Prepared for: Lake County Technical/Management Committee
Prepared by: Water Resource Associates
Date: November 27, 2006
Re: Technical Memorandum Number 1 – Phase 2, Task 2 of the Lake County Water Supply Plan

This task entails surveying Lake County and the region's current water resource related documents. Although the Lake County Water Supply Plan focuses on Lake County, surrounding counties, governments and initiatives will affect future water resource availability and development. Thus, it is essential to have an understanding of water supply development plans and initiatives in the areas surrounding Lake County and their potential influence on water supply projects currently underway or proposed for implementation. A review of existing water supply plans and other pertinent reports related to water needs and sources was carried out fulfill this need. These reports were obtained from utilities, local governments, and water management districts directly or from their websites.

Generally, the documents of interest fall into the following categories: Water supply plans, alternative water supply planning, and surface and groundwater modeling. The following is a list of the projects reviewed:

- 2005 SJRWMD Water Supply Plan;
- 2003 SJRWMD Water Supply Assessment;
- District alternative water supply planning studies (such as surface water from the SJRWMD); and
- Central Florida Regional Reuse Plan (SFWMD, Ongoing);
- Western Orange County/Southern Lake County Sub-Regional Reuse Master Plan (SJRWMD, Planned);
- Lake Apopka Treatability Studies (SJRWMD, Planned);
- Central Florida Aquifer Recharge Enhancement Phase 1 Project (SJRWMD, Ongoing);
- Surface Water Availability Assessment (Tohopekaliga Water Authority and SFWMD, Ongoing);
- East Central Florida Water Supply Planning Initiative, Phase 3 (SJRWMD,

Ongoing);

- Lake County Water Resources Game Plan (Lake County);
- Demineralized Concentrate Management Project (SJRWMD);
- Seawater Desalination Project (SJRWMD, Ongoing);
- St. Johns River (Lake Monroe) Water Supply Project (SJRWMD);
- Aquifer Protection Program (SJRWMD, Ongoing);
- Aquifer Storage and Recovery Test Program (SJRWMD, Ongoing);
- Kissimmee Basin Water Supply Plan (SFWMD, Ongoing);
- East Central Florida Regional Transient Groundwater Modeling (SJRWMD and SFWMD, Ongoing); and
- Wekiva Basin Integrated Surface/Groundwater Modeling (SJRWMD).
- Marion County Water Resource Assessment and Management Study (Marion County)
- Withlacoochee River Water Management District Water Supply Plan Update – 2005 (WRWSA)

Note that many of these projects have multiple associated documents. The complete list of documents and their report numbers is attached.

Each paper was reviewed and summarized for this task. The background, objectives and conclusions of each report are detailed in each summary. These summaries can are attached and can also be accessed via the project management website at http://wraconsultants.updatelog.com.

SJ94-PP3
1994
Revised Spring Conductance Coefficients
Wekiva River Basin Ground Water Flow Model
By:
Ching-tzu Huang, Ph.D., P.E.

Background:

The St. Johns River Water Management District (SJRWMD) uses a numerical ground water flow model for the Wekiva River Basin (GeoTrans 1992) to predict ground water levels and associated springs discharge within the basin. Springs represent the major source of base flow to the Wekiva River. Springs discharges referenced in this paper refer to ground water discharges from areas of diffuse upward leakage and from actual springs. GeoTrans of Herndon, Virginia, developed the model for SJRWMD. The model is based on the three-dimensional finite difference MODFLOW code (McDonald and Harbaugh 1988) and represents the aquifer systems in a quasi three-dimensional form. The model grid is finest in the area of the springs. The model domain encompasses the entire Wekiva River Basin. The model boundaries were designed to coincide as much as possible with ground water flow boundaries.

Objective:

Because of a change in the requirements of the project for which the model was developed, SJRWMD has revised the spring conductance coefficients in the model to increase the precision with which the model simulates spring discharges. The description of the methods used to achieve the revisions and the results are presented in this professional paper.

Conclusion:

The revised spring conductance coefficients provided an improvement in the precision with which the model predicts springs discharges. The predictive capability of the Wekiva River Basin ground water flow model is enhanced by using the revised spring conductance coefficients. Using the revised values, the model simulates between 94.2 and 97.9 percent of observed 1988 (postdevelopment) spring discharges, compared to 87.5 and 95.9 percent using the unrevised spring conductance coefficients. The potentiometric head difference for 1988 postdevelopment conditions using the unrevised and revised spring conductance coefficients indicated that the revised spring conductance coefficients did not alter the potentiometric head contour distribution in the model area except in the close vicinity of several springs.

SJ96-SP4
April 1996
Water Supply Needs and Sources Assessment
Alternative Water Supply Strategies Investigation
Surface Water Withdrawal Sites
By:
CH2M Hill

Background:

St. Johns River Water Management District is evaluating surface water as one of several alternative water supply sources.

Objective:

The primary objective of this evaluation is determining the type and size of water supply facilities required to develop selected surface water sources for public supply, on a preliminary feasibility level. The first step of this procedure is completed, and provided an inventory of available information and established an evaluation procedure. The second step, which is documented in this TM, involves the selection of six candidate withdrawal sites for quantitative evaluation.

Conclusion:

The process used to select the withdrawal sites recommended in Step2 is as follows:

- Plot projected public supply demand increases by county or major demand center on a planning area base map. Counties included were Brevard, Lake, Orange, St. Johns, Seminole, and Volusia.
- On a similar base map, plot the approximate maximum developable surface water supply for each stream gauging station. Maximum developable yield is estimated as 20 percent of the mean annual streamflow.
- Identify candidate withdrawal sites by visual inspection of the relative geographic location of demand centers and the magnitude of the potential surface water yield.

Application of this procedure yielded the following candidate withdrawal sites:

- Lake Griffin (Haines Creek) in Lake County near Leesburg
- St. Johns River near Cocoa
- St. Johns River near Titusville
- St. Johns River at Sanford (Lake Monroe)
- St. Johns River at DeLand
- St. Johns River near Switzerland (northern St. Johns County)

St. Johns River Water Management District approval of the six candidate surface water withdrawal sites identified in this TM is recommended.

SJ97-SP4
1997
Water Supply Needs and Sources Assessment
Alternative Water Supply Strategies Investigation
A Tool for Assessing the Feasibility of Aquifer Storage Recovery
By:
CH2M Hill

Background:

The public water supply within the St. Johns River Water Management District is generally provided by high-quality ground water. Increasing ground water usage without incurring unacceptable environmental impacts is unlikely. SJRWMD has initiated an investigation of the feasibility of alternative water supply strategies. In recent years, aquifer storage recovery (ASR) has been developed as an alternate means of water storage. ASR is defined as storing water in a suitable aquifer through a well during times when water is available, and recovering the water from the same well during times when it is needed..

Objective:

This technical memorandum has provided a tool to assist the SJRWMD and utilities in determining whether ASR would be a feasible alternative in solving a utility's water supply needs. The primary objective for this report is to store water for potable and agricultural use in the study area. It must be determined from the technical, economic, and regulatory perspective whether ASR can replace traditional surface reservoirs and tanks.

Conclusion:

Obstacles in public perception and regulation must be overcome. To date, No Florida ASR system permit has been challenged by the public in such a way as to restrict or delay permitting. Considerable sensitivity exists regarding any existing or proposed activity related to injection wells. Basic education about ASR systems can greatly lessen the potential for such challenges and achieve public approval. Before ASR, regulations were passed to control industrial wastewater injection and to protect drinking water supplies from this waste. The regulations are now realizing the possibility of storing relatively clean water into USDWs and recovering that water for public consumption.

The following rule modifications were provided to FDEP by CH2M HILL (Pyne, 1994) in hopes of adopting distinct rules for ASR technology in order to separate it from existing injection well constraints that impede ASR implementation:

- Remove the requirement for a renewable operating permit for ASR wells that store treated drinking water.

- For ASR wells that store high-quality water that does not fully meet all PDWS, the existing regulations provide a process for issuance of a major or minor aquifer exemption. The aquifer exemption is not really a suitable objective, since it removes protection of the high-quality stored water from potential contamination by other adjacent water users. As a result, the existing regulatory process may have the effect of stunting logical extension of ASR technology from current storage of treated water to future storage of high-quality, but non-potable, water from various sources. An alternative to the existing UIC process, or an alternative track within the UIC process, which applies to ASR wells that store high-quality water that does not quite meet all PDWS, is needed.
- Consolidate ASR permitting regulations in a subsection of Chapter 62-528 F.A.C. pertaining to Class V, Group 7 wells. Divide this subsection into three parts; a) recharge with water that meets PDWS and SDWS; b) recharge with high-quality water that does not quite meet PDWS and SDWS due to exceedance of a selected list of benign parameters such as sodium, chloride, TDS, color, turbidity, corrosivity, and coliforms, and c) recharge with water that is poorer in quality than category b).
- For recharge waters that meet all DWS, regulations would delineate procedures and standards appropriate for such wells. Reflecting the substantially lower degree of risk, such requirements would not include typical Class I well requirements such as mechanical integrity testing 0.5-inch minimum casing thickness and extensive geophysical logging. The requirements would be more closely aligned with requirements for typical municipal production wells.
- For high-quality recharge water that does not quite meet all DWS, the regulations would provide for a permitting track that does not require a UIC aquifer exemption for each site. The preferred approach is a regional water quality exemption, regional USDW variance, or a regional, or site-specific ZOD.

ASR is becoming an integral part of water supply and resource management throughout Florida. ASR practicability extends to other areas of resources management, such as regional aquifer recharge with surface water to augment distant future water supplies, wetland management, drainage control, and others.

SJ97-SP7
1997
Water Supply Needs and Sources Assessment
Alternative Water Supply Strategies Investigation
Surface Water Availability and Yield Analysis
By:
CH2M Hill

Background:

St. Johns River Water Management District is evaluating surface water as one of several alternative water supply sources to help meet municipal water supply needs within the St. Johns River Water Management District. The first surface water supply TM addressed data availability and development of the methodology to be used in the feasibility evaluation. The second TM addressed selection of six candidate surface water withdrawal sites for quantitative analysis.

Objective:

The six candidate sites include Lake Griffin on Haines Creek, in Lake County, and five sites located on the main stem of the St. Johns River from Cocoa downstream to Jacksonville. This TM presents the results of the quantitative water supply availability and yield analysis.

Conclusion:

A similar series of analyses was conducted for each of the six candidate withdrawal sites. The maximum reliable municipal water supply yield for each of the six candidate withdrawal sites is summarized below:

- Lake Griffin (Haines Creek) 28 mgd
- St. John River near Cocoa 108 mgd
- St. Johns River near Titusville 143 mgd
- St. Johns River at Sanford (Lake Monroe) 279 mgd
- St. Johns River near DeLand 351 mgd
- St. Johns River above Jacksonville 419 mgd

The maximum water supply yield estimates are based on application of the previously established surface water evaluation methodology. However, because planned SJRWMD minimum flows and levels analysis for Lake Griffin may result in different, and possibly more restrictive, withdrawal criteria, only 50 percent of the calculated maximum yield, or 14 mgd, will be considered in subsequent areawide alternative water supply evaluations.

Maximum reliable yields for the Lake Griffin and St. Johns River sites are independent hydrologic systems. Water supply development on Lake Griffin will not affect the potential for water supply development on the St. Johns River. However, the maximum

yield values for the individual St. John Rivers sites are not independent and represent the cumulative amount for each individual site and all upstream sites. For example, if a 100-mgd reliable water supply were developed near Titusville, then the maximum reliable yield at DeLand (or another downstream site) would be reduced by 100 mgd.

Facilities required include a river diversion structure, an off-line raw water reservoir, a water treatment plant, and an aquifer storage recovery system and will vary by location. Lake Griffin is the only true freshwater site; the St. Johns River sites will require some desalting facilities. The most downstream site, the St. Johns River above Jacksonville, is tidal, has poor water quality characteristics, is classified as saline and would require extensive desalting facilities generating large quantities of waste concentrate.

Five of the six water supply withdrawal sites are technically viable. They include Lake Griffin and the four upstream sites located on the main stem of the St. Johns River, from near Cocoa to near DeLand. The most downstream site, the St. Johns River above Jacksonville, does not provide a viable municipal water supply source and should not be considered further.

SJ97-SP16
1997
Water Supply Needs and Sources Assessment
Alternative Water Supply Strategies Investigation
Aquifer Storage and Recovery Utility Evaluations
By:
CH2M Hill

Background:

The public water supply within the St. Johns River Water Management District is generally provided by high-quality ground water. Increasing ground water usage without incurring unacceptable environmental impacts is unlikely. SJRWMD has initiated an investigation of the feasibility of alternative water supply strategies. In recent years, aquifer storage recovery (ASR) has been developed as an alternate means of water storage. ASR is defined as storing water in a suitable aquifer through a well during times when water is available, and recovering the water from the same well during times when it is needed..

Objective:

The primary objective is to apply the ASR feasibility tool previously outlined to specific utilities within SJRWMD. The primary focus of this application is on potable water storage; however, during the review of utility data it became apparent that other ASR application, such as raw surface and ground water storage and reclaimed water storage for eventual irrigation could be applicable in some situations. This evaluation addressed the feasibility of using ASR to satisfy potable water storage needs from technical, economic, and regulatory perspectives and to determine if ASR should be further considered by the selected utilities.

Conclusion:

In consultation with CH2M HILL, the District selected five utilities for trial application of the ASR screening tool: the City of Melbourne Water and Sewer Division; the City of New Smyrna Beach Utilities Commission; the City of Port Orange Public Utilities; the City of Titusville Water Resources Department; and the St. Johns County Utilities Department. Each of the utilities was visited by project staff, including a water resources engineer and hydrogeologist, between October 4 and October 29, 1996. The purpose of the site visits was to develop an understanding of the utilities; operations and needs, and to gather information required for application of the ASR screening tool. Site history, existing problems, water use projections, anticipated water supply development issues, and acquisition of available data were discussed during the visits.

In each case, it was found that ASR is technically feasible and potentially useful, based on currently available information. Neither cost nor regulatory aspects would affect the feasibility of using ASR at each utility.

The screening evaluation identified several options for using ASR at the five utilities. CH2M Hill makes the following recommendations:

- Each utility should evaluate the possibility of incorporating ASR into its long-term plan. This evaluation will include goals specific to each utility in meeting future water demands.
- Before proceeding with additional hydrogeologic data collection, the use of ASR to address wetland impacts should be undertaken. If this evaluation demonstrates that ASR could effectively address wetland impacts, the District and the utilities may want to consider ASR in review of future CUP applications.
- Once a utility has decided that ASR warrants further investigation, an ASR test plan for the facility should be developed, launching the Phase II portion of the ASR implementation procedure.

SJ98-SP11
1998
Central Florida Artificial Recharge Demonstration Program:
Alternative Water Supply Strategies in the St. John River Water Management District
By:
CH2M HILL

Background:

The St. Johns River Water Management District (SJRWMD) previously evaluated the potential impacts of increased ground water withdrawal through the year 2010 (Vergara 1994). Based on this evaluation, SJRWMD identified areas, known as Priority Water Resource Caution Areas (PWRCAs), where water supply problems are now critical or will become critical. In these area, future public water supply needs may not be fully met by the increased use of ground water resources without incurring unacceptable environmental impacts, which include wetlands dehydration, reduced springflows, and the increased potential for saltwater intrusion. New water supply alternatives will be needed to supplement existing supplies to avoid potential problems.

Objective:

SJRWMD is investigating the feasibility of several alternative water supply strategies, including artificial recharge of the Floridan aquifer. The purpose of this report is identify an artificial recharge demonstration program for central Florida that will answer the questions that have been identified related to the appropriate use of artificial recharge wells, including the efficacy of the current regulatory approach.

Conclusion:

There is considerable interest among local governments, SJRWMD, and FDEP in conducting the research necessary to objectively evaluate current drainage well management policy. Local governments interested in participating in the Central Florida Artificial Recharge Demonstration Program include the City of Altamonte Springs, the City of Orlando, and Orange County. Each has identified a demonstration project for inclusion in the program. The individual demonstration projects are:

- Lake Orienta project—A 135-acre urban lake with a 916-acre tributary watershed. It is completely landlocked and is served by two existing drainage wells owned by the City of Altamonte Springs. Adjacent urban lands are subject to periodic and chronic flooding. The Lake Orienta artificial recharge demonstration project would involve construction of an additional lake level control well and several monitoring wells. The objectives are to monitor the fate of pollutants, including total coliform bacteria, entering the aquifer from a new lake level control well; investigate the necessity and feasibility of recharge water disinfection; and provide much needed relief from flooding without diminishing aquifer recharge. A site is available to construct the new well, appropriate monitoring wells, and a recharge water treatment facility, if necessary.

- Mills Avenue Street Drainage Treatment Project—The City of Orlando owns and operates approximately 80 street or urban drainage wells, most of which are located in downtown Orlando. The proposed demonstration project at Mills Avenue and Minnesota Street would abandon in place the existing street drainage well and redirect the stormwater runoff to an adjacent residential lot. The lot, which is for sale, would be purchased, the existing structure demolished and an appropriate passive stormwater treatment facility would be constructed. The treated stormwater runoff would then be directed to a new recharge well constructed adjacent to the treatment facility. This demonstration project would not increase recharge volume, but would reduce aquifer pollutant loads, resulting in a net benefit to the aquifer.
- Lake Sherwood Project—Lake Sherwood is a 119-acre lake with a direct tributary area of 1,240 acres, for a total basin area of 1,359 acres. During flood condition, the lake will receive inflow from four upstream lakes, increasing the total maximum tributary area to 5,450 acres. The lake is served by one Lake level control well owned by Orange County. The well operates only during extreme hydrologic conditions. Orange County is preparing a comprehensive watershed management plan for the Lake Sherwood basin. One of the issues being investigated is lowering the existing lake level control well inflow elevation to provide the necessary increase in flood protection. Hydrologic analyses are being performed to quantify the relationship between inflow control elevation and level of flood protection provided, and the total recharge volume emplaced. Watershed planning is also quantifying the relationship between additional stormwater treatment provided and improvements in recharge water quality. The objective of this analysis is to identify the combination of inlet elevation and additional stormwater treatment that will increase flood protection and aquifer recharge without increasing pollutant loads to the aquifer. This project will demonstrate the concept of net benefits to the aquifer in the context of comprehensive watershed planning and water resource management.

The proposed Central Florida Artificial Recharge Demonstration Program would provide important and useful information for water resources management decision making. Program results should provide insight into the fate and transport of bacteria, including total coliform, in the upper Floridan aquifer. The program should also quantify the cost of bacteria removal as a function of the level of control provided.

Aquifer recharge wells should be an available water resource management option. Like other water management alternatives, this technology has benefits and risks, and should be used when the benefits, including flood control and additional water supply, outweigh the risks. The Central Florida Artificial Recharge Demonstration Program would help quantify the risks and costs associated with artificial recharge wells in central Florida.

SJ2003-SP1
September 2003
Demineralization Concentrate Management Plan
Investigation of Demineralization Concentrate Management—FINAL REPORT
By
Reiss Environmental, Inc.
Subconsultants
Parsons, Brinckerhoff, Quade and Douglas
and Malcolm Pirnie

Background:

St. Johns River Water Management District (SJRWMD) has identified brackish groundwater, brackish surface water and seawater as potentially significant alternative sources of supply to meet projected 2020 demands. The use of these mineralized water sources requires management of the concentrate that is a by-product of the demineralization. These technologies are primarily pressure driven membrane processes that include reverse osmosis and nanofiltration. During this process, minerals in the source water, including salt, are removed producing potable water as well as a by-product known as demineralization concentrate.

Objective:

The relative suitability of various demineralization concentrate management alternatives was evaluated for the 19-county SJRWMD area. From this assessment it was determined that the Florida Department of Environmental Protection (FDEP) regulations, which govern demineralization concentrate, largely determine the viability of a given project. In addition, there is a perception in the municipal demineralization community that current regulations present a challenge that is potentially inconsistent with the characteristics associated with demineralization concentrate. FDEP is actively working with affected parties to evaluate this issue.

Conclusion:

Review of existing demineralization concentrate management projects in SJRWMD revealed a history of permitting challenges. These permitting challenges appear to have occurred mainly because existing regulations were not designed to address demineralization concentrate but were designed to deal with domestic and industrial wastewater discharges. Demineralization concentrate has water quality characteristics dissimilar to those commonly associated with domestic and industrial wastewater. Key issues related to demineralization concentrate were identified as part of this Demineralization Concentrate Management Plan (DCMP).

The assessment of demineralization concentrate management alternatives, which is described in this document, considered various factors that affect the relative suitability of a given application. The approach included consideration of the location and

characteristics of the alternative source waters including brackish groundwater, brackish surface water and seawater and the characteristics of potential receiving waters.

SJ2004-2
2004
Middle St. Johns River Minimum Flows and Levels
Hydrologic Methods Report
By:
C. Price Robison, P.E.

Background:

The middle St. Johns River (MSJR) is being considered as a possible alternative water supply source to help meet the projected future increased demand for water in the St. Johns River Water Management District (SJRWMD). Minimum flows and levels (MFLs) will provide the initial limits to surface water withdrawals from the MSJR, although, other factors may ultimately be more limiting.

Objective:

The purpose of this report is to describe and document the development of the models used in assessing MFLs for the MSJR. Also included in this report are five examples of hypothetical MSJR surface water withdrawal alternatives as they relate to MFLs.

Conclusion:

Modeling results indicate that all three adopted MFLs are being met on the MSJR under existing conditions Depending on withdrawal criteria, the models indicate that between 143 and 175 million gallons per day of water are available from the river before the MFLs cease to be met. Additional analyses will be performed as part of a comprehensive investigation of the potential water supply yield of the MSJR, given the proposed MFLs.

SJ2004-3
2004
Status and Trends in Water Quality at Selected Sites in the St. Johns River Water Management District
By:
Steve Winkler and Aisa Ceric

Background:

The St. Johns River Water Management District (SJRWMD) is one of five legislatively established water management districts in Florida. SJRWMD's mission is to manage water resources to ensure their continued availability while maximizing environmental and economic benefits. The current population of 3.5 million is expected to exceed 5 million by 2020 (Vergara 2000). Most of the population is concentrated in the major urban areas, such as Jacksonville, Orlando, Gainesville, Ocala, and a string of cities along he coast from St. Augustine to Vero Beach.

Objective:

Water quality districtwide was last assessed in 2000 as part of the *District Water Management Plan* (Vergara 2000). This assessment is a continuation of that effort and was undertaken to characterize the current status of and trends in water quality for water bodies districtwide. Characterization of these water bodies will allow SJRWMD to identify problem areas and to evaluate the success of remedial or mitigation efforts.

Conclusion:

One hundred fifty-eight water quality monitoring sites located in lakes, estuaries, streams and springs were selected to represent ambient water quality conditions for the assessment. Ambient water quality data were compiled and analyzed in order to evaluate status and trends. Status results indicate whether water quality is improving or degrading. Springs and stream sites were evaluated using a water quality index; lake and estuarine sties were evaluated using a trophic state index. The water quality index incorporates nutrients, physical constituents, and bacteria, while the trophic state index incorporates nutrients and chlorophyll. Most of the sites in SJRWMD exhibited good or fair water quality, although some sites were degrading. Forty percent of the sites assessed districtwide had good water quality, 42% had fair quality, and 18% had poor quality. Thirty-seven percent did not have enough data to calculate a trend, while 42% had a statistically insignificant trend. More sites were degrading (13%) than were improving (8%). This study did not consider what factors were responsible for the trends found.

SJ2004-SP4
2003
East-Central Florida Water Supply Planning Initiative Phase II
Annual Report of Activities and Accomplishments

Background:

The east-central Florida area, which includes Brevard, Orange, Volusia and Seminole counties and portions of Lake Marion, Polk, Sumter, Osceola and Flagler counties, has been the subject of a major water supple planning initiative since 2002. The East-Central Florida Water Supply Planning Initiative is designed to assist in meeting future water supply needs, while protecting the water resources and related natural systems. The Initiative resulted from two regionwide water summits held in early 2002 where local government officials, water supply utilities, and the St. John River, South Florida and Southwest Florida water management districts began working together to develop solutions to their collective future water supply issues. Representatives from all ten counties in the east-central Florida area were invited to participate in Phase I of the Initiative. The Phase I process resulted in the East-Central Florida Water Agenda, which identifies six key water supply issue areas, 17 recommendations and 32 strategies developed by the Initiative Phase I participants. The six areas identified in the Agenda are:

- Enhance intergovernmental coordination
- Develop new water supply
- Link land use planning and water supply planning
- Increase use of reclaimed water
- Enhance aquifer recharge using reclaimed water
- Increase water conservation

Objective:

Phase II of the Initiative is designed to build upon the results of Phase I with the development of action plans and identification of specific projects to implement the Agenda recommendations and strategies. The St. Johns River Water Management District is managing the Phase II effort in coordination with the South and Southwest Florida water management districts. Initiative activities in 2003 were focused in six counties of the 10-county east-central Florida region – Volusia, Brevard, Orange, Seminole, Lake and Osceola counties. Marion County was not included in the focus area, but their representatives were invited to participate in Initiative meetings.

Conclusion:

The 2003 Initiative Phase II process included many workshops with east-central Florida water supply utilities and local government elected officials for the exchange of information and ideas. One of the major goals of these workshops was to identify

potential water supply development projects of interest to the local communities that could be incorporated into a 2004 interim update to DWSP.

2003 Initiative activities included:

- Encouraging intergovernmental coordination through Initiative group meetings, one-on-one meetings with elected officials, presentations to related water resource organizations and heightened communications with the public and media
- Educating local government elected officials, planning staffs and water supply utilities on new requirements to develop a 10-year water supply facilities work plan
- Developing and implementing a “Potable Water Availability” worksheet that will help local governments in the comprehensive plan amendment process to identify water supply availability considering both infrastructure and permitted allocation under consumptive use permits
- Assisting ongoing efforts to develop and implement areawide reuse of reclaimed water plans
- Assisting ongoing efforts to evaluate the feasibility and benefits of enhanced recharge using reclaimed water
- Developing model landscape ordinance language to be used as a guideline for local communities

Recommendations for 2004 Initial Phase II activities include developing countywide/intercounty water supply plans and partnerships between suppliers in each county, continuing on-going county/intercounty facilitation, amending DWSP to include potential projects identified during 2003, prioritizing potential projects, initiating feasibility investigations as appropriate, assisting local governments in development of water supply facilities work plans, assisting on-going efforts in development of areawide reuse plans and development of artificial recharge projects, and finalizing model landscape ordinance and initiating a pilot incentive program in Lake County.

SJ2004-SP6
January 23, 2004
Final Report on Five Potential Seawater Demineralization Project Sites – Task C.5
For the
Seawater Demineralization Feasibility Investigation
By
R. W. Beck, Inc.

Background:

As part of the St. Johns River Water Management District (SJRWMD) Water Resource Development Program, seawater demineralization is being examined as a potential means to provide future water supply within SJRWMD. SJRWMD retained R. W. Beck to perform a feasibility analysis of seawater demineralization.

Objective:

Five sites were identified for development of conceptual designs and costs within SJRWMD for seawater demineralization. R. W. Beck and SJRWMD identified these sites based upon the analysis described in the report titled "Identification of Favorable Sites for Feasible Seawater Demineralization – Task C.4," dated September 11, 2003 and other preferred features and water needs.

The five sites include:

1. Indian River Power Plant (Owner: Reliant Energy Indian River, LLC)
2. Cape Canaveral Power Plant (Owner: Florida Power & Light – FPL)
3. Daytona Beach/Bethune Point Wastewater Treatment Plant (Owner: City of Daytona Beach)
4. W. E. Swoope Generating Station Power Plant (Owner: City of New Smyrna Beach)
5. Northside Power Plant (Owner: Jacksonville Electric Authority – JEA)

One of the screening and scoring factors that affects a site ranking is the location of the site within ten miles of a SJRWMD priority water resource caution area. Following completion of the Task C.4 report dated September 11, 2003, which did not include the Northside Power Plant site, the proposed priority water resource caution areas were being redefined by SJRWMD in portions of Duval and St. Johns counties. Because of the potential for the Northside Power Plant site to be within ten files of a SJRWMD priority water resource caution area, it became a candidate for consideration as a favorable site for collocating a desalination facility. Additionally, and of greater significance, the Northside Power Plant has similar preferred site characteristics as the highly ranked Cape Canaveral Power Plant site and the Indian River Power Plant site. For these reasons, SJRWMD requested that the Northside Power Plant in Duval County be included in the five sites for conceptual design and costing. At the present time, based on subsequent evaluations, SJRWMD does not propose to identify the Duval

County area as a priority water resource caution area in its 2003 water supply assessment.

Conclusion:

This report summarizes the findings of Task C.5 of the SJRWMD contract with R. W. Beck, Inc., for the Seawater Demineralization Feasibility Investigation which involved the development of comparative-level cost estimates and concept designs for the five preferred sites for seawater demineralization.

Each design incorporates the following features:

- Influent pumping
- Pretreatment consisting of sand filtration and cartridge filtration
- Pretreatment chemical addition
- Demineralization consisting of reverse osmosis membranes
- Post treatment
- Concentrate management by a various methods appropriate to the specific site
- Ground storage
- Product water conveyance

The comparative project cost estimate elements include:

1. Construction
2. Land
3. Non-construction capital cost
4. Total Capital Cost (inclusive of items 1+2+3)
5. Annual O&M Cost at design capacity in $/year
6. Equivalent annual cost ($/year)
7. Unit production cost ($/kgal)

Summary of Costs			
Indian River Power Plant			
Treatment Capacity (mgd)	10	20	30
Cost/ 1,000 Gallons	$3.06	$2.80	$2.69
Cape Canaveral Power Plant			
Treatment Capacity (mgd)	10	20	30
Cost/ 1,000 Gallons	$3.06	$2.77	$2.63
Daytona Beach/Bethune Point Wastewater Treatment Plant			
Treatment Capacity (mgd)	5	10	15
Cost/ 1,000 Gallons	$3.93	$3.32	$3.11
W. E. Swoope Generating Station			
Treatment Capacity (mgd)	5	10	15
Cost/ 1,000 Gallons	$4.93	$3.90	$3.53
Northside Power Plant			
Treatment Capacity (mgd)	10	20	30
Cost/ 1,000 Gallons	$3.12	$2.76	$2.57

SJ2004-SP7
December 31, 2002
Technical Memorandum B.7 Demineralization Treatment Technologies
for the
Seawater Demineralization Feasibility Investigation
By
R. W. Beck, Inc.

Background:

Desalination, or demineralization is a treatment process that removes salt and other minerals from brackish water and seawater to produce high quality drinking water. Various desalination technologies have been in practice for more than 50 years, with nearly 1500 facilities worldwide, according to the International Desalination Association (IDA).

Due to concerns over continued population growth and depletion of our nation's water resources, finding alternative drinking water sources has been a problem faced by many water utility companies, municipalities and water management districts. This is especially true in states with the greatest population growth. Traditional groundwater and surface water sources have been over-pumped and are showing signs of environmental stress or have experienced salt-water intrusion into groundwater supplies.

Objective:

The St. Johns River Water Management District is proactively addressing the water supply needs in the northeast region of Florida to:

- Increase available water supplies and maximize overall water use efficiency to meet identified existing and future needs;
- Minimize damage from flooding, using non-structural approaches where feasible;
- Protect and restore floodplain functions;
- Protect and improve surface water quality;
- Protect and improve groundwater quality;
- Maintain the integrity and functions of water resources and related natural systems;
- Restore degraded water resources and related natural systems to a naturally functioning condition; and
- Ensure proper use of tax and other public revenue by focusing on priorities that further the District's mission and by maintaining a high level of organizational efficiency.

This technical memorandum is prepared to provide SJRWMD with information on current desalination technologies and an update on advancements in the industry.

Conclusion:
The most common desalination technologies that have experienced commercial success are:

Thermal
- Multi-stage Flash Distillation (MSF)
- Multiple-Effect Distillation (MED)
- Vapor Compression (VC)

Membrane
- Electrodialysis (ED)
- Reverse Osmosis (RO)

There are several emerging technologies that appear to have potential for significant advancements in the desalination field. These advancements relate to evaporation of concentrate to a dry salt for commercial use or disposal, and increased membrane sizes to improve the economies of scale for larger membrane plants.

Based on the water supply needs in SJRWMD, the following conclusions and recommendations are provided for consideration in the feasibility investigation of demineralization on the northeast coast of Florida

1. Brackish water desalination using ED or RO may prove to be a viable alternative for this coastal region.

2. Seawater desalination using RO can be cost-effective for larger municipal water supplies (>5mgd).

3. Co-location with power generation facilities should be considered for dilution of concentrate from the desalination process. The possibility for negotiated-lower energy rates should also be investigated.

4. Continue to monitor the development of emerging technologies for advancements related to evaporation technologies for producing a dry salt from the RO concentrate.

5. Continue to monitor the development of pretreatment system improvements, particularly microfiltration, and other processes for the ability to handle fluctuating raw water qualities with high turbidities.

6. Consider new, proven technologies that have been demonstrated at a commercial scale. Some new technologies, which claim less energy or greater product water recovery, must be proven in full-scale, operational facility, where treatment effectiveness, energy efficiency and costs can be proven. Some emerging technologies currently in development may prove to be great advancements in the desalination field; others may not.

SJ2004-SP8
December 31, 2002
Criteria for Preliminary Screening of Areas for Potential Seawater Demineralization Facilities Task C.1.
For the
Seawater Demineralization Feasibility Investigation
By
R.W. Beck, Inc.

Background:

As part of the St. Johns River Water Management District (SJRWMD) Water Resource Development Program, seawater demineralization is being examined as a potential means to provide future water supply within SJRWMD.

Objective:

The purpose of Task C.1 is to develop criteria suitable for use as a preliminary (macro level) screening measure within the coastal areas of the SJRWMD for siting seawater demineralization facilities. The criteria provide a rational way to perform a preliminary screening to identify up to twenty preferred sites for further consideration for a potential demineralization plant siting. This document identifies the macro screening criteria and presents the rationale for their application to the various potential sites. This step does not include a "ranking" of the sites but rather identifies whether a site has preferred features or not

Conclusion:

To identify potential sites, identification of the presence of preferred features is applied. The five primary preferred features are:

1. **Adequate Access to an Ample Seawater Source**
   - Availability of high quality seawater source. Class 1, 2 and 3 waters are preferred, with Class 1 being the most acceptable.
   - Located within five miles of an existing seawater intake of a once-through cooled power generating plan
   - Located within five miles to the sea shoreline

2. **Access to an Adequate Energy Source**
   - Location within 2 miles of a major power generation facility
   - Location within 2 miles of urban areas

3. **Proximate Access to a Water Transmission Site**
   - Site location within twenty miles of the water demand

4. **Areas of Projected Deficit**
    - A water system with a projected deficit between 2 and 20 mgd

5. **Acceptable Means for Demineralization Concentrate Management**
    - Disposal to existing suitable injection wells or areas defined as suitable for injection wells (within ten miles)
    - Within ten files of the coast (potential for new ocean outfall). Consideration of the length of the outfall may preclude this option
    - Access to an existing permitted wastewater outfall within ten miles
    - Blending with an existing high volume cooling water outfall from a power generating plant with once-through cooling within ten miles

SJ2004-SP9
November 20, 2002
Task B.6 Applicable Rules and Regulations for Seawater Demineralization
for the
Seawater Demineralization Feasibility Investigation
By
R. W. Beck, Inc.

Background:

St. Johns River Water Management District (SJRWMD) has identified brackish groundwater, brackish surface water and seawater as potentially significant alternative sources of supply to meet projected 2020 demands.

Objective:

The purpose of this task is to present rules and regulations applicable to the permitting of seawater demineralization plants in the St. Johns River Water Management District in Florida. These rules, regulations and permit requirements are important to an understanding of some of the restraints and schedule considerations associated with a seawater demineralization facility.

The Applicable rules, regulations and permit requirements were reviewed and summarized into this technical memorandum and it includes a discussion of permitting actions.

Conclusion:

There are federal, state, regional, and local regulatory agencies and other entities that have rules, regulations and permitting requirements that would pertain to the construction and operation of a Seawater Demineralization Facility.

Federal
United States Environmental Protection Agency Region IV
United States Army Corps of Engineers
United States Coast Guard
United States Fish and Wildlife Service
National Marine Fisheries Service
Occupational Safety and Health Administration

State
Florida Department of Environmental Protection (Primary Agency)
Florida Department of Transportation
Florida Fish and Wildlife Conservation Commission

Regional

St. Johns River Water Management District

Local
Environmental Resource Management or Natural Resource Management Departments
City / County Building Departments
City County Engineering Departments
City / County Planning or Zoning Departments

Other Entities
CSX Railroad Corporation
Public Service Commission
Florida Inland Water Navigation District
Power companies

The components of a seawater demineralization facility can be generally broken down into the following five physical project elements:

1. Raw water intake;
2. Water pretreatment;
3. Plant facility;
4. Concentrate disposal; and
5. Product water conveyance.

Various rules regulations and permits are applicable to each element of the facility but may differ depending upon the final chosen configuration for a particular facility.

The most significant permit requirements for the construction and operation of a demineralization facility include:

- NPDES permit for the concentrate discharge
    - Primary issues of concern:
        - Alterations of natural salinity patterns and water quality in the surface water receiving the concentrate discharge;
        - Impacts of increased salinity on benthos and other marine organisms;
        - Entrainment and impingement of marine organisms in the raw water intake structure; and
        - Secondary impacts to the West Indian Manatee if co-located on an electric generating power plant with once-through cooling using coastal waters.

- Federal 404 dredge and fill permit for construction of the facility and associated infrastructure (e.g., pipelines)
    - Primary issues of concern:
        - Wetland impacts from the construction of the facility and related infrastructure; and

        - Secondary impacts to the West Indian Manatee if co-located on an electric generating power plant with once-through cooling using coastal waters.

- Environmental Resource Permit for construction of the facility and associated infrastructure (e.g., pipelines)
    - Primary issues of concern:
        - Storm water treatment and management from the facility;
        - Wetland impacts from the construction of the facility and related infrastructure; and
        - Secondary impacts to the West Indian Manatee if co-located on an electric generating power plant with once-through cooling using coastal waters.

SJ2004-SP11
September 17, 2003
Identification of Favorable Sites for Feasible Seawater Demineralization – Task C.4
For the
Seawater Demineralization Feasibility Investigation
By
R. W. Beck, Inc.

Background:

As part of the St. Johns River Water Management District (SJRWMD) Water Resource Development Program, seawater demineralization is being examined as a potential means to provide future water supply within SJRWMD. Recently, seawater demineralization has proven to be economically feasible when co-located with other facilities such as power plants. Within SJRWMD, sites have been identified that may offer potential co-location opportunities. SJRWMD wants to examine potential sites and identify up to five preferred sites for seawater demineralization.

Objective:

Discuss the methodology applied to develop the list of five preferred sites and include the results of the intermediate screening steps and identify the five preferred sites.

Preferred site identification is a multi-step process consisting of data gathering, screening to at least 20 potential sites, and subsequent ranking of those sites. Data gathering includes qualitative and site-specific data useful in developing the screening and ranking criteria.

Site-specific date includes information pertinent to identifying site features affecting the siting of a seawater demineralization facility.

Application of macro screening criteria to site-specific data was used to develop a list of potentially viable sites.

Conclusion:

Of the original 56 sites being considered, 21 sites met the macro screening criteria. A ranking matrix was used to identify the five most preferred sites. Generally the ranking criteria represent a subset of the major criteria developed under the macro screening with the addition of criteria for resource constraints (such as habitats etc). The ranking matrix combines specific criteria with various weighting to derive a weighted score. A higher weighted score represents a more desirable site.

The ranking resulted in the following sites being identified as the most promising:

1. Indian River Power Plant (Owner: Reliant, Inc)

2. Cape Canaveral Power Plant (Owner: FPL)
3. Daytona Beach/Bethune Point Waste Water Treatment Plant (Owner: City of Daytona Beach)
4. BCUD/South Beaches Waste Water Treatment Plant (Owner: Brevard County)
5. W. E. Swoope Generating Station Power Plant (Owner: City of New Symrna Beach)
6. BCUD/Sykes Creek Regional Waste Water Treatment Facility (Owner: Brevard County)

Though the report was to identify the top 5 most preferred sites, sites 5 and 6 had equal scoring and are both presented here.

SJ2004-SP13
January 2002
Task B.5 Applicable Rules and Regulations for Concentrate Management
Investigation of Demineralization Concentrate Management
By
Reiss Environmental, Inc.

Background:

St. Johns River Water Management District (SJRWMD) has identified brackish groundwater, brackish surface water and seawater as potentially significant alternative sources of supply to meet projected 2020 demands. The use of these mineralized water sources requires management of the concentrate that is a by-product of the demineralization. These technologies are primarily pressure driven membrane processes that include reverse osmosis and nanofiltration. During this process, minerals in the source water, including salt, are removed producing potable water as well as a by-product known as demineralization concentrate.

The Demineralization Concentrate Management Plan will outline environmentally acceptable options for concentrate management which currently include deep well injection, land spreading, discharge to surface waters, discharge to domestic wastewater treatment facilities, and various forms of reuse (including blending with reclaimed water). Prior to development of the plan or implementation of the concentrate management alternative mentioned, it is important to have an understanding of applicable rules and regulations governing concentrate management.

Objective:

The purpose of this technical memorandum is to identify and summarize relevant demineralization concentrate management rules and regulations. This topic is very important since demineralization concentrate management and the associated regulations are primary considerations associated with the development of demineralization facilities within SJRWMD. Recommendations are provided regarding potential action to support an environmentally sound, logical and clear regulatory process.

This technical memorandum was prepared by identifying agencies that have direct or indirect impact on permitting of demineralization concentrate management, followed by the collecting and summarizing of rules and regulations. Information was obtained through a literature search and by contacting regulatory agency officials, other experts in the field, and utilities currently using demineralization processes.

Conclusion:

The Florida Department of Environmental Regulation is the primary agency responsible for the review and issuance of permits for demineralization concentrate management.

There are a number of agencies that would be considered “secondary,” as their review is related to ancillary facilities for concentrate disposal, such as pipelines and outfall structures. Agencies potentially requiring permits, approvals or authorization for demineralization concentrate management projects are:

Federal
U.S. Environmental Protection Agency, Region IV
U.S. Army Corps of Engineers
Occupational Safety and Health Administration
U.S. Geological Survey
U.S. Fish and Wildlife Service
National Marine Fisheries Service

State
Florida Department of Environmental Protection (Primary Agency)
St. Johns River Water Management District
Florida Department of Transportation
Florida Fish and Wildlife Conservation Commission

Local
Health Department
Local Pollution Control
Environmental Resource Management Department or Natural Resource Management Department
City/County Building and/or Zoning Departments
CSX Railroad Corporation

As seen above, a large number of agencies could directly or indirectly affect permitting of demineralization concentrate management. However, the requirements of the EPA and the FDEP are the most pertinent to demineralization concentrate management and represent the critical test of the viability of any demineralization concentrate management project.

SJ2004-SP14
October 2001
Demineralization Technologies Annotated Bibliography and Database
In Support of Task C.1 and C.2
For the
Investigation of Demineralization Concentrate Management Project
By
Reiss Environmental and Subconsultant, Malcolm Pirnie

This annotated bibliography is part of the overall scope of the Investigation of Demineralization Concentrate Management Project. It is an annotated bibliography and subject matrix representing the body of knowledge concerning demineralization technology and the environmental and cultural impacts of demineralization concentrate management.

The bibliography is the result of literature survey and a review of existing reports, articles, and other literature specifically related to demineralization technology and environmental and cultural impacts of demineralization concentrate management. The information in those reports and publications has been entered into an electronic database that allows a search of the documents through various listings and tables. This database lists documents that will be used to prepare the final Demineralization Concentrate Management Plan and also lists documents that may not specifically be used in preparing the plan but which contain information of related interest. A data field showing “Reference used in TM” with a yes/no entry in the field, will be used to identify whether the reference was used in the final plan.

For presentation purposes, the database is alphabetized by author, as is the standard for reference formats. Multiple author listings are further arranged by publication date.

SJ2004-SP15
October 2001
Geological Annotated Bibliography and Database
In Support of Task C.1 and C.2
For the
Investigation of Demineralization Concentrate Management Project
By
Reiss Environmental and Subconsultant, Parsons, Brinckerhoff, Quade and Douglas

This annotated bibliography is part of the overall scope of the Investigation of Demineralization Concentrate Management Project. It is an annotated bibliography and subject matrix representing the body of knowledge concerning the feasibility of subsurface injection as a means of demineralization concentrate management with the study area.

The bibliography covers four areas of hydrogeologic interest:

- Potential for Deep Well Injection
- Potential Concentrate Discharge Regimes
- Potential Source Regimes
- Potentially Acceptable Discharge Options

The bibliography is the result of literature survey and a review of publications specifically related to investigations of the surface and groundwater waters of the St. Johns River Water Management District and of the hydrologic, geologic, and quality parameters associated with those waters. The information in those reports and publications has been entered into an electronic database that allows a search of the documents through various listings and tables. The database lists documents that will be used to prepare the final Demineralization Concentrate Management Plan and also lists documents that may not specifically be used in preparing the plan but which contain information of related interest. A data field showing “Reference used in TM” with a yes/no entry in the field, will be used to identify if the reference was used in the final plan.

For presentation purposes, the database is alphabetized by author, as is the standard for reference formats. Multiple author listings are further arranged by publication date.

SJ2004-SP16
January 2002
Task B.2 and Task B.3 Demineralization Concentrate Database and GIS Data Layers
For the
Investigation of Demineralization Concentrate Management Project
By
Reiss Environmental and Subconsultants, Mickley and Associates and Malcolm Pirnie

The Demineralization Concentrate Database and GIS Data Layers a part of the overall scope of the St. Johns River Water Management District's Investigation of Demineralization Concentrate Management Project and are provided in fulfillment of the requirements of Task B.2 and Task B.3. The tasks require preparation of a relational database of information concerning demineralization concentrate management for demineralization plants greater than 0.1 million gallons per day (mgd) in Florida and development of GIS Data Layers (point coverage or shapefile) representing each category of location data identified from the demineralization plant database.

This document provides the following information to support the database and GIS deliverables:

- Methodology
- Content of database and GIS layers
- User's Guide
- References

The database was populated based on a survey of and collection of information from multiple sources throughout the state of Florida:

- Past surveys
- Florida Department of Environmental Protection (FDEP) district offices
- Membrane plant contacts
- Other

Past Surveys
The information collection process began with the development of a tentative list of water utility plants that utilize demineralization technologies. The initial list was compiled from past survey efforts (Mickley et al., 1993; Mickley 2001), which included a total of 73 plants and some background information available for many of these plants. This initial plant list was refined through interaction with FDEP and the individual demineralization plants.

A total of 22 plants were eliminated from further consideration due to one of the following reasons:

- Plant has been taken out of service (11 plants)

- Plant size is below the 0.1 mgd cutoff (8 plants)
- Plant was never built (3 plants)

In addition, a total of five plants not on the original list were added during the course of the project. Therefore, the final plant list has 51 operating plants, 2 stand-by plants, and 3 plants under construction, for a total of 56 plants.

Florida Department of Environmental Protection and Water Management Districts
Communications and data collection from FDEP were focused on the FDEP district offices. The first purpose for interaction with the FDEP district offices was to review and modify the initial plant list. Later interactions focused on obtaining copies of the concentrate disposal permits and discussing individual plant disposal issues with FDEP personnel. The water management districts (WMDs) were approached as part of the source water data collection effort. Source water information included production well depths, diameters, and well locations. Florida demineralization drinking water plants greater than 0.1 mgd are located in three of the five WMDs.

Membrane Plant Contact and Other Sources
After obtaining information from FDEP offices and the WMDs, the information compilation effort focused on the individual demineralization plants and other sources. 80% of the effort expended in information collection involved interactions with the plants. As for other sources, it was determined that Palm Beach County had developed GIS data for production wells in their county, but after contacting the Department of Health, they indicated that policy had been reviewed after September 11, 2001, and it had been decided that data should be collected directly from the demineralization plants.

In summary, the Access database includes a total of 56 individual demineralization plant summary reports, and the GIS data files include three Data Layers for the demineralization plant locations, plant source water locations and plant discharge regime locations. The access database and GIS Data Layers are linked.

SJ2004-SP20
February 2004
Surface Water Treatability and Demineralization Study
For
St. Johns River Water Management District
By
CH2M Hill, Inc.

Background:

The St. Johns River Water Management District (SJRWMD) and CH2M Hill conducted and extensive pilot study involving the use of integrated membrane systems to produce potable water from the St. Johns River. The study identified treatment processes and costs involved in using the St. Johns River as an alternative water supply. This source is one alternative being evaluated to offset a large water supply deficit projected in eastern central Florida.

Objective:

The purpose of this study is to demonstrate the treatability of the source water, identify the appropriate technology and basic design parameters for treatment, and determine both the capital and operational costs for a potential facility. The intent is that the information in this report will assist an entity in implementing a surface water treatment facility to be located in the reach between Titusville and DeLand on the St. Johns River and facilitate the next step for a water supply project of this type.

Conclusion:

A preliminary raw water characterization study was conducted to evaluate pretreatment technologies that would sufficiently reduce the organic and turbidity levels in the water (e.g., coagulation, clarification, and filtration) so that effective salt removal could be conducted with RO membranes. The first step of the pilot program was to meet with the stakeholders for the project and select the treatment processes for the study. The pilot plant design was developed based on the treatment alternatives selected. Based on the pilot testing, the pretreatment alternatives tested were able to sufficiently treat the St. Johns River water to meet potable standards as well as pretreat the water to allow the use of RO membranes for desalting. These treatment alternatives are as follows:

- Actiflo ballasted sand clarifier followed by dual media filtration
- SuperP blanket clarifier followed by dual media filtration
- Zenon ultrafilter operating in direct filtration mode (coagulation in tank)
- Zenon ultrafilter operating as a filter after high-rate clarification
- Memcor microfilter operating as a filter after high-rate clarification

The following RO membrane types recommended for desalting this pretreated source water based on the pilot study are:

- Filmtec BW30FR

- TriSep X-20

Considering the use of the MF/UF membrane used for either direct filtration or filtration after clarification, as well as the percentage of desalting with RO membranes, the following six potential treatment combinations can be recommended for treating this water based on the pilot results:

1. Zenon ZW-500-C (direct filtration) with 100 percent RO treatment
2. Zenon ZW-500-C (direct filtration) with 75 percent RO treatment
3. Actiflo/Granular Media Filtration with 75 percent RO treatment
4. SuperP/Granular Media Filtration with 75 percent RO treatment
5. Actiflo/Memcor CMF-S or Zenon 1000 with 100 percent RO treatment
6. Super-P/Memcor CMF-S or Zenon 1000 with 100 percent RO treatment

The study found that these are all feasible water treatment technologies, with each having a unique set of benefits and corresponding costs.

SJ2004-SP22
May 2002 Final Issued
Technical Memorandum Preliminary Raw Water Characterization
St. Johns River Water Supply Project
Surface Water Treatability and Demineralization Study
By
CH2M Hill

Background:

The purpose of this technical memorandum (TM) is to provide the preliminary raw water characterization for the St. Johns River Water Supply Project Surface Water Treatability and Demineralization Study. The study is being conducted to identify the treatment requirements for the St. Johns River water for a potential treatment facility to be located in the reach between Titusville and De Land.

Objective:

This TM was developed to review the raw water characteristics of the St. Johns River. These data are being summarized for use in the evaluation and selection of appropriate treatment processes for the pilot program. The initial water quality characterization presented in this TM will define the expected range of raw water quality parameters sufficiently to assist in the selection of appropriate water treatment process for testing. Additional analysis will be performed as additional data are collected and become available.

Conclusion:

The St. Johns River water is a slightly brackish surface water. The water has a low turbidity, high TOC, high hardness, and high TDS. TDS concentrations range from 1,118 mg/L to 645 mg/L. Hardness in the river ranges from 411 mg/L to 233mg/L and is primarily noncarbonate hardness due to the low alkalinity levels in the St. John River. Average TOC values range from approximately 25 mg/L at the southern monitoring stations to less than 20 mg/L at the northern monitoring stations. This initial water quality characterization summary will help facilitate the selection of pilot treatment technologies to be tested.

Throughout the course of this study, additional data will be collected and summarized for inclusion in the final report. After the pilot study, these raw water data will be used to quantify any differences in treatment levels that may be necessary due to changes in raw water quality along the river between Cocoa and De Land.

SJ2004-SP25
November 2003
Surface Water Treatment Plant Siting Study
Level 2 Analysis: Preliminary Site-Specific Screening
East Central Florida Water Supply Initiative
St. Johns River Water Supply Project
By
HDR Engineering, Inc.

Background:

The St. Johns River Water Management District (SJRWMD) implemented an interactive program with utilities, citizens and other interested parties to develop the District's Water Supply Plan (DWSP) through the Water 2020 planning process.
The need for alternative water supplies from the traditional use of groundwater became apparent through this process. Three projects, the Surface Water Treatment Plant Siting Study, the St. Johns River Treatability Study, and the Demand Projection and Affordability Study, will help to facilitate design, location, and costing of a complete surface water treatment facility, intake structure and connecting pipelines on a reach of the St. Johns River between the southern end of Lake Monroe and DeLand, Florida.

Objective:

The purpose of this technical memorandum is to present the methods, analysis, and results of the Level 1 and Level 2 Siting Analysis phases of the Surface Water Treatment Plant Siting Study. A final state of analysis will be conducted as a part of this siting study in the Level 3 Analysis.

Conclusion:

The Level 1 Analysis of The St. Johns River Water Project Water Treatment Plant Siting Study consisted of conducting a preliminary screening for water treatment plant sites through a GIS analysis. The screening included evaluating the study area, defined as the reach of the St. Johns River between the southern end of Lake Monroe in Sanford and DeLand extending five miles on each side of the river, for potential sites using a series of GIS overlays.

A suitability analysis was conducted using datasets. This suitability analysis included assigning each of the constraint factors a "High", "Moderate" or "Low" suitability class. Following the development of the environmental factors and assignment of suitability classes, the factors were combined utilizing GIS into five factor-specific suitability or overlay maps:

- Wetlands and Hydric Soils
- Floodplains
- Floral and Faunal Habitat

- Land Use/Land Cover
- Hazardous Material Sites

Each of these overlays showed areas of no/low constraints, moderate constraints, and high constraints. A combined overlay map was generated and levels of constraint were determined based on combined suitability classes that were developed and coded from one to five, where one represents an area with very low constraints; five represents an area that is severely constrained; and two, three, and four represent an area with varying combinations of moderate constraints.

The areas represented as those with low constraints (a suitability code of one) were then further screened based on size and distance to the St. Johns River. Size criteria were entered into the GIS model to identify areas with 50 or more acres available for a water treatment plant and its ancillary facilities. A distance criteria of less than three miles from the St. Johns River was treated as the most desirable condition and three to six miles was treated in the model as an acceptable condition.

A windshield survey of the identified areas was then conducted to field verify the GIS data and to select 11 potentially feasible areas for further evaluation.

The Level 2 Analysis was a preliminary site-specific screening analysis that included additional data collection and impact quantification for the eleven (11) sites identified through the Level 1 preliminary study screening process. Level 2 analysis also included environmental site assessment, hazardous material site screening, evaluation of land owner information, site boundary refinement, intake locations, pipeline routing analysis, and concentrate disposal.

At the conclusion of the Level 2 Analysis the sites were each scored based on the siting criteria. Weighting factors were developed for each criterion as compared to another criterion. The raw score for each criterion was multiplied by the corresponding weighting factor. The resultants were then summed to create a total weighted score for each site. The weighted totals were used to rank the sites as they compared to one another. The five sites with the highest weighted scores are those being carried forward to the Level 3 Analysis for further evaluation.

SJ2004-SP26
February 2004
Surface Water Treatment Plant Siting Study
Level 3 Analysis: Detailed Site-Specific Screening
East Central Florida Water Supply Initiative
St. Johns River Water Supply Project
By
HDR Engineering, Inc.

Background:

The St. Johns River Water Management District (SJRWMD) implemented an interactive program with utilities, citizens and other interested parties to develop the District's Water Supply Plan (DWSP) through the Water 2020 planning process.
The need for alternative water supplies from the traditional use of groundwater became apparent through this process. Three projects, the Surface Water Treatment Plant Siting Study, the St. Johns River Treatability Study, and the Demand Projection and Affordability Study, will help to facilitate design, location, and costing of a complete surface water treatment facility, intake structure and connecting pipelines on a reach of the St. Johns River between the southern end of Lake Monroe and DeLand, Florida.

Objective:

In the Level 1 Analysis, a preliminary screening of the study areas was conducted to identify potential areas for the development of a water treatment plant and eleven potential areas were identified. In the Level 2 Analysis, a preliminary site-specific screening of these areas was conducted to refine the areas boundaries into smaller site boundaries and to identify the five most feasible locations for a water treatment plant. The purpose of this technical memorandum is to present the methods, analysis, and results of the Level 3 Analysis, Detailed Site Specific Screening. The Level 3 Analysis included conducting more detailed site-specific evaluation of the treatment plant sites, the proposed river intake locations, the inter-connecting pipelines and concentrate management options.

Conclusion:

In the Level 3 Analysis, a more detailed analysis of the five water treatment plants sites short-listed through the Level 2 Analysis was conducted. The purpose of this more detailed analysis was to refine the data obtained through the GIS databases on field and aerial reviews of the sites.

Level 3 Analysis included:

1. Property Owner Coordination
    - Further attempts made to contact and coordinate with the property owners identified through property appraiser information

- Follow-up attempts to contact property owners via telephone to explain project and obtain permission for access to property

2. Environmental Assessment
    - Site reviews conducted to characterize each site and identify any substantial constraints such as protected species, habitat, potential contamination or on-site hazardous materials, and land use
3. Land use/Zoning Evaluation
    - Future land use and existing zoning classifications were evaluated
4. Land Valuation
    - A land valuation process was conducted
    - Evaluation of land use and zoning and parcel size
    - Evaluation of comparable land sales
    - Per acre land cost development for the sites in Seminole, Volusia and Lake Counties
    - Per acre costs applied to the five sites to develop potential land acquisition costs
5. Pipeline Routes
    - The pipeline routes previously identified were reviewed and revised as necessary to reflect more feasible pipeline corridors.
6. Intake Sites
    - Potential intake sites were identified
    - Consideration was given to potential environmental and social impacts as well as proximity to the proposed water treatment plant sites
    - Site reviews were completed to characterize each site and identify any substantial constraints such as protected species, habitat, potential contamination or on-site hazardous materials, and land use.
7. Concentrate Management Options
    A. Due to the close proximity to the source water, the St. Johns River, discharging the concentrate from the surface water treatment into the river was one of the concentrate management options
    B. Discharge to wastewater treatment facilities- Two Options:
        - The introduction of the concentrate to the influent of an existing wastewater treatment facility, whether into the collection system or at the headworks of the plant
        - The introduction of the concentrate to the effluent of an existing facility for surface discharge, subsurface injection, or reuse.
    C. Deep Well Injection

Based on the Level 3 Analysis, the five shortlisted water treatment plant sites appear to be feasible for the development of a surface water treatment plant that will treat water from the St. Johns River. The alternative combinations of raw water intakes, water treatment plant sites and finished water deliver points developed in this report correspond to those being evaluated in both the St. Johns River Treatability and Demineralized Concentrate Management Study and the Demand Projection and Affordability Study.

SJ2004-SP42
2004
East-Central Florida Water Supply Planning Initiative Phase II
Annual Report of Activities and Accomplishments

Background:

The east-central Florida area, which includes Brevard, Orange, Volusia and Seminole counties and portions of Lake Marion, Polk, Sumter, Osceola and Flagler counties, has been the subject of a major water supple planning initiative since 2002. The East-Central Florida Water Supply Planning Initiative is designed to assist in meeting future water supply needs, while protecting the water resources and related natural systems. The Initiative resulted from two regionwide water summits held in early 2002 where local government officials, water supply utilities, and the St. John River, South Florida and Southwest Florida water management districts began working together to develop solutions to their collective future water supply issues. Representatives from all ten counties in the east-central Florida area were invited to participate in Phase I of the Initiative. The Phase I process resulted in the East-Central Florida Water Agenda, which identifies six key water supply issue areas, 17 recommendations and 32 strategies developed by the Initiative Phase I participants. The six areas identified in the Agenda are:

- Enhance intergovernmental coordination
- Develop new water supply
- Link land use planning and water supply planning
- Increase use of reclaimed water
- Enhance aquifer recharge using reclaimed water
- Increase water conservation

Objective:

Phase II of the Initiative is designed to build upon the results of Phase I with the development of action plans and identification of specific projects to implement the Agenda recommendations and strategies. The St. Johns River Water Management District is managing the Phase II effort in coordination with the South and Southwest Florida water management districts. Initiative activities in 2003 were focused in six counties of the 10-county east-central Florida region – Volusia, Brevard, Orange, Seminole, Lake and Osceola counties. Marion County was not included in the focus area, but their representatives were invited to participate in Initiative meetings.

Initiative activities in 2004 were focused in seven counties of the 10-county east-central Florida region, Volusia, Brevard, Orange, Seminole, Lake, Flagler and Osceola.

Conclusion:

Enhance Intergovernmental Coordination
To better facilitate development of cooperative solutions, the focus shifted to facilitation at both the county level and at the project level. Facilitation efforts initiated in 2004are:

County-Level Activities

- Brevard County—District staff continued liaison with the Brevard Water Supply Board.
- Countywide Water Supply Plans—The District focused much of its attention in 2004 on securing local government interlocal agreements to support development of countywide water supply plans.

Project-Level Activities

- CROT Integrated Water Supply Alternative Study—The city of Cocoa, the Reedy Creek Improvement District, Orange County, and the Toho Water Authority (CROT) worked cooperatively during 2004 to identify possible joint alternative water supply projects, which, if implemented, could delay the need for more costly projects. The focus was on reclaimed water and stormwater projects.
- Taylor Creek Reservoir/St. Johns River Expansion Project—This project was identified as a water supply development project (Taylor Creek Reservoir Expansion Project) in the 2004 DWSP Interim Update. Emerging as the highest priority project for development because it is likely the least costly of the identified alternative water supply development projects for the east-central Florida area.
- The North Seminole Regional Reclaimed Water and Surface Water Augmentation System Expansion and Optimization Study—The District cooperatively funded this study, and District consultants facilitated and administered the effort.

General Activities

- Initiative and water supply issue information continues to be provided to elected officials, water supply utilities, the public, and the media through public meetings, one-on-one meetings, direct mail, the District's quarterly magazine (*Streamlines*), the District's monthly local government newsletter (WaterWatch), media interviews, and the District's Web site (*sjrwmd.com*).

Communication tools were developed to inform Initiative participants, the media, and the public of water supply issues and Initiative activities. Current tools include an updated project fact sheet, a project Web site, an Agenda summary, annual reports of activities and accomplishments, an upcoming meeting schedule, and a database of elected officials, water supply utilities, and other interested parties.

Develop New Water Supply
Water Supply Projects
One of the goals of the Initiative is to expand and enhance the findings of the DWSP, including further investigations of potential alternative water supply sources and identification of additional water supply development projects that could be implemented to develop these sources to help meet future east-central Florida water supply needs.

Projects originally identified in the 2000 DWSP include:

- Eastern I-4 Corridor Project
    - St. Johns River water supply facility component
    - Eastern Orange and Seminole counties regional reuse component
    - City of Apopka reuse component
- Strategic water conservation assistance project
- Strategic reclaimed water assistance project

In 2003, potential water supply development projects were identified and evaluated by Initiative participants to help meet future water supply needs in east-central Florida. Of those identified, 11 were added to the list of water supply development projects identified in DWSP with the publication of Special Publication SJ2004-SP28, *2004 Interim Update to Special Publication SJ2000-SP1, District Water Supply Plan*.

Link Land Use Planning and Water Supply Planning

2004 Initiative Activities continued work begun in 2003 regarding the implementation of the requirement that local governments consider the water management district's regional water supply plans in their comprehensive plans.

Water Supply Facilities Work Plans

In 2004, District staff activities included the following:

- Coordinated with DCA to determine the completion deadlines for work plans for all local governments in the District
- Developed a fact sheet providing basic information regarding the schedule and requirements for completing the work plans
- Distributed the fact sheet to all local governments
- Made the fact sheet available on the District Web site
- Provided some form of assistance to about half of the 48 local governments in east-central Florida that now have 2006 deadlines
- Reviewed and commented on four work plans submitted to DCA by local governments

Comprehensive Plan Amendments

In 2004, District staff activities included the following:

- Distributed the "Potable Water Availability" worksheet developed in 2003 to all local governments
- Implemented an interactive approach with local governments to obtain the information requested on the worksheet
- Provided comments to DCA regarding potable water availability and related water resource issues
- Assisted local governments with their responses to DCA concerns relative to water availability and related water resource issues

Increase Use of Reclaimed Water

Efforts, which were already under way prior to the start of the Initiative, continued along with new projects resulting from Initiative-funded efforts.

- Northwest Cities Reuse Interconnect Project

- Western Orange Reuse Plan
- Brevard County Barrier Island Reuse Plan

The North Seminole Regional Reclaimed Water and Surface Water Augmentation System Expansion and Optimization Study, performed cooperatively by Seminole County and the cities of Sanford and Lake Mary ("Tri-Party"), with a 50% match from the District, was completed this year.

Enhance Aquifer Recharge Using Reclaimed Water
A draft report is under review regarding the evaluation of recharge benefits associated with the Conserv II project.

The CFARE2 study to identify recharge projects in the Orange County area, including those using reclaimed water, was completed this year. A screening process was developed by which other recharge projects identified in the future could be evaluated for feasibility.

The North Seminole Regional Reclaimed Water and Surface Water Augmentation System Expansion and Optimization Study is a project that addresses the issue area of enhance aquifer recharge using reclaimed water as well as the issue area of increase use of reclaimed water.

The District will monitor a cooperative effort between Orange County and the U.S. Geological Survey to investigate the removal of nitrate in reclaimed water application sites in west Orange County.

Increase Water Conservation
2004 Initiative Activities included:

- Continuing to coordinate with the model landscape ordinance committee to develop an acceptable east-central Florida model landscape ordinance
- Continuing with ongoing regulatory/permitting and incentive programs
- Assessing the amount of reduction in water demand that can be reasonably expected through specific water conservation programs and practices (Coordinated with the Florida Department of Environmental Protection)

Recommendations for 2005 Phase II Initiative Activities
Enhance Intergovernmental Coordination

- Continue intergovernmental coordination among governments
- Continue the focus on developing countywide water supply plans and partnerships between suppliers
- Begin to identify additional opportunities to develop intercounty water supply plans and partnerships
- Continue ongoing county-level facilitation in Lake, Seminole, Flagler and Orange counties
- Provide appropriate water supply plan development support to Marion County
- Continue to support WAV

- Continue ongoing intercounty facilitation
- Continue to educate local government, state and federal elected officials, and the public on water supply issues and potential solutions
- Continue to coordinate Initiative activities with the South and Southwest Florida water management districts, FDEP, and DCA
- Continue to use existing water resource, planning, and business organizations to improve communications and coordination with other organizations
- Improve communications with the business community concerning water issues by identifying and contacting organizations to present information on Initiative activities
- Prepare funding request packages for programs and projects developed through the Phase II process

Develop New Water Supply

- Continue work with interested parties to accomplish TCR/SJR Expansion project
- Facilitate, as necessary, the planning for and development of other new projects listed in the 2004 DWSP update
- Evaluate other water supply projects, as appropriate
- Continue to support WAV

Link Land Use Planning and Water Supply Planning

- Continue to educate local governments about, provide support for, and assist in coordinating the development of their water supply facilities work plans
- Continue to educate local governments about water supply availability and related water resource issues relative to comprehensive plan amendments

Increase Use of Reclaimed Water

- Provide assistance to and monitor the progress of regional reuse projects
- Provide assistance to and monitor the plans of utilities to augment reclaimed water systems with alternative water supplies
- Continue to seek funding for regional reuse projects through the federal State and Tribal Assistance Grant Program, the Florida Forever Program and the District's Alternative Water Supply Cost-Share Program
- Continue to work with local governments to increase the beneficial use of reclaimed water to the extent economically, environmentally, and technically feasible, as a means of reducing per capita water use of potable water

Enhance Aquifer Recharge Using Reclaimed Water

- Report on the results of the Conserv II project analysis and develop the next steps for coordination between the water management districts and FDEP
- Provide assistance to and monitor the progress of the CFARE2 project

Increase Water Conservation

- Continue with ongoing regulatory/permitting and incentive programs

- Finalize the east-central Florida model landscape ordinance and initiate a pilot incentive program in Lake County
- Encourage local government and water supply utility participation in coordinated water conservation public awareness programs

SJ2005-SP12
2005
Aquifer Storage and Recovery Issues and Concepts
By:
R. David G. Pyne, P.E.
ASR Systems LLC

Background:

ASR wells have been operating in Florida since 1983. At least 65 ASR wells in 13 ASR wellfields are in operation, and more than 25 other ASR wellfields are in various states of development. During the past several years, concerns have been expressed by several public interest groups regarding whether ASR technology has been adequately proven in Florida, in the sense of whether proposed applications for storage of drinking water, treated surface water, reclaimed water, and fresh groundwater in Florida's brackish aquifers may create unacceptable water quality and environmental problems. Concerns have focused on potential leaching of metals such as arsenic, mercury, and uranium from the limestone into the recovered water or into the surrounding aquifer; potential contamination of the aquifer with disinfection byproducts (DBPs); potential contamination with pathogenic microbiota such as bacteria, viruses, and protozoa; and mixing with surrounding brackish water so that recovery efficiency is reduced to below acceptable levels.

Objective:

The St. Johns River Water Management District (SJRWMD) has prepared this paper to inform elected officials and other interested citizens regarding the scientific information that is available to support the decision-making process as it relates to the implementation of aquifer storage and recovery (ASR) technology.

Conclusion:

Scientific literature is substantial and consistent in showing that, under hydrogeologic conditions prevalent in Florida and almost all other ASR sites nationwide, DBP constituents are reduced or eliminated rapidly through natural processes during ASR storage, if these constituents are present in the recharge water. The principal mechanism for the reduction in the DBPs is microbial degradation. Several proven approaches are currently used at various Florida water treatment plants to control or eliminate the presence of DBPs in the recharge water, if needed. As such, DBPs should not be an issue for Florida ASR sites.

Metals occur naturally at low concentrations in the limestone of the Floridan aquifer. During ASR storage, these metals may tend to dissolve out of the limestone and create elevated concentrations in the recovered water. Elevated concentrations may also occur in the ASR storage zone. Metal concentrations typically decline with time, with distance from the ASR well, and with successive operating cycles. No long-term

operating ASR sites in Florida are known to have elevated concentrations of metals such as arsenic, uranium, or mercury, although metals data are sparse in most of the data sets, particularly those for the older facilities. Typically, it is anticipated that after four to eight ASR cycles at the same storage volume, arsenic concentrations should subside to acceptable levels. This anticipated decline in arsenic is based upon testing and operational experience at 13 ASR wellfields in Florida that have been in operation for up to 21 years. There have been no documented instances of water exceeding metal standards having been distributed to the public through drinking water distribution systems from Florida ASR wells.

Pathogenic microbiota are not present in recharge water to ASR wells in Florida, reflecting state and federal regulations and policies by FDEP and SJRWMD to recharge only water that meets drinking water standards for storage in our brackish aquifers. Scientific laboratory investigations and, to a lesser degree, field investigations in Florida, have shown that bacteria, viruses, and some protozoa attenuate naturally and rapidly during ASR storage and under controlled conditions approximating ASR storage. This natural attenuation serves as an additional barrier to protect groundwater quality and public health. No Florida data are currently available regarding the fate of Cryptosporidium and algal toxins during ASR storage; however, such data are available from sources outside Florida. This is not an issue for recharge water meeting drinking water standards.

Recovery efficiency is an indication of how much mixing occurs between the stored water and the native water in the aquifer system. Generally, for storage in Florida's brackish aquifers, efficiency starts out low and improves with successive operating cycles due to freshening of the storage zone around an ASR well. A majority of the ASR wells that have been operating for more than 5 years have reached acceptable and economically viable levels of recovery efficiency. The acceptable level of recovery efficiency varies amount individual water users and is generally in the range of 70% to 100%, with higher levels accomplished in less brackish aquifers and lower levels in highly saline or seawater aquifers.

The use of ASR as a water management tool, in conformance with state and federal regulations, has proven to be both scientifically sound and environmentally responsible. Emerging policies of FDEP continue to steer the development and implementation of ASR. ASR is a site-specific technology that is still evolving, and there is much to learn regarding its application in the different geological setting of Florida.

SJ2005-SP19
November 2005
East-Central Florida Water Supply Planning Initiative
Final Report

Background:

The east-central Florida area, which includes Brevard, Orange, Volusia and Seminole counties and portions of Lake Marion, Polk, Sumter, Osceola and Flagler counties, has been the subject of a major water supple planning initiative since 2002. The East-Central Florida Water Supply Planning Initiative is designed to assist in meeting future water supply needs, while protecting the water resources and related natural systems. The Initiative resulted from two regionwide water summits held in early 2002 where local government officials, water supply utilities, and the St. John River, South Florida and Southwest Florida water management districts began working together to develop solutions to their collective future water supply issues. Representatives from all ten counties in the east-central Florida area were invited to participate in Phase I of the Initiative. The Phase I process resulted in the East-Central Florida Water Agenda, which identifies six key water supply issue areas, 17 recommendations and 32 strategies developed by the Initiative Phase I participants. The six areas identified in the Agenda are:

- Enhance intergovernmental coordination
- Develop new water supply
- Link land use planning and water supply planning
- Increase use of reclaimed water
- Enhance aquifer recharge using reclaimed water
- Increase water conservation

Objective:

Phase II of the Initiative is designed to build upon the results of Phase I with the development of action plans and identification of specific projects to implement the Agenda recommendations and strategies. The St. Johns River Water Management District is managing the Phase II effort in coordination with the South and Southwest Florida water management districts. Initiative activities in 2003 were focused in six counties of the 10-county east-central Florida region – Volusia, Brevard, Orange, Seminole, Lake and Osceola counties. Marion County was not included in the focus area, but their representatives were invited to participate in Initiative meetings.

Initiative activities in 2004 were focused in seven counties of the 10-county east-central Florida region, Volusia, Brevard, Orange, Seminole, Lake, Flagler and Osceola.

2005 Initiative activities in 2005 were focused in eight counties of the 10-county east-central Florida region, Volusia, Brevard, Orange, Seminole, Lake, Marion, Flagler, and Osceola.

Conclusion:

Enhance Intergovernmental Coordination
To better facilitate development of cooperative solutions, the focus shifted to facilitation at both the county level and at the project level. Facilitation efforts initiated in 2004and continued in 2005 are:

County-Level Activities

- Brevard County—District staff continued liaison with the Brevard Water Supply Board.
- Countywide Water Supply Plans—The District focused much of its attention in 2005 on securing local government interlocal agreements to support development of county-level water supply plans.

Project-Level Activities

- CROT Integrated Water Supply Alternative Study—The city of Cocoa, the Reedy Creek Improvement District, Orange County, and the Toho Water Authority (CROT) worked cooperatively during 2004 to identify possible joint alternative water supply projects, which, if implemented, could delay the need for more costly projects. The focus was on reclaimed water and stormwater projects. An integrated water supply alternatives study began in FY 2005 and is expected to be complete in FY 2007.
- Taylor Creek Reservoir/St. Johns River Expansion Project—This project was identified as a water supply development project (Taylor Creek Reservoir Expansion Project) in the 2004 DWSP Interim Update. Emerging as the highest priority project for development because it is likely the least costly of the identified alternative water supply development projects for the east-central Florida area. Facilitated discussions held during 2004 and 2005 resulted in a proposed Memorandum of Agreement among six SUPPLIERS plus the St. Johns District and the South Florida District.
- The Lower Ocklawaha River in Putnam County Water Supply Evaluation—In response to a request from the Putnam County Commission, the District began the process to further evaluate the development of the Lower Ocklawaha River in Putnam County as a source of potable water supply.

General Activities

- Initiative and water supply issue information continued to be provided to elected officials, water supply utilities, the public, and the media through public meetings, one-on-one meetings, direct mail, the District's quarterly magazine (*Streamlines*), the District's monthly local government newsletter (WaterWatch), media interviews, and the District's Web site (*sjrwmd.com*).
- Communication tools were developed to inform Initiative participants, the media, and the public of water supply issues and Initiative activities. Current tools include an updated project fact sheet, a project Web site, an Agenda summary, annual reports of activities and accomplishments, an upcoming meeting

schedule, and a database of elected officials, water supply utilities, and other interested parties.

Develop New Water Supply

The 2005 Initiative Phase II work continued with efforts undertaken during the 2003-2004 period. In addition, the work was influenced by new legislation passed during the 2005 Florida legislative session.

2005 Legislative Actions

The Florida Water Protection and Sustainability Program (WPSP) was created through passage of Senate bills 360 and 444 during the 2005 legislative session and their subsequent signing into law by Gov. Jeb Bush. The purpose of this program is to provide cost-share funding for construction of alternative water supply projects. The legislative actions also included the requirement for local governments in priority water resource caution areas, such as east-central Florida, to select water supply development projects adequate to meet their demands within 18 months of adoption of the DWSP.

Water Supply Projects

- During 2005 the District prepared a draft 2005 DWSP. The document identified additional water supply development projects for the east-central Florida area.

Project Implementation

- St. Johns River/Taylor Creek Reservoir Water Supply Project—Project implementation began in November 2005 when the city of Cocoa, on behalf of the project partners, advertised for consultant services to accomplish a preliminary design report and Environmental Information Document for the water supply project.
- The Upper St. Johns River Basin Project—The District is investigating ways to optimize the Upper St. Johns River Basin Project to maintain flood control and environmental restoration goals while maximizing the amount of water available for public water supply.
- The status of implementation of reclaimed water projects is included in the section of this document titled Increase Use of Reclaimed Water.

Link Land Use Planning and Water Supply Planning

The 2005 Initiative activities focused on the review of local government comprehensive plan amendments and implementation of 2005 legislative changes regarding water supply requirements in local government comprehensive plans, including the development of water supply facilities work plans.

Water Supply Requirements in Comprehensive Plans

The District's efforts in 2005 focused on helping local governments understand their responsibilities relative to the cumulative legislative changes made in 2002, 2004, and 2005 regarding water supply requirements in comprehensive plans
In 2005, District staff activities included the following:

- Assisted with the development of frequently asked questions regarding water supply issues in comprehensive plans to post on the Department of Community Affair's (DCA's) Web page
- Assisted with the development of the water supply portion of DCA-sponsored regional workshops regarding implementation of SB 360 and delivered the presentation at the East Central Florida Regional Planning Council workshop held in Maitland
- Updated the District's comprehensive planning web page to provide useful information and links
- Worked with DCA, the Florida Department of Environmental Protection, and the other water management districts to draft changes to DCA's comprehensive plan amendment guidelines relative to water supply plans
- Provided assistance to local governments in the comprehensive plan evaluation and appraisal process

Comprehensive Plan Amendments
In 2005, District staff activities included the following:

- Continued to encourage the use of the District's "Potable Water Availability" worksheet when submitting comprehensive plan amendments
- Continued to work interactively with local governments to obtain the information requested on the worksheets
- Reviewed and commented on three amendments related to water supply facilities work plans
- Continued to provide comments to DCA regarding potable water availability and related water resource issues
- Continued to assist local governments with their responses to DCA concerns relative to water availability and related water resource issues
- Provided assistance to local governments in the comprehensive plan evaluation and appraisal process

Increase Use of Reclaimed Water
Identification of New Projects

- The West Melbourne Reclaimed Water Storage Project—This project was identified as an important project for the Brevard County Area.

Project Implementation

- City of Orlando Eastern Orange and Seminole Counties Regional Reuse Project
- The North Seminole Regional Reclaimed Water and Surface Water Augmentation System Expansion and Optimization Project
- DeLand Reclaimed Water and Surface Water Augmentation Project
- Lake Apopka Reuse Augmentation Project
- Leesburg Reclaimed Water Reuse Project
- Minneola Reclaimed Water Reuse Project
- New Smyrna Beach Utilities Commission Reclaimed Water Wet Weather Storage Pond Project

- Ormond Beach North Peninsula Reclaimed Water Storage Project
- Port Orange Reclaimed Water Reservoir and Recharge Basin Project
- Lake Apopka Basin Water Resource Development Project

Implementation of these reclaimed projects, with the exception of the Lake Apopka Water Resource Development Project, is expected to result in the use of about 26 mgd of reclaimed water to achieve a water resource benefit. The Lake Apopka Water Resource Development Project is expected to support the development of additional quantities of water to augment reclaimed water systems. These projects should decrease the projected 2025 groundwater deficit in east-central Florida

Enhance Aquifer Recharge Using Reclaimed Water

2005 Initiative Activities included:

- Staff prepared a final draft report titled *Estimates of Upper Floridan Aquifer Recharge Augmentation Based on Hydraulic and Water-Quality Data (1986-2002) from the Conserv II RIB Systems, Orange County, Florida* by Michael Merrit and David J. Toth.
- Central Florida Aquifer Recharge Enhancement (CFARE) project implementation began
- The North Seminole Regional Reclaimed Water and Surface Water Augmentation System Expansion and Optimization Study, which is described under Increase Use of Reclaimed Water, is a project that addresses enhanced aquifer recharge using reclaimed water and increased use of reclaimed water

Increase Water Conservation

2005 Initiative Activities included:

- Completed model landscape ordinance with the cooperation of a committee made up of state and local governments, and landscape and irrigation professionals
- Began participation in statewide irrigation standards group
- Continued with cooperative public information campaign. The goal of the 2005 Water Conservation Public Awareness Campaign was to educate the public on proper lawn and landscape irrigation techniques, to inform the public on the District's proposed rule amendments limiting landscape irrigation to no more than two days a week and to encourage public participation in the rule-making process

Recommendations for 2005 Phase II Initiative Activities

- The recent passage of Senate bills 444 and 360 and their subsequent signing into law by Gov. Jeb Bush have established new mechanisms for project identification and implementation. These new mechanisms reasonably assure that water suppliers in east-central Florida will proactively pursue alternative water supplies to meet future demands in a manner consistent with DWSP.

The new water supply framework in east-central Florida is supported largely by:

- New water supply planning and funding provisions, and local comprehensive planning provision of *Florida Statutes*
- Proactive interest on the part of water suppliers to develop alternative water supplies
- Commitment to identification of environmentally acceptable water supply projects by local-government partners working together at the county level
- Rule-based approach to water conservation

The new framework should successfully support the development of environmentally acceptable water supplies in east-central Florida without the continuation of the Initiative.

Therefore, the Initiative, as a separate effort, should be discontinued. The status of the following efforts should be annually reported to the Governing Board:

- Water supply development project identification through county-level planning efforts
- Water supply development project implementation
- District activities related to the new provisions of *Florida Statutes* and local comprehensive plan review

Deviations from the planned schedules for these efforts should be reported quarterly to the Governing Board.

SJ2006-1
2003 Water Supply Assessment SJRWMD

Background:

Water Supply Assessment (WSA) 2003 was performed to satisfy SJRWMD's purposes and to meet the requirements of Subparagraph 373.036(2)(b)4, *Florida Statutes* (F.S.), as follows:

A districtwide water supply assessment, to be completed no later than July 1, 1998, which determines for each water supply planning region

a. Existing legal uses, reasonably anticipated future needs, and existing and reasonably anticipated sources of water and conservation efforts; and
b. Whether existing and reasonably anticipated sources of water and conservation efforts are adequate to supply water for all existing legal uses and reasonably anticipated future needs and to sustain the water resources and related natural systems.

WSA 2003 was a required component of the District Water Management Plan (Subsection 373.036(2), F.S.). Because SJRWMD identified its entire jurisdictional area as one water supply planning region pursuant to the requirements of Subparagraph 373.036(2)(b)2. F.S., WSA 2003 is organized with a districtwide perspective. The assessment is based on a planning period extending through 2025 and is the first 5-year update to the initial *Florida Statutes* mandated assessment in association with updates to the District Water Management Plan.

The SJRWMD approach to addressing these requirements consists of the following:

- Defining the limits of water resource impacts beyond which an unacceptable water resource-related condition could occur (water resource constraints)
- Projecting the water resource impacts that could occur in 2025 as a result of projected changes in water use
- Identifying priority water resource caution areas (PWRCAs)

SJRWMD assessed water resource impacts in two primary categories:

- Impacts to natural systems
- Impacts to groundwater quality (saltwater intrusion)

Objective:

The St. Johns River Water Management District (SJRWMD) prepares water supply assessments for the purposes of:

- Identifying future water supply needs
- Identifying areas where those needs cannot be met by the water supply plans of major water users without unacceptable impacts to water resources and related natural systems (priority water resources caution areas)

SJRWMD also develops and implements water supply plans to assure that adequate and sustainable water supplies are available to meet projected future water supply needs without unacceptable impacts in priority water resource caution areas (PWRCAs).

Conclusion:

A major conclusion of the 2003 districtwide water supply assessment is that the SJRWMD 2005 water supply plan development process should focus on identifying water supply strategies that will assure that adequate and sustainable water supplies are available to meet projected future water supply needs without unacceptable impacts in the east-central Florida area including all or parts of Brevard, Flagler, Lake, Marion, Orange, Osceola, and Seminole counties.

SJ2006-2
2005 Water Supply Plan SJRWMD

Background:

Total water use for SJRWMD is projected to increase from about 1.36 billion gallons per day in 1995 to about 1.79 billion gallons per day in 2025, and from about 1.49 billion gallons per day in 2000 to 1.79 billion gallons per day in 2025, based on water use projections developed during the WSA 2003 development process. The projected increase from 1995 to 2025 of approximately 400 million gallons per day (mgd) and the projected increase from 2000 to 2025 of approximately 300 mgd represent total districtwide increases in water use of approximately 30% and 20% respectively. Public supply increases account for about 90% of these total projected changes.

Objective:

This 2005 District Water Supply Plan (DWSP 2005) addresses current and future water use and traditional and alternative water sources and water conservation required to meet 2025 water supply needs while sustaining water quality and protecting wetland and aquatic systems. DWSP 2005 is designed to meet the requirements of the water supply planning provisions of Section 373, *Florida Statutes* (F.S.), and is based on a planning horizon extending through 2025. It includes the following components:

- A water supply development component
- A water resource development component
- A minimum flows and levels component

Approximately 39% of SJRWMD is identified as priority water resource caution areas (PWRCAs) (WSA 2003). These are areas where existing and reasonably anticipated sources of water and water conservation efforts may not be adequate (1) to supply water for all existing legal uses and anticipated future needs and (2) to sustain the water resources and related natural systems. PWRCAs are the focus of DWSP 2005.

Conclusion:

DWSP 2005 identifies water supply development project options and water resource development projects that will meet future water supply needs while sustaining water quality and protecting wetland and aquatic systems. For portions of SJRWMD not designated as PWRCAs, existing water supply sources and water supply development plans are considered reasonably adequate to meet projected needs while sustaining water quality and protecting wetland and aquatic systems.

Identified water supply source options include

- Naturally occurring sources
  - Fresh groundwater

- Brackish groundwater
- Surface water
- Seawater

- Management techniques
  - Water resource development
    - Artificial recharge
    - Aquifer storage and recovery
    - Avoidance of the impacts of groundwater withdrawal through hydration
    - Water supply systems interconnections
  - Demand management (water conservation)
  - Use of reclaimed water

SJ2006-SP1
August 2005
Demineralization Concentrate Ocean Outfall Feasibility Study: Evaluation of Additional Information Needs
For
St. Johns River Water Management District
By
CH2M Hill, Inc.
With Input From
Atlantic Oceanographic and Meteorological Laboratory, National Oceanic and Atmospheric Administration

Background:

The District Water Supply Plan (DWSP) completed by St. Johns River Water Management District (SJRWMD) in 2000 identified alternative strategies for meeting projected 2020 water supply demands for municipal, agricultural, and industrial uses. High levels of interest exist regarding potential application of demineralization treatment technologies for potable water production with concentrate disposal via ocean outfalls, particularly for the utilities located in planning areas along the coast.

Objective:

To better define the feasibility of ocean outfall disposal of concentrate. And to help utilities understand relevant outfall implementation issues. SJRWMD designed the subject investigations in collaboration with the Atlantic Oceanographic and Meteorological Laboratory (AOML) of the National Oceanographic and Atmospheric Administration. AOML was retained to conduct these studies focused on understanding oceanographic conditions that might either favor or preclude ocean outfall feasibility.

Conclusion:

The information summarized in this technical memorandum represents the synthesis of input from AOML's information inventory and literature review, and the interagency discussions to date regarding the concept of demineralization concentrate ocean outfalls offshore of SJRWMD. The AOML investigation confirmed that while some relevant data exist for the study area, the information available is considered sparse at best, and AOML's conclusion is that additional field studies are needed to truly position SJRWMD for assisting utilities in evaluating whether demineralization technologies should be integral elements of their long-term water supply plans. On the basis of the information presented in this document, and the collective input form AOML, CH2M HILL, SJRWMD, and FDEP representatives, the following recommendations for management action are offered:

1. SJRWMD should proceed with having detailed scopes of work prepared for proposed Phases 2a and 2b as separate planning documents. The scopes of

work should be designed to produce a field study sampling plan as well as task definition for the other proposed Phase 2 study elements.

2. The Phase 2b sampling plan should be designed with input from FDEP and other agency participants. It should contain detailed text and tabular summaries providing clear definition of as a minimum, the following:
   - Study zones and stations within each zone, where applicable
   - Targeted data to be generated and rationale for each set of parameters (e.g., physical, chemical, and biological oceanographic information)
   - Instrumentation to be used and associated programming (if applicable)
   - Standard operating procedures for all field activities
   - Field and analytical quality control measures
   - Frequency of sampling/field surveys
   - Data management plans
   - Data interpretation and documentation schedules, including plans for adaptively managing field study scope elements an schedule

   The sampling plan should include, as appendices, candidate vendor information and detailed cost estimates for each field study element. Costing information corresponding to the conceptual study elements will be needed for SJRWMD to determine what elements are to be incorporated into Phase 2b.

3. The scopes of work for the other Phase 2 activities outlined in the TM should be prepared to the level of detail needed for SJRWMD management review and determination regarding which of these activities can be included under Phase 2a.

SJ2006-SP2
August 2005
Summary of AOML Oceanographic Information Inventory and Literature Review
Supporting a Demineralization Concentrate Ocean Outfall Feasibility Study
For
St. Johns River Water Management District
By
CH2M Hill, Inc.

Background:

The St. Johns River Water Management District (SJRWMD) is in the process of guiding long-term water supply planning within its jurisdictional boundaries, and in 2000, completed the District Water Supply Plan (DWSP) addressing alternative approaches to meeting water supply demands projected through the year 2020. The DWSP addresses a number of water supply management strategies, and one of them is support for emerging potable water treatment technologies. Demineralization methods produce a wastewater concentrate that bears elevated concentrations of minerals. Identifying an environmentally approvable concentrate disposal method is the primary impediment to gaining necessary regulatory approvals for demineralization treatment plant installation and operation. Discharge of concentrate to surface waters through ocean outfall is an option, but concerns exist regarding technical, regulatory, and economic feasibility.

Objective:

In the interest of better defining the feasibility of ocean outfall disposal of concentrate from water treatment plants located along the Atlantic Ocean coastline within its jurisdiction, SJRWMD initiated a phased investigation designed to help utilities understand the relevant issues as they prepare and subsequently implement their respective long-term water supply plans.

Conclusion:

This Technical Memorandum presents a summary of key physical oceanographic information presented in the AOML deliverable relevant to addressing concentrate ocean outfall feasibility.

The AOML information inventory and literature review focused on physical oceanographic characteristics considered relevant to determining how a concentrate discharged through an ocean outfall would be dispersed in the receiving water body. AOML's experience with ocean outfall studies and modeling of effluent plumes led it to focus in on the following types of parameters:

- Bathymetry

- Water column temperature and salinity profiles (for calculation of density profiles)
- Current velocity and direction as a function of depth within the water column
- Effects of inlets or coastline variations impacting nearshore physical conditions (currents and waves)

The AOML information inventory and literature review leads to the conclusion that detailed, long-term physical oceanographic datasets focused on ambient current velocity and direction records, and water column profiles of density-related parameters are not available for much, if not most, of the Northeast and Central Florida Atlantic coastal waters. As originally envisioned, Phase 2 of this overall investigation was intended to include focused field data gathering to supplement the results of this information inventory and literature review. Field investigation concepts are being developed by AOML for SJRWMD's review and approval, and to promote further discussions with FDEP and perhaps other stakeholder regarding how, where and when to conduct those field investigations.

Activities underway are leading in the direction of development of specific research proposals for up to three candidate sites along the Atlantic coast of SJRWMD, and depending on the interaction of factors including scope, locations, schedule, funding availability, and the interest of prospective stakeholder partners, final decisions regarding those field investigations will be made in the future. In the interim, the following recommendations are offered for SJRWMD's review and consideration:

1. SJRWMD should proceed with further discussions with FDEP regarding policy and rule constraints on the permitabilty of new ocean outfalls within coastal ocean waters (within 3 miles from shore)
2. SJRWMD should continue dialogue with federal and state agencies, or with academic/research institutions or consulting firms working on behalf of such agencies, to determine the availability of additional physical oceanographic datasets for areas north of Cape Canaveral.
3. SJRWMD should consider alternative funding mechanisms for prospective modeling or field investigations that are likely to be included in the set of recommendations being developed regarding Phase 2 project activities. On the basis of preliminary project discussions, it is clear that these activities likely to be proposed as element s of the Phase 2 investigations are going to require funding allocations well in excess of those envisioned at the onset of Phase 1.

It seems clear that demineralization processes will likely need to be a part of the long-term water supply strategy for achieving sustainable development within SJRWMD, and perhaps statewide. It is important to continue to investigate what engineering and environmental strategies are needed to identify administratively approvable infrastructure that supports achieving this long-term goal.

SJ2006-SP5
November 2002
East-Central Florida Water Supply Planning Initiative
East-Central Florida Water Agenda:
A Report on the Water Supply Planning Initiative Process

Background:

Water supply is a critical issue in the east-central Florida region. The Floridan aquifer which provides almost all of the region's existing public water supply and a large part of the agricultural water irrigation supply, will likely not be able to meet all future withdrawal requests without unacceptable impacts to wetlands, lake levels, spring flows and groundwater quality. Alternative water supply source options and management techniques must be developed to meet projected economic growth and increased water demands.

Objective:

In January and February 2002, two meetings convened among elected officials and other stakeholders to discuss the water supply situation in east-central Florida. For the purposes of this Initiative, elected officials and other stakeholders from all or portions of Brevard, Orange, Osceola, Volusia, Seminole, Lake, Polk, Flagler, Marion and Sumter counties were invited. Following the second summit, assessment meetings and interviews with elected officials and other stakeholders around the region were conducted, followed by a series of subregional workshops on several issues of interest and concern to the participants and a regionwide Forum on October 17, 2002 to review the Phase I results and discuss the interest in and design for Phase II.

Conclusion:

The following overall goal of the initiative was reviewed and refined by participants during the two rounds of workshops:

To develop a "East-Central Florida Water Supply Agenda" that seeks to over time:

- Ensure that new, sustainable water supplies are developed in ways that maximize the benefits and minimize harm to natural resources in the region;
- Preserve the economic vitality of the region;
- Draw linkages, as appropriate, to land use plans; and
- Identify cooperative, affordable and equitable solutions that minimize costs and avoid competition for remaining inexpensive water resources.

The Phase I process resulted in the East-Central Florida Water Agenda, which identifies six key water supply issue areas, 17 recommendations and 32 strategies developed by the Initiative Phase I participants. The six areas identified and the recommendations in the Agenda are:

1. Enhance intergovernmental coordination
    - Regional and subregional forums
    - Build on existing association forms
2. Develop new water supply
    - Identify specific alternative water supply projects
    - Seek alternative funding to equitably distribute costs
    - Provide incentives for alternative water supply projects
3. Link land use planning and water supply planning
    - Develop recommended approaches
    - Coordinate planning schedules
4. Increase use of reclaimed water
    - Develop areawide reuse plans
    - Provide incentives for development and implementation of areawide reuse plans
    - Seek additional funding to equitably distribute costs
5. Enhance aquifer recharge using reclaimed water
    - Coordinate regulatory policies and programs
    - Seek areawide support for studying recharge opportunities
    - Education on enhanced recharge as part of the overall reuse strategy
6. Increase water conservation
    - Implement water conservation practices
    - Adopt landscape ordinances
    - Coordinate water conservation programs
    - Determine conservation effectiveness and perform cost-effectiveness analysis

Phase II should commence and conclude in 2003 and seek to:

- Identify water supply partnerships
- Clarify roles and responsibilities for those partners and other interest stakeholders
- Identify and prioritize water supply partnerships projects in the region
- Identify and select funding options
- Develop legislative recommendations necessary for implementation of the Phase I and/or Phase II recommendations
- Consider appropriate revisions to the district's regional water supply plans

Phase II Approaches

1. Develop and support a regional coordination framework
2. Select regional and subregional approaches
    - Subregional Planning Forums. Convening a public form, with invited representation from the range of suppliers and other stakeholders in the subregion, that would meet regularly in order to develop a common base of information and address concerns
    - Pilot Partnership Projects. Joint development by suppliers and other stakeholders of partnership projects that will provide the building blocks

and establish trust for the broader collaboration on water supply in the region. Such efforts should seek to implement partnership projects to advance the East-Central Water Supply Agenda.

3. Collaborate with the Districts in 2003 and 2004 in the Update of the Regional Water Supply Plan

April 2001
Middle St. Johns River Basin Final Reconnaissance Report
Prepared for St. Johns River Water Management District
Prepared by URS

Background:

Rapid urbanization and natural constraints affect the balances within the Florida ecosystem. The effects of impacting these balances in the middle basin include degraded water quality of lakes and streams; aquifer levels and wetland systems adversely affected; flood problem areas, and ecosystems strained because of encroachments, channelized streams and decreased wildlife habitat areas.

Objective:

The middle basin reconnaissance report provides a general inventory of existing conditions. It provides a summary of the challenges and activities that exist within the basin, and the strategies needed to address them. The challenges result from an assessment of the gaps and deficiencies within the five planning units of the middle basin. The elements addressed are water quality, water quantity (such as stream flow and flood protection), ecosystems, and water supply.

Conclusion:

In the middle basin, the following challenges require attention:

- Development of a basin-wide comprehensive management action plan,
- Development of an integrated water quality assessment program,
- Stormwater master planning,
- Refining and enforcing stormwater management regulations, and
- Implementing stormwater retrofit programs to meet current standards to the maximum extent practicable.

The following strategies are recommended to address challenges and expand ongoing activities in the middle basin.

Water Quality

- Develop a SWIM plan
- Seek funding for regional water quality improvement projects
- Develop public outreach for awareness of water quality issues
- Expand water quality modeling
- Implement a basin-wide geographic database for water quality information
- Implement integrated water resource monitoring network to measure existing conditions and effectiveness of projects

Stormwater Retrofit and Non Point Source Pollution

- Expand compliance monitoring of permitted systems
- Prioritize stormwater retrofit programs for older developments
- Seek funding for stormwater retrofit projects consistent with master plans
- Standardize criteria for stormwater master planning
- Develop land acquisition plan for multi-use opportunities

Response to Regulatory Changes

- Commit resources and funding to meet requirements of NPDES and TMDL regulations
- Investigate land development rule changes to improve watershed protection

Water Conservation

- Promote water conservation on both the demand and supply sides
- Develop alternative sources of drinking water to reduce reliance on groundwater

Flood Protection

- Prepare master plans to address problem areas
- Update flood level information through new basin-wide contoured aerial mapping
- Increase participation in the FEMA Community Rating System (CRS) program
- Address closed basin flooding and drainwell management

Land Acquisition and Management

- Implement land acquisition plan for preservation of environmentally sensitive lands
- Expand land management programs to include recreational uses
- Acquire and manage lands for multiple uses consistent with basin goals

By developing the above strategies and initiating the SWIM priority planning process, a comprehensive basin management plan will be written with the consensus of government and the public. The reconnaissance report sets the stage for the development of a management action plan that will establish the long-term vision and basin goals needed to renew the middle basin.

Lake Monroe Sediment Accumulation and Past Water Quality
Final Report to:
St. Johns River Water Management District

W. T. Anderson, L. J. Scinto, E. E. Gaiser, B. Carroll, A. Quillen, and J. Haberer
Southeast Environmental Research Center, Florida International University, Miami, FL

Background:

The St. Johns River Water Management District (SJRWMD) required an assessment of the nutrients associated with the sediments in Lake Monroe to properly evaluate and facilitate water quality restoration measures.

Objective:

The primary goal of this sediment composition study was to quantitatively estimate nutrient dynamics and sedimentation rates in Lake Monroe.

Conclusion:

Sediment and floc thickness were characterized at 60 randomly chosen locations using metal rod and short cores. Results indicated that Lake Monroe has mean floc thickness of 15 cm and sediment thickness values ranging from 3 cm to 20 cm. From the original 60 locations, an additional 20 sites were cored using a piston corer. Recovered cores varied in length from 15 cm to 72 cm. Three main sediment types were identified: gyttja, peat, and sands/clays/grey mud (SCM). The different sediment types' organic matter content, total nitrogen, total phosphorus, were analyzed and characterized and various conclusions drawn on the likelihood of reasons for these parameters' values. Radiometric dating, stable isotope analysis and diatom stratigraphy were also carried out. Raidometric dating indicated that sedimentation rates were low and that the last 100 yrs was represented by the upper 15cm of organic rich gyttja. All the peates from the lower units of the cores dated older than 14,000 years before present. Diatom taxonomic analysis from the dated cores confirm a shift from predominantly surface-associated productivity by oligo- to mesotrophic taxa to planktonic productivity by eutrophic taxa. Sediment nutrient analyses also supports the diatom data showing increases in phosphorus accumulation over the same period, with maximum rates occurring in the 1990's.

Minimum and Guidance Levels for Big Gant Lake in Sumter County, Florida

Ecologic Evaluation Section
Resource Conservation and Development Department
Draft - September 2006

Background:

State law (Section 373.042, Florida Statutes; hereafter F.S.) directs the Department of Environmental Protection or the water management districts to establish minimum flows and levels (MFLs) for lakes, wetlands, rivers and aquifers. As currently defined by statute, the minimum level of an aquifer or surface water body is "the level of groundwater in the aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources of the area". Adoption of a minimum water level does not necessarily protect a water body from significant harm, however, protection, recovery or regulatory compliance can be gauged once a standard has been established.

Minimum flows and levels are to be established based upon the best available information and shall be developed with consideration of "…changes and structural alterations to watersheds, surface waters and aquifers, and the effects such changes or alterations have had, and the constraints such changes or alterations have placed on the hydrology of the affected watershed, surface water, or aquifer…", with the caveat that these considerations shall not allow significant harm caused by withdrawals (Section 373.0421, F.S.). Additional guidance for the establishment of minimum flows and levels is provided in the Florida Water Resources Implementation Rule (Chapter 62-40.473, Florida Administrative Code; hereafter F.A.C.), which requires that "consideration shall be given to the protection of water resources, natural seasonal fluctuations in water flows, and environmental values associated with coastal, estuarine, aquatic and wetland ecology, including: a) recreation in and on the water; b) fish and wildlife habitats and the passage of fish; c) estuarine resources; d) transfer of detrital material; e) maintenance of freshwater storage and supply; f) aesthetic and scenic attributes; g) filtration and absorption of nutrients and other pollutants; h) sediment loads; i) water quality; j) and navigation."

To address this legislative mandate within its jurisdictional boundaries, the Southwest Florida Water Management District (District or SWFWMD) has developed specific methodologies for establishing minimum flows or levels for lakes, wetlands, rivers and aquifers, and adopted them into the Water Levels and Rates of Flow Rule (Chapter 40D-8, F.A.C.). For lakes, methodologies have been developed for establishing Minimum Levels for systems with fringing cypress wetlands 0.5 acres or greater in size and for those without fringing cypress wetlands 0.5 acres or greater in size. Lakes with fringing cypress wetlands where water levels currently rise to an elevation expected to fully maintain the integrity of the wetlands are classified as Category 1 Lakes. Lakes

with fringing cypress wetlands that have been structurally altered such that lake water levels do not rise to former levels are classified as Category 2 Lakes. Lakes without fringing cypress wetlands are classified as Category 3 Lakes. Chapter 40D-8, F.A.C. also provides for the establishment of Guidance Levels, which serve as advisory information for the District, lake shore residents and local governments, or to aid in the management or control of adjustable water level structures.

Objective:
Typically two Minimum Levels and three Guidance Levels are established for lakes, and upon adoption by the District Governing Board, are incorporated into Chapter 40D-8, F.A.C. The levels, which are expressed as elevations in feet above the National Geodetic Vertical Datum of 1929 (NGVD), are described below.

The Ten Year Flood Guidance Level is provided as an advisory guideline for lake shore development. It is the level of flooding expected on a frequency of not less than the ten year recurring interval, or on a frequency of not greater than a ten percent probability of occurrence in any given year.

The High Guidance Level is provided as an advisory guideline for construction of lake shore development, water dependent structures, and operation of water management structures. The High Guidance Level is the elevation that a lake's water levels are expected to equal or exceed ten percent of the time (P10) on a long-term basis.

The High Minimum Lake Level is the elevation that a lake's water levels are required to equal or exceed ten percent of the time (P10) on a long-term basis.

The Minimum Lake Level is the elevation that a lake's water levels are required to equal or exceed fifty percent of the time (P50) on a long-term basis.

The Low Guidance Level is provided as an advisory guideline for water dependent structures, information for lake shore residents and operation of water management structures. The Low Guidance Level is the elevation that a lake's water levels are expected to equal or exceed ninety percent of the time (P90) on a long-term basis.

Conclusion:
In accordance with Chapter 40D-8, F.A.C., Minimum and Guidance Levels were developed for Big Gant Lake (Table 1), a Category 1 Lake located in Sumter County, Florida. The levels were established using best available information, including field data that were obtained specifically for the purpose of Minimum

Levels development. Data and analyses used for development of the Minimum and Guidance Levels are described in the remainder of this report.

Table 1. Minimum and Guidance Levels for Big Gant Lake.

Minimum and Guidance Levels	Elevation (feet above NGVD)
Ten Year Flood Guidance Level	77.6
High Guidance Level	76.1
High Minimum Lake Level	76.3
Minimum Lake Level	74.9
Low Guidance Level	73.4

Proposed Minimum and Guidance Levels for
Fort Cooper Lake in Citrus County, Florida

September 28, 2006
Draft

Ecologic Evaluation Section
Resource Conservation and Development Department
Southwest Florida Water Management District
Brooksville, Florida 34604-6899

Background:

State law (Section 373.042, Florida Statutes; hereafter F.S.) directs the Department of Environmental Protection or the water management districts to establish minimum flows and levels for lakes, wetlands, rivers and aquifers. As currently defined by statute, the minimum level of an aquifer or surface water body is "the level of groundwater in the aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources of the area". Adoption of a minimum water level does not necessarily protect a water body from significant harm. However, protection, recovery or regulatory compliance can be gauged once a standard has been established.

Minimum flows and levels are to be established based upon the best available information and shall be developed with consideration of "…changes and structural alterations to watersheds, surface waters and aquifers, and the effects such changes or alterations have had, and the constraints such changes or alterations have placed on the hydrology of the affected watershed, surface water, or aquifer…", with the caveat that these considerations shall not allow significant harm caused by withdrawals (Section 373.0421, F.S.). Additional guidance for the establishment of minimum flows and levels is provided in the Florida Water Resources Implementation Rule (Chapter 62-40.473, Florida Administrative Code; hereafter F.A.C.), which requires that "consideration shall be given to the protection of water resources, natural seasonal fluctuations in water flows, and environmental values associated with coastal, estuarine, aquatic and wetland ecology, including: a) recreation in and on the water; b) fish and wildlife habitats and the passage of fish; c) estuarine resources; d) transfer of detrital material; e) maintenance of freshwater storage and supply; f) aesthetic and scenic attributes; g) filtration and absorption of nutrients and other pollutants; h) sediment loads; i) water quality; and j) navigation."

To address this legislative mandate within its jurisdictional boundaries, the Southwest Florida Water Management District (District or SWFWMD) has developed specific methodologies for establishing minimum flows or levels for lakes, wetlands, rivers and aquifers, and adopted them into its Water Level and Rates of Flow Rule (Chapter 40D-8, F.A.C). For lakes, methodologies have been developed for establishing Minimum Levels for systems with fringing cypress-dominated wetlands greater than 0.5 acre in size, and for those without fringing cypress wetlands. Lakes with fringing cypress wetlands where water levels

currently rise to an elevation expected to fully maintain the integrity of the wetlands are classified as Category 1 Lakes. Lakes with fringing cypress wetlands that have been structurally altered such that lake water levels do not rise to former levels are classified as Category 2 Lakes. Lakes without fringing cypress wetlands are classified as Category 3 Lakes. Chapter 40D-8, F.A.C. also provides for the establishment of Guidance Levels, which serve as advisory information for the District, lakeshore residents and local governments, or to aid in the management or control of adjustable water level structures.

Objectives:
Typically, two Minimum Levels and three Guidance Levels are established for lakes, and upon adoption by the District Governing Board, are incorporated into Chapter 40D-8, F.A.C. The levels, which are expressed as elevations in feet above the National Geodetic Vertical Datum of 1929 (NGVD), are described below.

The Ten Year Flood Guidance Level is provided as an advisory guideline for lakeshore development. It is the level of flooding expected on a frequency of not less than the ten-year recurring interval, or on a frequency of not greater than a ten percent probability of occurrence in any given year.

The High Guidance Level is provided as an advisory guideline for construction of lakeshore development, water dependent structures, and operation of water management structures. The High Guidance Level is the elevation that a lake's water levels are expected to equal or exceed ten percent of the time on a long-term basis.

The High Minimum Lake Level is the elevation that a lake's water levels are required to equal or exceed ten percent of the time on a long-term basis.

The Minimum Lake Level is the elevation that a lake's water levels are required to equal or exceed fifty percent of the time on a long-term basis.

The Low Guidance Level is provided as an advisory guideline for water dependent structures, information for lakeshore residents and operation of water management structures. The Low Guidance Level is the elevation that a lake's water levels are expected to equal or exceed ninety percent of the time on a long-term basis.

Conclusion:
In accordance with Chapter 40D-8, F.A.C., proposed Minimum and Guidance Levels were developed for Fort Cooper Lake, a Category 3 Lake located in Citrus County, Florida. Levels were established using best available information, including data that were obtained specifically for the purpose of minimum levels development. The data and analyses used for development of the proposed levels are described in the remainder of this report.

Table 2. Proposed minimum and guidance levels for Fort Cooper Lake in Citrus County, Florida.

Level	Elevation (feet above NGVD)
Ten Year Flood Guidance Level	35.4
High Guidance Level	30.9
High Minimum Lake Level	30.1
Minimum Lake Level	28.7
Low Guidance Level	26.7

Minimum and Guidance Levels for Lake Deaton
in Sumter County, Florida

Ecologic Evaluation Section
Resource Conservation and Development Department
Draft - September 2006

Background:

State law (Section 373.042, Florida Statutes; hereafter F.S.) directs the Department of Environmental Protection or the water management districts to establish minimum flows and levels (MFLs) for lakes, wetlands, rivers and aquifers. As currently defined by statute, the minimum level of an aquifer or surface water body is "the level of groundwater in the aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources of the area". Adoption of a minimum water level does not necessarily protect a water body from significant harm, however, protection, recovery or regulatory compliance can be gauged once a standard has been established.

Minimum flows and levels are to be established based upon the best available information and shall be developed with consideration of "…changes and structural alterations to watersheds, surface waters and aquifers, and the effects such changes or alterations have had, and the constraints such changes or alterations have placed on the hydrology of the affected watershed, surface water, or aquifer…", with the caveat that these considerations shall not allow significant harm caused by withdrawals (Section 373.0421, F.S.). Additional guidance for the establishment of minimum flows and levels is provided in the Florida Water Resources Implementation Rule (Chapter 62-40.473, Florida Administrative Code; hereafter F.A.C.), which requires that "consideration shall be given to the protection of water resources, natural seasonal fluctuations in water flows, and environmental values associated with coastal, estuarine, aquatic and wetland ecology, including: a) recreation in and on the water; b) fish and wildlife habitats and the passage of fish; c) estuarine resources; d) transfer of detrital material; e) maintenance of freshwater storage and supply; f) aesthetic and scenic attributes; g) filtration and absorption of nutrients and other pollutants; h) sediment loads; i) water quality; j) and navigation."

To address this legislative mandate within its jurisdictional boundaries, the Southwest Florida Water Management District (District or SWFWMD) has developed specific methodologies for establishing minimum flows or levels for lakes, wetlands, rivers and aquifers, and adopted them into the Water Levels and Rates of Flow Rule (Chapter 40D-8, F.A.C.). For lakes, methodologies have been developed for establishing Minimum Levels for systems with fringing cypress wetlands 0.5 acres or greater in size and for those without fringing cypress wetlands 0.5 acres or greater in size. Lakes with fringing cypress wetlands where water levels currently rise to an elevation expected to fully maintain the integrity of the wetlands are classified as Category 1 Lakes. Lakes

with fringing cypress wetlands that have been structurally altered such that lake water levels do not rise to former levels are classified as Category 2 Lakes. Lakes without fringing cypress wetlands are classified as Category 3 Lakes. Chapter 40D-8, F.A.C. also provides for the establishment of Guidance Levels, which serve as advisory information for the District, lake shore residents and local governments, or to aid in the management or control of adjustable water level structures.

Objective:
Typically two Minimum Levels and three Guidance Levels are established for lakes, and upon adoption by the District Governing Board, are incorporated into Chapter 40D-8, F.A.C. The levels, which are expressed as elevations in feet above the National Geodetic Vertical Datum of 1929 (NGVD), are described below.

The Ten Year Flood Guidance Level is provided as an advisory guideline for lake shore development. It is the level of flooding expected on a frequency of not less than the ten year recurring interval, or on a frequency of not greater than a ten percent probability of occurrence in any given year.

The High Guidance Level is provided as an advisory guideline for construction of lake shore development, water dependent structures, and operation of water management structures. The High Guidance Level is the elevation that a lake's water levels are expected to equal or exceed ten percent of the time (P10) on a long-term basis.

The High Minimum Lake Level is the elevation that a lake's water levels are required to equal or exceed ten percent of the time (P10) on a long-term basis.

The Minimum Lake Level is the elevation that a lake's water levels are required to equal or exceed fifty percent of the time (P50) on a long-term basis.

The Low Guidance Level is provided as an advisory guideline for water dependent structures, information for lake shore residents and operation of water management structures. The Low Guidance Level is the elevation that a lake's water levels are expected to equal or exceed ninety percent of the time (P90) on a long-term basis.

Conclusion:
In accordance with Chapter 40D-8, F.A.C., proposed Minimum and Guidance Levels were developed for Lake Deaton (Table 1), a Category 3 Lake located in Sumter County, Florida. The levels were established using best available information, including field data that were obtained specifically for the purpose of Minimum Levels development. Data and analyses used for development of the

proposed Minimum and Guidance Levels are described in the remainder of this report.

Table 1. Proposed Minimum and Guidance Levels for Lake Deaton.

Minimum and Guidance Levels	Elevation (feet above NGVD)
Ten Year Flood Guidance Level	65.8
High Guidance Level	65.2
High Minimum Lake Level	64.8
Minimum Lake Level	63.2
Low Guidance Level	62.2

Proposed Minimum and Guidance Levels for
Lake Marion in Levy County, Florida

September 29, 2006
Draft

Ecologic Evaluation Section
Resource Conservation and Development Department
Southwest Florida Water Management District
Brooksville, Florida 34604-6899

Background:

State law (Section 373.042, Florida Statutes; hereafter F.S.) directs the Department of Environmental Protection or the water management districts to establish minimum flows and levels for lakes, wetlands, rivers and aquifers. As currently defined by statute, the minimum level of an aquifer or surface water body is "the level of groundwater in the aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources of the area". Adoption of a minimum water level does not necessarily protect a water body from significant harm. However, protection, recovery or regulatory compliance can be gauged once a standard has been established.

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To address this legislative mandate within its jurisdictional boundaries, the Southwest Florida Water Management District (District or SWFWMD) has developed specific methodologies for establishing minimum flows or levels for lakes, wetlands, rivers and aquifers, and adopted them into its Water Level and Rates of Flow Rule (Chapter 40D-8, F.A.C). For lakes, methodologies have been developed for establishing Minimum Levels for systems with fringing cypress-dominated wetlands greater than 0.5 acre in size, and for those without fringing cypress wetlands. Lakes with fringing cypress wetlands where water levels

currently rise to an elevation expected to fully maintain the integrity of the wetlands are classified as Category 1 Lakes. Lakes with fringing cypress wetlands that have been structurally altered such that lake water levels do not rise to former levels are classified as Category 2 Lakes. Lakes without fringing cypress wetlands are classified as Category 3 Lakes. Chapter 40D-8, F.A.C. also provides for the establishment of Guidance Levels, which serve as advisory information for the District, lakeshore residents and local governments, or to aid in the management or control of adjustable water level structures.

Objective:

Typically, two Minimum Levels and three Guidance Levels are established for lakes, and upon adoption by the District Governing Board, are incorporated into Chapter
40D-8, F.A.C. The levels, which are expressed as elevations in feet above the National Geodetic Vertical Datum of 1929 (NGVD), are described below.

The Ten Year Flood Guidance Level is provided as an advisory guideline for lakeshore development. It is the level of flooding expected on a frequency of not less than the ten-year recurring interval, or on a frequency of not greater than a ten percent probability of occurrence in any given year.

The High Guidance Level is provided as an advisory guideline for construction of lakeshore development, water dependent structures, and operation of water management structures. The High Guidance Level is the elevation that a lake's water levels are expected to equal or exceed ten percent of the time on a long-term basis.

The High Minimum Lake Level is the elevation that a lake's water levels are required to equal or exceed ten percent of the time on a long-term basis.

The Minimum Lake Level is the elevation that a lake's water levels are required to equal or exceed fifty percent of the time on a long-term basis.

The Low Guidance Level is provided as an advisory guideline for water dependent structures, information for lakeshore residents and operation of water management structures. The Low Guidance Level is the elevation that a lake's water levels are expected to equal or exceed ninety percent of the time on a long-term basis.

Conclusion:

In accordance with Chapter 40D-8, F.A.C., proposed Minimum and Guidance Levels were developed for Lake Marion, a Category 3 Lake located in Levy County, Florida. Levels were established using best available information, including data that were obtained specifically for the purpose of minimum levels development. The data and analyses used for development of the proposed levels are described in the remainder of this report.

Table 1. Proposed Minimum and Guidance Levels for Lake Marion.

Minimum and Guidance Levels	Elevation (feet above NGVD)
Ten Year Flood Guidance Level	56.6
High Guidance Level	55.3
High Minimum Lake Level	54.6
Minimum Lake Level	50.7
Low Guidance Level	47.7

Minimum and Guidance Levels for
Lake Miona and Black Lake
in Sumter County, Florida

Ecologic Evaluation Section
Resource Conservation and Development Department
Draft - September 2006

Background:

State law (Section 373.042, Florida Statutes; hereafter F.S.) directs the Department of Environmental Protection or the water management districts to establish minimum flows and levels (MFLs) for lakes, wetlands, rivers and aquifers. As currently defined by statute, the minimum level of an aquifer or surface water body is "the level of groundwater in the aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources of the area". Adoption of a minimum water level does not necessarily protect a water body from significant harm, however, protection, recovery or regulatory compliance can be gauged once a standard has been established.

Minimum flows and levels are to be established based upon the best available information and shall be developed with consideration of "…changes and structural alterations to watersheds, surface waters and aquifers, and the effects such changes or alterations have had, and the constraints such changes or alterations have placed on the hydrology of the affected watershed, surface water, or aquifer…", with the caveat that these considerations shall not allow significant harm caused by withdrawals (Section 373.0421, F.S.). Additional guidance for the establishment of minimum flows and levels is provided in the Florida Water Resources Implementation Rule (Chapter 62-40.473, Florida Administrative Code; hereafter F.A.C.), which requires that "consideration shall be given to the protection of water resources, natural seasonal fluctuations in water flows, and environmental values associated with coastal, estuarine, aquatic and wetland ecology, including: a) recreation in and on the water; b) fish and wildlife habitats and the passage of fish; c) estuarine resources; d) transfer of detrital material; e) maintenance of freshwater storage and supply; f) aesthetic and scenic attributes; g) filtration and absorption of nutrients and other pollutants; h) sediment loads; i) water quality; j) and navigation."

To address this legislative mandate within its jurisdictional boundaries, the Southwest Florida Water Management District (District or SWFWMD) has developed specific methodologies for establishing minimum flows or levels for lakes, wetlands, rivers and aquifers, and adopted them into the Water Levels and Rates of Flow Rule (Chapter 40D-8, F.A.C.). For lakes, methodologies have been developed for establishing Minimum Levels for systems with fringing cypress wetlands 0.5 acres or greater in size and for those without fringing cypress wetlands 0.5 acres or greater in size. Lakes with fringing cypress wetlands where water levels currently rise to an elevation expected to fully

maintain the integrity of the wetlands are classified as Category 1 Lakes. Lakes with fringing cypress wetlands that have been structurally altered such that lake water levels do not rise to former levels are classified as Category 2 Lakes. Lakes without fringing cypress wetlands are classified as Category 3 Lakes. Chapter 40D-8, F.A.C. also provides for the establishment of Guidance Levels, which serve as advisory information for the District, lake shore residents and local governments, or to aid in the management or control of adjustable water level structures.

Objective:
Typically two Minimum Levels and three Guidance Levels are established for lakes, and upon adoption by the District Governing Board, are incorporated into Chapter 40D-8, F.A.C. The levels, which are expressed as elevations in feet above the National Geodetic Vertical Datum of 1929 (NGVD), are described below.

The Ten Year Flood Guidance Level is provided as an advisory guideline for lake shore development. It is the level of flooding expected on a frequency of not less than the ten year recurring interval, or on a frequency of not greater than a ten percent probability of occurrence in any given year.

The High Guidance Level is provided as an advisory guideline for construction of lake shore development, water dependent structures, and operation of water management structures. The High Guidance Level is the elevation that a lake's water levels are expected to equal or exceed ten percent of the time (P10) on a long-term basis.

The High Minimum Lake Level is the elevation that a lake's water levels are required to equal or exceed ten percent of the time (P10) on a long-term basis.

The Minimum Lake Level is the elevation that a lake's water levels are required to equal or exceed fifty percent of the time (P50) on a long-term basis.

The Low Guidance Level is provided as an advisory guideline for water dependent structures, information for lake shore residents and operation of water management structures. The Low Guidance Level is the elevation that a lake's water levels are expected to equal or exceed ninety percent of the time (P90) on a long-term basis.

Conclusion:
In accordance with Chapter 40D-8, F.A.C., proposed Minimum and Guidance Levels were developed for Lake Miona and Black Lake (Table 1), a Category 3 Lake system located in Sumter County, Florida. The levels were established using best available information, including field data that were obtained

specifically for the purpose of Minimum Levels development. Data and analyses used for development of the proposed Minimum and Guidance Levels are described in the remainder of this report.

Table 1. Proposed Minimum and Guidance Levels for Lake Miona and Black Lake.

Minimum and Guidance Levels	Elevation (feet above NGVD)
Ten Year Flood Guidance Level	57.5
High Guidance Level	54.7
High Minimum Lake Level	53.9
Minimum Lake Level	51.3
Low Guidance Level	49.6

Minimum and Guidance Levels for Lake Okahumpka
in Sumter County, Florida

Ecologic Evaluation Section
Resource Conservation and Development Department
Draft – September 2006

Background:

State law (Section 373.042, Florida Statutes; hereafter F.S.) directs the Department of Environmental Protection or the water management districts to establish minimum flows and levels (MFLs) for lakes, wetlands, rivers and aquifers. As currently defined by statute, the minimum level of an aquifer or surface water body is "the level of groundwater in the aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources of the area". Adoption of a minimum water level does not necessarily protect a water body from significant harm, however, protection, recovery or regulatory compliance can be gauged once a standard has been established.

Minimum flows and levels are to be established based upon the best available information and shall be developed with consideration of "…changes and structural alterations to watersheds, surface waters and aquifers, and the effects such changes or alterations have had, and the constraints such changes or alterations have placed on the hydrology of the affected watershed, surface water, or aquifer…", with the caveat that these considerations shall not allow significant harm caused by withdrawals (Section 373.0421, F.S.). Additional guidance for the establishment of minimum flows and levels is provided in the Florida Water Resources Implementation Rule (Chapter 62-40.473, Florida Administrative Code; hereafter F.A.C.), which requires that "consideration shall be given to the protection of water resources, natural seasonal fluctuations in water flows, and environmental values associated with coastal, estuarine, aquatic and wetland ecology, including: a) recreation in and on the water; b) fish and wildlife habitats and the passage of fish; c) estuarine resources; d) transfer of detrital material; e) maintenance of freshwater storage and supply; f) aesthetic and scenic attributes; g) filtration and absorption of nutrients and other pollutants; h) sediment loads; i) water quality; j) and navigation."

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with fringing cypress wetlands that have been structurally altered such that lake water levels do not rise to former levels are classified as Category 2 Lakes. Lakes without fringing cypress wetlands are classified as Category 3 Lakes. Chapter 40D-8, F.A.C. also provides for the establishment of Guidance Levels, which serve as advisory information for the District, lake shore residents and local governments, or to aid in the management or control of adjustable water level structures.

Objective:
Typically two Minimum Levels and three Guidance Levels are established for lakes, and upon adoption by the District Governing Board, are incorporated into Chapter 40D-8, F.A.C. The levels, which are expressed as elevations in feet above the National Geodetic Vertical Datum of 1929 (NGVD), are described below.

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The High Guidance Level is provided as an advisory guideline for construction of lake shore development, water dependent structures, and operation of water management structures. The High Guidance Level is the elevation that a lake's water levels are expected to equal or exceed ten percent of the time (P10) on a long-term basis.

The High Minimum Lake Level is the elevation that a lake's water levels are required to equal or exceed ten percent of the time (P10) on a long-term basis.

The Minimum Lake Level is the elevation that a lake's water levels are required to equal or exceed fifty percent of the time (P50) on a long-term basis.

The Low Guidance Level is provided as an advisory guideline for water dependent structures, information for lake shore residents and operation of water management structures. The Low Guidance Level is the elevation that a lake's water levels are expected to equal or exceed ninety percent of the time (P90) on a long-term basis.

Conclusion:
In accordance with Chapter 40D-8, F.A.C., proposed Minimum and Guidance Levels were developed for Lake Okahumpka (Table 1), a Category 1 Lake located in Sumter County, Florida. The levels were established using best available information, including field data that were obtained specifically for the purpose of Minimum Levels development. Data and analyses used for

development of the proposed Minimum and Guidance Levels are described in the remainder of this report.

Table 1. Proposed Minimum and Guidance Levels for Lake Okahumpka.

Minimum and Guidance Levels	Elevation (feet above NGVD)
Ten Year Flood Guidance Level	59.9
High Guidance Level	58.1
High Minimum Lake Level	58.1
Minimum Lake Level	56.7
Low Guidance Level	55.0

Minimum and Guidance Levels for Lake Panasoffkee in Sumter County, Florida

Ecologic Evaluation Section
Resource Conservation and Development Department
Draft – September 2006

Background:

State law (Section 373.042, Florida Statutes; hereafter F.S.) directs the Department of Environmental Protection or the water management districts to establish minimum flows and levels (MFLs) for lakes, wetlands, rivers and aquifers. As currently defined by statute, the minimum level of an aquifer or surface water body is "the level of groundwater in the aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources of the area". Adoption of a minimum water level does not necessarily protect a water body from significant harm, however, protection, recovery or regulatory compliance can be gauged once a standard has been established.

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with fringing cypress wetlands that have been structurally altered such that lake water levels do not rise to former levels are classified as Category 2 Lakes. Lakes without fringing cypress wetlands are classified as Category 3 Lakes. Chapter 40D-8, F.A.C. also provides for the establishment of Guidance Levels, which serve as advisory information for the District, lake shore residents and local governments, or to aid in the management or control of adjustable water level structures.

Objective:
Typically two Minimum Levels and three Guidance Levels are established for lakes, and upon adoption by the District Governing Board, are incorporated into Chapter 40D-8, F.A.C. The levels, which are expressed as elevations in feet above the National Geodetic Vertical Datum of 1929 (NGVD), are described below.

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The **High Guidance Level** is provided as an advisory guideline for construction of lake shore development, water dependent structures, and operation of water management structures. The High Guidance Level is the elevation that a lake's water levels are expected to equal or exceed ten percent of the time (P10) on a long-term basis.

The **High Minimum Lake Level** is the elevation that a lake's water levels are required to equal or exceed ten percent of the time (P10) on a long-term basis.

The **Minimum Lake Level** is the elevation that a lake's water levels are required to equal or exceed fifty percent of the time (P50) on a long-term basis.

The **Low Guidance Level** is provided as an advisory guideline for water dependent structures, information for lake shore residents and operation of water management structures. The Low Guidance Level is the elevation that a lake's water levels are expected to equal or exceed ninety percent of the time (P90) on a long-term basis.

Conclusion:
In accordance with Chapter 40D-8, F.A.C., proposed Minimum and Guidance Levels were developed for Lake Panasoffkee (Table 1), a Category 1 Lake located in Sumter County, Florida. The levels were established using best available information, including field data that were obtained specifically for the purpose of Minimum Levels development. Data and analyses used for

development of the proposed Minimum and Guidance Levels are described in the remainder of this report.

Table 1. Proposed Minimum and Guidance Levels for Lake Panasoffkee.

Minimum and Guidance Levels	Elevation (feet above NGVD)
Ten Year Flood Guidance Level	42.8
High Guidance Level	40.5
High Minimum Lake Level	40.8
Minimum Lake Level	39.4
Low Guidance Level	38.9

January 2003
Middle St. Johns River Basin Surface Water Improvement and Management Plan

Background:

Under the Surface Water Improvement and Management (SWIM) Act of 1987, water management districts prioritize water bodies based on their need for protection and/or restoration. The St. Johns River Water Management District (SJRWMD) ranked the Middle St. Johns River Basin (MSJRB) as the 5th priority SWIM Program.

Objective:

The purpose of the MSJRB SWIM Plan is to set forth a realistic course of action, identifying the projects and the effort needed to accomplish them, consistent with the levels and trends of SWIM funding.

Conclusion:

The Middle Basin consists of five major planning units that contain 104 watersheds. The planning units are the Econlockhatchee River, Deep Creek, Lake Jesup, Lake Monroe, and the Wekiva River. The restoration plan focuses on four primary initiatives and a number of strategies and associated action steps developed to fulfill these initiatives.

1. Water quality enhancement, with emphasis on nutrient loading reduction and lake protection.
   - Design and implement an integrated water quality monitoring network
   - Water quality modeling
   - Prioritization of surface water to implement water quality enhancement opportunities

2. Watershed master planning with emphasis on completing hydrologic models of sub-basins.
   - Examine existing watershed master plan coverage and determine where gaps exist
   - Assist in the development and design of master plans and hydrologic models where gaps exist
   - Partner with local governments to implement existing plans

3. Stormwater retrofitting of areas built prior to 1983.
   - Prioritized stormwater retrofit program

4. Compliance and rule enforcement of existing permitted stormwater systems.
   - Implement compliance monitoring programs
   - Assess and manage resources and funding to support the requirements of current and emerging National Pollution Discharge Elimination System

(NPDES) and Total Maximum Daily Load (TMDL) regulations and Pollution Load Reduction Goals (PLRGs)

Local government has a role in maintaining water quality in the MSJRB through the improvement and maintenance of project s under their jurisdiction.

The successful implementation of this plan is going to require staff resources and dedicated funding. To accomplish all of the action steps, it is estimated that it will cost $97.8 million over the next five years to complete.

January 2004
Wekiva Area Water Budget
University of Central Florida Stormwater Management Academy
Martin Wanielista, Ewoud Hulstein, Yuan Li and Gour-Tsyh Yeh

Background/Objective

Development pressure in the Wekiva Watershed and Springshed may cause changes in the water quantity and quality of both the Springs and the River. Presented in this report are the results from hydrologicdata analysis that were used to document River flow, Springflow, groundwater and watershed conditions. Used for the analyses were five Spring discharge gauging stations, four rain gauging stations, twenty-six stream gauging stations, and seven wells located in the Wekiva Springshed.

Conclusion

Based on the data analysis and the modeling, it is recommended to maintain a water budget for the Wekiva Springshed that would allow for maintenance of infiltration and percolation of waters to meet pre conditions. Using or controlling the runoff from precipitation through a stormwater management program can do this efficiently and cost-effectively. Such a program could implement stormwater reuse through irrigation, rainwater harvesting through rooftop catchments, maintenance of open spaces, groundwater infiltration through constructed wetlands or pervious pavement, green roof programs, retention infiltration basins, swales, and etcetera.

The quantity and quality of water entering the aquifer Springshed must be maintained in order to preserve Springflow quantity and quality in the Wekiva River area. Off-site and on-site stormwater management methods can be used throughout the Springshed area to maintain the pre-development water budget in post-development. Besides maintaining Wekiva Springflow, a stormwater management program that maintains a water budget also will preserve potable water sources.

December 2002
Surface Water Quality Monitoring in the Middle St. Johns River Basin
Prepared by Maria Martinez

Background:

Water quality enhancement is the first of four initiatives listed under the Surface Water Improvement and Management Plan (SWIM) for restoring, protecting, and managing surface water resources of the Middle St. Johns River Basin (MSJRB). The first step in the process of improving water quality is to assess the status of water quality monitoring and use this information to assist in the design and implementation of an integrated water quality monitoring network.

Objective:

The purpose of this Water Quality Monitoring Network report is to identify current programs by federal and state agencies and local governments that monitor surface water quality, and to propose a complementary SJRWMD water-quality monitoring network for the Middle Basin that will provide useful information for developing water quality improvement goals and for verifying remedial actions.

Conclusion:

Applicable federal and state agencies and local governments were contacted for information about their water quality monitoring programs. These included City of Orlando, City of Maitland, Florida Department of Environmental Protection (FDEP), Florida LAKEWATCH, Lake County, Orange County, Seminole County, Volusia County, United States Geological Survey (USGS), and other working groups within the St. Johns River Water Management District (SJRWMD).

The report lists 158 water quality stations and 36 stations proposed for sampling beginning in FY 02-03 as part of the District's new MSJRB SWIM program. Of the 158, 102 are active. The information requested included frequency of sampling, date of sampling, list of parameters being sampled, and quality assurance procedures for field sampling and lab analysis followed by each agency.

The information collected in this report will be used to coordinate with other agencies in the design of a complementary water quality monitoring network to be implemented by the District beginning in FY 02-03 in cooperation with other agencies.

THE MSJRB SWIM Plan, completed in January 2002, was used as a guide in developing the MSJRB Water Quality Monitoring Network.

Withlacoochee Regional Water Supply Authority
Water Supply Plan Update – 2005
November 2006
Water Resource Associates

Background:
The Withlacoochee Regional Water Supply Authority (WRWSA) Regional Water Supply Plan Update – 2005 (RWSPU) is an update to the 1996 WRWSA Regional Water Supply Master Plan. In broad terms, the RWSPU delineates existing demands and provides a general pathway for the WRWSA to meet projected water demands for the region. The RWSPU responds to the WRWSA as it plans for the water supply needs of a growing region.

Objective:
Ultimately, the RWSPU presents options of traditional and non-traditional water supplies as a means to meet future water needs. The process of identifying water supply options combined a suite of analyses, includes water demand estimation, groundwater and surface water resource analyses, alternative water supply characterization, and project feasibility evaluation and ranking.

Conclusion:

While water demand for all users was considered, public supply water demand increases will top all use categories in both total quantity and percentage increase of usage. Public supply water use accounts for 69% of the total WRWSA demand increase over the planning horizon. These public supply demand increases will necessitate the development of water supply sources other than groundwater to protect environmental attributes of the region.

To 2025, the areas most likely to be restricted due to predicted groundwater impacts from future development of groundwater supplies are northeast and central Sumter County and central to southwest Hernando County. In addition to groundwater impacts, coastal Hernando County and Citrus County must also consider the potential for saltwater intrusion in their use of groundwater, by positioning future wellfields away from the brackish groundwater transition zones.

Future surface water supply development in the River Basin is likely to be directed primarily by the proximity of demand areas to major water bodies. The Withlacoochee River and the major water bodies along its reaches, including Lake Panasoffkee, Rainbow River, and Lake Rousseau, have available “safe” yield for future water supply development to 2025. However, potential withdrawals upstream of the Wysong-Coogler Water Conservation Structure will be limited at times, due to variations in seasonal and inter-annual flows. As with groundwater, surface water withdrawals to meet future water supply demands may be limited by MFL’s. Additionally, the major surface water bodies

within the Withlacoochee River Basin also have recreational and aesthetic functions that will require consideration during water supply development.

The potential alternative water supplies evaluated in this study included offshore springs, seawater desalination, brackish groundwater, stormwater, reclaimed water, and conservation (demand reduction). As groundwater sources become limited, alternative water supplies will play a large role in meeting future water demand within the WRWSA.