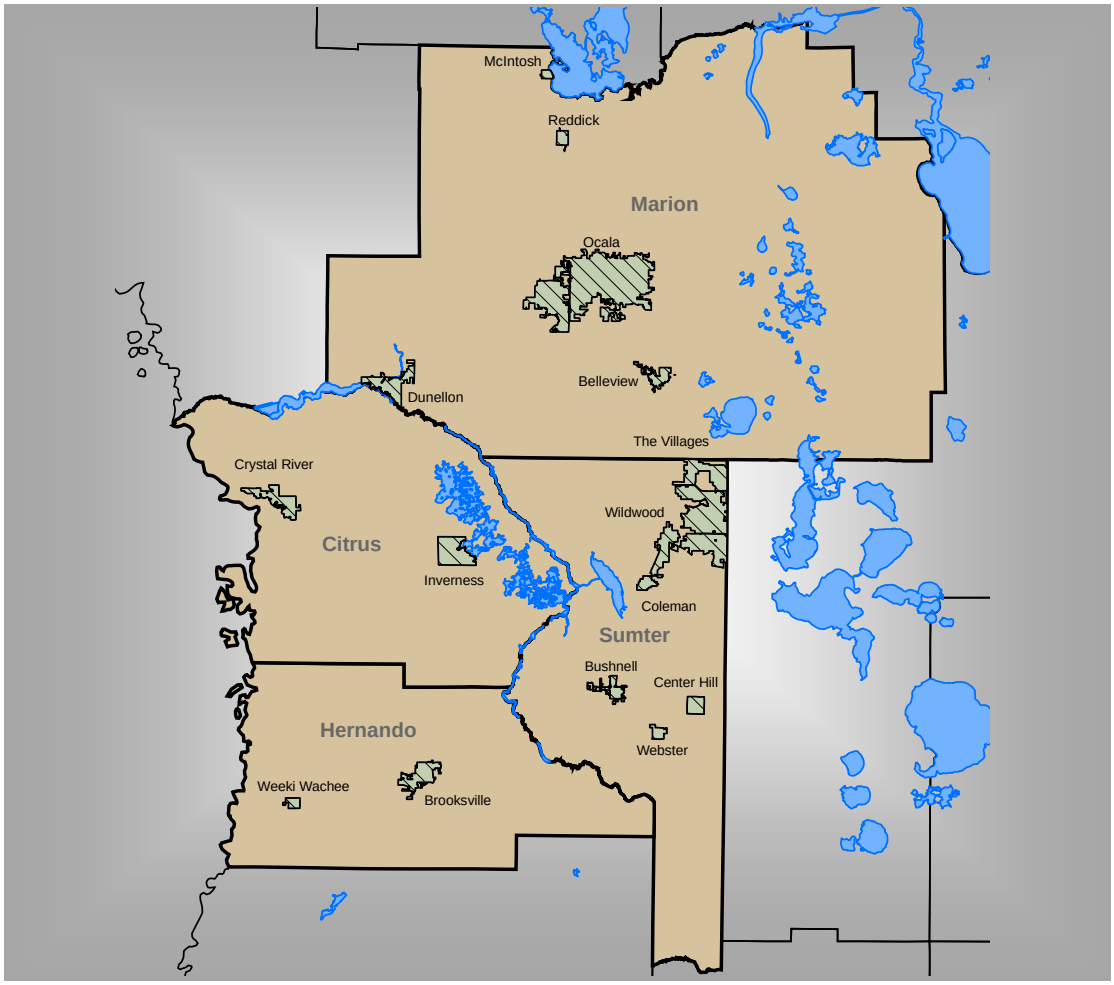
FINAL

Withlacoochee Regional Water Supply Authority

Phase II - Detailed Water Supply Feasibility Analyses



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Withlacoochee Regional Water Supply Authority

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CERTIFICATION

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Acronyms

$/kgal	Dollars per thousand gallons
ACTIFLO	Ballasted Flocculation / Sedimentation System
ADF	Average Daily Flow
AGMOD	District's Agricultural Water Use Allocation Program
AWS	Alternative Water Supply
BCC	Board of County Commissioners
BEBR	Bureau of Economic & Business Research
BMF	Benchmark Farms Program
CFCA	Central Florida Coordination Area
cfs	cubic feet per second
COE	Corps of Engineers
Compendium	Marion County Compendium
Conservation Credits	"Water Conservation Credits"
Conservation Initiative	"WRWSA - Water Conservation Initiative"
Crom	Prestressed Concrete Tanks
DAF	Dissolved Air Flotation
DBP	Disinfection Byproduct
DIP	Ductile Iron Pipe
District	Water Management District
DSS	Domestic Self Supply
DWRM-2	District Wide Regional Model-2
ECF	East-Central Florida
ECFGWB	East-Central Florida Groundwater Basin
ECFT model	East-Central Florida Transient model
EQ tank	Equalization tank
EWUR	Estimated Water Use Report
FAAS	Fujian Academy of Agricultural Sciences
FAC	Florida Administrative Code
FAS	Floridan Aquifer System
FDACS	Florida Department of Agriculture and Consumer Services
FDEP	Florida Department of Environmental Protection
Forest	Withlacoochee State Forest
GHB	General Head Boundary
gpcpd	gallons per capita per day
gpm	gallons per minute
HCUD	Hernando County Utilities Department
HCW&SD	Hernando County Water and Sewer District

HMLL	High Minimum Lake Level
I/C	Industrial/Commercial
ICI	Industrial, Commercial and Institutional
ICU	Intermediate Confining Unit
IFAS	University of Florida Institute of Food and Agricultural Science
LFA	Lower Floridan Aquifer
MCC	Motor Control Center
MCU I	Middle Confining Unit I
MCU II	Middle Confining Unit II
M/D	Mining/Dewatering
MFLs	Minimum Flow and Levels
mgd	million gallons per day
MLL	Minimum Lake Level
Model	Conservation Model
MSCU/MCU	Middle Semi-Confining Unit/Middle Confining Unit
NCF	North-Central Florida
ND	Northern District
NDGM	Northern District Groundwater Model
NDWRAP	Northern District Water Resources Assessment Project
NGF	National Golf Foundation
NGVD	National Geodetic Vertical Datum
NOAA	National Oceanic and Atmospheric Administration
NRC	Nuclear Regulatory Commission
NWCFGWB	Northern West-Central Florida Groundwater Basin
NWI	National Wetlands Inventory
O&M	Operation and Maintenance
OFW	Outstanding Florida Water
Optimizer	"Water Conservation Optimizer"
PAC	Powdered Activated Carbon
PF	Peninsular Florida
PG	Thermoelectric Power Generation
Polk Model	Polk County Version of the Optimizer
Power Plant	Progress Energy Crystal River Power Plant
ppt	parts per thousand
PSA’s	Public Service Announcement
PWRCA	Priority Water Resource Caution Area
R&R	Renewal and Replacement Costs
Reclaimed Plan	WRWSA Reclaimed Water Implementation Plan
Reclaimed Plan	WRWSA Reclaimed Water Implementation Plan
RIBs	Rapid Infiltration Basin

RO	Reverse Osmosis
ROMP	Regional Observation and Monitoring Program
RWSA	Regional Water Supply Authority
SA	Surficial Aquifer
SCEEC	Springs Coast Environmental Education Center
SJRWMD	St. Johns River Water Management District
SRWMD	Suwannee River Water Management District
SWFWMD	Southwest Florida Water Management District
SWFWMD Model	"SWFWMD Non-Agricultural Water Conservation Modeling"
SWPCG	Subcommittee of the Water Planning Coordination Group
SWTP	Surfacewater Treatment plant
SWUCA	Southern Water Use Caution Area
TBW	Tampa Bay Water
TOC	Total Organic Compounds
UFA	Upper Floridan Aquifer
ULV	Ultra Low Volume
USDA-SCS	U.S. Department of Agriculture-Soil Conservation Service
USGS	United States Geological Survey
W.A.T.E.R.	Water Awareness Through Education and Research
WCS	Water Conservation Structure
WMIS	Water Management Information System
WRWSA	Withlacoochee Regional Water Supply Authority
WRWSA - MWSP&IP	WRWSA Master Water Supply Planning and Implementation Program
WRWSA RWSPU	Withlacoochee Regional Water Supply Authority - Regional Water Supply Plan Update - 2005
WTP	Water Treatment Plant
WUPs	Water Use Permits
WWTFs	Wastewater Treatment Facilities
WWTP	Wastewater Treatment Plant

Executive Summary

A. Introduction

In 2005 the Withlacoochee Regional Water Supply Authority (WRWSA) established the WRWSA – Master Water Supply Planning and Implementation Program (WRWSA – MWSP&IP) which is a comprehensive process to plan for the region's water supply future. The WRWSA – MWSP&IP is a multi-year, multi-phase program that was follow-on to the WRWSA Regional Water Supply Plan Update (RWSPU). It contains phases for water supply planning. Identification and prioritization of water supply projects, the design of selected projects and implementation the projects and initiatives.

This report, the WRWSA – Detailed Water Supply Feasibility, was initiated in 2007 to follow-on to the WRWSA RWSPU and is considered Phase II of the WRWSA – MWSP&IP process. Its purpose is to update regional population and water demands and determine potential water supply projects to supply these needs. As the study progressed Marion County decided to rejoin the WRWSA. The inclusion of Marion County into the WRWSA added challenges and opportunities with respect to regionally sustainable water supply development. Geographically, the WRWSA has increased by approximately 86% from 1,892 square miles to 3,516 square miles. The existing population of the WRWSA has increased by approximately 68% from 494,931 to 732,681 (2005 estimate). It was decided to suspend work on the WRWSA – Detailed Water Supply Feasibility until Marion County was integrated into the planning process..

The inclusion of Marion County to the WRWSA required that the RWSPU be appended to consider existing and projected water demands in Marion County, and that the appended RWSPU outline the basis for future water supply development in the WRWSA region including Marion County. This was completed in December of 2009 with the publication of the RWSPU - Marion County Compendium.

B. WRWSA Detailed Water Supply Feasibility Study

As stated the WRWSA Detailed Water Supply Feasibility purpose is to update regional population and water demands and determine potential water supply projects to supply these needs. The projects are conceptualized, evaluated, ranked and prioritized according to short-term (0-20 years), medium-term (15-35 years), and long-term (30-50 years) planning horizons within this report.

C. Population and Water Demands within the WRWSA

Existing water demand and projections of future demand within the WRWSA were generated using 2005 as a base year. Water demand projections were evaluated based on a planning horizon of twenty (20) years from 2010-2030. The projections provide critical input to capital improvement plans and long-range water supply policy.

The vast majority of the current water demand within the WRWSA is from water withdrawn from groundwater sources. Public supply; domestic self-supply; industrial/commercial; mining/dewatering; power generation; agricultural; and recreational/aesthetic water use demands are considered in the report because these uses provide a comprehensive picture of

the total current and future water demands in the region. All water use categories are projected to increase over the planning horizon.

Public supply demands dominate, and will continue to be the largest water use within the WRWSA representing 70% of the increase. The total WRWSA public supply water demand was approximately 81.40 million gallons per day (mgd) in 2005 and is expected to increase to 147.77 mgd in 2030. The domestic self-supply water demand for the WRWSA was approximately 30.22 mgd in 2005, and expected to be 47.85 mgd in 2030. The total WRWSA industrial/commercial, mining/dewatering and power generation water demand was approximately 26.03 mgd in 2005, and estimated to decrease to 21.10 mgd in 2030. The total WRWSA recreational water demand was approximately 20.59 mgd in 2005, and anticipated to increase to 33.76 mgd in 2030. The total WRWSA agricultural water demand was approximately 16.12 mgd in 2005, and is expected to be about 18.59 mgd in 2030. The total WRWSA current demand is approximately 174.36 mgd. This total water demand is expected to increase to approximately 269.07 mgd in 2030. This demand equates to an approximate increase of 94.71 mgd (54%) in 2030.[1]

D. Water Resource Minimum Flows and Levels (MFLs)

MFLs for priority water bodies are required by Florida Statutes to be established by Florida's Water Management Districts to protect water resources and ecology from significant harm due to water withdrawals. Established MFLs can be constraints to water supply development. MFL priority water bodies are identified and scheduled based on the importance of the water resource and the existence of or potential for significant harm to the water resources or ecology of region. MFL priority lists are updated by the Districts annually.

The Southwest Florida Water Management District (SWFWMD) and the St. Johns River Water Management District (SJRWMD) have adopted 23 MFLs located in the WRWSA region. MFLs have been established for 21 lakes, one (1) wetland and one (1) spring. MFLs have been established in every county within the WRWSA.

The SWFWMD and SJRWMD have scheduled 14 MFLs located in the WRWSA for establishment. MFLs are scheduled for five (5) lakes, two (2) rivers, and seven (7) springs. These MFLs are also located throughout the WRWSA.

MFLs are scheduled, but have not been adopted for the Withlacoochee or Ocklawaha River systems and most of the springs within the WRWSA. These MFLs may have a significant impact on future groundwater and/or surface water development within the region.

As part of this report, the WRWSA has developed proxy thresholds on water systems that are yet to be completed. These proxy thresholds will ensure that proposed water supply projects recognize potential MFL withdrawal constraints. Proxy MFLs are developed for the Withlacoochee River and springs in Citrus, Sumter, and Hernando Counties

[1] Actual water demand in the future will vary based on a variety of factors, including the actual rate of population growth.

E. Regional Groundwater Assessment

The groundwater resource assessment completed in this report is a planning-level evaluation that identifies areas in the WRWSA where groundwater will be generally available or where further investigation into aquifer supplies is needed. The evaluation uses regional groundwater flow modeling to simulate declines in aquifer levels due to projected groundwater withdrawals in 2030, based on current population growth projections. The evaluation determined that existing permitted allocations, available local groundwater resources, conservation and reclaimed water will be generally sufficient to serve the projected 2030 groundwater demand in the WRWSA. However, localized resource constraints have the potential to materialize in certain areas prior to 2030.

The SWFWMD Northern District (ND) groundwater flow model is utilized for the groundwater assessment in the SWFWMD jurisdiction in Marion, Citrus, Sumter, and Hernando Counties. The SJRWMD North-Central Florida (NCF) groundwater flow model is utilized for the SJRWMD jurisdiction of Marion County. The projected groundwater withdrawals used for the 2030 evaluation assume continued reliance on groundwater extracted from existing withdrawal locations at current levels of water conservation, using current population growth projections for 2030. The assessment does not simulate increases in supplies of beneficial reuse, alternative water supply development, or reductions in future water demand (conservation or diminished growth). Simulated declines in aquifer levels are evaluated to determine the potential to affect lakes and wetlands, spring flows, and MFL priority water bodies due to increased groundwater withdrawals. Water resource criteria are used to identify potential adverse impacts to groundwater resources due to the simulated declines in aquifer levels. SWFWMD and SJRWMD resource assessment methodologies are used in the respective jurisdictions to determine potential adverse impacts to groundwater resources due to model simulated declines in aquifer levels. The presence (or absence) of potential adverse impacts is used to interpret the viability of fresh groundwater to serve future water demands to 2030.

Based on ND Model results within its domain and SWFWMD resource assessment methodologies, groundwater appears to be viable to serve projected water demand in 2030 in Citrus County and the SWFWMD jurisdiction in Marion County.

Based on NCF model results within its domain and SJRWMD resource assessment methodologies, groundwater does not appear to be viable to serve all projected water demand in 2030 in the SJRWMD jurisdiction in Marion County.

The potential effects of projected 2030 groundwater withdrawals in northern Sumter County and southern Marion County are difficult to interpret, but suggest a need for additional supplies or reductions in demand from conservation. Additional hydrogeologic data collection, monitoring, and analysis are warranted in this area.

In Hernando County, projected water demand in 2030 could lead to restrictions on groundwater withdrawals in the Spring Hill area, potentially requiring additional supplies or demand reduction from conservation. Dispersed groundwater withdrawals in Hernando County located to the north or east of the Weekiwachee springshed appear to be viable.

The SWFWMD and SJRWMD are developing an accelerated data collection and monitoring program in southern Marion, northwest Lake, and northern Sumter County over the next two

years (SWFWMD, 2008). Information gained from this program will provide important data for refinement of the groundwater flow models used in this assessment. The information used for this groundwater resource assessment will be updated by the SWFWMD and SJRWMD at minimum 5 year intervals.

F. Water Conservation

This report considers water conservation as an essential, cost-effective water supply management tool, with many potential means of implementation, ranging from the utilization of Florida Friendly Landscaping techniques to conservation rate structures. A variety of ad-hoc conservation efforts are currently in place among WRWSA members. Water conservation is considered first of the potential water planning and water supply options to handle future water demands in the region.

SWFWMD is in the process of implementing, and the SJRWMD is considering mandatory per capita requirements for the water users in their respective districts. SWFWMD has proposed rules to standardize and enhance water conservation and water use permitting requirements district-wide. Enhanced requirements include: compliance per capita rates, conservation rate structures, water billing requirements, water audits, wholesale permits and annual reports for public supply utilities. The WRWSA has directly funded water conservation programs in Hernando, Citrus, Marion and Sumter Counties.

This report includes an updated inventory of conservation measures, but also discusses and includes recent modeling completed by the SWFWMD that quantifies the potential savings and benefits of new water conservation devices. Optimized SWFWMD Model results indicate that significant conservation savings can be achieved in each county of the WRWSA. Water conservation efforts are categorized in three categories, as was done in the RWSP: Regulation, Education and Incentives. The report concludes that additional water conservation measures must be implemented to reduce the future water demands projected for the WRWSA.

G. Reclaimed Water

Reclaimed water systems are an important piece of a water supply strategy reducing the dependence on potable supplies for irrigation and industrial use and lowing per capita rates throughout the WRWSA. Some utilities in the WRWSA region now have special conditions in their water use permits that focus on reclaimed water and lower quality source expansions of their current water supply systems. Based on this many WRWSA member governments now recognize the benefits of reuse systems and are in the process of wastewater treatment plant (WWTP) upgrades to public supply standards and/or increasing the size of existing beneficial reuse facilities. Reclaimed water systems in the WRWSA are mostly in the early stages of development, except for a few larger population centers.

For water supply purposes, beneficial reuse is defined as that which replaces traditional groundwater or surfacewater uses. Fourteen domestic WWTPs in the WRWSA currently provide beneficial reuse or have funded expansions to do so. This is an increase of three WWTPs from the analysis completed as part of Phase I – WRWSA – Regional Water Supply Plan Update. Twenty-four domestic WWTPs in the WRWSA currently provide beneficial reuse or have identified projects and customers that will add or expand their reuse supply for beneficial use.

The reclaimed water chapter of this report identifies three additional reuse projects and prepares cost estimates for each project. Unit production costs range from $ 0.85 to $ 2.17 per 1,000 gallons; a large percentage of the cost is due to transmission to potential end users. Users identified for the three projects were golf courses due to their proximity, estimated potential groundwater offset and high efficiency of use. The cost and complexity of offsetting potable use with reuse water remains higher than that of traditional groundwater. Site-specific combinations of regulatory requirements and other factors will drive the implementation of specific reuse projects. The relationship of groundwater availability to beneficial reuse implementation suggests that regional coordination could benefit reclaimed water planning in the WRWSA.

H. Water Supply Project Ranking

This analysis evaluates and ranks potential regional water supply project options and conservation within the WRWSA. The intent of this analysis is to provide a menu of alternatives to the WRWSA and its members as they plan to meet future water demands within their jurisdictions. The potable water source projects were graded relative to their general feasibility for supply development, using a qualitative evaluation matrix.

These projects include: Northeast Sumter Regional Wellfield; Southern Citrus Regional Wellfield; Northwestern Marion Regional Wellfield; Eastern Marion Regional Wellfield; Lake Rousseau; Withlacoochee River near Holder – Reservoir; North Sumter "Conjunctive Use" Supply; Withlacoochee River Aquifer Recharge near Trilby; and Crystal River Power Plant Desalination. For comparison with projects involving water supply development, water conservation was also evaluated as a potential project, utilizing the results of the SWFWMD Model. The evaluation provides input to the WRWSA's prioritization process where the potential groundwater and AWS projects will be compared to the expected needs of member governments.

The water supply evaluation criteria include seven (7) categories which contain some of the key elements important to determining the viability of proposed water supply projects. The evaluation criteria include: Environmental Impacts: Ability to Permit; Public Perception; Long-Term Viability of Source; Costs; Ability to Serve Multiple Users; and Estimated Time to Implement.

Water conservation is the highest graded alternative of those considered for the project ranking. The option receives high grades in six of the seven evaluation categories. According to the SWFWMD Model results, the optimized cost of water conservation in each county of the WRWSA is below benchmark costs for dispersed groundwater and potable AWS development.

I. Water Supply Project Options

1. Potable Traditional Water Supply Development

Many utilities in the WRWSA region now have special conditions in their water use permits that require additional conservation measures and the development of alternative or non-local water supplies if unacceptable adverse impacts to natural resources are observed.

The dispersal of groundwater supplies helps to minimize adverse impacts from withdrawals, because aquifer declines resulting from withdrawals are dispersed rather than concentrated. Dispersed wellfields provide an option for member utilities facing local groundwater resource limitations to continue to rely on fresh groundwater for supply. Dispersed wellfield projects will need to comply with all water use permitting criteria, including requirement for participating members to utilize feasible lower quality sources and reduce demand through conservation.

Within the WRWSA – Detailed Water Supply Feasibility Analyses the following projects have been the focus of the analyses of the WRWSA region: **Fresh Groundwater:** Sumter Wellfield; Citrus Wellfield; Northwestern Marion Wellfield; and the Northeastern Marion Wellfield. Conceptual water production cost estimates for the groundwater projects range from $ 0.63 per thousand gallons to $ 0.81 per thousand gallons. Each of these projects reflects the cost-competitiveness of utilizing dispersed groundwater versus potable alternative water supplies.

Based on the water supply project ranking, the Sumter and Northwestern Marion Wellfields are recommended for possible implementation in the Short-Term (0-20 years). The Citrus and Northeastern Marion Wellfields are recommended for possible implementation in the Mid-Term or Long-Term (15-35 or 30-50 years).

Each project could serve to transmit future conjunctive or alternative water supplies through a project hub. Transmission pipelines for the groundwater projects could be part of an incremental approach towards potable alternative water supply. Additional study should occur to identify potential sites and easement routes for acquisition. Each of the project options will require more detailed analysis to fine tune the design elements in accordance with water use permitting criteria and the needs of utilities that choose to participate. A dispersed wellfield typically requires 3 to 5 years to implement.

2. Potable Alternative Water Supply Planning

Within the WRWSA – Detailed Water Supply Feasibility Analyses the following projects have been the focus of the long range AWS analyses of the WRWSA region: **Surface Water:** Lake Rousseau; Withlacoochee River near Holder – Reservoir; and the North Sumter “Conjunctive Use” Supply. **Aquifer Recharge:** the Withlacoochee River Aquifer Recharge near Trilby, and **Seawater:** Crystal River Power Plant Seawater Desalination. Each of these projects reflects the higher costs of utilizing potable alternative water supplies versus traditional groundwater supplies.

The conceptual water production costs for the Withlacoochee River project options range from $2.38 to $3.15 per thousand gallons. The conceptual water production cost for the seawater desalination project is $4.27 per thousand gallons. For the aquifer recharge option, depending on the amount of recharge, the unit production cost of the project may range from $0.76 to $6.85 per thousand gallons of recharge. Transmission costs range from about 25% to 50% of the water production costs for the Withlacoochee River options. Operating and transmission costs account for over 75% of the water production cost for the seawater desalination option.

Existing permitted allocations, available local groundwater resources, conservation and reclaimed water will be generally sufficient to serve the projected 2030 groundwater demand in the WRWSA. Therefore, none of the potable AWS projects are recommended for possible implementation in the Short-Term (0-20 years), and further updates will be needed to refine these complex and challenging projects as growth occurs over time.

Based on the water supply project ranking, the **Surface Water:** Lake Rousseau and North Sumter "Conjunctive Use" Supply projects are recommended for possible implementation in the Mid-Term or Long-Term (15-35 or 30-50 years). The **Seawater:** Crystal River Power Plant Seawater Desalination is recommended for possible implementation in the Mid-Term or Long-Term (15-35 or 30-50 years). The **Surface Water:** Withlacoochee River near Holder – Reservoir project is not recommended for possible implementation due to the high cost of the reservoir. The **Aquifer Recharge:** the Withlacoochee River Aquifer Recharge near Trilby project is not recommended for WRWSA implementation, but may be pursued by other entities.

Additional study is underway by the SJRWMD on the Lower Ocklawaha River and desalination from the east coast of Florida (Coquina Coast Desalination Plant). These projects could potentially provide alternative water supply to WRWSA members, but are not evaluated by the WRWSA.

Flexible strategies are needed to ensure that suitable supplies are available when groundwater is depleted and AWS is required to meet future water demands in the WRWSA region. Long-range planning for surface water development should consider dispersed groundwater development in the vicinity of the river systems. Dispersed groundwater projects could transmit future river supplies through their transmission systems.

J. Proposed Regional Framework for Future Water Supply

Water supply planning within the WRWSA is based on the knowledge that regionalization of water sources and alternative water supplies will be necessary at some point in the future. The challenge for the Authority is how to facilitate their introduction into the region. The economic slowdown has reduced the projected water demand in the region giving the WRWSA and its members an opportunity to comprehensively plan for the long-term water needs. A regional framework for a long-term water supply strategy that will manage the technical, economic, environmental and political issues associated with timely development of long-term, sustainable water supplies has been proposed by the WRWSA.

The regional framework is based on a number of critical assumptions including:

- Fresh groundwater is the preferred water source in the WRWSA;
- Water supply development should be based on short-, mid-, and long-term planning terms;
- Both centralized and decentralized water systems are appropriate within the WRWSA;
- Location of these systems are critical for future interconnections and the introduction of AWS; and

- Interconnected water systems have multiple benefits including the eventual introduction of AWS.

The regional framework contemplates that within the short-term timeframe, water conservation, reclaimed water projects and developing groundwater will provide the needed water to meet demands. Mid-term projects will include the interconnections of strategic water supplies throughout the WRWSA region. Long-term water supply projects will be the introduction of AWS into the interconnected regional system. The WRWSA has conceptually approved the regional framework concept and will continue working on its implementation.

K. Recommendations

A series of recommendations have been developed based on the WRWSA – Detailed Water Feasibility Analysis. These recommendations are an attempt to develop and raise a series of suggestions and options for consideration by the WRWSA. These recommendations are not necessarily prioritized or set in a sequential order but are important to consider as the WRWSA moves forward in these relatively uncertain times with respect to sustainable water supply for its members. The recommendations set the stage for considerable discussion and deliberation with the WRWSA Board as they consider the existing and future role of the Authority and how it will encompass its members.

The recommendations are organized by the following categories:

- Population and Water Demand;
- Hydrogeologic Data Collection and Resource Monitoring;
- Regional Groundwater Assessment;
- Water Conservation;
- Reclaimed Water;
- Water Supply Project Options;
- Water Supply Partnership Options;
- WRWSA - Water Supply Regional Framework;
- SWFWMD/SJRWMD Coordination and Consistency; and
- Coordination with Water Management District Program Initiative.