areas. Implementation efforts may involve the inspection of construction sites for erosion and sedimentation control measures in order to reduce off-site sedimentation and runoff of turbid water; protection of surface waters, streams, and drainage systems from the effects of sedimentation and excessive turbidity; the inspection of construction sites before and during clearing and construction based on priorities; and the initiation of law enforcement for violators. Restoration projects also occur in some areas where ecosystems have been impacted by past construction activities. This initiative includes projects for maintenance dredging of the Intracoastal Waterway and Jacksonville Harbor to maintain the required navigation depths in these areas. Public education is also a major focus within the sediment management initiative.

Goal for the Sediment Management Initiative

Perform erosion and sediment management in the interest of protecting and improving living resources and water quality in the LSJRB.

Identified Milestones for the Accomplishment of the Sediment Management Initiative

FY 2008–2012
• Program for determining the primary causes and sources of sedimentation in the LSJRB developed. • Primary causes and sources of sedimentation in the LSJRB identified. • Construction sites improving compliance with existing regulations and requirements regarding BMPs and NPDES regulations such as adherence to the stormwater pollution prevention plans. • Dewatering sites reducing adverse impacts (i.e., pumping muddy water into drainage systems, streams, and surface waters) particularly those occurring in clay soils.

3.3.1 Strategy: Investigate Causes and Sources of Sedimentation and Implement Projects, Programs, and Regulations to Control Sediments

Objectives:

- Identify the primary causes and sources of sedimentation in the LSJRB.
- Reduce the primary causes of sedimentation in the LSJRB.
- Eliminate in-place sedimentation loads in the LSJRB.

Sedimentation Management — Coordination with Other Agency Plans

The city of Jacksonville, Environmental Quality Division (EQD) will continue to conduct inspections of construction sites for erosion and sedimentation control BMPs within Duval County. The goal of this program is to reduce sedimentation in the LSJRB. EQD coordinates with FDEP and other agencies so that EQD is the primary inspector for those sites within Duval County (city of Jacksonville) boundaries. This allows FDEP and SJRWMD compliance staff to concentrate efforts outside of Duval County within the rest of the LSJRB.

3.3.2 Strategy: Provide Additional Education and Outreach to the Construction Industry and Citizens

Objectives:

- Improve compliance with existing regulations and requirements regarding BMPs at construction sites, and NPDES regulations, such as adherence to the stormwater pollution prevention plan.

Education and Outreach to the Construction Industry – Coordination with Other Agency Plans

Historically, several agencies have cooperatively offered the two-day Florida Stormwater Erosion and Sedimentation Control Inspectors Certification Class a minimum of several times per year in Jacksonville. The city of Jacksonville EQD will be coordinating this class twice per year, and will offer to help teach any other classes organized by other agencies held in the Jacksonville area. In addition, two-hour short classes or informative presentations have been cooperatively given to interested groups and companies and these will also continue. Other public education and outreach opportunities will be considered, such as additional presentations and brochures.

3.3.3 Strategy: Review Current Requirements for Improving Compliance and Simplifying Processes, while Maintaining Environmental Controls

Objectives:

- Improve compliance with existing regulations and requirements regarding BMPs at construction sites, and NPDES regulations such as adherence to the stormwater pollution prevention plan.

Improving Regulatory Compliance and Processes for Sediment Management — Coordination with Other Agency Plans

The city of Jacksonville EQD is responsible for inspections and regulation of erosion and sedimentation control BMPs from construction sites within Duval County. FDEP and SJRWMD provide inspections and regulation for sedimentation in the rest of the LSJRB.

3.3.4 Strategy: Encourage the Use of Polyacrylamide and Other Flocculants to Control Turbidity from Dewatering Operations

Objectives:

- Reduce adverse impacts from dewatering operations (pumping muddy water into drainage systems, streams, and surface waters), particularly those occurring in clay soils.

Use of Flocculants to Control Turbidity — Coordination with Other Agency Plans

During the two-day certification classes, the city of Jacksonville EQD and participating agencies have recently included much more information and discussion on the use of flocculants such as polyacrylamide to control turbidity from dewatering operations. This emphasis will continue in future classes. In addition, field inspections and enforcement meetings present opportunities for staff to stress the importance of preventing problems from dewatering operations by using flocculants.

3.3.5 Strategy: Develop Incentives for Innovative Solutions

Objectives:

- Encourage the development and implementation of new and better technology and best management practices to reduce sedimentation at the source.

Incentives for Sediment Management — Coordination with Other Agency Plans

The city of Jacksonville and FDEP work together in the sediment management efforts in the LSJRB. As part of the regulatory process, field inspections and enforcement meetings present opportunities for staff from these entities to encourage the use of new and better technology and BMPs to manage sedimentation.

3.4 Toxic Contaminants Remediation Initiative

Protecting water quality and natural systems are among SJRWMD's top priorities. With the help of many partners, SJRWMD is working to improve stormwater treatment, remove harmful sediment deposits, buy environmentally sensitive land, and execute projects designed to reverse negative trends in water quality and to preserve the areas still in good health. One new tool being used to determine the health of our waterways is a study to investigate the connection between water quality, sediments, and biology on the river bottom.

<u>Background</u>
In 1996, SJRWMD began a baseline monitoring project to assess the freshwater sediment quality of the St. Johns River. Eighty-six sites were selected, and the study concluded that the general quality of sediments was good. A few locations, however, had elevated concentrations of organic and metal contaminants, and further study was recommended.

SJRWMD conducted two separate detailed sediment quality assessment projects, which were completed in 1999. A total of 123 sites districtwide were studied. An additional 97 sites in the LSJRB and 58 sites in the Cedar-Ortega River Basin were also studied. The projects involved fieldwork such as collecting sediment samples, studying analytical chemistry and benthic ecology (the relationship between bottom-feeding organisms and their environment), testing sediment toxicity, analyzing data, and assessing risks. SJRWMD's effort is among the nation's most extensive sediment studies to date. The standards used in the study exceed those used by the EPA during the same period. SJRWMD used a higher standard because federal standards at the time were not sensitive enough to measure concentrations and levels of detection desired by SJRWMD and other cooperating agencies.

<u>Results</u>
SJRWMD's studies measured trace organic and metal contaminants in sediments. Freshwater sediments indicated good environmental quality for most of SJRWMD. However, a few sites showed elevated concentrations of contaminants when compared to other sites, previous studies, and reference data. These sites are:

- Lake Norris, in Lake County, showed elevated levels of pesticides.
- In Gainesville, Sweetwater Branch and Bivens Arm showed elevated levels of PCBs (typically associated with electrical transformers), pesticides and metals.
- Within the Harris Chain of Lakes, lakes Beauclair, Dora, and Eustis showed elevated levels of pesticides.
- In the lower St. Johns River, sediment data indicated good environmental quality.

The exceptions to good quality were the northernmost part of the river in Jacksonville; the urban tributaries, particularly the Cedar-Ortega River Basin in Jacksonville; Rice Creek; and river sediments in the Palatka area in Putnam County. Of the LSJRB sites, sediments in the Cedar-Ortega basin were of greatest concern due to elevated levels of contamination from PCBs, organic solvents, pesticides, lead, copper, silver, zinc, and chlordane. Sources of the contamination were not identified in the study but will be addressed in later studies.

<u>Recent/Current Actions</u>
SJRWMD is now assessing the study's results to determine the level of environmental impact. An environmental science study is under way to determine the age of the contamination, while engineers are determining the sources of contamination and developing a sediment transport computer model that may reveal how and where sediments move. SJRWMD engineers also are looking to see if stormwater treatment facilities may be strategically placed to trap pollutants before the pollutants can impact water quality and sediments in the waterways. SJRWMD also will conduct additional sampling of sediments and organisms. These projects are discussed below.

Conclusion

The sediment quality assessment project has significantly enhanced SJRWMD's understanding of environmental quality associated with water resources. This understanding enables SJRWMD scientists and engineers to make more informed decisions about further protecting and managing water resources.

Goal for Toxic Contaminants Remediation Initiative

Protect living resources in the LSJRB from toxic pollution to ensure protection and propagation of healthy and well-balanced communities.

Identified Milestones for the Accomplishment of the Toxic Contaminants Remediation Initiative

FY 2008–2012
• Point- and nonpoint sources of toxic contamination in the LSJRB identified. • The fate and effects of toxic contaminants on natural systems determined to point of assisting management decisions. • Contaminant data evaluated to guide contaminant assessment and planning. • Toxic contaminant evaluation methods identified for data collection and analysis. • Toxic contamination in LSJRB sediments remediated to Florida Sediment Quality Guidelines, or other protective levels, to the degree practicable.

3.4.1 Strategy: Toxic Contaminant Sediment Assessment and Diagnostics

Objectives:

- Identify and reduce point- and nonpoint sources of toxic contamination in the LSJRB to levels that will ensure protection and propagation of aquatic living resources.
- Determine the fate and effects of toxic contaminants on natural systems and living resources in the LSJRB.
- Remediate toxic contamination in LSJRB sediments to Florida Sediment Quality Guidelines, or to levels that will ensure protection and proliferation of living resources.
- Select or modify the toxic contaminant evaluation methods that will be used for toxic contaminant data collection and analysis.
- Evaluate contaminant data and describe conditions of natural habitats and living resources to guide contaminant assessment and planning.

Toxic Contaminant Sediment Assessment and Diagnostics — Coordination with Other Agency Plans

SJRWMD is planning several sediment assessment projects including Cedar River Regional Stormwater Treatment (RST) monitoring, Deer Creek remediation, Fishweir Creek remediation, rangia clam assessment, chlorophenolic contaminant assessment, and a pollution-induced community tolerance assessment. SJRWMD coordinates toxic sediment assessment and diagnostics projects with the appropriate federal, regional, state, county and city agencies.

3.4.2 Strategy: Toxic Contaminant Sediment Remediation Planning

Objectives:

- Identify and reduce point- and nonpoint sources of toxic contamination in the LSJRB to levels that will ensure protection and propagation of aquatic living resources.

- Remediate toxic contamination in LSJRB sediments to Florida Sediment Quality Guidelines, or to levels that will ensure protection and proliferation of living resources.

Toxic Contaminant Sediment Remediation Planning — Coordination with Other Agency Plans

SJRWMD and other agencies, such as the U.S. Army Corps of Engineers and city of Jacksonville, are actively engaged in several sediment remediation planning projects including Cedar River RST monitoring, Deer Creek remediation, and Fishweir Creek remediation. These projects are coordinated with appropriate federal, regional, state, county and city agencies. Once the planning level work is completed, SJRWMD involvement in the remediation activity is limited and the remediation is the primary responsibility of FDEP, EPA, U.S. Army Corps of Engineers, and associated sponsoring local government.

3.5 Public Education Initiative

The goal of SJRWMD's Office of Communications and Governmental Affairs and the Outreach Program is to educate the public, media, and governmental entities about water resources, to involve the public in protecting these resources, and to develop partnerships needed to advance the mission of SJRWMD.

Since the last update of the LSJRB SWIM Plan, SJRWMD has been a leader in the development of two notable partnership initiatives to restore the LSJRB to health: the 1998–2003 River Agenda and the 2006 River Accord. During this period, SJRWMD staff have given hundreds of educational presentations to homeowners, civic and school groups, and elected officials on the river's water quality and dozens of media tours of the river resulting in hundreds of articles aired or published.

Goal for the Public Education Initiative

Increase public awareness of water resource problems in the basin to generate public support for restoration and protection efforts.

Identified Milestones for the Accomplishment of the Public Education Initiative

FY 2008–2012
• Stakeholders and information users identified. • Database for maintaining outreach contact information developed. • Roles and areas of responsibility of key outreach staff identified. • Public outreach plan for LSJRB developed with indicators of public knowledge and awareness identified. • Public outreach plan being implemented.

Objectives:

- Increase public awareness of the importance of water resources, problems affecting these resources, and restoration/protection efforts in the LSJRB.
- Increase the public's knowledge and understanding of the St. Johns River ecosystem and actions needed to address its problems.

3.6 Intergovernmental Coordination

Goal for the Intergovernmental Coordination Initiative

Enhance interagency coordination and management of water resources throughout the basin.

Identified Milestones for the Accomplishment of the Intergovernmental Education Initiative

FY 2008–2012
• Administrative frameworks, interagency agreements, and technical linkages required to improve interagency coordination and management of the basin's surface waters and associated natural systems identified and under development • Priorities for action based on political, governmental, and public input established • Program for providing technical support for regulatory and management programs affecting the basin's natural systems developed

Objectives:

- Establish administrative frameworks, interagency agreements, and technical linkages required to improve interagency coordination and management of the basin's surface waters and associated natural systems.
- Establish priorities for action based on political, governmental, and public input. Address the needs of the LSJRB as a whole and specific needs related to the three planning regions and individual management units (subbasins).
- Provide technical support for regulatory and management programs affecting the basin's natural systems.

3.7 Past/Current Projects (1993–2007)

Water Quality Initiative Past/Current Projects

Agricultural BMP Cost-Share Program — Phase I (1998–2007): This SJRWMD water quality protection cost-share program was designed to promote grower adoption of in-field BMPs that reduce nutrient loading into receiving streams in the TCAA. Sign up of growers began in 2000 and grower contracts continue through 2010; phase II of this cost-share program began in 2008. This voluntary program provided a monetary incentive for farmers to implement BMPs and to compensate for any potential increase in cost or risk which may result while the farmers adjust to the new technology. The program provided cost-share funds for agricultural practices, which will sustain profitable crop yields and will have potential water conservation, runoff, and water quality benefits. Phase I of the program was successful, with 52 percent of area potato growers participating and 70 percent of the eligible potato and cabbage acres in the TCAA enrolled in the program.

Agricultural Receiving Streams Evaluation (1990–2007): SJRWMD conducted ambient monitoring as part of its Nonpoint Source Pollution Program, and monitored temporal water quality trends associated with agricultural watersheds. Numerous parameters were measured with consideration toward the physical, water chemistry, and toxicological characteristics of the samples collected. This project is expected to continue in future years.

Algal Toxin Monitoring (2005–2007): This SJRWMD project developed information on algal toxin occurrence and provided assistance to the Department of Health. The data collected documented the occurrence of high algal toxins during the large *Microcystis* bloom in 2005. This project is expected to continue in future years.

Ambient Water Quality Monitoring in the TCAA (1990–2007): Diagnostic data were collected by SJRWMD to determine long-term spatial and temporal water quality trends within the agricultural watersheds in the LSJRB. Agricultural subbasins were mapped and monitored as well as the receiving streams at the confluence of the lower St. Johns River. These data were also used for water quality model validation and calibration for TMDL development. Ambient water quality monitoring is expected to continue from 2008 to 2012.

Aquatic Organic Matter Characterization (2005–2007): This SJRWMD project evaluated new chemical and bioassay methods to characterize aquatic organic matter. The results of this evaluation allow for better characterization of the biodegradability and nutrient cycling of organic matter. This project is expected to continue in future years.

Best Management Practice (BMP) Effectiveness and Stormwater Monitoring (1998–2007): Diagnostic data were collected and studies designed to directly relate to the spatial and temporal water quality effects resulting from in-field BMP implementation and regional stormwater facilities. Monitoring was conducted over the 10-year time span of the BMP Implementation Program to measure the results and effectiveness of the program. This was a cooperative SJRWMD/UF-IFAS project.

Best Management Practice (BMP) Geographic Information System (GIS) Tracking Tool (1999–2007): This SJRWMD GIS project tracked the implementation of in-field BMPs that were implemented in the TCAA. These tracking data were used to correlate with water quality data collected in the TCAA and for compliance with the nutrient TMDL and BMAP for the mainstem. This effort is expected to continue through 2010.

City of Jacksonville Mainstem Run (1985–2007): The program sampled 10 ambient stations in the mainstem of the St. Johns River on a monthly basis. Goals of this program were to monitor water quality trends for nutrients and their impacts. Information collected assisted the state in establishing TMDLs for the lower St. Johns River in Duval County. TMDLs and nutrient reduction goals will then be incorporated into surface water discharge permits held by the city. This project will continue into the future.

COJ MS4 Permit Monitoring Program: Stormwater BMP Effectiveness Studies (2002–2007): This program constituted a portion of the city's NPDES/MS4 Monitoring Plan, required by the EPA and state of Florida. The goal of the program was to determine the effectiveness of certain designated stormwater treatment projects. Four projects were identified for study through this program. Pollutants monitored in this program range from nutrients to PCBs. This project will continue into the future.

COJ MS4 Permit Monitoring Program: Tributary Intensive Program (2002–2007): This program started in 2002 and was designed to provide more detailed water quality information about selected tributaries in Duval County. Sites were monitored in each of the following basins: Arlington River, Trout River, Cedar-Ortega rivers, and Julington/Durbin creeks. In addition, one site was located on each of the following minor tributary basins: McCoy, Deer, and Little Fishweir creeks. All of the 16 sites were also part of the "Routine Tributary" program. The sampling year was divided into wet and dry months based on National Weather Service average monthly rainfall from 1971–2000. In 2002, the 15 sites were sampled three times during wet months and two times during dry months. Data from this program were used in concert with mainstem water quality data to understand pollutant loading into the St. Johns River. The data were then used by the state to develop TMDLs. This program constituted a portion of the city's NPDES/MS4 Monitoring Plan, required by the EPA and state of Florida.

COJ Tributary Routine Program (1985–2007): The focus of this program was to monitor water quality in the tributaries of the St. Johns River in Jacksonville. Approximately 100 sites along Jacksonville tributaries were monitored quarterly for a variety of parameters. The tributaries provide significant littoral zone habitat for a variety of species and are extremely important to the ecology of the St. Johns River estuary system. Pollution impacts in the tributaries can be pronounced, since they have a smaller dilution potential than larger water bodies. Two important water quality parameters measured at the tributary monitoring sites were dissolved oxygen and fecal coliform bacteria. Data collected through the program were used to track long-term water quality trends, and to determine if the surface waters were meeting their designated use as Class III waters. If waters were not meeting their designated use, programs were put in place to restore the water quality. This program constituted a portion of the city's NPDES/MS4 Monitoring Plan, required by the EPA and state of Florida. This project will continue into the future.

City of Jacksonville Timucuan Preserve Program (1990–2007): This program was a cooperative effort between the city of Jacksonville, the NPS, FDEP, CAMA, and The Nature Conservancy's Machaba Balu Preserve. Cooperators assisted by providing field support when needed, and the NPS provided funding for chlorophyll analysis. The purpose of this effort was to collect water quality trend data for the surface waters in and adjacent to the Timucuan Ecological and Historic Preserve. Twelve sampling locations were monitored bimonthly to provide information that will be used to make land-use decisions in this area of the county. In addition, the state used the data collected to determine if the surface waters were meeting their designated use. If the waters did not meet the designated use, then a TMDL will be developed for the pollutants of concern. This project will continue into the future.

Comprehensive Nutrient and Water Use Research Project in the TCAA (2007): The SJRWMD provided funding to UF-IFAS to begin multiple subprojects in the effort to reduce nutrients in runoff and decrease water use.

- *Evaluation of Cut-Off Date for Nutrient Applications to Potato Crops* — This study was an evaluation of the days after planting when nutrient applications are no longer helpful to a potato crop (the cut-off date). Establishing this date could eliminate some fertilizer applications, which would decrease costs to the grower as well as result in nutrient reductions to the watershed.
- *Testing the Effectiveness of Controlled Release Fertilizer (CRF) on Sod* — This project evaluated the effectiveness of CRF products on sod compared to soluble fertilizers. If CRFs can effectively fertilize sod and reduce runoff concentrations, they have the potential for widespread use and subsequent reductions in urban runoff concentrations. Future work is planned if the pilot project indicates this is a viable alternative for sod fertilization.
- *Tracking Nutrients through Ditches and Canals* — This study evaluated the attenuation of nitrogen and phosphorus species as water travels from the field to the tributaries. The study included habitat assessments, algal counts, and algal species change evaluations. This project began in 2007 and will continue through 2010.

- *In-Canal BMPs for Sediment Stabilization* — This project was proposed as a pilot project to study the use of polyacrylamides in agricultural water furrows to stabilize sediments and reduce phosphorus concentrations in runoff. If this pilot project is funded in the future and the results are promising, a full research study will be proposed in cooperation with UF-IFAS.

Controlled Release Fertilizer (CRF) Field Demonstration Study Stormwater Analysis (2005–2006): This SJRWMD project provided an analysis of runoff water quality during storm events from the CRF demonstration fields. This assessment was used to quantify the water quality benefits of CRF use.

Controlled Release On-Farm Project: An Alternative Irrigation Program for Potato Crops to Reduce Water and Nutrient Use (2005–2007): Through funding from SJRWMD, UF-IFAS conducted research at the Plant Science Research and Education Unit's Hastings Farm to develop an alternative irrigation system for potatoes grown in the TCAA to reduce water and nutrient use. Specifically, factors that were measured included comparison of water use efficiencies, fertilizer use efficiencies, crop use, crop production, and tuber quality between a subsurface seepage and drip irrigation/fertigation system. SJRWMD also funded a water quality analysis of runoff during storm events in the CRF fields (2006–2007). The results indicated that the drip irrigation/fertigation system is a viable approach and future projects include in-field testing of the system.

Crop Yield Sap/Tissue Analysis for the Controlled Release Fertilizer Field Demonstration Study in the Tri-County Agricultural Area (2005–2007): The SJRWMD funded UF-IFAS to conduct routine sampling on three farms to assess CRF technology compared to conventional soluble fertilizers as a potential BMP in the TCAA. This effort was associated with the assessment of crop yields and sap/tissue analysis for potato plants located on the study fields where CRFs and conventional soluble fertilizers are applied. By reducing the amount of soluble phosphorus applied in the watershed, improvements to phosphorus loadings to the freshwater lower St. Johns River tributaries would be expected.

Dairy Baseline Water Quality Monitoring (1999–2007): This ambient monitoring was part of the SJRWMD Nonpoint Source Pollution Program, and monitored temporal water quality trends associated with dairy production. This project collected monthly surface grab samples at one-half meter, or one-half stream depth if stream depth was less than one meter. Numerous parameters were measured with consideration toward the physical, water chemistry, and toxicological characteristics of the samples collected.

Deep Creek West Regional Stormwater Treatment (1998–2006): In 1998, the Yarborough property was acquired to build a regional stormwater treatment (RST) system. The RST was designed and constructed to treat agricultural runoff in the Deep Creek subbasin. During the design phase, models were used to predict the performance and effectiveness of nutrient reductions for various designs. A wet retention and wetlands treatment system was selected to optimize nitrogen and phosphorus reductions. The site went online in 2006, performed well, and continued to operate in 2007. Continued monitoring, operations, and maintenance of the site are planned from 2008–2012.

Demonstration Project Using Controlled Release Fertilizers on In-Field Chip Potatoes (2005–2007): In 2007, SJRWMD and UF-IFAS completed a demonstration project on CRF used in chip potato growers' fields. Three farms were involved in the project with two fields per farm. At each farm, CRF was applied to one of the two fields and the other was treated with standard fertilizers (control field). The yields and water quality were measured at each site. This project led the way to creating a CRF BMP for chip potatoes.

Determination of Nutrient Release Curves for Controlled Release Fertilizer (2000–2004): Through a cooperative project with SJRWMD and UF-IFAS, field plots were established at the UF-IFAS Hastings Research Farm, which is located in the TCAA, to develop a CRF for chip potatoes. UF-IFAS worked with SJRWMD to develop application rates and practices to maximize the treatment efficiency of this new agronomic treatment technology. The resulting information showed that 75 percent of the nitrogen was needed by crops in the first 65 days after planting. The cooperators then worked with fertilizer companies to design a CRF product to meet the potato growers' needs.

Development of a Decision Matrix to Recommend Regional Surface and Stormwater Treatment Alternatives (2002): This SJRWMD project developed a regional treatment facility decision matrix based on a review of existing data and literature related to treatment methods for reducing pollutants associated with agricultural and urban stormwater runoff, as well as lake and riverine surface waters. The matrix was used as a guide to determine which treatment methodology is best suited for local conditions.

Development of the Watershed Assessment Model (WAM) (1997–2007): SJRWMD developed the WAM specifically for the TCAA to measure nutrient loadings from agricultural watersheds and to estimate the load reductions associated with BMP implementation. The model requires current land use and BMP implementation to be accurate in its predictions and; therefore, annual updates of the WAM model are planned. FDEP supplied Section 319 funding for this effort.

Edgefield Regional Stormwater Treatment (2001–2007): In 2001 the Edgefield property was acquired by SJRWMD. The RST system was designed and constructed to treat agricultural runoff in the Dog Branch subbasin. During the design phase, models were used to predict the performance and effectiveness of nutrient reductions for various designs. A wet retention and wetlands treatment system was selected to optimize nitrogen and phosphorus reductions. The site went online in 2007. Continued monitoring, operations, and maintenance of the site are planned from 2008–2012.

Effects of Fertilizer Types and Fertilization Practices on Nitrogen Release to Surface Waters (2002–2005): This cooperative SJRWMD/UF-IFAS project was designed to explain the fate and effect of different types and rates of agronomic fertilizers under production practices and simulated rainfall conditions.

Engineering and Design of the UF-IFAS Plant Science Research and Education Unit's Hastings Farm (2007): This project designed and re-engineered the UF-IFAS Hastings Research Farm for conducting water quality research associated with agronomic production. This effort, when implemented, will establish the research center as a state-of-the-art outdoor research facility for monitoring BMP effectiveness for addressing TMDL goals. This project was sponsored by SJRWMD. Future efforts will include implementing the site design and upgrades.

Evaluation of Stormwater Detention Treatment Efficiency Project (1993): This joint study between SJRWMD and the city of Jacksonville Environmental Resource Division evaluated the treatment effectiveness of various types of stormwater detention. The results of this study led to a rule change that revised stormwater BMPs.

Expansion of Controlled Release Fertilizer Testing for Additional Crops (2007): SJRWMD, UF-IFAS, and FDACS worked collaboratively on plot-level research at the UF-IFAS Hastings site on CRFs for crops such as cabbages, melons, corn, and greens. Different quantities and release times were tested as well as crop yields determined. As results are received, testing will move to in-field demonstration projects.

Geographic Information System (GIS) Land Use Assessment (2005): This SJRWMD project monitored the land use changes in the TCAA using GIS. The GIS land use coverages were updated and evaluated with both predicted and actual treatment efficiencies in priority areas. This effort is expected to be updated annually.

Implementation of Aquaculture BMPs (2003): This SJRWMD project implemented a plan to improve tailwater discharges from an existing aquaculture production operation. The aquaculture operation used groundwater to raise hybrid striped bass and eels. A wetland treatment system was constructed on-site to remove pollutants prior to discharge to the St. Johns River.

Land Use Effects on Shallow Groundwater Pollution (2006–2007): This project initiated by SJRWMD expanded SJRWMD's shallow groundwater monitoring network and developed a model to assess landscape effects on shallow groundwater quality. This project is expected to continue in future years.

Lower St. Johns River Groundwater Monitoring Program (2003–2007): This ambient monitoring network was designed to characterize shallow groundwater quality existing beneath major land uses and in areas where septic tank density is high, or where reuse water or land disposal of domestic waste was occurring. A major objective of the study was to identify the conditions that allow nutrient-enriched shallow groundwater to migrate to surface waters. Water quality samples were collected quarterly from 59 wells at 14 sites. In addition, an intensive sampling program examined five sites with five replicate wells three times per year. Numerous parameters were measured, with consideration toward the physical, water chemistry, and toxicological characteristics of the samples collected.

LSJR Mainstem Basin Management Action Plan Process (2005–2007): The FDEP in cooperation with SJRWMD and local stakeholders has been developing an implementation plan to reduce nitrogen and phosphorus loads to the lower St. Johns River. The approach included requiring significant reductions from both point and nonpoint sources and from permitted and non-permitted sources. Through a lengthy negotiation process with key stakeholders, the FDEP developed an approach that established load reduction responsibilities for domestic and industrial wastewater sources, permitted stormwater areas, and nonpoint sources that do not fall under the federal NPDES permit program, including agriculture. The BMAP is expected to be adopted in 2008 and will be implemented through permits and the authority of the BMAP itself. The TMDL and BMAP will be reevaluated and updated as necessary every five years.

LSJR Tributary Basin Management Action Plan Process (2005–2007): Through efforts of the FDEP, JEA, the city of Jacksonville, and the Duval County Health Department, preliminary assessment of fecal coliform contamination of the lower St. Johns River tributaries began. Sources included failing septic tank systems, leaking or malfunctioning wastewater collection systems, domestic animals and wildlife. In 2005, six tributaries were evaluated and sources of fecal coliform contamination were investigated. An assessment manual was developed to guide the evaluation of additional tributaries. In 2006 and 2007, additional tributaries were monitored and assessed and a BMAP Working Group was formed. Data compilation and assessment efforts continued and the results were used to begin the BMAP implementation plan to reduce fecal coliform bacteria in the tributaries. This process is expected to continue with an adoption of the BMAP in 2009.

Lower St. Johns Watershed Action Volunteers (1995–2007): This SJRWMD program supported volunteer monitoring in the LSJRB. Grab water quality samples of storm waterwere collected at various sites located on small (first-order) catchments during storm events. Numerous parameters were measured, with consideration toward the physical, water chemistry, and toxicological characteristics of the samples collected. This project is expected to continue in future years.

Macroinvertebrate Sampling in the TCAA Tributaries (1995–2007): The SJRWMD sampled macroinvertebrates in the TCAA tributaries to quantify the biological consequences of load reductions associated with implementation of BMPs in the TCAA.

Measurement of Lateral Flow in the Tri-County Agricultural Area (TCAA) (2005–2007): The fate of nutrients once they enter the shallow groundwater beneath the potato fields was not well understood. This project was necessary to determine if the nutrients in the shallow groundwater move out of the fields into drainage systems and the river or if they stay in the fields and are taken up by plants. This SJRWMD project helped determine if subsurface lateral movement of water occurs in fields that are seepage irrigated, determined the extent of lateral water movement from controlled fluctuations of the perched water table, and evaluated the effect of seasonal rainfall variations on the subsurface lateral water movement. This information helped resource managers with determining the need for management practices to deal with this potential source of nutrient pollution.

Mid-Mainstem Ambient Monitoring Network (1984–2007): This monitoring was part of SJRWMD Ambient Monitoring Network, and was specific to the mainstem of the St. Johns River within the LSJRB. Specifically, monitoring occured between Palatka and Green Cove Springs. The ambient monitoring network was designed to characterize spatial patterns, monitor annual and long-term temporal trends in water quality, and help identify where immediate problem issues occur. This project collected monthly surface samples that were either grab samples or a vertically integrated sample of the top three meters, depending on the site. Numerous parameters were measured with consideration toward the physical, water chemistry, and toxicological characteristics of the samples collected.

Mill Cove Flow Improvement Project (1999–2003): This project was undertaken by the USACE Northeast SJRWMD. The USACE designed and constructed a 6-ft by 80-ft flow improvement channel from the mouth of Mill Cove at Arlington Point to the navigational cut through Bartram Island east of the Dames Point Bridge. The channel was constructed to enhance flow through the cove and decrease siltation. The improved flushing is expected to improve water quality within the cove.

Monitoring Lower St. Johns Tide Levels (1999–2007): This SJRWMD project involved continuous monitoring of tide levels in support of water quality model development, calibration, and verification. This project is expected to continue in future years.

Northern Ambient Monitoring Network (1991–2007): This monitoring was part of the SJRWMD Ambient Monitoring Network, and was specific to the mainstem of the St. Johns

River within the LSJRB. Specifically, monitoring occured between Green Cove Springs and the Fuller Warren Bridge (including Doctors Lake). The ambient monitoring network was designed to characterize spatial patterns, monitor annual and long-term temporal trends in water quality, and help identify where immediate problem issues occur. This project collected surface grab samples on a monthly basis at one-half meter depth. Numerous parameters were measured with consideration toward the physical, water chemistry, and toxicological characteristics of the samples collected.

Northern Tributary Ambient Monitoring Network (1984–2007): This monitoring was part of the SJRWMD Ambient Monitoring Network, and was specific to tributaries of the St. Johns River within the LSJRB. Specifically, monitoring occured in tributaries north of Green Cove Springs. The ambient monitoring network was designed to characterize spatial patterns, monitor annual and long-term temporal trends in water quality, and help identify where immediate problem issues occur. This project collected surface grab samples on a monthly basis at one-half meter depth. Numerous parameters were measured with consideration toward the physical, water chemistry, and toxicological characteristics of the samples collected.

Nutrient Transport and Organic Decomposition in Agricultural Flatwood (2003–2004): This SJRWMD project assessed how nutrients move through the soil and reach receiving water in the TCAA. This information was used to improve the watershed models including the nutrient constituents and transport.

On-Site Sewage Treatment System Enforcement Project (1999–2007): This project, conducted by the Duval County Health Department, identified failed septic tanks along the mainstem and tributaries of the St. Johns River and enforced corrective action or hook up to municipal sewers where available. Septic tank failure areas were identified and earmarked for sewerage expansion by JEA.

Peters Creek Restoration Initiative/Black Creek Subbasin Agricultural Nonpoint Source Land Use Assessment (2000–2003): Peters Creek is located in the Black Creek watershed and had historically suffered from the discharge of cattle waste and low dissolved oxygen levels. This SJRWMD project developed BMPs to deal with the sources identified by previous projects. The assessment also aided development of the water quality model and the land use characterization of the Black Creek Subbasin needed for the model.

Point-Source Assessment Project (1994–1997): The project was conducted by FDEP, Duval County, and SJRWMD. The project produced the first comprehensive nutrient load budget for the lower St. Johns River, demonstrating that approximately half of the anthropogenic nutrient load comes from point sources.

Preliminary Lower St. Johns River Mainstem Nutrient BMAP Implementation (1997–2007): With the knowledge that the lower St. Johns River was considered impaired for nutrients, many local organizations began reductions while the nutrient TMDL was being developed. Projects included decreasing wastewater discharges, increasing the use of treated wastewater for irrigation (reuse), improving wastewater treatment, development and implementation of agricultural and stormwater BMPs, installation of regional treatment areas, and improving stormwater management practices and public education. These efforts are expected to continue and expand when the BMAP is adopted and further implementation efforts are required.

Salinity/Dissolved Oxygen/PAR Measurements (1996–2007): This ongoing project provided continuous water quality data for three parameters for the development of the hydrodynamic model and the water quality model. This project was a cost-share with the USGS and is expected to continue in future years.

Section 319 Best Management Practice (BMP) Project (1993–1997): Through cooperation and funding from FDEP, SJRWMD implemented BMPs on agricultural fields for four years. The runoff from these fields was measured and the project was designed to provide a baseline for the effects of BMP implementation. The estimated reductions as a result of BMP implementation were used in the TMDL model. The Watershed Assessment Model was used to determine the effects of BMP implementation on water quality.

Southern Ambient Monitoring Network (1993–2007): This monitoring was part of SJRWMD Ambient Monitoring Network, and was specific to the mainstem of the St. Johns River within the LSJRB. Specifically, monitoring occured between Palatka and Lake George (including Crescent Lake). The ambient monitoring network was designed to characterize spatial patterns, monitor annual and long-term temporal trends in water quality, and help identify where immediate problem issues occur. This network was also intended to characterize waters entering the lower St. Johns River from its three major inputs: the middle St. Johns River, the Ocklawaha River, and Dunns Creek. This project collected monthly surface samples that were either grab samples or a vertically integrated sample of the top three meters, depending on the site. Numerous parameters were measured with consideration toward the physical, water chemistry, and toxicological characteristics of the samples collected.

St. Johns River Nutrient Discharge Reduction (Algal) Initiative (2006–2007): In 2006, SJRWMD began the Nutrient Discharge Reduction project to reduce algal blooms in the Middle and Lower St. Johns River basins, including Lake George. As part of this effort, the staff began an assessment of options to reduce phosphorus loadings to the middle and lower basins, including agricultural subbasins. Once nutrient reduction options are identified, implementation of the best options will be pursued in conjunction with local partners. Work is expected to continue in 2008–2012.

St. Johns River Synoptic Survey (1997): Proposed, coordinated, and funded by FDEP, this week-long survey of river-wide water quality was performed twice during the year. This survey provided information that was essential to the calibration of the lower St. Johns River water quality model for the TMDL and identified significant spatial trends in water quality.

St. Johns River Water Quality Feasibility Study (1994): This was a cooperative project conducted by SJRWMD, USACE, National Ocean Service (NOS), and USGS. This assessment included reviews of results of studies on tide control and characteristics, horizontal control, reviews of needs for hydrodynamic water quality modeling, deep groundwater interactions, and upward leakance from the Floridan aquifer.

Study of Primary Production and Nutrient Limitation by Phytoplankton in the LSJR (1995–1997): This study was conducted by the University of Florida and SJRWMD. The results described existing benthic and planktonic communities and provided baseline data to evaluate success and failure of future cleanup and management efforts. The second part of the project determined which nutrients are most problematic in LSJRB. The results identified nitrogen as a pollutant of concern and identified the importance of light and location.

Tributary Discharge Monitoring (1996–2007): In a cost-share effort between FDEP and SJRWMD, this project provided the tributary flow data needed for the development of the LSJR hydrodynamic model and the water quality model. This project provided calibration data for watershed modeling in small urban basins.

USGS/SJRWMD Mainstem Water Quality Monitoring (1993–2007): This ongoing effort with USGS and SJRWMD provided flow and salinity data needed for the development of the LSJRB hydrodynamic model and the work was continued to support the development of the water quality model. The results provided accurate measurements of the flows in the St. Johns River and the extent of reverse flows caused by tide. This data collection is expected to continue in future years.

USGS Tributary and River Flow Gauging (1989–2007): This effort installed and maintained gauges in the LSJR tributaries and mainstem. These data were necessary for determination of pollutant loads and determining the effects of land use changes. This project established the first time the flows of the tidally-influenced tributaries were accurately measured. This data collection is expected to continue in future years.

Water Quality Monitoring Assessment (1988–2007): This ongoing project was part of the SJRWMD water quality monitoring program to assess system health and trends and contribute information to the Water Quality Atlas. This long-term data set has been an invaluable resource for assessments, water quality model calibration, and identification of water quality trends. This data collection is expected to continue in future years.

Water Quality Monitoring in the Timucuan Preserve (2004–2007): This project continuously measured standard physical water quality parameters every 30 minutes at three sites within the Timucuan Preserve. Initial funding to start this project was provided by the NPS and involved the monitoring of two alternating YSI 6600 EDS-S multiparameter data sondes at the Kingsley Plantation site. It has since been expanded by CAMA Northeast Florida Aquatic Preserves (FDEP) and incorporated monitoring at two additional stations: Clapboard Creek, a tributary of the St. Johns River, and Lofton Creek, a tributary of the Nassau River. In cooperation with the city of Jacksonville Environmental Resource Division, nutrient analysis was carried out on grab samples collected from these three sites on a monthly basis. On the same frequency, the NPS provided analysis of chlorophyll *a* samples which were collected at the same time. Nutrient sampling began at all three sites in November of 2004, and chlorophyll *a* sampling began at all three sites in November 2005. The main body of information obtained through this monitoring serves primarily as background condition data for this region of the state as it experiences ever increasing development pressures. This project is expected to continue into the future.

Biological Health Initiative Past/Current Projects

Ambient Light Levels within Grass Beds (2002): This project involved the monitoring and recording of light levels within and adjacent to submerged aquatic vegetation beds. The project was conducted by Water and Air Research.

Assess the Effects of Land Use Changes on the Lower St. Johns River Basin Watershed Detrital Input (2004–2007): Twenty watersheds were selected as a representative continuum from zero percent to 60 percent of impervious surface. Within the streams, several parameters were evaluated, including invertebrate community structure, secondary productivity, litter breakdown rates and inputs, and whole stream metabolism. In particular, this project looked at Nitrogen (N^{15}) spiraling and uptake efficiency. This project was conducted by the University of Alabama.

Assessment of Epiphyte Loading Associated with Submerged Aquatic Vegetation (SAV) Communities in the Lower St. Johns River (2005–2007): This project included monitoring a small number of high frequency sites, designated as the Permanent Monitoring Network (PMN), monthly for epiphyte biomass on SAV leaves. A portion of the project included assessing the effects of fertilization on SAV and epiphytes. This work was conducted under the direction of Dr. Dale Casamatta at the University of North Florida.

Before and After Effects of Developments of Regional Impacts on Receiving Streams (2005–2007): This monitoring study was designed to track water quality and biological changes in streams as developments of regional impact (DRIs) are constructed. DRIs were identified in the planning stages and sampling commenced prior to construction. Sampling will continue past build-out for each selected DRI. This project is expected to continue in future years.

Biological Monitoring-Phytoplankton (1994–2007): This SJRWMD monitoring program identified the types and amounts of algae and zooplankton to assess the LSJRB's biological health. The results indicated that blue green algae dominate nuisance blooms and adversely affect zooplankton populations. This data collection is expected to continue in future years.

The Effects of Changing Nutrient Conditions on the Structure and Function of the Phytoplankton of the Lower St. Johns River (2001–2004): This project scope was wide-ranging and included assessing spatial variability and productivity of phytoplankton sample growth under differing nutrient and light conditions.

Effects of Land Use on In-Stream Biota (2004–2007): This SJRWMD ambient monitoring study was part of the SJRWMD Natural Systems Program, and evaluated land use effects on in-stream invertebrate composition. Grab water quality samples were collected at one-half stream depth. Numerous parameters were measured with consideration toward the physical, water chemistry, and toxicological characteristics of the samples collected.

Elemental Contents in Submerged Aquatic Vegetation (SAV) Tissue in the Lower St. Johns River (2005): SAV tissue was collected in-house and analyzed for elemental components including carbon, nitrogen, and phosphorus over a spatial and temporal continuum.

Environmental Factors Affecting the Distribution and Health of Submerged Aquatic Plants in the Lower St. Johns River (1998–2003): The purpose of this project was to experimentally assess the effects of light levels, salinity, and nutrient loading on the growth of submerged aquatic plants.

Establishment of Native Vegetation Riparian Buffer Zones for Nutrient Reduction in the Lower St. Johns River Basin (2006–2007): This project had two primary objectives: (1) to characterize native riparian communities in the LSJRB; and (2) to investigate the performance of restored riparian buffers for nutrient reduction.

Estuarine Autonomous Instrumentation Platform and MERHAB (1999–2001): This new method of sampling was developed for the St. Johns River in northeast Florida. The Monitoring and Event Response for Harmful Algal Blooms (MERHAB) program began in

1999 and was a three-year comprehensive study of the lower St. Johns River estuary. One of the problems with many sampling programs, including those for harmful algal blooms, is obtaining representative samples from the area of interest. Often, few data points are used to represent long time periods or a large geographic area. The limiting factors are usually resources (time and personnel) and logistics. AMJ Equipment Corp of Lakeland, Florida, was contracted to design and build a platform with continuous recording instrumentation aboard. The autonomous platform was mounted on a pontoon boat deck, which permitted safe and convenient maintenance and portability among sites and was deployed in the St. Johns River in northeast Florida. This type of spot-sampling misses most of the high-frequency variability in aquatic ecosystems. Many programs are now using continuously recording instrumentation in the field. These remote sensors allow specific variables to be measured at short intervals for an extended period.

These types of high-frequency water quality data will help scientists to better understand the complex interactions of water quality, harmful algal blooms, and possibly fish-disease events.

Evaluation of Impacts to Fish Communities from Low Dissolved Oxygen Episodes in the Lower St. Johns, a Eutrophic Blackwater River (2005–2007): This three-year project was a joint partnership between the FWC FWRI's northeast Florida FIM program and SJRWMD and was funded by a Florida State Wildlife Grant (SWG). The lower St. Johns River in northeast Florida has been identified through the state and federal TMDL process as an impaired water body, exhibiting the symptoms of eutrophication brought about by nutrient enrichment. One of the chief symptoms of eutrophication in this river is severe low dissolved oxygen (DO) episodes, brought about by the death and decay of algal blooms. Though fish kills have occurred, and some limited fisheries monitoring data have shown evidence of low species numbers, no comprehensive FIM has been performed during low DO episodes to document the effects on fish communities. The objectives of this project were (1) conduct a literature review to determine low DO effects to regionally important fish and to evaluate the TMDL low DO criteria; and (2) conduct intensive fisheries monitoring during low DO times of year to determine possible effects to fish communities.

Evaluation of Relationships between Submerged Aquatic Vegetation (SAV) and Fish Community Structure in the St. Johns River (1995): This project was conducted by Jacksonville University.

Fish Community Structure in Four Tidal Creeks Tributary to the Lower St. Johns River (1996): This is a legacy project begun by the late Bob Brody with a retired UNF researcher; no additional information is available for this project.

Fisheries — Independent Monitoring Program (2001–2007): The FWC FWRI's FIM program is a long-term program designed to monitor the relative abundance of fishery resources in Florida's major estuarine, coastal, and reef systems. The program was developed to: (1) address the critical need for effective assessment techniques for an array of species and sizes of fishes and selected invertebrates; (2) provide timely information for use in management plans; and (3) monitor trends in the relative abundance of taxa in a variety of estuarine and marine systems throughout Florida. In 2005 the monitoring sites for the FIM program were expanded through funding from SJRWMD to include sites further upstream and to provide fisheries data that could be compared to water quality conditions and future comparisons as pollutant loads are reduced.

Hyperspectral Imaging for Submerged Aquatic Vegetation (SAV) Identification (2003, 2006): Hyperspectral imaging examines large portions of the electromagnetic spectrum for signatures indicative of specific terrain types. A combination of visible and infrared spectra was used to type different species or assemblages of SAV so that remote sensing can be used to quickly catalog nearshore benthos. This project was conducted by Hyperspectral Data International.

Land Acquisition (1994–2004): In the 10--year period from 1994–2004, SJRWMD has purchased or contributed to the purchase of 152 properties. Most of these properties were acquired to protect water resources, which implicitly includes protecting upland buffers.

Lower St. Johns River Submerged Aquatic Vegetation (SAV) Monitoring (1995–2007): The SAV monitoring program included monitoring a small number of high frequency sites (designated as the PMN) monthly or quarterly, conducted by Sagan Biological LLC. In addition, 75 transects were monitored annually (during the summer growing season), and 85 transects were monitored in-house. Data were collected for health, extent, and species composition of SAV and were used to groundtruth aerial photography. Data were also collected to characterize epiphytes and to correlate biomass with visual estimates of cover.

Microbial Food Web Dynamics in the Lower St. Johns River Basin (2007): This project had two primary objectives: (1) assess the role of microbial processes in hypoxic events (e.g., dissolved oxygen sags); and (2) assess the role of microbial processes in organic carbon fate and cycling in the river.

SAV-Coupled Macroinvertebrate Sampling in the Lower St. Johns River Basin (2007): The project included collection of invertebrates in the PMN of SAV (i.e., high frequency SAV sites), counting of invertebrates, and identification to the lowest practicable taxon. The work was conducted by Water and Air Research; Center for Systematics and Taxonomy; Ecoanalysts, Inc.; and MACTEC.

Sediment Characterization in Submerged Aquatic Vegetation (SAV) Beds (2005): Sediment cores were extracted in 15 random sites and characterized for nutrients, organic matter, grain size, sediment oxygen demand, and bulk weight/density. This project was conducted by Dr. John White at the University of Florida.

Shallow Groundwater Sampling in the Root Zone of Submerged Aquatic Vegetation (SAV) (2006–2007): This project was designed to characterize the water quality and variability of shallow groundwater in root zone sediments. Paired groundwater and surface water samples were obtained. This sampling occurred at SAV monitoring sites.

Spectral Processing Methodology for Development of Airborne Imagery of Submerged Aquatic Vegetation (SAV) in the Lower St. Johns River (2005): Hyperspectral imagery from 2003 was used to develop analysis techniques to identify SAV. This work was conducted under the direction Dr. Jonathan Jordan from the University of Florida.

Submerged Aquatic Vegetation (SAV) Photointerpretation (1998, 2002): Aerial photography was used to identify and classify SAV. In 1998, the aerial photographs were provided by U.S. Imaging. In 2002, this project was conducted by Jones Edmunds and Associates.

Sediment Management Initiative Past/Current Projects

Hogan Creek Ecosystem Restoration (2005): Funding for the Hogan Creek Ecosystem Restoration Project in downtown Jacksonville was suspended in 2005. The project team was evaluating wetland restoration alternatives in the feasibility phase when funding was suspended.

Maintenance Dredging of Intracoastal Waterway (2005–2006): The Intracoastal Waterway, managed by the Corps and the Florida Inland Navigation District (FIND), is dredged by the Corps as required to maintain a navigation depth of 12 ft. Within the St. Johns River watershed, maintenance dredging in the Palm Valley South Reach area removed approximately 1.2 million yards of dredged material in 2005 and 2006. This material was placed in Dredged Material Management Area SJ-14.

Maintenance Dredging of Jacksonville Harbor and Vicinity (1993–2007): Approximately 2 million cubic yards of material was dredged annually in the Jacksonville Harbor vicinity from the Terminal Channel (Commodore Point) to Entrance Channel Cut 3 (end of jetties). This total includes material dredged from the Federal Navigation Channel, JaxPort berthing areas, private industrial berthing areas, the Mill Cove Flow Improvement Channel, the U. S. Marine Corps Terminal at Blount Island, and the access channel and turning basin areas for the Mayport Naval Station. Dredged material was placed in upland Dredged Material Management Areas at Bartram Island, Buck Island, and Mayport; the south beach placement area at Mayport Naval Station and Katheryn Abbey Hanna Park; and the Jacksonville Ocean Dredged Material Management Area located approximately 3.5 miles east of the end of the entrance channel jetties.

Reduction of Adverse Effects from Construction Sites and Disturbed Areas (1987–2007): This program inspected construction sites in Duval County for erosion and sedimentation control measures in order to reduce off-site sedimentation and runoff of turbid water; to protect surface waters, streams, and drainage systems from the effects of sedimentation and excessive turbidity. The program consisted of a program director, two supervisors, four inspectors, and an education/outreach coordinator, and was funded through building permit fees. The program inspected construction sites before and during clearing and construction based on priorities, and initiated law enforcement for violators. The program also conducted education efforts, and offered a free two-day Erosion Control Inspector's Certification class twice per year. This project was sponsored by the COJ's EQD. This project is expected to continue in future years, funded by the city of Jacksonville through building construction permit fees.

Toxic Contaminants Remediation Initiative Past/Current Projects

Assessment of Tissue Contaminant Burdens Found in Animals Collected from the Lower St. Johns River (1996–1998, 2002–2003): The tissue burden results confirmed that contaminants were accumulating in river biota, with the most likely source being sediments (because use of PCBs, DDTs, dieldrin, and lindane were discontinued years ago). These preliminary results also indicated that mercury and PCB contamination are very problematic pollutants in the LSJRB. Clam tissue results confirmed that PCBs were the most problematic in the Cedar River. The bass, shrimp, and clam tissue results confirmed that the urban Jacksonville area, the area around the Naval Air Station, and tributaries including the Cedar and Ortega rivers and Rice Creek are the problem areas most in need of further investigation in the LSJRB.

Benthic Macroinvertebrate Data from Twenty Surface Water Sites within the Lower St. Johns River/An Evaluation of Benthic Macroinvertebrate Data from Twenty Surface Water Sites within the Lower St. Johns River (2002–2003): The two benthic macroinvertebrate reports supported the sediment assessment results (the results from the sediment assessments indicated that there was a significant potential for adverse biological impacts from sediment contaminants), indicating that contaminants were potentially causing adverse effects on the benthic populations, and that the Cedar and Ortega rivers were the most biologically impaired areas. Approximately 90 percent of the benthic deformities recorded in the first report were from sites in the Cedar and Ortega rivers, and indicated contaminant effects. These biological reports also indicated that benthic populations were impaired in the urban Jacksonville area, around the Naval Air Station and in tributaries including Rice Creek, although causes for the impairment as indicated by lower diversity and increased prevalence of pollution tolerant species were not determined.

Cedar River Stormwater Treatment Outfall Monitoring (2007): This diagnostic sediment assessment project was conducted prior to, and is proposed to follow, construction of the stormwater detention facility, to determine the effectiveness of the facility sediment and contaminant reduction measures. The objective was to analyze sediments for physical variables, total metals, semi-volatile organics, PCBs and chlorinated pesticides collected from the eastern tributary of the Cedar River. The results will be used to determine the presence and concentrations of contaminants that will be carried into and accumulate in the regional stormwater wet detention facility. In addition, sediment samples will be collected for three years following construction of the regional stormwater wet detention facility to calculate its efficiency.

Chemical Contamination of Sediments in the Cedar-Ortega River Basin (1998–1999): An intensive sediment quality assessment was conducted within the Cedar-Ortega River Basin. Results again showed widespread contamination with more consistently elevated levels than the St. Johns River. Median contaminant concentrations in Cedar and Ortega sediments were typically similar to the higher concentrations measured in the St. Johns River. As in the St. Johns River, the major contaminants elevated above ERM (effects range-medium or middle) and PEC (probable effect concentration) sediment quality guidelines were PAHs, PCBs, pesticides (again mainly DDT derivatives, chlordane, dieldrin), and metals (mercury, zinc, lead and silver).

Chevron Docks (2002): SJRWMD was consulted as an external party to provide technical assistance and review for the remediation project at the Chevron Docks. This project included dredging of sedimentation at the bulkhead of the docks. Dredging was completed in 2002. This was a cooperative effort between Chevron, FDEP, and SJRWMD.

Deer Creek Remediation (2000–2007): The efforts to date include completion of a preliminary site assessment, health and risk assessments, and a planning and alternatives analysis. Future efforts will include a detailed assessment, finalization of a remediation plan, and implementation of the project plan. This project is a cooperative effort between EPA, NOAA, FDEP, SJRWMD, and Kerr-McGee (Tronox).

Fishing Creek (1999): The purpose of this project was to improve access to a boat ramp located in Fishing Creek, a tributary to the Ortega River. Dredging occurred from the Ortega River confluence back upstream to the ramp site, thus improving accessibility to the St. Johns River from Fishing Creek. An assessment of contamination was performed at the mouth of Fishing Creek in order obtain funding for the dredge work. This project was completed through a cooperative effort of FIND, COJ, USACE, and SJRWMD.

Fishweir Creek Remediation (2005–2007): The efforts to date include preliminary diagnostic testing and a planning and alternatives analysis. Results from the preliminary diagnostic testing indicate low-level contamination with pesticides, metals, and other industrial contaminants. Future efforts will include more specific site assessments, determination of an appropriate remediation strategy, and implementation of the project plan. This project is a cooperative effort between USACE, COJ, FDEP, and SJRWMD.

McCoy Creek (1993–2007): SJRWMD was consulted as an external party to review the project scope for the flood control project at McCoy Creek, which included issues with sediment contamination. The project was put on hold, and a new site is being pursued for a stormwater treatment area (STA). This project was completed as a joint effort between the COJ and SJRWMD. This project is expected to continue as a new site is identified and the project continued.

Mill Cove Creek Remediation (2002): Prior to dredging by USACE for the Flow Enhancement Channel (cut in Mill Cove Creek), an assessment of contamination in the creek was performed. The findings of the assessment included minimal metal and organic contaminants, which allowed for upland disposal of dredged material. This project was completed through a cooperative effort of FDEP, COJ, USACE, and SJRWMD.

Moncrief Creek (2000–2007): An assessment was performed on a contaminated site identified in Moncrief Creek. The assessment indicated that the contamination was contained and minimal remediation was required/completed ("No Fishing" signs were posted). This project was completed as a cooperative effort between COJ, FDEP, Department of Health (state and local), and SJRWMD.

National Oceanic and Atmospheric Administration (NOAA) Status and Trends Monitoring in the Lower St. Johns River (2002–2004): The NOAA Coastal Storms Program conducted a pilot study in the St. Johns River watershed from 2002 through 2004. There were three components to the project: (1) a land use-based risk assessment of pesticides permitted for use within the watershed; (2) a ground and surface water model of transport and fate of three contaminants selected from the above risk assessment; and (3) toxicological tests, in all possible combinations, of the same three contaminants. The first item is available for use on the NOAA website (http://www.chbr.noaa.gov/easi) and is currently under review for updating and expansion of functions.

The Ecological Effects of Storm Impacts project was designed to provide easily accessible information on risks of chemically contaminated runoff resulting from storms. The impetus for the first component of the project came from frequent reports by field biologists that they observed large fish kills following storms that seemed to be associated with chemical runoff. The second component included a method to predict potential causes of fish kills. The *Pesticide Root Zone* and the *Exposure Analysis Modeling System* models were used to compare risk to resident biota in estuarine headwaters. The third component examined the toxicity of three pesticides, singly and in mixture, to grass shrimp (*Palaemonetes pugio*) larvae. The pesticides included atrazine, an herbicide used on turf grass and field crops; fipronil, a persistent insecticide used against termites and fire ants; and imidacloprid, a systemic insecticide used in agricultural and home products.

Naval Air Station (NAS) Jacksonville Remediation (1993–2000). This project involved the remediation of radioactive waste and solvents, cleaners, and PCBs, all of which have been completed. NAS Jacksonville was the lead in this effort, with coordination from EPA, NOAA, FDEP, and SJRWMD.

Pesticide Occurrence in Receiving Waters in the Tri-County Agricultural Area (1992–1997): This project examined the presence of pesticides in tributary and mainstem sediments as well as contaminants in surface water drainage and groundwater in the TCAA. Only low levels of pesticide occurrence were found at selected sites. This project was funded in part with EPA Section 319 funding.

Rice Creek Contaminant Assessment (2003): This project involved the annual sampling of fish tissue as required by the Georgia Pacific permit. The sampling was conducted and reported to the FDEP in fulfillment of the Georgia Pacific annual permit requirement.

In 2002, a request was made that the Agency for Toxic Substances and Disease Registry conduct a public health assessment of the fish in Rice Creek, which FDOH was contracted to perform. This study was adapted from the Georgia Pacific Plan of Study to meet FDOH guidelines. Results were then reported in a Health Consultation Report as per requirements from Agency for Toxic Substances and Disease Registry. FDOH determined through this study that a fish consumption advisory would not be issued for Rice Creek.

Sediment Contaminant Assessment Associated with Wet Detention (2007): The COJ, in a cooperative effort with SJRWMD, constructed a 14-acre regional stormwater wet detention facility that will provide retrofit treatment for 1,452 acres of tributary area that currently does not receive water quality treatment. Previous studies conducted by SJRWMD indicate that the Cedar-Ortega River confluence sediments are contaminated with a variety of constituents, including PAHs, PCBs, pesticides, and metals. The regional stormwater facility will provide water quality treatment for the area that is the potential source of some of these contaminants. This project will be a sediment and toxics assessment for the regional stormwater facility that will assist in determining the effectiveness of the wet detention pond at retaining these contaminants. The project will also provide data for evaluating the necessity for potential future remedial action of the sediments in the facility and at the confluence of the Cedar River. The property was acquired by SJRWMD and construction funding provided by the city of Jacksonville and FDEP. This project began in 2007.

Sediment Quality of the Lower St. Johns River and the Cedar-Ortega River Basin (1996–1999): A basinwide sediment quality assessment focused on the lower 100 miles of the St. Johns River and several tributaries. Results indicated widespread contamination with high variability in contaminant concentrations and in the physical characteristics of the sediment. These are not surprising results since the sample area of over 100 river miles included urban, industrial, residential, and rural land use patterns. The following areas were found to have significantly elevated sediment contaminant concentrations:

- LSJR in urban Jacksonville — probable sources are local industrial and wastewater treatment facility (WWTF) discharges, runoff, and downstream transport. In addition, one of the most polluted tributaries, the Cedar-Ortega River, discharges into this area of the St. Johns River.
- Cedar-Ortega River — preliminary results supported previous information indicating elevated contamination from this urban, industrial watershed and led to a more detailed assessment.

- LSJR around the Naval Air Station — most likely due to past military practices, leaching and runoff.
- Rice Creek, the confluence and downstream of Palatka — largest industrial discharge to the river, a pulp mill has operated and discharged here since the 1940s. In addition, urban runoff, WWTF effluent, and power generating plants discharge here.

Sediment contaminant concentrations were compared to Sediment Quality Guidelines and the most problematic pollutants, those that exceeded ERM (effects range-medium or middle) and PEC (probable effect concentration) values, were the typical urban industrial chemicals: PAHs, PCBs, and pesticides (mainly DDT derivatives, chlordane), and metals (mercury, zinc, lead, cadmium, chromium, silver and arsenic). Many other metals, pesticides, and organochlorine chemicals were also elevated in many areas of the river.

Sediment Transport Model for the Cedar-Ortega Rivers (1998–2002): After an initial assessment of sediment control measures for a stormwater treatment project in the Cedar-Ortega Basin, the investigation of contaminants and treatment alternatives for the Cedar-Ortega was expanded. A sediment transport model was developed to evaluate areas of sediment scouring and deposition as well as to assess the feasibility of using sediment traps to control and capture sediments. The completed sediment transport model predicted that sediment traps would be effective at controlling sediment movement. However, dredging and potential toxic contaminated sediment remediation are not included in the mission of SJRWMD, but are primarily the responsibility of other agencies.

Toxicological Plan for the Lower St. Johns River (1996–1998): This project focused on data collected in the early 1990s on contaminants measured in biota in the LSJRB. This project employed a toxicologist to review the data that had been collected and, based on those results, provided recommendations on remediation and management actions for the lower St. Johns River.

Public Education Initiative Past/Current Projects

1995 Outreach Efforts:

- SJRWMD began incorporating SWIM information into its education programs, including its Legacy Water Resource Education Program. Legacy is a long-term cooperative educational venture between SJRWMD and schools. Through the Legacy Program, educators and students learn to use natural, public land as an educational medium while helping public agencies make the land more accessible to surrounding communities.
- The first St. Johns River Celebration cleanup of the river and its tributaries was held in March 1995. The celebration is a one-day river cleanup in 15 counties in Florida and two counties in Georgia. SJRWMD continued at the helm of the annual celebration through March 2001. The following year, SJRWMD turned over the celebration's leadership to local entities. St. Johns River Celebration cleanups have been held each year since that time.
- Under SJRWMD's leadership for six years (1995–2001), the celebration attracted more than 33,900 volunteers, who removed nearly 2.5 million pounds of garbage from the St. Johns River and the St. Marys River systems.

1997 Outreach Efforts:

- The St. Johns River was designated as one of the nation's 14 American Heritage Rivers. The American Heritage Rivers initiative fosters community empowerment while providing focused attention and resources to help river communities restore their environment, revitalize their economy, renew their culture, and preserve their history. The Office of Communications and Governmental Affairs (OCGA) worked with river navigators and various community and elected leaders on efforts to promote the initiative's objectives in regard to water quality protection.
- In 1997, individuals from northeast Florida representing business, government, and the environment met in the first St. Johns River Summit. The summit resulted in pledges to restore and enhance the lower St. Johns River and a five-year plan known as the River Agenda. This group began working toward six goals established to protect the St. Johns River and, in large part, successfully accelerated the restoration of the lower St. Johns River.
- SJRWMD worked with elected officials and community leaders to develop a Lower St. Johns River Basin Restoration Plan, allocating $43.2 million to reduce pollution from urban and suburban areas, rehabilitate degraded aquatic habitats, reduce pollution from agricultural areas, and promote public awareness of the river and pollution sources.
- Over the years, the River Agenda effort netted $47.45 million in matching dollars for improvements to the LSJRB. Leveraging these dollars more than doubled the state's investment with local sources.

1998 Outreach Efforts:

- SJRWMD, with the assistance of partnering agencies, prepared the River Agenda booklet outlining the pledges of governmental entities and strategies and goals for the following five years.
- Public awareness goals included
    - Implementing an educational promotion campaign
    - Using TV/radio announcements, school programs, public workshops, and store promotions
    - Working with area businesses and professional organizations to increase awareness of environmental issues
    - Communicating to the public what habitat is being lost, why it is important, and what can be done to address the loss
    - Providing water resource workshops and hosting an annual event, such as the St. Johns River Strategic Planning meeting, targeting elected officials
    - Making information published by SJRWMD, FDEP, and COJ more accessible and readily available to the public
    - Promoting participation and increasing membership in new and existing volunteer groups, such as the Watershed Action Volunteer (WAV) Program
    - Educating students and teachers about environmental issues
    - Expanding SJRWMD's Legacy, FDEP's Adopt-a-School, and state park programs to increase understanding of ecosystems surrounding the river
    - Promoting the use of existing educational curricula, including W*aterways* and *EcoVentures*
    - Providing presentations to school boards on environmental education programs

1998–2002 Outreach Efforts

- Prepared and distributed annual "report cards" on the River Agenda's progress

2003 Outreach Efforts

- When the five-year River Agenda expired in 2003, work by the partnering groups continued. In January, a river-wide summit was held and new priorities were established, including priorities for the LSJRB. In addition, a working group created the St. Johns River Restoration Strategy (report) and formed a framework for the St. Johns River Alliance, which has participated in advancing the river's restoration.

2006 Outreach Efforts

- In summer 2006, SJRWMD joined with the COJ, JEA, FDEP, and EPA, as well as smaller local governments and utilities, in the "River Accord." The agencies committed to a $700 million program to exceed the TMDL nutrient allocation for the lower St. Johns River. This partnership will significantly improve water quality and provide approximately 70 million gallons per day in reuse to augment freshwater being used for irrigation.
- To promote SJRWMD's wastewater reduction and reuse initiative and the goals of the River Accord, OCGA staff developed an LSJRB Outreach Initiative to heighten awareness of river health issues and to educate the public on how human behaviors impact the river and how these behaviors can be changed.
- In April 2006, the staff began exploring the possibility of conducting a paid advertising, multimedia public awareness campaign to complement SJRWMD's successful unpaid public and media outreach and education efforts in the LSJRB. The initiative concentrates on four areas of communication: public awareness research, public and media outreach, local government outreach, and a paid media campaign.
- In SJRWMD's FY 2006–2007 budget, $1.09 million was allocated for the initiative and related research, to gain a better understanding of public perceptions about the river's health and pollution sources and to embark on a paid media campaign to complement existing efforts.
- In September 2006, Fry Hammond Barr, an Orlando-based advertising agency, was awarded a contract to develop a comprehensive paid media campaign with a memorable and compelling water quality protection message, and to coordinate and implement the campaign.

2007 Outreach Efforts

- The Lower Basin Public Outreach Initiative seeks to increase awareness about river health issues and to educate the public on how human behaviors impact the river and how negative behaviors can be changed.
- Developed with participation from the communication staffs of JEA, FDEP, and COJ, the initiative promotes consistent messages to be conveyed by SJRWMD and these entities, which are involved in a restoration partnership, called the River Accord, to improve the health of the lower St. Johns River.
- The paid media portion of the campaign launched in April 2007 with ads on television and in local newspapers and radio traffic sponsorships, and with billboards from April through early August. Collateral materials include a campaign-specific brochure and website, www.floridaswater.com.
- Media outreach includes LSJRB boat tours, editorial board visits, news releases and news stories, and appearances on public affairs radio and television broadcasts.

Presentations to civic organizations, schools and local governments spotlight river health issues.
- To evaluate the initiative's success, public awareness surveys are conducted before, during, and after the campaign.

Intergovernmental Coordination Initiative Past/Current Projects

Harmful Algal Bloom Coordination (1997–2007): SJRWMD dedicated a portion of their lower basin biologist's time to coordinate with HAB efforts within SJRWMD and the rest of the state. This function played an important role in information sharing and SJRWMD efforts in controlling harmful algal blooms in the LSJR. This role is expected to continue in the future.

Intergovernmental Coordination (1993–2007): SJRWMD supported two staff intergovernmental coordinator positions that cover geographic areas in the LSJRB. These staff are part of SJRWMD's Office of Communications and Governmental Affairs (OCGA) and were the main contacts for local governments in the basin and provided annual presentations for local governments making local budget requests (LBRs) for funding. These staff regularly communicated with the lower basin program manager in the project management section. The roles of these staff are expected to continue in the future.

Lower Basin Interagency Program Coordination (1993–2007): SJRWMD supported a staff position called the lower basin program manager to coordinate SJRWMD basinwide efforts and integrate information sharing across its departments and among other agencies. This position handled the special legislative funding request for the LSJRB. This position played a long-standing role within SJRWMD and also an important function in sharing information across departments and other efforts. This associate regularly communicated with their intergovernmental coordinator and public and media counterparts in OCGA. This position is expected to continue in the future and plays an important role in sharing information across departments and other efforts.

Lower St. Johns River Technical Advisory Committee (TAC) Support (1993–2007): The COJ, FDEP, and SJRWMD have supported the meetings of the LSJR TAC since the late 1980s when the SWIM program was initiated. The TAC has served as a scientific and management forum throughout this time. The TAC worked on the original (1989) SWIM plan and the 1993 update. The committee has provided input into nomination packages for National Estuary Program status and American Heritage River designation. It has reviewed and prioritized projects for funding through the Special Legislative Initiative each year. From 1993 to 2002, the committee was coordinated and staffed by the co-chairs of the lead sponsors. In 2002, the three agencies cooperatively funded a contractor to support the committee activities and this support continued through 2007 through various funding sources. The TAC continues to be the regional forum to discuss technical and management issues, funding opportunities and priorities, and information source for local and regional conferences. As of 2007, more than 150 people are considered members of the TAC and the group continues to meet quarterly. The TAC is also the LSJR Basin's technical advisory committee for the St. Johns River Alliance. This project is expected to continue.

Public and Media Communications Staff (1993–2007): SJRWMD supported an OCGA position to provide a media and public contact for questions and issues regarding projects in the LSJRB. This staff position regularly coordinated with many departments within SJRWMD and communicated with the intergovernmental coordinator and lower basin program manager. This position is supported by the other staff in OCGA and is expected to continue in the future.

Reuse Initiative/Integrated Water Management Plan (2006–2007): In 2006, the results of the optimization model to integrate wastewater and water supply/reuse options were forwarded to the long-standing Northeast Florida Utility Managers Group, which includes utilities from the LSJRB and Nassau River Basin. This group is supported by SJRWMD and became the forum to develop regional water reuse and wastewater improvement projects among local utilities. The group met approximately every two months to share information and work on opportunities for sending wastewater to reuse systems. This coordination and information sharing function is expected to continue in the future.

River Accord (2006–2007): In July 2006, a 10-year river restoration effort was announced titled the River Accord. The program included identification of $700 million in projects that are needed to restore the river. These include efforts to remove wastewater discharges, improve wastewater effluent and increase the use of reuse water for irrigation, eliminate failing septic tanks, improve stormwater, and produce an annual State of the River report. The COJ was the lead organization in the Accord along with the other key agencies and universities in the LSJRB, including SJRWMD, JEA, Water and Sewer Expansion Authority, and FDEP. These organizations are expected to coordinate their efforts for prioritizing projects and funding based on the priorities in the River Accord. Continued coordination of the River Accord efforts is expected to occur through the St. Johns River Alliance.

River Summits and River Agenda (1997–2003): In December 1997, the St. Johns River Strategic Planning Session was held, now known as the River Summit. This summit brought together the local, state, and federal leaders who made commitments to preserving and restoring the LSJRB. Six focus areas were identified as a result of the discussions at the summit. The focus areas included: point-source pollution, nonpoint source pollution, bacteria in the river's tributaries, aquatic habitat, water quality compliance and enforcement, and public awareness of river issues. Over the subsequent five years, an executive committee met regularly to solicit pledges of funding for river projects from appropriate sources, discuss the projects needed to address the focus areas, and review the progress of the projects being implemented. Annual report cards were published that documented the projects and progress to date. This process was a major effort to coordinate all the agencies working on the LSJRB restoration and to prioritize funding and restoration efforts.

In January 2003, a second River Summit was held in Jacksonville, Florida. This summit invited participation from the local, state, and federal leaders from the Upper, Middle, and lower St Johns River basins. Thousands of people attended the 2003 summit and provided input on the problems and possible solutions to river restoration. As a result of the 2003 River Summit, a St. Johns River Working Group was formed. The working group developed a management strategy, based on the input from the summit, to enhance work on river-wide restoration and improve public access and awareness of the river and nearby communities. The management strategy recommended continued coordination of local governments and agencies and the creation of a nonprofit organization called, the St. Johns River Alliance.

St. Johns River Alliance (2003–2007): The St. Johns River Alliance was created after the 2003 River Summit and subsequent working group recommendation that a river-wide organization was needed to focus on restoration and education efforts. The Alliance was established as a nonprofit organization with a Board of Directors who represent citizens, local governments, and key agencies along the river. The organization is supported by contributions from local governments, agencies, and private groups. The Alliance serves as a forum for all the key organizations in the entire basin to learn about efforts and develop projects and funding priorities that support restoration activities. In the future, the Alliance is expected to expand its role in educating those outside the region about restoration needs in the basin, developing a research consortium of universities in the watershed, and increasing public education and public access efforts. This project is expected to continue.

Total Maximum Daily Load (TMDL) Coordination Process (2001–2007): Through the authority of the federal Clean Water Act, the state of Florida, and the EPA are establishing TMDLs for the impaired waters in Florida. In the LSJRB, many of the tributaries as well as the mainstem of the river are considered impaired, meaning they do not meet the state water quality standards for their designated use. The FDEP is the lead state agency on the development of TMDLs and their subsequent BMAPs.

Although the FDEP is the lead agency, they coordinate their efforts with local stakeholders as the TMDLs and BMAP are written. This coordination is important because the TMDLs and BMAP provisions are enforceable and can amend existing federal permits including wastewater, industrial, and stormwater permits. The required load reductions can also require nonpoint source reductions from areas that do not currently have federal permits.

In 2001, the FDEP sponsored coordination meetings with a TMDL Stakeholders Group that provided input into the water quality model that was being developed by SJRWMD. This group met regularly to advise SJRWMD and to learn more about the modeling efforts. In 2002 the FDEP-Northeast District Office appointed a LSJR TMDL Executive Committee to provide input from the specific stakeholder groups that would be directly affected by the TMDL implementation. The appointed members included representatives from lead agencies such as FDEP, SJRWMD, FDACS, and USACE. The committee also included representatives from agriculture, utilities, industry, and environmental interest groups. Both the LSJR TMDL Executive Committee and Stakeholders Group have continued to meet regularly during the TMDL and BMAP process to address nutrients in the mainstem. A separate working group was established in 2006 to coordinate efforts on TMDLs to address fecal coliform bacteria impairments in the lower St. Johns River tributaries. This LSJR Tributaries Fecal Coliform Technical Working Group has also met regularly and includes representation from local governments, utilities, and agencies. These groups are expected to continue to meet throughout the TMDL implementation process and will update the BMAPs approximately every five years. TMDL coordination will continue in future years.

3.8 Future Projects (2008–2012)

Water Quality Initiative Future Projects

Agricultural BMP Cost-Share Program—Phase II (2008–2011): This SJRWMD water quality protection cost-share program is designed to promote grower adoption of in-field BMPs that reduce nutrient loading into receiving streams in the TCAA. This voluntary program provides a monetary incentive for farmers to implement verified BMPs and to compensate for any potential increase in cost or risk which may result while the farmers adjust to the new technology. The program provides cost-share funds for agricultural practices, which will sustain profitable crop yields and will have potential water conservation, runoff, and water quality benefits. Recommended practices in this phase will include those that have been defined and proven effective by the cooperative EPA Section 319 project work conducted by SJRWMD and other agencies and area growers. Also included in this phase are new BMP technologies that include CRF technologies that have demonstrated agricultural nitrogen load reductions by 60 to 80 percent during storm events.

Agricultural Receiving Streams Evaluation (2008–2010): SJRWMD will continue to conduct ambient monitoring as part of its Nonpoint Source Pollution Program, and will monitor temporal water quality trends associated with agricultural watersheds. Numerous parameters will be measured with consideration toward the physical, water chemistry, and toxicological characteristics of the samples to be collected. This project began in 1990.

Algal Toxin Monitoring (2008–2012): This SJRWMD project, which started in 2005, develops information on algal toxin occurrences in the lower St. Johns River and provides assistance to the Department of Health. The historic data documented the occurrence of high algal toxins during the large *Microcystis* bloom in 2006.

Ambient Water Quality Monitoring in the TCAA (2008–2012): Diagnostic data will be collected by SJRWMD to determine long-term spatial and temporal water quality trends within the agricultural watersheds in the LSJRB. Agricultural subbasins will be monitored as well as the receiving streams at the confluence of the lower St. Johns River. These data will also be used for water quality model validation and calibration for TMDLs as the model is upgraded. This is a continuation of an effort started in 1998.

Aquatic Organic Matter Characterization (2008–2009): This SJRWMD project, which began in 2005, evaluates new chemical and bioassay methods to characterize aquatic organic matter. The results of this evaluation will allow for better characterization of the biodegradability and nutrient cycling of organic matter.

Best Management Practice (BMP) Geographic Information System (GIS) Tracking Tool (2008–2010): This SJRWMD GIS project started in 1999 and tracks the implementation of in-field BMPs that are implemented in the TCAA. These data are used to correlate with water quality data collected in the TCAA and for compliance with the nutrient TMDL and BMAP for the mainstem of the lower St. Johns River. This effort is expected to continue through 2010.

Chip Potato Grower Demonstration Projects Using Controlled Release Fertilizers (2008–2010): SJRWMD and UF-IFAS will work on additional demonstration projects using CRF in chip potato growers' fields. IFAS will track different rates of nitrogen and phosphorus in the CRF and crop yield measurements.

City of Jacksonville Mainstem Run (2008–2012): The program currently samples 10 ambient stations in the mainstem of the St. Johns River on a monthly basis. Goals of this program are to monitor water quality trends for nutrients and their impacts. Information collected will assist the state in establishing TMDLs for the lower St. Johns River in Duval County. TMDLs and nutrient reduction goals are then incorporated into surface water discharge permits held by the city.

COJ MS4 Permit Monitoring Program: Stormwater BMP Effectiveness Studies (2008–2012): This program constitutes a portion of the city's NPDES/MS4 Monitoring Plan, required by the EPA and state of Florida. The goal of the program is to determine the effectiveness of certain designated stormwater treatment projects. Four projects have been identified for study through this program. Pollutants monitored in this program range from nutrients to PCBs.

COJ MS4 Permit Monitoring Program: Tributary Intensive Program (2008–2012): This program began in 2002 and is designed to provide more detailed water quality information about selected tributaries in Duval County. Sites are monitored in each of the following basins: Arlington River, Trout River, Cedar-Ortega rivers, and Julington/Durbin creeks. In addition, one site is located on each of the following minor tributary basins: McCoy, Deer and Little Fishweir Creeks. All of the 16 sites are also part of the "Routine Tributary" program. The sampling year is divided into wet and dry months based on National Weather Service average monthly rainfall from 1971- 2000. In 2002, the 15 sites were sampled three times during "wet" months and two times during dry months. Data from this program is used in concert with mainstem water quality data to understand pollutant loading into the St. Johns River. The data are then used by the state to develop TMDLs. This program constitutes a portion of the city's NPDES/MS4 Monitoring Plan, required by the EPA and state of Florida.

COJ Tributary Routine Program (2008–2012): The focus of this program is to monitor water quality in the tributaries of the St. Johns River in Jacksonville. Approximately 100 sites along Jacksonville tributaries are monitored quarterly for a variety of parameters. The tributaries provide significant littoral zone habitat for a variety of species and are extremely important to the ecology of the St. Johns River estuary system. Pollution impacts in the tributaries can be pronounced, since they have a smaller dilution potential than larger water bodies. Two important water quality parameters measured at the tributary monitoring sites are dissolved oxygen and fecal coliform bacteria. Data collected through the program are used to track long-term water quality trends, and to determine if the surface waters are meeting their designated use as Class III waters. If waters are not meeting their designated use, programs are put in place to restore the water quality. This program constitutes a portion of the city's NPDES/MS4 Monitoring Plan, required by the EPA and state of Florida.

City of Jacksonville Timucuan Preserve Program (2008–2012): This program is a cooperative effort between the city of Jacksonville, NPS, FDEP, CAMA, and The Nature Conservancy's Machaba Balu Preserve. Cooperators assist by providing field support when needed, and the NPS provides funding for chlorophyll analysis. The purpose of this effort is to collect water quality trend data for the surface waters in and adjacent to the Timucuan Ecological and Historic Preserve. Currently, 12 sampling locations are monitored bimonthly; the information will be used to make land-use decisions in this area of the county. In addition, the state uses data collected to determine if the surface waters are meeting their designated use. If the waters do not meet the designated use, a TMDL will be developed for the pollutants of concern.

Compliance with TMDL and PLRG Water Quality Goals (2008–2012): This SJRWMD project will improve river monitoring to evaluate the compliance of river water quality with the TMDL and PLRG target restoration goals.

Comprehensive Nutrient and Water Use Research Project in the TCAA (2008–2010): SJRWMD provides funding to UF-IFAS to conduct multiple subprojects in the effort to reduce nutrients in runoff and decrease water use. Based on the results of preliminary studies, additional work may be pursued to document the effectiveness of BMP techniques in the field.

- *Evaluation of Cut-Off Date for Nutrient Applications to Potato Crops* — This study is an evaluation of the days after planting when nutrient applications are no longer helpful to a potato crop (the "cut-off date"). Establishing this date could eliminate some fertilizer applications, which would decrease costs to the grower as well as result in nutrient reductions to the watershed.

- *Testing the Effectiveness of Controlled Release Fertilizer on Sod* — This project evaluates the effectiveness of CRF products on sod compared to soluble fertilizers. If CRFs can be effective at fertilizing sod and reducing runoff concentrations, they have the potential for widespread use and subsequent reductions in urban runoff concentrations. Future work is planned if the pilot project indicates this is a viable alternative for sod fertilization.
- *Tracking Nutrients through Ditches and Canals* — This study evaluates the attenuation of nitrogen and phosphorus species as water travels from the field to the tributaries. The assessment includes habitat assessments, algal counts, and algal species change evaluation. This project began in 2007 and will continue through 2010.
- *In-Canal BMPs for Sediment Stabilization* — This project was a pilot project, conducted in 2007, to study the use of polyacrylamides in agricultural water furrows to stabilize sediments and reduce phosphorus concentrations in runoff. If the results are good from this pilot study, a full research study will be conducted in cooperation with IFAS.

Controlled Release On-Farm Project: An Alternative Irrigation Program for Potato Crops to Reduce Water and Nutrient Use (2008): With cooperation from SJRWMD, UF-IFAS will conduct research testing the in-field use of a drip irrigation/fertigation system on potato crops that was first tested at the Plant Science Research and Education Unit's Hastings Farm. It is hoped that this alternative irrigation system for potatoes grown in the TCAA will reduce water and nutrient use. Factors that will be measured in-field include comparison of water use efficiencies, fertilizer use efficiencies, crop use, crop production, and tuber quality between a subsurface seepage and drip irrigation/fertigation system.

Dairy Baseline Water Quality Monitoring (2008–2012): This ambient monitoring is part of the SJRWMD Nonpoint Source Pollution Program, and monitors temporal water quality trends associated with dairy production. This project collects monthly surface grab samples at one-half meter, or one-half stream depth if stream depth is less than one meter. Numerous parameters will be measured with consideration toward the physical, water chemistry, and toxicological characteristics of the samples collected. This is a continuation of a project begun in 1999.

Development of Regional Stormwater Treatment (RST) (2008–2012): SJRWMD will continue to acquire land and develop RST in appropriate areas. The water quality from the outfalls will be monitored and assessed. As of 2007, three additional treatment areas are in the planning phase: Deep Creek East, Masters Project, and Flagler Estates Area RSTs. These projects are in different stages of development and will therefore be completed at different times. Additional RSTs may be pursued as water quality priorities are evaluated and land is acquired. As the projects are implemented, monitoring, operations, and maintenance will begin as described below.

Engineering and Design of the UF-IFAS Plant Science Research and Education Unit's Hastings Farm (2008): This project will implement the design and engineering plan developed in 2007 for the UF-IFAS Hastings Research Farm. The center was designed for conducting water quality research associated with agronomic production. This project will establish the research center as a state-of-the-art outdoor research facility for monitoring

BMP effectiveness for addressing TMDL goals. This project will be sponsored by SJRWMD and UF-IFAS.

Establishment of the UF-IFAS Field Station on Urban Nonpoint Source Reductions in Hastings (2008–2010): This project will re-develop a closed facility owned by the University of Florida to become a state-of-the-art outdoor research facility on urban nonpoint sources. The site will be designed to meet research-level monitoring requirements and site testing conditions. Research projects will be designed to test the effects of using reuse water for irrigation, different landscaping approaches, and swale effectiveness and management. There will be a public education center established at the site. Partners on this project include Putnam County, St. Johns County, UF-IFAS, and SJRWMD. Funding is provided by state legislative appropriations.

Expansion of Controlled Release Fertilizer Testing for Additional Crops (2008–2009): SJRWMD, UF-IFAS, and FDACS plan to work collaboratively on plot-level research at the UF-IFAS Hastings site on CRFs for crops such as cabbages, melons, corn, and greens. Different quantities and release times will be tested as well as crop yield measurements. As results are received, testing will move to in-field demonstration projects.

Extension of the Western Atlantic Tide Model (2008): This SJRWMD modeling effort will allow for unbiased establishment of the ocean boundary of the lower St. Johns River water quality model and explain some of the interactions between the inner continental shelf and river water.

Geographic Information System (GIS) Land Use Assessment (2010): This SJRWMD project will monitor the land use changes in the TCAA using GIS. The GIS land use coverages will be updated and evaluated with both predicted and actual treatment efficiencies in priority areas. This effort is expected to be updated annually.

Inner Shelf Water Quality in the South Atlantic Bight (2008–2012): This SJRWMD project will examine the effect of the lower St. Johns River and other SAB rivers on the inner continental shelf water quality and the interaction of water with tide reverse flows.

Land Use Effect on Shallow Groundwater Pollution (2008–2012): This project initiated by SJRWMD in 2006 increases the shallow groundwater monitoring network and develops a model to assess landscape effects on shallow groundwater quality.

Lower St. Johns River Groundwater Monitoring Program (2008–2012): This ambient monitoring network is designed to characterize shallow groundwater quality existing beneath major land uses and in areas where septic tank density is high, or where reuse water or land disposal of domestic waste was occurring. A major objective of the study is to identify the conditions that allow nutrient-enriched shallow groundwater to migrate to surface waters. Water quality samples will be collected quarterly from fifty-nine wells at fourteen sites. In addition, an intensive sampling program will examine five sites with five replicate wells three times per year. Numerous parameters will be measured with consideration toward the physical, water chemistry, and toxicological characteristics of the samples collected. This project began in 2003.

Lower St. Johns River Mainstem Nutrient BMAP Implementation (2008–2012): Implementation of the BMAP will include projects by municipalities, private businesses, Florida Department of Transportation (FDOT), stormwater management entities, and homeowners. Reductions will be achieved through projects such as wastewater treatment upgrades, taking wastewater discharges away from direct discharge and increasing reuse supplies, regional stormwater treatment, implementation of agricultural BMPs, building RSTs for agricultural areas, construction of additional stormwater treatment systems, improved fertilizer practices, and removal of failing septic tank systems.

Lower St. Johns Watershed Action Volunteers (2008–2012): This continuing SJRWMD program will support volunteer monitoring in the LSJRB. Grab water quality samples of storwmater will be collected at various sites located on small (first-order) catchments during storm events. Numerous parameters will be measured with consideration toward the physical, water chemistry, and toxicological characteristics of the samples to be collected.

Low Impact Development (LID) Stormwater Management Project (2008–2012): This project will be conducted at the new UF-IFAS Field Station on Urban Nonpoint Source Reductions in cooperation with SJRWMD. The project will monitor the effects of development at the site and compare pre- and post-development water quality information. Monitoring is expected to continue until 2012.

LSJR Mainstem Basin Management Action Plan Process (2008–2012): The FDEP in cooperation with SJRWMD and local stakeholders developed a BMAP to reduce nitrogen and phosphorus loads to the lower St. Johns River. The approach includes requirements for significant reductions from both point and nonpoint sources and from permitted and non-permitted sources. Through a lengthy negotiation process with key stakeholders, the FDEP developed an approach that establishes load reduction responsibilities for domestic and industrial wastewater sources, permitted stormwater areas, and nonpoint sources that do not fall under the federal NPDES permit program including agriculture. The BMAP, which is scheduled to be adopted in 2008, will be implemented through permits and the authority of the BMAP itself in 2008 and beyond. Milestones include an annual assessment of loads and load reductions and a re-evaluation of the TMDL and BMAP on the state's five year cycle.

LSJR Tributary Basin Management Action Plan Process (2008–2012): Through efforts of the FDEP, JEA, COJ, and the Duval County Health Department, preliminary assessment of fecal coliform contamination of the lower St. Johns River tributaries was begun. Sources include failing septic tank systems, leaking or malfunctioning wastewater collection systems, domestic animals, and wildlife. In 2005, six tributaries were evaluated and sources of fecal coliform contamination were investigated. In 2006 and 2007, additional tributaries were monitored and assessed and a BMAP Working Group was formed. Data compilation and assessment efforts continued and the results were used to begin the BMAP implementation plan to reduce fecal coliform bacteria in the tributaries. This process is expected to continue with an adoption of the BMAP scheduled for 2009.

Mid-Mainstem Ambient Monitoring Network (2008–2012): This monitoring is part of the SJRWMD Ambient Monitoring Network, and is specific to the mainstem of the St. Johns River within the lower basin. Specifically, monitoring occurs between Palatka and Green Cove Springs. The ambient monitoring network is designed to characterize spatial patterns, monitor annual and long-term temporal trends in water quality, and help identify where immediate problem issues occur. This project will continue to collect monthly surface samples that are either grab samples or a vertically integrated sample of the top three meters, depending on the site. Numerous parameters will be measured with consideration toward the physical, water chemistry, and toxicological characteristics of the samples collected. This project began in 1984.

Monitoring Lower St. Johns Tide Levels (2008–2012): This SJRWMD project began in 1999 and involves continuous monitoring of tide levels in support of water quality model development, calibration, and verification.

Monitoring, Operation and Maintenance of Regional Stormwater Treatment Areas (2008–2012): The existing RST areas (Deep Creek West and Edgefield) will be maintained and monitored and new RSTs will also be maintained as they are brought online. At the existing RSTs (within the wet retention areas and wetlands), fish populations will be monitored and fish tissue will be sampled for contaminants. Wildlife and vegetation on the site will also be assessed. Water quality discharged from the outfalls will be monitored and assessed. On an annual basis, these data will also be used in the watershed assessment model to determine effectiveness at treating regional stormwater. The results of agricultural area reductions will also be reported as part of the BMAP monitoring plan to assess the implementation of TMDLs and subsequent improvements in water quality in the mainstem.

Northern Ambient Monitoring Network-Mainstem (2008–2012): This monitoring is part of the SJRWMD Ambient Monitoring Network, and is specific to the mainstem of the St. Johns River within the lower basin. Specifically, monitoring occurs between Green Cove Springs and the Fuller Warren Bridge (including Doctors Lake). The ambient monitoring network is designed to characterize spatial patterns, monitor annual and long-term temporal trends in water quality, and help identify where immediate problem issues occur. This project will continue to collect surface grab samples on a monthly basis at one-half meter depth. Numerous parameters will be measured with consideration toward the physical, water chemistry, and toxicological characteristics of the samples collected. This project began in 1991.

Northern Tributary Ambient Monitoring Network (2008–2012): This monitoring is part of the SJRWMD Ambient Monitoring Network, and is specific to tributaries of the St. Johns River within the lower basin. Specifically, monitoring occurs in tributaries north of Green Cove Springs. The ambient monitoring network is designed to characterize spatial patterns, monitor annual and long-term temporal trends in water quality, and help identify where immediate problem issues occur. This project will continue to collect surface grab samples on a monthly basis at one-half meter depth. Numerous parameters will be measured with consideration toward the physical, water chemistry, and toxicological characteristics of the samples collected. This monitoring program began in 1984.

On-Site Sewage Treatment System Enforcement Project (2008–2009): This project, conducted by the Duval County Health Department, will identify failed septic tanks along the mainstem and tributaries of the St. Johns River and enforce corrective action or hook up to municipal sewers where available. Septic tank failure areas will be identified and earmarked for sewerage expansion by JEA.

Regional Stormwater Treatment Optimization Monitoring (2008–2012): A SJRWMD monitoring program will be designed to measure and optimize the performance of each RST facility. These measurements will assist resource managers who must make decisions regarding site specific operational changes for enhancing performance of the facility or the future design of new facilities. The quantitative results of this program will indicate the effectiveness of the RSTs for reducing nutrient concentrations in agricultural runoff.

Salinity/Dissolved Oxygen/PAR Measurements (2008–2012): This ongoing project, started in 1996, provides continuous water quality data for three parameters for the development of the hydrodynamic model and the water quality model. This project is a cost-share with the USGS.

Southern Ambient Monitoring Network (2008–2012): This monitoring is part of the SJRWMD Ambient Monitoring Network, and is specific to the mainstem of the St. Johns River within the lower basin. Specifically, monitoring occurs between Palatka and Lake George (including Crescent Lake). The ambient monitoring network is designed to characterize spatial patterns, monitor annual and long-term temporal trends in water quality, and to help identify where immediate problem issues occur. This network is also intended to characterize waters entering the lower St. Johns River from its three major inputs: the middle St. Johns River, the Ocklawaha River, and Dunns Creek. This project will continue to collect monthly surface samples that are either grab samples or a vertically integrated sample of the top three meters, depending on the site. Numerous parameters will be measured with consideration toward the physical, water chemistry, and toxicological characteristics of the samples collected. This project began in 1993 and is expected to continue.

St. Johns River Nutrient Discharge Reduction (Algal) Initiative (2008–2012): In 2006, SJRWMD began the Nutrient Discharge Reduction Initiative to reduce algal blooms in the Middle and Lower St. Johns River basins, including Lake George. As part of this effort, the staff continue their assessment of options to reduce phosphorus loadings to the middle and lower basins. In addition, the list of TCAA subbasins in need of RST will be updated. Once nutrient reduction options are identified, implementation of the best options will be pursued in conjunction with local partners.

Tide Marsh Exchange with the Lower St. Johns River (2008–2012): This project funded by SJRWMD will examine the role of the tide marsh interaction on the water quality of the St. Johns River’s mesohaline reach. The results will be used to further refine the water quality model.

Timucuan Preserve Probabilistic Survey (2008): This probabilistic survey will be a singular event occurring in 2008 and will be repeated in 5-year intervals. The survey will measure heavy metals in the sediments, standard water quality parameters, and nutrients at 30 randomly selected sites in the Nassau and lower St. Johns River drainage areas. This project is sponsored by the NPS.

Tributary Discharge Monitoring (2008–2012): In a cost-share effort between FDEP and SJRWMD, this project provides the tributary flow data needed for the continued refinement of the LSJR hydrodynamic model and the water quality model. This project began in 1996 and provides calibration data for watershed modeling in small urban basins.

Upgrade the Watershed Assessment Model (WAM) (2008–2012): SJRWMD plans to update the WAM model for the TCAA annually to include the most current watershed land uses and management activities such as BMPs and RST efforts. The model will be run annually to evaluate if the implemented BMPs will meet the TMDL requirements for load reductions from agricultural areas.

USGS/SJRWMD Mainstem Water Quality Monitoring (2008–2012): This ongoing effort with USGS and SJRWMD started in 1989 and provides flow and salinity data needed for the maintenance and refinement of the LSJRB hydrodynamic model and continues to support the development of the water quality model. The results provide accurate measurements of the flows in the St. Johns River and the extent of reverse flows caused by tide. This project is vital to the TMDL process and measuring the effects of load reductions under variable tide and rainfall conditions and the number of stations will be expanded to monitor dissolved oxygen levels more extensively. This effort is a component of the mainstem nutrient BMAP monitoring strategy.

USGS Tributary and River Flow Gauging (2008–2012): This effort maintains gauges in the LSJR tributaries and mainstem that were established in 1989. These data are necessary for continued evaluation of pollutant loads and determining the effects of land use changes. This project is vital to the TMDL process and measuring the effects of load reductions under variable tide and rainfall conditions and the number of gauges will be expanded to monitor dissolved oxygen levels more extensively. This effort is a component of the mainstem nutrient BMAP monitoring strategy.

Water Quality Monitoring Assessment (2008–2012): This ongoing project started in 1988 and is part of the SJRWMD water quality monitoring program to assess system health and trends and contributes information to the Water Quality Atlas. This long-term data set has been an invaluable resource for assessments, water quality model calibration, and identification of water quality trends. This effort is a component of the mainstem nutrient BMAP monitoring strategy.

Water Quality Monitoring in the Timucuan Preserve (2008–2012): This project continuously measures standard physical water quality parameters every 30 minutes at three sites within the Timucuan Preserve. Initial funding to start this project was provided by the NPS and involved the monitoring of two alternating YSI 6600 EDS-S multi-parameter data sondes at the Kingsley Plantation site. It has since been expanded by CAMA Northeast Florida Aquatic Preserves (FDEP) and now incorporates monitoring at 2 additional stations, Clapboard Creek, a tributary of the St. Johns River, and Lofton Creek, a tributary of the Nassau River. In cooperation with the city of Jacksonville Environmental Resource Division, nutrient analysis is carried out on grab samples collected from these three sites on a monthly basis. On the same frequency, the NPS provides analysis of chlorophyll *a* samples which are collected at the same time. Nutrient sampling began at all three sites in November 2004, and chlorophyll *a* sampling began at all three sites in November 2005. The main body of information obtained through this monitoring serves primarily as background condition data for this region of the state as it experiences ever increasing development pressures. This project began in 2005.

Biological Health Initiative Future Projects

As-Needed Sampling for Harmful Algal Blooms (2008–2012): SJRWMD will continue to sample surficial algal scums for toxin and species identification when needed. Data regarding phytoplankton toxins will be provided to FDOH for public dissemination and public health planning and response.

Before and After Effects of Developments of Regional Impacts on Receiving Streams (2008–2012): This project is a continuation of the monitoring study designed to track water quality and biological changes in streams as DRIs are constructed. DRIs were identified in the planning stages and sampling commenced prior to construction. Sampling will continue past build-out for each selected DRI.

Biological Monitoring-Phytoplankton (2008–2012): This SJRWMD monitoring program, which began in 1994, identifies the types and amounts of algae and zooplankton to assess the lower St. Johns River's biological health. The previous results indicated that blue green algae dominate nuisance blooms and adversely affect zooplankton populations.

Establishment of Native Vegetation Riparian Buffer Zones for Nutrient Reduction in the Lower St. Johns River Basin (2008–2009): This project has two primary objectives: (1) to characterize native riparian communities in the LSJRB; and (2) to investigate the performance of restored riparian buffers for nutrient reduction.

Evaluation of the Function and Importance of Tidal Marshes to the Biological Functions of the Lower St. Johns River (2009–2012): This project will include the evaluation of tidal marsh parameters including low oxygen, water inputs, Essential Fish Habitat, and organic carbon exports.

Evaluation of Impacts to Fish Communities from Low Dissolved Oxygen Episodes in the Lower St. Johns, a Eutrophic Blackwater River (2008): This three-year project is a joint partnership between the FWC FWRI's northeast Florida FIM Program and SJRWMD and is funded by a Florida SWG. The lower St. Johns River in northeast Florida has been identified through the state and federal TMDL process as an impaired water body, exhibiting the symptoms of eutrophication brought about by nutrient enrichment. One of the chief symptoms of eutrophication in this river is severe low DO episodes, brought about by the death and decay of algal blooms. Though fish kills have occurred, and some limited fisheries monitoring data has shown evidence of low species numbers, no comprehensive FIM has been performed during low DO episodes to document the effects on fish communities. The objectives of this project are: (1) conduct a literature review to determine low DO effects to regionally important fish and to evaluate the TMDL low DO criteria; and (2) conduct intensive fisheries monitoring during low DO times of year to determine possible effects to fish communities.

Fisheries — Independent Monitoring (FIM) Program (2008–2012): This FWC program will continue to conduct monthly samples of fisheries populations in the lower St. Johns River in conjunction with monitoring in nearby basins (St. Marys and Nassau rivers). Based on a randomized approach, stations will be sampled from the mouth at Mayport upstream to Doctors Lake. Expansion of sites upstream into Lake George is possible, although there are no specific plans to include Lake George at this time. In addition to species identification and standard lengths being documented, water chemistry data, habitat characteristics, and physical parameters will be recorded. Annual reports will be published by the FWC that document the results and data will be available electronically. This information is important to better understand and manage fisheries as well as the biological effects of water quality conditions.

Additional FIM sampling zones further upstream in the lower St. Johns River (Doctors Lake to Palatka) were established through a three-year grant from SJRWMD in July 2005. The data collected from this project is compatible with all other SRS fisheries sampling conducted in northeast Florida and adjacent water basins. The goal is to make this expanded sampling in the St. Johns River continuous and a regular part of the monthly FIM sampling regime, thus, providing a long-term fisheries monitoring data set for the entire LSJRB. SJRWMD funding for the expanded sites further upstream is committed through 2008 and is expected to continue thereafter.

Hyperspectral Imaging for Submerged Aquatic Vegetation (SAV) Identification (2008, 2010): Hyperspectral imaging examines large portions of the electromagnetic spectrum for signatures indicative of specific terrain types. A combination of visible and infrared spectra is used to type different species or assemblages of SAV so that remote sensing can be used to quickly catalog nearshore benthos. This project is conducted by Hyperspectral Data International.

Identification of Biological Indicators of Ecosystem Health (2010–2012): The project will include synthesis of work on existing conditions and determination of additional information needs for data gaps. An advisory panel will be used to review and assess the information. New information will be collected where data is lacking.

Lower St. Johns River Submerged Aquatic Vegetation (SAV) Monitoring (2007–2008): The SAV Monitoring program includes monitoring a small number of high frequency sites (designated as the PMN) monthly or quarterly, conducted by Sagan Biological LLC. In addition, 75 transects are monitored annually (during the summer growing season), and 85 transects are monitored in-house. Data is collected for health, extent, and species composition of SAV and is used to groundtruth aerial photography. Data is also collected to characterize epiphytes and to correlate biomass with visual estimates of cover.

Microbial Food Web Dynamics in the Lower St. Johns River Basin (2008–2010): This project has two primary objectives: (1) assess the role of microbial processes in hypoxic events (e.g., dissolved oxygen sags); and (2) assess the role of microbial processes in organic carbon fate and cycling in the river.

SAV-Coupled Macroinvertebrate Sampling in the Lower St. Johns River Basin (2008–2009): The project will include collection of invertebrates in the PMN of SAV (i.e., high frequency SAV sites), counting of invertebrates, and identification to the lowest practicable taxon. The work will be conducted by Water and Air Research, Center for Systematics and Taxonomy, Ecoanalysts, Inc., and MACTEC.

Shallow Groundwater Sampling in the Root Zone of Submerged Aquatic Vegetation (SAV) (2008–2010): This project is designed to characterize the water quality and variability of shallow groundwater in root zone sediments. Paired groundwater and surface water samples are obtained. This sampling occurs at SAV monitoring sites.

Sediment Management Initiative Future Projects

Big Fishweir Creek Ecosystem Restoration (2008–2012): This project is anticipated to be implemented within the next five years. The purpose of this project is to restore the aquatic ecosystem functions of Big Fishweir Creek that have been affected by sediment loadings from past off-site construction projects. The project is currently in the feasibility stage and construction, if approved by the Corps and funded by Congress, is not anticipated until 2009 or later.

Future Channel Improvements (2008–2012): Alternatives for future deepening increments in the river channel are currently being evaluated under a draft Environmental Impact Statement for the Corps Jacksonville Harbor Navigation Study, General Reevaluation Report 2. The Notice of Intent to Prepare a Draft Supplemental Environmental Impact Statement was entered into the Federal Register on April 13, 2007. A Feasibility Scoping Meeting regarding the draft Environmental Impact Statement is anticipated to be held in early 2008. Alternatives for improvements to hydrological flow at Mile Point (the intersection of the St. Johns River and the Intracoastal Waterway) are also currently being evaluated by the Corps.

Maintenance Dredging of Intracoastal Waterway (2009): The Intracoastal Waterway is dredged by the Corps as required to maintain a navigation depth of 12 ft. In 2009, approximately 500,000 cubic yards of material is expected to be removed from the Palm Valley North Reach area and placed into Dredged Material Management Area DU-9.

Maintenance Dredging of Jacksonville Harbor and Vicinity (2008–2012): Approximately 2 million cubic yards of material is dredged annually in the Jacksonville Harbor vicinity from the Terminal Channel (Commodore Point) to Entrance Channel Cut 3 (end of jetties). This total includes material dredged from the Federal Navigation Channel, JaxPort berthing areas, private industrial berthing areas, the Mill Cove Flow Improvement Channel, the U.S. Marine Corps Terminal at Blount Island, and the access channel and turning basin areas for the Mayport Naval Station. Dredged material is placed in upland Dredged Material Management Areas at Bartram Island, Buck Island, and Mayport; the south beach placement area at Mayport Naval Station and Katheryn Abbey Hanna Park; and the Jacksonville Ocean Dredged Material Management Area located approximately 3.5 miles east of the end of the entrance channel jetties.

Reduction of Adverse Effects from Construction Sites and Disturbed Areas (2008–2012): This program inspects construction sites for erosion and sedimentation control measures in order to reduce off-site sedimentation and runoff of turbid water; to protect surface waters, streams, and drainage systems from the effects of sedimentation and excessive turbidity. Currently the program consists of a program director, two supervisors, four inspectors, and an education/outreach coordinator, and is funded through building permit fees. The program inspects construction sites before and during clearing and construction based on priorities, and initiates law enforcement for violators. The program also conducts education, and offers a free two-day Erosion Control Inspector's Certification class twice per year. This project is sponsored by the COJ EQD.

Toxic Contaminants Remediation Initiative Future Projects

Agricultural Pesticide and Contaminant Assessment (2009): The purpose of this project is to look at contaminants in the St. Johns River, especially those areas adjacent to agricultural areas, and to prepare remediation plans in cooperation with UF-IFAS and other partners. Data obtained will be used to determine the level of risk of these contaminants to biota and to humans. This work will also assist in the future development of BMPs for pesticides and other contaminants and help guide future cleanup efforts.

Cedar River Stormwater Treatment Outfall Monitoring (2009–2011): This diagnostic sediment assessment project was conducted prior to, and is proposed to follow, construction of the stormwater detention facility, to determine the effectiveness of the facility sediment and contaminant reduction measures. The objective is to analyze sediments for physical variables, total metals, semi-volatile organics, PCBs, and chlorinated pesticides collected from the eastern tributary of the Cedar River. The results will be used to determine the presence and concentrations of contaminants that will be carried into and accumulate in the regional stormwater wet detention facility. In addition, sediment samples will be collected for three years following construction of the regional stormwater wet detention facility to calculate its efficiency.

Contaminant Assessment in the Lower St. Johns River (2009–2012): This work will assess the contaminant levels in sediments and key animals in the known contaminant areas to determine environmental impact to the river and it will also aide the Department of Health in their determination of human risk.

Deer Creek Remediation (2008–2012): The efforts to date (2000–2007) include completion of a preliminary site assessment, health and risk assessments, and a planning and alternatives analysis. Future efforts will include a detailed assessment, finalization of a remediation plan, and implementation of the project plan. This project is a cooperative effort between EPA, NOAA, FDEP, SJRWMD, and Kerr-McGee (Tronox).

Fishweir Creek Remediation (2008–2012): The efforts to date (2005–2007) include preliminary diagnostic testing and a planning and alternatives analysis. Results from the preliminary diagnostic testing indicate low-level contamination with pesticides, metals, and other industrial contaminants. Future efforts will include more specific site assessments, determination of an appropriate remediation strategy, and implementation of the project plan. This project is done as a cooperative effort between USACE, COJ, FDEP, and SJRWMD.

McCoy Creek (2008–2012): SJRWMD was consulted as an external party to review the project scope for the flood control project at McCoy Creek, which included issues with sediment contamination. The project was put on hold, and a new site is being pursued for a STA. This project is being conducted as a joint effort between the COJ and SJRWMD. This project is expected to continue as a new site is identified and the stormwater treatment project continues.

Sediment Contaminant Assessment Associated with Wet Detention (2008–2011): The COJ, in a cooperative effort with SJRWMD, is constructing a 14-acre regional stormwater wet detention facility that will provide retrofit treatment for 1,452 acres of tributary area that currently does not receive water quality treatment. Previous studies conducted by SJRWMD indicate that the Cedar-Ortega River confluence sediments are contaminated with a variety of constituents, including PAHs, PCBs, pesticides, and metals. The regional stormwater facility will provide water quality treatment for the area that is the potential source of some of these contaminants. This project will be a sediment and toxics assessment for the regional stormwater facility that will assist in determining the effectiveness of the wet detention pond at retaining these contaminants. The project will also provide data for evaluating the necessity for potential future remedial action of the sediments in the facility and at the confluence of the Cedar River. The property was acquired by SJRWMD and construction funding is provided by the COJ and FDEP. This project began in 2007.

Public Education Initiative Future Projects

The Public Education Initiative future efforts and funding for the LSJRB and Lake George Basin will include the following:

- The Lower Basin Public Education Initiative will continue seeking to increase awareness about river health issues and to educate the public on how human behaviors impact the river and how negative behaviors can be changed.
- Continue coordination efforts with the communication staffs of JEA, FDEP, and COJ. This initiative promotes consistent messages to be conveyed by SJRWMD and these entities, which are involved in a restoration partnership, called the River Accord, to improve the health of the lower St. Johns River.

- Continue and adapt the paid media portion of the campaign that launched in April 2007 with ads on television and in local newspapers, radio traffic sponsorships, and billboards. Collateral materials include a campaign-specific brochure and website (www.floridaswater.com).
- Media outreach will include LSJRB boat tours, editorial board visits, news releases and news stories, and appearances on public affairs radio and television broadcasts. Presentations to civic organizations, schools, and local governments will spotlight river health issues.
- To evaluate the initiative's success, public awareness surveys will be conducted before, during, and after the campaign.

Intergovernmental Coordination Initiative Future Projects

Harmful Algal Bloom Coordination (2008–2012): SJRWMD dedicates a portion of their Lower Basin biologist's time to coordinate with HAB efforts within SJRWMD and the rest of the state. This function plays an important role in information sharing and SJRWMD efforts in controlling harmful algal blooms in the lower St. Johns River.

Lower Basin Interagency Program Coordination (2008–2012): SJRWMD supports a staff position called the lower basin program manager to coordinate basinwide efforts and integrate information sharing across its departments and among other agencies. This position handles the special legislative funding request for the LSJRB. This position plays a long-standing role within SJRWMD and plays an important function in sharing information across departments and other efforts.

Intergovernmental Coordination (2008–2012): SJRWMD supports two staff intergovernmental coordinator positions that cover geographic areas in the LSJRB. These staff are part of SJRWMD's Office of Communications and Governmental Affairs (OCGA) and are the main contacts for local governments in the basin and provide annual presentations for local governments making LBR requests for state funding. These staff regularly communicate with the lower basin program manager in the Project Management Section.

Lower St Johns River Technical Advisory Committee (TAC) Support (2008–2012): The COJ, FDEP, and SJRWMD will continue to support the meetings and activities of the LSJR TAC as they have since the late 1980s. The TAC will continue to serve as a scientific and management forum; support updates to the SWIM as needed and advise SJRWMD on its content; be the regional forum to discuss technical and management issues, funding opportunities and priorities, and information source for local and regional conferences; and be the LSJRB's technical advisory committee for the St. Johns River Alliance.

Public and Media Communications Staff (2008–2012): SJRWMD supports a position within OCGA to provide a media and public contact for questions and issues regarding projects in the LSJRB. This staff position regularly coordinates with many departments within SJRWMD and regularly communicates with the intergovernmental coordinator and lower basin program manager. This position is also supported by the other districtwide staff in OCGA.

Reuse Initiative/Integrated Water Management Plan (2008–2012): The current role of this group is to integrate wastewater and water supply/reuse options, and includes utilities from the LSJRB and Nassau River Basin. The Northeast Florida Utility Managers Group is supported by SJRWMD and is the forum to develop regional water reuse and wastewater improvement projects among local utilities. The group will meet as appropriate to share information and work on opportunities for sending wastewater to reuse systems.

River Accord (2008–2012): The River Accord (2006–2016) river restoration effort is expected to continue to coordinate funding and project priorities. The program includes identification of $700 million in projects that are needed to restore the river. These include continuing efforts to remove wastewater discharges, improve wastewater effluent and increase the use of reuse water for irrigation, eliminate failing septic tanks, improve stormwater, and produce an annual “State of the River” report. The COJ will be the lead organization in the Accord along with the other key agencies and universities in the LSJRB. These organizations are expected to coordinate their efforts for prioritizing projects and funding based on the priorities in the River Accord. Continued coordination of the River Accord efforts is expected to occur through the St. Johns River Alliance.

St. Johns River Alliance (2008–2012): The St. Johns River Alliance will continue and expand its river-wide role focusing on restoration, public access, and education efforts. The Alliance is expected to expand its role in educating those outside the region about restoration needs in the basin, developing a research consortium of universities in the watershed, and increasing public education and public access efforts.

Total Maximum Daily Load (TMDL) Coordination Process (2008–2012): Through the authority of the federal Clean Water Act, the state of Florida and the EPA will continue to establish TMDLs for the impaired waters in Florida. The FDEP will continue as the lead state agency on the development of TMDLs and their BMAPs.

Continued coordination of TMDL implementation is expected through the TMDL Stakeholders Group, LSJR TMDL Executive Committee, and LSJR Tributary Working Group to provide input from the specific stakeholder groups that would be directly affected by the TMDL implementation. These groups are expected to continue as TMDL implementation continues and the BMAPs are updated in five-year cycles.

4.0 PAST FUNDING STRATEGIES AND FUTURE BUDGETS

The following sections generally outline the funding strategies as they apply to projects completed since the 1993 LSJRB SWIM Plan. These descriptions are provided by initiative for three different time frames: the Early Years (1993–1996), the Recent Years (1997–2007), and the Next Five Years (2008–2012). The projected budgets for the future projects are provided in Table 4-1.

4.1 The Early Years (1993–1996)

4.1.1 Water Quality Initiative

In the Water Quality Initiative, most early year funding focused on collecting data and building tools for water quality modeling and developing effective BMPs in the TCAA. Data were collected on the various subbasins to determine loadings to the mainstem. Diagnostic research was also performed in the TCAA to identify the subbasins with the highest loads and sources for those loads. BMP development was focused on the largest priority crops, such as potatoes, and basins with the largest loads. However, there were some well-documented sources of pollution that could be addressed without additional diagnostic or feasibility work to define problems and identify solutions. These “immediate action” projects addressed sources that were easily identified and controlled with conventional means. Chief among these were cooperative programs that provided funding for staff and equipment to local public health departments to increase enforcement and correction of failed septic tanks. Typically, these programs lasted for three years and, in addition to correcting failed septic tanks, the programs identified septic tank failure areas that were then targeted for public sewerage expansion to provide a permanent solution to this wide-spread source of nutrient and bacterial pollution.

4.1.2 Biological Health Initiative

Funding for the Biological Health Initiative during the early years was fairly limited and projects were conducted as joint studies with academia (e.g., Jacksonville University). These studies were primarily focused on evaluating the relationship between SAV and fish community structure in the lower St. Johns River.

4.1.3 Sediment Management Initiative

During the early years, funding for the Sediment Management Initiative was focused on dredging and management of sediment from construction sites. The Jacksonville Harbor and surrounding area was dredged on an annual basis. Construction sites in Duval County were also inspected for sediment management and control measures. These sites were inspected by the city of Jacksonville Water Quality Branch staff whose positions were created and funded by general tax revenue. Although not aimed entirely at sediment management, the development of the city of Jacksonville’s Master Stormwater Management Plan was one of the earliest SWIM efforts conducted within the basin. This cooperative project between SJRWMD and the city was one of the first funded by SWIM. The implementation of this plan is well under way and where older urban areas have been retrofitted with stormwater treatment facilities, stormwater runoff is treated and sediments removed before being discharged to receiving waters.

4.1.4 Toxic Contaminants Remediation Initiative

Funding for the Toxic Contaminants Remediation Initiative in the early years was primarily focused on basinwide sediment quality assessments. The objectives of these assessments was to determine the presence, concentration, and distribution of potentially toxic organic compounds and metals, with areas of high concentration identified for more intensive sampling and characterization.

4.1.5 Public Education Initiative

Public education budgets during this time sponsored in-house staff at SJRWMD to give educational presentations to homeowners, civic and school groups, and elected officials on the river's water quality. Staff also provided media tours of the river, which resulted in many articles on the river being aired or published.

4.1.6 Intergovernmental Coordination Initiative

Intergovernmental coordination budgets during this period sponsored in-house staff at agencies and local governments to share information, prioritize projects, and coordinate efforts. These roles continued throughout this period.

4.2 The Recent Years (1997–2007)

4.2.1 Water Quality Initiative

In the Water Quality Initiative, major funds were dedicated to land acquisition and development of two RST facilities to treat agricultural runoff. Both systems came online at the end of this period and will continue to operate and reduce nutrients over time. At least three more RST facilities are planned and land has been acquired for those sites.

In addition to treating stormwater, extensive work was performed on BMP testing and development in cooperation with UF-IFAS and local growers. The BMP Cost-Share Program was initiated with local growers to encourage implementation of agricultural BMPs. CRFs were tested as a possible BMP and investigations will be expanded in future years on additional crops. Work began on redevelopment of a research facility in Hastings to test and develop better urban stormwater BMPs. Further work is planned at the site in the future.

During this period, monitoring of water quality and biological monitoring was conducted in the TCAA and throughout the basin, including expanded efforts in Lake George. A detailed water quality model was developed for the mainstem and nutrient TMDLs were established for the freshwater and marine sections of the mainstem.

4.2.2 Biological Health Initiative

Funding for projects under the Biological Health Initiative during the past decade was more extensive than the early years. A number of projects in recent years focused on photointerpretation and hyperspectral imaging for SAV identification. In addition, there have been multiple projects related to SAV monitoring and assessment of SAV responses to changing conditions (e.g., land use, environmental factors, nutrients). These projects have been done in-house as well as with the assistance of academia and specialized contractors.

FIM began in 2001 and provided important data on the fisheries populations in the region. In 2005, the monitoring sites for the FIM program were expanded through funding from SJRWMD to include sites further upstream and to provide fisheries data that could be compared to water quality conditions and future comparisons as pollutant loads are reduced.

Other programs were funded such as a three-year continuous study of water quality conditions using the MERHAB automated system. This continuous monitoring supported a greater understanding of the changing conditions in the river and the linkage to water quality conditions and HAB. Also, in 2005, funding began for a study of the impacts of low oxygen conditions on fisheries in the lower St. Johns River. The project results will be documented and the project completed in 2008.

4.2.3 Sediment Management Initiative

During this period, the maintenance dredging of the Jacksonville Harbor continued as did the inspection program for construction sites. In 1997, as part of the NDPES permit for their MS4, the city of Jacksonville expanded the inspection program to also focus on impacts to the MS4 system. Then, in 2005, the efforts associated with these inspection programs were combined and expanded into the Erosion and Sediment Control program, which was funded by the building construction permit fees. This expanded program allowed for additional compliance and enforcement activities, increased inspections, and more education and outreach to the community. Funding during this time also went to maintenance dredging of the Intracoastal Waterway.

4.2.4 Toxic Contaminants Remediation Initiative

Results from assessments completed during the early years indicated widespread contamination with high variability in contaminant concentrations and in the physical characteristics of the sediment. Funding during the recent years was then focused on more targeted assessments of the mainstem and Cedar-Ortega basins, including detailed sediment characterizations, benthic macroinvertebrate studies, and tissue assessments of bass, shrimp, and bivalves. Funding was also used for remediation planning, where SJRWMD was a cooperative partner with other federal, state, and/or local entities for site remediation projects.

4.2.5 Public Education Initiative

During this time, funding was provided for SJRWMD staff to develop two major partnership initiatives: the 1998–2003 River Agenda and the 2006 River Accord. Also during this time, District staff continued with their educational presentations to homeowners, civic and school groups, and elected officials on the river’s water quality. Staff also gave media tours of the river to raise awareness, which resulted in aired and published media coverage.

4.2.6 Intergovernmental Coordination Initiative

The year 1997 brought the first River Summit and a higher profile to intergovernmental coordination efforts in the LSJRB. SJRWMD continued to support in-house staff to promote input from other agencies and stakeholders. In 2002, funding was provided to support a facilitator for LSJR TAC and TMDL efforts. The year 2003 included the second River Summit and marked the first year of the St Johns River Alliance. Funding was provided by numerous local governments and agencies in 2004. In 2006, additional funds were provided to support the Northeast Florida Utility Managers Group and the River Accord, which are related efforts to increase reuse for irrigation and reduce wastewater discharges to the river.

4.3 The Next Five Years (2008–2012)

4.3.1 Water Quality Initiative

At least three new RST sites are planned and additional land acquisition and treatment system development may be needed in the TCAA. Continued work with UF-IFAS on developing CRFs and "fertigation" techniques will be pursued to help the growers meet the requirements of the TMDLs. The new Urban Stormwater Research Station will begin new research projects to guide effective BMP use in urban areas, which is especially important for this basin that is experiencing very high population growth and conversion of agricultural areas to urban land uses.

4.3.2 Biological Health Initiative

Future projects include a mix of continued projects and new initiatives. Monitoring of SAV and hyperspectral imaging for SAV identification will be continued into future years. New initiatives include projects to understand more about the intricacies of the individual and cumulative components within the LSJRB, such as microbial food web dynamics, the evaluation of functioning tidal marshes, and the identification of biological indicators of ecosystem health.

State funding is expected to continue for the FIM program; SJRWMD funding for the expanded sites further upstream is committed through 2008 and is expected to continue thereafter. Funding for the conclusion of the MERHAB project ends in 2008.

4.3.3 Sediment Management Initiative

Maintenance dredging of both the Jacksonville Harbor and Intracoastal Waterway are expected to continue into the future with funding from the USACE. The Erosion and Sediment Control Program is also expected to continue during this time, funded by the city of Jacksonville through Building Construction Permit fees. The program is expected to have between six and eight staff dedicated to sediment and erosion control inspections, enforcement, and education. Additional funding in the future is expected to go towards river channel improvements and restoration of the Big Fishweir Creek, which has been affected by sedimentation from past construction projects.

4.3.4 Toxic Contaminants Remediation Initiative

Future efforts of the Toxic Contaminants Remediation Initiative will be focused on further assessment and monitoring. This will include known problem areas (e.g., Cedar-Ortega rivers), and proposed regional stormwater facilities, which will provide retrofit water quality treatment.

4.3.5 Public Education Initiative

Future funding for the Public Education Initiative will continue the existing roles of agency staff for public education and awareness of the river's water quality. This includes continuing to provide educational presentations and media tours to increase public knowledge about the river.

4.3.6 Intergovernmental Coordination Initiative

In the future, funding for intergovernmental coordination is expected to maintain the existing roles of agency staff. Funding or staff support will be provided for the HAB coordination, LSJR TAC, TMDL process, St. Johns River Alliance (and the River Accord), and Northeast Florida Utility Managers Group.

4.3.7 Future Projects and Estimated Budget

Table 4-1: Lower St. Johns River Projected Budget, Fiscal Years 2008–2012

Planned Projects	FY 2008	FY 2009	FY 1010	FY 2011	FY 2012
Water Quality Initiative					
Agricultural BMP Cost- Share Program-Phase II	$200,000	$250,000	$250,000	$250,000	
Agricultural Receiving Streams Evaluation	SJRWMD staff time.	SJRWMD staff time.	SJRWMD staff time.		
Algal Initiative	$100,000	$500,000	$1,000,000	$1,000,000	$1,000,000
Algal Toxin Monitoring	$10,000	$10,000	$10,000	$10,000	$10,000
Ambient Water Quality Monitoring in the TCAA	$107,655	$107,655	$107,655	$107,655	$107,655
Aquatic Organic Matter Characterization	$75,000				
Best Management Practice (BMP) Geographic Information System (GIS) Tracking Tool	SJRWMD staff time.	SJRWMD staff time.	SJRWMD staff time.		
Chip Potato Grower Demonstration Projects Using Controlled Release Fertilizers	$35,000	$35,000	$35,000		
City of Jacksonville Mainstem Run	COJ staff time	COJ staff time	COJ staff time	COJ staff time	COJ staff time
COJ MS4 Permitting Monitoring Program: Stormwater BMP Effectiveness Studies	$100,000	$100,000	$100,000	$100,000	$100,000
COJ MS4 Permitting Monitoring Program: Tributary Intensive Program	$100,000	$100,000	$100,000	$100,000	$100,000
COJ Tributary Routine Program	COJ staff time	COJ staff time	COJ staff time	COJ staff time	COJ staff time
City of Jacksonville Timucuan Preserve Program	COJ staff time	COJ staff time	COJ staff time	COJ staff time	COJ staff time
Compliance with the TMDL and PLRG Water Quality Goals	$120,000$120,000	$120,000	$120,000	$120,000	$120,000
Comprehensive Nutrient and Water Use Research Project in the TCAA	$259,700	$275,282	$291,799		

Planned Projects	FY 2008	FY 2009	FY 1010	FY 2011	FY 2012
Controlled Release On-Farm Project: An Alternative Irrigation Program for Potato Crops to Reduce Water and Nutrient Use	$90,857				
Dairy Baseline Water Quality Monitoring	$23,453	$23,453	$23,453	$23,453	$23,453
Development of Regional Stormwater Treatment (RST)	$500,000	$500,000	$1,000,000	$1,500,000	$2,000,000
Engineering and Design of the IFAS Plant Science Research and Education Unit's Hastings Farm	$450,000				
Establishment of the University of Florida/IFAS Field Station on Urban Nonpoint Source Reductions in Hastings	$175,000				
Expansion of Controlled Release Fertilizer Testing for Additional Crops	$100,000	$100,000			
Extension of the Western Atlantic Tide Model	$60,000	$60,000			
Geographic Information System (GIS) Land Use Assessment	$10,000				
Inner Shelf Water Quality in the South Atlantic Bight	$50,000	$30,000	$30,000	$30,000	$30,000
Land Use Effect on Shall Groundwater Pollution	Estimate under development				
Lower St. Johns River Groundwater Monitoring Program	$15,000	$15,500	$16,000	$16,500	$17,000
Lower St. Johns River Mainstem Nutrient BMAP Implementation	Estimate under development				
Lower St. Johns Watershed Action Volunteers	$75,000	$75,000	$75,000	$75,000	$75,000

Planned Projects	FY 2008	FY 2009	FY 1010	FY 2011	FY 2012
Low Impact Development (LID) Stormwater Management Project	$100,000				
LSJR Mainstem Basin Management Action Plan (BMAP) Process	Estimate under development				
LSJR Tributary BMAP Process	Estimate under development				
Mid-Mainstem Ambient Monitoring Network	$66,142	$66,142	$66,142	$66,142	$66,142
Monitoring the Lower St. Johns Tide Levels	Estimate under development				
Monitoring, Operation and Maintenance of Regional Stormwater Treatment Areas	$50,000	$50,000	$50,000	$75,000	$100,000
Northern Ambient Monitoring Network – Mainstem	$60,652	$60,652	$60,652	$60,652	$60,652
Northern Tributary Ambient Monitoring Network	$44,184	$44,184	$44,184	$44,184	$44,184
Regional Stormwater Treatment Optimization Monitoring	$37,313	$37,313	$37,313		
Salinity/Dissolved Oxygen/ PAR Measurements	Estimate under development				
Southern Ambient Monitoring Network	$55,163	$55,163	$55,163	$55,163	$55,163
Tide Marsh Exchange with the Lower St. Johns River	$40,000				
Timucuan Preserve Probabilistic Survey	$83,036				
Tributary Discharge Monitoring	Estimate under development				
Upgrade the Watershed Assessment Model (WAM)	$42,620				
USGS/SJRWMD Mainstem Water Quality Monitoring	Estimate under development				
USGS Tributary and River Flow Gauging	Estimate under development				
Water Quality Monitoring Assessment	Estimate under development				

Planned Projects	FY 2008	FY 2009	FY 1010	FY 2011	FY 2012
Water Quality Monitoring in the Timucuan Preserve	$45,000 (FDEP) $1,500 (NPS)	$45,000 (FDEP) $1,500 (NPS)	$45,000 (FDEP) $1,500 (NPS)	$45,000 (FDEP) $1,500 (NPS)	$45,000 (FDEP) $1,500 (NPS)
Biological Health Initiative					
As-Needed Sampling for Harmful Algal Blooms	$10,000	$10,000	$10,000	$10,000	$10,000
Before and After Effects of Developments of Regional Impacts on Receiving Streams	$14,600	$14,600	$14,600	$14,600	$14,600
Biological Monitoring – Phytoplankton	$70,000	$70,000	$70,000	$70,000	$70,000
Establishment of Native Vegetation Riparian Buffer Zones for Nutrient Reduction in the Lower St. Johns River Basin	$71,000				
Evaluation of the Function and Importance of Tidal Marshes to the Biological Functions of the Lower St. Johns River		$100,000	$100,000	$100,000	$100,000
Evaluation of the Impacts to Fish Communities from Low Dissolved Oxygen Episodes in the Lower St. Johns, A Eutrophic Blackwater River	$53,000				
Fisheries - Independent Monitoring (FIM) Program	FWC funding and staff $50,000 LSJRB ext	FWC funding and staff $50,000 LSJRB ext	FWC funding and staff $50,000 LSJRB ext	FWC funding and staff $50,000 LSJRB ext	FWC funding and staff $50,000 LSJRB ext
Hyperspectral Imaging for Submerged Aquatic Vegetation (SAV) Identification	$75,000		$80,000		$85,000
Identification of Biological Indicators of Ecosystem Health			$133,000	$133,000	$133,000
Lower St. Johns River Submerged Aquatic Vegetation (SAV) Monitoring	$50,000				

Planned Projects	FY 2008	FY 2009	FY 1010	FY 2011	FY 2012
Microbial Food Web Dynamics in the Lower St. Johns River Basin	$60,000	$120,000	$120,000	$85,000	
SAV-Coupled Macroinvertebrate Sampling in the Lower St. Johns River Basin	$68,000	$70,000	$72,000	$74,000	$76,000
Shallow Groundwater Sampling in the Root Zone of Submerged Aquatic Vegetation (SAV)	$25,000	$25,000	$25,000		
St Johns River Expansion of Fisheries — Independent Monitoring (FIM) Sites	$50,000	$75,000	$75,000	$75,000	$75,000
Sediment Management Initiative					
Big Fishweir Creek Ecosystem Restoration	$1 mill (Corps) $350,000 (local)	$1 mill (Corps) $350,000 (local)	$1 mill (Corps) $350,000 (local)	$1 mill (Corps) $350,000 (local)	$1 mill (Corps) $350,000 (local)
Future Channel Improvements	Estimate under development				
Maintenance Dredging of Intracoastal Waterway	$1.5 mill	$1.5 mill	$1.5 mill	$1.5 mill	$1.5 mill
Maintenance Dredging of Jacksonville Harbor and Vicinity	$1.2 mill	$1.2 mill	$1.2 mill	$1.2 mill	$1.2 mill
Reduction of Adverse Effects from Construction Sites and Disturbed Areas	No projects identified yet.				
Toxic Contaminants Remediation Initiative					
Agricultural Pesticide and Contaminant Assessment		$25,000			
Cedar River Stormwater Treatment Outfall Monitoring		$97,000	$48,000	$48,000	
Contaminant Assessment in the Lower St. Johns River		$80,000	$80,000	$80,000	$80,000
Deer Creek Remediation	$10,000	$10,000	$10,000	$10,000	$10,000
Fishweir Creek Remediation	$3,000	$3,000	$3,000	$3,000	$3,000
McCoy Creek	$1,000	$1,000	$1,000	$1,000	$1,000

Planned Projects	FY 2008	FY 2009	FY 1010	FY 2011	FY 2012
Sediment Contaminant Assessment Associated with Wet Detention	$148,902	$47,256	$48,120	$48,120	
Public Education Initiative					
Continue Paid Media Campaign	$1,000,000	$500,000 to $1,000,000	$500,000 to $1,000,000	$500,000 to $1,000,000	$500,000 to $1,000,000
Intergovernmental Coordination Initiative					
Harmful Algal Bloom Coordination	$38,000	$38,000	$38,000	$38,000	$38,000
Intergovernmental Coordination	$100,000	$100,000	$100,000	$100,000	$100,000
Lower Basin Interagency Program Coordination	$120,000	$120,000	$120,000	$120,000	$120,000
Lower St Johns River Technical Advisory Committee (TAC) Support	$80,000	$85,000	$90,000	$95,000	$100,000
Public and Media Communications Staff	$100,000	$100,000	$100,000	$100,000	$100,000
Reuse Initiative/Integrated Water Management Plan	$200,000	$50,000	$50,000	$50,000	$50,000
River Accord	$700 mill total $15 million SJRWMD	$15 million	$15 million	$15 million	$15 million
St. Johns River Alliance	$92,500	$92,500	$92,500	$92,500	$92,500
Total Maximum Daily Load (TMDL) Coordination Process	$175,000	$175,000	$175,000	$175,000	$175,000

5.0 THE LAKE GEORGE BASIN

5.1 Introduction

Restoration and protection of the St. Johns River has been a goal of the SJRWMD Governing Board since its creation in 1973. As stated in chapter 1, the 1987 SWIM Act directed the state's five water management districts, in cooperation with state agencies and local governments, to prioritize water bodies of regional or statewide significance within each district and, based on their need for restoration and protection, design plans for surface water improvement and management.

Both the state and SJRWMD list the Lower, Middle, and Upper St. Johns River basins as priority water bodies. Historically, the Lake George Basin has been considered as a basin separate from both the middle and lower basins of the St. Johns River and has, therefore, not been considered a SWIM water body. This 2008 update of the LSJRB SWIM Plan identifies the Lake George Basin as a SWIM water body. This chapter reflects the special status of the Lake George basin and its association with both the middle and lower basins of the St. Johns River and is the first time it has been included in a SWIM plan. Inclusion of the lake and its watershed is justified because water quality has been shown to be impaired (i.e., it is not meeting state designated use classifications). In addition, recent hydrodynamic and natural resource assessment efforts have shown the importance of improving and maintaining water quality within the Lake George Basin to the subsequent health of both the Middle and Lower St. Johns River basins.

This chapter is not intended to be a separate SWIM plan for the Lake George Basin. To do so would result in repetition of numerous aspects of the remainder of the LSJB SWIM Plan. Instead, this section will provide a description of the Lake George Basin similar to that of the LSJRB (as found in chapter 2) but will focus primarily on characteristics that make it distinct.

Due to its natural integration (i.e., co-location, climate, hydrology, topography, and natural resources) with the St. Johns River, it would seem reasonable to apply the planning goals and objectives for the LSJRB (as described in chapter 1) to the Lake George Basin as well. However, it should be noted that the Lake George program is not as fully developed as the programs for the Lower and Middle St. Johns River basins. Currently, the Lake George program is in the planning stage, which includes reconnaissance and assessment efforts to further identify the most critical issues facing the lake and help develop potential strategies to address them. Therefore, this chapter will also provide a description of the assessment efforts that currently affect the Lake George Basin. As the program becomes more developed, future plan updates will be provided in this chapter.

5.2 General Basin Description

The Lake George Basin is large covering approximately 520,000 acres in area and is composed of four planning units. A planning unit is either an individual, usually large, primary tributary basin or a group of small adjacent primary tributary basins with similar characteristics. An explanation of why and how each planning unit was created can be found in Appendix B of SJRWMD technical report SJ97-1. Each of the basin’s four planning units will be discussed in greater detail in the section to follow. Discussions are provided for the region’s hydrology, geology and groundwater resources, soils and related land uses, and water quality problems as they are related to historical and current land uses. Information in the discussions on water quality problems is primarily adapted from the FDEP 2003 Middle St. Johns River Basin Status Report.

Location: Lake George is a flow-through lake located in the St Johns River, an elongated shallow river estuary. The Lake George Basin is located in northeast Florida and fits within a bounding rectangle of NW: 29.499244, -81.872830 and SE: 28.868153, -81.246698. Centered about 118 miles upstream from the Atlantic Ocean, Lake George is Florida's second largest lake, with an area of 73 square miles and a volume of 0.118 mi^3. It is approximately 6 miles wide by 9 miles (11.63 miles in the channel from mouth to mouth, shortest distance north to south is 10.40 miles) in length. The mean depth of the lake is 8 feet. The Lake George Basin drainage area represents approximately 816 square miles and includes parts of Volusia, Marion, Lake, and Putnam counties (Figure 5-1).

Climate: Climate in the Lake George Basin is similar to the remainder of the basin as described in the 1993 LSJRB SWIM Plan Update, except that the mean maximum temperature in the Lake George Basin can be as low as 16^{o}C (60^{o}F).

Winds: Wind patterns within the lake basin are similar to those described for the LSJRB with the exception that there is a greater prevalence of easterly winds and northwest winds.

Precipitation: Rainfall patterns are similar to those of the remainder of the basin as well with two distinct rainfall seasons occurring: a wet season (June-–October) and a dry season (November–May). However, on average, rainfall amounts appear to be less than other portions of the basin, with the normal wet season rainfall for the basin being about 31.7 inches while the normal dry season rainfall amounts to 21.4 inches. In the Lake George Basin, most of the precipitation occurs in the summer. During the normal warm season (June–September), precipitation in the basin is about 28 inches compared with the cold season (December–March) rainfall that is equivalent to 13 inches. These data have been extracted from the six long-term NOAA rain gauge stations covering the Lake George Basin located in Crescent City, DeLand, Lisbon, Lynne, Palatka, and Sanford. Appendix E contains a list of all active rain gauge stations in the Lake George Basin.

Topography: Topography within the Lake George Basin is generally flat with many wetlands and marsh areas in its central regions. There are numerous lakes, depressions and swamps throughout the region. The elevation increases east to west with ridges and terraces appearing. In the west of the Lake George Basin, there are many ridges, i.e., Atlantic Beach ridge, Silver Bluff terrace, Rim ridge, Talbot terrace, DeLand ridge and the Crescent City ridge. These ridges are formed parallel to the ocean shoreline and are the remnants of ocean floor and dunes formed in the interglacial periods of the Pleistocene age. Surface elevations in the basin range from 50 meters at Riverside Island to one meter at the Norwalk marsh land (Figure 5-2).

Hydrology: A list of currently active hydrologic stations in the basin is presented in Appendix E of this update. Stations are grouped according to the planning unit in which they are located and characterized by the type of event it monitors (rainfall, stream flow/discharge, or stage/water level). Data from these stations will be used in water quality and hydrological evaluations. A more detailed overview of the surface water system and the existing rainfall and stream flow monitoring networks in the Lake George Basin can be found within the various hydrologic reports published electronically at the following SJRWMD Web link:
http://www.sjrwmd.com/hydroconditionsreport/otherhydroreports.html.

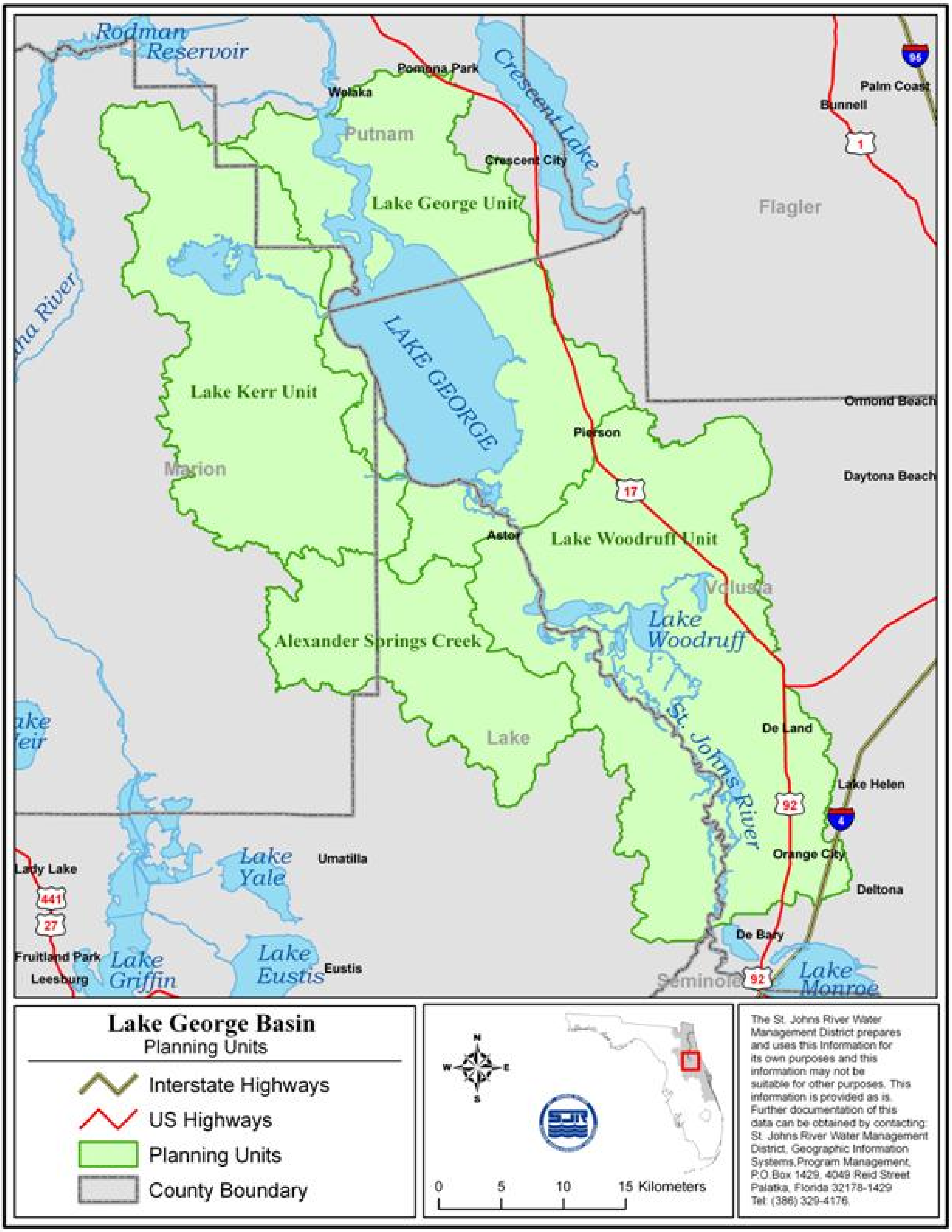

Figure 5-1: Planning Units of the Lake George Basin

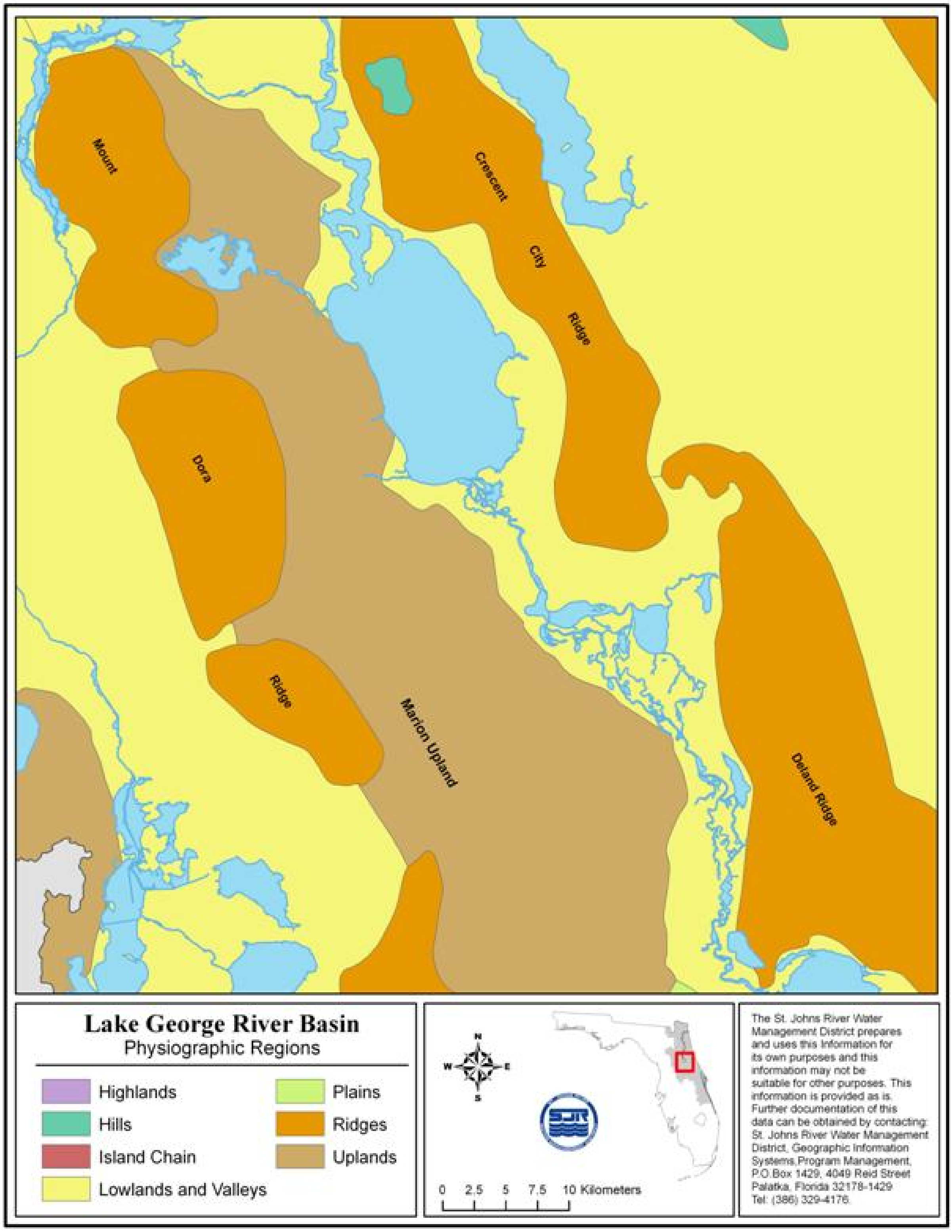

Figure 5-2: Physiographic Regions of the Lake George Basin

Governmental Involvement in the Lake George Basin: The relationship between local, state and federal programs and governmental entities involved with the management of Lake George is essentially the same as that described for the lower St. Johns River. Figure 5-3 shows the geopolitical breakdown of the Lake George Basin. Table 5-1 shows the population statistics for the counties included within the Lake George Basin.

Demographics of the Lake George Basin: Table 5-1 lists historical, current, and projected population figures for the basin's counties and major cities. Relatively small portions of Putnam and Marion counties are included in the basin, and those portions are largely rural or contained within the Ocala National Forest. Future growth is expected in and around DeLand and an increase in commercial and industrial development is anticipated along the Interstate 4 corridor.

Table 5-1: Lake George Population Statistics

County or City	1950 Census Population	1990 Census Population	2000 Census Population	2020 Projected Population
Marion County	38,187	194,833	258,916	379,642
Lake County	36,340	152,104	210,528	321,900
Putnam County	23,615	65,070	70,423	80,614
Volusia County	74,229	370,712	443,343	583,387
DeLand		16,622	20,904	
Total	**172,371**	**799,341**	**1,004,114**	**1,365,543**
Source data: FDEP Middle St. Johns Basin Status Report 2003				

5.2.1 Surface Waters

St. Johns River: The St. Johns River is the major river in the Lake George Basin and drains approximately 90 percent of the basin. The river meanders about 50 miles throughout the area, entering from the south and exiting the north side of the basin while passing through Lake George. The longitudinal slope in this stretch of the river is minimal (average slope is 0.1 ft/mile) resulting in generally low flows. This results in increased residence times as compared to upstream areas. Lake George is unaffected by marine salinity (the greatest upstream encroachment of marine salinity is 112 km), but can reach appreciable levels of dissolved solids due to the influence of in-lake and upstream brackish springs. This imparts marine characteristics into the lake. Tides propagate upstream as far as the lake, where they are largely dampened out; although under certain conditions, they may extend as far south as Lake Monroe. Due to the flatness of the riverbed, the St. Johns River throughout its course is surrounded by marshlands and swamps. The river is relatively narrow in the south and gets wider in the north.

Tributaries: Many tributaries, both large and small, discharge into the St. Johns River as the river flows through the basin. The largest tributary of the St. Johns River is the Ocklawaha River that enters the river approximately 8 km downstream of Lake George. There are 28 major tributaries in the basin (**Figure 5-4**), which are listed in **Table 5-2**. These tributaries drain into marshlands surrounding the St. Johns River and Lake George.

A large portion of the upper St. Johns River floodplain was converted to farming during the 20th century and is likely affecting the quality of surface water inflows to Lake George. Agricultural practices continue, but most of the floodplain has been bought back by SJRWMD and managed for flood control to improve water quality and environmental benefits. The Middle St. Johns River Basin, including the Orlando metropolitan area, is undergoing rapid urbanization. Nutrient loading enters the St. Johns River through surface runoff, and other sources such as septic systems and wastewater treatment plants. There is also an increase in nutrient concentration coming into the system from springs (e.g., Wekiwa, Rock, DeLeon, and Volusia Blue).

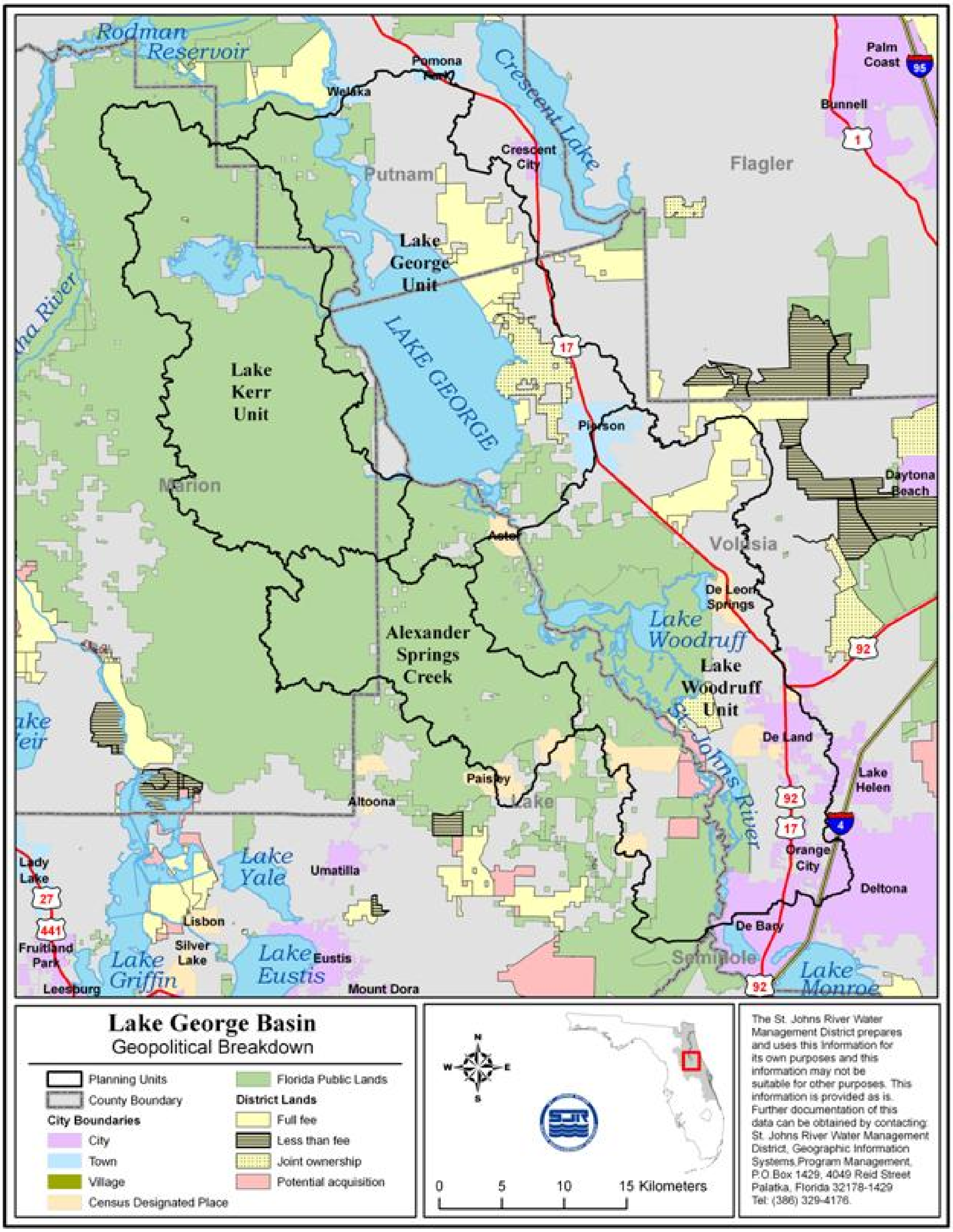

Figure 5-3: Geopolitical Breakdown of the Lake George Basin

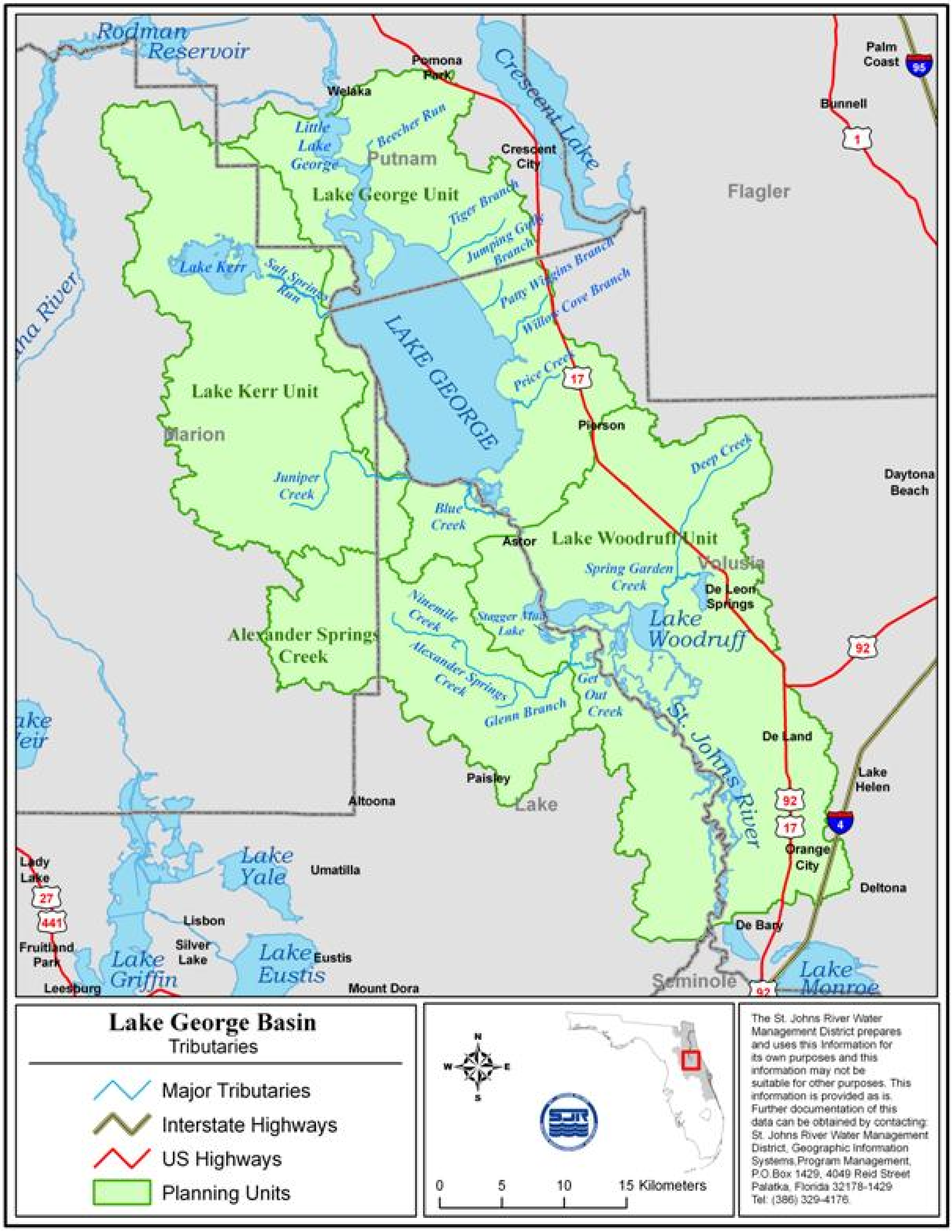

Figure 5-4: Tributaries of the Lake George Basin

Table 5-2: Tributaries of the Lake George Basin

Planning Unit (Subbasin)	Drainage Area (sq. mi.)	Tributaries
Alexander Springs Creek	100	Alexander Springs Creek
		Boyd Lake Outlet
		Ninemile Creek
		St. Johns River
		Glenn Branch
Lake George	252	Lake George
		St. Johns River
		Price Creek
		Blue Creek
		Willow Cove Branch
		Patty Wiggins Branch
		Tiger Branch
		Georgetown Slough
		Lake Laura outlet
		Beecher Run
		Jumping Gully Creek
		Silver Glen Spring Run
Lake Kerr	188	Little Lake Kerr outlet
		Juniper Creek
		Salt Springs Run
Lake Woodruff	276	Lake Woodruff outlet
		Deleon Spring
		Deer Haven Lake outlet
		Get Out Creek
		St. Johns River
		Stone Pone outlet
		Spring Garden Creek
		Deep Creek
		Shaw Lake outlet
		Cain Lake outlet
		Dan George Lake outlet
		Stagger Mud Lake
Source data: FDEP Middle St. Johns Basin Status Report 2003; SJRWMD Technical Publication SJ97-1		

Lakes: There are numerous lakes in the Lake George Basin ranging from less than one acre to almost 50,000 acres. Lake George, the second largest lake in the state, has a surface area of 46,000 acres. Spring water enters Lake George on the west side from three main tributaries. Other prominent lakes in the basin include (from south to north) Lake Beresford, Lake Spring Garden, Lake Woodruff, Lake Dexter, Lake Kerr, Lake Delancy, Lake Louise, Lake Margaret, and Little Lake George. Downstream, Little Lake George receives discharge from three springs, and the Ocklawaha River enters the St. Johns River from the west at the north end of Little Lake George.

It is believed that Lake George, as well as the other mainstem lakes that form the St. Johns River (e.g., Harney and Monroe), initially developed from natural depressions in an ancient seafloor. These depressions were formed from the repeated scouring and redepositing of material by wave action and water currents during interglacial periods of the Pleistocene Age when sea level was higher. When sea level fell, these depressions filled with freshwater. Riverine processes have continued to enlarge the lakes. Other lakes within the basin were formed by solution processes. Lakes formed by solution processes typically have a strong link with groundwater.

Classification of Basin Surface Waters: Waters within the state are classified by Chapter 17-3, *F.A.C.*, which provides use designations and defines the criteria for each use.

Class III Surface Waters — Lake George, the St. Johns River, their tributaries, and other lakes within the basin are Class III waters. Their designated use is for "recreation and the propagation and maintenance of a healthy, well-balanced population of fish and wildlife" (Chapter 17-3, *F.A.C.*). Class III use is often impaired by poor water quality.

Outstanding Florida Waters (OFWs) — The OFW designation is given to waters that are "worthy of special protection due to their natural attributes" (Section 403.061, F.S.); these waters are listed in Section 62-302.700, *F.A.C*. The OFW designation affords the highest protection possible under state water quality rules. Its purpose is to protect ambient water quality. A comprehensive list of OFWs within the LSJRB and the Lake George Basin through 2003 is represented in Table 5-3.

Table 5-3: OFWs in the Lake George Basin (through 2003)

County	OFW	Effective Date
Marion	Juniper Springs	9/1/1982
	Juniper Creek	9/1/1982
	Salt Springs	9/1/1982
	Salt Springs Run	9/1/1982
	Lake Kerr	9/1/1982
	Little Lake Kerr	9/1/1982
Lake	Alexander Springs	9/1/1982
	Alexander Springs Creek	9/1/1982
Lake and Volusia	Waters within Lake Woodruff National Wildlife Refuge	3/1/1979
	Hontoon Island State Park	3/1/1979
Volusia	Blue Spring State Park	3/1/1979
	DeLeon Springs State Recreation Area	5/14/1986
	Stark Tract	10/4/1990
	Volusia Water Recharge Area	3/1/1979

5.2.2 Geology and Groundwater

The geology and resulting groundwater influences emanating from numerous springs within the basin have a significant impact on the water quality of the lake. Florida owes its geologic structure to the variability of sea level over millions of years. The springs of the St. Johns River in the region around Lake George also owe their existence to this process. Water flows through underground passages in the relic limestone that make up the Floridan aquifer. The presence of this constant artesian source has also helped to preserve the present course of the St. Johns River.

The abundant groundwater contribution in the Lake George Basin is derived from three distinct aquifers: (1) the surficial aquifer, (2) intermediate aquifer, and (3) the Floridan aquifer. The surficial aquifer is composed of interbedded sand, shell and clay sediments. Depending on the presence and the amount of the clay in the profile, the surficial aquifer can form a good water bearing stratum. The thickness of the surficial aquifer varies, ranging from 25 to 80 ft. Water supply in this aquifer is limited, but in the areas where the Floridan aquifer contains marginal quality waters, this water could be utilized for agriculture and municipal purposes. In the Lake George Basin, the intermediate aquifer is located 40 to 90 ft below the ground surface.

The Floridan aquifer is the major source of municipal, industrial, and agricultural water supply in the basin. In this region, the Floridan aquifer is composed of dolomite and limestone and the water contained in it is under artesian pressure. Water quality of the top Floridan aquifer, at depths of less than 200 ft, is potable, while water from layers, deeper than 200 ft contains considerable amounts of dissolved salt.

SJRWMD identified priority water resource caution areas (PWRCA) based on the water resource constraints and the results of water use, groundwater, and surface water assessments. A PWRCA was identified along the eastern shore of Lake George (refer to Figure 2-4). The purpose of the PWRCA is to identify that a water supply issue has been shown or is projected to occur in the near future and to coordinate with consumptive users of water to address the issue before it becomes worse or to solve the issue prior to the problem developing.

Springs: There are 14 named springs within the Lake George Basin (Figure 5-5). These springs derive from substrates of a marine origin and yield water with high conductivities. All the springs in the basin introduce salts into the system in varying quantities. The three largest contributors of spring water are Silver Glen Springs, Alexander Springs, and Blue Spring, all of which are first magnitude. There are a number of second-magnitude springs as well, including Salt Springs, Croaker Hole Spring, DeLeon Springs, Fern Hammock Springs, Sweetwater Springs, and Juniper Springs. Salt Springs is the largest contributor of locally derived salt. The highest density of springs in the Lake George Basin occurs in the Lake George and Lake Kerr planning units, which contain 10 of the 14 springs in the basin. Discharge rates of the 14 named springs are provided in Table 5-4. The three tributaries on the west side of Lake George are named for their origins. Salt Springs and Silver Glen Springs are the primary sources of their runs, while the third, Juniper Creek, is comprised of three main springs (Juniper, Fern Hammock, and Sweetwater) and numerous smaller, unnamed springs. Within Lake George itself, recent comparisons of low- and high-flow conditions using both model simulations and field observations indicate that there is spatial variability of salt concentrations within the lake due to the presence of springs and indicates that, at times, horizontal mixing within the lake is incomplete. Downstream of Lake George, Croaker Hole, Forest, and Mud springs enter Little Lake George. In addition to the springs directly in the basin, the Wekiva River and Blackwater Creek upstream contribute spring discharge into the St. Johns River. Furthermore, the Ocklawaha River, whose baseflow is almost entirely derived from Silver Springs near Ocala, is by far the largest contributor of spring discharge to the basin when it enters the system at the north end of Little Lake George.

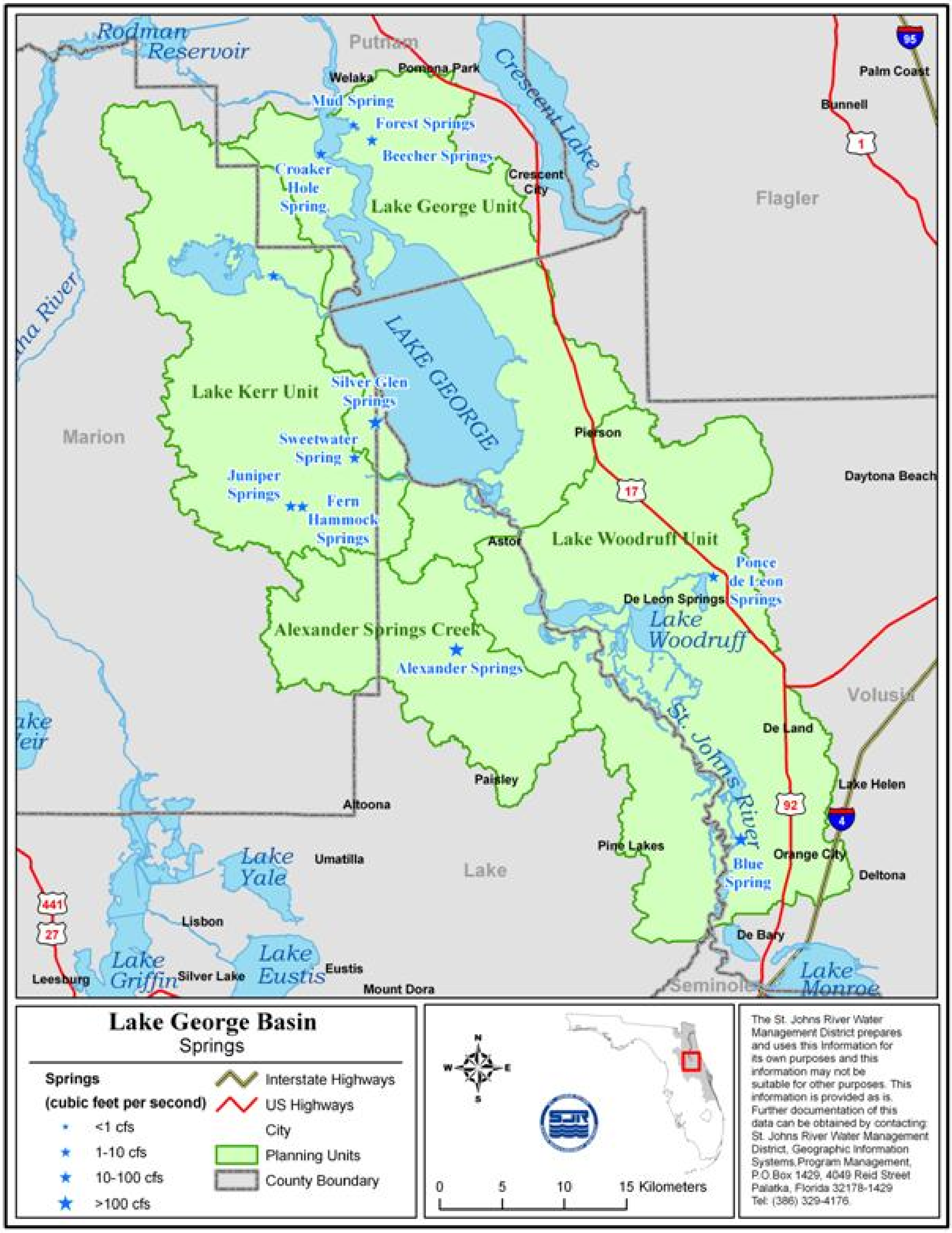

Figure 5-5: Springs of the Lake George Basin

Table 5-4: Springs of the Lake George Basin

Spring Name	Planning Unit	County	Magnitude	Avg. Discharge Rate (cfs)
Alexander	Alexander Spring Creek	Lake	1	104
Volusia Blue	Lake Woodruff	Volusia	1	157
Silver Glen	Lake George	Marion	1	104
Juniper	Lake Kerr	Marion	2	10.6
Ponce de Leon	Lake Woodruff	Volusia	2	27.6
Croaker Hole	Lake George	Putnam	2	76.2
Salt	Lake Kerr	Marion	2	80.9
Fern Hammock	Lake Kerr	Marion	2	12.5
Sweetwater	Lake Kerr	Marion	2	12.9
Beecher	Lake George	Putnam	3	9.13
Mosquito	Lake Woodruff	Marion	3	1.59
Morman Branch	Lake Kerr	Marion	3	7.41
Mud	Lake George	Putnam	3	1.16
Forest	Lake George	Putnam	4	0.29
Source data: SJRWMD "Springs of the District" data layer 2007				

Soils: In the Lake George Basin, soils consist primarily of sand, loam shell, clay, and organic matter. The percentage of each element changes with topography. In low-lying areas, flat woods, and flood plains, the soil contains higher percentages of organic matter, possesses lower hydraulic conductivity, and the water table is shallow. With the exception of excessively drained areas, the soil is sandy to a depth of 20 to more than 40 inches, with loam below. The water table fluctuates throughout the year, sometimes reaching the ground surface. In the excessively drained, nearly level to strongly sloping soils of uplands, the soil is mainly sandy to a depth of 80 inches and more.

Land Uses: The majority of the land in the Lake George Basin is undeveloped (refer to Figure 5-3 for the locations of public lands). The remaining land area consists of water bodies, agriculture, conservation, and residential (Figure 5-6). A more detailed discussion of land uses and the subsequent effect on sediment and water quality within each planning unit is contained in section 3. A table representing these data is also available in Appendix F of the FDEP 2003 MSJ Basin Status Report.

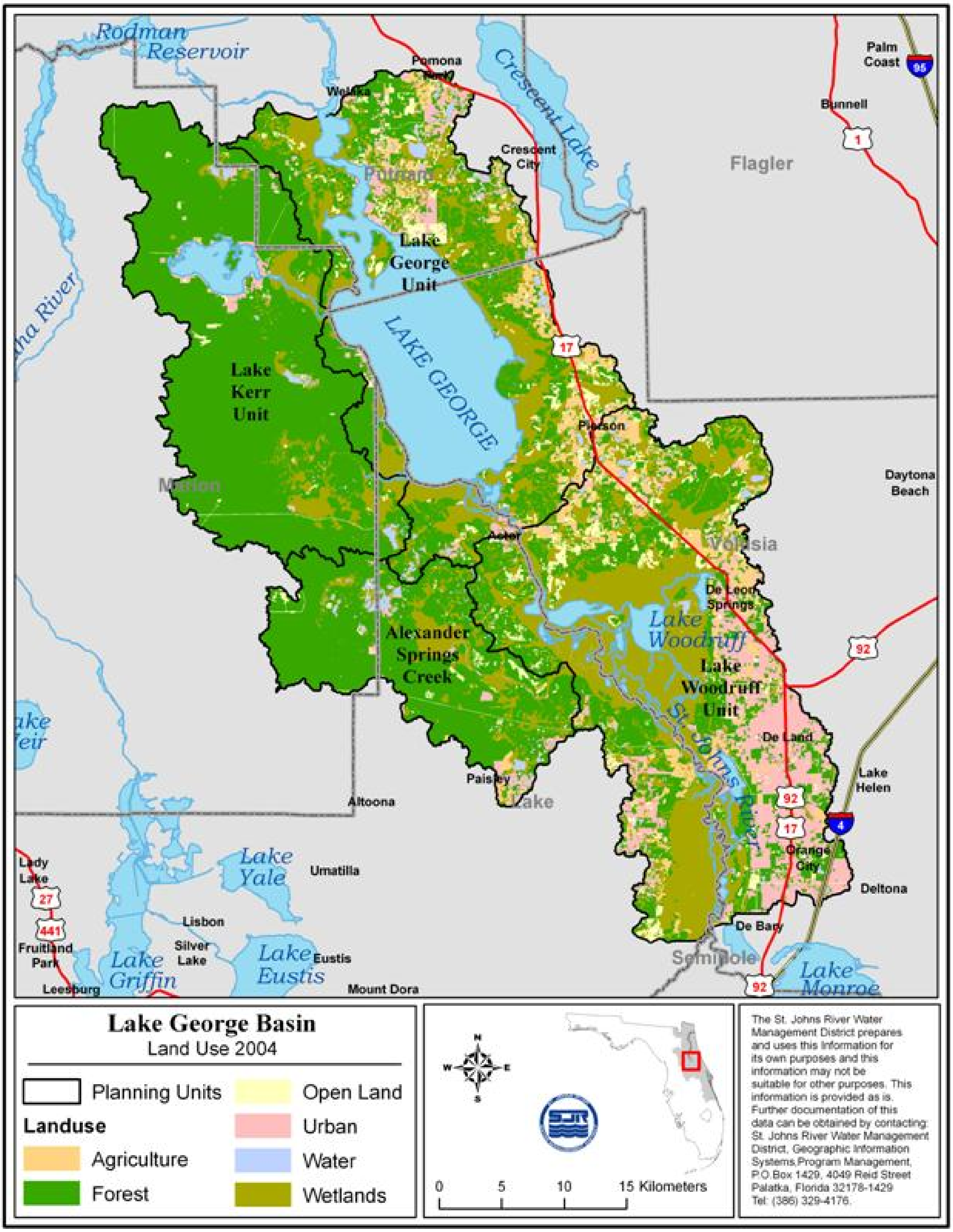

Figure 5-6: Land Use in the Lake George Basin (2004)

5.2.3 Natural Resources

Shellfish and Finfish Resources: The ichthyofauna of Lake George is unique due to intrusion of artesian and spring flows of groundwater containing high levels of chlorides, the lake's minimal change in elevation from mouth to headwaters, and historic processes. Historically, the St. Johns River was a coastal lagoon similar to the Indian River Lagoon or Halifax River, serving as habitat to numerous marine species. During interglacial periods of the Pleistocene, terraces were added to the Florida Peninsula and the St. Johns River eventually acquired its present course, interlacing through these terraces along relic lagoon structures. Starting with ocean salinity, salts gradually leached from substrates until they reached present concentrations and relative abundances. This process continues today, as measured in spring discharges, for example. The influence of the Atlantic Ocean translates into the Lake George Basin through high frequency (tides) and low frequency (large-scale processes) changes in the water level. This influence coupled with the presence of local sources of salt have provided habitat that allows a large assemblage of marine species to reside in the lake. The same processes may have had a similar role in the adaptation of marine species, such as the Atlantic stingray, to life in the river well upstream of Lake George for thousands of years. Due to the relatively high chloride levels, numerous euryhaline species, such as croaker and blue crab, reside in or routinely invade the lake. Ninety-seven species of fish are listed for the St. Johns River around the lake, with approximately 41 marine species, including striped bass and mullet. It was one of the most productive freshwater fisheries in the late 19th century, but began to decline in the mid-1900s. Shrimp migrate into the area under ideal conditions, and the lake still supports a local blue crab fishery.

Primary commercial finfish species sought are white catfish, channel catfish, bullheads (brown and yellow), striped mullet, American eel, and the exotic tilapia. The primary shellfish resource in the lake is the blue crab. Limited numbers of freshwater prawn (*Macrobranchium carcinus*) are also harvested commercially. Significant recreational fishing effort is expended in Lake George. Species most sought are largemouth bass, black crappie, bluegill, redear sunfish, and striped bass.

Special Aquatic and Wetland-Dependent Species: The LSJRB SWIM Plan describes a few of the most prominent aquatic and wetland dependent species in need of protection within the river basin. Many of these are common to the Lake George Basin as well including those listed in Table 5-5 below. Loss and degradation of habitat is the primary reasons for species listing.

Table 5-5: Key Endangered, Threatened and Species of Special Concern of the Lake George Basin

Species	Status
West Indian Manatee (*Trichechus manatus*)	Endangered
Bald Eagle (*Haliaeetus leucocephalus*)	Threatened
Wood Stork (*Mycteria Americana*)	Endangered
Shortnose Sturgeon (*Acipenser brevirostrum*)	Endangered
Atlantic Sturgeon (*A. oxyrhynchus*)	Species of Special Concern
American Alligator (*Alligator mississippiensis*)	Species of Special Concern
Alligator Snapping Turtle (*Macroclemys temmincki*)	Species of Special Concern
Black Bear (*Ursus americanus floridanus*)	Threatened
Limpkin (*Aramus guaruana*)	Species of Special Concern
Florida sandhill Crane (*Grus canadensis pratensis*)	Threatened
Gopher Tortoise (*Gopherus polyphemus)*	Threatened

Species	Status
Bluenose Shiner (*Pteronotropis welaka*)	Species of Special Concern
Source data: SJRWMD 1988 Lake George Draft SWIM Plan; 2006 FWC Florida's Endangered Species, Threatened Species, and Species of Special Concern Official Listing, USFWS Endangered Species Program	

Freshwater Wetlands: Freshwater wetlands range from submerged beds of aquatic plants to bottomland hardwood forests. Shallow areas near the shoreline support submerged beds of eel-grass (*Vallisneria americana*) and coontail (*Ceratophyllum* demersum). Marshes occur along shorelines where water depth is less than one meter and sunlight is sufficient to permit growth of emergent vegetation such as cattails (Typha spp.), bulrushes (Scirpus spp.), and willows (Salix caroliniana). Floating marshes are comprised of water shield (Brasenia schreberi), spatterdock (Nuphar luteum), and the invasive, exotic water hyacinth (Eichhornia crassipes). All of these habitats serve as important nursery and feeding areas for many aquatic organisms. Palustrine and riverine habitats subject to semipermanent or seasonal flooding typically include bay trees (i.e. *Gordonia lasianthus*), cypress (*Taxodium spp.*), red maple (*Acer rubrum*), ash (*Fraxinus spp.*), and cabbage palm (*Sabel palmetto*). Pine trees, such as pond pine (*Pinus serotina*) and slash pine (*Pinus elliottii*), occur in transitional habitats.

Saline Wetlands: Saline wetlands are limited to two known locations; Salt Springs and a salt flat located on the eastern shore of Lake George. Salt Springs, as the name indicates, is a large saline spring on the northwest side of Lake George that is home to an unusual community of salt tolerant organisms. The salt flat is characterized by communities of salt grass (*Distichlis spicata*) and glasswort (*Salicornia spp.*).

5.3 Basin Delineation

As described in section 5.2, the Lake George Basin includes approximately 520,000 acres in area and is composed of four smaller planning units. Each of the basin's four planning units is described in one of the following sections. Discussions are provided for each of the planning units' location, water quality, point sources, land use, and ecological resources. Information in the discussions on water quality problems is primarily adapted from FDEP's 2003 Middle St. Johns River Basin Status Report.

5.3.1 Lake George Planning Unit

General Description: The Lake George planning unit, in portions of Lake, Marion, Volusia, and Putnam counties, comprises 161,139 acres (252 square miles), with Lake George itself taking up 46,000 of these acres (72 square miles). The major water bodies in the planning unit include Lake George, Little Lake George, the St. Johns River above the Ocklawaha River, Price Creek, and Jumping Gully Creek. The lands surrounding Lake George in Volusia County are now in the Lake George State Forest.

Water Quality Summary: Water quality data from 61 monitoring stations were used for assessment. There are four potentially impaired water bodies in the Lake George planning unit. These include the St. Johns River above the Ocklawaha (WBID 2213O), Lake George (WBID 2893A), the St. Johns River below Lake George (WBID 2893A1), and the St. Johns River above Lake George (WBID 2893A2).

Lake George is potentially impaired for low dissolved oxygen (DO), elevated levels of nutrients (total nitrogen and total phosphorus), cadmium, selenium, and biology. Moderately eutrophic, the lake receives nutrient loading from both human-made and natural sources, which causes periodic algal blooms to occur. This watershed is surrounded by metropolitan areas in the uplands of the west (Ocala) and to the south-southeast of the basin (Orlando and DeLand).

Lake George is especially vulnerable to pollutants because the river water slows as it drains into the large, shallow lake, increasing the retention time of the water. Segments of the St. Johns River upstream and downstream of Lake George are also impaired for nutrients (total nitrogen and total phosphorus). The verified list of impaired waters in the Lake George planning unit is presented in Appendix G.

Water quality and water quality trends were evaluated by the FDEP as part of the 2006 Integrated Water Quality Report for Florida. These data indicated Lake George is impaired based on the trophic state index (TSI). Lake George has a TSI of 84.1. Lakes are potentially impaired for nutrients if the annual mean TSI for colored lakes [mean color greater than 40 platinum cobalt units (PCUs)] exceeds 60 and for clear lakes (mean color less than 40 PCUs) exceeds 40. In Florida, the TSI classifies lakes based on total nitrogen, chlorophyll *a*, and total phosphorus.

Because of the prevalence of atmospheric nitrogen fixing species in the spring and summer cyanobaterial blooms of Lake George, significant levels of nitrogen are added to the overall nutrient budget to compensate for the prevailing nitrogen limiting conditions. Through an examination of input and output budgets, the annual nitrogen load added to Lake George by way of this process is approximately 760 metric tons per year. The biomass achieved in Lake George blooms can at times be very high, in excess of 150 µg/L as chlorophyll *a*. In seven out of 10 years from 1998 through 2007, Lake George blooms exceeded the “40 µg/L less than 40 days” freshwater reach criteria developed for the LSJRB TMDL process. Similar to the freshwater reach of the lower St. Johns River, very low levels of dissolved oxygen have been observed with the collapse of these blooms.

Point Sources: There are 14 total permitted point source dischargers in the Lake George planning unit (refer to Appendix A). Of these, 12 are domestic wastewater facilities and two are industrial wastewater facilities. Discharges range from 0.0990 to 0.0043 million gallons per day (mgd), and none are NPDES permitted. The facilities discharge to percolation ponds, drain fields, or holding ponds. The facility with the largest discharge is the Welaka Wastewater Treatment Plant (0.0990 mgd), which discharges into the lower St. Johns River above the Ocklawaha confluence.

Other contributors of point source discharges include one closed Class I and two closed Class II solid waste landfills, as well as one closed construction and debris landfill. There are no delineated areas pursuant to Chapter 62-524, *F.A.C*. (Potable Delineated Water Well Permitting in Delineated Areas), Superfund, or state-funded hazardous waste sites. A list of all permitted dischargers located in the Lake George Basin is available in Appendix E of the FDEP 2003 Middle St. Johns River Basin Status Report.

Land Use: Water (32.7 percent), upland forest (30.8 percent), and wetlands (21.6 percent) occupy most of the land area in the Lake George planning unit. Urban and built-up lands cover about 7 percent of the total land area, mostly concentrated around the town of Pierson, on the eastern side of the planning unit (on the north shore of Lake George). Agriculture accounts for 5.4 percent of the total land area. A detailed analysis of land use in the Lake George Basin is available in Appendix F of the FDEP 2003 Middle St. Johns River Basin Status Report.

Major pollution in the Lake George planning unit comes from urban and agricultural runoff. It also has been suggested that leakage of old sanitary sewers could be contributing to water quality degradation. However, the highest nutrient pollution loading into the basin is probably being carried by the St. Johns River itself.

Ecological Resources: The Lake George State Forest is one of several public, jointly owned tracts of land encircling Lake George. This parcel and the adjacent Lake George Conservation Area include over nine miles of forest that border the St. Johns River providing a wealth of ecologically valuable communities, as well as river-based recreation. The surrounding landscape of the forest contributes to water resource protection of the Lake George watershed and aquifer recharge. The Lake George region is also part of an extensive wildlife corridor that provides habitat and roaming areas vital to the survival of the local black bear population (*Ursus americanus floridanus*). Other wildlife that make their homes in the forest include bald eagle (*Haliaeetus leucocephalus*), sandhill crane (*Grus canadensis pratensis*), white-tailed deer (*Odocoileus virginianus*), wild turkey (*Meleagris gallopavo silvestris*), bobcat (*Lynx rufus*), and gopher tortoise (*Gopherus polyphemus*). One of the largest concentrations of bald eagles statewide can be found around Lake George. This cluster of bald eagle nests is one of 13 clusters statewide needed to ensure the survival of the species within Florida (Figure 5-7).

Rare and imperiled or unique species of fish and aquatic invertebrates occur in the planning unit. The endangered shortnose sturgeon (*Acipenser brevirostrum*) is thought by fishery biologists to have used the St. Johns River upstream to Lake George. The collection of shortnose sturgeon in recent years has been rare. Other rare and imperiled fish observed in the Lake George watershed are blueback herring (*Alosa aestivalis*) and bluenose shiner (*Pteronotropis welaka*). The Silver Glen Springs crayfish (*Procambarus attiguus*) is found in Silver Glen Springs. Croaker Hole, a spring in the bed of the St. Johns River, is the primary thermal refuge for striped bass (*Morone spp.*), although stripers may occur as far upstream as Lake Jesup and have been observed in Silver Glen Spring and where the Wekiva River joins the St. Johns River.

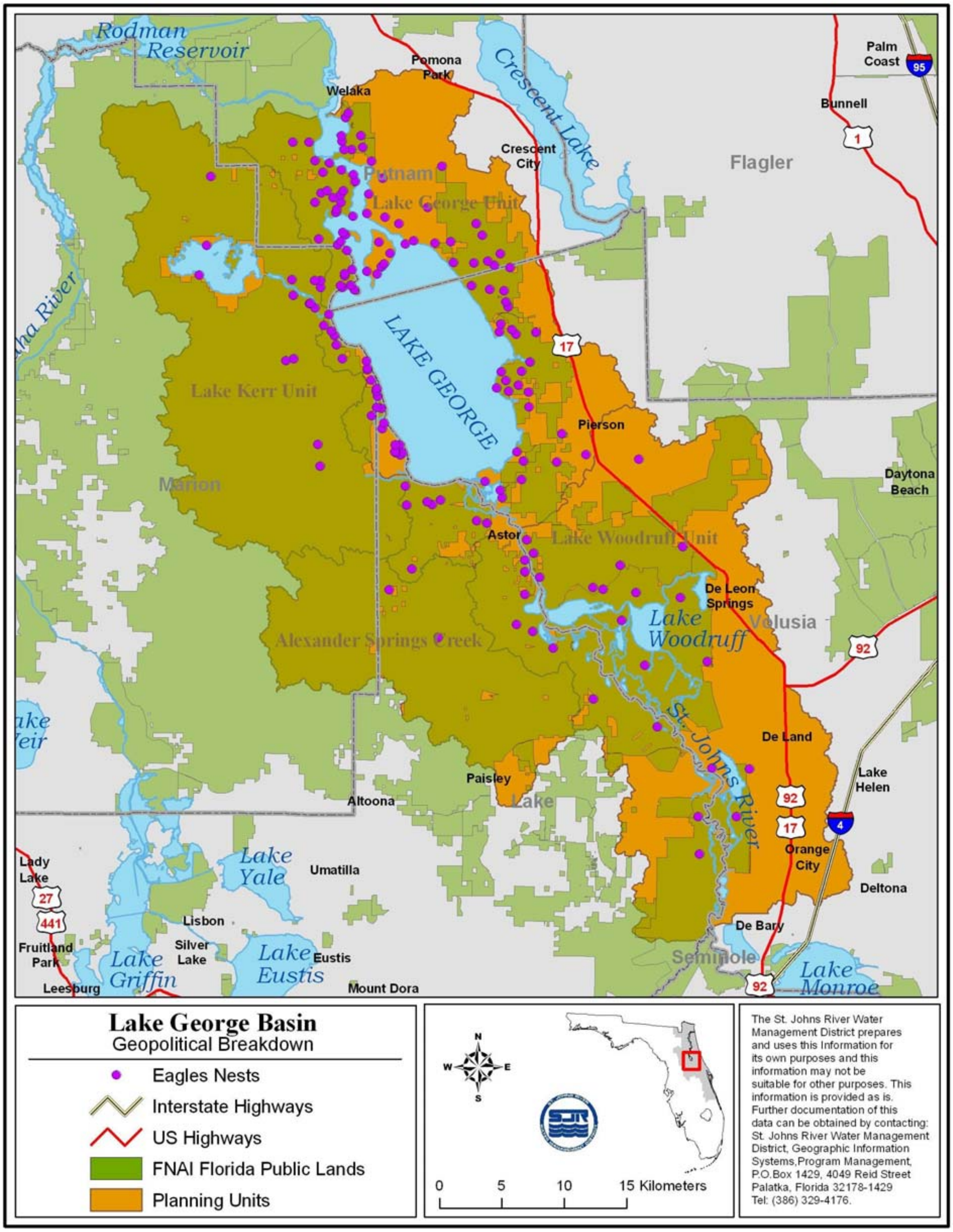

Figure 5-7: Active Eagles Nests in the Lake George Basin

5.3.2 Lake Kerr Planning Unit

General Description: Located in portions of Lake, Marion, and Putnam counties, the Lake Kerr planning unit covers 120,498 acres (188 square miles). Major water bodies include Lake Kerr and Juniper Creek. Lake Kerr is an OFW. Predominantly undeveloped, the planning unit is entirely within the Ocala National Forest.

Water Quality Summary: Water quality data from 13 sampling stations were used for assessment. There are three potentially impaired water bodies in the Lake Kerr planning unit. These include the Little Lake Kerr outlet, Hopkins Prairie, and Lake Kerr. Parameters of concern for these three water bodies are DO, zinc, and lead for Hopkins Prairie; copper, lead, selenium, and silver for Lake Kerr; and silver for Little Lake Kerr Outlet. Lake Kerr also has a limited fish consumption advisory (for elevated levels of mercury) for largemouth bass, bowfin, and gar. The list of verified impaired waters in the Lake Kerr planning unit is presented in Appendix G.

Point Sources: The planning unit has three permitted domestic wastewater dischargers and none are NPDES permitted (see Appendix A). The largest discharge is 0.0850 mgd from the Salt Springs Wastewater Treatment Plant, which discharges into percolation ponds. The smallest discharge is 0.0028 mgd from the Fountain Center Wastewater Treatment Facility, which also discharges into percolation ponds. The Juniper Springs Recreational Area discharges 0.0190 mgd into the Juniper Springs watershed through drain fields.

The planning unit has no Superfund or state-funded hazardous waste sites; no Class I, II, or III solid waste landfills and debris landfills; and no delineated areas under Chapter 62-524, *F.A.C.*, Potable Water Well Permitting in Delineated Areas. A list of all permitted dischargers located in the Lake George Basin is available in Appendix E of the FDEP 2003 Middle St. Johns River Basin Status Report.

Land Use: The Lake Kerr planning unit is predominately upland forest (86 percent), with wetlands making up another 9 percent of land use. Water comprises 4 percent, and less than 2 percent is urban and built-up. Rangeland, barren land, communications, transportation, and utilities make up less than 1 percent of land use, combined. A detailed analysis of land use in the entire Lake George Basin is available in Appendix F of the FDEP 2003 Middle St. Johns River Basin Status Report.

5.3.3 Lake Woodruff Planning Unit

General Description: Volusia and Lake counties bisect the Lake Woodruff planning unit, which drains 176,782 acres (276 square miles). Major water bodies include Lake Woodruff and Lake Dexter. In the planning unit, the St. Johns River extends through Beresford Lake, Lake Woodruff, and Lake Dexter. The St. Johns River makes up the western border of the 21,500-acre (33.5-square-mile) Lake Woodruff National Wildlife Refuge, which is completely contained within the planning unit. The typical landscape comprises freshwater marshland and swamp bordering the St. Johns River.

Water Quality Summary: Water quality data from 42 sampling stations were used for assessment. There are five potentially impaired water bodies in the Lake Woodruff planning unit. These include Volusia Blue Spring, the St. Johns River above Lake Woodruff, Lake Beresford, the St. Johns River above Lake George, and Lake Woodruff. Four of these water bodies are potentially impaired for DO. The majority of impairments, by mileage, are in the planning unit's streams. However, Lake Beresford is potentially impaired for nutrients, and Lake Woodruff is potentially impaired for DO. Volusia Blue Spring is listed as impaired for nutrients on the 1998 303(d) list (the only spring on the 303(d) list in the planning unit). Nitrate–nitrite concentrations have increased from approximately 0.1 mg/L in the 1970s to about 0.6 mg/L in recent years, with some measurements in excess of 1 mg/L. Between 2000 and 2006 Volusia Blue Spring has averaged a stream condition index rating of about 12, which is well below the healthy score of 34. The list of verified impaired waters in the Lake Woodruff planning unit is presented in Appendix G.

Point Sources: There are 34 permitted point source dischargers in the Lake Woodruff planning unit (see Appendix A). Of these, 27 are domestic wastewater facilities, and 7 are industrial wastewater facilities. The DeLand/Wiley Nash domestic wastewater facility is the only NPDES facility in the planning unit and has a permitted capacity of 6.0 mgd, but may only discharge 4.0 mgd into the St. Johns River. Four facilities are allowed to discharge more than 0.100 mgd. They are Volusia County Utilities Department (VCUD)/Southwest Regional (domestic wastewater, permitted to 0.544 mgd into a noncontributing area), Florida Power Corp DeBary (industrial wastewater permitted to 0.420 mgd), and VCUD/Four Townes (domestic wastewater, 0.300 mgd into a noncontributing area). A list of all permitted dischargers located in the Lake George Basin is available in Appendix E of the FDEP 2003 Middle St. Johns River Basin Status Report.

Two facilities in the planning unit have implemented reuse plans. These are DeLand/Wiley Nash for reuse for irrigation and VCUD/Southwest Regional for public access reuse. The total volume discharged for reuse is 1.52 mgd, with DeLand/Wiley Nash discharging 1.0 mgd and VCUD/Southwest Regional discharging the remaining 0.52 mgd.

The planning unit contains no Superfund or state-funded hazardous waste sites; however, there is one closed Class I solid waste landfill as well as two closed and one active Class III solid waste landfills, with one inactive and one active construction and debris landfill. One area is delineated for groundwater contamination pursuant to Chapter 62-524, *F.A.C.*, Potable Water Well Permitting in Delineated Areas, for EDB.

Land Use: The majority of land use in the planning unit is a combination of wetlands (35 percent) and upland forest (30 percent). Other major land uses include urban and built-up (17 percent), agriculture (10 percent), water (5 percent), and rangeland (2 percent). Less than 1 percent of the total land area is barren land and transportation, communications, and utilities. A detailed analysis of land use in the entire Lake George Basin is available in Appendix F of the FDEP 2003 Middle St. Johns River Basin Status Report.

Ecological Resources: The planning unit supports several unique or ecologically imperiled aquatic species. The blueback herring (*Alosa aestivalis*) has been observed in this portion of the St. Johns River and Lake Woodruff. Unique aquatic invertebrate species that are sensitive to water quality are associated with Blue Spring. These are the Blue Spring silt snail (*Cincinnatia parva*) and the Blue Spring hydrobe (*Aphaostracon asthenes*).

5.3.4 Alexander Springs Creek Planning Unit

General Description: The Alexander Springs Creek planning unit, in the Ocala National Forest, covers 63,953 acres (100 square miles) and lies within portions of Lake and Marion counties. Alexander Springs, for which the planning unit is named, is a first-magnitude spring with an average discharge of 104 cubic ft per second (refer to Table 5-4). Alexander Springs Creek flows east for approximately 8 miles until it meets the St. Johns River just south of Lake Dexter. Other major water bodies include Buck Lake (for which the Buck Lake Wildlife Area is named), Akron Lake, and Sellers Lake.

Water Quality Summary: There were 23 surface water quality monitoring stations used for analysis. There is only one potentially impaired water body in the Alexander Springs Creek planning unit. Buck Lake, the site of a national forest campground, was potentially impaired for fecal coliform bacteria.

Point Sources: There are four permitted point-source discharges in the Alexander Springs Creek planning unit (see Appendix A). All of these are domestic wastewater facilities permitted for less than 0.100 mgd, and none discharge to surface waters (not NPDES permitted). Permitted discharges range from 0.055 to 0.0090 mgd. The Country Squire Motor Home Vehicle Park is allowed the largest discharge, 0.055 mgd, into percolation ponds. The smallest allowed discharges are at Spring Creek Elementary School and the U.S. Naval Tracking Station. Each is allowed 0.0090 mgd and discharges into a drainage field and percolation pond, respectively. The only other facility is Alexander Springs Recreational Center, which discharges 0.0300 mgd into a drain field. A list of all permitted dischargers located in the Lake George Basin is available in Appendix E of the FDEP 2003 Middle St. Johns River Basin Status Report.

Land Use: Most of the Alexander Springs Creek planning unit is relatively undeveloped. Major land uses are upland forest (78 percent), wetlands (14 percent), and water (4 percent). Much of the planning unit's land area lies within the boundaries of the Ocala National Forest. Urban and built-up land accounts for less than 3 percent of the land area, and agricultural land use covers about 1 percent of the planning unit. A detailed analysis of land use in the entire Lake George Basin is available in Appendix F of the FDEP 2003 Middle St. Johns River Basin Status Report.

The types of nonpoint pollutants in stormwater runoff vary depending on land use activities. Storm water in urban areas typically contains fertilizers, bacteria, metals, sediments, and petroleum compounds. In agricultural areas, the major contaminants are fertilizers, bacteria, sediments, and lesser amounts of metals. Septic tanks, another common nonpoint source of pollution, contribute nutrients and bacteria to ground and surface waters.

A sinkhole is located in Shockley Heights in Lake County that connects to the Floridan aquifer. The sinkhole is located approximately 3,500 ft east of SR 19 and 700 ft north of CR 455. This is about five miles southwest and upgradient from Alexander Springs. This sinkhole drains a large swampy area and a portion of CR 455. It is suspected that septic tank effluent also makes its way into the aquifer through this sinkhole since elevated bacteria levels have been found in nearby wells. This sinkhole is in the groundwater basin for Alexander Springs and has negatively impacted drinking water wells in Shockley area.

Ecological Resources: The dense hydrobe snail (*Aphaostracon pyncus*) is found in Alexander Springs in the Ocala National Forest. The bluenose shiner (*Pteronotropis welaka*) has also been observed in Alexander Springs.

5.4 Issues and Associated Management Programs

Four major groups of water resource issues are addressed in the Lake George portion of the LSJRB SWIM Plan:

1. Point- and nonpoint source pollution, including
    - Deteriorating surface and sediment quality
2. Deterioration of natural systems, including
    - Alteration of wetlands, nursery areas, and special habitats
    - Alteration of benthic habitat

    - Riverine shoreline erosion
3. Insufficient interagency coordination and management, including
    - Regulation and management of surface waters
    - Total maximum daily loads (TMDLs)
    - Wetlands policies and regulations
4. Limited public awareness and environmental education programs

5.4.1 Issue: Point and Nonpoint Pollution

Surface water quality problems within the Lake George Basin originate from either point or nonpoint sources of pollution. Point sources are end-of-pipe discharges, which include discharges of sewage effluent from domestic wastewater treatment plants, point sources that are permitted to discharge to drain fields, and industrial effluent discharged through outfall pipes or ditches.

Nonpoint sources, which likely account for a large portion of pollution within the Lake George Basin, include urban, residential, and agricultural sources, such as:

- Surface runoff originating from urban, residential, and agricultural lands;
- Untreated discharges from drainage ditches serving agricultural lands;
- Contaminated groundwater seepage from drain fields of septic tank systems;
- Erosion and sediment disturbance;
- Controlled discharges from stormwater management systems;
- Chemical aquatic weed control and naturally occurring organic inputs; and
- Naturally-occurring peak discharges of storm water.

Deteriorating water quality and sediment conditions affect the species composition and overall health of aquatic communities within the Lake George Basin. Some examples are as follows:

- Discharges from sewage treatment plants, agricultural runoff, and seepage from septic tank drain fields can cause nutrient-enrichment of receiving waters. These high nutrient levels can contribute to conditions that are optimal for algal blooms, elevated bacterial levels, and increased biological oxygen demand (BOD). Increased BOD levels can lower oxygen concentrations to the point of impairment and if severe enough to the point of lethality (fish kills). Species adapted to low oxygen levels may become prevalent with a concomitant reduction in species diversity.
- Survival and reproductive rates as well as diversity of aquatic organisms can be affected by toxic substances originating from industry or agriculture. Culturally introduced or naturally-occurring organic particulates provide substrate for adsorption of nutrients and pollutants. Many of these substances and suspended particulates precipitate out of the water column and reside in the sediments directly affecting benthic organisms. When sediments and associated contaminates are resuspended into the water column organisms can be exposed to those contaminates.
- Abnormally high peak flows of storm water can be detrimental to the receiving water body. Major storm events result in the discharge of large volumes of water into the Lake George Basin. This storm water may carry significant loadings of humics and suspended organic matter and associated contaminants, resulting in a rapid change in water quality.
- Excessive low flows when combined with point- and nonpoint source pollution can be detrimental to aquatic communities. Low flows can occur as a result of drought, or excessive groundwater or surface water withdrawals. Contaminants become concentrated and dissolved oxygen concentrations decrease, creating lethal conditions for aquatic organisms.

Problems with turbidity, BOD, nutrients, and metals have led to symptoms of deterioration such as periodic fish kills, algae blooms, aquatic weed problems, and a declining fishery. Sedimentation is primarily influenced by sources located outside the basin. A major portion of the inorganic and organic particulate matter introduced into the St. Johns River upstream of the lake ultimately resides in the sediments of Lake George. The volume and quality of this material will directly impact the benthic community. Nutrient-laden sediment material could provide a source for internal nutrient recycling to the lake water column.

5.4.2 Issue: Deterioration of Natural Systems

In addition to point- and nonpoint source pollution, another major resource problem in the Lake George Basin is the deterioration of its natural systems. For the purposes of this 2008 LSJRB SWIM plan, the term natural systems refers to wetlands, nursery areas of indigenous aquatic life, and special habitats.

Wetlands are defined by SJRWMD's Management and Storage of Surface Water (MSSW) rule (Chapter 40C-4, *F.A.C.*) as areas that are "inundated or saturated by surface or groundwater with a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas." This definition recognizes hydrology, vegetation, and soils as integral components of a wetland.

Nursery areas of indigenous aquatic life are defined in Chapter 17-3, *F.A.C.*, as "… any bed of [listed] aquatic plants, either in monoculture or mixed or any area used by the early-life stages, larvae and post-larvae, of aquatic life during the period of rapid growth and development into the juvenile states."

Special habitats under this plan are defined as natural areas that support unique functions related to fish and wildlife resources and economic and recreational values. Special habitats may be wetlands, nursery areas, or aquatic environments within important physical features. They may be uplands that protect wetland functions, or that support wetland-dependent species such as the bald eagle. Special habitats may, or may not, be vegetated. Examples of special habitats include areas frequented by manatees in the summer and fall, and spring discharges that attract manatees in the winter. Other examples are areas that support aquatic or wetland-dependent species that have been identified as needing special protection by the USFWS, FWC, or FDEP.

Alteration of Wetlands, Nursery Areas, and Special Habitats: At the present time, the majority of the immediate watershed of Lake George is undeveloped. Major landholders are the National Forest Service, private silviculture operations, and SJRWMD. Large tracts of sensitive lands have been purchased for public ownership immediately adjacent to the lake. These provide effective protection from direct wetland and buffer zone alterations in these sensitive areas.

A decline in quality and quantity of wetland and nursery habitat in Lake George is also occurring due to land use changes which impact sedimentation and water discharge, as well as water quality degradation, and have caused a reduction in littoral zone macrophyte diversity. Cattail (*Typha spp.*) has become the dominant emergent macrophyte in Lake George, likely due to declining water quality and accumulated sediments. Submerged vegetation is being impacted by sedimentation and reduced light availability as the lake becomes more eutrophic. Algal blooms in this basin are occurring due to upstream development and its associated nutrient enrichment through point- and nonpoint source pollution, and from aquatic weed spraying to eliminate floating water hyacinth. The increased nutrient loading and spraying for water hyacinth have caused primary production to shift from dominance by macrophytes to dominance by phytoplankton.

Alteration of Benthic Habitat: Benthic habitat in Lake George is primarily influenced by allochthonous sources from upstream areas. Since the lake is an in-line water body, it functions as a settling basin for the St. Johns River downstream from Lake Monroe. Increases in sediment and particulate organic loading in this section of the river result in increased deposition to the lake basin. Deposition of organic sediments high in nutrients and/or contaminants results in decreased diversity of the lake benthos. A loss of benthic production in lake sediments may be one cause of declines in the game fish component of Lake George fish populations.

Riverine Shoreline Erosion: The St. Johns River abruptly narrows to a width of a few hundred feet immediately south of Lake George. The narrow river channel winds through extensive wooded swamp which normally provides quality river shoreline habitat for game-fish species. Recreational boat traffic has increased dramatically in this section of the river as has commercial barge traffic. Wakes created by this boat traffic are seriously eroding river shorelines. Although these shoreline habitats are normally excellent spawning areas for sunfish and related centrarchid fish species, FWC biologists indicate that spawning success is limited due to constant erosion and sediment disturbance from boat wakes.

5.4.3 Issue: Regulation and Management of Natural Resources

Limited funding is often thought to be the controlling factor in effective water resource management. However, where agencies have overlapping or have closely related responsibilities, improved coordination of programs could increase management effectiveness without substantially increasing costs. Programs being implemented by several state agencies, local governments, and SJRWMD can be significantly more effective when they are focused on clearly defined and mutually supportive goals and objectives.

Regulation and Management of Surface Waters: The use of statewide water quality standards for receiving waters and performance standards for pollution abatement systems may not be adequate to protect surface waters, and in particular entire watersheds. In addition, pollutant loads from unregulated sources compound receiving water problems originating from permitted systems.

Florida's statutory authorities for protecting the quality of state waters are implemented in two ways: (1) establishment of criteria for designated uses (or classes) of surface waters; (2) application of statewide performance standards for pollution abatement systems.

Reliance on surface water quality criteria that are applied statewide may not be adequate to protect or enhance basin waters. The existing criterion for nutrients is an example. Presently there are no numerical standards for nutrients; e.g., phosphates and nitrates. Current regulations are limited to a narrative standard stating, “In no case shall nutrient concentrations of a body of water be altered so as to cause an imbalance in natural populations of aquatic flora or fauna” (62-302 *F.A.C.*).

Presently, biological assessments and water quality monitoring efforts within this subbasin are insufficient for the enforcement of nutrients criterion. This inadequacy makes the current nutrients criterion of limited value in preventing surface water pollution. Also, nutrients, which result in unwanted eutrophication of surface waters, are dependent on variables that can be difficult to define. The state is developing numerical standards for nutrients; however, until those standards are adopted insufficient data for specific water bodies limits the ability of agencies to apply the current nutrient criteria, a factor contributing to surface water pollution.

Initial performance standards for treatment systems are also a problem. An example is SJRWMD's stormwater rule, which relies on performance standards to assure that pollution loads to surface waters do not significantly increase as land comes under development. The standards are based on the presumption that their application will result in 80 percent treatment efficiency for total suspended solids in Class III waters. In other words, 80 percent of the suspended solids generated by new developments should be prevented from being transported by storm water to receiving waters. However, nutrients have been identified as the primary constituent of concern impacting surface waters of the state and current stormwater treatment rules are now being revised to more adequately address nutrients. However, in the meantime, current rules still allow an increase in nutrient loadings resulting from development. Depending on pre-development land use and the quality of the receiving water, which may already be degraded, the current performance standards may be inadequate for maintaining water quality. Beyond the statewide rule improvements mentioned in this section, TMDLs will be established for the impaired waters within the Lake George watershed over the next few years.

Total Maximum Daily Loads: During the next few years, considerable data collection and analysis will be performed to establish TMDLs for impaired waters in the Lake George Basin. A watershed management plan to reduce the amount of pollutants that cause impairments will also be produced. These activities will depend heavily on the active participation of SJRWMD, local governments, businesses, and other watershed stakeholders. In particular, the FDEP will work with these groups and individuals to undertake or continue reductions in the discharge of pollutants and achieve the established TMDLs for impaired water bodies.

The verified list of impaired waters will be adopted by Secretarial Order in accordance with the Florida Watershed Restoration Act. Once adopted, the list will be submitted to the EPA for approval as the state’s Section 303(d) list for the basin.

Wetland Policies and Regulations: The policies and rules of three regulatory agencies affect wetlands within the Lake George Basin: USACE, FDEP, and SJRWMD. In addition, local governments may also have wetland ordinances. Historically, the jurisdictional authorities of the regulatory agencies differed based upon their separate and broadly defined legislated missions.

Jurisdictional authority for the USACE is granted under Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act for activities within navigable waters and "waters of the United States," respectively. The USACE generally regulates filling, not excavation, and their nationwide permitting program often allows fill of up to 10 acres without mitigation.

The FDEP regulates dredge and fill activities within wetlands that are connected to or contiguous with waters of the state under Chapters 17-4 and 17-12, *F.A.C.* FDEP does not regulate dredge and fill activities in isolated wetlands; i.e., wetlands that are not connected to or contiguous with waters of the state.

SJRWMD regulates wetlands where construction is not exempt from SJRWMD's MSSW rule (Chapter 40C-4). MSSW permits are required when projects meet certain thresholds. These thresholds are based on the existence and size of certain features including traversing works, dams, pits, wetlands and anticipated cover by impervious surfaces. When a permit is required, SJRWMD evaluates the impacts that the proposed project will have on off-site aquatic and wetland-dependant species relative to the functions that the wetland serves for those species. If the wetland serves aquatic or wetland-dependant species which are also endangered or threatened, impacts to both off-site and on-site species are assessed. Impacts to on-site isolated wetlands greater than one-half acre also come under review during the permitting process. SJRWMD defines an isolated wetland as one that is not within FDEP's jurisdiction for dredge and fill activities.

The regulatory programs of all the agencies provided a significant degree of wetland protection; however, wetland systems continued to be degraded for various reasons including the following limitations shared by the programs:

- Wetlands are frequently filled or dredged without the necessary permits. The “after the fact" resolution of these cases, if discovered, generally results in a compromise of the regulatory standards.
- Exemptions exist under all the regulatory programs. Many types of wetland impacts do not require permits.
- Mitigation is a mechanism that is allowed under most regulatory programs. It usually consists of either creating new wetlands from uplands or enhancing, by rehydrating, existing degraded wetlands.
- Silviculture and agriculture are generally exempt, except where alterations are for the sole or predominate purpose of impounding or obstruction surface waters (Chapter 373.406(2), F.S.).
- Wetlands and aquatic habitats can be affected as surrounding lands are altered or as land uses are intensified. Currently, construction setbacks from wetlands are not required under existing regulations.

Coordination between these programs has improved. In 1995 SJRWMD, in coordination with the FDEP, instituted the Environmental Resource and Surface Water Permitting Program (ERP). The ERP combines the former dredge and fill permit issued by FDEP and the MSSW permit issued by SJRWMD. This approach provides improved coordination of permitting activities related to new construction or the proposed filling of wetlands. The program includes monitoring focusing on surface water discharges, including agricultural discharges, and monitoring of wetlands.

5.4.4 Issue: Limited Public Awareness and Environmental Education Programs

To date, there has been limited public education effort focusing on Lake George specifically; however, recent years have seen increased efforts to educate the public about the importance of the St. Johns River as a whole and to educate them about their potential impacts. These efforts should be expanded to the Lake George Basin to help the public develop a better understanding of their relationship with the Lake George ecosystem and what changes they can make to improve the aquatic environment of the basin.

5.5 Management Programs in the Lake George Basin

As noted before, the Lake George program is earlier in its development than the programs for the Lower and Middle St. Johns River basins. Efforts currently focus on planning, reconnaissance, and assessment activities. These efforts will be the shared responsibility of SJRWMD staff from both the Lower and Middle St. Johns River basins. Similar to the development of the lower and middle basin programs, initial planning efforts are currently focused on a few key initiatives: water quality, biological health, sediment management, public education, and intergovernmental coordination. Initial objectives and strategies for each of these initiatives are presented below. Additional initiatives, objectives, and strategies could be added as more information about the basin is collected and the program matures. This section will be updated as the assessment efforts are completed and will present similar information to what is shown in chapter 3 for the LSJRB.

Over the next five years, reconnaissance, assessment, modeling, and public education and outreach will occur for the Lake George Basin. Reconnaissance will occur during FY 2008 and FY 2009 with assessment efforts beginning in FY 2009 and extending to FY 2011. During the assessment phase, modeling will also occur and extend through FY 2012. Public education and outreach will begin once enough information is gathered through reconnaissance and assessment (approximately FY 2010) and extend until the end of the five year period of study to FY 2012. Initiative specific milestones will also be developed as more information about the Lake George Basin is collected.

A list of management projects and descriptions is included in Section 5.5.6: Past/Current Projects and Section 5.5.7: Future Projects. This project list will continue to be developed throughout the assessment phase. The projects are considered in terms of the strategy and management activity which they are designed to accomplish. Management activities include resource assessment, development of management tools, and implementation efforts. Appendix F contains a summary table of management projects within the Lake George Basin.

5.5.1 Water Quality Initiative

In 2004 SJRWMD prepared the Status and Trends Report, which included sampling information for three lake, one spring, and three stream sites. The study found that Blue Spring, which was the only spring evaluated in this assessment, had good water quality but was getting worse. The spring run enters the St. Johns River upstream of the city of DeLand, where the water quality was fair with insufficient data for trend determination. Lake Woodruff is farther north and had good water quality with insufficient data for trend determination. The St. Johns River at SR 40 showed good water quality with insufficient data for trend evaluation. Lake George had fair quality with no significant trends. Lake Kerr drains to the north end of Lake George and had good quality with no significant trends. The St. Johns River at channel marker 72 had good quality, but with insufficient data to evaluate trends.

Other than the above information, very little data exists to fully analyze the Water Quality Initiative in the Lake George Basin. In response to increased discussions about the potential of waters within the Lake George Basin for consumptive purposes, SJRWMD is considering ways to more fully incorporate the Lake George Basin into its future management efforts. There is currently not a Lake George program at SJRWMD similar to the Lower, Middle, and Upper basins; however, SJRWMD has begun planning efforts in the basin and is proposing assessments as outlined in this 2008 LSJRB SWIM Plan.

5.5.1.1 Strategy: Review and Strengthen Water Quality Policies and Regulations

Objectives:

- Complete updates, as needed, of SJRWMD water quality status and trends assessment, Integrated Water Resources Monitoring quarterly progress reports within contractual time frames, assessment reports on the Integrated Water Resources Monitoring Tier 1 Network, and evaluate benthic and sediment interpretive reports produced by contractors.
- Establish a water balance model for the basin.

- Recommend PLRGs as described for priority SWIM basins and implement them through appropriate regulatory and non-regulatory programs.
- Assist FDEP in establishing and implementing TMDLs for impaired waters and in evaluating the effectiveness of TMDL implementation.
- Establish strengthened water quality regulations based on improved BMPs and nutrient standards adoption.
- Evaluate the effectiveness of currently accepted BMPs for surface water and stormwater management systems, publish evaluation results periodically, and develop and adopt new or improved BMPs when there is a demonstrated need.
- Continue SJRWMD's annual Stormwater Management Projects Cost-Share Program.

5.5.1.2 Strategy: Support the State's Water Policy Guidelines for Reuse

Objectives:

- Support the state's water policy guidelines for reuse by permitted surface water discharges in priority areas (Chapter 17-40, *F.A.C.*) along with SJRWMD reuse requirements associated with consumptive reuse permitting.

5.5.1.3 Strategy: Evaluate Impacts of Agricultural and Silvicultural Operations and Implement BMPs to Address Those Impacts

Objectives:

- Evaluate effects of agriculture and silviculture practices on water quality.
  Develop and implement matching grants program to encourage use of agricultural BMPs.
- Monitor effectiveness of implemented agriculture and silviculture BMPs.

5.5.1.4 Strategy: Compile and Analyze Available Water and Sediment Quality Data in Conjunction with Biological/Bioassessment, Data to Evaluate the Extent Causes, and Effects of Pollution on the Basin's Surface Waters

Objectives:

- Establish basinwide monitoring programs and create a database for water quality/quantity, sediment, and biological data to assess current health and future trends in the basin.
- Investigate nutrient inputs into the Lake George Basin from upstream sources.
- Inventory hydrologic units.
- Delineate basins and subbasins.
- Identify and install hydrologic and climatological monitoring network.
- Identify seepage areas. Design and set up groundwater seepage monitoring program.
- Identify and monitor areas where stormwater runoff quantity and/or quality is significant and characterize storm discharges.
- Identify and work to reduce excessive sources of nutrients to basin water bodies.
- Establish partnerships with local governments to compile and evaluate local data.

5.5.2 Biological Health Initiative

Very little data exists to analyze the Biological Health Initiative in the Lake George Basin. In response to increased discussions about the potential of waters within the Lake George Basin for consumptive purposes, SJRWMD is considering ways to more fully incorporate the Lake George Basin into its future management efforts. There is currently not a Lake George program at SJRWMD similar to the lower, middle, and upper basins; however, SJRWMD has begun planning efforts in the basin and is proposing assessments as outlined in this 2008 LSJRB SWIM Plan.

5.5.2.1 Strategy: Protect Existing Habitat through Enforcement of Regulations for Land Development and Alteration

Objectives:

- Determine habitat protection needs within the basin.
- Develop special basin criteria for habitat protection.
- Recommend regulatory initiatives to enhance habitat protection (e.g., construction setbacks).
- Provide information for the protection or mitigation of habitats to regulatory and management offices having responsibilities in the basin.
- Coordinate enforcement of regulations with all agencies involved.

5.5.2.2 Strategy: Acquire Environmentally Sensitive Land within the Lake George Basin Including Buffer Zones and Wildlife Corridors

Objectives:

- Purchase 100 percent of the land identified in the SJRWMD Florida Forever work plan and annually update to allow completion of major SJRWMD surface water projects under this or other funding programs.
- Utilize less-than-fee acquisition where continuation of existing land use is compatible with conservation objectives.

5.5.2.3 Strategy: Inventory Existing Natural Systems, Fisheries, Invertebrates and Wildlife in the Basin and Determine Their Condition, Monitor Their Condition, and Identify Wildlife Habitat Needs

Objectives:

- Monitor natural systems and analyze trends utilizing information on growth, land use, changes, etc. Determine effectiveness of protection and restoration efforts. Input digitized data into SJRWMD's GIS.
- Initiate technical investigations to identify wildlife and their habitat needs, including protection corridors in the basin.
- Monitor effectiveness of protection and restoration projects.

5.5.3 Sediment Management Initiative

Sediment quality at sites along the mainstem of the St. Johns River, including Lake George, was evaluated as part of a larger districtwide evaluation of metals and organic contaminants. Data were collected during 1996 and 1997. Additional detailed sediment studies were conducted on Lake George during 1998. It was found that relative to other sampling locations within SJRWMD the sum of PCB congeners concentrations and PCB concentrations normalized to total organic carbon were the lowest for samples collected from Lake George.

Except for the information provided above, very little data exists to fully analyze the Sediment Management Initiative in the Lake George Basin. In response to increased discussions about the potential of waters within the Lake George Basin for consumptive purposes, SJRWMD is considering ways to more fully incorporate the Lake George Basin into its future management efforts. There is currently not a Lake George program at SJRWMD similar to the lower, middle, and upper basins; however, SJRWMD has begun planning efforts in the basin and is proposing assessments as outlined in this LSJRB SWIM Plan.

5.5.3.1 Strategy: Upstream Reductions Including Lake George and the Ocklawaha

Objectives:

- Support development and implementation of PLRGs and TMDLs.
- Conserve freshwater resources and protect surface waters.
- Continue to evaluate historical water chemistry data to describe trends in ambient water quality as well as point-source and nonpoint source pollution to evaluate effects and interrelationships.
- Select or modify the water quality assessment methods that will be used for water quality data collection and analysis.

5.5.4 Public Education Initiative

Very little work is being done to satisfy the Public Education Initiative's objectives in the Lake George Basin. In response to increased discussions about the potential of waters within the Lake George Basin for consumptive purposes, SJRWMD is considering ways to more fully incorporate the Lake George Basin into its future management efforts. There is currently not a Lake George program at SJRWMD similar to the lower, middle, and upper basins; however, SJRWMD has begun planning efforts in the basin and is proposing assessments as outlined in this 2008 LSJRB SWIM Plan.

5.5.4.1 Strategy: Heighten Public Awareness and Understanding of Problems with the Basin's Surface Waters and Associated Natural Systems, the Cultural Impacts Contributing to Their Deterioration, and Protection and Restoration Efforts in the Basin

Objectives:

- Plan and implement projects to inform the general public about the status and trends of aquatic environmental quality in the Lake George Basin.
- Inform local governments and the general public about the goals and objectives of the Lake George SWIM Plan through presentations, meetings, and publications.
- Develop activities related to protection and restoration of environmental quality in the Lake George Basin that involve the public or special interest groups.
- Encourage public participation in local government planning, regulatory, and management processes which impact the Lake George Basin.
- Develop an environmental center bordering Lake George that provides a learning experience for children and adults (e.g., camping, nature trails).
- Involve the Watershed Action Volunteer (WAV) program in sampling, cleanup, and other activities.

5.5.5 Intergovernmental Coordination Initiative

There is currently not a Lake George program at SJRWMD similar to the lower, middle, and upper basins; however, SJRWMD has begun planning efforts in the basin and is proposing assessments as outlined in this 2008 LSJRB SWIM Plan. These assessment efforts will be conducted in coordination with SJRWMD project management and scientific staff from both the Lower and Middle St. Johns River basins.

5.5.5.1 Strategy: Improve GIS Data Used for Regulation and Management Decision Making

Objectives:

- Digitize data to provide maps, tables, and charts for land use/cover, topographic contours, bathymetry, seismic profiles, flood plains, soils, marinas, pollutant discharges, septic tanks, dredge and fill projects, historic aerial photography, and other useful information and integrate with SJRWMD's GIS.
- Cooperate with other agencies to gather and disperse GIS information to resource managers making regulatory, policy, and land acquisition decisions.
- Collect annual rectified aerial photography and incorporate it into GIS to monitor changes in the basin.

5.5.5.2 Strategy: Enhance Interagency Coordination and Management of Surface Waters and Natural Systems in the Lake George Basin

Objectives:

- Promote incorporation of SWIM protection and restoration efforts into local comprehensive plans. Coordinate and cost-share research, planning, and regulatory efforts. Support local environmental policy that enhances water quality and habitat in the Lake George Basin.
- Cooperate on conservation land identification and acquisition with local governments and the Florida Forever program.
- Promote communication and partnerships among local governments to identify, commit to, and pursue Lake George improvement projects.

5.5.6 Past/Current Projects (1993–2007)

<u>Water Quality Initiative Past/Current Projects</u>

Continuous Water Quality Monitoring in Lake George (1994–2007): Performed automated, continuous measurements of meteorological and water quality variables to determine short-term changes in lake condition and to provide input and calibration data for water quality models.

Expansion of the LSJR Water Quality Model through Lake George (2005–2007): This SJRWMD project allowed for the evaluation of nutrient load reductions, water use and waste disposal scenarios. The modeling results have shown the lake's distinct zonation, flow patterns, and nutrient sources and sinks within the lake. This project is expected to continue in future years.

Lake George Phosphorus Removal Feasibility Project-Reconnaissance Phase (2007): Conducted an analysis of the feasibility of various management techniques to reduce the load of phosphorus imported to and/or exported from Lake George, as part of SJRWMD's St. Johns River Algal Initiative. Eutrophication is the most significant water quality impairment to the middle and lower St. Johns River. In the freshwater reach of the river, phosphorus is the nutrient controlling maximum algal growth. While significant funding is being dedicated to the removal of nitrogen from the marine reach of the river, an assessment effort is being directed to phosphorus reduction in the freshwater reach.

Lake George Water Quality Modeling (2007): Conducted the portion of the Lake George water quality modeling effort related to sediment interactions with the water column and created an entirely new module to the LSJR and Lake George Water Quality Model that would simulate the growth of floating aquatic macrophytes and ancillary effects on nutrient, light, oxygen, and carbon. Potential use of a floating aquatic macrophyte model is expected as a means to evaluate possible changes in floating aquatic plant management for the lake, and the possibility that hyacinth harvesting could be used as a means to reduce the nutrient content of the lake.

Plankton Enumeration and Identification in Lake George (1997–2007): This project conducted the regular, monthly identification and enumeration of phytoplankton and zooplankton at the outlet of Lake George. The identification of the members to the plankton community can provide valuable information on the status of the community, such as the propensity for atmospheric nitrogen fixation, toxin production, or competitive interactions and food chain effects.

Biological Health Past/Current Projects

The Effects of Changing Nutrient Conditions on the Structure and Function of the Phytoplankton of the Lower St. Johns River (2001–2004): This project scope was wide-ranging (from Lake George to the mouth of the lower St. Johns River) and included assessing spatial variability and productivity of phytoplankton sample growth under differing nutrient and light conditions.

Submerged Aquatic Vegetation (SAV) Monitoring (1999–2003): SAV was monitored at one site on the eastern shore of Lake George. Vegetation sampling included percent coverage and canopy height for each species. Data also include water depth and sediment type. Water quality samples were also collected at this site.

Sediment Management Initiative Past/Current Projects

Examination of Sediment Exchange in Lake George (2006–2007): This SJRWMD project characterized the sediment-water column exchange in the lake and its effect on water quality, nutrient availability, and algal growth. This project is expected to continue in future years.

Public Education Initiative Past/Current Projects

Refer to LSJRB past/current projects (Section 3.7), as no specific projects were conducted for the Lake George watershed.

Intergovernmental Coordination Initiative Past/Current Projects

Refer to LSJRB past/current projects (Section 3.7), as no specific projects were conducted for the Lake George watershed.

5.5.7 Future Management Projects (2008–2012)

Water Quality Initiative Future Projects

Assessment of Phosphorus Reduction Targets in Lake George (2008–2010): Assay work to assess the relationship between in-lake phosphorus levels and nitrogen-fixation, in order to evaluate phosphorus reduction targets based on the amount of internal nitrogen load that could potentially be eliminated.

Continuous Water Quality Monitoring in Lake George (2008–2012): Perform automated, continuous measurements of meteorological and water quality variables to determine short-term changes in lake condition and to provide input and calibration data for water quality models.

Effect of Control Methods on Relative Composition of Water Lettuce (2009–2011): Follow-up on the possibility for a change in the techniques, targeted spraying, or herbicides used in floating aquatic plant management to increase the relative composition of water lettuce, and perhaps allow for the increase in overall cover of water lettuce.

Expansion of the LSJR Water Quality Model Through Lake George (2008–2010): This SJRWMD project was started in 2005 and allows for the evaluation of nutrient load reductions, water use and waste disposal scenarios. The initial modeling results have shown the lake's distinct zonation, flow patterns, and nutrient sources and sinks within the lake.

Fisheries Composition Survey Work (2008–2010): Fisheries composition survey work designed to assess the potential for gizzard shad harvesting.

Floating Aquatic Plant Cultivation Feasibility (2008–2010): Feasibility/design work on a floating aquatic plant cultivation project.

Floating Aquatic Plant Module Application Modeling (2008–2009): Application modeling with the floating aquatic plant module of the LSJR and Lake George water quality model, currently under development by the USACE water quality modeling branch, in order to assess growth rate, cover, phytoplankton reduction and phosphorus and nitrogen removal under various mechanical harvesting scenarios.

Lake George Phosphorus Removal Feasibility Project (2008): As part of the St. Johns River Algal Initiative, this project will conduct an analysis of the feasibility of various management techniques to reduce the load of phosphorus imported to and/or exported from Lake George. Eutrophication is the most significant water quality impairment to the middle and lower St. Johns River. In the freshwater reach of the river, phosphorus is the nutrient controlling maximum algal growth. While significant funding is dedicated to the removal of nitrogen form the marine reach of the river, an assessment effort is being directed to phosphorus reductions in the freshwater reach.

Lake George Phosphorus Sediment Flux (2008–2010): Lakes George, Jesup, and Monroe are combined in this project to develop a general theoretical model for the large, shallow lakes of the middle St. Johns. Objectives are to (1) determine the rates, mechanisms and amounts of cycling of nutrients, organic carbon, and oxygen between the water column and sediments through both turbulent re-suspension and diffusive flux; (2) determine the significant pathways of transformation and loss within the sediments; (3) determine the effect of this cycling on lake dissolved oxygen, suspended solids, and the renewal of macronutrient resources for the pelagic phytoplankton community; and (4) propose a general model of shallow, eutrophic lake sediment interaction for adaptation to the existing sediment flux model of the CE-QUAL-ICM eutrophication model.

Lake George Water Quality Modeling (2008–2009): This project began in 2007 and will continue the portion of the Lake George water quality modeling effort related to sediment interactions with the water column to create an entirely new module to the LSJR and Lake George Water Quality Model that would simulate the growth of floating aquatic macrophytes and ancillary effects on nutrient, light, oxygen, and carbon. Potential use of a floating aquatic macrophyte model is expected as a means to evaluate possible changes in floating aquatic plant management for the lake, and the possibility that hyacinth harvesting could be used as a means to reduce the nutrient content of the lake.

Plankton Enumeration and Identification in Lake George (2008–2012): This project conducts the regular, monthly identification and enumeration of phytoplankton and zooplankton at the outlet of Lake George. The identification of the members to the plankton community can provide valuable information on the status of the community, such as the propensity for atmospheric nitrogen fixation, toxin production, or competitive interactions and food chain effects.

Potential Uses of Recycled Biomass (2010–2011): Follow-up on the potential for harvested biomass disposal from either ATS or mechanical harvesting, including compost or biofuel generation technologies, markets, and potential for a regional biomass recycling facility.

Biological Health Initiative Future Projects

Primary Productivity in Lake George (2008–2010): This project will examine the relative balance of photosynthesis (oxygen production) and bacterial production (oxygen depletion). This study will determine the relative rates of external and internal carbon used and define the basic structure and function of the microbial food web.

Sediment Management Initiative Future Projects

Examination of Sediment Exchange in Lake George (2008–2012): This SJRWMD project started in 2006 continues the characterization of the sediment-water column exchange in the lake and its effect on water quality, nutrient availability and algal growth.

Public Education Initiative Future Projects

The future efforts for the Public Education Initiative in the Lake George Basin will be conducted as part of the education efforts in the LSJRB, as follows:

- The Lower Basin Public Education Initiative will continue seeking to increase awareness about river health issues and to educate the public on how human behaviors impact the river and how negative behaviors can be changed.
- Continue coordination efforts with the communication staffs of JEA, FDEP, and COJ. This initiative promotes consistent messages to be conveyed by SJRWMD and these entities, which are involved in a restoration partnership, called the River Accord, to improve the health of the lower St. Johns River.
- Continue and adapt the paid media portion of the campaign that began in April 2007 with ads on television and in local newspapers, radio traffic sponsorships, and billboards. Collateral materials include a campaign-specific brochure and Web site (www.floridaswater.com).
- Media outreach will include boat tours, editorial board visits, news releases and news stories, and appearances on public affairs radio and television broadcasts. Presentations will also be given to civic organizations, schools, and local governments to spotlight basin health issues.
- To evaluate the initiative's success, public awareness surveys will be conducted before, during, and after the campaign.

- Monitor the Algal Initiative work for opportunities to provide assistance.

Intergovernmental Coordination Initiative Future Projects

The Intergovernmental Coordination Initiative will have similar projects as what is expected for the LSJRB (refer to section 3.8). In addition, efforts will be made to monitor the Algal Initiative work for opportunities to provide assistance.

5.5.8 Future Projects and Estimated Budget

Table 5-6: Lake George Basin Projected Budget, Fiscal Years 2008–2012

Planned Projects	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Water Quality Initiative					
Assessment of Phosphorus Reduction Targets in Lake George	Estimate under development				
Continuous Water Quality Monitoring in Lake George	$25,000	$25,000	$25,000	$25,000	$25,000
Effect of Control Methods on Relative Composition of Water Lettuce	Estimate under development				
Expansion of the LSJR Water Quality Model Through Lake George	Estimate under development				
Lake George Phosphorus Removal Feasibility Project	Estimate under development				
Floating Aquatic Plant Cultivation Feasibility	Estimate under development				
Floating Aquatic Plant Module Application Modeling	Estimate under development				
Lake George Phosphorus Sediment Flux	Estimate under development				
Fisheries Composition Survey Work	$50,000	$50,000	$50,000	$50,000	$50,000
Plankton Enumeration and Identification in Lake George	$15,000	$15,000	$15,000	$15,000	$15,000
Lake George Water Quality Modeling	$30,000	$30,000	$30,000	$30,000	$30,000
Potential Uses of Recycled Biomass	Estimate under development				
Biological Health Initiative					
Primary Productivity in Lake George	$15,000	$15,000	$15,000		
Sediment Management Initiative					
Examination of Sediment Exchange in Lake George	$32,000	$80,000			
Public Education Initiative					
Expand LSJRB Efforts	No added cost	No added cost	No added cost	No added cost	No added cost
Intergovernmental Coordination Initiative					
Expand LSJRB Efforts	No added cost	No added cost	No added cost	No added cost	No added cost

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APPENDIX A: PERMITTED DISCHARGES TO THE LOWER ST. JOHNS RIVER AND LAKE GEORGE BASINS

A-1: Permitted Discharges to the Lower St. Johns River Basin

Facility Name	Facility Permit Number	Facility Type	Permitted Discharge (mgd)
Black Creek Planning Unit			
E.I. Dupont De Nemours Trailridge Mine	FL0000051	Industrial Wastewater	30
Cecil Commerce Center WWTF	FL0020966	Domestic WWTP	1.2
Camp Blanding WWTP	FL0022853	Domestic WWTP	0.9
Orange Park, Town of	FL0023922	Domestic WWTP	2.5
Miller Street WWTP	FL0025151	Domestic WWTP	5
Penney Farms Retirement Center	FL0032557	Domestic WWTP	0.09
Ridaught Landing	FL0039721	Domestic WWTP	1.875
E.I. Dupont De Nemors – Maxville Mine	FL0040274	Industrial Wastewater	4
Fleming Island System WWTP	FL0043834	Domestic WWTP	1.5
Middleburg Bluffs	FL0113743	Domestic WWTP	0.0099
Bailey's Mobile Home Park	FL0115231	Domestic WWTP	0.003
Spencer WWTP	FL0173371	Domestic WWTP	0.25
Powdertech Plus	FL0182851	Industrial Wastewater	
Crescent Lake Planning Unit			
Bunnell, City of	FL0020907	Domestic WWTP	0.3
Crescent City, City of	FL0021610	Domestic WWTP	0.25
Palm Coast Membrane Softening Facility	FL0042838	Industrial Wastewater	2.625
Paradise Point WWTP	FL0043176	Domestic WWTP	0.005
East Coast Concrete – Bunnell Plant	FLG110013	Concrete Batch GP	
Deep Creek Planning Unit			
Hastings, Town of	FL0042315	Domestic WWTP	0.12
Hastings WTP – RO Reject	FL0169226	Industrial Wastewater	0.087
Central Tractor Parts and Equipment, Inc.	FL0182885	Industrial Wastewater	
Etonia Creek Planning Unit			
Georgia Pacific Corp. - Palatka	FL0002763	Industrial Wastewater	
Montco Research Products, Inc.	FL0037800	Industrial Wastewater	
PUTNAM LANES	FL0117129	Domestic WWTP	0.003
Intracoastal Waterway Planning Unit			
Jacksonville Beach WWTF	FL0020231	Domestic WWTP	4.5
Neptune Beach WWTF	FL0020427	Domestic WWTP	1.5
Buccaneer WWTF	FL0023248	Domestic WWTP	1.3
San Pablo WWTF	FL0024767	Domestic WWTP	0.499
Atlantic Beach WWTF	FL0038776	Domestic WWTP	3
V-Bar Edge Trailer Park	FL0042188	Domestic WWTP	0.005
Innlet Beach	FL0044237	Domestic WWTP	0.5
Players Club South	FL0044245	Domestic WWTP	0.5
Marsh Landing WWTP	FL0044253	Domestic WWTP	0.6
Julington Creek Planning Unit			
Westminster Woods WWTF	FL0022489	Domestic WWTP	0.09
Royal Lakes Subdivision	FL0026751	Domestic WWTP	
North Mainstem Planning Unit			
Stone Container Corporation	FL0000400	Industrial Wastewater	20
Royal Lakes Subdivision	FL0026751	Domestic WWTP	3.25
Jefferson Smurfit Corp. – Jax	FL0000892	Industrial Wastewater	
USN Mayport	FL0000922	Domestic WWTP	2
JEA Southside Gen Station	FL0001015	Industrial Wastewater	0.105
JEA Kennedy Generating Station	FL0001023	Industrial Wastewater	0.3
JEA Northside Units 1 2 3	FL0001031	Industrial Wastewater	827

Facility Name	Facility Permit Number	Facility Type	Permitted Discharge (mgd)
Williams Terminal Holdings L.P.	FL0001287	Industrial Wastewater	0.93
Amerada Hess Corporation	FL0001295	Industrial Wastewater	
Coastal Fuels Marketing, Inc.	FL0001350	Industrial Wastewater	
Southwest District WWTF	FL0036468	Domestic WWTP	
JEA – Jacksonville International Airport WWTF	FL0023221	Domestic WWTP	0.2
Monterey WWTF	FL0023604	Domestic WWTP	3.6
Holly Oaks Subdivision	FL0023621	Domestic WWTP	1
San Jose Subdivision	FL0023663	Domestic WWTP	2.25
Buckman Street WWTF	FL0026000	Domestic WWTP	52.5
Arlington East WWTF	FL0026441	Domestic WWTP	15
JEA District II WWTF	FL0026450	Domestic WWTP	10
Beacon Hills WWTF	FL0026778	Domestic WWTP	1.3
Woodmere Subdivision	FL0026786	Domestic WWTP	0.5
St Servicesmain Terminal (FKA Stuart Petroleum)	FL0037761	Industrial Wastewater	
Gate Maritime Properties, Inc.	FL0037818	Domestic WWTP	0.01
JEA St Johns River Power	FL0037869	Industrial Wastewater	
JPA Blount Island	FL0038334	Domestic WWTP	0.055
Mercury Luggage Manufacturing Co.	FL0039250	Domestic WWTP	0.0075
Riverside Plaza	FL0039691	Industrial Wastewater	2.1
Atlantic Dry Dock	FL0040592	Domestic WWTP	0.06
Anheuser Busch-Main St, Old Sod Farm	FL0041530	Industrial Wastewater	
Singleton's Seafood Shack	FL0042056	Domestic WWTP	0.005
LA Cruise INC.	FL0042994	Domestic WWTP	0.03
Suntree Mobile Home Park Inc	FL0043311	Domestic WWTP	0.024
Cedar Bay Cogeneration Plant	FL0061204	Industrial Wastewater	
CSX Transportation, Inc. Moncrief Rail Yard	FL0176877	Industrial Wastewater	0.138
Gingiss Formalwear	FL0182834	Industrial Wastewater	
Radiant Industries, Inc.	FL0182893	Industrial Wastewater	
Ortega River Planning Unit			
Reichhold Chemicals Inc	FL0000060	Industrial Wastewater	
Jacksonville Heights WWTF	FL0023671	Domestic WWTP	2.5
Justiss Trailer Park	FL0024279	Domestic WWTP	0.015
Ortega Hills Subdivision	FL0025828	Domestic WWTP	0.22
Southwest District WWTF	FL0026468	Domestic WWTP	
Azalea Mobile Home Park	FL0040550	Domestic WWTP	0.025
Kellys Trailer Park	FL0042196	Domestic WWTP	0.009
Royal Court Mobile Home Park #2 (North)	FL0043095	Domestic WWTP	0.015
Royal Court Mobile Home Park #2 (North)	FL0043141	Domestic WWTP	0.015
Napoli's Mobile Home Village	FL0043150	Domestic WWTP	0.015
Sunny Acres Mobile Home Park WWTF	FL0043915	Domestic WWTP	0.015
East Coast Oils, Inc.	FL0115410	Industrial Wastewater	0.072
Stuart Avenue Warehouse WWTP	FL0115436	Domestic WWTP	0.0029
Former Eagle Picher Industries Facility	FL0167061	Industrial Wastewater	0.018
Norco Executive Center	FL0175471	Domestic WWTP	2
Sixmile Creek Planning Unit			
Mill Creek Elementary School WWTF	FL0025658	Domestic WWTP	0.02
South Mainstem Planning Unit			
Iluka Resources, Inc (FKA RGC Mineral Sands, Inc)	FL0002119	Industrial Wastewater	
Green Cove Springs, City of	FL0020915	Domestic WWTP	0.75
Mandarin WWTF	FL0023493	Domestic WWTP	7.5

Facility Name	Facility Permit Number	Facility Type	Permitted Discharge (mgd)
South Green Cove Springs WWTF	FL0030210	Domestic WWTP	0.5
FPL Putnam Steam PP PA74-01	FL0032166	Industrial Wastewater	
Fleming Oaks WWTP	FL0032875	Domestic WWTP	0.49
Seminole Electric – Seminole Steam	FL0036498	Industrial Wastewater	
Palatka, City of	FL0040061	Domestic WWTP	3
Price Brothers Co.	FL0041319	Industrial Wastewater	0.015
Port Buena Vista Mobile Home Park	FL0042617	Domestic WWTP	0.015
Hiawatha & Hart Point WWTF	FL0043389	Domestic WWTP	0.036
Julington Creek WWTP	FL0043591	Domestic WWTP	1
Cypress Landing WWTF	FL0043842	Domestic WWTP	0.0075
Blacksford Regional WWTF	FL0174441	Domestic WWTP	0.49
Trout River Planning Unit			
Millennium Specialty Chemicals (FKA SCM Glidco)	FL0000884	Industrial Wastewater	5
Bush Boake Allen, A Subsidiary of IFF	FL0001040	Industrial Wastewater	2.34
Silver Dolphin Trailer Park	FL0023001	Domestic WWTP	0.0075
Ideal Trailer Park	FL0023426	Domestic WWTP	0.011
Briarwood Mobile Home Park	FL0025704	Domestic WWTP	0.006
Cherokee Village MHP	FL0032271	Domestic WWTP	0.005
Produce Terminal of Jacksonville	FL0033405	Domestic WWTP	0.0042
Centurion Truck Plaza	FL0042421	Domestic WWTP	0.02
Study Estates MHP	FL0043419	Domestic WWTP	0.0175

A-2: Permitted Discharges to the Lake George Basin

Facility Name	City	Facility Type	Permitted Discharge (mgd)
Alexander Springs Creek Planning Unit			
Spring Creek Elementary School	Paisley	Domestic WWTP	0.0090
Alexander Springs Recreational Area	Astor Park	Domestic WWTP	0.0096
Country Squire MHV	Paisley	Domestic WWTP	0.0240
U.S. Naval Tracking Station STP	Astor	Domestic WWTP	0.0090
Lake George Planning Unit			
Taylor Jr-Sr High School	Pierson	Domestic WWTP	0.0250
Pine Island Fishing Resort STP	Lake George	Domestic WWTP	0.0080
VCUD/Pine Island	Seville	Domestic WWTP	0.0150
St Johns River Campground	Astor	Domestic WWTP	0.0075
Blairs Jungle Den	Astor	Domestic WWTP	0.0300
Welaka WWTF	Welaka	Domestic WWTP	0.0990
River Park Utilities WWTF	Fruitland	Domestic WWTP	0.0250
Shannon Car Wash	Astor Park	Industrial Wastewater	0.0049
Holiday Haven	Astor	Domestic WWTP	0.0250
Wildwoods Campground	Astor Park	Domestic WWTP	0.0075
Pierson Laundromat	Pierson	Industrial Wastewater	0.0043
Jungle Den	Astor	Domestic WWTP	0.0210
Paramore's Campground	Astor	Domestic WWTP	0.0120
Anglers Paradise Lodge	Welaka	Domestic WWTP	0.0100
Lake Kerr Planning Unit			
Juniper Springs Recreational Area	Silver Springs	Domestic WWTP	0.0190
Fountain Center WWTF	Salt Springs	Domestic WWTP	0.0028
Salt Springs	Salt Springs	Domestic WWTP	0.0850
Lake Woodruff Planning Unit			
VCUD/Four Townes	Orange City	Domestic WWTP	0.3000
VCUD/Southwest Regional	Debary	Domestic WWTP	0.5440
DeLand/Wiley Nash	DeLand	Domestic WWTP	7.3700
Rinker Materials/DeLand Concrete Batch Plan	DeLand	Industrial Wastewater	0.0016
Highbanks Marina & Camp Resort	Debary	Domestic WWTP	0.0240
T.G. Lee Foods/Lifestyle Division	DeLand	Industrial Wastewater	0.0690
Sparton Electronics STP	DeLeon Springs	Domestic WWTP	0.0120
Hidden Valley MHP	DeLeon Springs	Domestic WWTP	0.0300
Arlington Square Apartments	DeLand	Domestic WWTP	0.0060
Lakeview Terrace MHP	DeLand	Domestic WWTP	0.0100
Lingering Lane MHP	DeLand	Domestic WWTP	0.0150
Orange City Comfort Inn	Orange City	Domestic WWTP	0.0100
Holly Bluff Marina	DeLand	Domestic WWTP	0.0100
Duvall Home for Retarded Children	Glenwood	Domestic WWTP	0.0600
Sunny Sands Resort	Pierson	Domestic WWTP	0.0100
Land-o-Lakes MHC	Orange City	Domestic WWTP	0.0270
Days Inn of Orange City	Orange City	Domestic WWTP	0.0040
1876 Heritage Inn	Orange City	Domestic WWTP	0.0100
Florida Power Corp Debary	Debary	Industrial Wastewater	0.4200
St Johns River Club Condo Association	DeLand	Domestic WWTP	0.0060
Candlelight MHP	Orange City	Domestic WWTP	0.0270
Traders Cove MHP	Debary	Domestic WWTP	0.0200
Hontoon Island State Park	DeLand	Domestic WWTP	0.0050
Blue Spring State Park	Orange City	Domestic WWTP	0.0240

Facility Name	City	Facility Type	Permitted Discharge (mgd)
McInnis Elementary School	DeLeon Springs	Domestic WWTP	0.0100
VCUD/Northwest Barn Equipment & Truck Wash Recycle System	DeLand	Industrial Wastewater	
Eagles Nest S/D	Astor	Domestic WWTP	0.0100
Deerhaven Campground	Paisley	Domestic WWTP	0.0250
Powells Campground	Astor	Domestic WWTP	0.0120
DeLeon Laundry and Car Wash	DeLeon Springs	Industrial Wastewater	0.0047
Tarmac/DeLand Concrete Batch Plant	DeLand	Industrial Wastewater	
Tropical Apartments & Marina	DeLand	Domestic WWTP	0.0030
Iced Out Auto Detailing	DeLand	Industrial Wastewater	
DeLand/Orange City KOA Campground	Orange	Domestic WWTP	0.0150

APPENDIX B: STATE OF FLORIDA TMDL PROGRAM

Florida's water quality standards are designed to ensure that surface waters can be used for their designated purposes, such as drinking water, recreation, and shellfish harvesting. Currently, most surface waters in Florida, including those in the Lower St. Johns River Basin (LSJRB), are categorized as Class III waters, which mean they must be suitable for recreation and must support the propagation and maintenance of a healthy, well-balanced population of fish and wildlife. Table B-1 shows other designated use categories.

Under Section 303(d) of the federal Clean Water Act, every two years each state must identify its "impaired" waters, including estuaries, lakes, rivers, and streams, that do not meet their designated uses and are not expected to meet applicable water quality standards within the subsequent two years. The Florida Department of Environmental Protection (FDEP) is responsible for developing this "303(d) list" of impaired waters.

Table B-1: Designated Use Attainment Categories for Florida Surface Waters

Category	Description
Class I *	Potable water supplies
Class II *	Shellfish propagation or harvesting
Class III	Recreation, propagation and maintenance of a healthy, well-balanced population of fish and wildlife
Class IV	Agricultural water supplies
Class V	Navigation, utility, and industrial use (*no current Class V designations*)

* Class I and II waters include the uses of the classifications listed below them.

Florida's 303(d) list identifies hundreds of water segments that fall short of water quality standards. The three most common water quality concerns are coliforms, nutrients, and oxygen-demanding substances. FDEP develops and adopts total maximum daily loads (TMDLs) for the water body segments it identifies as impaired. A TMDL is the maximum amount of a specific pollutant that a water body can assimilate while maintaining its designated uses.

The administrative process for listing impaired waters and establishing TMDLs are authorized by Section 403.067, *Florida Statutes* (F.S.), known as the Florida Watershed Restoration Act (FWRA), and the listing methodology is contained in Florida's Identification of Impaired Surface Waters Rule, Chapter 62-303, *Florida Administrative Code (F.A.C.).* Nutrient TMDLs have been established for the impaired segments of the lower St. Johns River, and these TMDLs identify the amount of total phosphorus (TP) and total nitrogen (TN) they can receive and still maintain their Class III designated uses.

TMDLs are developed, allocated, and implemented through a watershed management approach (managing water resources within their natural boundaries) that addresses the state's 52 major hydrologic basins in five groups, on a rotating schedule. Table B-2 shows the hydrologic basins within each of the five groups, with the FDEP District office of jurisdiction. Table B-3 illustrates the repeating five-year basin rotation schedule.

Table B-2: Major Hydrologic Basins by Group and FDEP District Office

FDEP District	Group 1 Basins	Group 2 Basins	Group 3 Basins	Group 4 Basins	Group 5 Basins
NW	Ochlockonee-St. Marks	Apalachicola-Chipola	Choctawhatchee-St. Andrews Bay	Pensacola Bay	Perdido Bay
NE	Suwannee	Lower St. Johns		Nassau-St. Marys	Upper East Coast
Central	Ocklawaha	Middle St. Johns	Upper St. Johns	Kissimmee	Indian River Lagoon

FDEP District	Group 1 Basins	Group 2 Basins	Group 3 Basins	Group 4 Basins	Group 5 Basins
SW	Tampa Bay	Tampa Bay Tributaries	Sarasota Bay-Peace-Myakka	Withlacoochee	Springs Coast
S	Everglades West Coast	Charlotte Harbor	Caloosahatchee	Fisheating Creek	Florida Keys
SE	Lake Okeechobee	St. Lucie-Loxahatchee	Lake Worth Lagoon-Palm Beach Coast	Southeast Coast Biscayne Bay	Everglades

Each group will undergo a cycle of five phases on a rotating schedule:

Phase 1: Preliminary evaluation of water quality
Phase 2: Strategic monitoring and assessment to verify water quality impairments
Phase 3: Development and adoption of TMDLs for waters verified as impaired
Phase 4: Development of basin management action plan (BMAP) to achieve the TMDL
Phase 5: Implementation of the BMAP and monitoring of results

Table B-3: Basin Rotation Schedule for TMDL Development and Implementation

Year	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10
	Phases of the Cycle					Phases of the Cycle				
Group 1	1	2	3	4	5	1	2	3	4	5
Group 2		1	2	3	4	5	1	2	3	4
Group 3			1	2	3	4	5	1	2	3
Group 4				1	2	3	4	5	1	2
Group 5					1	2	3	4	5	1
	1st Five-year Cycle – High-priority Waters					2nd Five-year Cycle – Medium-Priority Waters				

* Projected years for phases 3, 4, and 5 may change due to accelerated local activities, length of plan development, legal challenges, etc.

TMDL development and implementation are ongoing, cyclical processes, as illustrated in Table B-3. FDEP will reevaluate impaired waters every five years to determine whether improvements are being achieved, and to refine loading estimates and TMDL allocations using new data. If any changes in a TMDL are required, the applicable TMDL rule will be revised, thereby providing a point of legal entry for interested parties. Changes to a TMDL would prompt revisions to the applicable BMAP, which will be revisited at least every five years and modified as necessary.

APPENDIX C: ALLOCATION TABLE FOR THE LSJR MAINSTEM NUTRIENT TMDL

Table C-1: Marine Nitrogen Allocations (as of June 2008)

Source Category or Name of Facility	Allocation		Net Reduction from Starting Point
	kg/yr	lbs/yr	
Wastewater Treatment Facilities (WWTFs) and Aggregated Loads			
Anheuser Busch – Main Street	12,418	27,320	49.10%
Atlantic Beach (WWTFs)	21,863	48,099	55.63%
Clay County Utility Authority (WWTFs)	84,058	184,928	-36.53%
Jacksonville Beach WWTF	23,878	52,532	40.53%
JEA (WWTFs)	654,672	1,440,278	53.12%
Neptune Beach WWTF	7,014	15,431	38.73%
Orange Park WWTF	9,999	21,998	59.82%
Smurfit – Jax (closed facility)	0	0	0.00%
Smurfit-Stone Container	74,305	163,471	49.10%
U.S. Navy (WWTFs)	16,118	35,460	40.80%
Future APRICOT/RO Dischargers	4,979	10,954	0.00%
Point Sources-MS4s[1]			
Atlantic Beach MS4	976	2,147	60.56%
Clay County Marine Urbanized Area	10,556	23,223	58.19%
City of Jacksonville/FDOT	96,016	211,235	60.56%
Jacksonville Beach MS4	1,941	4,270	60.98%
Neptune Beach MS4	585	1,287	62.84%
Orange Park MS4	1,289	2,836	62.64%
St. Johns County	746	1,641	75.59%
U.S. Navy MS4s	2,798	6,156	62.84%
Non-MS4 Stormwater[1]			
Camp Blanding – State of Florida	1,220	2,684	57.48%
Clay County Marine Non-Urbanized Area	4,898	10,776	59.35%
Penney Farms	163	359	0.00%
St. Johns County Marine Non-Urbanized Area	4,865	10,703	50.59%
Other Sources			
Agriculture	4,170	9,174	67.43%
Atmospheric Deposition	95,028	209,062	0.00%

[1] Loads shown for Non-MS4s are provided only for purposes of trading and aggregation of loads. The allocations are expressed in percent reduction.

Table C-2: Freshwater Nitrogen Allocations (as of June 2008)

Source Category or Name of Facility	Allocation		Net Reduction from Starting Point
	kg/yr	lbs/yr	
Wastewater Treatment Facilities (WWTFs) and Aggregated Loads			
Georgia-Pacific	165,909	365,000	35.7%
Green Cove Springs (WWTFs)	9,052	19,914	38.0%
Palatka WWTF	40,795	89,749	33.0%
Seminole Electric	14,732	32,410	30.0%
Future APRICOT/RO Dischargers	9,961	21,914	0.0%
Point Sources-MS4s[1]			
Clay County	1,983	4,363	28.4%
Green Cove Springs MS4	4,984	10,965	28.4%
Non-MS4 Stormwater[1]			
Alachua County Non-Urbanized Area	0.0	0.0	0.0%
Clay County Non-Urbanized Area	4,416	9,715	20.9%
Flagler County Non-Urbanized Area	7	15	0.0%
Hastings	449	988	28.1%
Palatka	6,932	15,250	28.4%

Pomona Park	108	238	0.00%
Putnam County	34,093	75,005	21.8%
St. Johns County Non-Urbanized Area	25,427	55,939	6.8%
Welaka	841	1,850	28.4%
Other Sources			
Agriculture	195,001	429,002	37.2%
Atmospheric Deposition	94,963	208,919	10.1%
[1] Loads shown for the MS4s and Non-MS4s are provided only for purposed of trading and aggregation of loads. The allocations are expressed in percent reduction.			

Table C-3: Freshwater Phosphorus Allocations (as of June 2008)

Source Category or Name of Facility	Allocation		Net Reduction from Starting Point
	kg/yr	lbs/yr	
Wastewater Treatment Facilities (WWTFs) and Aggregated Loads			
Georgia-Pacific	33,182	73,000	48.05%
Green Cove Springs (WWTFs)	2,397	5,273	38.00%
Palatka WWTF	6,670	14,674	33.00%
Future APRICOT/RO Dischargers	3,320	7,304	0.00%
Point Sources-MS4s[1]			
Clay County	212.6	467.7	47.44%
Green Cove Springs MS4	575.9	1,267.0	47.44%
Non-MS4 Stormwater[1]			
Alachua County Non-Urbanized Area	83.8	184.4	0.00%
Clay County Non-Urbanized Area	499.4	1,098.7	34.92%
Flagler County Non-Urbanized Area	0.9	2.0	0.00%
Hastings	49.3	108.5	46.93%
Palatka	792.5	1,743.5	47.44%
Pomona Park	15.8	34.8	0.00%
Putnam County	3,964.9	8,722.8	33.81%
St. Johns County Non-Urbanized Area	3,296.6	7,252.5	11.56%
Welaka	90.4	198.9	47.44%
Other Sources			
Agriculture	70,974	156,143	14.96%
Atmospheric Deposition	1,356	2,983	0.00%
[1] Loads shown for the MS4s and Non-MS4s are provided only for purposes of trading and aggregation of loads. The allocations are expressed in percent reduction.			

APPENDIX D: STORMWATER MASTER PLANS IN THE LSJRB

In the future, applications for Section 319 or other federal funding will be limited to those projects that are part of a local watershed plan. Since local watershed plans will become such an important part of receiving federal funding, having a watershed plan in place that meets EPA's nine elements for a comprehensive management plan will be important as funding availability is often the major limitation to project implementation.

Table D-1 lists the entities in the Lower St. Johns River Basin that have stormwater master plans and indicates whether these plans meet the EPA criteria for a comprehensive management plan. The information in this table reflects that provided by representatives of each listed entity between September 20 and December 18, 2007, and may not provide the most up-to-date information available.

Table D-1: Local Stormwater Plans in the Lower St. Johns River Basin

Local Entity	County	Stormwater Master Plan		Meet EPA criteria for 319 Funds		Year Completed
		Yes	No	Yes	No	
Clay County	Clay	x			x	2007–2008
Green Cove Springs	Clay		x		x	-
Orange Park	Clay		x		x	
Penney Farms	Clay		x		x	
Keystone Heights	Clay/Bradford		x		x	-
City of Jacksonville	Duval	x		x		2008–2009
Atlantic Beach	Duval	x		x		2008–2009
Neptune Beach	Duval	x		x		2008–2009
Jacksonville Beach	Duval	x		Undetermined		-
NS Mayport	Duval		x		x	-
NAS Jax	Duval	x		Undetermined		2007
Palatka	Putnam	x		Undetermined		1997
Welaka	Putnam		x		x	-
Pomona Park	Putnam		x		x	-
Putnam County	Putnam	x			x	pending
Interlachen	Putnam		x		x	-
Hastings	St. Johns		x		x	-
St. Johns County	St. Johns		x		x	-
Pierson	Volusia		x		x	-
DeBary	Volusia	x		Undetermined		-
Deltona	Volusia		x		x	
Orange City	Volusia	x		Undetermined		2009
De Land	Volusia		x		x	-
Volusia County	Volusia		x		x	pending
Crescent City	Volusia		x		x	-
Daytona Beach	Volusia	x		Undetermined		2006
Palm coast	Flagler		x		x	-
Flagler County	Flagler		x		x	-
Bunnell	Flagler		x		x	pending

APPENDIX E: ACTIVE HYDROLOGIC STATIONS IN THE LOWER ST. JOHNS RIVER AND LAKE GEORGE BASINS

Table E-1: Active Hydrologic Stations in the Lower St. Johns River Basin

Station Name	Event Type	Planning Unit
Black Ck	Rain (RN)	Black Creek
Black Ck Maxville	Rain (RN)	Black Creek
Black Ck Middleburg	Rain (RN)	Black Creek
Camp Blanding NOAA	Rain (RN)	Black Creek
Codys Corner	Rain (RN)	Crescent Lake
Crescent City	Rain (RN)	Crescent Lake
Hell Cat Bay	Rain (RN)	Crescent Lake
Sam Tilton Frm	Rain (RN)	Crescent Lake
SR40 & 11	Rain (RN)	Crescent Lake
Elkton	Rain (RN)	Deep Creek Unit
Hastings 4NE	Rain (RN)	Deep Creek Unit
Chesser Well	Rain (RN)	Etonia Creek
DHQ	Rain (RN)	Etonia Creek
Etonia E V Rd	Rain (RN)	Etonia Creek
Gold Head SP	Rain (RN)	Etonia Creek
Jacksonville Bch	Rain (RN)	Intracoastal Waterway
Jax Bch WP	Rain (RN)	Intracoastal Waterway
Losco Rd	Rain (RN)	Julington Creek
Jacksonville AP	Rain (RN)	North Lower Basin Unit
Jacksonville WB	Rain (RN)	North Lower Basin Unit
National Weather Srv	Rain (RN)	North Lower Basin Unit
Rolling Hills	Rain (RN)	Ortega River
Bayard Point	Rain (RN)	South Lower Basin Unit
Federal Point Rn	Rain (RN)	South Lower Basin Unit
Pritchard Rd	Rain (RN)	Trout River
N Fork Black Ck	Discharge	Black Creek
S Fork Black Ck	Discharge	Black Creek
Wadesboro Spg	Discharge	Black Creek
Dunns Ck USGS	Discharge	Crescent Lake
Haw Ck Russell	Discharge	Crescent Lake
Haw Creek	Discharge	Crescent Lake
Lt Haw Ck	Discharge	Crescent Lake
Middle Haw Ck	Discharge	Crescent Lake
Deep Ck nr Hastings	Discharge	Deep Creek Unit
Deep Ck RR Brdg	Discharge	Deep Creek Unit
Allig Ck above Lowry	Discharge	Etonia Creek
Allig Greble Rd	Discharge	Etonia Creek
Spg above Lowry	Discharge	Etonia Creek
Big Davis Ck	Discharge	Julington Creek
SJR at Jax	Discharge	North Lower Basin Unit
Cedar Rv	Discharge	Ortega River
Ortega R Kirwin	Discharge	Ortega River
Black Ck Dr Inlet	Discharge	South Lower Basin Unit
SJR at Buffalo Bluff	Discharge	South Lower Basin Unit
Green Cove Spg	Discharge	South Mainstem Unit
Camp Blanding CR315	Water Level (WL)	Black Creek
Camp Blanding CR315	Water Level (WL)	Black Creek
Camp Blanding CR315	Water Level (WL)	Black Creek
Camp Blanding CR315	Water Level (WL)	Black Creek
Camp Blanding N Rd	Water Level (WL)	Black Creek
Camp Blanding N Rd	Water Level (WL)	Black Creek

Station Name	Event Type	Planning Unit
Camp Blanding N Rd	Water Level (WL)	Black Creek
Camp Blanding SR16	Water Level (WL)	Black Creek
Camp Blanding SR16	Water Level (WL)	Black Creek
Camp Blanding SR16	Water Level (WL)	Black Creek
Canvasback Rd	Water Level (WL)	Black Creek
Canvasback Rd	Water Level (WL)	Black Creek
Canvasback Rd	Water Level (WL)	Black Creek
Canvasback Rd	Water Level (WL)	Black Creek
Kingsley Lk	Water Level (WL)	Black Creek
Lk Asbury Wells	Water Level (WL)	Black Creek
Lk Asbury Wells	Water Level (WL)	Black Creek
N Fork Black Ck	Water Level (WL)	Black Creek
N Fork Black Ck	Water Level (WL)	Black Creek
Penny Frms Twr	Water Level (WL)	Black Creek
Penny Frms Twr	Water Level (WL)	Black Creek
Penny Frms Twr	Water Level (WL)	Black Creek
S Fork Black Ck	Water Level (WL)	Black Creek
Sheelar Lk	Water Level (WL)	Black Creek
SR16 St. Marys Kraft	Water Level (WL)	Black Creek
State Rd 16	Water Level (WL)	Black Creek
Thunderbolt ES	Water Level (WL)	Black Creek
Thunderbolt ES	Water Level (WL)	Black Creek
Tynes ES	Water Level (WL)	Black Creek
Tynes ES	Water Level (WL)	Black Creek
Tynes ES	Water Level (WL)	Black Creek
Wadesboro Spg	Water Level (WL)	Black Creek
Yellow Water Ck	Water Level (WL)	Black Creek
Yellow Water Ck	Water Level (WL)	Black Creek
Yellow Water Ck	Water Level (WL)	Black Creek
Argenta Lk	Water Level (WL)	Crescent Lake
Codys Crn Wells	Water Level (WL)	Crescent Lake
Coon Pd	Water Level (WL)	Crescent Lake
County Line	Water Level (WL)	Crescent Lake
Cow Pd	Water Level (WL)	Crescent Lake
Cowarts Rd	Water Level (WL)	Crescent Lake
Dan Ford Rd N	Water Level (WL)	Crescent Lake
DeLand USGS	Water Level (WL)	Crescent Lake
DeLand USGS	Water Level (WL)	Crescent Lake
DeLand USGS	Water Level (WL)	Crescent Lake
Dinner Is	Water Level (WL)	Crescent Lake
Dinner Is	Water Level (WL)	Crescent Lake
Dinner Is	Water Level (WL)	Crescent Lake
Dream Pd	Water Level (WL)	Crescent Lake
Dunns Ck USGS	Water Level (WL)	Crescent Lake
English Lk	Water Level (WL)	Crescent Lake
F-0179 at SR 11	Water Level (WL)	Crescent Lake
Flagler F-0087	Water Level (WL)	Crescent Lake
Gore Lk	Water Level (WL)	Crescent Lake
Haw Ck Russell	Water Level (WL)	Crescent Lake
Haw Creek	Water Level (WL)	Crescent Lake
Hendrix Well	Water Level (WL)	Crescent Lake
Hendrix Well	Water Level (WL)	Crescent Lake

Station Name	Event Type	Planning Unit
Horseshoe Lk	Water Level (WL)	Crescent Lake
Horseshoe Lk	Water Level (WL)	Crescent Lake
Indian Lk	Water Level (WL)	Crescent Lake
Indian Lk Site 3	Water Level (WL)	Crescent Lake
Indian Lk Site 4	Water Level (WL)	Crescent Lake
Indian Lk Site 5	Water Level (WL)	Crescent Lake
Indian Lk Site 6	Water Level (WL)	Crescent Lake
Lawrence Frms	Water Level (WL)	Crescent Lake
Lawrence Frms	Water Level (WL)	Crescent Lake
Lee AP	Water Level (WL)	Crescent Lake
Lee AP	Water Level (WL)	Crescent Lake
Lee AP	Water Level (WL)	Crescent Lake
Lk Broward	Water Level (WL)	Crescent Lake
Lk Broward Wells	Water Level (WL)	Crescent Lake
Lk Broward Wells	Water Level (WL)	Crescent Lake
Lk Daugharty	Water Level (WL)	Crescent Lake
Lk Daugharty	Water Level (WL)	Crescent Lake
Lk Daugharty	Water Level (WL)	Crescent Lake
Lk Daugharty	Water Level (WL)	Crescent Lake
Lk Dias	Water Level (WL)	Crescent Lake
Lk Disston	Water Level (WL)	Crescent Lake
Lk Hires	Water Level (WL)	Crescent Lake
Lk Juanita	Water Level (WL)	Crescent Lake
Lk Omega	Water Level (WL)	Crescent Lake
Lk Winona	Water Level (WL)	Crescent Lake
Lt Haw Ck	Water Level (WL)	Crescent Lake
Lt Mall Lk	Water Level (WL)	Crescent Lake
Middle Haw Ck	Water Level (WL)	Crescent Lake
Murphy Is	Water Level (WL)	Crescent Lake
N Lk Talmadge	Water Level (WL)	Crescent Lake
Palmer Lk	Water Level (WL)	Crescent Lake
R. Nolan	Water Level (WL)	Crescent Lake
Relay Twr	Water Level (WL)	Crescent Lake
Relay Twr	Water Level (WL)	Crescent Lake
San Mateo	Water Level (WL)	Crescent Lake
San Mateo	Water Level (WL)	Crescent Lake
San Mateo	Water Level (WL)	Crescent Lake
San Mateo Twr	Water Level (WL)	Crescent Lake
Scoggin Lk	Water Level (WL)	Crescent Lake
Seville Ftwr	Water Level (WL)	Crescent Lake
Seville Ftwr	Water Level (WL)	Crescent Lake
Seville Ftwr	Water Level (WL)	Crescent Lake
Seville Ftwr	Water Level (WL)	Crescent Lake
Silver Lk Crescent	Water Level (WL)	Crescent Lake
SR40 and 11	Water Level (WL)	Crescent Lake
SR40 and 11	Water Level (WL)	Crescent Lake
SR40 and 11	Water Level (WL)	Crescent Lake
Stella Lk	Water Level (WL)	Crescent Lake
Stella Lk Wells	Water Level (WL)	Crescent Lake
Stella Lk Wells	Water Level (WL)	Crescent Lake
Stella Lk Wells	Water Level (WL)	Crescent Lake
Tiger Bay	Water Level (WL)	Crescent Lake

Station Name	Event Type	Planning Unit
Tiger Bay Mile W	Water Level (WL)	Crescent Lake
Tiger Bay near Samsula	Water Level (WL)	Crescent Lake
Union Camp V-0088	Water Level (WL)	Crescent Lake
Union Camp V-0090	Water Level (WL)	Crescent Lake
V-0788 near Middle Haw	Water Level (WL)	Crescent Lake
Westside Bapt	Water Level (WL)	Crescent Lake
Westside Bapt	Water Level (WL)	Crescent Lake
Westside Bapt	Water Level (WL)	Crescent Lake
Deep Ck near Hastings	Water Level (WL)	Deep Creek Unit
Deep Ck RR Brdg	Water Level (WL)	Deep Creek Unit
Dick Reid Frm	Water Level (WL)	Deep Creek Unit
Sykes Frms	Water Level (WL)	Deep Creek Unit
Tilton	Water Level (WL)	Deep Creek Unit
Allig Ck above Lowry	Water Level (WL)	Etonia Creek
Allig Greble Rd	Water Level (WL)	Etonia Creek
Big Lk Johnson	Water Level (WL)	Etonia Creek
Blue Pd	Water Level (WL)	Etonia Creek
DHQ	Water Level (WL)	Etonia Creek
DHQ	Water Level (WL)	Etonia Creek
Etonia Buck Spg Rd	Water Level (WL)	Etonia Creek
Etonia Buck Spg Rd	Water Level (WL)	Etonia Creek
Etonia Buck Spg Rd	Water Level (WL)	Etonia Creek
Etonia E V Rd	Water Level (WL)	Etonia Creek
Etonia E V Rd	Water Level (WL)	Etonia Creek
Etonia E V Rd	Water Level (WL)	Etonia Creek
FL Rock MW1	Water Level (WL)	Etonia Creek
Georges Lk	Water Level (WL)	Etonia Creek
Gold Head SP	Water Level (WL)	Etonia Creek
Gold Head SP	Water Level (WL)	Etonia Creek
Gold Head SP	Water Level (WL)	Etonia Creek
Hollister Work Cntr	Water Level (WL)	Etonia Creek
Hollister Work Cntr	Water Level (WL)	Etonia Creek
Lk Brooklyn	Water Level (WL)	Etonia Creek
Lk Brooklyn Wells	Water Level (WL)	Etonia Creek
Lk Brooklyn Wells	Water Level (WL)	Etonia Creek
Lk Brooklyn Wells	Water Level (WL)	Etonia Creek
Lk Geneva	Water Level (WL)	Etonia Creek
Lk Geneva C-0031	Water Level (WL)	Etonia Creek
Lk Geneva Wells	Water Level (WL)	Etonia Creek
Lk Geneva Wells	Water Level (WL)	Etonia Creek
Lk Geneva Wells	Water Level (WL)	Etonia Creek
Lk Grandin	Water Level (WL)	Etonia Creek
Lk Grandin Wells	Water Level (WL)	Etonia Creek
Lk Grandin Wells	Water Level (WL)	Etonia Creek
Lk Grandin Wells	Water Level (WL)	Etonia Creek
Lk Melrose	Water Level (WL)	Etonia Creek
Lowry Lk	Water Level (WL)	Etonia Creek
Lt Lk Johnson	Water Level (WL)	Etonia Creek
Magnolia Lk Telem	Water Level (WL)	Etonia Creek
Moody Wells	Water Level (WL)	Etonia Creek
Moody Wells	Water Level (WL)	Etonia Creek

Station Name	Event Type	Planning Unit
Pebble Lk	Water Level (WL)	Etonia Creek
Spg above Lowry	Water Level (WL)	Etonia Creek
Sungarden Twr	Water Level (WL)	Etonia Creek
Sungarden Twr	Water Level (WL)	Etonia Creek
Sungarden Twr	Water Level (WL)	Etonia Creek
Sungarden Twr	Water Level (WL)	Etonia Creek
Swan Lk	Water Level (WL)	Etonia Creek
Swan Lk Well	Water Level (WL)	Etonia Creek
Bch Haven	Water Level (WL)	Intracoastal Waterway
City of Neptune Bch	Water Level (WL)	Intracoastal Waterway
Oaks Landing	Water Level (WL)	Intracoastal Waterway
Ponte Vedra Test	Water Level (WL)	Intracoastal Waterway
Southside and Butler	Water Level (WL)	Intracoastal Waterway
Southside Ftwr	Water Level (WL)	Intracoastal Waterway
Southside Ftwr	Water Level (WL)	Intracoastal Waterway
Southside Ftwr	Water Level (WL)	Intracoastal Waterway
Big Davis Ck	Water Level (WL)	Julington Creek
Chesser Lk Rd E	Water Level (WL)	Julington Creek
Chesser Lk Rd E	Water Level (WL)	Julington Creek
Greenland Pines ES	Water Level (WL)	Julington Creek
Greenland Pines ES	Water Level (WL)	Julington Creek
Julington Ck Wells	Water Level (WL)	Julington Creek
Julington Ck Wells	Water Level (WL)	Julington Creek
Arlington E STP	Water Level (WL)	North Lower Basin Unit
Camden Rd	Water Level (WL)	North Lower Basin Unit
Ft George Wells	Water Level (WL)	North Lower Basin Unit
Ft George Wells	Water Level (WL)	North Lower Basin Unit
Ft. Caroline	Water Level (WL)	North Lower Basin Unit
Ft. Caroline	Water Level (WL)	North Lower Basin Unit
Ft. Caroline Nat Pk	Water Level (WL)	North Lower Basin Unit
Hanna Pk Test Well	Water Level (WL)	North Lower Basin Unit
SJR at Bar Pilot Dock	Water Level (WL)	North Lower Basin Unit
SJR at Main St Brdg	Water Level (WL)	North Lower Basin Unit
SJR at Dames Pt	Water Level (WL)	North Lower Basin Unit
SJR at Jax	Water Level (WL)	North Lower Basin Unit
Cedar Rv	Water Level (WL)	Ortega River
Indian Trls	Water Level (WL)	Ortega River
NAS Jax WP 3	Water Level (WL)	Ortega River
NAS Jax WP 3	Water Level (WL)	Ortega River
NAS Jax WP 3	Water Level (WL)	Ortega River
NAS Jax WP 3	Water Level (WL)	Ortega River
NAS Jax WP 3	Water Level (WL)	Ortega River
Ortega R Kirwin	Water Level (WL)	Ortega River
Rolling Hills	Water Level (WL)	Ortega River
Bakersville Twr	Water Level (WL)	Sixmile Creek
Bakersville Twr	Water Level (WL)	Sixmile Creek
Durbin Ftwr	Water Level (WL)	Sixmile Creek
Durbin Ftwr	Water Level (WL)	Sixmile Creek
Durbin Ftwr	Water Level (WL)	Sixmile Creek
Trout Ck Pk	Water Level (WL)	Sixmile Creek
Trout Ck Pk	Water Level (WL)	Sixmile Creek
Trout Ck Pk	Water Level (WL)	Sixmile Creek

Station Name	Event Type	Planning Unit
Trout Ck Pk	Water Level (WL)	Sixmile Creek
Twelve Mile Swamp	Water Level (WL)	Sixmile Creek
Twelve Mile Swamp	Water Level (WL)	Sixmile Creek
Twelve Mile Swamp	Water Level (WL)	Sixmile Creek
Twelve Mile Swamp	Water Level (WL)	Sixmile Creek
Barge Port	Water Level (WL)	South Lower Basin Unit
Bayard WMA Well Rd	Water Level (WL)	South Lower Basin Unit
Bayard WMA Well Rd	Water Level (WL)	South Lower Basin Unit
Bayard nr Walkill	Water Level (WL)	South Lower Basin Unit
Bayard Point	Water Level (WL)	South Lower Basin Unit
Bayard Point	Water Level (WL)	South Lower Basin Unit
Bayard Point	Water Level (WL)	South Lower Basin Unit
Bayard Point	Water Level (WL)	South Lower Basin Unit
Bayard WMA at Camp	Water Level (WL)	South Lower Basin Unit
Bayard WMA at Camp	Water Level (WL)	South Lower Basin Unit
Bayard WMA at Camp	Water Level (WL)	South Lower Basin Unit
Bayard WMA at Camp	Water Level (WL)	South Lower Basin Unit
Bayard WMA Bayard Rd	Water Level (WL)	South Lower Basin Unit
Bayard WMA Gate 3	Water Level (WL)	South Lower Basin Unit
Bayard WMA Gate 3	Water Level (WL)	South Lower Basin Unit
Bayard WMA Tram Rd	Water Level (WL)	South Lower Basin Unit
Bayard WMA Tram Rd	Water Level (WL)	South Lower Basin Unit
Black Ck Dr Inlet	Water Level (WL)	South Lower Basin Unit
EH Miller Sch	Water Level (WL)	South Lower Basin Unit
EH Miller Sch	Water Level (WL)	South Lower Basin Unit
EH Miller Sch	Water Level (WL)	South Lower Basin Unit
Greenbrier Rd	Water Level (WL)	South Lower Basin Unit
Mandarin Terrace	Water Level (WL)	South Lower Basin Unit
Orange Mill Well	Water Level (WL)	South Lower Basin Unit
Ravine St Gardens	Water Level (WL)	South Lower Basin Unit
Riverdale Pk	Water Level (WL)	South Lower Basin Unit
Riverdale Pk	Water Level (WL)	South Lower Basin Unit
SJR at Racy Point	Water Level (WL)	South Lower Basin Unit
SJR at Shands Brdg	Water Level (WL)	South Lower Basin Unit
SJR at Buffalo Bluff	Water Level (WL)	South Lower Basin Unit
Walkill	Water Level (WL)	South Lower Basin Unit
Green Cove Spg	Water Level (WL)	South Mainstem Unit
Dinsmore	Water Level (WL)	Trout River
Panama Pk	Water Level (WL)	Trout River

Table E-2: Active Hydrologic Stations in the Lake George Basin

Station Name	Event Type	Planning Unit
Camp Ocala 4H	Rain (RN)	Alexander Springs Creek
Lk George Marker 5	Rain (RN)	Lake George Unit
Pierson AP	Rain (RN)	Lake George Unit
Silver Pd Wells	Rain (RN)	Lake George Unit
Forest Rd 88	Rain (RN)	Lake Kerr Unit
DeLand 1 SSE	Rain (RN)	Lake Woodruff Unit
S of Blue Spg Repl	Rain (RN)	Lake Woodruff Unit
Alex Spg Run CR445	Discharge	Alexander Springs Creek
Alex Spg Tracy Cnl	Discharge	Alexander Springs Creek
Alexander Spg	Discharge	Alexander Springs Creek
Croaker Hole Spg	Discharge	Lake George Unit
Silver Glen Spg	Discharge	Lake George Unit
Fern Hammock Spg	Discharge	Lake Kerr Unit
Juniper Spg	Discharge	Lake Kerr Unit
Salt Spg	Discharge	Lake Kerr Unit
Sweetwater Spg	Discharge	Lake Kerr Unit
Blue Spg Org City	Discharge	Lake Woodruff Unit
Ponce De Leon Spg	Discharge	Lake Woodruff Unit
SJR at Astor USGS	Discharge	Lake Woodruff Unit
SJR near DeLand USGS	Discharge	Lake Woodruff Unit
Alex Spg Run CR445	Water Level (WL)	Alexander Springs Creek
Alex Spg Tracy Cnl	Water Level (WL)	Alexander Springs Creek
Alexander Spg	Water Level (WL)	Alexander Springs Creek
Alexander Spg Cr445	Water Level (WL)	Alexander Springs Creek
Alexander Spg Cr445	Water Level (WL)	Alexander Springs Creek
Alexander Spg Wells	Water Level (WL)	Alexander Springs Creek
Bombing Range	Water Level (WL)	Alexander Springs Creek
Bunch Ground Pd	Water Level (WL)	Alexander Springs Creek
Astor Pk	Water Level (WL)	Lake George Unit
Astor Pk	Water Level (WL)	Lake George Unit
Banana Lk	Water Level (WL)	Lake George Unit
Bayard WMA Camp Rd	Water Level (WL)	Lake George Unit
Bayard WMA Camp Rd	Water Level (WL)	Lake George Unit
Bell Lk	Water Level (WL)	Lake George Unit
Bird Pd	Water Level (WL)	Lake George Unit
Clear Lk Cres City	Water Level (WL)	Lake George Unit
Como Lk	Water Level (WL)	Lake George Unit
Crystal Lk Putnam	Water Level (WL)	Lake George Unit
Drudy Lk	Water Level (WL)	Lake George Unit
Echo Lk	Water Level (WL)	Lake George Unit
Estella Lk	Water Level (WL)	Lake George Unit
Forest Rd 77	Water Level (WL)	Lake George Unit
Fruitland Handy Way	Water Level (WL)	Lake George Unit
Fruitland Wells	Water Level (WL)	Lake George Unit
Fruitland Wells	Water Level (WL)	Lake George Unit
J C Mew	Water Level (WL)	Lake George Unit
Lk Howell	Water Level (WL)	Lake George Unit
Lk Lizzie	Water Level (WL)	Lake George Unit
Lk Pierson	Water Level (WL)	Lake George Unit

Station Name	Event Type	Planning Unit
Lower Lk Louise	Water Level (WL)	Lake George Unit
Lt Como Lk	Water Level (WL)	Lake George Unit
Margaret Lk	Water Level (WL)	Lake George Unit
Marvin Jones Rd	Water Level (WL)	Lake George Unit
Marvin Jones Rd	Water Level (WL)	Lake George Unit
Marvin Jones Rd	Water Level (WL)	Lake George Unit
McGrady Lk	Water Level (WL)	Lake George Unit
McKasel Lk	Water Level (WL)	Lake George Unit
Middle Rd	Water Level (WL)	Lake George Unit
Middle Rd	Water Level (WL)	Lake George Unit
Middle Rd	Water Level (WL)	Lake George Unit
Middle Rd	Water Level (WL)	Lake George Unit
Middle Rd	Water Level (WL)	Lake George Unit
N Como Pk Lk	Water Level (WL)	Lake George Unit
Niles Rd Wells	Water Level (WL)	Lake George Unit
Niles Rd Wells	Water Level (WL)	Lake George Unit
Niles Rd Wells	Water Level (WL)	Lake George Unit
Nolan Rd	Water Level (WL)	Lake George Unit
Nolan Rd	Water Level (WL)	Lake George Unit
Ocala Nat Forest 77	Water Level (WL)	Lake George Unit
Ocala Nat Forest 77	Water Level (WL)	Lake George Unit
Old Bubbly New	Water Level (WL)	Lake George Unit
Pierson AP	Water Level (WL)	Lake George Unit
Pierson AP	Water Level (WL)	Lake George Unit
Pierson AP	Water Level (WL)	Lake George Unit
Pierson AP	Water Level (WL)	Lake George Unit
Prior Lk	Water Level (WL)	Lake George Unit
S Como Pk Lk	Water Level (WL)	Lake George Unit
Shell Harbor Rd E	Water Level (WL)	Lake George Unit
Shell Harbor Rd E	Water Level (WL)	Lake George Unit
Shell Harbor Rd E	Water Level (WL)	Lake George Unit
Shell Harbor Rd W	Water Level (WL)	Lake George Unit
Silver Glen Spg	Water Level (WL)	Lake George Unit
Silver Pd Wells	Water Level (WL)	Lake George Unit
Silver Pd Wells	Water Level (WL)	Lake George Unit
Silver Pd Wells	Water Level (WL)	Lake George Unit
Tarhoe Lk	Water Level (WL)	Lake George Unit
Thunderbird AP	Water Level (WL)	Lake George Unit
Trone Lk	Water Level (WL)	Lake George Unit
Upper Lk Louise	Water Level (WL)	Lake George Unit
W Pierson	Water Level (WL)	Lake George Unit
W Pierson	Water Level (WL)	Lake George Unit
W Pierson	Water Level (WL)	Lake George Unit
Welaka SF Trl 10	Water Level (WL)	Lake George Unit
Welaka SF Trl 14	Water Level (WL)	Lake George Unit
Welaka SF Trl 9	Water Level (WL)	Lake George Unit
WSF Apaloosa Trl	Water Level (WL)	Lake George Unit
WSF Fire Break	Water Level (WL)	Lake George Unit
WSF Fire Break	Water Level (WL)	Lake George Unit
WSF Paso Fino Trl	Water Level (WL)	Lake George Unit
WSF Paso Fino Trl	Water Level (WL)	Lake George Unit
Fern Hammock Spg	Water Level (WL)	Lake Kerr Unit

Station Name	Event Type	Planning Unit
Forest Rd 75	Water Level (WL)	Lake Kerr Unit
Frontier Dance Hall	Water Level (WL)	Lake Kerr Unit
Frontier Dance Hall	Water Level (WL)	Lake Kerr Unit
FSR 31 and FSR 97	Water Level (WL)	Lake Kerr Unit
FSR 90 W SR19	Water Level (WL)	Lake Kerr Unit
Halfmoon Lk	Water Level (WL)	Lake Kerr Unit
Hopkins Pr	Water Level (WL)	Lake Kerr Unit
Hopkins Pr T1	Water Level (WL)	Lake Kerr Unit
Hopkins Pr T1	Water Level (WL)	Lake Kerr Unit
Hopkins Pr T1	Water Level (WL)	Lake Kerr Unit
Hopkins Pr T1	Water Level (WL)	Lake Kerr Unit
Juniper Spg	Water Level (WL)	Lake Kerr Unit
Lk Kerr	Water Level (WL)	Lake Kerr Unit
Salt Run	Water Level (WL)	Lake Kerr Unit
Salt Spg	Water Level (WL)	Lake Kerr Unit
SR19 and 40	Water Level (WL)	Lake Kerr Unit
Sweetwater Spg	Water Level (WL)	Lake Kerr Unit
Barberville Wells	Water Level (WL)	Lake Woodruff Unit
Barberville Wells	Water Level (WL)	Lake Woodruff Unit
Blue Spg Org City	Water Level (WL)	Lake Woodruff Unit
Blue Spg Org City	Water Level (WL)	Lake Woodruff Unit
Blue Spg Wells	Water Level (WL)	Lake Woodruff Unit
Coleman Sch	Water Level (WL)	Lake Woodruff Unit
Crosby Realty	Water Level (WL)	Lake Woodruff Unit
Crosby Realty	Water Level (WL)	Lake Woodruff Unit
Crows Bluff	Water Level (WL)	Lake Woodruff Unit
Davis Fernery	Water Level (WL)	Lake Woodruff Unit
De Leon Spg Ftwr	Water Level (WL)	Lake Woodruff Unit
De Leon Spg SP	Water Level (WL)	Lake Woodruff Unit
De Leon Spg SP	Water Level (WL)	Lake Woodruff Unit
De Leon Spg SP	Water Level (WL)	Lake Woodruff Unit
Deep Ck Dawson Rd	Water Level (WL)	Lake Woodruff Unit
Deep Ck Wells	Water Level (WL)	Lake Woodruff Unit
Deep Ck Wells	Water Level (WL)	Lake Woodruff Unit
Dexter Point	Water Level (WL)	Lake Woodruff Unit
Dexter Point	Water Level (WL)	Lake Woodruff Unit
Franklin St	Water Level (WL)	Lake Woodruff Unit
Glenwood	Water Level (WL)	Lake Woodruff Unit
Grand Ave	Water Level (WL)	Lake Woodruff Unit
Holiday Hills	Water Level (WL)	Lake Woodruff Unit
Jones Fernery	Water Level (WL)	Lake Woodruff Unit
Jones Fernery	Water Level (WL)	Lake Woodruff Unit
Jones Is	Water Level (WL)	Lake Woodruff Unit
Kalota	Water Level (WL)	Lake Woodruff Unit
Kalota	Water Level (WL)	Lake Woodruff Unit
Lk Emporia	Water Level (WL)	Lake Woodruff Unit
Lk Gertie	Water Level (WL)	Lake Woodruff Unit
Lk Purdom	Water Level (WL)	Lake Woodruff Unit
Lk Woodruff NWR	Water Level (WL)	Lake Woodruff Unit
Lk Woodruff Well	Water Level (WL)	Lake Woodruff Unit
Orange City Ftwr	Water Level (WL)	Lake Woodruff Unit
Orange City Ftwr	Water Level (WL)	Lake Woodruff Unit

Station Name	Event Type	Planning Unit
Orange City Ftwr	Water Level (WL)	Lake Woodruff Unit
Orange City Ftwr	Water Level (WL)	Lake Woodruff Unit
Pine Is Wells	Water Level (WL)	Lake Woodruff Unit
Pine Is Wells	Water Level (WL)	Lake Woodruff Unit
Ponce De Leon Spg	Water Level (WL)	Lake Woodruff Unit
S of Blue Spg Repl	Water Level (WL)	Lake Woodruff Unit
Shaw Lk	Water Level (WL)	Lake Woodruff Unit
SJR at Astor USGS	Water Level (WL)	Lake Woodruff Unit
SJR at High Banks Rd	Water Level (WL)	Lake Woodruff Unit
SJR near DeLand USGS	Water Level (WL)	Lake Woodruff Unit
Southwest MS	Water Level (WL)	Lake Woodruff Unit
Southwest MS	Water Level (WL)	Lake Woodruff Unit
SR44 and Ridgewood	Water Level (WL)	Lake Woodruff Unit
Tall Oaks Dr	Water Level (WL)	Lake Woodruff Unit
Tall Oaks Dr	Water Level (WL)	Lake Woodruff Unit
Tick Is	Water Level (WL)	Lake Woodruff Unit
Trout Lk Volusia	Water Level (WL)	Lake Woodruff Unit
USFS Well	Water Level (WL)	Lake Woodruff Unit
Wolfs Well	Water Level (WL)	Lake Woodruff Unit

APPENDIX F: MANAGEMENT PROJECTS SUMMARY TABLES FOR THE LOWER ST. JOHNS RIVER AND LAKE GEORGE BASINS

Tables F-1 and F-2 list the management projects described in sections 3.7, 3.8, 5.5.6, and 5.5.7 of the 2007 SWIM Plan Update. These projects are considered in terms of the strategy and management activity that they are designed to accomplish. Management activities include resource assessment (RA) (research and assessment projects), development of management tools (DMT) (projects that develop tools such as models), and implementation efforts (IE) (projects that are physical implementation such as a restoration project or installation of a BMP). A "√" in the box below the management activity column (designated with the abbreviation RA, DMT, or IE, respectively) represents the primary management activity for which the project is designed to accomplish. An "x" in the box below the management activity column represents those activities that the project supports as a secondary or tertiary objective.

Table F-1: Past/Current Management Projects in the Lower St. Johns River Basin

Past/Current Projects	Initiative		Strategy		Management Activity			Sponsoring Entity	Dates (FY)
	Primary	Supportive	Primary	Supportive	RA	DMT	IE		
WATER QUALITY INITIATIVE									
Agricultural BMP Cost-Share Program - Phase I	3.1		3.1.2				√	SJRWMD/ IFAS/ USDA	1998–2007
Agricultural Receiving Streams Evaluation	3.1	3.4	3.1.2	3.1.5	√	x		SJRWMD	1990–2007
Algal Initiative	3.1		3.1.2			√	x	SJRWMD	2006–2007
Algal Toxin Monitoring	3.1	3.2	3.1.1	3.1.3	√			SJRWMD	2005–2007
Ambient Water Quality Monitoring in the TCAA	3.1		3.1.2		√	x		SJRWMD	1990–2007
Aquatic Organic Matter Characterization	3.1		3.1.1		√	x		SJRWMD	2005–2007
Best Management Practice (BMP) Effectiveness and Stormwater Monitoring	3.1		3.1.2		√	x		SJRWMD/ IFAS	1998–2007
Best Management Practice (BMP) Geographic Information System (GIS) Tracking Tool	3.1		3.1.2			√	x	SJRWMD	1999-2007
City of Jacksonville Mainstem Run	3.1	3.2	3.1.1	3.1.2, 3.1.5	√	x		COJ	1985–2007
COJ MS4 Permit Monitoring Program: Stormwater BMP Effectiveness Studies	3.1	3.2 3.4	3.1.1	3.1.5	√	x		COJ	2002-2007
COJ MS4 Permit Monitoring Program: Tributary Intensive Program	3.1	3.2, 3.4	3.1.1	3.1.5	√	x		COJ	2002–2007
COJ Tributary Routine Program	3.1	3.2, 3.4	3.1.1	3.1.5	√	x		COJ	1985–2007

Past/Current Projects	Initiative		Strategy		Management Activity			Sponsoring Entity	Dates (FY)
	Primary	Supportive	Primary	Supportive	RA	DMT	IE		
City of Jacksonville Timucuan Preserve program	3.1	3.2	3.1.1	3.1.2, 3.1.5	√	x		COJ/NPS	1990–2007
Comprehensive Nutrient and Water Use Research Project in the TCAA	3.1		3.1.2		√	x	x	SJRWMD/ IFAS	2007
Controlled Release Fertilizer (CRF) Field Demonstration Study Stormwater Analysis	3.1		3.1.2		√	x	x	SJRWMD	2005–2006
Controlled Release On-Farm Project: An Alternative Irrigation Program for Potato Crops to Reduce Water and Nutrient Use	3.1		3.1.2		√	x	x	SJRWMD/ IFAS	2005–2007
Crop Yield Sap/Tissue Analysis for the Controlled Release Fertilizer Field Demonstration Study in the Tri-County Agricultural Area	3.1		3.1.2		√	x	x	SJRWMD/ IFAS	2005-– 2007
Dairy Baseline Water Quality Monitoring	3.1	3.4	3.1.2	3.1.5	√	x		SJRWMD	1999–2007
Deep Creek West Regional Stormwater Treatment	3.1		3.1.2				√	SJRWMD	1998–2006
Demonstration Project Using Controlled Release Fertilizers on In-Field Chip Potatoes	3.1		3.1.2		√	x		SJRWMD/ IFAS	2005–2007
Determination of Nutrient Release Curves for Controlled Release Fertilizer	3.1		3.1.2		√	x	x	SJRWMD/ IFAS	2000–2004
Development of a Decision Matrix to Recommend Regional Surface and Stormwater Treatment Alternatives	3.1		3.1.2			√	x	SJRWMD	2002
Development of the Watershed Assessment Model (WAM)	3.1		3.1.2			√	x	SJRWMD	1997–2007
Edgefield Regional Stormwater Treatment	3.1		3.1.2				√	SJRWMD	2001–2007
Effects of Fertilizer Types and Fertilization Practices on Nitrogen Release to Surface Waters	3.1		3.1.2		√	x	x	SJRWMD/ IFAS	2002–2005

Past/Current Projects	Initiative		Strategy		Management Activity			Sponsoring Entity	Dates (FY)
	Primary	Supportive	Primary	Supportive	RA	DMT	IE		
Evaluation of Developments of Regional Impacts and Their BMP Efficiencies	3.1	3.2	3.1.1	3.1.5	√	x		SJRWMD	2005–2007
Evaluation of Stormwater Detention Treatment Efficiency Project	3.1		3.1.1		√	x		SJRWMD/ COJ	1993
Engineering and Design of the IFAS Plant Science Research and Education Unit's Hastings Farm	3.1		3.1.2			√	x	SJRWMD/ IFAS	2007
Expansion of Controlled Release Fertilizer Testing for Additional Crops	3.1		3.1.2		√	x	x	SJRWMD/ IFAS/ FDACS	2007
Geographic Information System (GIS) Land Use Assessment	3.1		3.1.2			√	x	SJRWMD	2005
Implementation of Aquaculture BMPs	3.1		3.1.2				√	SJRWMD	2003
Land Use Effect on Shallow Groundwater Pollution	3.1		3.1.1			√		SJRWMD	2006–2007
Lower St. Johns River Groundwater Monitoring Program	3.1	3.4	3.1.6	3.1.5	√	x		SJRWMD	2003–2007
LSJR Mainstem Basin Management Action Plan Process	3.1		3.1.1	3.1.3			√	FDEP/ SJRWMD	2005–2007
LSJR Tributary Basin Management Action Plan Process	3.1		3.1.1	3.1.3		x	√	FDEP/ SJRWMD	2005–2007
Lower St. Johns Watershed Action Volunteers	3.1	3.4	3.1.1	3.1.5	√	x		SJRWMD	1995–2007
Macroinvertebrate Sampling in the TCAA Tributaries	3.1	3.2	3.1.2		√			SJRWMD	1995–2007
Measurement of Lateral Flow in the Tri-County Agricultural Area (TCAA)	3.1		3.1.2		√	x	x	SJRWMD	2005–2007
Mid-Mainstem Ambient Monitoring Network	3.1	3.4	3.1.1, 3.1.2	3.1.5	√	x		SJRWMD	1984–2007
Monitoring Lower St. Johns Tide Levels	3.1		3.1.1	3.1.3, 3.1.4	√	x		SJRWMD	1999–2007
Northern Ambient Monitoring Network	3.1	3.2, 3.4	3.1.1, 3.1.2	3.1.5	√	x		SJRWMD	1991–2007
Northern Tributary Ambient Monitoring Network	3.1	3.2, 3.4	3.1.1, 3.1.2	3.1.5	√	x		SJRWMD	1984–2007

Past/Current Projects	Initiative		Strategy		Management Activity			Sponsoring Entity	Dates (FY)
	Primary	Supportive	Primary	Supportive	RA	DMT	IE		
Nutrient Transport and Organic Decomposition in Agricultural Flatwood	3.1		3.1.2		√	x		SJRWMD	2003–2004
Peters Creek Restoration Initiative/ Black Creek Subbasin Agricultural Nonpoint Source Land Use Assessment	3.1		3.1.2		√	x		SJRWMD	2000–2003
Point-Source Assessment Project	3.1		3.1.3		√	x		FDEP/ Duval County/ SJRWMD	1994–1997
Preliminary Lower St. Johns River Mainstem Nutrient BMAP Implementation	3.1		3.1.1	3.1.3			√	SJRWMD	1997–2007
Salinity/Dissolved Oxygen/PAR Measurements	3.1		3.1.1	3.1.3, 3.1.4	√	x		USGS/ SJRWMD	1996–2007
Section 319 Best Management Practice (BMP) Project	3.1		3.1.2		√	x		FDEP/ SJRWMD	1993–1997
Southern Ambient Monitoring Network	3.1	3.2, 3.4	3.1.1, 3.1.2	3.1.5	√	x		SJRWMD	1993–2007
St. Johns River Synoptic Survey	3.1		3.1.1		√			SJRWMD	1997
St. Johns River Water Quality Feasibility Study	3.1		3.1.1		√	x		SJRWMD/ USACE/ NOS/ USGS	1994
Study of Primary Production and Nutrient Limitation by Phytoplankton in the LSJR	3.1	3.2	3.1.1		√	x		UF/SJRWMD	1995–1997
Tributary Discharge Monitoring	3.1		3.1.1	3.1.3	√	x		FDEP/ SJRWMD	1996–2007
USGS/SJRWMD Mainstem Water Quality Monitoring	3.1		3.1.1	3.1.3	√	x		SJRWMD/ USGS	1993–2007
USGS Tributary and River Flow Gauging	3.1		3.1.1	3.1.3	√	x		SJRWMD/ USGS	1989–2007
Water Quality Monitoring Assessment	3.1		3.1.1	3.1.3	√	x		SJRWMD	1988–2007
Water Quality Monitoring in the Timucuan Preserve	3.1	3.2	3.1.1	3.1.2, 3.1.5	√	x		FDEP/ NPS/ COJ-ERD	2005–2007

Past/Current Projects	Initiative		Strategy		Management Activity			Sponsoring Entity	Dates (FY)
	Primary	Supportive	Primary	Supportive	RA	DMT	IE		
BIOLOGICAL HEALTH INITIATIVE									
Ambient Light Levels within Grassbeds	3.2		3.2.3		√			Water and Air Research	2002
Assess the Effects of Land Use Changes on the Lower St. Johns River Basin Watershed Detrital Input	3.2		3.2.3		√	x		University of Alabama	2004–2007
Assessment of Epiphyte Loading Associated with Submerged Aquatic Vegetation (SAV) Communities in the Lower St. Johns River	3.2		3.2.2	3.2.3, 3.2.4	√	x		UNF	2005–2007
Before and After Effects of Developments of Regional Impacts on Receiving Streams	3.2		3.2.1					SJRWMD	2005–2007
Biological Monitoring-Phytoplankton	3.2	3.1	3.2.4	3.2.1	√			SJRWMD	1994–2007
The Effects of Changing Nutrient Conditions on the Structure and Function of the Phytoplankton of the Lower St. Johns River	3.2	3.1	3.2.4	3.1.5	√			SJRWMD	2001–2004
Effects of Land Use on In-Stream Biota	3.2	3.1, 3.4	3.2.1	3.2.3	√	x		SJRWMD	2004–2007
Elemental Contents in Submerged Aquatic Vegetation (SAV) Tissue in the Lower St. Johns River	3.2		3.2.2		√			SJRWMD	2005
Environmental Factors Affecting the Distribution and Health of Submerged Aquatic Plants in the Lower St. Johns River	3.2		3.2.2	3.2.3	√	x		SJRWMD	1998–2003
Establishment of Native Vegetation Riparian Buffer Zones for Nutrient Reduction in the Lower St. Johns River Basin	3.2		3.2.3	3.2.6		√		SJRWMD/ UNF	2006–2007
Estuarine Autonomous Instrumentation Platform and MERHAB	3.2		3.2.5		√			SJRWMD	1999–2001

Past/Current Projects	Initiative		Strategy		Management Activity			Sponsoring Entity	Dates (FY)
	Primary	Supportive	Primary	Supportive	RA	DMT	IE		
Evaluation of Impacts to Fish Communities from Low Dissolved Oxygen Episodes in the Lower St. Johns, a Eutrophic Blackwater River	3.2		3.2.5	3.2.4	√	x		Florida State Wildlife Grant	2005–2007
Evaluation of Relationships between Submerged Aquatic Vegetation (SAV) and Fish Community Structure in the St. Johns River	3.2		3.2.2	3.2.5	√			SJRWMD	1995
Fish Community Structure in Four Tidal Creeks Tributary to the Lower St. Johns River	3.2		3.2.5		√			SJRWMD/ UNF	1996
Fisheries - Independent Monitoring (FIM) Program	3.2		3.2.5		√	x		FWCC	2001–2007
Hyperspectral Imaging for Submerged Aquatic Vegetation (SAV) Identification	3.2		3.2.2	3.2.3	√	x		SJRWMD	2003, 2006
Land Acquisition	3.2		3.2.6				√		1994–2004
Lower St. Johns River Submerged Aquatic Vegetation (SAV) Monitoring	3.2		3.2.2		√			SJRWMD	1995–2007
Microbial Food Web Dynamics in the Lower St. Johns River Basin	3.2		3.2.3			√		SJRWMD	2007
SAV-Coupled Macroinvertebrate Sampling in the Lower St. Johns River Basin	3.2		3.2.1		√			SJRWMD	2007
Sediment Characterization in Submerged Aquatic Vegetation (SAV) Beds	3.2		3.2.2	3.2.3	√	x		University of Florida	2005
Shallow Groundwater Sampling in the Root Zone of Submerged Aquatic Vegetation (SAV)	3.2							SJRWMD	2006–2007
Spectral Processing Methodology for Development of Airborne Imagery of Submerged Aquatic Vegetation (SAV) in the Lower St. Johns River	3.2		3.2.2		√			University of Florida	2005

Past/Current Projects	Initiative		Strategy		Management Activity			Sponsoring Entity	Dates (FY)
	Primary	Supportive	Primary	Supportive	RA	DMT	IE		
Submerged Aquatic Vegetation (SAV) Photointerpretation	3.2		3.2.2	3.2.3	√	x		SJRWMD/ U.S. Imaging/ Jones Edmunds & Assoc	1998, 2002
SEDIMENT MANAGEMENT INITIATIVE									
Hogan Creek Ecosystem Restoration	3.2		3.2.3		√			USACE	2005
Maintenance Dredging of Intracoastal Waterway	3.3		3.3.1				√	USACE	2005–2006
Maintenance Dredging of Jacksonville Harbor and Vicinity	3.3		3.3.1				√	USACE	1993–2007
Reduction of Adverse Effects from Construction Sites and Disturbed Areas	3.3		3.3.1				√	COJ	1987–2007
TOXIC CONTAMINANTS REMEDIATION INITIATIVE									
Assessment of Tissue Contaminant Burdens Found in Animals Collected from the Lower St. Johns River	3.4	3.2	3.4.1		√			SJRWMD	1996–1998, 2002–2003
Benthic Macroinvertebrate Data from Twenty Surface Water Sites within the Lower St. Johns River / An Evaluation of Benthic Macroinvertebrate Data from Twenty Surface Water Sites within the Lower St. Johns River	3.4	3.2	3.4.1		√			SJRWMD	2002–2003
Cedar River Stormwater Treatment Outfall Monitoring	3.4		3.4.1		√	x		SJRWMD	2007
Chemical Contamination of Sediments in the Cedar-Ortega River Basin	3.4		3.4.1		√			SJRWMD	1998–1999
Chevron Docks	3.4		3.4.2				√	Chevron/ FDEP/ SJRWMD	2002

Past/Current Projects	Initiative		Strategy		Management Activity			Sponsoring Entity	Dates (FY)
	Primary	Supportive	Primary	Supportive	RA	DMT	IE		
Deer Creek Remediation	3.4		3.4.2				√	EPA/NOAA/ FDEP/ SJRWMD/ Kerr-McGee (Tronox)	2000–2007
Fishing Creek	3.4		3.4.2				√	FIND/COJ/ USACE/ SJRWMD	
Fishweir Creek Remediation	3.4		3.4.2				√	USACE/ COJ/FDEP/ SJRWMD	2005–2007
McCoy Creek	3.4		3.4.2				√	COJ/ SJRWMD	1993–2007
Mill Cove Creek Remediation	3.4		3.4.2				√	FDEP/COJ/ USACE/ SJRWMD	2002
Moncrief Creek	3.4		3.4.2				√	COJ/ FDEP/ DOH/ SJRWMD	
National Oceanic and Atmospheric Administration (NOAA) Status and Trends Monitoring in the Lower St. Johns River	3.4	3.1, 3.2	3.4.1		√	x		NOAA	2002–2004
Naval Air Station (NAS) Jacksonville Remediation	3.4		3.4.2				√	NAS Jax/EPA/ NOAA/ FDEP/ SJRWMD	1993–2000
Pesticide Occurrence in Receiving Waters in the Tri-County Agricultural Area	3.4		3.4.1		√			SJRWMD/ EPA	1992–1997
Rice Creek Contaminant Assessment	3.4		3.4.1		√			FDOH	2003
Sediment Contaminant Assessment Associated with Wet Detention	3.4		3.4.1		√	x		COJ/ SJRWMD	2007
Sediment Quality of the Lower St. Johns River and the Cedar-Ortega River Basin	3.4		3.4.1		√			SJRWMD	1996–1999

Past/Current Projects	Initiative		Strategy		Management Activity			Sponsoring Entity	Dates (FY)
	Primary	Supportive	Primary	Supportive	RA	DMT	IE		
Sediment Transport Model for the Cedar-Ortega Rivers	3.4		3.4.1			√	x	SJRWMD	1998–2002
Toxicological Plan for the Lower St. Johns River	3.4		3.4.1		√	x		SJRWMD	1996–1998
INTERGOVERNMENTAL COORDINATION INITIATIVE									
Harmful Algal Bloom Coordination	3.6							SJRWMD	1997–2007
Intergovernmental Coordination	3.6							SJRWMD	1993–2007
Lower Basin Interagency Program Coordination	3.6							SJRWMD	1993–2007
Lower St. Johns River Technical Advisory Committee (TAC) Support	3.6							SJRWMD/ local sponsors	1993–2007
Public and Media Communications Staff	3.6							SJRWMD	1993–2007
Reuse Initiative/Integrated Water Management Plan	3.6							SJRWMD	2006–2007
River Accord	3.6							COJ/ SJRWMD/ JEA/ WSEA/ FDEP	2006–2007
River Summits and River Agenda	3.6							SJRWMD/ local and state representatives	1997–2003
St. Johns River Alliance	3.6							SJRWMD; Brevard, Indian River, Osceola, Lake, Orange, Seminole, Volusia, Putnam, Flagler, Clay, and St. Johns counties; COJ; Private Sponsors	2003–2007
Total Maximum Daily Load (TMDL) Coordination Process	3.6							FDEP	2001–2007

Table F-2: Future Management Projects in the Lower St. Johns River Basin

Future Projects	Initiative		Strategy		Project Type			Sponsoring Entity	Dates (FY)
	Primary	Supportive	Primary	Supportive	RA	DMT	IE		
WATER QUALITY INITIATIVE									
Agricultural BMP Cost-Share Program—Phase II	3.1		3.1.2				√	SJRWMD/ IFAS/ USDA	2008–2011
Agricultural Receiving Streams Evaluation	3.1	3.4	3.1.2	3.1.5	√	x		SJRWMD	2008–2010
Algal Initiative	3.1		3.1.2			√	x	SJRWMD	2008–2012
Algal Toxin Monitoring	3.1	3.2	3.1.1	3.1.3	√			SJRWMD	2008–2012
Ambient Water Quality Monitoring in the TCAA	3.1		3.1.2		√	x		SJRWMD	2008–2012
Aquatic Organic Matter Characterization	3.1		3.1.1			√	x	SJRWMD	2008–2009
Best Management Practice (BMP) Geographic Information System (GIS) Tracking Tool	3.1		3.1.2			√	x	SJRWMD	2008–2010
Chip Potato Grower Demonstration Projects Using Controlled Release Fertilizers	3.1		3.1.2			√	x	SJRWMD/ IFAS	2008–2010
City of Jacksonville Mainstem Run	3.1	3.2	3.1.1	3.1.2, 3.1.5	√	x		COJ	2008–2012
COJ MS4 Permit Monitoring Program: Stormwater BMP Effectiveness Studies	3.1	3.2, 3.4	3.1.1	3.1.5	√	x		COJ	2008–2012
COJ MS4 Permit Monitoring Program: Tributary Intensive Program	3.1	3.2, 3.4	3.1.1	3.1.5	√	x		COJ	2008–2012
COJ Tributary Routine Program	3.1	3.2, 3.4	3.1.1	3.1.5	√	x		COJ	2008–2012
City of Jacksonville Timucuan Preserve program	3.1	3.2	3.1.1	3.1.2, 3.1.5	√	x		COJ/ NPS	2008–2012
Compliance with TMDL and PLRG Water Quality Goals	3.1		3.1.1	3.1.3	√	x		SJRWMD	2008–2012
Comprehensive Nutrient and Water Use Research Project in the TCAA	3.1		3.1.2		√	x	x	SJRWMD/ IFAS	2008–2010
Controlled Release On-Farm Project: An Alternative Irrigation Program for Potato Crops to Reduce Water and Nutrient Use	3.1		3.1.2		√	x	x	SJRWMD/ IFAS	2008

Future Projects	Initiative		Strategy		Project Type			Sponsoring Entity	Dates (FY)
	Primary	Supportive	Primary	Supportive	RA	DMT	IE		
Dairy Baseline Water Quality Monitoring	3.1	3.4	3.1.2	3.1.5	√	x		SJRWMD	2008–2012
Development of Regional Stormwater Treatment (RST)	3.1		3.1.2				√	SJRWMD/ FDOT	2008–2012
Engineering and Design of the IFAS Plant Science Research and Education Unit's Hastings Farm	3.1		3.1.2			√	x	SJRWMD/ IFAS	2008
Establishment of the University of Florida/IFAS Field Station on Urban Nonpoint Source Reductions in Hastings	3.1		3.1.2			√		SJRWMD/ IFAS	2008–2010
Evaluation of Developments of Regional Impacts and Their BMP Efficiencies	3.1	3.4	3.1.1	3.1.5	√	x		SJRWMD	2008–2010
Expansion of Controlled Release Fertilizer Testing for Additional Crops	3.1		3.1.2		√	x	x	SJRWMD/ IFAS/ FDACS	2008–2009
Extension of the Western Atlantic Tide Model	3.1		3.1.1	3.1.4		√		SJRWMD	2008
Geographic Information System (GIS) Land Use Assessment	3.1		3.1.2			√	x	SJRWMD	2010
Inner Shelf Water Quality in the South Atlantic Bight	3.1		3.1.1	3.1.3, 3.1.4	√	x		SJRWMD	2008–2012
Land Use Effect on Shallow Groundwater Pollution	3.1		3.1.1			√		SJRWMD	2008–2012
Lower St. Johns River Groundwater Monitoring Program	3.1	3.4	3.1.6	3.1.5	√	x		SJRWMD	2008–2012
Lower St. Johns River Mainstem Nutrient BMAP Implementation	3.1		3.1.1	3.1.3			√	FDEP/ SJRWMD	2008–2012
Lower St. Johns Watershed Action Volunteers	3.1	3.4	3.1.1	3.1.5	√	x		SJRWMD	2008–2012
Low Impact Development (LID) Stormwater Management Project	3.1		3.1.2			√		SJRWMD/ IFAS	2008–2012
LSJR Mainstem Basin Management Action Plan Process	3.1		3.1.1	3.1.3			√	FDEP/ SJRWMD	2008–2012
LSJR Tributary Basin Management Action Plan Process	3.1		3.1.3			x	√	FDEP/ SJRWMD	2008–2012
Mid-Mainstem Ambient Monitoring Network	3.1	3.4	3.1.1, 3.1.2	3.1.5	√	x		SJRWMD	2008–2012

Future Projects	Initiative		Strategy		Project Type			Sponsoring Entity	Dates (FY)
	Primary	Supportive	Primary	Supportive	RA	DMT	IE		
Monitoring Lower St. Johns Tide Levels	3.1		3.1.1	3.1.3, 3.1.4	√	x		SJRWMD	2008–2012
Monitoring, Operation & Maintenance of Regional Stormwater Treatment Areas	3.1		3.1.2				√	SJRWMD	2008–2012
Northern Ambient Monitoring Network-Mainstem	3.1	3.4	3.1.1, 3.1.2	3.1.5	√	x		SJRWMD	2008–2012
Northern Tributary Ambient Monitoring Network	3.1	3.4	3.1.1, 3.1.2	3.1.5	√	x		SJRWMD	2008–2012
Regional Stormwater Treatment Optimization Monitoring	3.1		3.1.2				√	SJRWMD	2008–2012
Salinity/Dissolved Oxygen/PAR Measurements	3.1		3.1.1	3.1.3, 3.1.4	√	x		USGS/ SJRWMD	2008–2012
Southern Ambient Monitoring Network	3.1	3.4	3.1.1, 3.1.2	3.1.5	√	x		SJRWMD	2008–2012
Tide Marsh Exchange with the Lower St. Johns River	3.1		3.1.1	3.1.3	√	x		SJRWMD	2008–2012
Timucuan Preserve Probabilistic Survey	3.1	3.4	3.1.1	3.1.5	√			NPS	2008
Tributary Discharge Monitoring	3.1		3.1.1	3.1.3	√	x		FDEP/ SJRWMD	2008–2012
Upgrade the Watershed Assessment Model (WAM)	3.1		3.1.2			√	x	SJRWMD	2008–2012
USGS/SJRWMD Mainstem Water Quality Monitoring	3.1		3.1.1	3.1.3	√	x		USGS/ SJRWMD	2008–2012
USGS Tributary and River Flow Gauging	3.1		3.1.1	3.1.3	√	x		USGS	2008–2012
Water Quality Monitoring Assessment	3.1		3.1.1	3.1.3	√	x		SJRWMD	2008–2012
Water Quality Monitoring in the Timucuan Preserve	3.1	3.2	3.1.1	3.1.2, 3.1.5	√	x		FDEP/ NPS/ COJ-ERD	2008–2012
BIOLOGICAL HEALTH INITIATIVE									
As-Needed Sampling for Harmful Algal Blooms	3.2		3.2.4		√			SJRWMD	2008–2012
Before and After Effects of Developments of Regional Impacts on Receiving Streams	3.2		3.2.1					SJRWMD	2008–2012
Biological Monitoring-Phytoplankton	3.2	3.1	3.2.4	3.2.1	√			SJRWMD	2008–2012

Future Projects	Initiative		Strategy		Project Type			Sponsoring Entity	Dates (FY)
	Primary	Supportive	Primary	Supportive	RA	DMT	IE		
Establishment of Native Vegetation Riparian Buffer Zones for Nutrient Reduction in the Lower St. Johns River Basin	3.2		3.2.3	3.2.6		√		SJRWMD, UNF	2008–2009
Evaluation of the Function and Importance of Tidal Marshes to the Biological Functions of the Lower St. Johns River	3.2		3.2.1	3.2.5	√			SJRWMD	2009–2012
Evaluation of Impacts to Fish Communities from Low Dissolved Oxygen Episodes in the Lower St. Johns, A Eutrophic Blackwater River	3.2		3.2.5	3.2.4	√	x		Florida State Wildlife Grant	2008
Fisheries - Independent Monitoring (FIM) Program	3.2		3.2.5		√			FWC/ SJRWMD	2008–2012
Hyperspectral Imaging for Submerged Aquatic Vegetation (SAV) Identification	3.2		3.2.2	3.2.3	√			SJRWMD	2008, 2010
Identification of Biological Indicators of Ecosystem Health	3.2		3.2.1			√		SJRWMD	2010–2012
Lower St. Johns River Submerged Aquatic Vegetation (SAV) Monitoring	3.2		3.2.2		√			SJRWMD	2008
Microbial Food Web Dynamics in the Lower St. Johns River Basin	3.2		3.2.3			√		SJRWMD	2008–2010
SAV-Coupled Macroinvertebrate Sampling in the Lower St. Johns River Basin	3.2		3.2.1		√			SJRWMD	2008–2009
Shallow Groundwater Sampling in the Root Zone of Submerged Aquatic Vegetation (SAV)	3.2							SJRWMD	2008–2010
SEDIMENT MANAGEMENT INITIATIVE									
Big Fishweir Creek Ecosystem Restoration	3.3		3.3.1		√			USACE	2008–2010
Future Channel Improvements	3.3		3.3.1				√	USACE	2008–2010
Maintenance Dredging of Intracoastal Waterway	3.3		3.3.1				√	USACE	2009
Maintenance Dredging of Jacksonville Harbor and Vicinity	3.3		3.3.1				√	USACE	2008–2010

Future Projects	Initiative		Strategy		Project Type			Sponsoring Entity	Dates (FY)
	Primary	Supportive	Primary	Supportive	RA	DMT	IE		
Reduction of Adverse Effects from Construction Sites and Disturbed Areas	3.3		3.3.1				√	COJ	2008–2012
TOXIC CONTAMINANTS REMEDIATION INITIATIVE									
Agricultural Pesticide and Contaminant Assessment	3.4		3.4.1	3.4.2	√	x		SJRWMD/ IFAS	2009
Cedar River Stormwater Treatment Outfall Monitoring	3.4		3.4.1	3.4.2	√	x		SJRWMD	2009–2011
Contaminant Assessment in the Lower St. Johns River								SJRWMD	2009–2012
Deer Creek Remediation	3.4		3.4.2				√	EPA/ NOAA/ FDEP/ SJRWMD/ Kerr-McGee (Tronox)	2008–2012
Fishweir Creek Remediation	3.4		3.4.2				√	USACE/ COJ/ FDEP/ SJRWMD	2008–2012
McCoy Creek	3.4		3.4.2				√	COJ/ SJRWMD	2008–2012
Sediment Contaminant Assessment Associated with Wet Detention	3.4		3.4.1		√	x		COJ/ SJRWMD	2008–2011
INTERGOVERNMENTAL COORDINATION INITIATIVE									
Harmful Algal Bloom Coordination	3.6							SJRWMD	2008–2012
Intergovernmental Coordination	3.6							SJRWMD	2008–2012
Lower Basin Interagency Program Coordination	3.6							SJRWMD	2008–2012
Lower St Johns River Technical Advisory Committee (TAC) Support	3.6							SJRWMD and local sponsors	2008–2012
Public and Media Communications Staff	3.6							SJRWMD	2008–2012
Reuse Initiative/Integrated Water Management Plan	3.6							SJRWMD	2008–2012

Future Projects	Initiative		Strategy		Project Type			Sponsoring Entity	Dates (FY)
	Primary	Supportive	Primary	Supportive	RA	DMT	IE		
River Accord	3.6							COJ/ SJRWMD/ JEA/ WSEA/ FDEP	2008–2012
St. Johns River Alliance	3.6							SJRWMD; Brevard, Indian River, Osceola, Lake, Orange, Seminole, Volusia, Putnam, Flagler, St. Johns, and Clay counties; COJ; Private Sponsors	2008–2012
Total Maximum Daily Load (TMDL) Coordination Process	3.6							FDEP	2008–2012

Table F-3: Past/Current Management Projects in the Lake George Basin

Past/Current Projects	Initiative		Strategy		Project Type			Sponsoring Entity	Dates (FY)
	Primary	Supportive	Primary	Supportive	RA	DMT	IE		
WATER QUALITY INITIATIVE									
Continuous Water Quality Monitoring in Lake George	5.5.1		5.5.1.4		√			SJRWMD	1994–2007
Expansion of the LSJR Water Quality Model through Lake George	5.5.1		5.5.1.1			√		SJRWMD	2005–2007
Lake George Phosphorus Removal Feasibility Project-Reconnaissance Phase	5.5.1		5.5.1.4			√		SJRWMD	2007
Lake George Water Quality Modeling	5.5.1		5.5.1.1			√		SJRWMD	2007
Plankton Enumeration and Identification in Lake George	5.5.1		5.5.1.4		√			SJRWMD	1997–2007
BIOLOGICAL HEALTH INITIATIVE									
The Effects of Changing Nutrient Conditions on the Structure and Function of the Phytoplankton of the Lower St. Johns River	5.5.2	5.5.1	5.5.2.3	5.5.1.4	√			SJRWMD	2001–2004
Submerged Aquatic Vegetation (SAV) Monitoring	5.5.2		5.5.2.3					SJRWMD	1999–2003
SEDIMENT MANAGEMENT INITIATIVE									
Examination of Sediment Exchange in Lake George	5.5.3	3.1.5, 5.5.2	5.5.4	3.1.5, 5.5.1.4	√			SJRWMD	2006–2007

Table F-4: Future Management Projects in the Lake George Basin

Future Projects	Initiative		Strategy		Project Type			Sponsoring Entity	Dates (FY)
	Primary	Supportive	Primary	Supportive	RA	DMT	IE		
WATER QUALITY INITIATIVE									
Assessment of P reduction Targets in Lake George	5.5.1		5.5.1.4		√	x		SJRWMD	2008–2010
Continuous Water Quality Monitoring in Lake George	5.5.1		5.5.1.4		√			SJRWMD	2008–2012
Effect of Control Methods on Relative Composition of Water Lettuce	5.5.2		5.5.2.3			√		SJRWMD	2009–2011
Expansion of the LSJR Water Quality Model Though Lake George	5.5.1		5.5.1.1			√		SJRWMD	2008–2010
Fisheries Composition Survey Work	5.5.2		5.5.2.3		√	x		SJRWMD	2008–2010
Floating Aquatic Plant Cultivation Feasibility	5.5.1		5.5.1.4			√		SJRWMD	2008–2010
Floating Aquatic Plant Module Application Modeling	5.5.1		5.5.1.4			√		USACE/ SJRWMD	2008–2009
Lake George Phosphorus Removal Feasibility Project	5.5.1		5.5.1.4			√		SJRWMD	2008–2009
Lake George Phosphorus Sediment Flux	5.5.1		5.5.1.4			√		SJRWMD	2008–2010
Lake George Water Quality Modeling	5.5.1		5.5.1.1			√		SJRWMD	2008–2009
Plankton Enumeration and Identification in Lake George	5.5.1	5.5.2	5.5.1.4	5.5.2.3	√			SJRWMD	2008–2012
Potential Uses of Recycled Biomass	5.5.1		5.5.1.4			√		SJRWMD	2010–2011
BIOLOGICAL HEALTH INITIATIVE									
Primary Productivity in Lake George	5.5.2	5.5.1	5.5.2.3	5.5.1.4				SJRWMD	2008–2010
SEDIMENT MANAGEMENT INITIATIVE									
Examination of Sediment Exchange in Lake George	5.5.3		5.5.1.4		√	x		SJRWMD	2008–2012

APPENDIX G: LIST OF VERIFIED IMPAIRED WATERS IN THE LOWER ST. JOHNS RIVER AND LAKE GEORGE BASINS

Table G-1: List of Verified Impaired Waters in the Lower St. Johns River Basin

WBID	Waterbody Segment Name	Waterbody Type	Parameters Assessed Using the Impaired Waters Rule	Projected Year for TMDL Development
2181	Dunn Creek	Stream	Fecal Coliforms	2008
2191	Broward River	Estuary	Dissolved Oxygen, Fecal Coliforms	2008
2203	Trout River	Stream	Dissolved Oxygen, Fecal Coliforms	2008
2203A	Trout River	Estuary	Fecal Coliforms	2008
2204	Terrapin Creek	Stream	Dissolved Oxygen, Fecal Coliforms	2008
2207	Block House Creek	Stream	Fecal Coliforms	2008
2210	West Branch	Stream	Fecal Coliforms	2008
2213A	St. Johns River Above Mouth	Estuary	Iron, Copper, Nickel	2008
2213B	St. Johns River Above ICWW	Estuary	Copper, Iron, Lead, Nickel	2008
2213C	St. Johns River Above Dames Pt	Estuary	Copper, Iron, Nickel	2008
2213D	St. Johns River Above Trout River	Estuary	Copper, Iron, Nickel	2008
2213E	St. Johns River Above Warren Bridge	Estuary	Copper, Iron, Nickel	2008
2213G	St. Johns River Above Doctor's Lake	Lake	Cadmium	2008
2213I	St. Johns River Above Black Creek	Lake	Silver	2008
2213P	Ortega River	Stream	Nutrients (chlorophyll a), Dissolved Oxygen, Fecal Coliforms, Lead	2008
2220	Ninemile Creek	Stream	Dissolved Oxygen, Fecal Coliforms	2008
2224	Ribault River	Stream	Dissolved Oxygen, Fecal Coliforms	2008
2227	Sherman Creek	Stream	Dissolved Oxygen, Fecal Coliforms	2008
2228	Moncrief Creek	Estuary	Copper, Fecal Coliforms, Iron, Lead, Nutrients (chlorophyll a)	2004
2232	Sixmile Creek Reach	Stream	Fecal Coliforms	2008
2233	Long Branch	Stream	Fecal Coliforms	2008
2235	New Castle Creek	Stream	Fecal Coliforms	2008
2238	Little Sixmile Creek	Stream	Fecal Coliforms	2008
2239	Strawberry Creek	Stream	Fecal Coliforms	2008
2240	Greenfield Creek	Stream	Fecal Coliforms	2008
2244	Cow Head Creek	Stream	Fecal Coliforms	2008
2246	Jones Creek	Stream	Fecal Coliforms	2008
2248	Gin House Creek	Stream	Fecal Coliforms	2008
2249A	Ortega River	Stream	Fecal Coliforms	2008
2249B	McGirts Creek	Stream	Fecal Coliforms	2008
2252	Hogan Creek	Stream	Fecal Coliform	2004
2254	Red Bay Branch	Stream	Fecal Coliforms	2008
2256	Deer Creek	Stream	Dissolved Oxygen, Fecal Coliforms	2008
2257	McCoy Creek	Stream	Fecal Coliforms	2008
2262	Cedar River	Stream	Dissolved Oxygen, Fecal Coliforms	2004
2265A	Arlington River	Estuary	Nutrients (chlorophyll a)	2008

WBID	Waterbody Segment Name	Waterbody Type	Parameters Assessed Using the Impaired Waters Rule	Projected Year for TMDL Development
2265B	Pottburg Creek	Stream	Fecal Coliforms	2008
2266	Hopkins Creek	Stream	Fecal Coliforms	2008
2270	Hogpen Creek	Stream	Fecal Coliforms	2008
2273	Mill Dam Creek	Stream	Dissolved Oxygen	2008
2278	Silversmith Creek	Stream	Fecal Coliforms	2008
2280	Big Fishweir Creek	Stream	Fecal Coliforms	2008
2282	Wills Branch	Stream	Fecal Coliforms	2004
2284	Little Pottsburg Creek	Stream	Fecal Coliforms	2008
2287	Miller Creek	Stream	Dissolved Oxygen	2008
2297	Craig Creek	Stream	Dissolved Oxygen, Fecal Coliforms	2008
2299	Open Creek	Stream	Fecal Coliforms	2008
2304	Miramar Creek	Stream	Fecal Coliforms	2008
2306	New Rose Creek	Stream	Fecal Coliforms	2008
2308	Leeds Pond	Lake	Fecal Coliforms	2008
2316	Williamson Creek	Stream	Fecal Coliforms	2004
2321	Christopher Branch	Stream	Fecal Coliforms	2008
2322	Butcher Pen Creek	Stream	Dissolved Oxygen, Fecal Coliforms, Nutrients (chlorophyll a)	2004
2324	Fishing Creek	Stream	Dissolved Oxygen, Fecal Coliforms	2004
2326	Goodbys Creek	Stream	Dissolved Oxygen, Fecal Coliforms	2008
2356	Big Davis Creek	Stream	Fecal Coliforms	2008
2361	Deep Bottom Creek	Stream	Fecal Coliforms	2008
2365	Durbin Creek	Stream	Dissolved Oxygen, Fecal Coliforms, Nutrients (chlorophyll a)	2004
2370	Oldfield Creek	Stream	Fecal Coliforms	2008
2381	Cormorant Creek	Stream	Fecal Coliforms	2008
2382	Unnamed Drain	Stream	Dissolved Oxygen, Fecal Coliforms	2008
2385	Mandarin Drain	Stream	Fecal Coliforms	2008
2389	Doctors Lake	Lake	Nutrients (TSI)	2008
2410	Swimming Pen Creek	Stream	Nutrients (chlorophyll a)	2008
2415A	Black Creek Above St. Johns River	Stream	Dissolved Oxygen	2008
2423	Mill Log Creek	Stream	Dissolved Oxygen, Iron, Lead	2008
2424	Bradley Creek	Stream	Dissolved Oxygen, Lead	2008
2460	Mill Creek	Stream	Dissolved Oxygen, Nutrients (chlorophyll a)	2008
2538	Cedar Creek	Stream	Nutrients (chlorophyll a)	2008
2540	Moccain Branch	Stream	Dissolved Oxygen	2004
2543F	Lake Ross	Lake	Nutrients (TSI)	2008
2549	Deep Creek	Stream	Dissolved Oxygen, Nutrients (chlorophyll a)	2004
2561	Unnamed Ditches	Stream	Dissolved Oxygen	2008
2569	West Run Interceptor D	Stream	Dissolved Oxygen	2004
2571	Unnamed Ditch	Stream	Dissolved Oxygen	2008

WBID	Waterbody Segment Name	Waterbody Type	Parameters Assessed Using the Impaired Waters Rule	Projected Year for TMDL Development
2575Q	Cue Lake	Lake	Mercury - Fish	2011
2578	Dog Branch	Stream	Dissolved Oxygen	2008
2583	Cow Branch	Stream	Dissolved Oxygen	2008
2589	Sixteenmile Creek	Stream	Dissolved Oxygen, Nutrients (chlorophyll a)	2008
2592	Mill Branch	Stream	Dissolved Oxygen, Fecal Coliforms, Nutrients (chlorophyll a)	2004
2606A	Dunns Creek	Stream	Dissolved Oxygen, Nutrients (chlorophyll a)	2008
2606B	Crescent Lake	Lake	Iron, Nutrients (TSI)	2008
2622A	Haw Creek Above Crescent Lake	Stream	Dissolved Oxygen, Iron, Nutrients (chlorophyll a)	2004
2630A	Little Haw Creek	Stream	Iron	2004
2630B	Lake Disston	Lake	Iron, Mercury-Fish, Selenium	2008
2630C	Little Haw Spring	Stream	Dissolved Oxygen	2008
2630I	South Lake Talmadge	Lake	Nutrients (TSI)	2008
2680A	Lake Molly	Lake	Nutrients (TSI)	2008
8998	Florida Atlantic Coast	Coastal	Mercury - Fish	2011

Table G-2: List of Verified Impaired Waters in the Lake George Basin

Planning Unit	WBID	Waterbody Segment	Waterbody Type	Parameters Assessed Using the IWR	Projected Year for TMDL Development
Lake George	2213O	St. Johns River Above Ocklawaha River	Stream	Nutrients (Chlorophyll *a*)	2008
Lake George	2892	Lake Margaret	Lake	Mercury (in fish tissue)	2011
Lake George	2893A	Lake George	Lake	Nutrients (TSI)	2008
Lake George	2893A1	St. Johns River Below Lake George	Stream	Nutrients (Chlorophyll *a*)	2008
Lake George	2893A2	St. Johns River Above Lake George	Stream	Dissolved Oxygen	2008
Lake George	2893A2	St. Johns River Above Lake George	Stream	Nutrients (Chlorophyll *a*)	2008
Lake George	2916B	Grasshopper Lake	Lake	Mercury (in fish tissue)	2011
Lake Kerr	2905C	Wildcat Lake	Lake	Mercury (in fish tissue)	2011
Lake Woodruff	2893U	Lake Beresford	Lake	Nutrients (TSI)	2008

ST. JOHNS RIVER WATER MANAGEMENT DISTRICT