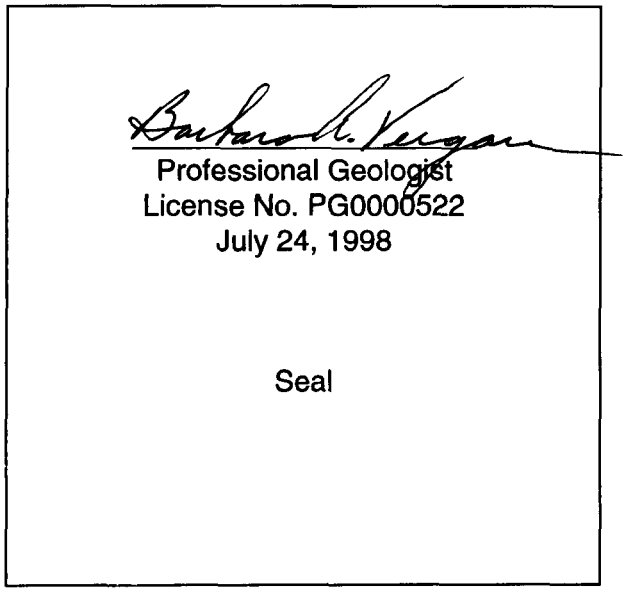
Technical Publication SJ98-2

WATER SUPPLY ASSESSMENT 1998 ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

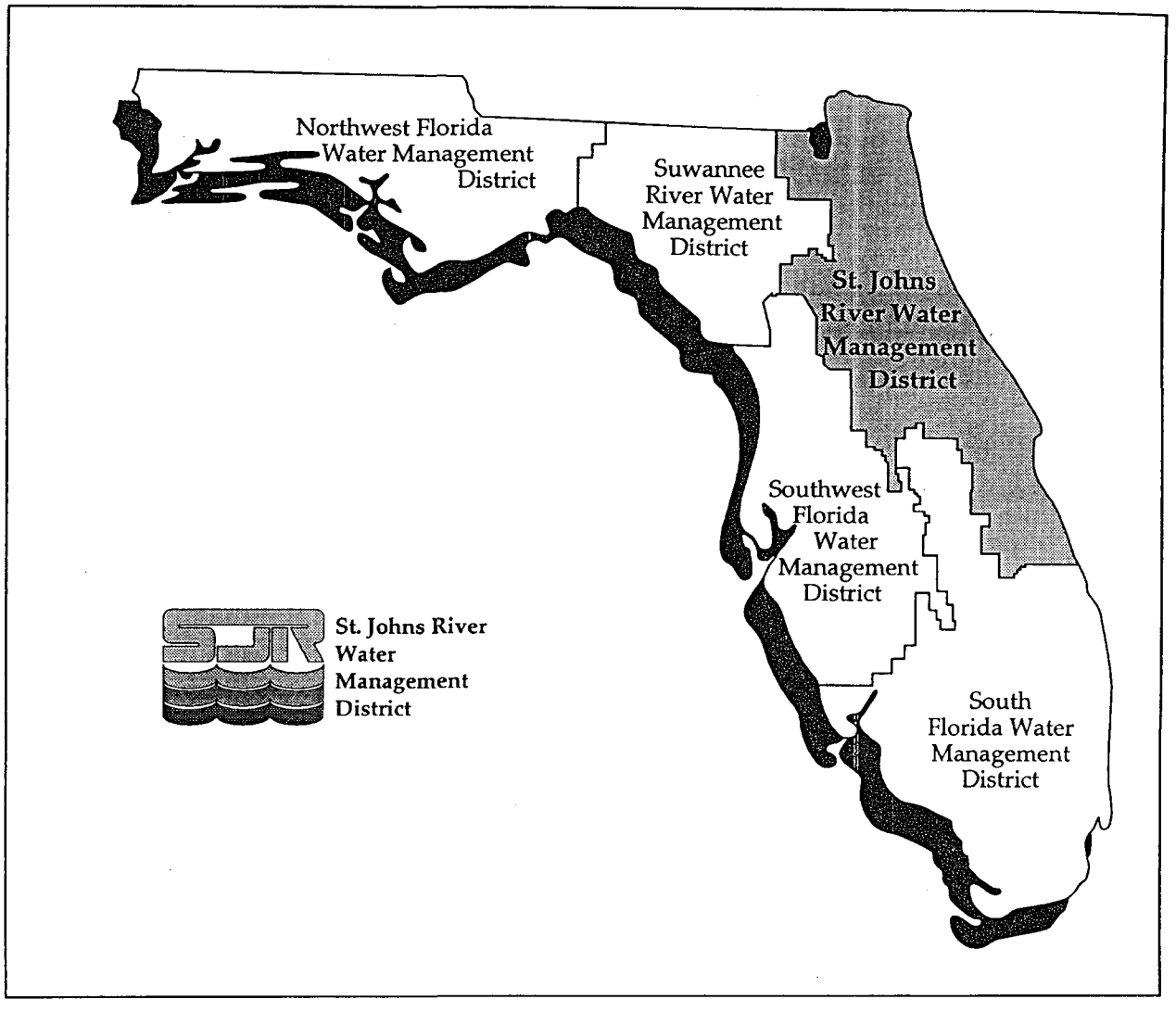
Edited by

Barbara A. Vergara, P.G.



St. Johns River Water Management District
Palatka, Florida

1998



The **St. Johns River Water Management District** (SJRWMD) was created by the Florida Legislature in 1972 to be one of five water management districts in Florida. It includes all or part of 19 counties in northeast Florida. The mission of SJRWMD is to manage water resources to ensure their continued availability while maximizing both environmental and economic benefits. It accomplishes its mission through regulation; applied research; assistance to federal, state, and local governments; operation and maintenance of water control works; and land acquisition and management.

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PREFACE

The St. Johns River Water Management District does not consider projections of possible future water resource conditions, as identified in this assessment, to represent conditions that are certain to exist. The projections were developed using modeling techniques that used the best information available. However, the lack of data in some areas could affect the accuracy of the projections. Additional projects are under way to improve the accuracy of the projections. The purpose of the District's Water 2020 project is to focus attention on developing water supply plans designed to correct or prevent possible water resource problems through the year 2020.

EXECUTIVE SUMMARY

The 1998 districtwide water supply assessment for the St. Johns River Water Management District (SJRWMD) has been performed to meet the requirements of the Governor's Executive Order 96-297 and Subparagraph 373.036(2)(b)4, *Florida Statutes (FS)*, 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.

This 1998 assessment is a required component of the District Water Management Plan (Subsection 373.036(2), *FS*). Because SJRWMD has identified its entire jurisdictional area as one water supply planning region (Figure ES1) pursuant to the requirements of Executive Order 96-297 and Subparagraph 373.036(2)(b)2, *FS*, this 1998 assessment is organized with a districtwide perspective. The assessment is based on a planning period extending through 2020 and is scheduled to be updated every 5 years in association with updates to the District Water Management Plan.

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

- Defining the limits of water resource impacts beyond which a water resource-related problem could occur (water resource constraints)
- Projecting the water resource impacts that could occur in 2020 as a result of projected changes in water use
- Identifying priority water resource caution areas

SJRWMD assessed resource problems in four primary categories.

These categories are as follows:

- Impacts to natural systems
- Impacts to groundwater quality
- Impacts to existing legal users of water
- Failure to identify a source of supply for planned development

SJRWMD completed an assessment similar to this assessment in 1994. This earlier assessment is commonly referred to as the water supply needs and sources assessment. The 20-year projection period used in the 1994 assessment extends through the year 2010. Water resource caution areas identified as a result of the 1994 assessment include about 38% of the SJRWMD jurisdictional area (Figure ES2). The identification of the water resource caution areas was based almost exclusively on water resource problems that were anticipated to become critical based on projected 2010 water use rather than on existing problems. The areas of anticipated critical water resource problems—located in Brevard, Flagler, Lake, Orange, Osceola, Seminole, Volusia, and St. Johns counties—are related largely to projected increases in public supply water use to serve an increasing population. The only area with an identified existing critical water resource problem was the area of eastern Putnam County–western St. Johns County impacted by seasonal groundwater withdrawals associated with potato crop irrigation.

Projections of possible future water resource conditions identified as part of the 1994 assessment were not considered by SJRWMD to represent conditions that were certain to exist. The projections were developed using modeling techniques that used the best information available. However, the limited data available in some areas could have affected the accuracy of the projections. Additional data and modeling were identified as means of improving the accuracy of the projections.

Immediately upon completion of the 1994 assessment, SJRWMD began work on a 5-year update of the assessment, which was scheduled to be complete in 1999. This work included constructing additional monitor wells and collecting more data. Particular emphasis was placed on the Lower Floridan aquifer in east-central Florida and the surficial aquifer system, revisions to groundwater flow models, water use projections updated through 2015, and revised water resource constraints.

Subsequent to the 1996 Florida legislative session, during which water supply development and funding received considerable attention but no substantive final action, Governor Lawton Chiles signed Executive Order 96-297 on September 30, 1996. The executive order brought heightened focus to Florida's water supply planning process through the inclusion of requirements for the development of water supply assessments and water supply plans. The executive order resulted in the creation of the Water Supply Development and Funding Work Group. This work group issued a final report in February 1997. The report contained numerous recommendations concerning water supply development and funding. The work group's recommendations were incorporated in water supply legislation adopted by the 1997 Florida Legislature. This legislation, enacted as Chapter 97-160, *Laws of Florida*, included amendments to Chapter 373, *FS*, including Subparagraph 373.036(2)(b)4, *FS*.

The Florida Department of Environmental Protection and Florida's five water management districts joined together to form the Water Planning Coordination Group (WPCG) for the purpose of developing strategies for implementation of Executive Order 96-297 and the new water supply provisions of Chapter 373, *FS*. WPCG identified the need to develop consistency standards to be followed by the water management districts in association with the water supply assessment and water supply planning processes. One of the consistency standards agreed to was that the projection horizon would be 2020 for the water supply assessment due on July 1, 1998.

Because of the new due date for the assessment and the change in the projection horizon, SJRWMD modified its plans for the scheduled 1999 update of the 1994 water supply needs and sources assessment. The expedited assessment schedule precluded the use of revised groundwater models as a basis for projecting the likely impacts of projected 2020 water use.

SJRWMD plans to continue to develop improved groundwater flow models and water resource constraints and to use these models and constraints to assist in the development of water supply plans, which will focus on priority water resource caution areas identified in this 1998 assessment. In addition, SJRWMD plans to prepare a revised assessment or an addendum to the 1998 assessment in 1999, if

necessary. This revised assessment or addendum will be based on the results of evaluations using the improved groundwater models and water resource constraints.

SJRWMD, based on the requirements of Subparagraph 373.036(2)(b)4a, *FS*, and based on the guidance provided by WPCG, inventoried existing legal uses of water, reasonably anticipated future needs (demands), and existing and reasonably anticipated sources of water and conservation efforts. An existing legal use of water is defined, for the purposes of this water supply assessment, as a use that was allowed based on the 1995 requirements of 40C-2 *Florida Administrative Code*, the SJRWMD rule about consumptive uses of water.

Total water use in SJRWMD in 1995 from ground and surface water sources totaled 1,369.59 million gallons per day (mgd) (Table ES1), of which 455.19 mgd, or about 33% was used by large public supply systems that use at least 0.25 mgd annual average daily flow. Agriculture accounted for about 43% of the total amount used, or 586.97 mgd. The greatest use of freshwater from groundwater sources by category was for public supply, followed closely by agriculture.

In a year of average rainfall, total water demand in SJRWMD is projected to increase by 24% from 1995 to 2020. The category with the most significant projected increase during this period is public supply, where demand is estimated to increase by 58% to 719.29 mgd. This percentage increase compares to an estimated projected increase of 50% in total SJRWMD population. Agricultural water use, the second largest category of use, is expected to remain essentially unchanged. Although recreational demand is expected to increase by 58%, the total amount used in this category is only a small fraction of the total projected use. The demand from domestic self-supply and small public-supply users is expected to decrease by 10%, probably reflecting an increase in the percentage of population served by public supply utilities.

Total demand in a 1-in-10-year drought event is also expected to increase by 36%, with an increase in total demand of 160.15 mgd over total demand for an average rainfall year.

The projected percent change in water use between 1995 and 2020, by county, ranges from a high of 65% in Flagler County to a low of 8% in

Indian River County, excluding changes in Polk, Osceola, Okeechobee, Baker, and Bradford counties (Table ES2). The 1995 demand in the SJRWMD portion of these five counties was insignificant, so that the impact of a relatively small projected change in water use will result in a disproportionately large projected percentage change. Total demand is projected to decrease by 2% in Brevard County due to a decrease in agricultural demand.

Because projected 2020 demands are reasonably similar to those projected for 2010, SJRWMD assumed that the hydrologic impacts of projected 2020 demands on ground and surface water resources will be reasonably similar to those reported for 2010. Based on the 1994 assessment, if major water users' current water supply plans for 2020 are implemented, the elevation of the potentiometric surface of the Floridan aquifer system is expected to decline regionally in response to the cumulative withdrawals of water from the Floridan aquifer system (Figure ES3). In response to these declines in the elevation of the potentiometric surface of the Floridan aquifer system and in response to withdrawals from the intermediate and surficial aquifer systems, the elevation of the water table of the surficial aquifer system is expected to decline (Figure ES4). Also in response to these declines, the discharges of numerous springs are expected to decline and chloride concentrations are expected to increase in public supply wells in eastern Orange County and coastal Volusia County.

Projections of possible future water resource conditions identified as part of this 1998 assessment are not considered by SJRWMD to represent conditions that are certain to exist. The projections were developed using modeling techniques that used the best information available. However, the lack of data in some areas could affect the accuracy of the projections. Additional data and modeling have been identified as means of improving the accuracy of the projections.

SJRWMD identified priority water resource caution areas based on a comparison of water resource constraints to the results of assessments of hydrologic impacts due to projected 2020 demands (Figure ES5). Priority water resource caution areas are areas where existing and reasonably anticipated sources of water and conservation efforts may not be adequate (1) to supply water for all existing legal uses and reasonably anticipated future needs and (2) to sustain the water resources and related natural systems. SJRWMD identified priority

water resource caution areas based on the water resource constraints and the results of water use, groundwater, and surface water assessments (see p. 41).

The terms *water resource caution area* and *priority water resource caution area* are comparable. The term water resource caution area used in the 1994 assessment has been replaced in the current assessment by the term priority water resource caution area.

These priority water resource caution areas cover 40% of SJRWMD and include all or parts of Brevard, Duval, Flagler, Lake, Orange, Osceola, Seminole, St. Johns, Putnam, and Volusia counties. The 1998 boundaries of the priority water resource caution areas include two areas that were not within the 1994 boundaries: northern St. Johns County–southeastern Duval County and a portion of Lake County south of the Ocala National Forest. These areas are identified because both have significant planned growth without an identified source of supply.

Changes in projected quantities and locations of 2020 groundwater and surface water withdrawals can change the boundaries of priority water resource caution areas. Therefore, areas located outside of the identified priority water resource caution areas should not be assumed to be able to support future groundwater and surface water withdrawals without resulting in unacceptable water resource conditions.

Projected 2020 water use in areas to the south of the SJRWMD boundary in the South Florida Water Management District (SFWMD) will contribute to the anticipated unacceptable water resource conditions. SJRWMD is coordinating closely with SFWMD concerning this matter, based on the provisions of a memorandum of understanding entered into by the two districts. This coordination will continue throughout the water supply plan development process.

Pursuant to Paragraph 373.0361(1), *FS*, SJRWMD is required to initiate water supply planning for each water supply planning region where it determines that sources of water are not adequate for the planning period to supply water for all existing and projected reasonable-beneficial uses and to sustain the water resources and related natural systems. Priority water resource caution areas identified by SJRWMD

represent areas within which existing and anticipated sources of water and conservation efforts are not adequate to supply water for all existing and projected reasonable-beneficial uses and to sustain the water resources and related natural systems through 2020. Therefore, because SJRWMD has identified its entire jurisdictional area as one water supply planning region, one districtwide water supply plan is proposed.

Prior to the signing of Executive Order 96-297 and the adoption of water supply legislation by the 1997 Florida Legislature, SJRWMD had initiated a water supply planning process based on the results of its 1994 water supply needs and sources assessment. SJRWMD made necessary modifications to its process to make it consistent with the legislative and executive requirements. SJRWMD has implemented this water supply planning process and is developing a districtwide water supply plan.

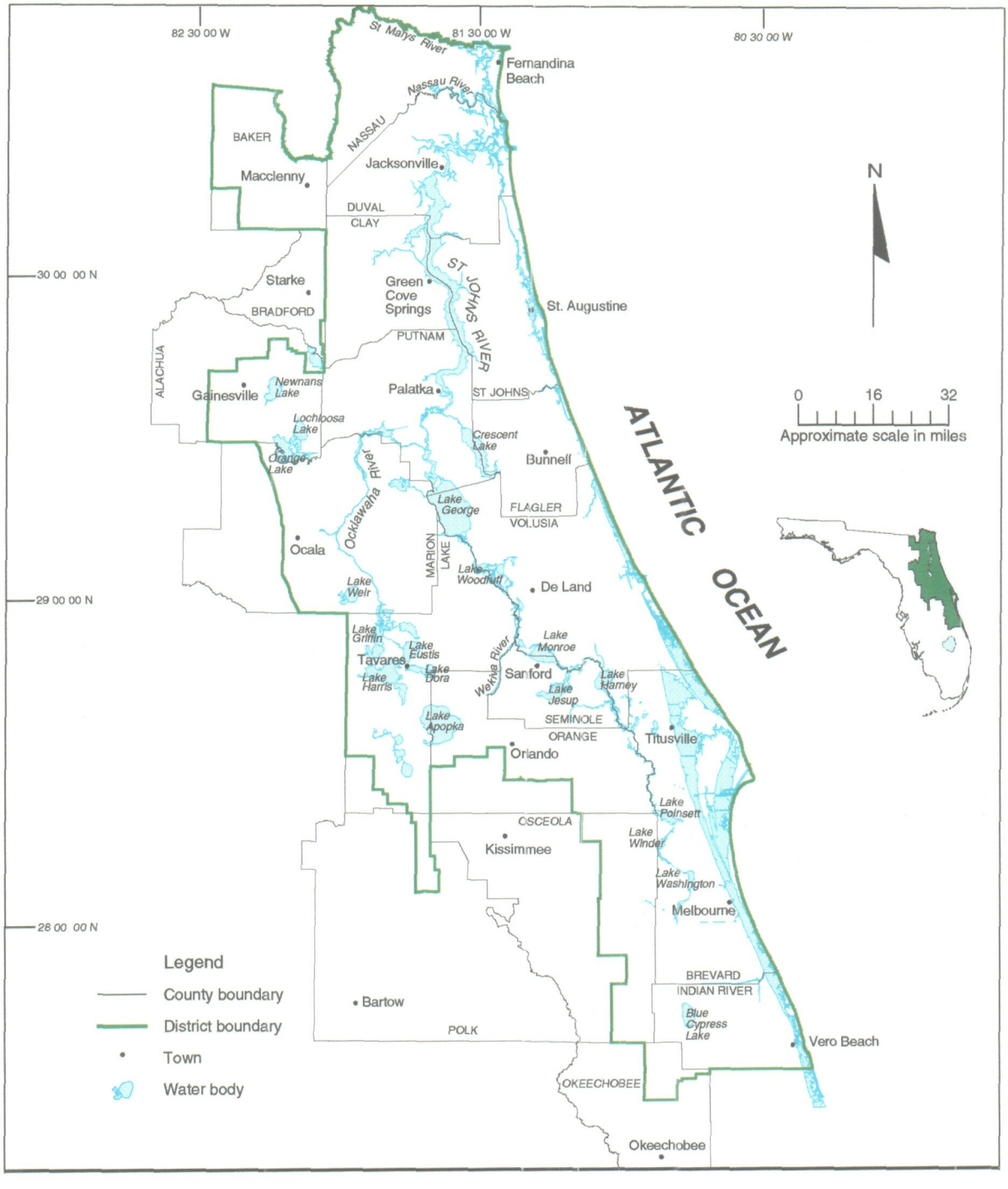

Figure ES1. The St. Johns River Water Management District. *The entire District was identified as a water supply planning region on July 1, 1997.*

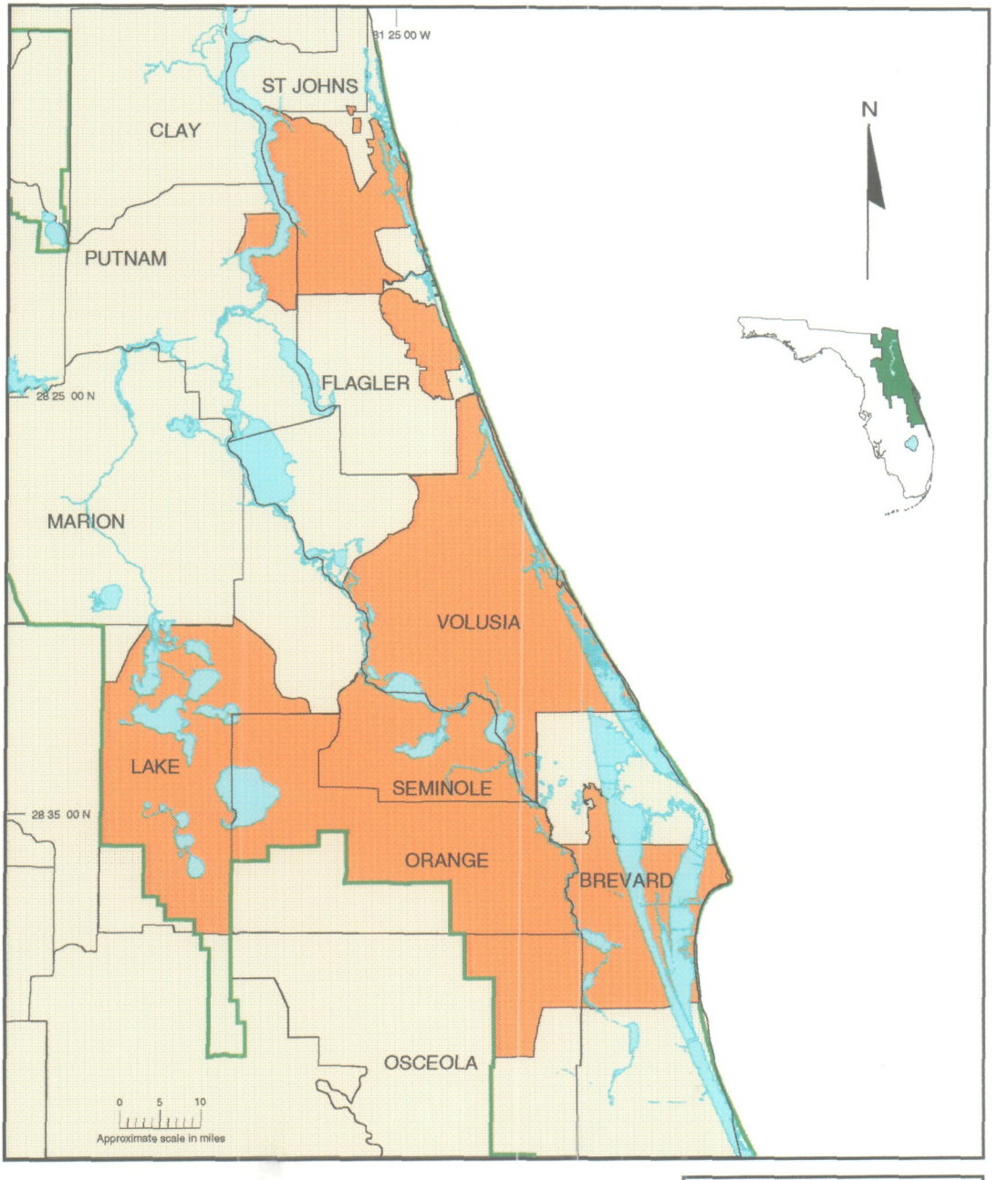

Figure ES2. Water resource caution areas in the St. Johns River Water Management District, 1994

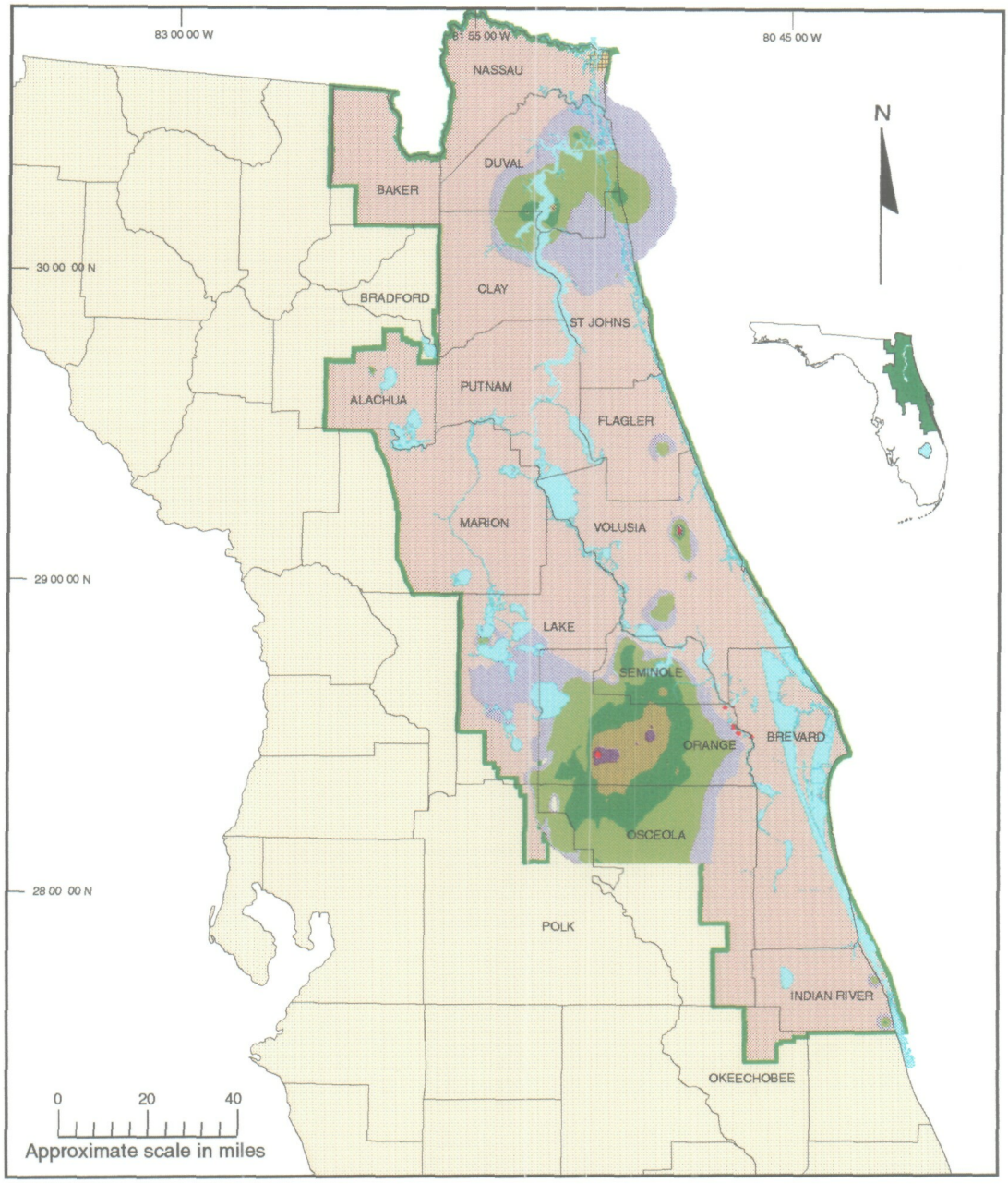

Figure ES3. Projected changes in the elevation of the potentiometric surface of the Floridan aquifer system in response to projected increases in groundwater withdrawals, 1995–2020

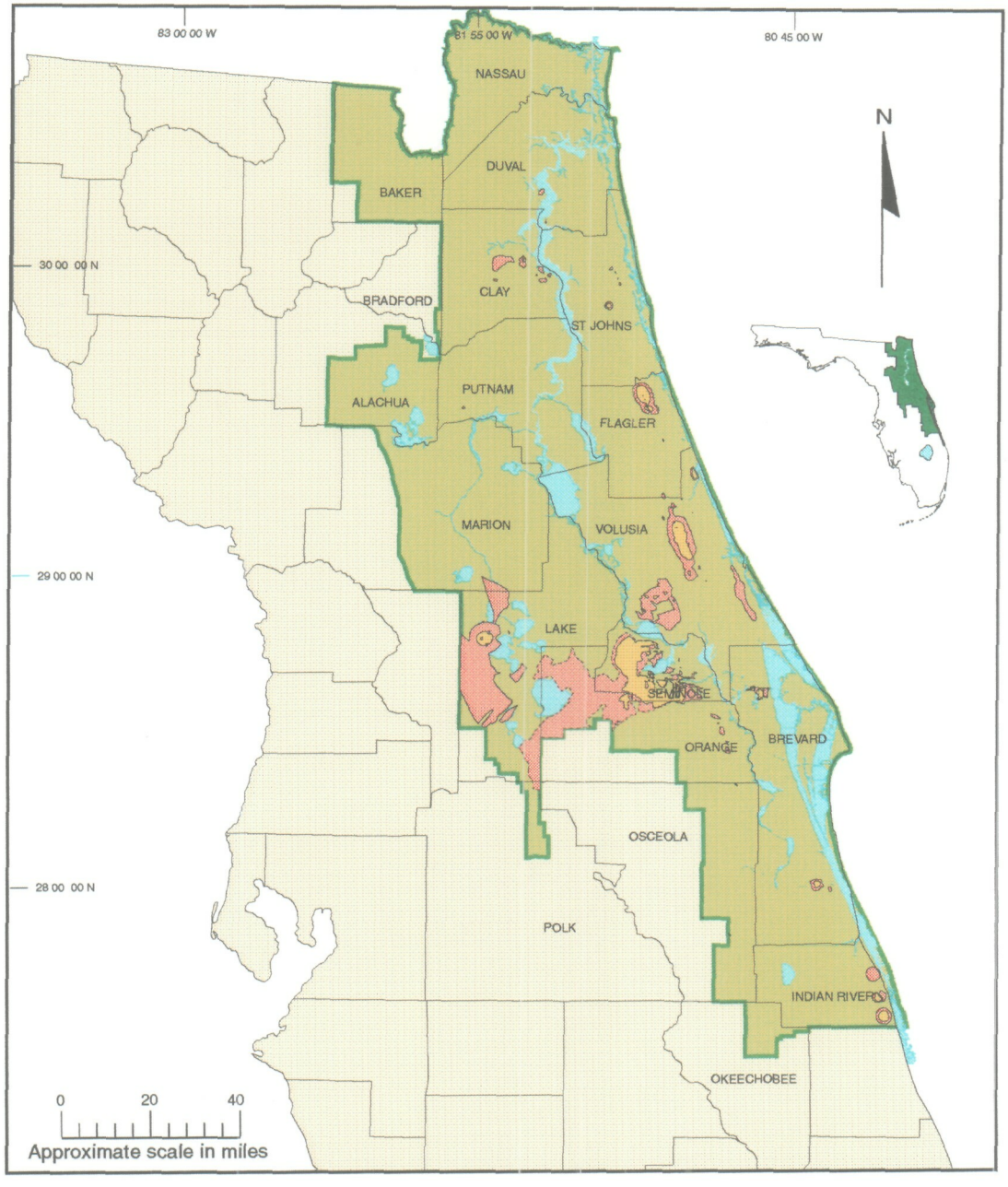

Figure ES4. Projected changes in the elevation of the water table of the surficial aquifer system in response to projected increases in groundwater withdrawals, 1995–2020

Legend
- District boundary
- County boundary
- Decline in elevation of less than 1 ft
- Decline in elevation of 1 to 2.5 ft
- Decline in elevation of greater than 2.5 ft
- Water body

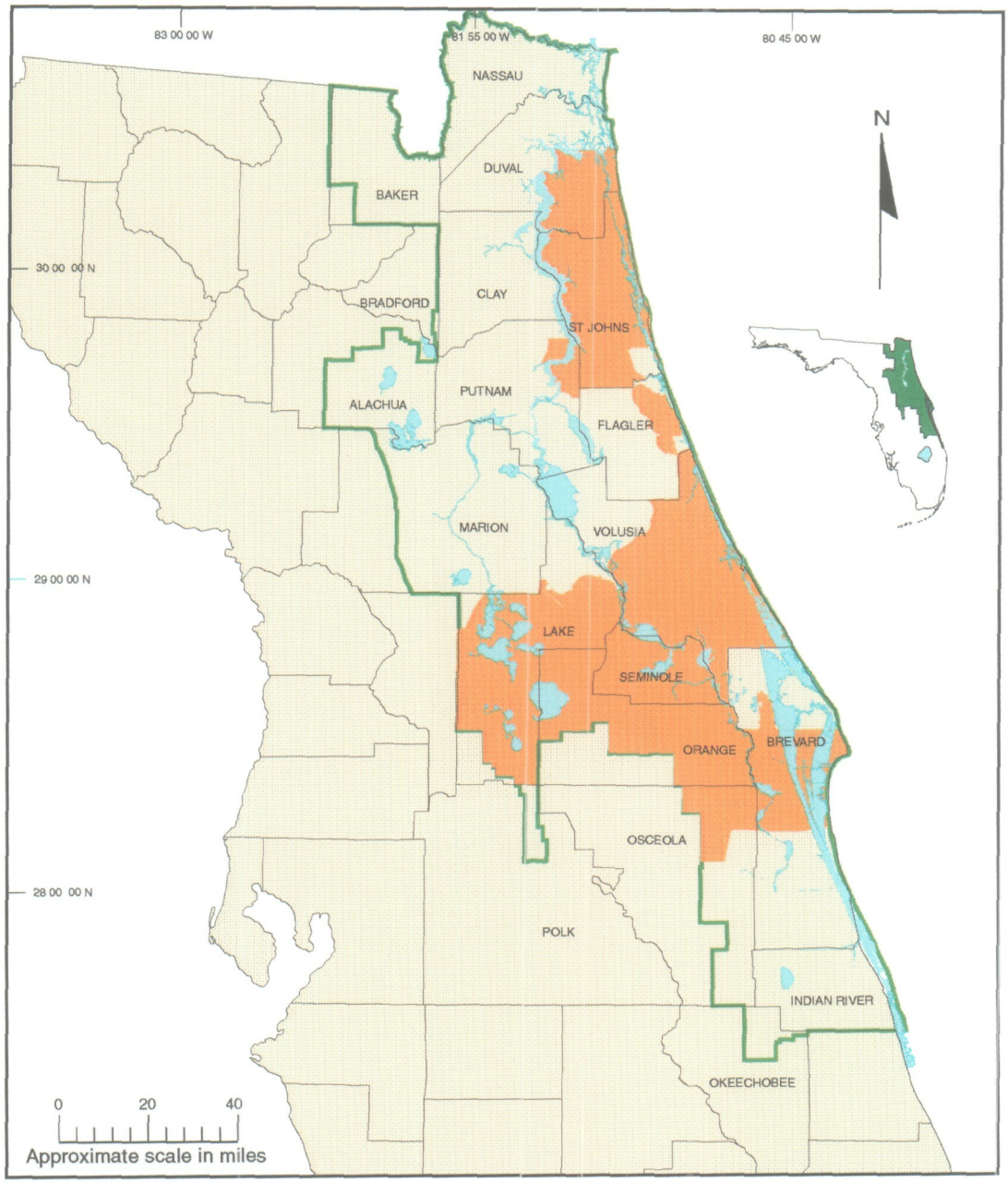

Figure ES5. Priority water resource caution areas in the St. Johns River Water Management District, 1998

Table ES1. Total water demand (A) for 1995 and 2020, by category of water use, in the St. Johns River Water Management District and (B) as a percent of total change by category of water use

A.

Category	1995 Water Use* (mgd)			2020 Water Use† (mgd) Average Rainfall Year				2020 Water Use† (mgd) Dry Rainfall Year			
	Ground	Surface	Total	Ground	Surface	Total	Percent Change‡	Ground	Surface	Total	Percent Change‡
Public supply	443.04	12.15	455.19	702.48	16.81	719.29	58	744.63	17.82	762.45	68
Domestic and other small public-supply	71.98	0.00	71.98	64.84	0.00	64.84	-10	68.73	0.00	68.73	-5
Agricultural irrigation	363.58	223.39	586.97	368.45	220.69	589.14	0	430.76	267.55	698.31	19
Recreational irrigation	68.78	30.35	99.13	107.77	48.67	156.44	58	110.51	49.89	160.40	62
Commercial/industrial/ institutional	96.03	38.13	134.16	102.63	44.19	146.82	9	102.63	44.19	146.82	9
Thermoelectric power generation	7.66	14.50	22.16	11.13	16.42	27.55	24	11.13	16.42	27.55	24
Total	1,051.07	318.52	1,369.59	1,357.30	346.78	1,704.08	24	1,468.24	395.99	1,864.23	36

B.

Category	Average Year	Dry Year
Public supply	79%	62%
Domestic and other small public-supply	-2%	-1%
Agricultural irrigation	1%	23%
Recreational irrigation	17%	12%
Commercial/industrial/institutional	4%	3%
Thermoelectric power generation	2%	1%
Total	101%	100%

Note: mgd = million gallons per day
SJRWMD = St. Johns River Water Management District

*Public supply, commercial/industrial/institutional, and thermoelectric power generation categories are based on actual water use in 1995. All other categories are based on estimated 1995 data
†SJRWMD population-based projections
‡Percent change from total water use in 1995

Table ES2. Total water demand for 1995 and 2020, by county, in the St. Johns River Water Management District

County	1995 Water Use (mgd)			2020 Water Use* (mgd) Average Rainfall Year			
	Ground	Surface	Total	Ground	Surface	Total	Percent Change†
Alachua	34.55	0.79	35.34	49.37	1.21	50.58	43
Baker	3.77	0.86	4.63	5.13	0.86	5.99	29
Bradford	0.29	0.00	0.29	0.35	0.00	0.35	21
Brevard	164.37	30.12	194.49	152.72	37.82	190.54	-2
Clay	21.08	0.52	21.60	33.32	0.85	34.17	58
Duval	143.07	1.06	144.13	184.18	1.44	185.62	29
Flagler	14.70	1.22	15.92	23.44	2.80	26.24	65
Indian River	87.23	172.43	259.66	105.10	176.30	281.40	8
Lake	92.06	15.79	107.85	141.43	22.53	163.96	52
Marion	32.98	1.87	34.85	48.43	2.69	51.12	47
Nassau	56.86	4.72	61.58	67.65	6.32	73.97	20
Okeechobee	14.25	0.00	14.25	13.42	0.00	13.42	-6
Orange	136.82	19.20	156.02	199.99	11.43	211.42	36
Osceola	6.57	9.99	16.56	6.06	9.99	16.05	-3
Polk	3.31	0.24	3.55	6.54	0.57	7.11	100
Putnam	32.70	50.05	82.75	51.06	58.58	109.64	32
St. Johns	48.63	2.26	50.89	60.67	4.06	64.73	27
Seminole	67.13	1.57	68.70	101.82	2.37	104.19	52
Volusia	90.70	5.83	96.53	106.62	6.96	113.58	18
Total	1,051.07	318.52	1,369.59	1,357.30	346.78	1,704.08	24

Note: mgd = million gallons per day
SJRWMD = St. Johns River Water Management District

*SJRWMD population-based projections
†Percent change from total water use in 1995

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INTRODUCTION—by Barbara Vergara, P.G.

The 1998 districtwide water supply assessment for the St. Johns River Water Management District (SJRWMD) has been performed to meet the requirements of the Governor's Executive Order 96-297 (Appendix A) and Subparagraph 373.036(2)(b)4, *Florida Statutes (FS)* (1997), as follows:

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>
> 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.

The 1998 assessment is a required component of the District Water Management Plan (DWMP) (Subsection 373.036(2), *FS*).

Pursuant to the requirements of Executive Order 96-297 and Subparagraph 373.036(2)(b)2, *FS*, SJRWMD has identified its entire jurisdictional area as one water supply planning region (Figure 1). Therefore, this 1998 assessment is organized with a districtwide perspective. The assessment is based on a planning period extending through 2020 and is scheduled to be updated every 5 years in association with DWMP updates.

SJRWMD is required, pursuant to the requirements of Subsection 373.0361(1), *FS*, to initiate water supply planning for each water supply planning region where priority water resource caution areas are identified (Figure 2). Because SJRWMD has identified its entire jurisdictional area as one water supply planning region, SJRWMD proposes to develop one districtwide water supply plan, which will focus on the identified priority water resource caution areas.

SJRWMD completed an assessment similar to this assessment in 1994 (Vergara 1994). This earlier assessment is commonly referred to as the water supply needs and sources assessment. The 20-year projection

period used in the 1994 assessment extended through the year 2010. Water resource caution areas identified as a result of the 1994 assessment included about 38% of the SJRWMD jurisdictional area (Figure 3). The identification of the water resource caution areas was based almost exclusively on water resource problems that were anticipated to become critical based on projected 2010 water use rather than on existing problems. The areas of anticipated critical water resource problems located in Brevard, Flagler, Lake, Orange, Osceola, Seminole, Volusia, and St. Johns counties are related largely to projected increases in public supply water use to serve an increasing population. The only area with an identified existing critical water resource problem was the area of eastern Putnam County–western St. Johns County impacted by seasonal groundwater withdrawals associated with potato crop irrigation.

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SJRWMD plans to continue to develop improved groundwater flow models and water resource constraints and to use these models and constraints to assist in the development of water supply plans, which will focus on priority water resource caution areas identified in this 1998 assessment. In addition, SJRWMD plans to prepare a revised assessment or an addendum to the 1998 assessment in 1999, if necessary. This revised assessment or addendum will be based on the results of evaluations using the improved groundwater models and water resource constraints.

SJRWMD made copies of the draft version of this 1998 assessment available for review to other governments, water suppliers, and the public. SJRWMD staff developed recommended changes to the document based on comments received, and presented the draft document along with these recommended changes to the SJRWMD Governing Board for consideration. The draft water supply assessment was adopted by the Governing Board at its meeting of June 10, 1998.

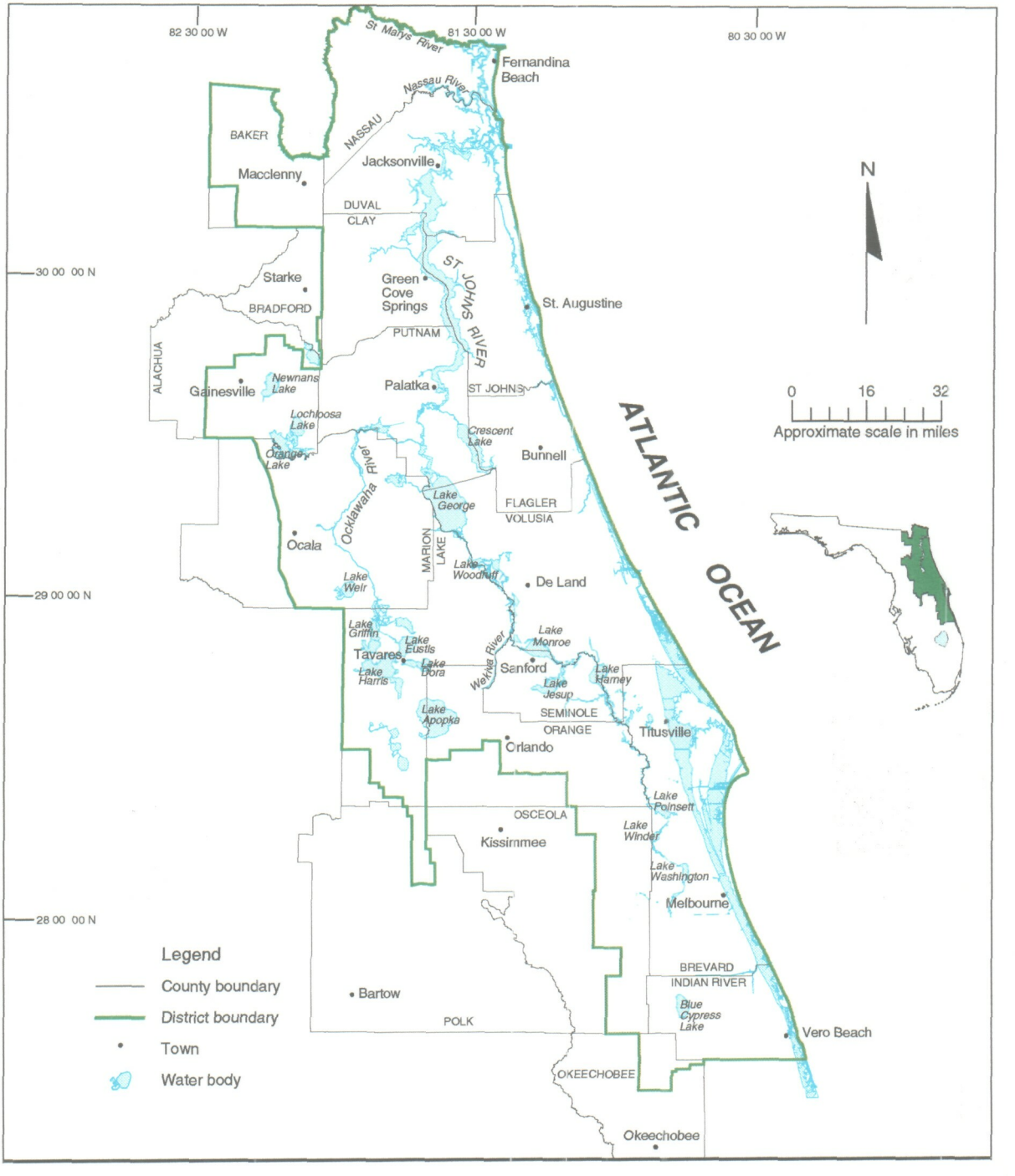


Figure 1. The St. Johns River Water Management District. *The entire District was identified as a water supply planning region on July 1, 1997.*

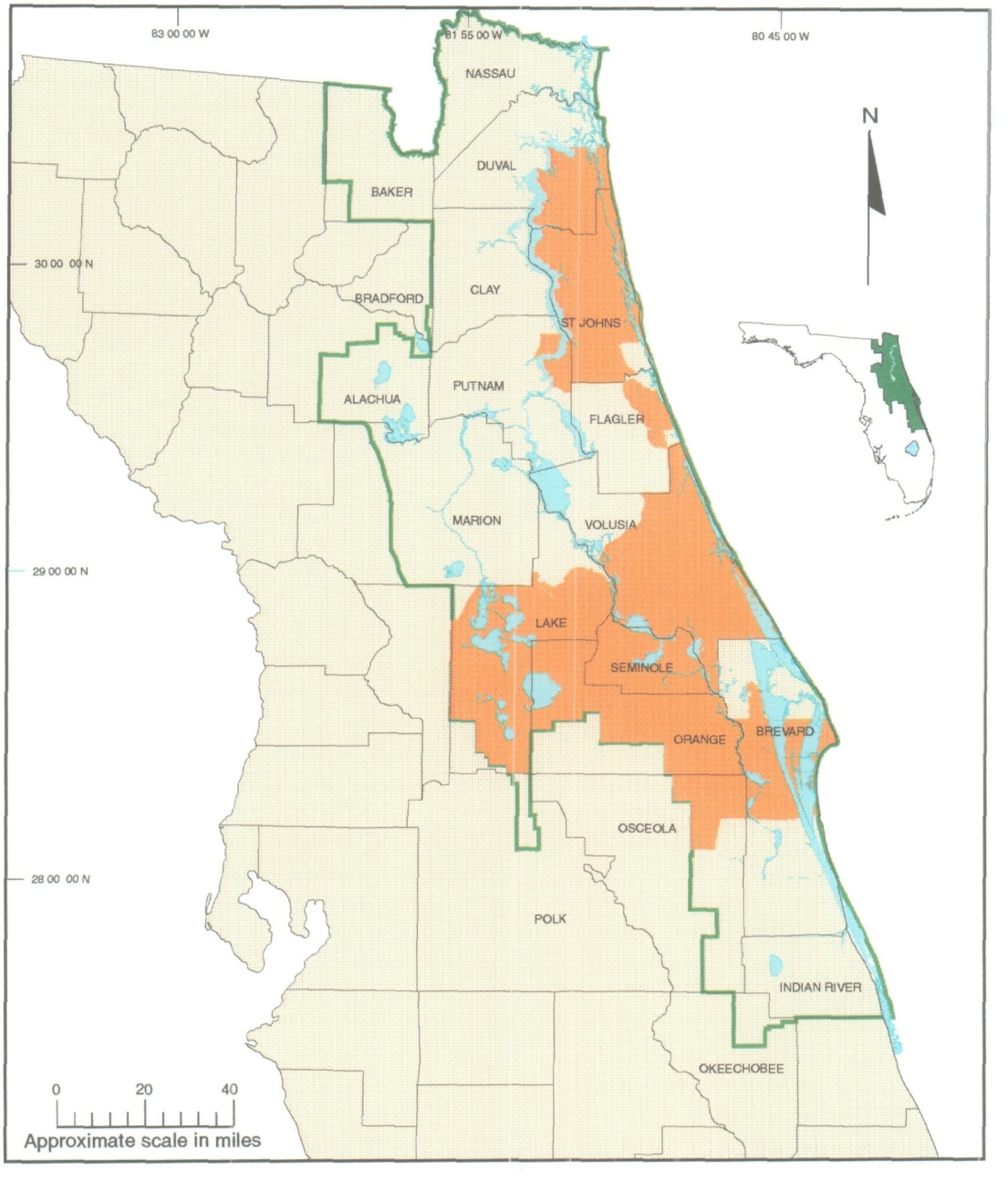
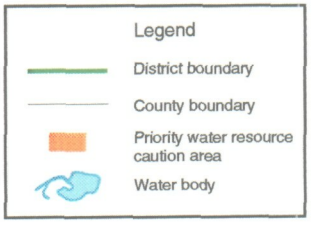


Figure 2. Priority water resource caution areas in the St. Johns River Water Management District, 1998



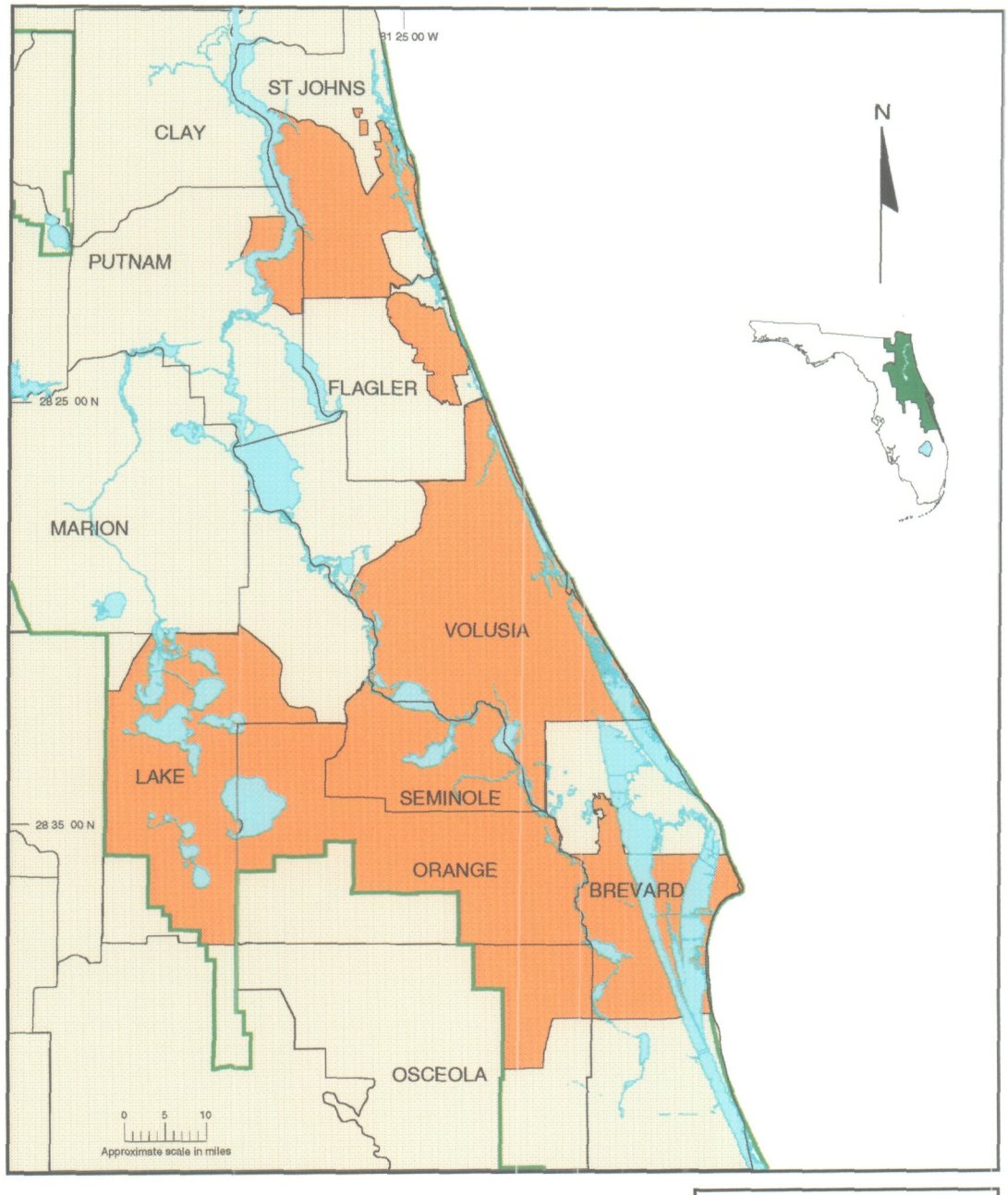


Figure 3. Water resource caution areas in the St. Johns River Water Management District, 1994 (Vergara 1994)

ASSESSMENT APPROACH—by Barbara Vergara, P.G.

The 1998 assessment was designed to address the water supply assessment requirements of Subparagraph 373.036(2)(b)4, *FS*, and Executive Order 96-297.

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

- Defining water resource impact limits beyond which water resource-related problems could occur (water resource constraints)
- Projecting water resource impacts that could occur in 2020 as a result of projected changes in water use
- Comparing projected water resource impacts with water resource constraints to identify priority water resource caution areas

The application of this approach consisted of the following components:

- Water resource constraint development
- Water use assessment
- Groundwater assessment
- Surface water assessment
- Priority water resource caution area identification
- Intergovernmental, water supplier, and public coordination
- Recommended additional data collection and water resource investigations

WATER RESOURCE CONSTRAINT DEVELOPMENT

SJRWMD assessed water resource problems in four primary categories. These categories are as follows:

- Impacts to natural systems
- Impacts to groundwater quality
- Impacts to existing legal users of water

- Failure to identify a source of supply for planned development

For each category considered, SJRWMD developed a water resource constraint to identify areas where existing and reasonably anticipated sources of water and conservation efforts are not adequate (1) to supply water for all existing legal uses and reasonably anticipated future needs and (2) to sustain the water resources and related natural systems. These constraints are considered to be limits beyond which unacceptable water resource problems would occur.

A detailed description of these constraints is included on pages 41–47.

WATER USE ASSESSMENT

Water use needs for 1995 have been identified and have been projected to 2020 for the following categories of water use:

- Public supply
- Domestic self-supply and small public-supply systems
- Commercial/industrial/institutional self-supply
- Thermoelectric power generation self-supply
- Agricultural self-supply
- Recreational self-supply

SJRWMD has made a concerted effort to develop water use projections that are consistent with the specific plans of major water users. SJRWMD shared its projections with major water users and revised these projections in response to comments received from these users.

A detailed description of the water use needs assessment is included in the next chapter and on pages 27–34.

GROUNDWATER ASSESSMENT

SJRWMD performed detailed hydrologic impact assessments in association with its 1994 water supply needs and sources assessment to determine the impacts of projected 2010 demands on groundwater resources (Vergara 1994). Because projected 2020 demands are reasonably similar to those projected for 2010, SJRWMD assumed that the hydrologic impacts of projected 2020 demands on groundwater

resources will be reasonably similar to those reported for 2010. An additional groundwater assessment has not been performed in association with this 1998 assessment.

Surface Water Assessment

SJRWMD performed detailed hydrologic impact assessments in association with its 1994 water supply needs and sources assessment to determine the impacts of projected 2010 demands on surface water resources (Vergara 1994). Because projected 2020 demands are reasonably similar to those projected for 2010, SJRWMD assumed that the hydrologic impacts of projected 2020 demands on surface water resources will be reasonably similar to those reported for 2010. The accuracy of the assessments of these impacts can be improved through use of improved groundwater models. Improved models are currently being developed by SJRWMD. An additional surface water assessment has not been performed in association with this 1998 assessment.

Priority Water Resource Caution Area Identification

Priority water resource caution areas are areas where existing and reasonably anticipated sources of water and conservation efforts may not be adequate (1) to supply water for all existing legal uses and reasonably anticipated future needs and (2) to sustain the water resources and related natural systems. SJRWMD identified priority water resource caution areas based on the water resource constraints and the results of water use, groundwater, and surface water assessments (see p. 41).

The terms *water resource caution area* and *priority water resource caution area* are comparable. The term water resource caution area used in the 1994 assessment has been replaced in the current assessment by the term priority water resource caution area.

Intergovernmental, Water Supplier, and Public Coordination

SJRWMD coordinated its assessment activities with other governments, water suppliers, and the public. This coordination was planned to achieve the following objectives:

- To disseminate and explain project-related information
- To assure, to the extent possible, that data being used to perform the assessment are the best data available
- To address the project-related concerns of other governments, water suppliers, and the public
- To develop a consensus concerning the identification of priority water resource caution areas
- To develop a consensus concerning necessary additional data collection
- To develop a consensus concerning the need to develop a water supply plan that would identify technically, environmentally, and economically feasible and acceptable water supply strategies

SJRWMD attempted to achieve these objectives through direct contacts with water suppliers; through working groups composed of local, regional, and state governments, water suppliers, special-interest groups, and the public representing the areas identified as water resource caution areas in 1994; and through presentations and discussions with local government representatives.

Immediately upon completion of the 1994 assessment, SJRWMD began work on a 5-year update of the assessment, which was scheduled to be complete in 1999. The project coordination associated with this update was scheduled to be carried out beginning in the summer of 1998 and continuing through November 1999, when the Governing Board would consider the final water supply assessment.

This project coordination schedule could not be sufficiently expedited to meet the July 1, 1998, deadline mandated by the 1997 Florida Legislature. Therefore, this 1998 assessment was developed with less project coordination than was originally planned by SJRWMD.

SJRWMD plans to prepare a revised assessment or an addendum to the 1998 assessment in 1999, if necessary. Any revision of the assessment will result from coordinated efforts with other

governmental agencies, water suppliers, and the public, as originally planned.

Recommended Additional Data Collection and Water Resource Investigations

Based on the results of the water use, groundwater, and surface water assessments, SJRWMD identified areas where data collection and water resource investigations needed to be performed to better evaluate the potential for future water resource problems and to prevent water resource problems from occurring. The necessary data collection and water resource investigations were scheduled to be identified by SJRWMD staff.

The schedule could not be sufficiently expedited to meet the July 1, 1998, deadline mandated by the 1997 Florida Legislature. Therefore, any recommendations in this 1998 assessment result from less data than was originally anticipated.

SJRWMD plans to prepare a revised assessment or an addendum to the 1998 assessment in 1999, if necessary. This revised assessment or addendum will include identification of areas where additional data collection and water resource investigations need to be performed.

METHODOLOGY OF DEMAND PROJECTIONS FOR ALL WATER USE CATEGORIES—By Cynthia Moore

SJRWMD, based on the requirements of Subparagraph 373.036(2)(b)4a, *FS,* determined "existing legal uses, reasonably anticipated future needs, and existing and reasonably anticipated sources of water and conservation efforts." SJRWMD followed the guidance of WPCG in choosing the base year of 1995 and the projection horizon of 2020.

Based on the guidance provided by WPCG, existing legal uses of water have been reported for 1995 and reasonably anticipated future needs (demands) for water have been projected to 2020 for the following water use categories:

- Public supply
- Domestic self-supply and small public-supply systems
- Commercial/industrial/institutional self-supply
- Thermoelectric power generation self-supply
- Agricultural self-supply
- Recreational self-supply

An existing legal use of water is defined, for the purposes of this water supply assessment, as a use that was allowed based on the 1995 requirements of 40C-2, *Florida Administrative Code (F.A.C.),* the SJRWMD rule about consumptive uses of water.

Definition of the demand categories was determined by the Water Demand Projection Subcommittee (WDPS), a subcommittee of WPCG. WDPS was comprised of representatives of Florida's five water management districts and DEP. The demand projection methodologies used by SJRWMD (Table 1) are consistent with the recommendations of WDPS (1998).

The SJRWMD goal in projecting water demands was to develop estimates of projected need that are mutually acceptable to the water users and SJRWMD and that appear to be reasonable based on the best information available. Projections are consistent with permit allocations for utilities that have had permit renewals through 1997.

SJRWMD recognizes that these are planning level projections and that the projections may be subject to change in subsequent evaluations.

Demand projections presented in this 1998 assessment are based on the assumption that current levels of water conservation will be continued through 2020 for all categories. If public suppliers have plans to increase levels of water conservation, these plans will be reflected in the projections made by each public supply utility.

Demand projections for a 1-in-10-year drought have been made for the public supply, domestic self-supply and small public-supply systems, agricultural self-supply, and recreational self-supply categories. Drought events do not have significant impacts on demands in the commercial/industrial/institutional or the thermoelectric power generation self-supply categories. Demands for these categories are primarily related to processing and production needs.

PUBLIC SUPPLY

Public supply water demand refers to water demand from publicly and privately owned utilities that supply public water and have a projected annual average daily flow of at least 0.25 million gallons per day (mgd) in 2020. Public supply water includes water for a variety of uses including domestic, lawn irrigation, recreational, and commercial/industrial. SJRWMD inventoried 1995 demands and projected demands for 2020 for these suppliers. The initial list of suppliers in the inventory was obtained from the SJRWMD consumptive use permit (CUP) database and from additional information supplied to SJRWMD by DEP.

Reported use for 1995 is based on reports to DEP of actual use by public supply utilities. Demand projections for public suppliers identified as potentially using at least 0.25 mgd in 2020 were made jointly by the supplier and SJRWMD. Suppliers were asked to provide their best estimates of average annual daily flow in 2010, 2015, and 2020. They also were asked to provide estimates of their service area populations in these years; however, these population estimates were not considered reliable by SJRWMD because of the many different ways in which the estimates were calculated and interpreted.

SJRWMD made its own demand projections based on estimates of population growth within the service area boundaries of public suppliers. SJRWMD projections were then compared with the utility-based projections. Suppliers were asked to review their projections if the projections were greater than 120% of the SJRWMD population-based projections. This 120% value is the observed statistical median in variation of the ratio of utility-based projections to SJRWMD population-based projections. SJRWMD provided the suppliers with all the information it had used to make its projections. In the majority of cases, the suppliers either adjusted their projections to a level more consistent with the SJRWMD projections or provided sufficient justification as to why their projections should be maintained at a higher level. Finally, the utility director subgroup or the demand projection subgroup for each water supply planning work group area was asked to develop a consensus on the acceptability of the projections for their respective work group areas (Appendix B contains a description of water supply planning work groups and areas). This step was considered important in the water supply assessment and planning process because it will increase the reliability of individual projections and the reliability of cumulative demand projections and impacts. If a consensus was not reached, SJRWMD documented which utilities' projections were questionable, but agreed to use the utility-based projections as the basis of its initial hydrologic analysis. SJRWMD expects that the questionable utility-based projections will be adjusted to more realistic values in the water supply planning process when projected demands and resultant water resource impacts are examined more intensively.

The process of developing utility-based and SJRWMD population-based projections results in two different lists of projections for public supply. Rather than maintain two separate lists, SJRWMD opted to publish a list of utility-based projections of demand. SJRWMD considers that the public supply utilities are the best source of information concerning planned future use. The projections developed by each utility were used as the initial basis of projecting impacts to the water resources. SJRWMD used the cumulative water resource impacts based on the utility-based projections as the starting point of discussion in the water supply planning process. SJRWMD is committed to a planning process that involves all major water users and seriously considers the water supply plan of these users.

SJRWMD realizes that the use of utility-based projections results in a percent increase in demand from 1995 to 2020 that exceeds the projected percent increase in population growth for the same period. This disparity in percentages is attributed to several factors. By allowing an increase of 20% from the SJRWMD population-based projections for each utility, the aggregate of the utility-based projections will exceed population growth. The increases in demand projected by several large utilities compound the margin of error—the projections are even higher than the SJRWMD 20% margin of variance. The relatively high per capita consumption rate of these utilities also compounds the margin of error. The projected high increases in demand are believed to be associated with double counting of population in areas targeted for expansion by more than one utility and with expectations of rapid growth (to 2020) in new developments. The net effect is a disproportionately high rate of increase in public supply demand relative to the projected rate of increase in population. SJRWMD will work toward resolution of this disparity through the water supply planning process.

The aggregate total increase in public supply demand at the county level based on utility-based projections is significantly higher than the increase based on SJRWMD population-based projections. Therefore, SJRWMD calculated county-level public supply demand based on a countywide estimate of public supply population multiplied by the countywide average per capita demand. Per capita demand is the average per capita demand from 1990 through 1995.

SJRWMD evaluated the change in projected demand for all public uses—public and domestic. Demand for water to meet the general needs of the public is reported in two categories—in the public supply category for users withdrawing at least 0.25 mgd and in the domestic self-supply and small public-supply category (domestic category). This combined water use is referred to as public-use water. Because changes in demand in one category may be partially offset by changes in the other category, an analysis of projected change in demand for public use was performed based on demand in both categories.

SJRWMD projections were made based on available population growth data such as countywide estimates made by the Bureau of Economic and Business Research (BEBR) at the University of Florida and transportation analysis zone (TAZ) data prepared for the Florida

Department of Transportation in the metropolitan planning organization districts. TAZ population data distributes the BEBR countywide projections on a smaller scale throughout the county, based on U.S. census population blocks. TAZ population data were used as the basis for making population-based demand projections in five counties (Brevard, Orange, Osceola, Volusia, and Seminole). However, because TAZ data were not available in digital form for the remaining 14 counties, SJRWMD developed its own population growth and distribution model. The model was developed for all 19 counties within the SJRWMD boundaries, but was only used as the basis for making demand projections where the TAZ data did not exist in digital form.

The population growth and distribution model was developed for SJRWMD by the Department of Urban and Regional Planning at the University of Florida and GeoFocus, Inc., a private consulting firm specializing in geographic information system (GIS) and global positioning system (GPS) applications.

The SJRWMD model applied the BEBR projection methodology to each section (as in section, township, and range) within a county, using the Florida Department of Revenue tax database to estimate the distribution of population in 1990 and to provide historical statistics on growth in each section from 1980 to 1990. The methodology is described in greater detail in Doty (1997, draft). The SJRWMD population projections based on use of this model tend to be low, primarily in counties experiencing high growth in new areas for which there is no history of growth. SJRWMD is working to integrate information on population growth within developments of regional impact and other county level information into the model to reflect recent high growth, thereby making projections in these areas more accurate.

Working in a GIS environment, SJRWMD estimated population within a utility's service area for 1995 and 2020 by overlaying this boundary coverage on population growth grids. The final boundary coverage reflected 1997, which was considered to be a reasonable approximation of 1995 conditions. Population was calculated using a GIS program written in automated macro language (AML). Maps also were prepared for each public supplier, showing the distribution of population growth using a color coded display. These maps and a

copy of the population database were distributed to suppliers that were requested by SJRWMD to review their projections and to other suppliers and county planning agencies that requested this material.

Population-based demand projections for average annual daily flow were made by multiplying the average per capita use, in gallons per day, for each supplier by its projected population in 2020. The average per capita use was based on total water use (i.e., commercial, industrial, institutional, residential, and recreational) for the period 1990 to 1995, the period for which both consistent population and water use data exist. Total average annual daily flow for each utility was divided by the population estimate for that utility service area, culminating in a per capita use for each year using a consistent population base. This method results in a gross per capita use, which assigns a portion of the total public supply use to each individual. Reports of average annual daily flow were obtained from the SJRWMD annual water use surveys for 1990 through 1995 (Florence 1992, 1994, 1995, 1996a, 1996b, 1997), all of which use data from the monthly operating reports submitted regularly by all public suppliers to DEP.

Projections of demand based solely on population growth are inherently simplistic but are reasonably accurate historically for areas of established growth. In areas where rapid growth is a more recent phenomenon, SJRWMD was more lenient in accepting disproportionately high growth rates as compared to countywide growth rates. The lack of solid historical data to substantiate model projections in these areas made it difficult to justify rigorous application of the model results. SJRWMD stated the assumptions used in making population projections to calculate future demand and invited the suppliers to provide better information if they felt that these assumptions led to erroneous projections.

Both the TAZ and SJRWMD population models normalize the total population count in a county to BEBR projections. SJRWMD used the most current BEBR projections—January 1998—as the normalization base (Smith and Nogle 1998). The BEBR projections may be low for counties experiencing new, high growth, in particular Lake, Marion, Flagler, and St. Johns counties.

Projections for a 1-in-10-year drought event were calculated using an average-to-drought year factor of +6%. This factor was agreed to by

the 1-in-10-Year Drought Subcommittee, which is a subcommittee of WPCG. This subcommittee is composed of representatives from the water management districts and DEP. The rationale for use of the +6% factor is addressed in the subcommittee's report (1998, draft).

The subcommittee found a very weak correlation between rainfall deficit and public supply demand; a statistical analysis showed that 80% of the variation resulted from reasons other than rainfall deficit. For this reason, the 1-in-10-Year Drought Subcommittee chose not to use an exclusively meteorologically-based definition of drought to meet the intent of the legislation. Instead, a demand-based definition was developed: "The level of certainty water supply planning goal is to assure at least a 90% probability, during any given year, that all reasonable and beneficial water needs will be met." This means that the 1-in-10-year demand high, for whatever reason it may occur, will be used as the basis of 1-in-10-year drought planning.

DOMESTIC SELF-SUPPLY AND SMALL PUBLIC-SUPPLY SYSTEMS

Demand in the domestic self-supply and small public-supply systems category comes primarily from these two types of supply systems. Small public-supply systems refer to supply systems with an average annual daily flow between 0.01 mgd and 0.25 mgd. Domestic self-supply refers primarily to demand from individual users not serviced by a public system (i.e., less than 0.01 mgd). However, the domestic self-supply category also may contain estimates of demand associated with lawn irrigation and other residential uses from private wells in areas serviced by a public supplier. It also may include demand for a planned expansion for which the source of withdrawal has not yet been identified. This type of demand is increasingly typical in counties where sources of water for planned new developments have not yet been identified.

The assessment of demand in this category relies heavily on projections of population growth, based on the most current estimates published by BEBR for 1995 and 2020 for entire counties (Smith and Nogle 1998). SJRWMD used population estimates for the portion of each county located within SJRWMD boundaries. This information was subdivided into either the public supply or the domestic self-supply and small public-supply systems categories. Domestic self-supply and small public self-supply populations are estimated by

subtracting the public supply population for each county from the total SJRWMD population for each county.

Because no empirical demand data for SJRWMD exist for this category, an approximation of demand of 100 gallons per day (gpd) per capita has been used. This rate is considered a reasonable approximation of demand based on an examination of the range of per capita use among the public supply utilities in SJRWMD, with special consideration given to utilities primarily serving rural populations. The 100 gpd per capita demand for this category has been used in published studies of water demand in the central Florida area (e.g., PBS&J 1995). The 100-gpd-per-capita value is somewhat higher than the commonly used estimates of indoor water use of between 65 and 80 gpd, because demands in this category include an outdoor use component.

Total demand for the domestic self-supply and small public-supply systems category is calculated by multiplying the population in this category for 1995 and 2020 by 100 gpd.

Demand by domestic self-supply and small public-supply utilities in a 1-in-10-year drought event was calculated by increasing the total projection for an average rainfall year by +6%, based on the guidance of the 1-in-10-Year Drought Subcommittee of WPCG.

AGRICULTURAL SELF-SUPPLY

SJRWMD determines crop supplemental irrigation needs by multiplying irrigated acreage by a supplemental irrigation requirement calculated using an agricultural water use simulation model (SJRWMD 1987). SJRWMD used published data for a normal and 2-in-10 year rainfall probability and assumed that all growers operated at the medium efficiency rate to compensate for the slight increase in demand that would occur during a 1-in-10-year rainfall probability event. In order to maintain consistency across shared borders among water management districts, SJRWMD adopted the average year and 1-in-10-year supplemental irrigation requirements for citrus used by South Florida Water Management District (SFWMD) in its permitting program. Data from the SJRWMD Benchmark Farms Monitoring Project was used to calculate irrigation needs of potatoes and fern (Singleton 1996 and pers. com. 1998; Florence, pers. com. 1998). These data have been determined to be highly reliable indicators

of irrigation needs for these two crops grown under Florida conditions. This demand projection methodology is consistent with the recommendation of WDPS.

Calculations of potential changes in irrigated acreage were initially prepared by SJRWMD. The trend analysis performed by IFAS for the 1994 SJRWMD assessment was extended to 2020, with some slight modifications to integrate observed changes in trends. Information from published reports such as the annual reports by the Division of Plant Inspection of the Florida Department of Agriculture and Consumer Services and the citrus industry was used to verify 1995 crop acreage and ascertain trends in acreage. SJRWMD projections were reviewed and approved by staff of the county cooperative extension services, specific grower associations, and county planning offices.

Recreational Self-Supply

The recreational self-supply category in SJRWMD includes only golf course irrigation demands. SJRWMD does not have reliable estimates of either acreage or water demands for other recreational uses. Irrigated golf course acreage in 1995 was determined using information obtained from the SJRWMD CUP database. Acreage projections for each county were calculated by multiplying the irrigated acreage in each county in 1995 by the respective county population growth rates. Irrigation demands for an average and a 1-in-10 rainfall probability in 2020 were estimated using the Blaney-Criddle data (SJRWMD 1987). SJRWMD recognizes that the methodology for projecting demands for this category generally overestimated demand and needs to be improved.

Commercial/Industrial/Institutional Self-Supply

All permitted commercial/industrial/institutional self-suppliers listed in the SJRWMD CUP database with an average daily use of at least 0.25 mgd were asked to provide projections of estimated average use in 2020. Projections are estimated by SJRWMD for users not responding to its information request and for users with an average daily use of less than 0.25 mgd. SJRWMD projections are made by multiplying the 1995 use by the countywide rate of population growth

between 1995 and 2020. Information on actual use in 1995 is obtained from Florence (1997) or from the SJRWMD CUP database.

THERMOELECTRIC POWER GENERATION SELF-SUPPLY

All permitted thermoelectric power generation self-suppliers listed in the SJRWMD CUP database were inventoried and queried about their projected 2020 demand. SJRWMD projected demand for suppliers who did not respond to its request for information by multiplying the 1995 average daily use by the countywide rate of population growth. Because of the uncertainties associated with the potential deregulation of the industry, projections in this sector may be subject to significant change in subsequent water supply assessments. SJRWMD distinguished between water used for once-through cooling and recirculation and for all other uses associated with thermoelectric power generation. This distinction was made because the use of water for cooling and circulation is generally considered to be nonconsumptive. In addition, it is typically returned to the same source from which it was withdrawn without a noticeable water resource impact. Only uses other than those for once-through cooling and recirculation are considered in the total demands reported in this 1998 assessment.

Table 1. Water demand categories for water supply planning

Category	Projection Methodology	Information Source
Public supply	Projected population multiplied by • Per capita use • Historical use trends • Utility generated projections	Historical records, BEBR population projections, TAZ population projections, United States census data, in-house models, utility population and demand projections, district permit information, local government comprehensive plans, USGS or DEP data
Domestic self-supply and small public-supply systems	Estimated population not served by public supply category multiplied by • A county per capita estimate • Per capita of the nearest utility • A district standard per capita	Historical records, BEBR population projections, TAZ population projections, United States census data, in-house models, utility population and demand projections, district permit information, local government comprehensive plans, USGS or DEP data
Agricultural self-supply	Projected irrigated crop acreage multiplied by crop irrigation requirements	Acreage estimates and projections: econometric models, trend analyses, IFAS cooperative extension offices, input from grower organizations, and data from FASS, IFAS, DPI, NRCS Irrigation requirements: agricultural water use simulation models used by the districts, actual crop water use obtained from districts' agricultural water use monitoring projects
Recreational self-supply	Population-based or time trend acreage projections	BEBR population projections, district permit information, United States census data, BEBR, golf course publications, water use projection models, metered water use data
Commercial/industrial/ institutional self-supply	User supplied estimates Trends associated with population projections	BEBR population projections, TAZ population projections, United States census data

Table 1—*Continued*

Category	Projection Methodology	Information Source
Thermoelectric power generation self-supply	User-supplied estimates	User information and district permit information

Note: BEBR = Bureau of Economic and Business Research
DEP = Department of Environmental Protection
DPI = Department of Plant Industries
FASS = Florida Agricultural Statistics Services
IFAS = Institute of Food and Agricultural Services
NRCS = National Resources and Conservation Service
TAZ = transportation analysis zone
USGS = U.S. Geological Survey

PLANNING REGION ASSESSMENTS —by Barbara Vergara, P.G.; Bruce Florence; Cynthia Moore; and David Toth, Ph.D., P.G.

SJRWMD identified its entire jurisdictional area as one water supply planning region pursuant to the requirements of Executive Order 96-297 and Subparagraph 373.036(2)(b)2, *FS*. Therefore, the 1998 SJRWMD assessment includes an evaluation of the groundwater and surface water resources of the 19-county area of SJRWMD. This evaluation was performed to assess the availability of these resources to supply existing legal uses and reasonably anticipated future needs and to sustain the water resources and related natural systems through 2020.

The 1994 SJRWMD assessment of water supply needs and sources included ground and surface water source evaluations and identified water resource caution areas based on the water demand projections through 2010. Demand projections updated through 2020 are presented in this 1998 assessment along with an assessment of the impacts of projected 2020 demands on ground and surface water resources in SJRWMD.

EXISTING USE FOR EACH WATER USE CATEGORY—1995

SJRWMD, based on the requirements of Subparagraph 373.036(2)(b)4a, *FS*, and based on the guidance provided by WPCG, has inventoried existing legal uses of water for the year 1995. An existing legal use of water is defined, for the purposes of this assessment, as a use that was allowed based on the 1995 requirements of 40C-2, *F.A.C.*, the SJRWMD rule about consumptive uses of water.

The total 1995 population in SJRWMD was 3,470,009 (Table 2). The total water use in SJRWMD in 1995 from ground and surface water sources totaled 1,369.59 mgd (Table 3), of which 455.19 mgd, or about 33%, was used by large public supply systems that use at least 0.25 mgd average annual daily flow. Agriculture accounted for about 43% of the total amount used (excluding saline water), or 586.97 mgd. The greatest use of freshwater from groundwater sources by category was for public supply, followed closely by agriculture.

The three counties with the largest water use from groundwater sources in 1995 were Brevard, Duval, and Orange (Table 4). These counties all use greater than 100 mgd. Five counties—Indian River, Lake, Nassau, Seminole, and Volusia—use between 50 and 100 mgd.

Public Supply

The 1995 water use of large public supply utilities is listed by source and county (Table 5) and by individual utility (Table 6). The total water use by public supply utilities was 455.19 mgd, of which 443.04 mgd was groundwater. Only in Brevard County was water used from a surface water source (12.15 mgd, 3% of the category total). The county with the largest consumption of public supply water was Orange County (105.27 mgd, 23% of the category total), followed by Duval county (98.94 mgd, 22% of the category total).

Domestic Self-Supply and Small Public-Supply Systems

The 1995 water use for domestic self-supply and small public-supply systems was approximately 16% of the public supply water use (71.98 mgd vs. 455.19 mgd) (Tables 7 and 5).

Agricultural Self-Supply

Agricultural self-supply is the second largest use category for groundwater (363.58 mgd, Table 3) and the largest use category for ground and surface water sources combined (586.97 mgd). Approximately 62% of the water used for supplemental irrigation in 1995 came from groundwater sources (Tables 8 and 9). The counties with the largest use of ground and surface water sources were Indian River (237.35 mgd) and Brevard (124.81 mgd). Over 70% of the irrigation water used in Indian River County came from surface water sources. Both Brevard and Indian River counties have significant acreage in citrus and improved pasture. Citrus and pasture were the largest use categories of agricultural irrigation water in 1995 (293.54 mgd and 148.76 mgd, respectively, Table 10).

A portion of the water used for agricultural irrigation in 1995 came from reclaimed water sources. An SJRWMD survey of reclaimed water providers indicates that 15.95 mgd of reclaimed water was supplied for agricultural irrigation throughout SJRWMD in 1995 (Brandes 1995).

The methodologies for estimating 1995 agricultural irrigation requirements and for estimating reclaimed water use are different. The quantities of reclaimed water use reported to SJRWMD were the quantities that were supplied regardless of whether they were reasonably-beneficially used. Therefore, subtracting the quantity of reclaimed water supplied for agricultural irrigation from the total water demand for agricultural irrigation was not considered an acceptable means of determining the amount of groundwater and surface water used for agricultural irrigation. SJRWMD recognizes the need to more accurately assess the impact of using reclaimed water on the demands for groundwater and surface water. SJRWMD will work toward addressing this need in its ongoing survey of wastewater treatment and reuse. This information will be included in the next scheduled update of the water supply assessment.

Recreational Self-Supply

Total recreational self-supply water use in 1995 was 99.13 mgd, of which 68.78 mgd, or 69%, was groundwater (Table 11). A portion of the water used for recreational self-supply in 1995 came from reclaimed water sources. An SJRWMD survey of reclaimed water providers indicates that 20.73 mgd of reclaimed water was supplied for recreational self-supply purposes throughout SJRWMD in 1995 (Brandes 1995).

The methodologies for estimating 1995 recreational self-supply requirements and for estimating reclaimed water use are different. The quantities of reclaimed water use reported to SJRWMD were the quantities that were supplied regardless of whether they were reasonably-beneficially used. Therefore, subtracting the quantity of reclaimed water supplied for recreational self-supply purposes from the total water demand for recreational self-supply was not considered an acceptable means of determining the amount of groundwater and surface water used for recreational self-supply purposes. SJRWMD recognizes the need to assess more accurately the impact of using reclaimed water on the demands for groundwater and surface water. SJRWMD will work toward addressing this need in its ongoing survey of wastewater treatment and reuse. This information will be included in the next scheduled update of the water supply assessment.

Commercial/Industrial/Institutional Self-Supply

Total commercial/industrial/institutional self-supply water use in 1995 was 134.16 mgd, of which 96.03 mgd was from groundwater sources (Tables 12 and 13). An insignificant amount of the water use in this category comes from saline surface water sources and is used for nonconsumptive purposes. Saline surface water for this category is not addressed in this 1998 assessment. The only counties with significant use in this category are Duval (24.75 mgd), Lake (11.37 mgd), Nassau (36.74 mgd), and Putnam (46.25 mgd). Approximately 28% of the total use came from surface water sources.

Thermoelectric Power Generation Self-Supply

Total freshwater use for noncooling purposes in this category in 1995 was 22.16 mgd, of which 7.66 mgd came from groundwater sources (Tables 14 and 15). Water for cooling purposes from saline and fresh surface water sources totaled 1,840.49 mgd. Seven counties in SJRWMD had thermoelectric power generation facilities in 1995.

Reasonably Anticipated Future Needs for Each Water Use Category—2020

SJRWMD, based on the requirements of Subparagraph 373.036(2)(b)4a, *FS*, and based on guidance provided by WPCG, has determined reasonably anticipated future needs and reasonably anticipated sources of water and conservation efforts. SJRWMD followed the guidance of WPCG in choosing 2020 as the projection horizon. Projections of reasonably anticipated future needs presented in this 1998 assessment were developed based on the methodologies presented in the previous chapter.

Population in SJRWMD is expected to increase from 3,470,009 in 1995 to 5,196,261 in 2020, an increase of 50% (Table 2). In a year of average rainfall, total water demand in SJRWMD is projected to increase by 24% from 1995 to 2020 (Table 3). The category with the most significant projected increase during this period is public supply, where demand is estimated to increase by 58% to 719.29 mgd. This percentage increase compares to an estimated projected increase of 50% in total SJRWMD population (Table 2). Increases in water demand are slightly greater

than population growth primarily because the utilities expect higher growth in population than BEBR projected. Agricultural water use, the second largest category of use, is expected to remain essentially unchanged. Although recreational demand is expected to increase by 58%, the total amount used in this category is only a small fraction of the total projected use. The demand from domestic self-supply and small public-supply users is expected to decrease by 10%, reflecting an increase in the percentage of population to be served by public supply utilities.

Total demand in a 1-in-10-year drought event is also expected to increase by 36%, with an increase in total demand of 160.15 mgd over total demand for an average rainfall year (Table 3).

The projected percent increase in water use between 1995 and 2020, by county, ranges from a high of 65% in Flagler County to a low of 8% in Indian River County, excluding changes in Polk, Osceola, Okeechobee, Baker, and Bradford counties (Table 4). The 1995 demand in the SJRWMD portion of these five counties was insignificant, so that the impact of a relatively small projected change in water use will result in a disproportionately large projected percentage change. Total demand is expected to decrease by 2% in Brevard County due to a decrease in agricultural demand (Tables 4 and 9).

Public Supply

SJRWMD reports the total projected demand in this category based on population-based projections rather than on utility-based projections. Demand in this category is projected to experience the greatest amount of change of all reported categories. Not only is demand projected to increase by 58% but this increase represents 79% of the total projected demand for all categories during an average rainfall year (Tables 3 and 5). This relationship is consistent with the findings of the 1994 SJRWMD assessment (Vergara 1994). The projected demand in Brevard County includes the water projected to be withdrawn in Orange and Osceola counties by the City of Cocoa, which serves a large population in Brevard County. There are no large public supply demands projected for 2020 in the SJRWMD portions of Bradford, Okeechobee, Osceola, and Polk counties, and Baker County is projected to have an insignificant demand in the SJRWMD portion of that county. Of the 14 remaining counties, Alachua, Duval, Putnam,

and Volusia have a projected increase in demand of less than 50%. The relatively small percentage increase in Duval in comparison to the increases projected for the adjacent counties of Clay, Baker, and St. Johns is probably due largely to the increasing role played by these counties as "bedroom" communities to the City of Jacksonville. The five counties of Baker, Flagler, Indian River, Lake, and Nassau are expected to experience an increase in public supply demand of greater than 100% between 1995 and 2020. These counties (except Baker) are projected to experience significant increases in residential populations largely through the development of new subdivisions and other planned developments.

As in the 1994 assessment, groundwater is projected to continue to be the largest source of water to supply the projected demands in this category. By 2020, 702.48 mgd of groundwater is projected to be used to support public supply demands. Surface water sources are projected to be used to support projected public supply demands only in Brevard County. Both the Cities of Melbourne and Cocoa propose to use surface water—Lake Washington and the Taylor Creek Reservoir, respectively. Melbourne plans to reduce its surface water use, and Cocoa plans to begin to use surface water.

Demands in a 1-in-10-year drought event are projected to increase by approximately 43 mgd over the amount in an average rainfall year (from 719.29 mgd to 762.45 mgd, Table 5).

Domestic Self-Supply and Small Public-Supply Systems

The demand in this category is projected to decrease by 10% based on an average rainfall year in 2020 (Table 7). Eight counties are projected to experience a decrease in demand: Brevard, Duval, Flagler, Indian River, Lake, Nassau, St. Johns, and Seminole. The decrease in demand in this category reflects expansion of public supply service areas and an associated increase in the percentage of the population served by public supply utilities within these service areas.

Demands in a 1-in-10-year drought event are projected to increase from 64.84 mgd in an average rainfall year to 68.73 mgd (Table 7).

The demand for water to meet the general need of the public is the aggregate demand (public-use demand) of the public supply and the

domestic self-supply and small public-supply demand. Total projected demand for public-use water is estimated to increase 49%, from 527.17 mgd in 1995 to 784.13 mgd in 2020 (Table 16). The projected 58% increase in demand in the public supply category is offset by the 10% decrease in demand in the domestic and small public-supply category. The result is a rate of increase in demand for water to meet the general needs of the public that is consistent with the projected rate of increase in population of 50% (Tables 2 and 16).

Agricultural Self-Supply

Total irrigated agricultural acreage is projected to decline from about 331,886 acres to about 309,347 acres between 1995 and 2020 (Tables 8 and 9). Growth is projected in the greenhouse/nursery industry, particularly in Clay, Brevard, Lake, and Putnam counties. Increased sod production is expected to occur primarily in Brevard, Duval, and Putnam counties where land formerly used to grow pasture grass and potatoes is projected to be converted into sod production. In addition, citrus acreage is expected to increase by about 47% in Lake County and by 137% in Polk County between 1995 and 2020. Citrus in both counties suffered significant losses in the aftermath of freezes in the 1980s. Projected 2020 citrus acreage is less than the prefreeze acreage in these counties.

The combined effect of a decline in acreage and shift in crop production is projected to result in no perceptible change in total water demand in 1995 to an average rainfall year in 2020 (586.97 to 589.14 mgd).

Projected demands in a 1-in-10-year drought event are projected to increase by 19%, from 586.97 mgd in 1995 to 698.31 mgd (Table 8).

Recreational Self-Supply

Recreational self-supply water demand is projected to increase from 99.13 mgd in 1995 to 156.44 mgd in 2020, an increase of about 58% (Table 11). This represents an increase of about 57 mgd. The increase in this sector may be a concern in localized situations, where there is a heavy concentration of this type of use. However, a portion of the projected demand is expected to be supplied by reclaimed water and stormwater. SJRWMD, through its CUP process, routinely requires the

use of reclaimed water and stormwater when such use is technically, environmentally, and economically feasible.

SJRWMD recognizes the need to more accurately assess the impact of using reclaimed water on demands for groundwater and surface water. SJRWMD will work toward addressing this need in its analysis of water use reports from CUP permit holders and an ongoing survey of wastewater treatment and reuse. This information will be included in the next scheduled update of the water supply assessment.

The total demand is projected to increase from 156.44 mgd in an average rainfall year to 160.40 mgd in a drought year (Table 11).

Commercial/Industrial/Institutional Self-Supply

An increase in commercial/industrial/institutional self-supply demand of approximately 9%, to a total of 146.82 mgd, is projected to occur between 1995 and 2020 (Tables 12 and 13). The total amount of projected demand in this category may not appear to be significant in comparison to other categories. However, withdrawals of water by individual users to support demands in this category are often relatively large withdrawals that are concentrated in relatively small areas, a combination that often results in concerns regarding the hydrologic impacts of withdrawals.

Thermoelectric Power Generation Self-Supply

The use of freshwater for noncooling purposes for thermoelectric power generation is projected to increase by 24% from 22.16 mgd in 1995 to 27.55 mgd in 2020 (Tables 14 and 15). Saline and fresh surface water use for cooling purposes is expected to increase by 37% to 2,498.91 mgd in 2020 from 1,825.99 mgd in 1995.

SOURCE EVALUATION

SJRWMD identified its entire jurisdictional area as one water supply planning region pursuant to the requirements of Executive Order 96-297 and Subparagraph 373.036(2)(b)2, *FS*. Therefore, this 1998 assessment includes an evaluation of the groundwater and surface water resources in the 19-county area of SJRWMD. This evaluation was performed to assess the availability of these resources to supply

existing legal uses and reasonably anticipated future needs and to sustain the water resources and related natural systems through 2020.

OVERVIEW OF HYDROLOGIC SYSTEM

Water supplies in SJRWMD are available from both ground and surface water systems. These systems contain an abundance of water but the nature of these systems and their relationship to one another must be carefully considered when planning the development of water supplies.

Overview of Groundwater Resources

Three aquifer systems supply groundwater in SJRWMD: the surficial, the intermediate, and the Floridan (Figure 4). The hydrogeologic nature of these aquifer systems has been described by the Southeastern Geological Society (1986).

Surficial Aquifer System. The surficial aquifer system is composed primarily of sand and sandy clay. It is located from land surface downward to the top of the confining unit of the intermediate aquifer system, where present, or to the top of the confining unit of the Floridan aquifer system. The surficial aquifer system contains the water table, which is the top of the saturated zone within the aquifer. Water within the surficial aquifer system occurs mainly under unconfined conditions, but beds of low permeability cause semiconfined or locally confined conditions to prevail in its deeper parts.

Water quality in the surficial aquifer system is generally good. Based on a review of U.S. Geological Survey (USGS) and SJRWMD data, chloride, sulfate, and total dissolved solids (TDS) concentrations are generally below the secondary drinking water standards of 250, 250, and 500 milligrams per liter (mg/L), respectively (Subsection 62-550.320(1), *F.A.C.*). Iron concentrations, however, are generally high and in many places exceed the secondary drinking water standard of 0.3 mg/L (Subsection 62-550.320(1), *F.A.C.*). In coastal areas, such as the barrier islands, this aquifer system is prone to saltwater intrusion.

The surficial aquifer system is a source of water for public supply in St. Johns, Flagler, Brevard, and Indian River counties. It is also used as

a source of water for domestic self-supply, mainly along the coastal portions of SJRWMD but also in inland areas scattered throughout SJRWMD.

Intermediate Aquifer System. The intermediate aquifer system is composed of thin water-bearing zones of sand, shell, and limestone, which lie within or between less permeable units of clayey sand to clay. In places, poorly yielding to non-water-yielding strata occur, and there the term "intermediate confining unit" applies. This intermediate confining unit is geologically referred to as the Hawthorn Group. In other places, one or more low-to-moderate yielding aquifers may be interlayered with relatively impermeable confining beds. The aquifers within this aquifer system contain water under confined conditions. Within the intermediate aquifer system, confining units are generally more extensive than water-bearing units.

The top of the intermediate aquifer system or the intermediate confining unit coincides with the base of the surficial aquifer system. The base of the intermediate aquifer system or the intermediate confining unit lies immediately above the Floridan aquifer system.

Based on a review of available USGS and SJRMWD data, water quality in the intermediate aquifer system is generally good in the northern part of SJRWMD where chloride, sulfate, and TDS concentrations are below the secondary drinking water standards. Water quality in the southern part of SJRWMD approaches or exceeds the secondary drinking water standards for chloride and TDS concentrations.

The intermediate aquifer system is used as a source of water for domestic self-supply in Duval and Clay counties.

Floridan Aquifer System. The Floridan aquifer system is one of the world's most productive aquifers. The sediments that comprise the aquifer system underlie the entire state, although this aquifer system does not contain potable water at all locations. The Floridan aquifer system is generally composed of limestone and dolomite. Water in the Floridan aquifer system occurs under confined conditions throughout most of SJRWMD. Unconfined conditions occur in parts of Alachua and Marion counties.

The Floridan aquifer system is subregionally divided on the basis of the vertical occurrence of two zones of relatively high permeability (Miller 1986). These zones are called the Upper and Lower Floridan aquifers. A less permeable limestone and dolomitic limestone sequence generally separates the Upper and Lower Floridan aquifers. It is referred to as the middle semiconfining unit. Throughout much of Baker, Union, Bradford, western Alachua, and northwestern Marion counties, the middle semiconfining unit is missing and the Lower Floridan aquifer does not occur (Miller 1986).

Based on a review of USGS and SJRWMD data, water quality in the Upper Floridan aquifer varies depending on its location in SJRWMD. Water quality in this aquifer is generally good in the northern and western portions of SJRWMD where chloride, sulfate, and TDS concentrations are below the secondary drinking water standards. Chloride and TDS concentrations in the Upper Floridan aquifer generally exceed the secondary drinking water standards throughout Brevard and Indian River counties; in southern St. Johns and most of Flagler counties; in areas bordering the St. Johns River south of Clay County; in parts of Putnam, Marion, Lake, Volusia, Seminole, Orange, and Osceola counties; and in eastern Volusia County. Sulfate concentrations also often exceed the secondary drinking water standards.

Based on a review of USGS and SJRWMD data, water quality in the Lower Floridan aquifer also varies depending on its location in SJRWMD. Water quality in this aquifer is generally good in the northern and western portions of SJRWMD where chloride and TDS concentrations are below the secondary drinking water standards. Chloride concentrations in the Lower Floridan aquifer generally exceed the secondary drinking water standards throughout all of Flagler, Brevard, and Indian River counties; in eastern Nassau and Volusia counties; and in areas bordering the St. Johns River in Putnam, Marion, Lake, Volusia, Seminole, Orange, and Osceola counties (Sprinkle 1989). TDS concentrations in the Lower Floridan aquifer generally exceed the secondary drinking water standards throughout all of St. Johns, Flagler, Brevard, and Indian River counties; in most of Nassau and Duval counties; in eastern Clay and Volusia counties; and in areas bordering the St. Johns River in Putnam, Marion, Lake, Volusia, Seminole, Orange, and Osceola counties (Sprinkle 1989).

The Upper Floridan aquifer is the primary source of water for public supply water use in SJRWMD. This aquifer is a source of water for public supply in the northern and central portions of SJRWMD where the aquifer contains water that generally meets primary and secondary drinking water standards. The Upper Floridan aquifer is also a source of water for public supply in the southern portion of SJRWMD where water withdrawn from the aquifer is treated by reverse osmosis. Portions of the Lower Floridan aquifer also are tapped as a source of water for public supply in Duval, central and western Orange, and southern and southwestern Seminole counties. The Floridan aquifer system in the southern portion of SJRWMD, where the aquifer system generally contains water that exceeds secondary drinking water standards for chloride, sulfate, and TDS, is widely used as a source of irrigation water.

Overview of Surface Water Resources

Streams, lakes, canals, and other surface water bodies in SJRWMD provide water for various consumptive and nonconsumptive uses. Although aquifers usually contain relatively high-quality water and are likely to remain the most widely used freshwater supply sources in SJRWMD, pressure to develop surface water sources could increase as groundwater becomes less available. If environmentally and economically feasible, additional surface water could be made available for future use.

Water quality can limit surface water availability for certain uses if it is not economically feasible to treat the water to the level required for those intended uses. Surface water quality in SJRWMD varies both spatially and temporally due to natural processes and human activities that affect the chemical and microbiological character of water bodies. The linkage between water quality and water availability is determined by the quality requirements for different intended uses. For example, TDS concentrations of 35,000 mg/L (equivalent to seawater) can be used by some industries, whereas a maximum of 500 mg/L is recommended for public supply (Prasifka 1988).

Compared to most groundwater sources in SJRWMD, surface water sources generally are of lower quality. Surface waters tend to contain silts and suspended sediments, dissolved organic matter from topsoil, and chemical and microbiological contaminants from municipal

wastewater discharges, stormwater runoff, and industrial and agricultural activities. The quality of surface water may vary seasonally with variation in flow rates or water levels.

Salinity is one of the most important water quality considerations in SJRWMD. In the coastal rivers of SJRWMD and the tidal reaches of the St. Johns, St. Marys, and Nassau rivers (Figure 1), the influx of seawater limits potential water uses to recreation and power plant cooling. Chloride concentrations generally decrease upstream from the mouths of these rivers as tidal influence diminishes.

In addition to the influence of tides, inflows of groundwater with salinities higher than in receiving waters affect the spatial distribution of chloride concentrations in the St. Johns River. During low-flow periods, when there is little dilution from freshwater inflows, higher chloride concentrations occur in the tidally influenced lower reach of the river and in an upper reach between Lakes Harney and Poinsett (Figure 1). The higher chloride concentrations in the upper reach of the St. Johns River are due to inflows of groundwater with higher chloride concentrations than in the receiving water, primarily through diffuse upward leakage and possible spring discharge (Tibbals 1990). In some reaches of the St. Johns River, the cost of treating saline water to the degree necessary for most agricultural and public supply needs may be too high.

Water Availability from Streams. Monthly stream discharges generally reflect the seasonal distribution of annual rainfall. Streams in SJRWMD usually exhibit at least two high- and low-flow seasons over the course of the year. The highest average monthly discharges throughout SJRWMD tend to occur in August, September, and October, when summer thunderstorms are common and tropical storms are most likely to occur. The high-flow period in March and April is more significant in the northern area of SJRWMD than in the southern area. More important, the lowest average monthly discharges tend to occur during the late fall to early winter months (November and December) and the late spring to early summer months (May and June). Some of the highest demands for surface water occur during these low-flow periods. High irrigation water demands often occur during May, June, and December. December is the beginning of the season for frost-and-freeze protection. USGS publishes *Water resources for northeast Florida* on a water year basis (October through September)

for all active surface water gages. These reports are the most comprehensive sets of surface water stage and discharge data available for water bodies in SJRWMD.

A review of available USGS discharge data indicates that there are very few sites in SJRWMD where substantial quantities of water are likely to be available throughout the year. With the rare exception of streams with very stable base flows resulting from constant groundwater discharge, most streams in SJRWMD would require artificial storage for an assured supply of water. An example is Lake Washington (Figure 1), which is a natural water body with a dam to improve its water storage, located within the St. Johns River near Melbourne. The City of Melbourne receives its water supplies from Lake Washington (about 15 mgd) even though flow ceases occasionally in the St. Johns River.

Quantities of water that can be developed from surface water sources will be limited by the requirements of natural systems and the costs of treatment, storage, and distribution facilities. Streams with high flows generally offer greater potential as sources of water to meet projected needs. The feasibility of developing potential sites for water supply should be assessed based upon the quantity of water to be withdrawn, the associated impacts on natural systems, and the cost of treatment, storage, and distribution facilities.

SJRWMD has assessed the feasibility of withdrawing surface water from the St. Johns River and from Haines Creek in Lake County between Lakes Eustis and Griffin (Figure 1). The results of these assessments indicate that development of water supplies of up to 351 mgd from the St. Johns River and up to 14 mgd from Haines Creek is technically, environmentally, and economically feasible (CH2M HILL 1996a, 1996b, 1997a, 1997b). These levels are planning quantities that could change based on the establishment of minimum flows and levels; minimum flows and levels are under development but have not yet been established for these surface water systems.

Water Availability from Stormwater Retention/Detention Facilities. Stormwater throughout the developed areas of SJRWMD is typically captured in constructed stormwater drainage and retention/detention systems. Water from these systems can be directly used to meet many

nonpotable water needs. Stormwater is commonly used as a source of golf course irrigation water.

A comprehensive assessment of the availability of water from these facilities has not been performed as part of this 1998 assessment.

Water Availability from Lakes. Most of the larger lakes in SJRWMD are part of the Ocklawaha or St. Johns river systems (Figure 1), and the water quality and stage fluctuations of these lakes are similar to those of the rivers of which they are a part. Major lakes in the upper Ocklawaha River chain of lakes include Apopka, Harris, Eustis, Griffin, and Dora. Major lakes of the St. Johns River system include George, Harney, Monroe, Jesup, Poinsett, Washington, and Crescent. Other major lakes, including Newnans, Lochloosa, and Orange, are located in the lower Ocklawaha River Basin.

SJRWMD has begun the process of setting minimum lake levels pursuant to the provisions of Section 373.042, *FS*. These minimum lake levels may restrict the amount of water available from lakes. Levels established to date are included in Chapter 40C-8, *F.A.C.* (Appendix C). The plan for establishment of additional levels is described in SJRWMD (1997) (Appendix D).

ASSESSMENT CRITERIA USED

Subparagraph 373.036(2)(b)4, *FS*, requires that SJRWMD determine whether existing and reasonably anticipated sources of water and conservation efforts are adequate to supply water for all existing uses and reasonably anticipated future needs and to sustain the water resources and related natural systems. SJRWMD has made this determination based on a comparison of water resource constraints to the results of hydrologic impact assessments, which were based on projected 2020 demands. Areas within which anticipated sources of water and conservation efforts are determined not to be adequate to supply all existing and reasonably anticipated future needs are identified as priority water resource caution areas. Within these identified priority water resource caution areas, the impacts of current or projected demands exceed the water resource constraints for natural systems, groundwater quality, or existing legal users of water.

Impacts to Natural Systems

SJRWMD considered two impacts based on natural systems in its identification of priority water resource caution areas:

- Impacts to native vegetation
- Impacts to minimum flows and levels

Impacts to Native Vegetation. The SJRWMD process for assessing impacts to native vegetation is described in Kinser and Minno (1995). This process is based on a GIS model that uses soil permeabilities, sensitivities of plant communities to dewatering, and projected declines in the elevation of the water table of the surficial aquifer system to estimate the relative likelihood of harm to native plant communities. Based on this process, the 1994 assessment identified areas of SJRWMD having low, moderate, and high likelihoods of harm to native vegetation as a result of projected declines in the elevation of the water table of the surficial aquifer system between 1988 and 2010. These areas were part of the water resource caution areas identified as a result of the 1994 assessment (Vergara 1994).

Because projected 2020 demands are reasonably similar to the projected 2010 demands in Vergara (1994), SJRWMD assumed that the impacts of projected 2020 water use on native vegetation will be reasonably similar to those identified in the 1994 assessment. Therefore, areas having moderate to high likelihoods of harm to native vegetation, areas where projected declines in the elevation of the potentiometric surface of the Floridan aquifer system and of the water table of the surficial aquifer system will contribute to this condition, and public supply service areas associated with the projected groundwater withdrawals that contributed to the projected declines have been identified as areas that contribute to the overall designation of priority water resource caution areas.

Impacts to Minimum Flows and Levels. SJRWMD assessed the potential for impacts to minimum flows and levels in 2020 by comparing established minimum flows and levels for surface water courses or minimum groundwater levels to surface water flows and levels or groundwater levels projected to occur in 2020 . SJRWMD identified those areas where a projected 2020 flow or level is less than a minimum flow or level contained in Chapter 40C-8, *F.A.C.* These

areas—along with the areas where projected declines in the elevation of the potentiometric surface of the Floridan aquifer system will contribute to this condition, and the public supply service areas associated with projected groundwater withdrawals that will contribute to these projected declines—have been identified as areas that contribute to the overall designation of priority water resource caution areas.

The 1994 assessment identified areas where proposed increases in groundwater withdrawals between 1988 and 2010 are projected to cause the discharge of seven springs in the Wekiva River System to fall below the minimum discharges set forth in Chapter 40C-8, *F.A.C.*

Because projected 2020 demands are reasonably similar to the 2010 demands in Vergara (1994), SJRWMD assumed that the impacts of projected 2020 water use on flows and levels for surface water courses and groundwater levels will be reasonably similar to those identified in the 1994 assessment. Therefore, SJRWMD compared established minimum flows and levels for surface water courses or minimum groundwater levels to surface water flows and levels or groundwater levels projected to occur in 2010, as reported in the 1994 assessment document.

SJRWMD has not yet established minimum discharges for springs outside of the Wekiva River System. In general, a projected decrease of 15% or more in the discharge of a spring is considered to be enough decrease to pose a reasonable likelihood of natural systems problems and to warrant further investigation in order to establish minimum discharges (Kinser and Minno, pers. com. 1994)

Springs with projected decreases in discharge of 15% or more, areas where projected declines in the elevation of the potentiometric surface of the Floridan aquifer system contribute to these decreases in discharge, and public supply service areas associated with the projected groundwater withdrawals that contribute to these projected declines have been identified as areas that contribute to the overall designation of priority water resource caution areas.

Projected declines in the elevation of the potentiometric surface of the Floridan aquifer system are expected to affect the levels of some lakes. SJRWMD adopts minimum lake levels by rule (Chapter 40C-8, *F.A.C.*).

To provide for protection of important lake characteristics and functions, multiple minimum levels (typically three) are set for each lake. Each minimum level has an associated minimum hydrologic frequency (generally expressed as a minimum percent inundation); for example, a lake should be at or above the minimum average level at least 50% of the time over a duration sufficiently long to represent long-term rainfall conditions.

A comprehensive evaluation of the impacts of projected declines in the elevation of the potentiometric surface of the Floridan aquifer system on established minimum lake levels is complex. Such an evaluation generally requires that lake-specific water budget models be created to project long-term lake hydroperiods. Models also are needed to predict the relationship between groundwater and surface water levels for each lake. Water budget models have been developed for a subset of the lakes with established minimum levels, and a lake-groundwater interaction model is under development by USGS. When these tools are completed, SJRWMD plans to perform a detailed assessment of projected groundwater level declines on lakes with minimum levels.

Impacts to Groundwater Quality

SJRWMD considered the impacts of projected saltwater intrusion on the future availability of potable groundwater. Projected changes in the concentrations of chlorides in water in the Floridan aquifer system were the basis of assessing the projected magnitude of saltwater intrusion. Other water quality constituents, such as sulfates and TDS, also are important to consider when assessing the suitability of groundwater for various uses. However, concentrations of chlorides are considered to be perhaps the best indicator of the presence of saltwater intrusion. The subregional groundwater flow and water quality model results reported on in the 1994 assessment (Vergara 1994) were used to describe the projected magnitude of saltwater intrusion.

In association with the 1994 assessment, SJRWMD relied heavily on the input of a group of technical and legal consultants to define, for purposes of that assessment, groundwater quality limits beyond which water resource problems would occur (SJRWMD unpublished). Those groundwater quality limits were used as a water resource constraint in this 1998 assessment.

Areas where chloride concentrations in the water in the Floridan aquifer system result in an inadequate thickness of water with quality suitable to supply existing or projected 2020 uses through the year 2110, areas where projected declines in the elevation of the potentiometric surface of the Floridan aquifer system contribute to this condition, and the public supply service areas associated with the projected groundwater withdrawals that contribute to these projected declines have been identified as areas that contribute to the overall designation of priority water resource caution areas.

SJRWMD projected the impacts of projected 2020 water use through 2110, because saltwater intrusion occurs slowly in response to declines in the elevation of the potentiometric surface of the Floridan aquifer system, probably on the order of tens to hundreds of years.

The specific evaluations performed in association with this groundwater quality constraint concentrated on projected changes in the location of the 250-mg/L isochlor. This 250-mg/L limit of chloride concentration was chosen because it is the recommended limit of the U.S. Environmental Protection Agency for chloride concentrations in public drinking water. As such, waters with chloride concentrations above this limit generally require different and more expensive public drinking water treatment systems.

The availability of groundwater supplies for other water use purposes (e.g., agricultural self-supply) will be limited by higher concentrations of chlorides and other constituents such as TDS than those for drinking water. SJRWMD has not developed a specific method for the assessment of the potential impacts of saltwater intrusion on the availability of groundwater to supply uses other than public supply and domestic self-supply.

Impacts to Existing Legal Users

SJRWMD considered one constraint in its evaluation of projected impacts to existing legal users of water based on projected 2020 water use. That constraint is the interference of an existing legal user's ability to withdraw water from a well because of water level declines in the well caused by other users of water.

SJRWMD considers areas where significant potential exists for existing users to be unable to withdraw adequate quantities of water from their wells as a result of water level declines in the wells caused by groundwater withdrawals by other users to contribute to the overall designation of priority water resource caution areas. This situation currently exists seasonally in portions of northeast Putnam County and southwest St. Johns County during periods of potato crop irrigation.

During these irrigation periods, groundwater withdrawals result in a regional lowering of the elevation of the potentiometric surface of the Floridan aquifer system. This kind of lowering historically has caused privately owned wells and aeration systems supplying water for domestic use to be rendered inoperable for short periods of time, usually a matter of days. The Putnam County Board of County Commissioners enacted Ordinance 87-2 to require well construction standards for new wells in a portion of Putnam County where this problem occurs. These well construction standards were designed to prevent future interference with withdrawals of water from new wells by requiring that new wells be constructed to adequate depths and be equipped with appropriate pumping equipment. Similar requirements are not in place in the remaining portions of Putnam County and in St. Johns County within the area experiencing interference problems.

The St. Johns County Public Health Unit, pursuant to an agreement with SJRWMD, is the agency responsible for well construction permitting in the county. The Public Health Unit distributes printed information concerning well construction guidelines that can be followed to prevent interference problems. This printed information was designed to prevent future interference with withdrawals of water from new wells by encouraging well construction contractors and well owners to construct new wells to adequate depths and to equip wells with appropriate pumping equipment. This printed information is published for the Public Health Unit by SJRWMD.

Although the well construction standards enacted by Putnam County and the information distributed by the St. Johns County Public Health Unit are effective in preventing future interference problems, these standards and this information do not prevent problems in wells that were constructed prior to the effective date of the ordinance.

Failure to Identify a Source of Supply for Planned Development

SJRWMD considers areas projected to experience significant planned development requiring new, but unidentified, water supplies and associated areas that could reasonably be expected to be impacted by the development of new sources to supply these areas, if not already identified based on another constraint, to be in priority water resource caution areas.

Hydrologic Impacts Due to Demands

SJRWMD performed detailed hydrologic impact assessments in 1994 (Vergara 1994) to determine the impacts of projected 2010 demands on ground and surface water resources. Because projected 2020 demands are reasonably similar to those projected for 2010, SJRWMD assumed that the hydrologic impacts of projected 2020 demands on ground and surface water resources will be reasonably similar to those reported for 2010. Based on this earlier work, if major water users' current water supply plans for 2020 are implemented, the elevation of the potentiometric surface of the Floridan aquifer system is expected to decline regionally in response to the cumulative withdrawals of water from the Floridan aquifer system (Figure 5). In response to these declines in the elevation of the potentiometric surface of the Floridan aquifer system and in response to withdrawals from the intermediate and surficial aquifer systems, the elevation of the water table of the surficial aquifer system is expected to decline (Figure 6). Also in response to these declines, the discharges of numerous springs are expected to decline and chloride concentrations are expected to increase in public supply wells in eastern Orange County and coastal Volusia County. The accuracy of the assessments of these impacts can be improved through use of improved groundwater models. Improved groundwater models are currently being developed by SJRWMD.

Adequacy of Regional Sources

The primary focus of this 1998 assessment is the identification of areas where existing and reasonably anticipated sources of water and conservation efforts are not adequate to supply water for all existing legal uses and reasonably anticipated future needs and to sustain the

water resources and related natural systems through 2020—priority water resource caution areas (Figure 2).

These priority water resource caution areas cover about 40% of SJRWMD. Changes in projected quantities and locations of 2020 groundwater and surface water withdrawals can change the boundaries of these areas. Therefore, areas located outside of the identified priority water resource caution areas should not be assumed to be able to support future groundwater and surface water withdrawals without resulting in unacceptable water resource conditions.

A review of Figures 7 through 9 indicates that projected 2020 water use in areas to the south of the SJRWMD boundary, in SFWMD, will contribute to the anticipated unacceptable water resource conditions. SJRWMD is coordinating closely with SFWMD concerning this matter, based on the provisions of a memorandum of understanding entered into by the two districts.

Projections of possible future water resource conditions identified as part of this 1998 assessment are not considered by SJRWMD to represent conditions that are certain to exist. The projections were developed using modeling techniques that used the best information available. However, the lack of data in some areas could affect the accuracy of the projections. Additional data and modeling have been identified as means of improving the accuracy of the projections.

Impacts to Natural Systems

SJRWMD considered two factors in its identification of priority water resource caution areas based on natural systems:

- Impacts to native vegetation
- Impacts to minimum flows and levels

Impacts to Native Vegetation. SJRWMD identified areas with moderate to high likelihoods of harm to native vegetation, areas where projected declines in the elevation of the potentiometric surface of the Floridan aquifer system will contribute to this condition, and areas served by public supply utilities with projected groundwater

withdrawals that will contribute to these projected declines to be in priority water resource caution areas (Figure 7).

Impacts to Minimum Flows and Levels. SJRWMD identified areas where projected 2020 flows or levels are less than minimum flows or levels contained in Chapter 40C-8, *F.A.C.*

Proposed increases in groundwater withdrawals are projected to result in water resource conditions that will cause the discharge of seven springs in the Wekiva River subbasin to fall below the minimum discharges set forth in Chapter 40C-8, *F.A.C.* These springs are Wekiva, Rock, Miami, Sanlando, Starbuck, Palm, and Seminole. SJRWMD identified the area in the immediate vicinity of these springs, the area in the Wekiva River downstream of these springs, areas where projected declines in the elevation of the potentiometric surface of the Floridan aquifer system contribute to the projected declines in spring discharge through 2020, and the public supply service areas associated with the projected groundwater withdrawals that contribute to these projected declines (Figure 8) to be in priority water resource caution areas.

SJRWMD identified springs with projected decreases in discharge of 15% or more, areas where projected declines in the elevation of the potentiometric surface of the Floridan aquifer system contribute to these decreases in discharge, and service areas for public supply associated with the projected groundwater withdrawals that contribute to these projected declines (Figure 8) to be in priority water resource caution areas.

SJRWMD is in the process of reviewing hydrologic data (water levels in lakes and potentiometric levels of the Upper Floridan aquifer) and available water budget models for lakes with established minimum levels. Based on this review, SJRWMD has identified one lake at this time that will likely not meet established minimum levels over the long term. This lake, Lake Daugharty, is located just north of De Land in Volusia County within the Crescent City–De Land Ridge area. Lake Daugharty's level has been impacted by declines in the elevation of the potentiometric surface of the Upper Floridan aquifer and by surface water drainage alterations that have occurred in the past. However, based on the evaluations performed to date, the specific impact of existing and projected groundwater withdrawals on the level of Lake

Daugharty is uncertain. Therefore, SJRWMD cannot conclude that groundwater withdrawals are a significant contributor to the lowered level of Lake Daugharty. SJRWMD will continue the evaluation and will report the results in the next update of the water supply assessment.

Impacts to Groundwater Quality

Because projected 2020 demands are reasonably similar to the 2010 demands in Vergara (1994), SJRWMD assumed that the impacts of projected 2020 water use on groundwater quality, and specifically on saltwater intrusion, will be reasonably similar to those identified in the 1994 assessment. Comparison of the water resource constraint for saltwater intrusion to the results of the groundwater quality models indicates two areas that are anticipated to experience inadequate thickness of water with quality suitable to supply projected 2020 uses through 2110 (Figure 9). Within these two areas, one in coastal Volusia County and the other in eastern Orange County, the 250-mg/L isochlor is projected to move upward and to intersect the open hole portion of public supply wells. SJRWMD anticipates that this movement will result in an increase in the chloride concentration in water produced from these wells from less than 250 mg/L to greater than 250 mg/L.

SJRWMD identified areas where projected declines in the elevation of the potentiometric surface of the Floridan aquifer system contribute to these changes in chloride concentration and public supply service areas associated with the projected groundwater withdrawals that contribute to these projected chloride concentration increases (Figure 9) to be in priority water resource caution areas.

Impacts to Existing Legal Users

Because projected 2020 demands are reasonably similar to the 2010 demands in Vergara (1994), SJRWMD assumed that the impacts of projected 2020 water use on existing legal users, specifically interference with withdrawals of water from wells, will be reasonably similar to those identified in the 1994 assessment. Therefore, the area identified in this 1998 assessment as experiencing unacceptable impacts to existing legal users is the same area identified in the 1994

assessment. This area includes portions of northeast Putnam County and southwest St. Johns County (Figure 10).

Failure to Identify a Source of Supply for Planned Development

SJRWMD identified two areas that are projected to experience significant planned development requiring new, but unidentified, water supplies and identified associated areas that could reasonably be expected to be impacted by the development of new sources to supply these areas, if not already identified based on another constraint (Figure 11) to be in priority water resource caution areas. One of these areas is located in northern St. Johns County and in Duval County south of the St. Johns River. The other area is located in Lake County south of the Ocala National Forest. In these areas, a significant number of planned developments including planned unit developments (PUD) and developments of regional impact (DRI) have been approved by the county commissions. These planned developments are generally aligned along major transportation corridors. SJRWMD has been unable to identify planned sources of water supply for a significant number of these developments.

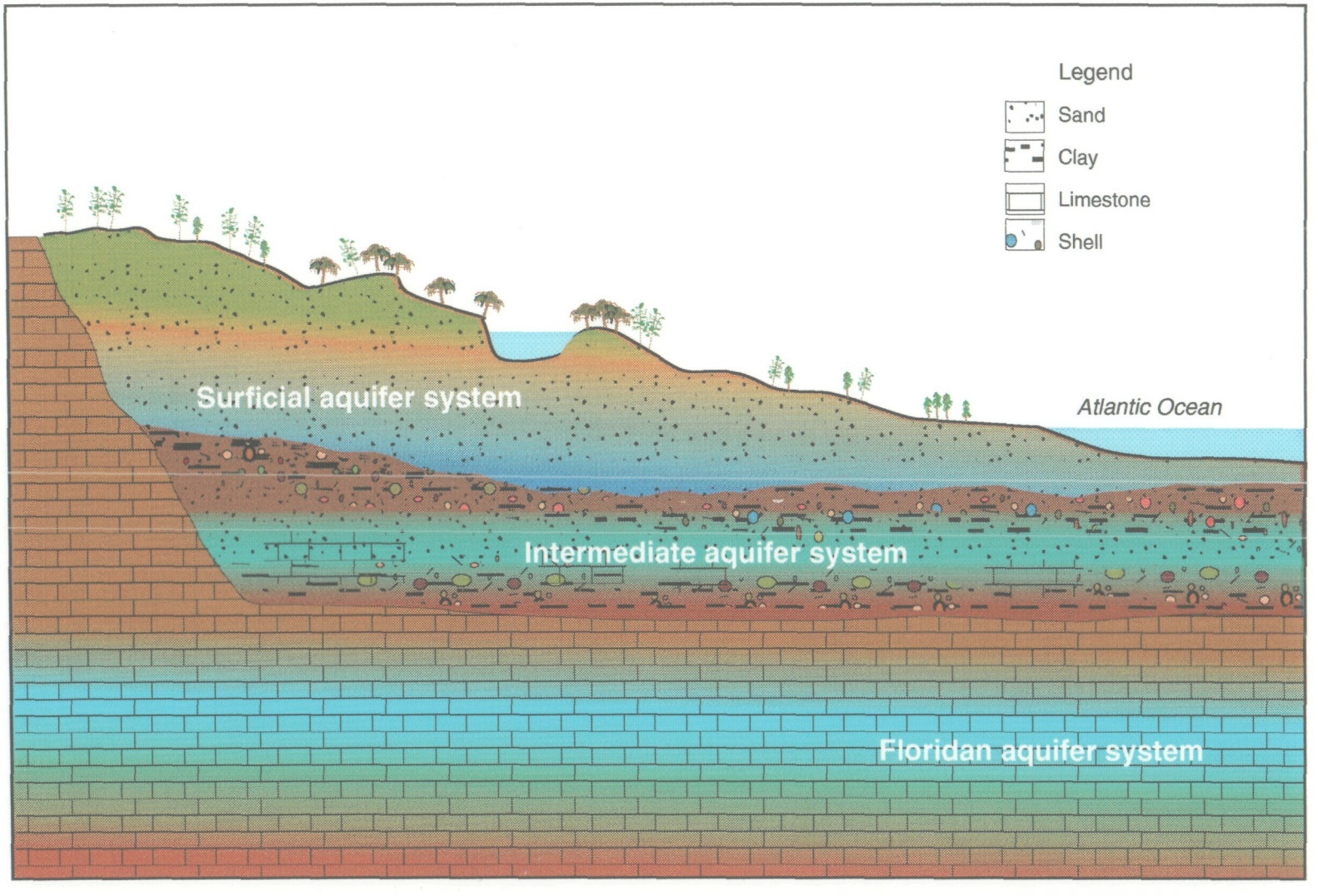


Figure 4. Generalized east-west hydrogeologic cross section of the St. Johns River Water Management District

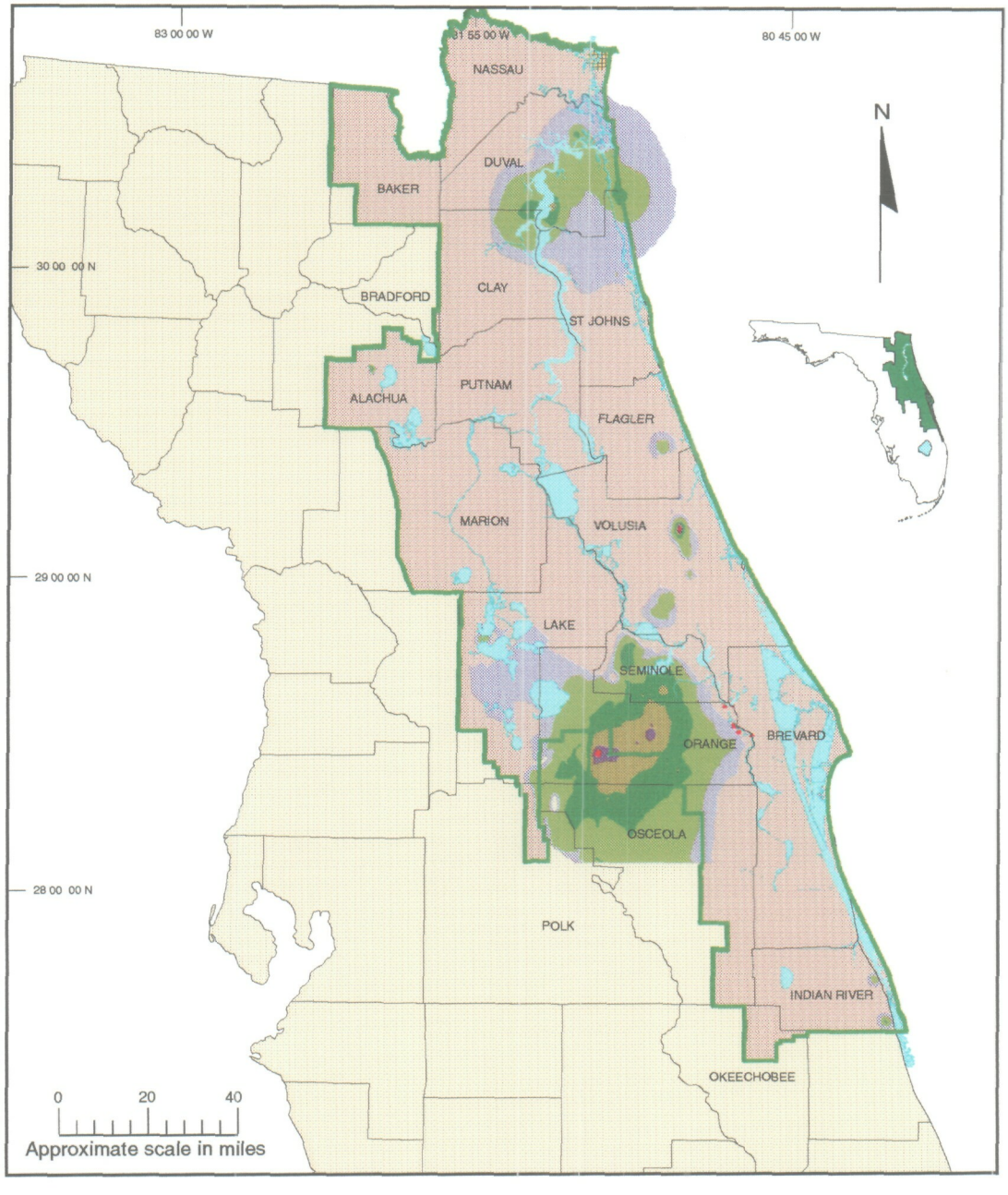
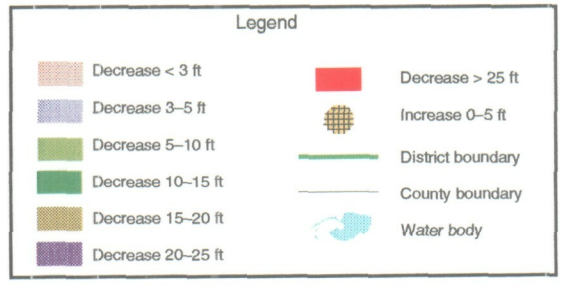


Figure 5. Projected changes in the elevation of the potentiometric surface of the Floridan aquifer system in response to projected increases in groundwater withdrawals, 1995–2020



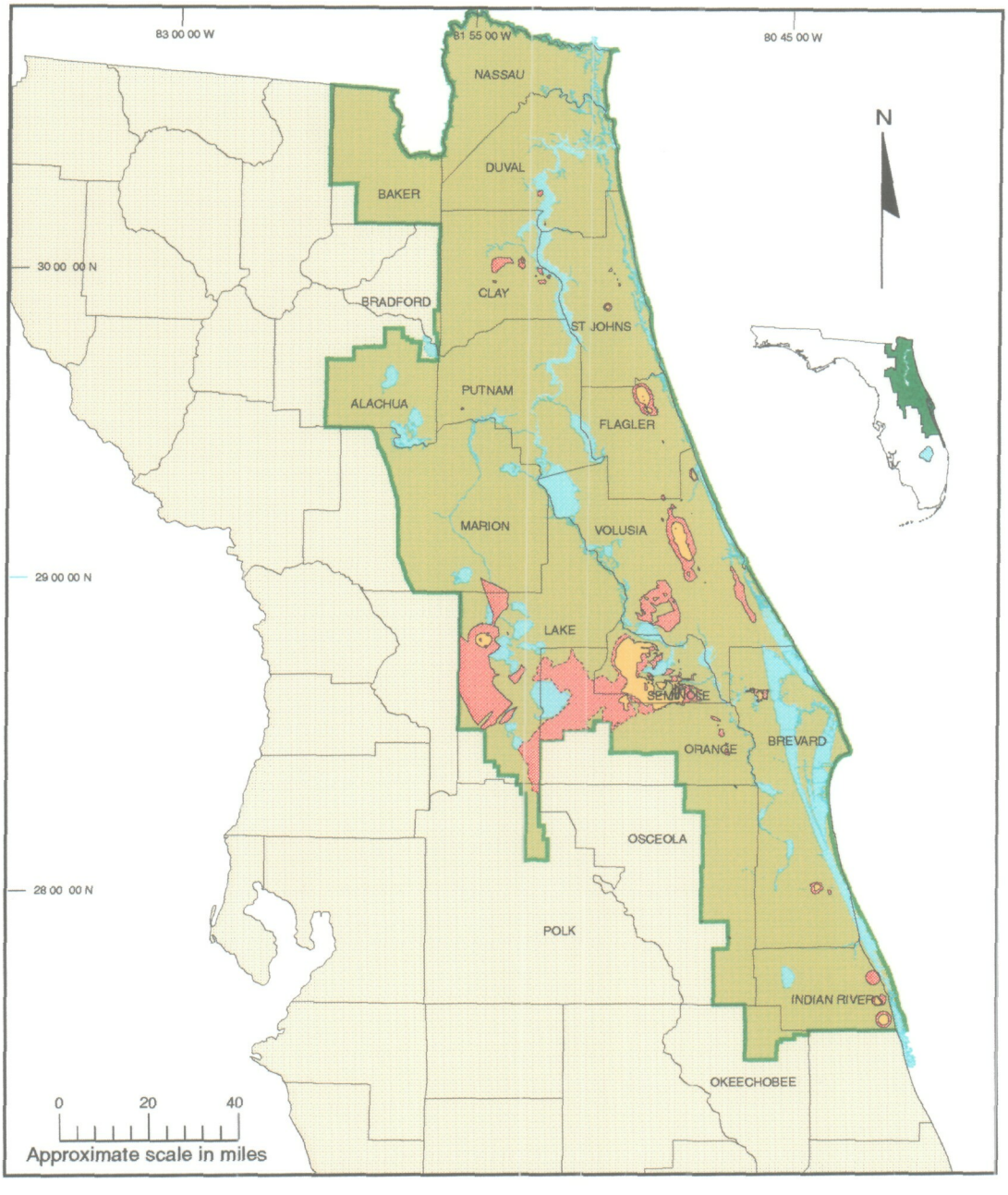


Figure 6. Projected changes in the elevation of the water table of the surficial aquifer system in response to projected increases in groundwater withdrawals, 1995–2020

Legend
- District boundary
- County boundary
- Decline in elevation of less than 1 ft
- Decline in elevation of 1 to 2.5 ft
- Decline in elevation of greater than 2.5 ft
- Water body

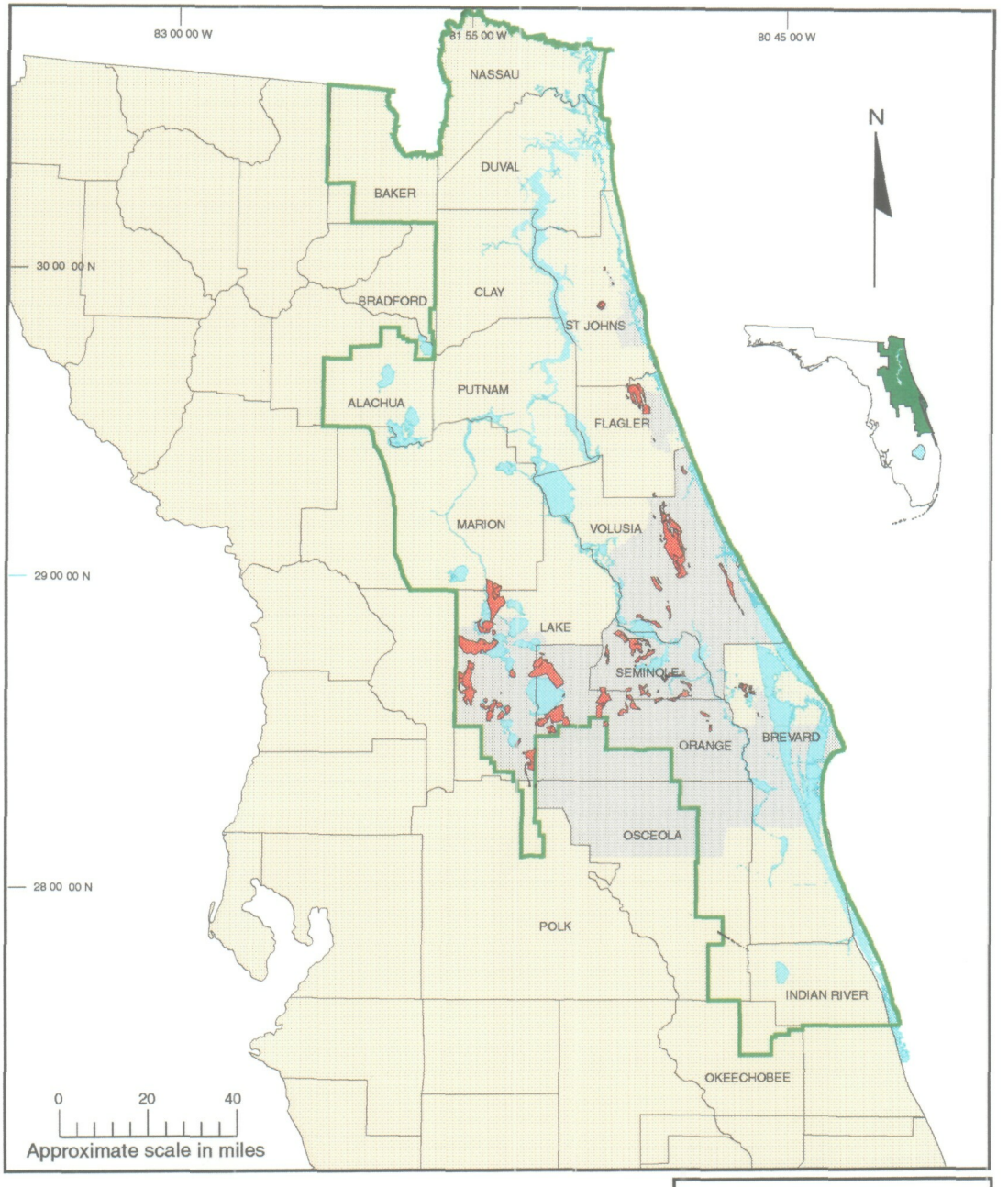


Figure 7. General areas within which anticipated water sources are not adequate to supply projected 2020 demands based on impacts to native vegetation

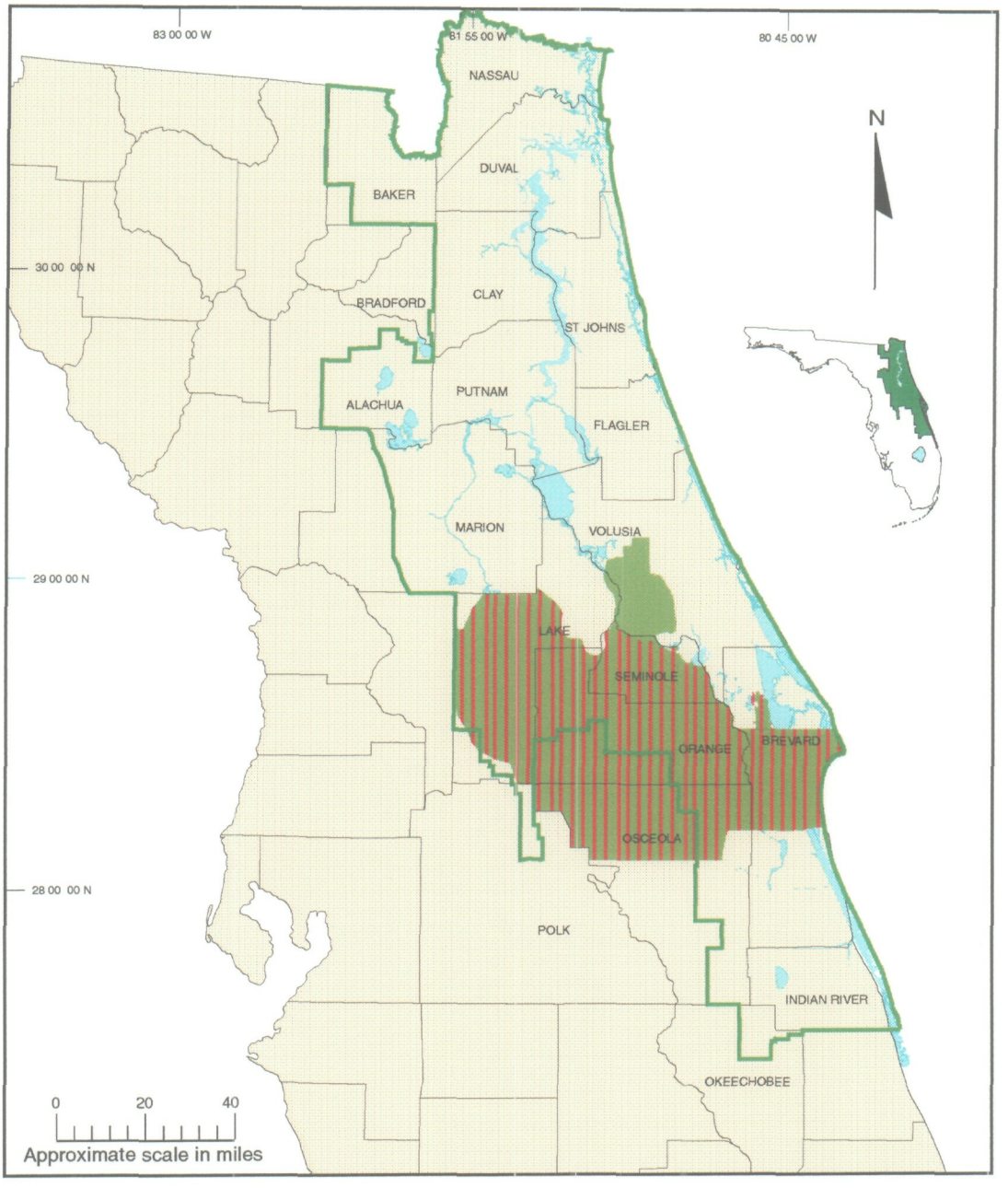


Figure 8. General areas within which anticipated water sources are not adequate to supply projected 2020 demands based on projected impacts to minimum flows and levels

Legend

- Area containing withdrawals and service areas that contribute to projected decreases in spring discharge of 15% or more
- Area containing withdrawals and service areas that contribute to projected decreases in spring discharge below established minimum discharges in the Wekiva River System
- District boundary
- County boundary
- Water body

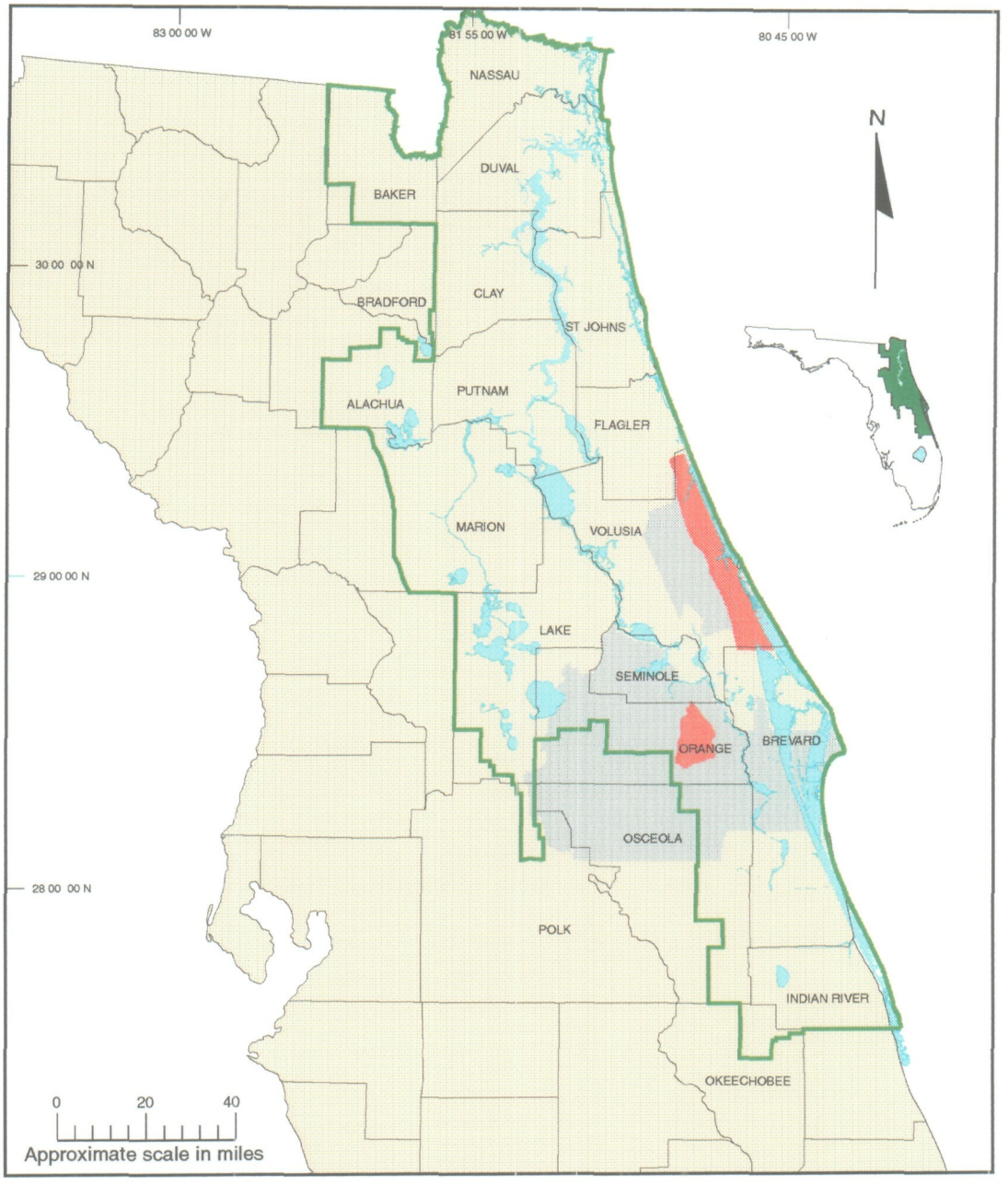


Figure 9. General areas within which anticipated water sources are not adequate to supply projected 2020 demands based on projected impacts to groundwater quality

Legend

- Area projected to have inadequate thickness of suitable quality water
- Area containing groundwater withdrawals and service areas that contribute to projected inadequate thickness of suitable quality water
- District boundary
- County boundary
- Water body

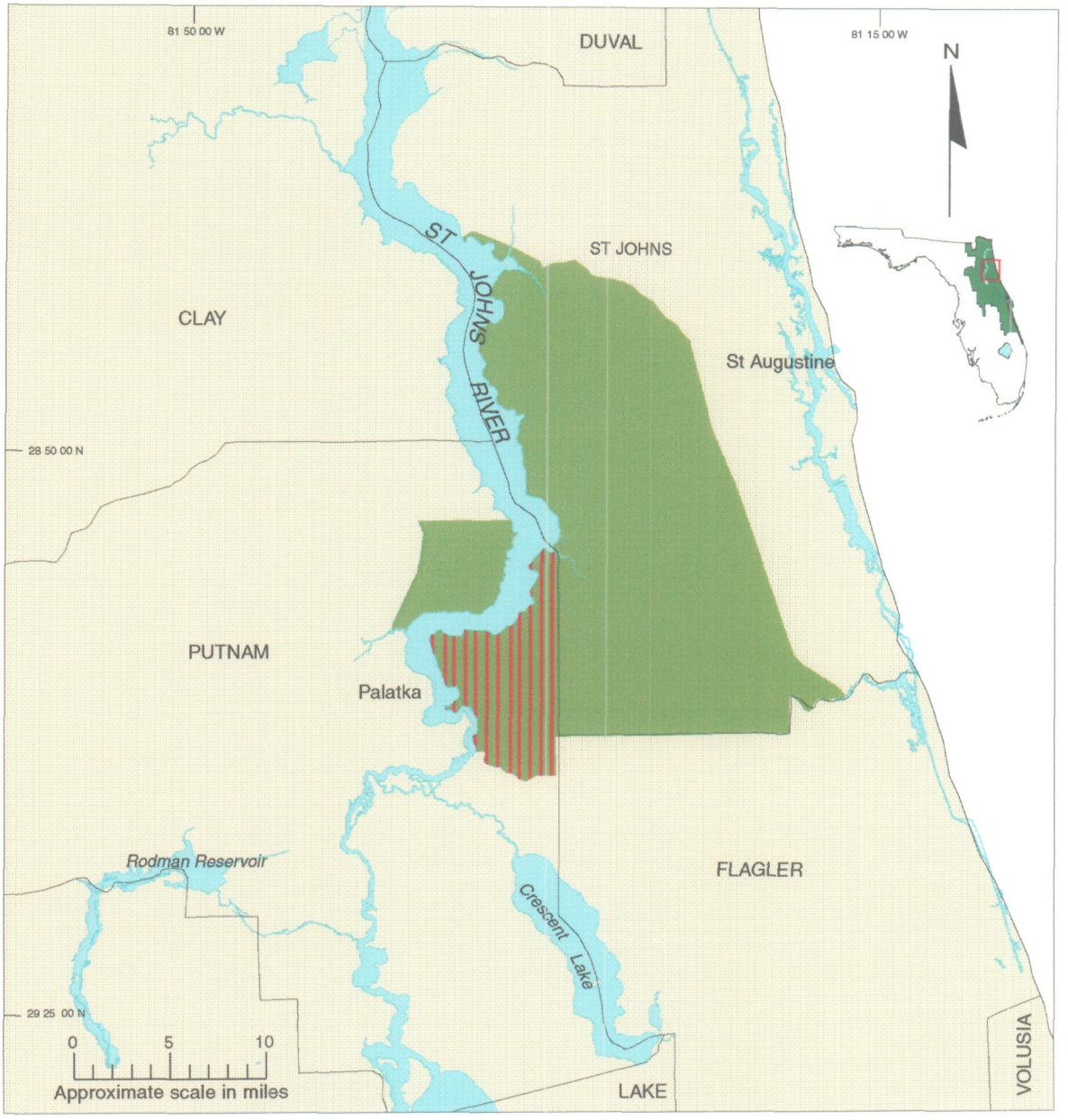


Figure 10. General areas within which anticipated water sources are not adequate to supply projected 2020 demands based on interference with existing legal users of water

Legend
County boundary
Well construction standards in place
Area experiencing declines in groundwater levels during periods of potato crop irrigation
Water body

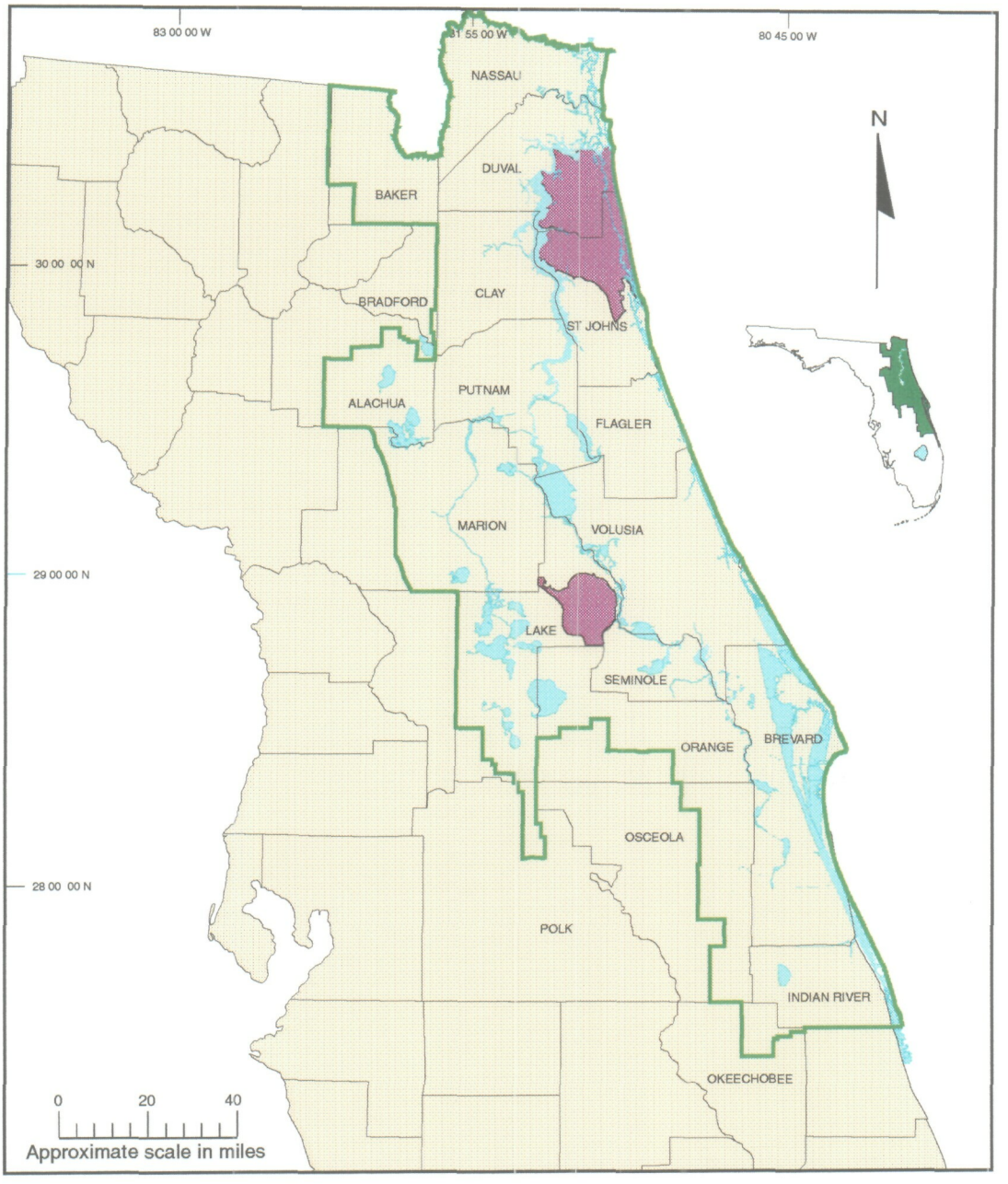


Figure 11. General areas within which anticipated water sources are not adequate to supply projected 2020 demands based on failure to identify a source of water for planned development

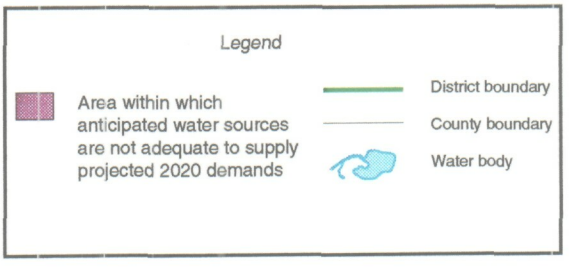


Table 2. Population for 1995 and 2020, by county, in the St. Johns River Water Management District

County	1995				2020				Percent Change in SJRWMD Population
	County Population	SJRWMD Population	SJRWMD Public Supply Population	SJRWMD Domestic Population	County Population	SJRWMD Population	SJRWMD Public Supply Population	SJRWMD Domestic Population	
Alachua	198,261	154,644	131,871	22,773	282,400	220,272	192,667	27,605	42
Baker	20,275	19,261	4,194	15,067	28,700	27,265	8,387	18,878	42
Bradford	24,336	1,217	0	1,217	30,600	1,530	0	1,530	26
Brevard	444,992	444,992	382,787	62,205	653,800	653,800	632,502	21,298	47
Clay	120,896	120,896	90,615	30,281	196,800	196,800	160,385	36,415	63
Duval	718,355	718,355	638,710	79,645	940,700	940,700	889,871	50,829	31
Flagler	36,997	36,997	25,143	11,854	84,700	84,700	83,484	1,216	129
Indian River	100,261	100,261	60,389	39,872	154,100	154,100	145,450	8,650	54
Lake	176,931	175,162	115,000	60,162	297,100	294,129	281,440	12,689	68
Marion	224,612	175,197	70,800	104,397	371,500	289,770	141,886	147,884	65
Nassau	49,127	49,127	22,842	26,285	78,800	78,800	57,059	21,741	60
Okeechobee	32,855	616	0	616	48,200	964	0	964	56
Orange	758,962	569,222	531,300	37,922	1,231,900	886,968	826,837	60,131	56
Osceola	136,627	395	0	395	261,700	763	0	763	93
Polk	443,153	8,863	0	8,863	615,000	12,300	0	12,300	39
Putnam	69,516	69,516	18,471	51,045	87,500	87,500	31,706	55,794	26
St. Johns	98,188	98,188	55,806	42,382	176,700	176,700	148,711	27,989	80
Seminole	324,130	324,130	298,512	25,618	514,800	514,800	493,532	21,268	59
Volusia	402,970	402,970	303,422	99,548	574,400	574,400	453,992	120,408	43
Total	4,381,444	3,470,009	2,749,862	720,147	6,629,400	5,196,261	4,547,909	648,352	50

Note: SJRWMD = St. Johns River Water Management District

Source: University of Florida 1996; Smith and Nogle 1998

Table 3. Total water demand (A) for 1995 and 2020, by category of water use, in the St. Johns River Water Management District and (B) as a percent of total change by category of water use

A.

Category	1995 Water Use* (mgd)			2020 Water Use† (mgd) Average Rainfall Year				2020 Water Use† (mgd) Dry Rainfall Year			
	Ground	Surface	Total	Ground	Surface	Total	Percent Change‡	Ground	Surface	Total	Percent Change‡
Public supply	443.04	12.15	455.19	702.48	16.81	719.29	58	744.63	17.82	762.45	68
Domestic and other small public supply	71.98	0.00	71.98	64.84	0.00	64.84	-10	68.73	0.00	68.73	-5
Agricultural irrigation	363.58	223.39	586.97	368.45	220.69	589.14	0	430.76	267.55	698.31	19
Recreational irrigation	68.78	30.35	99.13	107.77	48.67	156.44	58	110.51	49.89	160.40	62
Commercial/industrial/ institutional	96.03	38.13	134.16	102.63	44.19	146.82	9	102.63	44.19	146.82	9
Thermoelectric power generation	7.66	14.50	22.16	11.13	16.42	27.55	24	11.13	16.42	27.55	24
Total	1,051.07	318.52	1,369.59	1,357.30	346.78	1,704.08	24	1,468.24	395.99	1,864.23	36

B.

Category	Average Year	Dry Year
Public supply	79%	62%
Domestic and other small public supply	-2%	-1%
Agricultural irrigation	1%	23%
Recreational irrigation	17%	12%
Commercial/industrial/institutional	4%	3%
Thermoelectric power generation	2%	1%
Total	101%	100%

Note: mgd = million gallons per day
SJRWMD = St. Johns River Water Management District

*Public supply, commercial/industrial/institutional, and thermoelectric power generation categories are based on actual water use in 1995. All other categories are based on estimated 1995 data

†SJRWMD population-based projections

‡Percent change from total water use in 1995

Table 4. Total water demand for 1995 and 2020, by county, in the St. Johns River Water Management District

County	1995 Water Use (mgd)			2020 Water Use* (mgd) Average Rainfall Year			
	Ground	Surface	Total	Ground	Surface	Total	Percent Change†
Alachua	34.55	0.79	35.34	49.37	1.21	50.58	43
Baker	3.77	0.86	4.63	5.13	0.86	5.99	29
Bradford	0.29	0.00	0.29	0.35	0.00	0.35	21
Brevard	164.37	30.12	194.49	152.72	37.82	190.54	-2
Clay	21.08	0.52	21.60	33.32	0.85	34.17	58
Duval	143.07	1.06	144.13	184.18	1.44	185.62	29
Flagler	14.70	1.22	15.92	23.44	2.80	26.24	65
Indian River	87.23	172.43	259.66	105.10	176.30	281.40	8
Lake	92.06	15.79	107.85	141.43	22.53	163.96	52
Marion	32.98	1.87	34.85	48.43	2.69	51.12	47
Nassau	56.86	4.72	61.58	67.65	6.32	73.97	20
Okeechobee	14.25	0.00	14.25	13.42	0.00	13.42	-6
Orange	136.82	19.20	156.02	199.99	11.43	211.42	36
Osceola	6.57	9.99	16.56	6.06	9.99	16.05	-3
Polk	3.31	0.24	3.55	6.54	0.57	7.11	100
Putnam	32.70	50.05	82.75	51.06	58.58	109.64	32
St. Johns	48.63	2.26	50.89	60.67	4.06	64.73	27
Seminole	67.13	1.57	68.70	101.82	2.37	104.19	52
Volusia	90.70	5.83	96.53	106.62	6.96	113.58	18
Total	1,051.07	318.52	1,369.59	1,357.30	346.78	1,704.08	24

Note: mgd = million gallons per day
SJRWMD = St. Johns River Water Management District

*SJRWMD population-based projections
†Percent change from total water use in 1995

Table 5. Public supply water use for 1995 and 2020, by county, in the St. Johns River Water Management District

County	1995 Water Use* (mgd)			2020 Water Use† (mgd) Average Rainfall Year				2020 Water Use† (mgd) Dry Rainfall Year			
	Ground	Surface	Total	Ground	Surface	Total	Percent Change from 1995 Total	Ground	Surface	Total	Percent Change from 1995 Total
Alachua	20.44	0.00	20.44	29.86	0.00	29.86	46	31.65	0.00	31.65	55
Baker	0.65	0.00	0.65	1.49	0.00	1.49	129	1.58	0.00	1.58	143
Bradford	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0
Brevard	38.96	12.15	51.11	63.52	16.81	80.33	57	67.33	17.82	85.15	67
Clay	11.78	0.00	11.78	21.97	0.00	21.97	87	23.29	0.00	23.29	98
Duval	98.94	0.00	98.94	135.26	0.00	135.26	37	143.38	0.00	143.38	45
Flagler	4.40	0.00	4.40	15.36	0.00	15.36	249	16.28	0.00	16.28	270
Indian River	10.87	0.00	10.87	28.51	0.00	28.51	162	30.22	0.00	30.22	178
Lake	22.63	0.00	22.63	47.00	0.00	47.00	108	49.82	0.00	49.82	120
Marion	13.34	0.00	13.34	22.84	0.00	22.84	71	24.21	0.00	24.21	81
Nassau	4.34	0.00	4.34	10.38	0.00	10.38	139	11.00	0.00	11.00	153
Okeechobee	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0
Orange	105.27	0.00	105.27	158.75	0.00	158.75	51	168.28	0.00	168.28	60
Osceola	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0
Polk	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0
Putnam	3.34	0.00	3.34	4.82	0.00	4.82	44	5.11	0.00	5.11	53
St. Johns	10.42	0.00	10.42	18.44	0.00	18.44	77	19.55	0.00	19.55	88
Seminole	50.05	0.00	50.05	83.90	0.00	83.90	68	88.93	0.00	88.93	78
Volusia	47.61	0.00	47.61	60.38	0.00	60.38	27	64.00	0.00	64.00	34
Total	443.04	12.15	455.19	702.48	16.81	719.29	58	744.63	17.82	762.45	68

Note: mgd = million gallons per day
SJRWMD = St. Johns River Water Management District

*Actual water used in 1995, not estimated
†SJRWMD population-based projections, not utility-based projections

Table 6. Public supply water use for 1995 and 2020, by county and utility, in the St. Johns River Water Management District

Utility/Facility	1995 Water Use* (mgd)			2020 Water Use† (mgd) Average Rainfall Year			
	Ground	Surface	Total	Ground	Surface	Total	Percent Change‡
Alachua County							
Gainesville, City of	20.44	0.00	20.44	34.68	0.00	34.68	70
Total	20.44	0.00	20.44	34.68	0.00	34.68	70
Baker County							
Macclenny, City of	0.65	0.00	0.65	1.30	0.00	1.30	100
Total	0.65	0.00	0.65	1.30	0.00	1.30	100
Brevard County							
Avatar Utilities	0.47	0.00	0.47	0.81	0.00	0.81	72
Cocoa, City of	24.21	0.00	24.21	30.36	8.81	39.17	62
Melbourne, City of	3.74	12.15	15.89	16.00	8.00	24.00	51
North Brevard County Utilities	0.70	0.00	0.70	1.24	0.00	1.24	77
Palm Bay Utilities	4.94	0.00	4.94	7.77	0.00	7.77	57
Titusville, City of	4.90	0.00	4.90	8.44	0.00	8.44	72
Total	38.96	12.15	51.11	64.62	16.81	81.43	59
Clay County							
Clay County Utilities Authority	8.87	0.00	8.87	17.00	0.00	17.00	92
Green Cove Springs, Town of	0.91	0.00	0.91	1.48	0.00	1.48	63
Orange Park, City of	1.62	0.00	1.62	1.75	0.00	1.75	8
FWS-Keystone Heights	0.38	0.00	0.38	0.48	0.00	0.48	26
Total	11.78	0.00	11.78	20.71	0.00	20.71	76
Duval County							
Atlantic Beach, City of	3.15	0.00	3.15	8.13	0.00	8.13	158
FWS-Beacon Hills	1.28	0.00	1.28	2.40	0.00	2.40	88
FWS-Woodmere	0.55	0.00	0.55	0.86	0.00	0.86	56
Jacksonville Beach, City of	2.90	0.00	2.90	3.80	0.00	3.80	31
Jacksonville, City of	75.28	0.00	75.28	98.51	0.00	98.51	31
Neptune Beach, City of	1.21	0.00	1.21	2.16	0.00	2.16	79
Normandy Village Utilities	0.39	0.00	0.39	0.51	0.00	0.51	31
Ortega Utilities	0.94	0.00	0.94	1.23	0.00	1.23	31
Regency Utilities	0.94	0.00	0.94	1.23	0.00	1.23	31
United Water Florida	12.30	0.00	12.30	15.83	0.00	15.83	29
Total	98.94	0.00	98.94	134.66	0.00	134.66	36
Flagler County							
Bunnell, City of	0.25	0.00	0.25	1.50	0.00	1.50	500
Flagler Beach, City of	0.49	0.00	0.49	1.16	0.00	1.16	137
Palm Coast Utilities	3.66	0.00	3.66	10.28	0.00	10.28	181
Total	4.40	0.00	4.40	12.94	0.00	12.94	194

Table 6—*Continued*

Utility/Facility	1995 Water Use* (mgd)			2020 Water Use† (mgd) Average Rainfall Year			
	Ground	Surface	Total	Ground	Surface	Total	Percent Change‡
Indian River County							
Indian River County Utilities	3.75	0.00	3.75	19.08	0.00	19.08	409
Sebastian Highlands	0.36	0.00	0.36	0.55	0.00	0.55	53
Vero Beach, City of	6.76	0.00	6.76	8.73	0.00	8.73	29
Total	10.87	0.00	10.87	28.36	0.00	28.36	161
Lake County							
Astor Park Water Association	0.27	0.00	0.27	0.70	0.00	0.70	159
Clermont, City of	1.63	0.00	1.63	8.37	0.00	8.37	413
Eustis, City of	2.33	0.00	2.33	4.97	0.00	4.97	113
FWS-Carlton Village	0.04	0.00	0.04	0.19	0.00	0.19	375
FWS-Sunshine Parkway	0.09	0.00	0.09	0.99	0.00	0.99	1,000
FWS-Silver Lake Estates	0.92	0.00	0.92	1.14	0.00	1.14	24
FWS-Palisades	0.08	0.00	0.08	0.61	0.00	0.61	663
Fruitland Park, City of	0.59	0.00	0.59	1.04	0.00	1.04	76
Greater (Lake) Groves	0.12	0.00	0.12	3.62	0.00	3.62	2,917
Groveland, City of	0.36	0.00	0.36	1.21	0.00	1.21	236
Hawthorne at Leesburg	0.42	0.00	0.42	0.71	0.00	0.71	69
Lady Lake Central	0.26	0.00	0.26	0.44	0.00	0.44	69
Lake Utility Company	0.53	0.00	0.53	0.89	0.00	0.89	68
Leesburg, City of	4.87	0.00	4.87	18.35	0.00	18.35	277
Mascotte, Town of	0.25	0.00	0.25	0.36	0.00	0.36	44
Mid-Florida Lakes MHP	0.31	0.00	0.31	0.52	0.00	0.52	68
Minneola, City of	0.39	0.00	0.39	1.50	0.00	1.50	285
Monteverde, Town of	0.15	0.00	0.15	1.00	0.00	1.00	567
Mount Dora, City of	2.72	0.00	2.72	4.57	0.00	4.57	68
Southlake Utilities	0.07	0.00	0.07	4.55	0.00	4.55	6,400
Sunlake Estates	0.28	0.00	0.28	0.24	0.00	0.24	-14
Tavares, City of	1.49	0.00	1.49	2.65	0.00	2.65	78
Umatilla, City of	0.44	0.00	0.44	0.60	0.00	0.60	36
Utilities Inc. of Florida	0.29	0.00	0.29	0.49	0.00	0.49	69
Villages of Lake-Sumter	3.39	0.00	3.39	10.36	0.00	10.36	206
Water Oak Estates	0.34	0.00	0.34	0.57	0.00	0.57	68
Total	22.63	0.00	22.63	70.64	0.00	70.64	212
Marion County							
Belleview, City of	0.63	0.00	0.63	1.73	0.00	1.73	175
Marion County Utilities	1.90	0.00	1.90	3.18	0.00	3.18	67
Marion Utilities	0.43	0.00	0.43	0.71	0.00	0.71	65
Ocala, City of	8.70	0.00	8.70	18.00	0.00	18.00	107
Ocala Oaks Utilities	0.32	0.00	0.32	0.24	0.00	0.24	-25

Table 6—*Continued*

Utility/Facility	1995 Water Use* (mgd)			2020 Water Use† (mgd) Average Rainfall Year			
	Ground	Surface	Total	Ground	Surface	Total	Percent Change‡
Spruce Creek South Utilities	0.87	0.00	0.87	1.44	0.00	1.44	66
Sunshine Utilities	0.49	0.00	0.49	1.14	0.00	1.14	133
Total	13.34	0.00	13.34	26.44	0.00	26.44	98
Nassau County							
FPU, City of Fernandina Beach	3.22	0.00	3.22	7.90	0.00	7.90	145
FWS-Amelia Island	1.12	0.00	1.12	2.05	0.00	2.05	83
Total	4.34	0.00	4.34	9.95	0.00	9.95	129
Orange County							
Apopka, City of	5.90	0.00	5.90	24.01	0.00	24.01	307
Eatonville, Town of	0.65	0.00	0.65	1.77	0.00	1.77	172
Florida Water Services	1.06	0.00	1.06	0.02	0.00	0.02	-98
Maitland, City of	2.82	0.00	2.82	2.80	0.00	2.80	-1
Oakland, Town of	0.11	0.00	0.11	0.90	0.00	0.90	718
Ocoee, City of	3.68	0.00	3.68	6.66	0.00	6.66	81
Orange County Utilities	24.65	0.00	24.65	72.89	0.00	72.89	196
Orlando Utilities Commission	51.97	0.00	51.97	80.48	0.00	80.48	55
Park Manor Estates	0.38	0.00	0.38	0.62	0.00	0.62	63
Winter Garden, City of	1.86	0.00	1.86	8.03	0.00	8.03	332
Winter Park, City of	11.35	0.00	11.35	16.50	0.00	16.50	45
Zellwood Station Utilities	0.57	0.00	0.57	1.06	0.00	1.06	86
Zellwood Water Association	0.27	0.00	0.27	0.48	0.00	0.48	78
Total	105.27	0.00	105.27	216.22	0.00	216.22	105
Putnam County							
Crescent City, City of	0.32	0.00	0.32	0.39	0.00	0.39	22
Florida Water Services	0.20	0.00	0.20	0.25	0.00	0.25	25
Palatka, City of	2.82	0.00	2.82	5.00	0.00	5.00	77
Total	3.34	0.00	3.34	5.64	0.00	5.64	69
St. Johns County							
Julington Creek Subdivision	0.32	0.00	0.32	2.70	0.00	2.70	744
Intercoastal Utilities	1.08	0.00	1.08	6.09	0.00	6.09	464
North Beach Water System	0.22	0.00	0.22	1.20	0.00	1.20	445
St. Augustine, City of	2.24	0.00	2.24	3.91	0.00	3.91	76
St. Johns County Utilities	3.20	0.00	3.20	13.50	0.00	13.50	322
St. Johns Service Company	1.96	0.00	1.96	3.53	0.00	3.53	80
United Water Florida	1.40	0.00	1.40	3.45	0.00	3.45	146
Total	10.42	0.00	10.42	34.38	0.00	34.38	230

Table 6—*Continued*

Utility/Facility	1995 Water Use* (mgd)			2020 Water Use† (mgd) Average Rainfall Year			
	Ground	Surface	Total	Ground	Surface	Total	Percent Change‡
Seminole County							
Altamonte Springs, City of	6.48	0.00	6.48	12.40	0.00	12.40	91
Casselberry, City of	5.92	0.00	5.92	7.13	0.00	7.13	20
FWS-Meredith Manor	0.27	0.00	0.27	0.28	0.00	0.28	4
FWS-Apple Valley	0.46	0.00	0.46	0.89	0.00	0.89	93
FWS-Chuluota	0.21	0.00	0.21	0.30	0.00	0.30	43
Lake Mary, City of	1.75	0.00	1.75	4.64	0.00	4.64	165
Longwood, City of	2.00	0.00	2.00	5.39	0.00	5.39	170
Oviedo, City of	2.82	0.00	2.82	5.40	0.00	5.40	91
Palm Valley MHP	0.23	0.00	0.23	0.50	0.00	0.50	117
Sanford, City of	5.74	0.00	5.74	12.33	0.00	12.33	115
Sanlando Utilities	8.81	0.00	8.81	10.52	0.00	10.52	19
Seminole County Utilities	11.03	0.00	11.03	25.42	0.00	25.42	130
Utilities Inc. of Florida	0.78	0.00	0.78	1.24	0.00	1.24	59
Winter Springs, City of	3.55	0.00	3.55	8.40	0.00	8.40	137
Total	50.05	0.00	50.05	94.84	0.00	94.84	89
Volusia County							
Daytona Beach, City of	12.42	0.00	12.42	18.61	0.00	18.61	50
De Land, City of	5.08	0.00	5.08	7.38	0.00	7.38	45
Edgewater, City of	1.49	0.00	1.49	4.10	0.00	4.10	175
FWS-Deltona Utilities	9.12	0.00	9.12	14.57	0.00	14.57	60
Holly Hill, City of	1.16	0.00	1.16	1.70	0.00	1.70	47
Lake Beresford Water Association	0.17	0.00	0.17	0.43	0.00	0.43	153
Lake Helen, City of	0.24	0.00	0.24	0.85	0.00	0.85	254
New Smyrna Beach, City of	4.27	0.00	4.27	9.81	0.00	9.81	130
Orange City, Town of	1.33	0.00	1.33	2.82	0.00	2.82	112
Ormond Beach, City of	4.90	0.00	4.90	7.23	0.00	7.23	48
Port Orange, City of	5.28	0.00	5.28	8.98	0.00	8.98	70
Volusia County Utilities	2.15	0.00	2.15	14.41	0.00	14.41	570
Total	47.61	0.00	47.61	90.89	0.00	90.89	91
St. Johns River Water Management District Total	**443.04**	**12.15**	**455.19**	**846.27**	**16.81**	**863.08**	**90**

Note: FPU = Florida Public Utilities
FWS = Florida Water Services
mgd = million gallons per day
MHP = mobile home park
SJRWMD = St. Johns River Water Management District

*Actual water used in 1995, not estimated
†Utility-based projections, not SJRWMD population-based projections
‡Percent change from total water use in 1995

Table 7. Domestic self-supply and other small public-supply water use for 1995 and 2020, by county, in the St.Johns River Water Management District

County	1995 Water Use (mgd)			2020 Water Use (mgd) Average Rainfall Year				2020 Water Use (mgd) Dry Rainfall Year			
	Ground	Surface	Total	Ground	Surface	Total	Percent Change*	Ground	Surface	Total	Percent Change*
Alachua	2.28	0.00	2.28	2.76	0.00	2.76	21	2.93	0.00	2.93	29
Baker	1.51	0.00	1.51	1.89	0.00	1.89	25	2.00	0.00	2.00	32
Bradford	0.12	0.00	0.12	0.15	0.00	0.15	25	0.16	0.00	0.16	33
Brevard	6.22	0.00	6.22	2.13	0.00	2.13	-66	2.26	0.00	2.26	-64
Clay	3.03	0.00	3.03	3.64	0.00	3.64	20	3.86	0.00	3.86	27
Duval	7.96	0.00	7.96	5.08	0.00	5.08	-36	5.38	0.00	5.38	-32
Flagler	1.19	0.00	1.19	0.12	0.00	0.12	-90	0.13	0.00	0.13	-89
Indian River	3.99	0.00	3.99	0.87	0.00	0.87	-78	0.92	0.00	0.92	-77
Lake	6.02	0.00	6.02	1.27	0.00	1.27	-79	1.35	0.00	1.35	-78
Marion	10.40	0.00	10.40	14.79	0.00	14.79	42	15.68	0.00	15.68	51
Nassau	2.63	0.00	2.63	2.17	0.00	2.17	-17	2.30	0.00	2.30	-13
Okeechobee	0.06	0.00	0.06	0.10	0.00	0.10	67	0.11	0.00	0.11	83
Orange	3.79	0.00	3.79	6.01	0.00	6.01	59	6.37	0.00	6.37	68
Osceola	0.04	0.00	0.04	0.08	0.00	0.08	100	0.08	0.00	0.08	100
Polk	0.89	0.00	0.89	1.23	0.00	1.23	38	1.30	0.00	1.30	46
Putnam	5.10	0.00	5.10	5.58	0.00	5.58	9	5.91	0.00	5.91	16
St. Johns	4.24	0.00	4.24	2.80	0.00	2.80	-34	2.97	0.00	2.97	-30
Seminole	2.56	0.00	2.56	2.13	0.00	2.13	-17	2.26	0.00	2.26	-12
Volusia	9.95	0.00	9.95	12.04	0.00	12.04	21	12.76	0.00	12.76	28
Total	71.98	0.00	71.98	64.84	0.00	64.84	-10	68.73	0.00	68.73	-5

Note: mgd = million gallons per day

*Percent change from total water use in 1995

Table 8. Agricultural irrigation water use and acreage for 1995 and 2020, by county, in the St. Johns River Water Management District

County	1995 Water Use (mgd)			2020 Water Use (mgd) Average Rainfall Year				2020 Water Use (mgd) Dry Rainfall Year				Acres		
	Ground	Surface	Total	Ground	Surface	Total	Percent Change*	Ground	Surface	Total	Percent Change*	1995	2020	Percent Change
Alachua	4.82	0.21	5.03	6.97	0.39	7.36	46	7.82	0.43	8.25	64	5,485	7,456	36
Baker	1.28	0.86	2.14	1.27	0.86	2.13	0	1.38	0.93	2.31	8	567	560	-1
Bradford	0.09	0.00	0.09	0.09	0.00	0.09	0	0.11	0.00	0.11	22	110	113	3
Brevard	113.19	11.62	124.81	78.73	11.68	90.41	-28	84.58	12.75	97.33	-22	88,630	61,556	-31
Clay	0.80	0.00	0.80	1.39	0.00	1.39	74	1.49	0.00	1.49	86	419	611	46
Duval	2.19	0.18	2.37	2.84	0.28	3.12	32	2.97	0.29	3.26	38	1,342	1,716	28
Flagler	8.77	0.16	8.93	7.19	0.37	7.56	-15	8.30	0.39	8.69	-3	7,235	6,261	-13
Indian River	67.33	170.02	237.35	67.91	172.60	240.51	1	81.88	212.47	294.35	24	95,032	96,127	1
Lake	43.91	7.06	50.97	64.01	9.28	73.29	44	78.03	11.34	89.37	75	24,570	32,210	31
Marion	5.80	0.72	6.52	6.91	0.79	7.70	18	7.96	0.88	8.84	36	5,173	6,130	18
Nassau	0.25	0.00	0.25	0.28	0.00	0.28	12	0.32	0.00	0.32	28	205	231	13
Okeechobee	14.19	0.00	14.19	13.32	0.00	13.32	-6	16.06	0.00	16.06	13	7,785	7,181	-8
Orange	16.18	17.76	33.94	18.20	9.10	27.30	-20	21.64	10.80	32.44	-4	29,935	18,214	-39
Osceola	6.53	9.99	16.52	5.98	9.99	15.97	-3	6.90	10.59	17.49	6	12,354	12,354	0
Polk	2.42	0.24	2.66	5.31	0.57	5.88	121	6.58	0.70	7.28	174	1,060	2,423	129
Putnam	11.85	0.81	12.66	26.26	0.85	27.11	114	30.07	1.08	31.15	146	9,315	14,392	55
St. Johns	30.07	0.00	30.07	32.40	0.00	32.40	8	39.22	0.00	39.22	30	26,180	28,196	8
Seminole	9.46	0.34	9.80	7.75	0.42	8.17	-17	8.78	0.45	9.23	-6	4,797	3,704	-23
Volusia	24.45	3.42	27.87	21.64	3.51	25.15	-10	26.67	4.45	31.12	12	11,692	9,912	-15
Total	363.58	223.39	586.97	368.45	220.69	589.14	0	430.76	267.55	698.31	19	331,886	309,347	-7

Note: mgd = million gallons per day

*Percent change from total water use in 1995

Table 9. Agricultural irrigation water use for 1995 and 2020, by county and crop, in the St. Johns River Water Management District

Crop	1995 Water Use (mgd)			2020 Water Use (mgd) Average Rainfall Year				2020 Water Use (mgd) Dry Rainfall Year			Acres		
	Ground	Surface	Total	Ground	Surface	Total	Percent Change*	Ground	Surface	Total	1995[1]	2020	Percent Change
Alachua County													
Citrus	0.09	0.00	0.09	0.09	0.00	0.09	0	0.11	0.00	0.11	40	40	0
Fern	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Field crops	0.13	0.00	0.13	0.13	0.00	0.13	0	0.16	0.00	0.16	175	175	0
Other fruit and nuts	1.20	0.14	1.34	1.69	0.19	1.88	40	1.91	0.22	2.13	1,980	2,780	40
Pasture	0.78	0.00	0.78	0.78	0.00	0.78	0	0.83	0.00	0.83	680	680	0
Greenhouse/nursery	0.43	0.07	0.50	1.27	0.20	1.47	194	1.37	0.21	1.58	104	304	192
Sod	0.11	0.00	0.11	0.11	0.00	0.11	0	0.11	0.00	0.11	50	50	0
Turf grass	0.47	0.00	0.47	0.66	0.00	0.66	40	0.70	0.00	0.70	406	577	42
Vegetables, melons, and berries	1.61	0.00	1.61	2.24	0.00	2.24	39	2.63	0.00	2.63	2,050	2,850	39
Total	4.82	0.21	5.03	6.97	0.39	7.36	46	7.82	0.43	8.25	5,485	7,456	36
Baker County													
Citrus	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Fern	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Field crops	0.00	0.06	0.06	0.00	0.06	0.06	0	0.00	0.07	0.07	80	80	0
Other fruit and nuts	0.05	0.00	0.05	0.04	0.00	0.04	-20	0.05	0.00	0.05	67	60	-10
Pasture	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Greenhouse/nursery	1.23	0.80	2.03	1.23	0.80	2.03	0	1.33	0.86	2.19	420	420	0
Sod	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Turf grass	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Vegetables, melons, and berries	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Total	1.28	0.86	2.14	1.27	0.86	2.13	0	1.38	0.93	2.31	567	560	-1
Bradford County													
Citrus	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Fern	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Field crops	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Other fruit and nuts	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0

Table 9—*Continued*

Crop	1995 Water Use (mgd)			2020 Water Use (mgd) Average Rainfall Year				2020 Water Use (mgd) Dry Rainfall Year			Acres		
	Ground	Surface	Total	Ground	Surface	Total	Percent Change*	Ground	Surface	Total	1995[1]	2020	Percent Change
Pasture	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Greenhouse/nursery	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Sod	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Turf grass	0.01	0.00	0.01	0.01	0.00	0.01	0	0.02	0.00	0.02	10	13	30
Vegetables, melons, and berries	0.08	0.00	0.08	0.08	0.00	0.08	0	0.09	0.00	0.09	100	100	0
Total	0.09	0.00	0.09	0.09	0.00	0.09	0	0.11	0.00	0.11	110	113	3
Brevard County													
Citrus	12.62	4.91	17.53	7.83	3.04	10.87	-38	9.78	3.80	13.58	6,450	4,000	-38
Fern	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Field crops	2.27	0.00	2.27	0.99	0.00	0.99	-56	1.14	0.00	1.14	2,300	1,000	-57
Other fruit and nuts	0.29	0.03	0.32	0.19	0.02	0.21	-34	0.21	0.02	0.23	460	300	-35
Pasture	93.71	4.93	98.64	61.77	3.25	65.02	-34	65.02	3.42	68.44	75,860	50,000	-34
Greenhouse/nursery	1.02	0.00	1.02	2.42	0.00	2.42	137	2.60	0.00	2.60	210	500	138
Sod	1.16	1.74	2.90	3.57	5.35	8.92	208	3.66	5.49	9.15	1,300	4,000	208
Turf grass	0.83	0.01	0.84	1.22	0.02	1.24	48	1.29	0.02	1.31	650	956	47
Vegetables, melons, and berries	1.29	0.00	1.29	0.74	0.00	0.74	-43	0.88	0.00	0.88	1,400	800	-43
Total	113.19	11.62	124.81	78.73	11.68	90.41	-28	84.58	12.75	97.33	88,630	61,556	-31
Clay County													
Citrus	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Fern	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Field crops	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Other fruit and nuts	0.01	0.00	0.01	0.01	0.00	0.01	0	0.01	0.00	0.01	13	13	0
Pasture	0.11	0.00	0.11	0.11	0.00	0.11	0	0.12	0.00	0.12	100	100	0
Greenhouse/nursery	0.48	0.00	0.48	0.97	0.00	0.97	102	1.04	0.00	1.04	100	200	100
Sod	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Turf grass	0.17	0.00	0.17	0.27	0.00	0.27	59	0.29	0.00	0.29	146	238	63
Vegetables, melons, and berries	0.03	0.00	0.03	0.03	0.00	0.03	0	0.03	0.00	0.03	60	60	0
Total	0.80	0.00	0.80	1.39	0.00	1.39	74	1.49	0.00	1.49	419	611	46

Table 9—*Continued*

Crop	1995 Water Use (mgd)			2020 Water Use (mgd) Average Rainfall Year				2020 Water Use (mgd) Dry Rainfall Year			Acres		
	Ground	Surface	Total	Ground	Surface	Total	Percent Change*	Ground	Surface	Total	1995†	2020	Percent Change
Duval County													
Citrus	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Fern	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Field crops	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Other fruit and nuts	0.01	0.00	0.01	0.01	0.00	0.01	0	0.02	0.00	0.02	20	20	0
Pasture	0.57	0.00	0.57	0.57	0.00	0.57	0	0.61	0.00	0.61	500	500	0
Greenhouse/nursery	0.35	0.00	0.35	0.35	0.00	0.35	0	0.37	0.00	0.37	72	72	0
Sod	1.09	0.18	1.27	1.68	0.28	1.96	54	1.73	0.29	2.02	600	927	55
Turf grass	0.17	0.00	0.17	0.23	0.00	0.23	35	0.24	0.00	0.24	150	197	31
Vegetables, melons, and berries	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Total	2.19	0.18	2.37	2.84	0.28	3.12	32	2.97	0.29	3.26	1,342	1,716	28
Flagler County													
Citrus	0.18	0.00	0.18	0.00	0.00	0.00	-100	0.00	0.00	0.00	50	0	-100
Fern	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Field crops	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Other fruit and nuts	0.07	0.00	0.07	0.05	0.00	0.05	-29	0.07	0.00	0.07	120	87	-28
Pasture	0.80	0.00	0.80	0.89	0.00	0.89	11	0.94	0.00	0.94	695	776	12
Greenhouse/nursery	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Sod	0.46	0.00	0.46	0.26	0.00	0.26	-43	0.27	0.00	0.27	220	126	-43
Turf grass	0.01	0.16	0.17	0.03	0.37	0.40	135	0.03	0.39	0.42	150	344	129
Vegetables, melons, and berries	7.25	0.00	7.25	5.96	0.00	5.96	-18	6.99	0.00	6.99	6,000	4,928	-18
Total	8.77	0.16	8.93	7.19	0.37	7.56	-15	8.30	0.39	8.69	7,235	6,261	-13
Indian River County													
Citrus	50.65	151.93	202.58	51.42	154.23	205.65	2	64.24	192.72	256.96	65,446	66,436	2
Fern	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Field crops	0.19	2.12	2.31	0.24	2.58	2.82	22	0.27	2.99	3.26	2,350	2,850	21
Other fruit and nuts	0.12	0.00	0.12	0.12	0.00	0.12	0	0.14	0.00	0.14	170	178	5
Pasture	13.33	13.33	26.66	12.94	12.94	25.88	-3	13.63	13.63	27.26	22,747	22,094	-3
Greenhouse/nursery	0.41	0.00	0.41	0.41	0.00	0.41	0	0.44	0.00	0.44	85	85	0

Table 9—*Continued*

Crop	1995 Water Use (mgd)			2020 Water Use (mgd) Average Rainfall Year				2020 Water Use (mgd) Dry Rainfall Year			Acres		
	Ground	Surface	Total	Ground	Surface	Total	Percent Change*	Ground	Surface	Total	1995†	2020	Percent Change
Sod	0.91	1.38	2.29	0.99	1.50	2.49	9	1.02	1.54	2.56	1,000	1,088	9
Turf grass	0.00	0.06	0.06	0.00	0.10	0.10	67	0.00	0.10	0.10	54	83	54
Vegetables, melons, and berries	1.72	1.20	2.92	1.79	1.25	3.04	4	2.14	1.49	3.63	3,180	3,313	4
Total	67.33	170.02	237.35	67.91	172.60	240.51	1	81.88	212.47	294.35	95,032	96,127	1
Lake County													
Citrus	33.91	5.07	38.98	49.85	7.45	57.30	47	62.31	9.31	71.62	16,842	24,758	47
Fern	1.31	0.15	1.46	1.67	0.19	1.86	27	2.15	0.24	2.39	550	700	27
Field crops	0.25	0.25	0.50	0.23	0.23	0.46	-8	0.28	0.28	0.56	650	585	-10
Other fruit and nuts	0.33	0.01	0.34	0.69	0.02	0.71	109	0.81	0.02	0.83	552	1,156	109
Pasture	2.06	0.10	2.16	1.68	0.08	1.76	-19	1.78	0.08	1.86	1,886	1,535	-19
Greenhouse/nursery	4.85	0.23	5.08	9.23	0.44	9.67	90	9.94	0.47	10.41	1,050	2,000	90
Sod	0.08	0.49	0.57	0.09	0.55	0.64	12	0.09	0.56	0.65	250	279	12
Turf grass	0.11	0.02	0.13	0.19	0.04	0.23	77	0.20	0.04	0.24	120	202	68
Vegetables, melons, and berries	1.01	0.74	1.75	0.38	0.28	0.66	-62	0.47	0.34	0.81	2,670	995	-63
Total	43.91	7.06	50.97	64.01	9.28	73.29	44	78.03	11.34	89.37	24,570	32,210	31
Marion County													
Citrus	1.50	0.10	1.60	1.98	0.13	2.11	32	2.47	0.17	2.64	700	925	32
Fern	0.05	0.00	0.05	0.13	0.00	0.13	160	0.17	0.00	0.17	20	50	150
Field crops	0.33	0.15	0.48	0.30	0.13	0.43	-10	0.35	0.15	0.50	484	440	-9
Other fruit and nuts	0.75	0.00	0.75	1.06	0.00	1.06	41	1.24	0.00	1.24	1,230	1,726	40
Pasture	0.66	0.42	1.08	0.72	0.46	1.18	9	0.76	0.49	1.25	940	1,030	10
Greenhouse/nursery	0.27	0.05	0.32	0.35	0.07	0.42	31	0.37	0.07	0.44	66	86	30
Sod	1.49	0.00	1.49	1.51	0.00	1.51	1	1.55	0.00	1.55	660	668	1
Turf grass	0.10	0.00	0.10	0.16	0.00	0.16	60	0.17	0.00	0.17	83	137	65
Vegetables, melons, and berries	0.65	0.00	0.65	0.70	0.00	0.70	8	0.88	0.00	0.88	990	1,068	8
Total	5.80	0.72	6.52	6.91	0.79	7.70	18	7.96	0.88	8.84	5,173	6,130	18
Nassau County													
Citrus	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0

Table 9—*Continued*

Crop	1995 Water Use (mgd)			2020 Water Use (mgd) Average Rainfall Year				2020 Water Use (mgd) Dry Rainfall Year			Acres		
	Ground	Surface	Total	Ground	Surface	Total	Percent Change*	Ground	Surface	Total	1995†	2020	Percent Change
Fern	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Field crops	0.07	0.00	0.07	0.07	0.00	0.07	0	0.09	0.00	0.09	90	93	3
Other fruit and nuts	0.01	0.00	0.01	0.01	0.00	0.01	0	0.01	0.00	0.01	15	15	0
Pasture	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Greenhouse/nursery	0.10	0.00	0.10	0.10	0.00	0.10	0	0.10	0.00	0.10	20	20	0
Sod	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Turf grass	0.03	0.00	0.03	0.05	0.00	0.05	67	0.06	0.00	0.06	30	48	60
Vegetables, melons, and berries	0.04	0.00	0.04	0.05	0.00	0.05	25	0.06	0.00	0.06	50	55	10
Total	0.25	0.00	0.25	0.28	0.00	0.28	12	0.32	0.00	0.32	205	231	13
Okeechobee County													
Citrus	10.67	0.00	10.67	10.22	0.00	10.22	-4	12.77	0.00	12.77	4,668	4,471	-4
Fern	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Field crops	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Other fruit and nuts	0.08	0.00	0.08	0.00	0.00	0.00	-100	0.00	0.00	0.00	117	0	-100
Pasture	3.44	0.00	3.44	3.10	0.00	3.10	-10	3.29	0.00	3.29	3,000	2,710	-10
Greenhouse/nursery	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Sod	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Turf grass	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Vegetables, melons, and berries	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Total	14.19	0.00	14.19	13.32	0.00	13.32	-6	16.06	0.00	16.06	7,785	7,181	-8
Orange County													
Citrus	7.64	0.85	8.49	10.62	1.18	11.80	39	13.28	1.47	14.75	3,596	5,000	39
Fern	0.11	0.00	0.11	0.11	0.00	0.11	0	0.14	0.00	0.14	40	40	0
Field crops	0.44	0.15	0.59	0.44	0.15	0.59	0	0.51	0.18	0.69	600	600	0
Other fruit and nuts	0.09	0.00	0.09	0.37	0.00	0.37	311	0.43	0.00	0.43	150	600	300
Pasture	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Greenhouse/nursery	4.77	0.83	5.60	4.77	0.83	5.60	0	5.13	0.89	6.02	1,157	1,157	0
Sod	0.24	0.28	0.52	0.24	0.28	0.52	0	0.25	0.29	0.54	200	200	0
Turf grass	0.37	0.07	0.44	0.59	0.11	0.70	59	0.63	0.12	0.75	381	617	62

Table 9—*Continued*

Crop	1995 Water Use (mgd)			2020 Water Use (mgd) Average Rainfall Year				2020 Water Use (mgd) Dry Rainfall Year			Acres		
	Ground	Surface	Total	Ground	Surface	Total	Percent Change*	Ground	Surface	Total	1995†	2020	Percent Change
Vegetables, melons, and berries	2.52	15.58	18.10	1.06	6.55	7.61	-58	1.27	7.85	9.12	23,811	10,000	-58
Total	16.18	17.76	33.94	18.20	9.10	27.30	-20	21.64	10.80	32.44	29,935	18,214	-39
Osceola County													
Citrus	3.71	0.00	3.71	3.16	0.00	3.16	-15	3.92	0.00	3.92	1,174	1,174	0
Fern	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Field crops	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Other fruit and nuts	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Pasture	2.82	9.99	12.81	2.82	9.99	12.81	0	2.98	10.59	13.57	11,180	11,180	0
Greenhouse/nursery	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Sod	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Turf grass	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Vegetables, melons, and berries	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Total	6.53	9.99	16.52	5.98	9.99	15.97	-3	6.90	10.59	17.49	12,354	12,354	0
Polk County													
Citrus	2.13	0.24	2.37	5.04	0.57	5.61	137	6.29	0.70	6.99	1,000	2,368	137
Fern	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Field crops	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Other fruit and nuts	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Pasture	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Greenhouse/nursery	0.29	0.00	0.29	0.27	0.00	0.27	-7	0.29	0.00	0.29	60	55	-8
Sod	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Turf grass	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Vegetables, melons, and berries	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Total	2.42	0.24	2.66	5.31	0.57	5.88	121	6.58	0.70	7.28	1,060	2,423	129
Putnam County													
Citrus	0.47	0.00	0.47	1.18	0.00	1.18	151	1.45	0.00	1.45	200	500	150
Fern	3.19	0.79	3.98	3.19	0.79	3.98	0	4.11	1.01	5.12	1,500	1,500	0
Field crops	0.39	0.02	0.41	1.17	0.06	1.23	200	1.41	0.07	1.48	500	1,500	200

Table 9—*Continued*

Crop	1995 Water Use (mgd)			2020 Water Use (mgd) Average Rainfall Year				2020 Water Use (mgd) Dry Rainfall Year			Acres		
	Ground	Surface	Total	Ground	Surface	Total	Percent Change*	Ground	Surface	Total	1995†	2020	Percent Change
Other fruit and nuts	0.19	0.00	0.19	0.22	0.00	0.22	16	0.28	0.00	0.28	320	360	13
Pasture	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Greenhouse/nursery	1.69	0.00	1.69	12.09	0.00	12.09	615	13.02	0.00	13.02	350	2,500	614
Sod	0.51	0.00	0.51	2.30	0.00	2.30	351	2.36	0.00	2.36	220	1,000	355
Turf grass	0.03	0.00	0.03	0.04	0.00	0.04	33	0.04	0.00	0.04	25	32	28
Vegetables, melons, and berries	5.38	0.00	5.38	6.07	0.00	6.07	13	7.40	0.00	7.40	6,200	7,000	13
Total	11.85	0.81	12.66	26.26	0.85	27.11	114	30.07	1.08	31.15	9,315	14,392	55
St. Johns County													
Citrus	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Fern	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Field crops	1.64	0.00	1.64	1.64	0.00	1.64	0	1.98	0.00	1.98	2,000	2,000	0
Other fruit and nuts	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Pasture	1.15	0.00	1.15	1.15	0.00	1.15	0	1.21	0.00	1.21	1,000	1,000	0
Greenhouse/nursery	0.48	0.00	0.48	0.48	0.00	0.48	0	0.52	0.00	0.52	100	100	0
Sod	0.12	0.00	0.12	0.12	0.00	0.12	0	0.13	0.00	0.13	60	60	0
Turf grass	0.02	0.00	0.02	0.04	0.00	0.04	100	0.04	0.00	0.04	20	36	80
Vegetables, melons, and berries	26.66	0.00	26.66	28.97	0.00	28.97	9	35.34	0.00	35.34	23,000	25,000	9
Total	30.07	0.00	30.07	32.40	0.00	32.40	8	39.22	0.00	39.22	26,180	28,196	8
Seminole County													
Citrus	4.36	0.00	4.36	2.19	0.00	2.19	-50	2.75	0.00	2.75	1,816	914	-50
Fern	0.05	0.00	0.05	0.13	0.00	0.13	160	0.17	0.00	0.17	20	50	150
Field crops	0.05	0.00	0.05	0.08	0.00	0.08	60	0.10	0.00	0.10	50	85	70
Other fruit and nuts	0.05	0.00	0.05	0.01	0.00	0.01	-80	0.01	0.00	0.01	75	16	-79
Pasture	0.56	0.00	0.56	0.42	0.00	0.42	-25	0.44	0.00	0.44	490	366	-25
Greenhouse/nursery	2.57	0.33	2.90	3.17	0.40	3.57	23	3.42	0.43	3.85	600	740	23
Sod	0.81	0.00	0.81	0.85	0.00	0.85	5	0.86	0.00	0.86	320	332	4
Turf grass	0.14	0.01	0.15	0.23	0.02	0.25	67	0.24	0.02	0.26	136	216	59
Vegetables, melons, and berries	0.87	0.00	0.87	0.67	0.00	0.67	-23	0.79	0.00	0.79	1,290	985	-24
Total	9.46	0.34	9.80	7.75	0.42	8.17	-17	8.78	0.45	9.23	4,797	3,704	-23

Table 9—*Continued*

Crop	1995 Water Use (mgd)			2020 Water Use (mgd) Average Rainfall Year				2020 Water Use (mgd) Dry Rainfall Year			Acres		
	Ground	Surface	Total	Ground	Surface	Total	Percent Change*	Ground	Surface	Total	1995†	2020	Percent Change
Volusia County													
Citrus	2.33	0.18	2.51	1.36	0.10	1.46	-42	1.70	0.13	1.83	1,100	640	-42
Fern	14.82	3.04	17.86	15.42	3.16	18.58	4	19.83	4.06	23.89	6,726	7,000	4
Field crops	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Other fruit and nuts	0.04	0.00	0.04	0.03	0.00	0.03	-25	0.03	0.00	0.03	67	44	-34
Pasture	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Greenhouse/nursery	1.92	0.08	2.00	1.92	0.08	2.00	0	2.06	0.08	2.14	412	412	0
Sod	3.98	0.00	3.98	2.31	0.00	2.31	-42	2.38	0.00	2.38	1,837	1,066	-42
Turf grass	0.16	0.12	0.28	0.23	0.17	0.40	43	0.25	0.18	0.43	245	350	43
Vegetables, melons, and berries	1.20	0.00	1.20	0.37	0.00	0.37	-69	0.42	0.00	0.42	1,305	400	-69
Total	24.45	3.42	27.87	21.64	3.51	25.15	-10	26.67	4.45	31.12	11,692	9,912	-15
St. Johns River Water Management District Total	**363.58**	**223.39**	**586.97**	**368.45**	**220.69**	**589.14**	**0**	**430.76**	**267.55**	**698.31**	**331,886**	**309,347**	**-7**

*Percent change from total water use in 1995
†Data from Florence 1997

Table 10. Agricultural irrigation water use for 1995 and 2020, by crop category, in the St. Johns River Water Management District

Crop	1995 Water Use (mgd)			2020 Water Use (mgd) Average Rainfall Year				2020 Water Use (mgd) Dray Rainfall Year				Acres		
	Ground	Surface	Total	Ground	Surface	Total	Percent Change*	Ground	Surface	Total	Percent Change*	1995	2020	Percent Change
Citrus	130.26	163.28	293.54	144.94	166.70	311.64	6	181.07	208.30	389.37	33	103,082	111,226	8
Fern	19.53	3.98	23.51	20.65	4.14	24.79	5	26.57	5.31	31.88	36	8,856	9,340	5
Field crops	5.76	2.75	8.51	5.29	3.21	8.50	0	6.29	3.74	10.03	18	9,279	9,408	1
Other fruit and nuts	3.29	0.18	3.47	4.50	0.23	4.73	36	5.22	0.26	5.48	58	5,356	7,355	37
Pasture	119.99	28.77	148.76	86.95	26.72	113.67	-24	91.61	28.21	119.82	-19	119,078	91,971	-23
Greenhouse/ nursery	20.86	2.39	23.25	39.03	2.82	41.85	80	42.00	3.01	45.01	94	4,806	8,651	80
Sod	10.96	4.07	15.03	14.03	7.96	21.99	46	14.41	8.17	22.58	50	6,717	9,796	46
Turf grass	2.62	0.45	3.07	3.95	0.83	4.78	56	4.20	0.87	5.07	65	2,606	4,046	55
Vegetables, melons, and berries	50.31	17.52	67.83	49.11	8.08	57.19	-16	59.39	9.68	69.07	2	72,106	57,554	-20
Total	363.58	223.39	586.97	368.45	220.69	589.14	0	430.76	267.55	698.31	19	331,886	309,347	-7

Note: mgd = million gallons per day

*Percent change from total water use in 1995

Table 11. Recreational irrigation (golf course) water use and acreage for 1995 and 2020, by county, in the St. Johns River Water Management District

County	1995 Water Use (mgd)			2020 Water Use (mgd) Average Rainfall Year				2020 Water Use (mgd) Dry Rainfall Year				Acres		
	Ground	Surface	Total	Ground	Surface	Total	Percent Change*	Ground	Surface	Total	Percent Change*	1995	2020	Percent Change
Alachua	4.70	0.58	5.28	6.67	0.82	7.49	42	6.84	0.84	7.68	45	2,394	3,400	42
Baker	0.14	0.00	0.14	0.21	0.00	0.21	50	0.21	0.00	0.21	50	70	100	43
Bradford	0.08	0.00	0.08	0.11	0.00	0.11	38	0.11	0.00	0.11	38	38	48	26
Brevard	3.89	6.35	10.24	5.72	9.33	15.05	47	5.85	9.54	15.39	50	3,987	5,860	47
Clay	1.01	0.52	1.53	1.65	0.85	2.50	63	1.69	0.87	2.56	67	667	1,087	63
Duval	3.76	0.88	4.64	4.93	1.16	6.09	31	5.06	1.19	6.25	35	2,193	2,872	31
Flagler	0.16	1.06	1.22	0.36	2.43	2.79	129	0.37	2.49	2.86	134	588	1,346	129
Indian River	4.88	2.41	7.29	7.52	3.70	11.22	54	7.71	3.80	11.51	58	3,175	4,889	54
Lake	9.27	7.59	16.86	15.58	12.74	28.32	68	15.98	13.07	29.05	72	7,360	12,364	68
Marion	1.59	1.15	2.74	2.63	1.90	4.53	65	2.70	1.95	4.65	70	1,200	1,979	65
Nassau	15.15	2.47	17.62	24.24	3.95	28.19	60	24.90	4.05	28.95	64	8,095	12,952	60
Okeechobee	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0	0
Orange	7.56	1.44	9.00	12.25	2.33	14.58	62	12.53	2.39	14.92	66	3,405	5,516	62
Osceola	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	733	1,407	92
Polk	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0	0
Putnam	0.20	0.00	0.20	0.25	0.00	0.25	25	0.26	0.00	0.26	30	87	110	26
St. Johns	3.84	2.26	6.10	6.92	4.06	10.98	80	7.08	4.16	11.24	84	2,940	5,291	80
Seminole	4.92	1.23	6.15	7.82	1.95	9.77	59	8.00	2.00	10.00	63	2,415	3,839	59
Volusia	7.63	2.41	10.04	10.91	3.45	14.36	43	11.22	3.54	14.76	47	4,490	6,422	43
Total	68.78	30.35	99.13	107.77	48.67	156.44	58	110.51	49.89	160.40	62	43,837	69,482	59

Note: mgd = million gallons per day

*Percent change from total water use in 1995

Table 12. Commercial/industrial/institutional total freshwater use for 1995 and 2020, by county, in the St. Johns River Water Management District

County	1995 Water Use* (mgd)			2020 Water Use (mgd) Average Rainfall Year			Percent Change from 1995		
	Ground	Surface	Total	Ground	Surface	Total	Ground	Surface	Total
Alachua	1.91	0.00	1.91	2.71	0.00	2.71	42	0	42
Baker	0.19	0.00	0.19	0.27	0.00	0.27	42	0	42
Bradford	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
Brevard	1.80	0.00	1.80	1.87	0.00	1.87	4	0	4
Clay	4.46	0.00	4.46	4.67	0.00	4.67	5	0	5
Duval	24.75	0.00	24.75	29.03	0.00	29.03	17	0	17
Flagler	0.18	0.00	0.18	0.41	0.00	0.41	128	0	128
Indian River	0.16	0.00	0.16	0.29	0.00	0.29	81	0	81
Lake	10.23	1.14	11.37	13.57	0.51	14.08	33	-55	24
Marion	1.85	0.00	1.85	1.26	0.00	1.26	-32	0	-32
Nassau	34.49	2.25	36.74	30.58	2.37	32.95	-11	5	-10
Okeechobee	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
Orange	3.61	0.00	3.61	3.53	0.00	3.53	-2	0	-2
Osceola	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
Polk	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
Putnam	11.51	34.74	46.25	13.12	41.31	54.43	14	19	18
St. Johns	0.06	0.00	0.06	0.11	0.00	0.11	83	0	83
Seminole	0.14	0.00	0.14	0.22	0.00	0.22	57	0	57
Volusia	0.69	0.00	0.69	0.99	0.00	0.99	43	0	43
Total	96.03	38.13	134.16	102.63	44.19	146.82	7	16	9

Note: mgd = million gallons per day

*Actual water used in 1995, not estimated

Table 13. Commercial/industrial/institutional water use for 1995 and 2020, by county and user, in the St. Johns River Water Management District

Facility	Category	1995 Water Use* (mgd)			2020 Water Use (mgd) Average Rainfall Year		
		Ground	Surface	Total	Ground	Surface	Total
Alachua County							
University of Florida	Institutional	1.71	0.00	1.71	2.43	0.00	2.43
Other small users		0.20	0.00	0.20	0.28	0.00	0.28
Total		1.91	0.00	1.91	2.71	0.00	2.71
Baker County							
Other small users		0.19	0.00	0.19	0.27	0.00	0.27
Total		0.19	0.00	0.19	0.27	0.00	0.27
Brevard County							
JFK Space Center	Institutional	1.65	0.00	1.65	1.65	0.00	1.65
Other small users		0.15	0.00	0.15	0.22	0.00	0.22
Total		1.80	0.00	1.80	1.87	0.00	1.87
Clay County							
E.I. Dupont, Trail Ridge	Industrial	1.46	0.00	1.46	0.50	0.00	0.50
RGC Mineral Sands	Industrial	1.35	0.00	1.35	1.48	0.00	1.48
Camp Blanding Military Base	Institutional	0.28	0.00	0.28	0.46	0.00	0.46
FRI, Goldhead Sand	Industrial	0.95	0.00	0.95	1.55	0.00	1.55
Other small users		0.42	0.00	0.42	0.68	0.00	0.68
Total		4.46	0.00	4.46	4.67	0.00	4.67
Duval County							
Building Products (Celotex)	Industrial	0.12	0.00	0.12	0.25	0.00	0.25
Cecil Field NAS	Institutional	0.60	0.00	0.60	0.00	0.00	0.00
Gate Maritime	Industrial	0.07	0.00	0.07	0.32	0.00	0.32
Jefferson Smurfit, Jacksonville	Industrial	6.69	0.00	6.69	6.69	0.00	6.69
SCM Glidco Organics	Industrial	1.81	0.00	1.81	5.00	0.00	5.00
Simplex Mfg. Company	Industrial	0.48	0.00	0.48	0.48	0.00	0.48
Stone Container	Industrial	8.84	0.00	8.84	8.36	0.00	8.36
U.S. Gypsum	Industrial	0.41	0.00	0.41	0.41	0.00	0.41
Bush Boake & Allen, Inc.	Industrial	1.73	0.00	1.73	2.27	0.00	2.27
Jacksonville NAS	Institutional	1.52	0.00	1.52	1.99	0.00	1.99
Jacksonville University	Institutional	0.41	0.00	0.41	0.54	0.00	0.54
Mayport NAS	Institutional	1.44	0.00	1.44	1.89	0.00	1.89
Other small users		0.63	0.00	0.63	0.83	0.00	0.83
Total		24.75	0.00	24.75	29.03	0.00	29.03
Flagler County							
Other small users		0.18	0.00	0.18	0.41	0.00	0.41
Total		0.18	0.00	0.18	0.41	0.00	0.41
Indian River County							
Ocean Spray processing plant	Industrial	0.10	0.00	0.10	0.19	0.00	0.19
Fellsmere Packing House	Industrial	0.03	0.00	0.03	0.05	0.00	0.05
Indian River Correctional Facility	Institutional	0.03	0.00	0.03	0.05	0.00	0.05
Total		0.16	0.00	0.16	0.29	0.00	0.29

Table 13—*Continued*

Facility	Category	1995 Water Use* (mgd)			2020 Water Use (mgd) Average Rainfall Year		
		Ground	Surface	Total	Ground	Surface	Total
Lake County							
B&W Canning, Groveland plant	Industrial	0.21	0.00	0.21	0.34	0.00	0.34
Coca Cola, Leesburg plant	Industrial	0.51	0.00	0.51	1.75	0.00	1.75
Eustis Sand Company	Industrial	0.93	1.14	2.07	0.42	0.51	0.93
FRI, Astatula Mine	Industrial	0.11	0.00	0.11	0.11	0.00	0.11
Golden Gem, Umatilla plant	Industrial	0.96	0.00	0.96	2.51	0.00	2.51
Silver Sand Company, Clermont mine	Industrial	6.14	0.00	6.14	6.14	0.00	6.14
Other small users		1.37	0.00	1.37	2.30	0.00	2.30
Total		10.23	1.14	11.37	13.57	0.51	14.08
Marion County							
FRI, Marion mine	Industrial	0.83	0.00	0.83	0.83	0.00	0.83
Marion Correctional Facility	Institutional	0.26	0.00	0.26	0.43	0.00	0.43
Other small users		0.76	0.00	0.76	0.00	0.00	0.00
Total		1.85	0.00	1.85	1.26	0.00	1.26
Nassau County							
Jefferson Smurfit, Fernandina	Industrial	19.18	0.00	19.18	14.40	0.00	14.40
Rayonier	Industrial	15.28	2.25	17.53	16.13	2.37	18.50
Other small users		0.03	0.00	0.03	0.05	0.00	0.05
Total		34.49	2.25	36.74	30.58	2.37	32.95
Orange County							
University of Central Florida	Institutional	0.57	0.00	0.57	1.22	0.00	1.22
Winter Garden Citrus plant	Industrial	1.99	0.00	1.99	1.99	0.00	1.99
Sun Resort Inc.	Institutional	0.20	0.00	0.20	0.32	0.00	0.32
Other small users		0.85	0.00	0.85	0.00	0.00	0.00
Total		3.61	0.00	3.61	3.53	0.00	3.53
Putnam County							
Feldspar Corp. Edgar plant	Industrial	0.22	1.85	2.07	0.06	0.49	0.55
FRI, Grandin Sand	Industrial	2.78	0.00	2.78	2.62	0.00	2.62
FRI, Keuka Industrial Sand	Industrial	0.45	0.00	0.45	0.45	0.00	0.45
FRI, Keuka Sand	Industrial	0.10	0.00	0.10	0.10	0.00	0.10
Georgia-Pacific, Palatka plant	Industrial	7.40	32.89	40.29	9.18	40.82	50.00
Other small users		0.56	0.00	0.56	0.71	0.00	0.71
Total		11.51	34.74	46.25	13.12	41.31	54.43
St. Johns County							
Other small users		0.06	0.00	0.06	0.11	0.00	0.11
Total		0.06	0.00	0.06	0.11	0.00	0.11
Seminole County							
Other small users		0.14	0.00	0.14	0.22	0.00	0.22
Total		0.14	0.00	0.14	0.22	0.00	0.22

Table 13—*Continued*

Facility	Category	1995 Water Use* (mgd)			2020 Water Use (mgd) Average Rainfall Year		
		Ground	Surface	Total	Ground	Surface	Total
Volusia County							
Other small users		0.69	0.00	0.69	0.99	0.00	0.99
Total		0.69	0.00	0.69	0.99	0.00	0.99
Total St. Johns River Water Management District		**96.03**	**38.13**	**134.16**	**102.63**	**44.19**	**146.82**

Note: FRI = Florida Rock Industries
mgd = million gallons per day
NAS = Naval Air Station

*Actual water used in 1995, not estimated

Table 14. Thermoelectric power generation water use for 1995 and 2020, by county, in the St. Johns River Water Management District

	1995 Fresh Water Use* (mgd)			2020 Fresh Water Use (mgd) Average Rainfall Year			Percent Change from 1995			Saline Surface Water (mgd)	
County	Ground	Surface	Total	Ground	Surface	Total	Ground	Surface	Total	1995	2020
Alachua	0.40	0.00	0.40	0.40	0.00	0.40	0	0	0	0.00	0.00
Baker	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.00	0.00
Brevard	0.31	0.00	0.31	0.75	0.00	0.75	142	0	142	1,197.31	1,592.61
Bradford	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.00	0.00
Clay	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.00	0.00
Duval	5.47	0.00	5.47	7.04	0.00	7.04	29	0	29	575.09	851.40
Flagler	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.00	0.00
Indian River	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	53.59	54.90
Lake	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.00	0.00
Marion	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.00	0.00
Nassau	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.00	0.00
Okeechobee	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.00	0.00
Orange	0.41	0.00	0.41	1.25	0.00	1.25	205	0	205	0.00	0.00
Osceola	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.00	0.00
Polk	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.00	0.00
Putnam	0.70	14.50	15.20	1.03	16.42	17.45	47	13	15	0.00	0.00
St. Johns	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.00	0.00
Seminole	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.00	0.00
Volusia	0.37	0.00	0.37	0.66	0.00	0.66	78	0	78	0.00	0.00
Total	7.66	14.50	22.16	11.13	16.42	27.55	45	13	24	1,825.99	2,498.91

Note: mgd = million gallons per day

*Actual water used in 1995, not estimated

Table 15. Thermoelectric power generation water use for 1995 and 2020, by county and user, in the St. Johns River Water Management District

Facility	1995 Fresh Water Use* (mgd)			2020 Fresh Water Use (mgd) Average Rainfall Year			Saline Surface Water (mgd)	
	Ground	Surface	Total	Ground	Surface	Total	1995	2020
Alachua County								
Gainesville Regional Utilities	0.40	0.00	0.40	0.40	0.00	0.40	0.00	0.00
Total	0.40	0.00	0.40	0.40	0.00	0.40	0.00	0.00
Brevard County								
FPL, Cape Canaveral	0.18	0.00	0.18	0.56	0.00	0.56	680.79	823.00
OUC, Indian River	0.13	0.00	0.13	0.19	0.00	0.19	516.52	769.61
Total	0.31	0.00	0.31	0.75	0.00	0.75	1,197.31	1,592.61
Duval County								
Cedar Bay Generating Facility	0.91	0.00	0.91	0.91	0.00	0.91	0.00	0.00
Jacksonville Electric Authority	0.99	0.00	0.99	1.00	0.00	1.00	494.94	801.00
SJR Power Park	3.57	0.00	3.57	5.13	0.00	5.13	80.15	50.40
Total	5.47	0.00	5.47	7.04	0.00	7.04	575.09	851.40
Indian River County								
Vero Beach Power Plant	0.00	0.00	0.00	0.00	0.00	0.00	53.59	54.90
Total	0.00	0.00	0.00	0.00	0.00	0.00	53.59	54.90
Orange County								
OUC, Station Power Plant	0.41	0.00	0.41	1.25	0.00	1.25	0.00	0.00
Total	0.41	0.00	0.41	1.25	0.00	1.25	0.00	0.00
Putnam County								
FPL, Palatka Plant	0.09	1.32	1.41	0.18	1.92	2.10	0.00	0.00
Seminole Electric	0.61	13.18	13.79	0.85	14.50	15.35	0.00	0.00
Total	0.70	14.50	15.20	1.03	16.42	17.45	0.00	0.00
Volusia County								
FPC, DeBary	0.01	0.00	0.01	0.01	0.00	0.01	0.00	0.00
FPC, Lake Monroe	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FPL, Sanford	0.36	0.00	0.36	0.65	0.00	0.65	0.00	0.00
Total	0.37	0.00	0.37	0.66	0.00	0.66	0.00	0.00
St. Johns River Water Management District total	**7.66**	**14.50**	**22.16**	**11.13**	**16.42**	**27.55**	**1,825.99**	**2,498.91**

Note: FPL = Florida Power and Light SJR = St. Johns River
FPC = Florida Power Corporation OUC = Orlando Utility Commission

*Actual water used in 1995, not estimated

Table 16. Demand for public-use water, 1995 and 2020

County	1995 Water Use (mgd)			2020 Water Use (mgd) Average Rainfall Year			Percent Change		
	Public Supply*	Domestic Self-Supply and Small Public Supply	Total Public-Use Demand	Public Supply Water Use†	Domestic Self-Supply and Small Public Supply	Total Public-Use Demand	Public Supply	Domestic Self-Supply and Small Public Supply	Public-Use Demand
Alachua	20.44	2.28	22.72	29.86	2.76	32.62	46	21	44
Baker	0.65	1.51	2.16	1.49	1.89	3.38	129	25	56
Bradford	0.00	0.12	0.12	0.00	0.15	0.15	0	25	25
Brevard	51.11	6.22	57.33	80.33	2.13	82.46	57	-66	44
Clay	11.78	3.03	14.81	21.97	3.64	25.61	87	20	73
Duval	98.94	7.96	106.90	135.26	5.08	140.34	37	-36	31
Flagler	4.40	1.19	5.59	15.36	0.12	15.48	249	-90	177
Indian River	10.87	3.99	14.86	28.51	0.87	29.38	162	-78	98
Lake	22.63	6.02	28.65	47.00	1.27	48.27	108	-79	68
Marion	13.34	10.40	23.74	22.84	14.79	37.63	71	42	59
Nassau	4.34	2.63	6.97	10.38	2.17	12.55	139	-17	80
Okeechobee	0.00	0.06	0.06	0.00	0.10	0.10	0	67	67
Orange	105.27	3.79	109.06	158.75	6.01	164.76	51	59	51
Osceola	0.00	0.04	0.04	0.00	0.08	0.08	0	100	100
Polk	0.00	0.89	0.89	0.00	1.23	1.23	0	38	38
Putnam	3.34	5.10	8.44	4.82	5.58	10.40	44	9	23
St. Johns	10.42	4.24	14.66	18.44	2.80	21.24	77	-34	45
Seminole	50.05	2.56	52.61	83.90	2.13	86.03	68	-17	64
Volusia	47.61	9.95	57.56	60.38	12.04	72.42	27	21	26
Total	455.19	71.98	527.17	719.29	64.84	784.13	59	-10	49

Note: mgd = million gallons per day
SJRWMD = St. Johns River Water Management District

*Actual water used in 1995, not estimated
†SJRWMD population-based projections, not utility-based projections

CONCLUSIONS—by Barbara Vergara, P.G.

PROJECTED 2020 WATER RESOURCE CONDITIONS

SJRWMD performed assessments to determine the impacts of projected 2020 demands on groundwater and surface water resources. Because projected 2020 demands are reasonably similar to those projected for 2010 (Vergara 1994), SJRWMD assumed that the hydrologic impacts of projected 2020 demands on groundwater and surface water resources will be reasonably similar to those reported for 2010 in the 1994 assessment document. If the current water supply plans of major water users are implemented, the elevation of the potentiometric surface of the Floridan aquifer system is expected to decline regionally in response to the cumulative withdrawals of water from the Floridan aquifer system (Figure 5). In response to these declines in the elevation of the potentiometric surface and in response to withdrawals from the intermediate and surficial aquifer systems, the elevation of the water table of the surficial aquifer system is expected to decline (Figure 6). Also in response to these declines, the discharges of numerous springs are expected to decline and chloride concentrations are expected to increase in public supply wells in eastern Orange County and coastal Volusia County.

The accuracy of the assessments of these impacts can be improved through use of the improved groundwater models. Improved groundwater models are currently being developed by SJRWMD. SJRWMD plans to continue the development of these improved groundwater flow models and will use these models to assist in the development of updated assessments of the hydrologic impacts of projected 2020 demands. These updated impact assessments will be used in the development of water supply plans, which will focus on priority water resource caution areas identified in this 1998 assessment. In addition, SJRWMD plans to prepare a revised assessment or an addendum to the 1998 assessment in 1999, if necessary. The revised assessment or addendum will be based on the results of evaluations using the improved groundwater models and associated hydrologic impact assessments.

Projections of future water resource conditions identified as part of this 1998 assessment are not considered by SJRWMD to represent conditions that are certain to exist. The projections were developed using modeling techniques that used the best information available. However, the limited data available in some areas could have affected the accuracy of the projections. Additional data and modeling have been identified as means of improving the accuracy of the projections.

PRIORITY WATER RESOURCE CAUTION AREAS

SJRWMD has identified priority water resource caution areas (Figure 2) based on a comparison of water resource constraints to the results of assessments of hydrologic impacts due to projected 2020 demands. These are areas within which anticipated sources of water and conservation efforts are determined to be not adequate to supply water for all existing uses and reasonably anticipated future needs and to sustain the water resources and related natural systems through 2020. Within these identified priority water resource caution areas, the impacts of current or projected demands exceed the water resource constraints for natural systems, groundwater quality, existing legal users of water, or failure to identify a source of supply for planned development.

These priority water resource caution areas cover about 40% of SJRWMD and include all or parts of Brevard, Duval, Flagler, Lake, Orange, Osceola, Seminole, St. Johns, Putnam, and Volusia counties. The 1998 boundaries of the priority water resource caution areas include two areas that were not within the 1994 boundaries: northern St. Johns County–southeastern Duval County and a portion of Lake County south of the Ocala National Forest. These areas are identified because both have significant planned growth without an identified source of supply.

Changes in projected quantities and locations of 2020 groundwater and surface water withdrawals can change the boundaries of these priority water resource caution areas. Therefore, areas located outside of the identified priority water resource caution areas should not be assumed to be able to support future groundwater and surface water withdrawals without resulting in unacceptable water resource conditions.

Projected 2020 water use in areas to the south and west of the SJRWMD boundary, in SFWMD, will contribute to the anticipated unacceptable water resource conditions. SJRWMD is coordinating closely with SFWMD concerning this matter, based on the provisions of a memorandum of understanding entered into by the two districts.

REGIONAL WATER SUPPLY PLAN DEVELOPMENT

Pursuant to Paragraph 373.0361(1), *FS*, SJRWMD is required to initiate water supply planning for each water supply planning region where it determines that sources of water are not adequate for the planning period to supply water for all existing and projected reasonable-beneficial uses and to sustain the water resources and related natural systems. Priority water resource caution areas identified by SJRWMD represent areas within which existing and anticipated sources of water and conservation efforts are not adequate to supply water for all existing and projected reasonable-beneficial uses and to sustain the water resources and related natural systems through 2020. Therefore, because SJRWMD has identified its entire jurisdictional area as one water supply planning region (Figure 1), one districtwide water supply plan is proposed.

Prior to the signing of Executive Order 96-297 and the adoption of water supply legislation by the 1997 Florida Legislature, SJRWMD had initiated a water supply planning process based on the results of its 1994 water supply needs and sources assessment. SJRWMD made necessary modifications to its process to make it consistent with the legislative and executive requirements. SJRWMD has implemented this water supply planning process (Appendix B) and is developing a districtwide water supply plan.

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APPENDIX A—STATE OF FLORIDA, OFFICE OF THE GOVERNOR, EXECUTIVE ORDER 96-297

State of Florida

OFFICE OF THE GOVERNOR

EXECUTIVE ORDER NUMBER 96-297

WHEREAS, Florida has an abundance of water resources and related natural systems, whose sustainability is vital to the economic and environmental health of the State, and

WHEREAS, Florida water law is founded on the principles that water is a state resource that belongs to the public, and that water use must be managed both to protect Florida's rivers, lakes, wetlands, aquifers, and coastal waters and to meet the water supply needs of the public, and

WHEREAS, in certain areas of the state, withdrawals and diversions from surface watercourses, aquifers, and surface waters have caused harm to water resources and related natural systems, emphasizing the need for adequate funding and prudent development of water supplies within the context of coordinated water supply and land use planning, and

WHEREAS, we must adequately inventory, conserve, manage, and develop our water resources in a manner to ensure their sustainability and the sustainability of related natural systems, while meeting the water supply needs of the public, and

WHEREAS, Chapters 163, 373, 380, and 403, Florida Statutes, and various other laws, provide authority and direction to preserve and protect the waters of the state and to plan, manage, and provide for their proper use consistent with the public interest, and

WHEREAS, the Land Use and Water Planning Task Force and the Water Management District Review Commission provided recommendations regarding water resources issues, many of which can be implemented under existing statutory authority, and

WHEREAS, the Governor has the constitutional duty to faithfully execute Florida law, and the Water Management Districts, under the general supervisory authority of the Department of Environmental Protection pursuant to section 373.026(7), Florida Statutes, serve as trustees of Florida's publicly owned water resources.

NOW, THEREFORE, I, LAWTON CHILES, Governor of the State of Florida, by the powers vested in me by the Constitution and laws of the State of Florida, do hereby promulgate the following executive order, effective immediately:

Section 1.

To promote the establishment of minimum flows and levels, as needed, throughout the state, the Department of Environmental

Protection (hereinafter the "Department") is directed to work with the Water Management Districts (hereinafter the "Districts") to ensure that by November 15, 1996, and annually thereafter, each District submits to the Department a priority list and schedule for the establishment of minimum flows and levels for surface watercourses, aquifers, and surface waters within the District.

The initial priority list and the updated priority lists are to be based upon the importance of the waters to the state or region and the existence of, or potential for, significant harm as set forth in section 373.042(1), Florida Statutes.

Special consideration is to be given to establishing minimum flows and levels for waters within designated water resource caution areas.

It is expected that the Southwest Florida Water Management District will include on its initial priority list waters within the area described in section 373.042(2), Florida Statutes.

Section 2.

The Department shall work with the Districts, providing technical and staff assistance where possible, to help ensure that the Districts:

(1) Complete the establishment of minimum flows and levels for surface watercourses, aquifers, and surface waters on their initial priority lists by the end of fiscal year 1999, except that establishment of minimum flows and levels for waters within the area described in section 373.042(2), Florida Statutes, is to be completed pursuant to the time requirement in section 373.042(3), Florida Statutes.

(2) Base the establishment of minimum flows and levels on scientific determinations of the sustainability of water resources and related natural systems, using the best information available.

(3) Re-evaluate minimum flows and levels periodically and revise them when necessary.

(4) Implement minimum flows and levels equitably and fairly, and in a manner to help ensure the sustainability of water resources and related natural systems.

(5) Develop consistent methods for establishing and implementing minimum flows and levels where needed and practicable, including consistent processes for peer review. However, peer review for minimum flows and levels for waters within the area described in section 373.042(2), Florida

Statutes, is to be conducted pursuant to section 373.042(4), Florida Statutes.

Section 3.

The Department is directed to work with the Districts to help ensure comprehensive water supply planning by the Districts, for at least a 20-year planning period, which is done in coordination with land use planning, which considers other local and regional water supply plans, which is open to the public, and which includes broad participation by interested and affected parties, within the following framework:

(1) By July 1, 1997, one or more water supply planning regions shall be identified within each District, which singly or together encompass the entire district, based on surface watersheds, groundwater basins, and other factors, as appropriate.

(2) By July 1, 1998, a district-wide water supply assessment shall be completed which determines for each water supply planning region, for at least a 20-year planning period:

(a) Existing legal uses, reasonably anticipated future needs, and existing and reasonably anticipated sources of water and conservation efforts.

(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 natural systems.

(c) Whether harm to the water resources or related natural systems has occurred or is reasonably expected to occur, wholly or partially as a result of water withdrawals.

(3) By October 1, 1998, regional water supply planning shall be initiated for each region where sources of water are determined not to be adequate for the planning period to supply water for all existing legal uses and reasonably anticipated future needs, and to sustain the natural systems, or where harm to the water resources or related natural systems has occurred or is reasonably expected to occur wholly or partially as a result of water withdrawals, in order to meet the water supply needs of all existing and future legal uses and the natural systems within the region.

(a) Each regional water supply plan is to be completed within eighteen months of being initiated, unless a delay is justified.

(b) Each regional water supply plan shall identify water supply options, including alternative water supplies, which are

environmentally, technically, and economically feasible for the planning region; a proposed schedule and projected costs for implementing feasible options; and funding mechanisms.

(c) Each regional water supply plan shall incorporate the minimum flows and levels that are established within the planning region.

(4) The district-wide assessments and the regional water supply plans are to be updated at least every five years. Additional regional water supply planning is to be initiated and completed, as needed pursuant to the guidelines in this section.

(5) Beginning November 15, 1997, and annually thereafter, the Department will submit to the Office of the Governor and the Legislature a report on the status of water supply planning in each District. Working in cooperation with the Districts, the Department of Community Affairs, and local government, the Department will include in the report a section on efforts and accomplishments in coordinating regional water supply planning and land use planning.

(6) This section is not intended to restrict water supply planning efforts, but to ensure accountability to the people of this State and provide a consistent framework within which to conduct regionally based water supply planning.

Section 4.

In furtherance of water supply planning pursuant to section 3 of this Executive Order, the Office of the Governor will develop and conduct a process to investigate and formulate recommendations on effective means for water supply development and funding and, as necessary, water supply planning. This process will be open to the public and will encourage and provide the opportunity for the voluntary participation of all interested private interests, levels of government, and members of the Legislature. For purposes of this executive order, "water supply development" means the development and distribution of adequate, safe, and dependable water supplies, including traditional and alternative supplies, for all existing and projected legal uses, in a manner which sustains water resources and related natural systems.

(1) In the consideration of local, regional, and statewide issues and approaches, as appropriate, this process will address:

(a) Mechanisms for water supply development, including the legal and institutional framework needed for water supply development, and the assignment of responsibilities.

(b) The relationship of water supply planning and land use planning to water supply development and funding.

(c) Various funding options for water supply development, with consideration of new or existing federal, state, regional, or local government or private sources, joint ventures, grant and loan programs, water use fees, rate structures, and others.

(d) Existing and potential incentives for, and obstacles to, development of economically, environmentally, and technically feasible water supplies, with particular emphasis on water conservation, alternative water supply development, and the application of innovative technologies.

(2) This process may include discussion of other related issues, as appropriate, including relevant recommendations of the Land Use and Water Planning Task Force and the Water Management District Review Commission.

(3) The Departments of Environmental Protection and Community Affairs are directed and the Public Service Commission, the Office of Public Counsel, and the Water Management Districts are requested to provide assistance as needed to carry out the provisions of this section.

(4) By February 1, 1997, the Office of the Governor shall submit to the Governor and the Legislature appropriate recommendations, if any, developed through the process conducted pursuant to this section. This process may be continued beyond

February, 1997, as deemed appropriate, to develop further recommendations.

Section 5.

The Office of the Governor recognizes the extensive and diligent work of the Water Management District Review Commission and commends the Commission for its general support for maintaining Florida Water Law and for maintaining and improving Florida's system of water management.

Consistent with the Commission's recommendation regarding Executive approval of District budgets, the Legislature has enacted and the Office of the Governor will implement section 373.536(5), Florida Statutes.

Many of the Commission's recommendations which address improving District operations and programs are consistent with Florida law and can be implemented under existing statutory authority. The Department is directed to work with the Districts to develop a report, to be submitted to the Governor by November 1, 1996, which lists the recommendations of the Water Management District Review Commission the Department and Districts are implementing or will implement under their existing statutory authority, and how they are implementing or will implement the listed recommendations. The Department will provide copies of

the report to the Legislature and will make copies available to other interested parties, including local governments.

Section 6.

This executive shall expire five years from the date it becomes effective unless an extension is required to further the goals stated herein.

IN TESTIMONY WHEREOF, I have hereunto set my hand and have caused the Great Seal of the State of Florida to be affixed at Tallahassee, the Capitol, this 30th day of September, 1996.

Lawton Chiles
GOVERNOR

ATTEST:

Sandra B. Mortham
SECRETARY OF STATE

APPENDIX B—DISTRICT WATER SUPPLY PLANNING PROCESS, WATER SUPPLY NEEDS AND SOURCES ASSESSMENT, ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

DISTRICT WATER SUPPLY PLANNING PROCESS
Water Supply Needs and Sources Assessment
St. Johns River Water Management District

Introduction

As part of its *Water Supply Needs and Sources Assessment* report completed in 1994, the St. Johns River Water Management District (SJRWMD) identified approximately 38% of the District as Priority Water Resource Caution Areas. These are areas where water supply problems currently exist or where proposed withdrawals to meet demands for the year 2010 are projected to result in significant harm to ground or surface water resources. For groundwater, the criteria used to determine significant harm are impacts to native vegetation, minimum flows from springs, groundwater quality, or impacts to existing legal users. For surface water, the criteria used are the minimum flows and levels established for specific lakes and stream segments.

Executive Order No. 96-297, signed by the Governor on September 30, 1996, requires the water management districts (WMDs) to accomplish certain tasks relating to the development of regional water supply plans by specific dates. Those tasks include a requirement for each WMD to identify "one or more water supply planning regions...which singly or together encompass the entire district" by July 1, 1997, and then to initiate planning "for each [planning] region where sources of water are determined not to be adequate for the planning period" by October 1, 1998.
This same language is included in CS/HB 715, now known as Chapter 97-160, *Laws of Florida*, which was passed by the 1997 legislature, signed by the Governor on May 29, 1997, and is effective July 1, 1997. Chapter 97-160 is more specific in terms of the contents of the regional plans than the Governor's Executive Order, except that, although both the Order and Chapter 97-160 require that the regional plans be initiated by October 1, 1998, Chapter 97-160 has no deadline for completion whereas the Order requires completion within 18 months. Because both the Executive Order and Chapter 97-160 are in force and do not conflict, the WMDs will have to comply with the requirements of both, for example, initiate the plans by October 1, 1998, and complete them within 18 months. Chapter 97-160 also states that the planning for the regional plans "be conducted in an open public process."

To meet the requirements of both the Executive Order and Chapter 97-160 concerning the identification of planning regions, the entire St. Johns River Water Management District will be considered one water supply planning region (Figure 1). However, within this one water supply planning region, five separate water supply work group areas based on water supply planning issues have been identified (Figure 2). Work

group areas focus on Priority Water Resource Caution Areas (PWRCAs), but some work group areas also include surrounding areas within which groundwater withdrawals may influence conditions in the PWRCAs and/or withdrawals in the PWRCA may influence conditions in the surrounding areas. In one case, Work Group Area I, the work group area extends beyond the boundaries of SJRWMD, into the South Florida and Southwest Florida WMDs.

The planning process described below has been designed to develop work group area water supply plans as a bases for a regional water supply plan for the entire District through a cooperative process that is open to water suppliers, water users, local and state governments, environmental and special-interest groups, and the general public. The SJRWMD goal in preparing the regional water supply plan for the District is to avoid the potential water supply problems in the PWRCAs through the identification and development of dependable alternative sources of water that will not violate the impact criteria. To avoid confusion, the regional water supply plan for the entire District required by the Executive Order and Chapter 97-160 will be referred to as the District Water Supply Plan.

Planning Process

The planning process to be implemented over a period of two years is described below, including a schedule.

Step 1. Investigate the technical, environmental, and economic feasibility of various alternative water supply strategies.

These feasibility investigations are underway and are scheduled to be completed in mid-1997. They include the use of surface water, aquifer storage and recovery, lower quality water sources, mitigation and avoidance of the impacts of groundwater withdrawals, artificial recharge, water conservation and the reuse of reclaimed water, interconnection of water supply facilities, interconnection of wastewater facilities, and optimization/relocation of groundwater withdrawals. The investigations are being guided and reviewed by the Water Supply Planning Advisory Group, which consists of public water supply engineers, agricultural water users, and state government and WMD staff. When completed, the results of the investigations will be reviewed with the Water Utility Advisory Board and Agricultural Advisory Committee and will be available for use by participants in the regional water supply planning process.

Step 2. Identify perspective participants for water supply planning work groups.

SJRWMD in consultation with the Alternative Water Supply Strategies Consultant Team and the Water Supply Planning Advisory Group, Water Utility Advisory Board, and Agricultural Advisory Committee will develop a mailing list of major water suppliers, environmental groups, public-interest groups, representatives of relevant governments, and developer groups as perspective participants in the water supply planning work groups for each water supply planning work group area. These work groups will work closely with SJRWMD staff and consultants to develop acceptable water supply plans for their respective work group area. It is anticipated that sub-groups may need to be established within some of the work groups to address specific issues and that significant communication between work groups may be necessary.

Step 3. Announce initiation of cooperative planning process.

A letter from SJRWMD's Executive Director will be sent to the chief elected and professional official in each local government, the directors of municipally owned and private water utilities, and the heads of major water user groups, environmental groups, public-interest groups, and developer groups within each work group area explaining the concept of water supply plans and their development, and requesting their cooperation and the active participation in the plan development process. This letter will be designed to succinctly describe the District's water supply planning process and the importance of all stakeholders' participation in the process, and will also announce the workshops described in Step 4. The letter will be sent to all those on the mailing lists developed in Step 2 for each work group area.

Step 4. Present information and obtain input on the planning process at public workshops.

The purpose of the public information workshops will be to 1) present the water supply planning process, 2) review the concept and work of the water supply planning work groups, 3) present the results of work done to date on the alternative water supply feasibility investigations, and 4) request input that could lead to changes in the recommended planning approach or work of the work groups. The public workshops will include representatives of all major water suppliers, local governments, environmental groups, regional planning councils, relevant state agencies, special-interest groups, and the interested public within each work group area. Workshops in different geographic areas of the work group area may be necessary to adequately inform stakeholders of the process. The mailing list for the first workshop announcement will be that developed in Step 2. The original workshop mailing list will be refined based on workshop attendance and other input. Separate mailing lists will be

developed for each work group area, although some organizations and individuals may appear on more than list.

Step 5. Develop proposed water supply plans through water supply planning work groups.

SJRWMD, through coordination with the water supply planning work groups, will develop proposed water supply plans for each work group area (WGA), which are acceptable to the members of the work group and SJRWMD. The schedule and agenda for each work group meeting will be mailed to individuals on that WGA mailing list. These meetings will be open to the public. As envisioned, the work groups will be comprised of the individuals who attend each work group meeting. Therefore, it is critical that the importance of participating in the publicized work group sessions be communicated to all interested groups and individuals. The WGA plans will be developed using the results of investigations described in Step 1 and will be designed to solve any existing water supply problems and to avoid predicted water supply problems. SJRWMD staff and consultants will assist the work groups by conducting further investigations as necessary and in the use of an integrated decision model being developed for the SJRWMD by the University of Florida Center for Applied Optimization to compare costs and optimize solutions for consideration. The plans will contain a water supply development component, a water resource development component, a funding strategy component, and other components as required by Sec. 373.0361, *FS*, created by Section 4 of Chapter 97-160, *Laws of Florida.* The planning process is designed to insure the acceptability of the plans based on SJRWMD impact criteria. Representatives of major water suppliers participating in the work groups will be expected to coordinate as necessary with the involved local governments to ensure, to the extent possible, that the portion of the plan associated with each local government is acceptable to the officials of that local government so that they will support the plans' implementation. In addition, although there is no specific requirement in the Executive Order or Chapter 97-160, the plans should be considered in updates of the appropriate local comprehensive plans. It is anticipated that considerable interaction between work groups as well as individual water suppliers will be necessary during this process. SJRWMD will facilitate this interaction as appropriate. Regular reports of the work groups' progress will be presented to the District's Governing Board, the Water Utility Advisory Board, and the Agricultural Advisory Committee. Interested groups will be noticed and encouraged to attend these progress reports; SJRWMD can also make these regular reports to interested groups directly, when needed.

Step 6. Present draft work group area water supply plans to major water suppliers, local and regional government officials, and interested public within each work group area.

This presentation of the draft WGA plans will be made in a workshop setting. The purpose of this workshop will be to receive input that could be the bases of revisions to the plans. As in Step 4, workshops in different geographic areas of the WGA may be required. Presentations to individual water user groups, government officials, special-interest groups, and others will be scheduled as necessary.

Step 7. Public comment taken back to water supply work groups for revisions and finalization of draft WGA plans.

Comments from the workshops on the draft WGA water supply plans will be reported to the appropriate work groups for their consideration and possible revision and finalization of the draft plans.

Step 8. Present draft District Water Supply Plan to the Governing Board.

The final plans of the water supply planning work groups will be combined by SJRWMD staff and consultants into the draft District Water Supply Plan that will be presented to SJRWMD's Governing Board for review. Recommendations concerning SJRWMD's funding of the implementation of the plan will also be presented.

Step 9. Notify work groups, major water suppliers, local and regional government officials, and interested public on changes to the draft District Water Supply Plan by the Governing Board.

The Governing Board's recommended comments and changes to the draft District Water Supply Plan will be shared with the work groups, major water suppliers, local and regional government officials, all the involved and interested groups, and the general public. Follow-up meetings with the work groups will be held only if needed. All interested persons and groups will be notified of the date for final Governing Board action, the process to make comments, and the availability of the draft plan for review.

Step 10. Develop final District Water Supply Plan.

Based on the results of the Governing Board presentation described in Step 8 and the comments received from the process described in Step 9, the draft District Water Supply Plan and associated implementation strategies will be revised and finalized. The final District Water Supply Plan will be prepared by SJRWMD staff and consultants for

review and acceptance by SJRWMD's Governing Board. A public workshop will be held to review the final plan on the morning prior to the Board's vote on approval of the plan. The approved final plan will be adopted by reference in the update of the DWMP, which must be completed by November 1999.

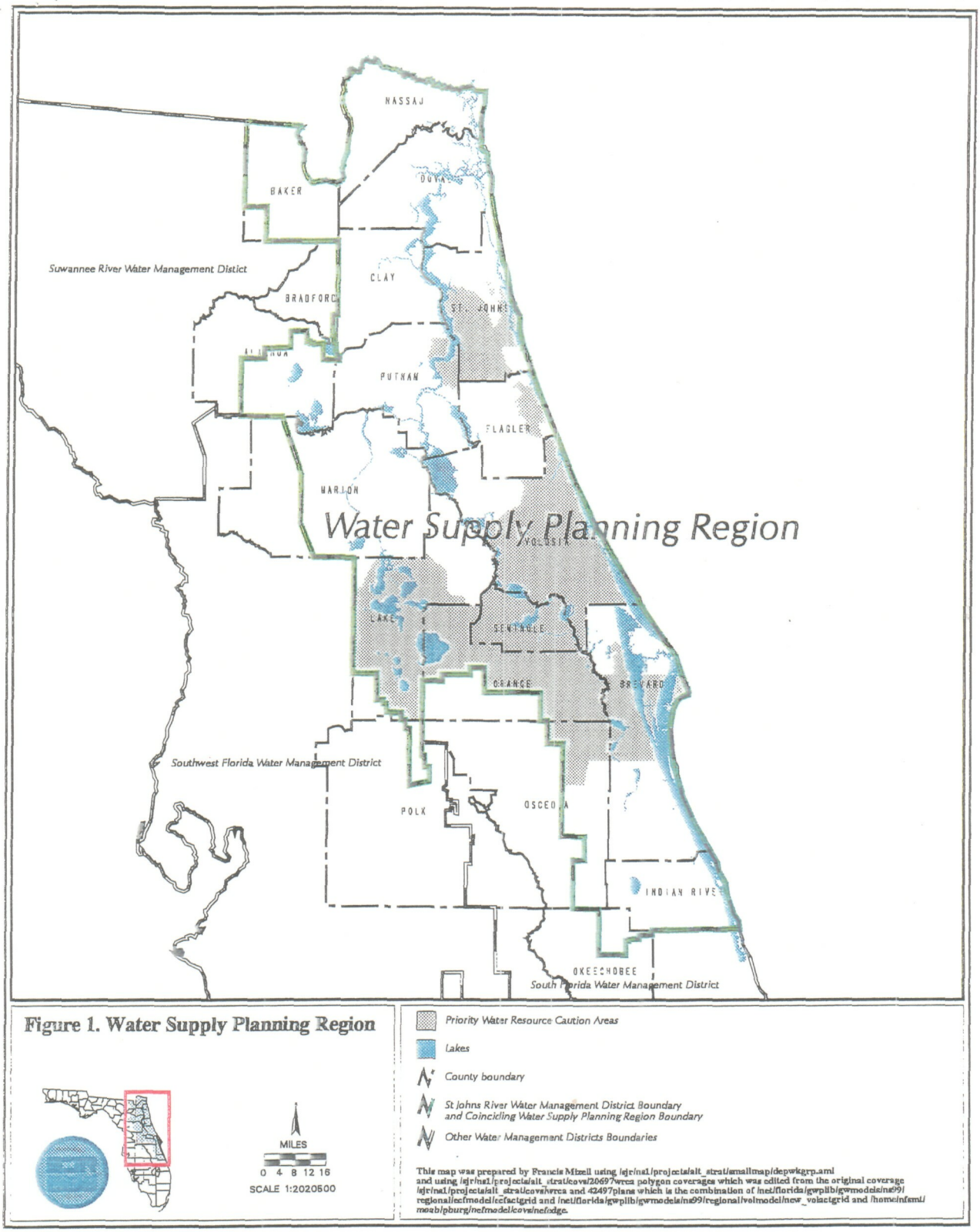

Figure 1. Water Supply Planning Region

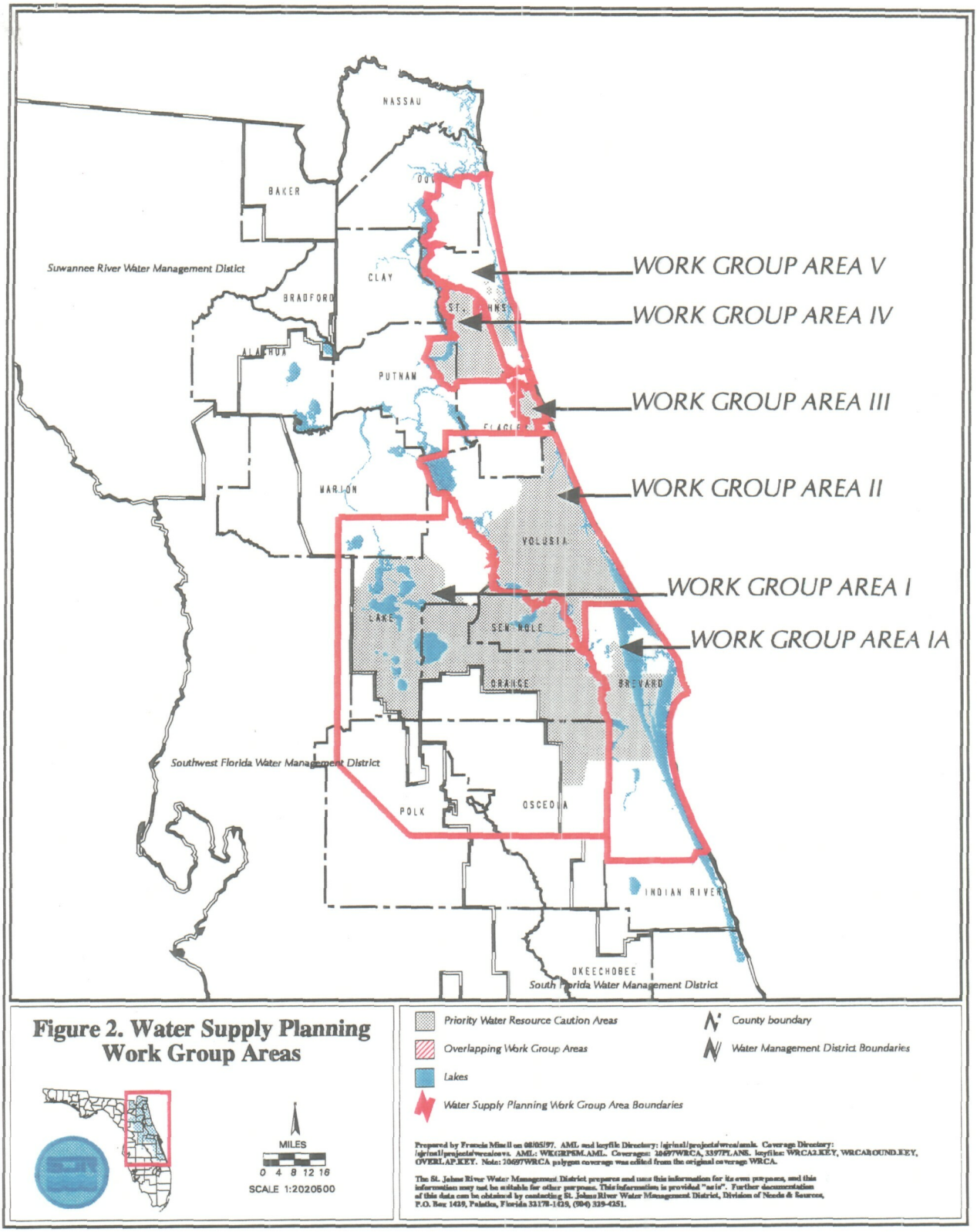

Figure 2. Water Supply Planning Work Group Areas

OUTREACH PROGRAM PLAN
District Water Supply Planning Process
St. Johns River Water Management District

OVERVIEW

To meet the requirements of Executive Order 96-297, signed by the Governor of September 30, 1996, and Chapter 97-160, *Laws of Florida*, SJRWMD has developed a two-year planning process for the development of regional water supply plans for the entire District. The process began with the review of the process and the planning regions by SJRWMD's Governing Board in June 1997, and will end with the Board's review and acceptance of the final District Water Supply Plan in September 1999. A description of the SJRWMD Water Supply Planning Process is attached.

As described in the planning process document, the entire SJRWMD is considered to be one water supply planning region, and within this one region, five separate work group areas (WGAs) have been identified. WGAs are the basic planning unit for the water supply planning process and will be the bases for the District Water Supply Plan. The WGAs include areas both within and outside of the Priority Water Resource Caution Areas (PWRCAs). The PWRCAs are areas where there are current or potential water supply problems based on projected water withdrawals to the year 2020. Because the WGAs are of different sizes and there are different water supply planning issues associated with each, the Outreach Program will be implemented on varying scales. A full-scale plan would be appropriate for a large WGA with a variety of potential water supply problems and a large number of stakeholders. The activities described can be scaled down to meet the needs of the specific WGA for which a plan is being developed. However, the goals and general strategies are appropriate for an outreach program on any scale.

Because Chapter 97-160 requires that the development of the water supply plans "be conducted in an open public process," and the Executive Order contains similar language, SJRWMD has designed the planning process to be a cooperative effort involving the SJRWMD, its consultants, and as many of the groups and individuals interested in water supply as can be identified. To assure the involvement of as many stakeholders as possible, the Outreach Program described below is a basic part of the planning process. It is designed to obtain and maintain involvement and support from utilities, water users, elected state and local officials, governmental agency staffs, environmental, agricultural and developers groups, and the general public to assist in the development of the WGA plans and the District Water Supply Plan (DWSP), to

support the DWSP as it moves through the review and approval process, and to assure its timely implementation.

OUTREACH GOALS

- To involve all affected governments, water suppliers and users, special-interest groups, and the general public in the planning process.
- To build consensus on the planning process.
- To obtain support from all affected governments, water suppliers and users, special-interest groups, and the general public for the development and, more importantly, the implementation of the District Water Supply Plan.

GENERAL ISSUES AND STRATEGIES

The primary issues, are 1) that there will be water supply problems in some areas of SJRWMD (Priority Water Resource Caution Areas) if withdrawals to the year 2020 are made as projected, and 2) that there will be increased costs to develop alternative water sources to meet the projected needs in the PWRCAs. The proposed general strategy to address both these issues, especially the cost issue, is to involve as many of the affected governments, groups and individuals, i.e., stakeholders, as possible over a two-year planning period through an outreach program using all types of media, personal meetings, workshops, and publications. The objective of the outreach program is to convince the government officials, groups, and general public of the need for alternative water supply development and to involve them in the selection of the alternatives for their regions with full knowledge of the costs. If this involvement can be achieved, support for acceptance and implementation of the plans should follow even if increased water rates are required.

Stakeholder involvement in the planning process will be primarily through public workshops designed to inform them about water supply issues and potential problems, and to obtain their input on these topics. In addition, involvement by stakeholders is also needed on the Water Supply Work Groups that will assist the SJRWMD staff in the development of the work group area water supply plans, and in the review of the draft DWSP developed from the work group plans. Stakeholders will also have the opportunity to comment on the draft and final work group area plans and DWSP in public workshops included in the planning process. The Outreach Program is designed to ensure that all stakeholders are informed about and participate in these input opportunities.

SJRWMD will implement the intergovernmental coordination with local and state government elected officials and the public outreach effort through a coordinated effort

by SJRWMD's Division of Policy and Planning (P&P), which includes intergovernmental coordinators, and the Office of Public Information (OPI), which includes the public outreach coordinators.

This coordinated effort will include the use of the existing communications tools at SJRWMD, such as the District's Internet Web page, *StreamLines*, P&P's monthly mailer to local elected officials, and OPI's educational programs such as the grade school *WaterWays* curriculum, and the middle and high school *Legacy* resource management education program. In addition, new tools, such as a brochure about the planning process, a newsletter, news releases, and other brochures will be developed. A logo and standard graphic design format will be developed to identify any new printed materials with the water supply planning process. The logo and design will also be used to identify articles about the process in existing publications.

In addition to news releases based on specific events or milestones throughout the two-year planning process, special media campaigns (outreach blitzes) will occur at three crucial times.

- Prior to the public workshops scheduled in October 1997
- Prior to the draft plan workshops scheduled for January 1999
- Prior to the SJRWMD Governing Board consideration of the final District Water Supply Plan for approval in September 1999.

Reporters will be alerted and press releases issued to draw attention to these milestones in the planning process. In addition, speakers' bureaus, media tours and other specific activities will be used to focus public attention on these milestones.

The Intergovernmental Coordinators will inform municipal, county and state elected officials about the planning process in the normal course of their visits to these officials. Specific visits will also be made for this purpose. Special information materials including a water supply planning brochure and a slide show and/or video (available later in the summer) will be used during these visits.

A mailing list of all interested groups, such as environmental, developer/builders, agricultural, other special-interest groups, and citizens groups, such as the League of Women Voters and tax watch groups within each WGA will be developed to alert people about the process and how they can be involved. Consensus is best reached if all interests are allowed to participate from the beginning of the water supply planning process.

A series of workshops or meetings will be planned to inform government officials, their staffs and citizens about the process, and to ask for their involvement when the process begins and at key points throughout the development of the plans. The following pages describe outreach efforts for various stakeholder groups or target audiences.

Target Audience: Elected Local and State Officials

Audience Description: Local elected officials are critical to the plan development process since the majority of water supply utilities in the PWRCAs are municipally owned and governed by elected local officials. It is the local elected officials and utilities that will implement the plans and will have to make difficult decisions concerning sources of funding to support alternative sources. Their understanding of the problems, involvement in the planning process and continuing support for the process at each step is the only way to assure ultimate approval and implementation of the plans. In addition, local elected official support is needed for involvement of local government staffs, who are also important to the success of the planning process (see next Targeted Audience).

State elected officials must be involved so that they understand the problems and planning process, to assure that state legislation supports the planning process as proposed and possibly to provide financial and other types of assistance to local governments in the implementation phase of the plans.

Audience Goal: To educate, inform, and provide technical support to local and state elected officials throughout the entire planning process to assure their involvement, and that of their staffs, in developing the plans and to assure the plans' implementation once approved.

Key Messages To Audience:

- PWRCAs are areas where water supply problems currently exist or where withdrawals proposed to meet demands for the year 2020 are projected to result in significant harm to ground or surface water resources.
- Extensive study and planning efforts are underway to avoid potential problems and meet the future water needs of the municipalities and legislative districts represented by them.
- Water supply planning must take place regionally based on groundwater and surface water basins (work group areas).
- Their involvement is critical since these plans will affect their communities directly, particularly in relation to the future sources and costs of water.

Strategies:

- A letter from Henry Dean will be sent to every city, county and state elected official within each work group area (WGA), with a description of the water supply planning process, and his invitation for their involvement in the process. The letter will also include an invitation to one of the workshops that will be scheduled for several locations within the WGA to provide information on the process and describe planning work groups.
- Follow-up meetings will be held by Intergovernmental Coordinators (IGCs) and/or other SJRWMD or utility staff based upon requests from elected officials as a result of H. Dean's letter.
- Preworkshop meetings will be conducted on water supply overview and the promotion of future workshops (**Note:** need for these to be determined from responses to H. Dean's letter and IGCs' meetings.).
- Implement the schedule of workshops throughout the WGA with the purpose to review the planning process and to review the proposed planning work groups suggested by the Water Utility Advisory Board and the Agriculture Advisory Committee. Workshops will be creatively designed to allow for input from officials, which may change composition of the planning work groups. One concept is to have three discussion groups with appropriate SJRWMD staff concerned with water supply problems, potential solutions, and implementation strategies, and encourage the local officials to move from group to group providing their input at each group. Local officials might meet in afternoon and general public/interest groups in evening based on DWMP workshop model.
- Provide a continuous flow of information throughout process to elected officials through all available means such as Web page, *StreamLines*, Monthly Mailer, informational brochures and fact sheets, personal contacts by IGCs and other SJRWMD staff, presentation to city and county commissions, speakers' bureau, tours, slide shows.
- Monitor changes to elected offices as a result of elections during the planning process and make a special effort through the Intergovernmental Coordinators and other appropriate staff to inform and update the newly elected officials on the background and status of the planning process in the area they represent.
- Hold meetings to present draft WGA plans to elected officials when they are completed. Input obtained will be used to finalize plans.
- Send invitations to all elected officials to attend Governing Board meeting for presentation of the draft District Water Supply Plan.
- Send invitations to all elected officials to attend Governing Board meeting for presentation of final District Water Supply Plan.
- Determine if meetings/workshops necessary for implementation phase of the final plan.

Target Audience: Local Government, State, and Regional Agency Staff

Audience Description: Staff to elected officials are another key component in developing support for the planning process. These are the professionals who are involved in the day to day activities of operating the various levels of government and their supporting agencies. Their involvement is important since they will be providing information to the elected officials and, more importantly, they are the ones who will actually be involved in the implementation of the approved plans. They also have detailed information about local conditions and problems, which will be helpful in the planning process. Their involvement depends upon the support of their elected officials to allow the commitment of staff time, while at the same time, the information and support of the staff will have a significant impact on the level of support of the elected officials for the planning process. Therefore, the programs and information provided to the elected officials and their professional staffs must be closely coordinated. State agencies involved will be primarily the DEP and Public Service Commission (PSC); regional agencies will be other water management districts and regional planning councils, and any other special districts that might express an interest. Although not always composed of professionals, appointed advisory boards to local governments and state agencies, e.g., environmental or water advisory boards, should be included in this group where relevant.

Audience Goal: To educate, inform, and provide technical support to local, state and regional agency staffs throughout the entire planning process to assure their involvement in developing the WGA plans and to assure the final DWSP implementation once approved.

Key Messages To Audience:

- PWRCAs are areas where water supply problems currently exist or where withdrawals proposed to meet demands for the year 2020 are projected to result in significant harm to ground or surface water resources.
- Extensive study and planning efforts are underway to avoid potential problems and meet the future water needs of their municipalities and districts.
- Water supply planning must take place regionally based on groundwater and surface water basins (work group areas).
- Agency staff involvement is critical since the plans will affect their communities directly, particularly in relation to the future sources and costs of water, and they will be the professionals who will have to implement the plans that are approved.

Strategies:

- Agency staffs will be included in the workshops and meetings listed under "local elected officials."
- Since attendance at functions for elected official and involvement in the planning work groups might be limited to a few top managers from each agency, a separate series of workshops and/or meetings may have to scheduled for the staff personnel that actually do the day to day work. The material provided at these meetings and through various mailings could be more technical than that provided to the elected officials. The need for and development of a program for agency staffs will depend on the response to H. Dean's letter and how elected officials choose to be represented at the workshops and on planning work groups.
- Create a separate mailing list of staff personnel to allow for dissemination of technical information in addition to that provided to elected officials
- Provide information to local government staffs (cities and counties) informing and encouraging them to include information about the water supply planning process in their Evaluation and Appraisal Reports (EARs) for their Comprehensive Plans. Even though the final WGA water supply plans will not be complete by the due dates for many of the municipalities' EARs, information about each municipality's involvement in the process and any relevant information developed should be included in their report.

Target Audience: Environmental/Public-interest Groups

Audience Description: Several environmental and public-interest groups, such as the Florida Audubon Society, the Sierra Club, The Friends of Wekiva, The League of Women Voters are active throughout the District, while others such as the Lake County Conservation Council are concerned with specific areas within the District. Statewide associations, such as the League of Cities, Association of Counties, Association of Special Districts, the Regional Councils Association, and other similar associations are included in this audience.

Audience Goal: To obtain the involvement and support of these groups in the planning, approval, and implementation phases of the planning process. Environmental groups are particularly critical to this planning process, since water supply is a basically an environmental issue.

Key Messages To Audience:

- PWRCAs are areas where water supply problems currently exist or where withdrawals proposed to meet demands for the year 2020 are projected to result in significant harm to ground or surface water resources.

- Extensive study and planning efforts are underway to avoid potential problems and meet the future water needs of Florida.
- Water supply planning must take place regionally based on groundwater and surface water basins (work group areas).
- The involvement of the environmental community is needed to ensure that environmental concerns are not overlooked in the selection of alternative sources.
- Regional and statewide environmental and public-interest groups need to be involved to insure that the interests they represent are considered and served in the planning process.

Strategies:

- Grassroots meetings can be arranged to inform the leadership of the various organizations on the water supply planning process. These groups will be asked for their support and informed on how they might assist the process.
- These groups should be invited to participate in the workshops and WGA planning sessions.
- Environmental, public-interest and statewide groups are capable of producing newspaper "letters to the editor." They also make wonderful sources for newspaper and television coverage. Members of these groups are invaluable in presenting the "public view." Generally speaking, a volunteer member of the League of Women Voters or Friends of the Wekiva comes across as more credible than a paid employee of a water utility or the water management district. An informed and vocal member of the public does not have those apparent conflicts of interest.
- Provide presentations and/or displays at conventions or meetings of any of the groups in this audience.

Target Audience: **Builder/Developer, Economic/Community Development, and Business Groups**

Audience Description: The common interest of these groups is primarily economic. Their interest and reason for involvement in water supply planning revolves around their ability to continue residential, commercial, and industrial developments without the constraining problem of water shortage. Without their support it will be almost impossible to have the plans accepted and implemented.

Audience Goal: To educate, inform, and gain the support of these economically oriented groups throughout the entire planning process and to obtain their involvement in developing the plans and supporting their acceptance and implementation of the plans.

Key Messages To Audience:

- PWRCAs are areas where water supply problems currently exist or where withdrawals proposed to meet demands for the year 2020 are projected to result in significant harm to ground or surface water resources.
- Extensive study and planning efforts are underway to avoid potential problems and meet the future water needs of the municipalities and areas in which they operate.
- Water supply planning must take place regionally based on groundwater and surface water basins (work group areas).
- Without the development of these water supply plans through a rational and open planning process, the future of economic development in the PWRCAs of SJRWMD is uncertain.

Strategies:

- Generally, these groups will be approached using the same strategies listed under the "Environmental/Public-interest Groups" above.
- These groups should be invited to participate in the workshops and WGA planning sessions.
- A specific presentation should be developed for meetings of home builders, economic development groups, and chambers or commerce including economic issues related to the need for water supply planning in each work group area.
- SJRWMD has recently joined many of the major chambers of commerce and can use involvement in working committees and chamber activities as a means to share information about water supply.
- Create a separate mailing list for this group to allow for dissemination of economic and technical information in addition to that provided to other groups.
- Provide presentations and/or displays at conventions or meetings of any of the groups in this audience, including related professional such as engineers, architects, landscape architects, and others.

Target Audience: General Public

Audience Description: This group would include every one who is not included in one of the groups listed above, including students at all grade levels. Their interest in water supply planning relates to concerns for future water supply, especially how they and their lifestyles might be affected by water shortages or restrictions on use. This group would provide the broad base of support needed and wanted for the acceptance and implementation of the plans. The general public is in fact the group that will ultimately bear the increased costs associated with alternative water supplies.

Audience Goal: To educate, inform, and gain the support of this group throughout the entire planning process and to obtain their involvement in developing, supporting acceptance and implementation of the plans.

Key Messages To Audience:

- PWRCAs are areas where water supply problems currently exist or where withdrawals proposed to meet demands for the year 2020 are projected to result in significant harm to ground or surface water resources.
- Extensive study and planning efforts are underway to avoid potential problems and meet the future water needs of their municipalities.
- Water supply planning must take place regionally based on groundwater and surface water basins (work group areas).
- Without the development of regional water supply plans through a rational and open planning process, water shortages or restrictive water use regulations may affect this group's current lifestyle.

Strategies:

- Generally, this group will be approached using the same strategies listed under the "Environmental/Public-interest Groups" plus the relevant strategies in the "General Issues and Strategies."
- Representatives of this group should be invited to participate in the workshops and WGA planning sessions.
- The material provided to this group should be relatively basic and oriented to lifestyles that might be affected for those residing in each work group area.
- Create a separate mailing list for this group to allow for dissemination of more generalized information than that provided to other groups.
- Utilize *StreamLines*, newspaper and other media coverage, and the Internet Web site as a means to reach this large and diverse group.
- Provide presentations and/or displays at meetings or functions attended by the general public, e.g., environmental or water-oriented fairs, home and garden shows, and Earth Day programs.
- Include material about water supply planning process in regular presentations to school/student groups.

Target Audience: Media

Audience Description: The major regional, daily newspapers and small community-based weekly newspapers, television and radio stations.

Audience Goal: To use the media to educate and involve the public in the water supply planning effort and support for final approval and implementation of plans.

Key Messages To Audience:

- PWRCAs are areas where water supply problems currently exist or where withdrawals proposed to meet demands for the year 2020 are projected to result in significant harm to ground or surface water resources.
- Water supply planning must take place regionally based on groundwater and surface water basins (work group areas).
- Extensive study and planning efforts are underway to avoid potential problems and meet the future water needs of Florida.

Strategies:

- Develop news stories around key events or activities during the process. News reporters have a tough time dealing with large, weighty topics. Therefore, the process will be pitched in manageable chunks. For example, the creation of a federal partnership can be a story. The implementation of water supply planning workshops, if designed for public consumption, is another story to be pitched, and so on as opportunities arise. The work at Lake Apopka provides a reasonable analogy. The SJRWMD outreach effort rarely pitches "The Lake Apopka Restoration," rather individual aspects of the restoration work are used as news hooks. For example, we might pitch the Duda Farm purchase closing, or the start of marsh flow-way construction.
- All forms or media coverage will have to be keyed to status of the work group plans in different work group areas (WGAs) since they will be developed on different schedules.

  Special contacts and news releases will be issued at the three milestone events discussed above under "General Issues and Strategies." Periodic press releases containing the "news hook" will also be issued as additional outreach opportunities present themselves. Newspapers will be approached about doing multiday "projects" about the potential water supply concerns and the work to create solutions in specific WGAs.
- Radio will be used in a limited way to provide coverage of community events relating to water supply planning.
- Feature stories are also a possibility. For example, a technology writer might be interested in doing a story about groundwater modeling. Personality profiles about persons involved in the water supply planning effort are also potential story ideas. Any and all story ideas suggested by committee members will be considered. The outreach team is open to any suggestions about producing stories for specialty publications such as agriculture-interest magazines, utility newsletters, Florida

Environments, Florida Specifier, Florida Trend, or any other publication that will help educate the public about the need to meet water supply challenges.

APPENDIX C—ST. JOHNS RIVER WATER MANAGEMENT DISTRICT, CHAPTER 40C-8, *F.A.C.*, MINIMUM FLOWS AND LEVELS

(Revised October 20, 1996)

ST. JOHNS RIVER WATER MANAGEMENT DISTRICT
MINIMUM FLOWS AND LEVELS

40C-8.011 Policy and Purpose.

(1) This chapter establishes minimum flows and levels for surface watercourses and minimum levels for groundwater at specific locations within the St. Johns River Water Management District.

(2) Where appropriate, minimum flows and levels may reflect seasonal and long term variations and may include a schedule of variations and other measures appropriate for the protection of nonconsumptive uses of a water resource.

(3) In establishing minimum flows and levels, the Governing Board shall use the best information and methods available to establish limits which prevent significant harm to the water resources or ecology. The Governing Board will also consider, and at its discretion provide for, the protection of nonconsumptive uses, including navigation, recreation, fish and wildlife habitat, and other natural resources.

(4) Where a minimum flow has been established for a specific watercourse or a minimum level has been established for a specific surface water body, the flow or level is expressed as a fluctuation regime which will include a series of minimum flows or levels reflecting a temporal hydrologic regime that will prevent significant harm to water resources or ecology.

(5) Minimum flows and levels prescribed in this chapter are used as a basis for imposing limitations on withdrawals of groundwater and surface water, for reviewing proposed surface water management and storage systems and stormwater management systems, and for imposing water shortage restrictions. The limitations and review criteria which relate to these minimum flows and levels are prescribed in other rule chapters of the District.

Specific Authority: 373.044, 373.113 FS. Law Implemented: 373.042, 373.415 FS. History--New 9-16-92. Amended 8-17-94.

40C-8.021 Definitions. Unless the context indicates otherwise, the following terms shall have the following meanings.

(1) "Blackwater Creek" means that watercourse designated Blackwater Creek within the Wekiva River Hydrologic Basin as defined by section 40C- 41.023, F.A.C.

(2) "Determined minimum surface water flow" means a flow, expressed in cubic feet per second combined with a temporal element. The temporal element may be specifically expressed as a duration and return interval or may be generally expressed as a hydroperiod category.

(3) "Determined minimum surface water level" means an elevation in feet NGVD combined with a temporal element. The temporal element, for purposes of this chapter may be specifically expressed as a duration and return interval or may be generally expressed as a hydroperiod category.

(4) "Intermittently exposed" means a hydroperiod category where surface water is present throughout the year except in years of extreme drought. In most lakes this category does not typically support emergent vegetation and would be characterized as open water or floating-leaved deep marsh. Water levels causing inundation are expected to occur more than ninety per cent of the time over a long term period of record.

(5) "Intermittently flooded" means a hydroperiod category where the substrate is usually exposed, but surface water is present with variable frequency and duration. Water levels causing inundation are expected to occur on average approximately once every ten years or more. Years may intervene between periods of inundation. On recharge lakes (sandhill type lakes), the dominant vegetation growing at this elevation can change as soil moisture conditions change, from a dominance of upland species to wetland species or the reverse. Duration of inundation is on the order of several months. Water levels are expected to inundate less than two per cent of the time over a long term period of record.

(6) "Long term or "long term period of record" means at least a 30 year continuos period.

(7) "Minimum frequent high" means a chronically high surface water level or flow with an associated frequency and duration that allows for inundation of the floodplain at a depth and duration sufficient to maintain wetland functions.

(8) "Minimum infrequent high" means an acutely high surface water level or flow with an associated frequency and duration that is expected to be reached or exceeded during or immediately after periods of high rainfall so as to allow for inundation of a floodplain at a depth and duration sufficient to maintain biota and the exchange of nutrients and detrital material.

(9) "Minimum average" means the surface water level or flow necessary over a long period to maintain the integrity of hydric soils and wetland plant communities.

(10) "Minimum frequent low" means a chronically low surface water level or flow that generally occurs only during periods of reduced rainfall. This level is intended to prevent deleterious effects to the composition and structure of floodplain soils, the species composition and structure of floodplain and instream biotic communities, and the linkage of aquatic and floodplain food webs.

(11) "Minimum infrequent low" means an acutely low surface water level or flow with an associated frequency and duration which may occur during periods of extreme drought below which there will be a significant negative impact on the biota of the surface water which includes associated wetlands.

(12) "NGVD" means National Geodetic Vertical Datum of 1929.

(13) "Permanently flooded" means a hydroperiod category where water covers the land surface throughout the year in all years. Vegetation, if present, is composed of aquatic macrophytes.

(14) "Phased Restriction" means the level or flow (based on the past 30 consecutive day average level or flow) at which a water use shortage phase (Phase I - IV as defined by 40C-21.251, F.A.C.), is declared and its associated restrictions imposed.

(15) "Seasonally flooded" means a hydroperiod category where surface water is typically present for extended periods (30 days or more) during the growing season, resulting in a predominance of submerged or submerged and transitional wetland species. During extended periods of normal or above normal rainfall, lake levels causing inundation are expected to occur several weeks to several months every one to two years.

(16) "Semi-permanently flooded" means a hydroperiod category where surface water inundation persists in most years. When surface water is absent the water table is usually near the land surface. In many lakes with emergent marshes this water level is near the lower elevation that supports emergent marsh or floating vegetation and peat substrates, or other highly organic hydric substrates. This characterization may not be true for herbaceous wetlands around sandhill type lakes, which often have emergent vegetation that follows declining water levels to below the lower elevation of peat substrate. Water levels causing inundation are expected to occur approximately eighty percent of the time over a long term period of record. Water levels causing inundation are expected to re-occur, on average, about every five to ten years for extended periods (several or more months) during moderate droughts.

(17) "Temporarily Flooded" means a hydroperiod category where surface water is present or the substrate is flooded for brief periods (up to several weeks) approximately every five years. Plants of upland and wetland species are characteristic. The composition of the vegetation at this water level is dependent upon whether the flooding predominantly occurs in the growing season, whether seepage from higher elevations is pronounced, and the nature of the soil. Lake water levels are expected to equal or exceed this elevation five per cent of the time or less over a long term period of record.

(18) "Typically saturated" means a hydroperiod category where for extended periods of the year the water level should saturate or inundate. This results in saturated substrates for periods of one-half year or more during non-flooding periods of typical years. Water levels causing inundation are expected to occur fifty to sixty per cent of the time over a long term period of record. This water level is expected to have a recurrence interval, on the average, of one or two years over a long term period of record. Obligate wetland plant species are expected to be predominate near this water level.

(19) "Wekiva River" means that watercourse designated Wekiva River within the Wekiva River Hydrologic Basin as defined by section 40C-41.023, F.A.C.

Specific Authority: 373.044, 373.113 FS. Law Implemented: 373.042, 373.415 FS. History--New 9-16-92. Amended 8-17-94, 6-8-95.

40C-8.031 Minimum Surface Water Levels and Flows and Groundwater Levels.

(1) The following minimum surface water levels and flows and minimum groundwater levels are established:

Wekiva River at the SR 46 Bridge.

	Level (ft NGVD)	Flow (cfs)	Duration (days)	Return Interval (years)
Minimum Infrequent High	9.0	880	≥7	≤5
Minimum Frequent High	8.0	410	≥30	≤2
Minimum Average	7.6	240	180	≥1.7
Minimum Frequent Low	7.2	200	≤90	≥3
Phase 1 Restriction	7.0	190	NA	NA
Phase 2 Restriction	6.9	180	NA	NA
Phase 3 Restriction	6.7	160	NA	NA
Phase 4 Restriction	6.5	150	NA	NA
Minimum Infrequent Low	6.1	120	≤7	≥100

Wekiva River Minimum Groundwater Levels and Spring Flows

	Head (ft NGVD)	Discharge (cfs)
Messant Spring	32	12
Seminole Spring	34	34
Rock Spring	31	53
Wekiva Spring	24	62
Miami Spring	27	4
Sanlando Spring	28	15
Starbuck Spring	31	13
Palm Spring	27	7

Black Water Creek at the SR 44 Bridge

	Level (ft NGVD)	Flow (cfs)	Duration (days)	Return Interval (years)
Minimum Infrequent High	27.0	340	≥7	≤5
Minimum Frequent High	25.8	145	≥30	≤2
Minimum Average	24.3	33	180	≥1.7
Minimum Frequent Low	22.8	.5	≤90	≥15
Phase 1 Restriction	22.7	2	NA	NA
Phase 2 Restriction	22.5	1	NA	NA
Phase 3 Restriction	22.4	0.6	NA	NA
Phase 4 Restriction	22.3	0.3	NA	NA
Minimum Infrequent Low	21.9	0	≤7	≥100

(2) The following minimum surface water levels are established:

LAKE NAME	COUNTY	HYDROPERIOD CATEGORY	MINIMUM INFREQUENT HIGH	MINIMUM FREQUENT HIGH	MINIMUM AVERAGE LEVEL	MINIMUM FREQUENT LOW	MINIMUM INFREQUENT LOW
ARGENTA	Putnam	Seasonally Flooded		50.1			
		Typically Saturated			47.7		
		Semipermanently Flooded				46.3	
BANANA	Putnam	Seasonally Flooded		38.0			
		Typically Saturated			36.2		
		Semipermanently Flooded				34.4	
BELL	Putnam	Temporarily Flooded		42.5			
		Typically Saturated			40.5		
		Semipermanently Flooded				38.7	
BLUE POND	Clay	Temporarily Flooded		174.1			
		Typically Saturated			173.3		
		Semipermanently Flooded				171.7	
BROOKLYN	Clay	Temporarily Flooded		114.6			
		Typically Saturated			108.0		
		Semipermanently Flooded				101.0	
BROWARD	Putnam	Temporarily Flooded		40.0			
		Typically Saturated			38.25		
		Semipermanently Flooded				36.5	
CLEAR	Putnam	Temporarily Flooded		37.4			
		Typically Saturated			36.4		
		Semipermanently Flooded				34.9	
COLBY	Volusia	Seasonally Flooded		28.3			
		Typically Saturated			26.6		
		Semipermanently Flooded				25.2	
COMO	Putnam	Seasonally Flooded		38.0			
		Typically Saturated			36.2		
		Semipermanently Flooded				34.4	
COMO, LITTLE LAKE	Putnam	Seasonally Flooded		38.0			
		Typically Saturated			36.6		
		Semipermanently Flooded				35.2	
COW POND	Volusia	Seasonally Flooded		40.5			
		Typically Saturated			39.8		
		Semipermanently Flooded				37.6	
CRYSTAL/ BAKER	Putnam	Seasonally Flooded		35.5			
		Typically Saturated			33.9		
		Semipermanently Flooded				33.0	
DAUGHARTY	Volusia	N/A	46.3				
		N/A		45.5			
		N/A			44.5		
		N/A				43.0	
		N/A					41.5
DORR	Lake	Seasonally Flooded		43.5			
		Typically Saturated			43.1		
		Semipermanently Flooded				42.1	

LAKE NAME	COUNTY	HYDROPERIOD CATEGORY	MINIMUM INFREQUENT HIGH	MINIMUM FREQUENT HIGH	MINIMUM AVERAGE LEVEL	MINIMUM FREQUENT LOW	MINIMUM INFREQUENT LOW
DREAM POND	Putnam	Seasonally Flooded		49.0			
		Typically Saturated			47.5		
		Semipermanently Flooded				46.0	
DRUDY	Volusia	Seasonally Flooded		42.3			
		Typically Saturated			41.8		
		Semipermanently Flooded				40.5	
EMPORIA	Volusia	Seasonally Flooded		37.5			
		Typically Saturated			36.4		
		Semipermanently Flooded				35.0	
ESTELLA	Putnam	Seasonally Flooded		38.6			
		Typically Saturated			37.2		
		Semipermanently Flooded				36.5	
GENEVA	Clay	Seasonally Flooded		103.0			
		Typically Saturated			101.0		
		Semipermanently Flooded				98.5	
GEORGES LAKE	Putnam	Seasonally Flooded		98.4			
		Typically Saturated			97.8		
		Semipermanently Flooded				97.0	
GRANDIN	Putnam	Seasonally Flooded		81.8			
		Typically Saturated			81.3		
		Semipermanently Flooded				80.1	
HELEN	Volusia	Temporarily Flooded		46.1			
		Typically Saturated			44.2		
		Semipermanently Flooded				43.6	
HOWELL	Putnam	Seasonally Flooded		34.5			
		Typically Saturated			33.6		
		Semipermanently Flooded				31.8	
KERR	Marion	Seasonally Flooded		24.4			
		Typically Saturated			22.9		
		Semipermanently Flooded				21.5	
LIZZIE	Putnam	Seasonally Flooded		43.9			
		Typically Saturated			42.7		
		Semipermanently Flooded				41.7	
LOWER LAKE LOUISE	Volusia	Seasonally Flooded		32.0			
		Typically Saturated			30.5		
		Semipermanently Flooded				29.2	
MAGNOLIA	Clay	Seasonally Flooded		124.7			
		Typically Saturated			124.2		
		Semipermanently Flooded				121.4	
MALL, LITTLE LAKE	Putnam	Seasonally Flooded		38.7			
		Typically Saturated			36.8		
		Semipermanently Flooded				35.2	
MARGARET	Putnam	Seasonally Flooded		35.2			
		Typically Saturated			34.5		
		Semipermanently Flooded				32.5	
MARVIN	Putnam	Seasonally Flooded		38.6			
		Typically Saturated			37.3		
		Semipermanently Flooded				36.3	

LAKE NAME	COUNTY	HYDROPERIOD CATEGORY	MINIMUM INFREQUENT HIGH	MINIMUM FREQUENT HIGH	MINIMUM AVERAGE LEVEL	MINIMUM FREQUENT LOW	MINIMUM INFREQUENT LOW
NETTLES/ ENGLISH	Putnam	Seasonally Flooded		44.3			
		Typically Saturated			42.7		
		Semipermanently Flooded				41.7	
NORRIS	Lake	Seasonally Flooded		30.5			
		Typically Saturated			29.7		
		Semipermanently Flooded				29.1	
OMEGA	Putnam	Temporarily Flooded		57.4			
		Typically Saturated			56.1		
		Semipermanently Flooded				54.0	
PIERSON	Volusia	Seasonally Flooded		35.5			
		Typically Saturated			34.2		
		Semipermanently Flooded				32.5	
PURDOM	Volusia	Seasonally Flooded		37.0			
		Typically Saturated			36.4		
		Semipermanently Flooded				35.0	
SAND HILL	Clay	Seasonally Flooded		132.0			
		Typically Saturated			131.65		
		Semipermanently Flooded				129.5	
SHAW	Volusia	N/A	38.5				
		N/A		36.9			
		N/A			36.2		
		N/A				34.0	
		N/A					32.0
SILVER	Putnam	Seasonally Flooded		36.5			
		Typically Saturated			35.1		
		Semipermanently Flooded				34.0	
STELLA	Putnam	Seasonally Flooded		39.9			
		Typically Saturated			39.6		
		Semipermanently Flooded				38.0	
TARHOE	Putnam	Seasonally Flooded		37.0			
		Typically Saturated			36.0		
		Semipermanently Flooded				35.2	
TRONE	Putnam	Seasonally Flooded		37.5			
		Typically Saturated			35.7		
		Semipermanently Flooded				34.3	
UPPER LAKE LOUISE	Volusia	Seasonally Flooded		35.4			
		Typically Saturated			34.7		
		Semipermanently Flooded				33.8	
WINNEMISETT	Volusia	Seasonally Flooded		59.5			
		Typically Saturated			57.8		
		Semipermanently Flooded				56.0	

(3) The following minimum levels are established for Blue Cypress Water Management Area (BCWMA):

(a) The minimum average level, calculated as the long term mean of BCWMA water levels, is 24 feet NGVD. Water levels shall be at or above this level at least 75% of time over the long term.

(b) The minimum frequent low is 23.0 feet NGVD. The daily BCWMA water level shall not fall to this level or below more often than once every 2.5 years over the long term.

(c) The minimum infrequent low is 22.5 feet NGVD. The BCWMA water level shall not fall to this level or below for 60 continuous days more frequently than once every 10 years over the long term.

(4) Ground or surface water withdrawals or surface water works must not cause the infrequent high or frequent high surface water flows and levels to occur less frequently or for at lesser duration than stated. Ground or surface water withdrawals or surface water works must not cause the minimum average, frequent low, or infrequent low surface water levels and flows to occur more frequently or for longer durations than stated.

Specific Authority: 373.044, 373.113 FS. Law Implemented: 373.042, 373.103, 373.415 FS. History--New 9-16-92. Amended 8-17-94, 6-8-95, 1-17-96, 8-20-96, 10-20-96.

APPENDIX D—PRIORITY LIST AND SCHEDULE FOR ESTABLISHING MINIMUM FLOWS AND LEVELS, ST. JOHNS RIVER WATER MANAGEMENT DISTRICT, NOVEMBER 6, 1997

Source: SJRWMD 1997

Priority List and Schedule for Establishing Minimum Flows and Levels

St. Johns River Water Management District

November 6, 1997

Introduction:

SJRWMD has prepared a priority list and schedule (attached hereto) for establishing minimum flows and levels (MFLs) as required by Subsection 373.042 (2), F.S. The document lists those waterbodies that SJRWMD intends to establish MFLs on during 1998, along with an indication of those waterbodies that SJRWMD intends to voluntarily undertake peer review.

The SJRWMD Governing Board adopted a District Minimum Flows & Levels Project Plan in June 1994. This plan sets forth a comprehensive program for the District's MFL program, including data collection and data management, applied research, priority list for setting specific MFLs, follow-up monitoring to verify MFLs, and implementation of MFLs through permitting and water supply planning. In 1996 the MFL Plan was updated and a priority list and schedule was created in response to Executive Order 96-297. The attached priority list and schedule being submitted pursuant to subsection 373.042(2), F.S., is based on the SJRWMD MFL Plan, along with supplemental information available from the SJRWMD Water Supply Needs and Sources Assessment (WSNSA), adopted in November 1994, and subsequent water resource and MFL studies. Most MFL priorities are located within the Priority Water Resource Caution Area (PWRCA) and are shown in Figure 1.

Summary of MFLs already established:

Under the SJRWMD MFL Plan, MFLs have already been established for the following watercourses, waterbodies, and aquifers:

Surface Waters:

- 7 lakes in the Keystone Heights area of Clay & Putnam Counties (Fig 2)
- 33 lakes in the Crescent City & De Land Ridge area of Putnam & Volusia counties (Fig 3)
- Blue Cypress Water Management Area (Fig 5)
- 3 lakes in other areas

Surface Watercourses:

- Wekiva River @ SR 46 (Fig 4)
- Blackwater Creek @ SR 44 (Fig 4)

Aquifers:

- 8 Springs (minimum spring flow and a level in the aquifer at the springhead) in the Wekiva River Basin (Fig 4)

In addition, technical work on another 28 lakes has been completed. Rulemaking for these lakes is scheduled to be completed in FY 98. Work is ongoing for Orange Creek, Newnans Lake, Orange Lake, Lochloosa Lake, Taylor Creek, Lake Washington, and additional lakes. A draft report on Blue Springs has been completed and will be peer reviewed in FY 98. The District is continuing to set MFLs for at least 20 systems each year as specified in the Project Plan and required by a settlement agreement entered into with Concerned Citizens of Putnam County for Responsive Government, Inc., and Citizens for Water, Inc.

As MFLs are established, they are implemented primarily through the SJRWMD's Water Supply Planning (Water Supply Management) and Consumptive Use Permitting programs.

Discussion of Priority List & Schedule for establishment of MFLs

Surface watercourses

Minimum flows will be established for the following watercourses during 1998:

- **Taylor Creek, downstream of Taylor Creek Reservoir**

The City of Cocoa is currently permitted to withdraw surface water from Taylor Creek Reservoir for public supply. MFLs in Taylor Creek will be used to set constraints on the maximum water supply yield from Taylor Creek and establish a low flow discharge release schedule, if necessary, from the District's water control structure at Taylor Creek reservoir. Portions of Taylor Creek are within the Tosohatchee State Reserve and this system has been structurally altered by the construction and operation of the reservoir. Technical work is substantially completed and recommendations are being prepared for a voluntary peer review. Following completion of peer review, SJRWMD will initiate rulemaking to adopt MFLs by rule.

- **St. Johns River, immediately downstream of Lake Washington (Fig 5)**

The City of Melbourne currently withdraws surface water from Lake Washington, along with brackish groundwater for public supply. Lake Washington and the St. Johns River downstream of Lake Washington have been altered by the construction of the Lake Washington Weir, as well as substantial structural changes upstream of Lake Washington in the upper basin. In addition to establishment of MFLs for the St. Johns River immediately downstream of Lake Washington, SJRWMD is currently designing a replacement structure for the weir and is evaluating the potential for additional withdrawals from Lake Washington to partially restore historical hydrologic conditions downstream of Lake Washington. Recommendations have been prepared and the SJRWMD will voluntarily obtain peer review prior to establishing these MFLs. Final

implementation of MFLs at this location will be contingent upon completion of a new water control structure at Lake Washington.

In addition, the following efforts are underway or planned to support the establishment of MFLs within the next three years:

- **St. Johns River, between Cocoa and Deland**

SJRWMD is currently investigating four potential sites along the St. Johns River for development of surface water supplies as an alternative source to meet future water supply demands in the Priority Water Resource Caution Areas. These sites are on the St. Johns River near Deland, Lake Monroe, Titusville, and Cocoa (see Figures 4 and 5). Feasibility studies completed in early 1997 provide planning level cost estimates for the development of a public water supply source at each location. Costs for this alternative will be compared with other water supply alternatives in the SJRWMD's water supply planning effort, which will result in a regional water supply plan by the end of 1999. During the next year, SJRWMD will conduct hydrologic evaluations to determine if the proposed quantities of withdrawal are expected to have any discernible impacts to riverine hydrology or water quality. Based on the outcome of these evaluations and developments in the water supply planning effort, SJRWMD will determine if MFLs need to be established at this time.

- **Orange Creek Basin**

Minimum flows in Orange Creek will be used, along with environmental studies on the Orange Creek basin, to establish a recommended basin water management plan. This basin includes Newnans Lake, Orange Lake, and Lochloosa Lake. Anticipated date for establishment of MFLs is 1999.

- **Wekiva River**

In response to peer review comments and ongoing data collection & validation efforts, SJRWMD anticipates that it will be beneficial to make some minor amendments to existing MFLs in the Wekiva Basin. Most notably, minimum levels should be established at a location upstream of SR 46 that is hydraulically stable. This effort is expected to be ongoing during the next three years, with possible amendments to the existing rules as early as 1999.

- **Upper Oklawaha River (including Lake Griffin)**

Feasibility studies have recently been completed on the potential for developing a public water supply from the Oklawaha Chain of lakes at Lake Griffin. Costs for this alternative will be compared to other water supply alternatives in the SJRWMD's water supply planning effort, which will result in a regional water supply plan by the end of 1999. As part of the SWIM program, SJRWMD is also developing proposed plans for restoration of the Oklawaha Chain of Lakes. During the next year, SJRWMD plans to include, as part of the ongoing efforts to develop restoration plans for these lakes, an evaluation of the potential hydrologic impacts of any proposals to withdraw surface water. Based on the outcome of these evaluations, SJRWMD's

proposed restoration plans, and the water supply planning process, SJRWMD will determine if MFLs should be established.

Lakes

SJRWMD will establish MFLs for the following lakes during 1998:

- **28 Lakes with completed technical assessments**

SJRWMD has completed technical studies and initial staff recommendations on MFLs for 28 lakes. Currently, these recommendations are being reviewed by SJRWMD for consistency with the recent legislation concerning establishment of MFLs. SJRWMD plans to finalize establishment of MFLs for these 28 lakes during 1998.

- **15 Lakes within the Priority Water Resource Caution Area**

For 1998, 15 additional lakes have been added to the priority list. Most of the priority lakes are located within portions of the Priority Water Resource Caution Area identified to have the greatest potential for significant water table declines in the future. Additionally, these lakes contain significant wetland communities, have staff gauges and some hydrologic records, and are accessible for field investigations. While the 15 new lakes included on the attached list are the SJRWMD priority at this time, additional lakes may need to be addressed as a result of CUP or ERP permitting decisions and an anticipated agreement that will provide for modifications of the settlement agreement referenced above. Should other lakes become a higher priority during the coming year, SJRWMD may substitute those lakes for certain lakes on this list. However, substitution of any lakes will not affect SJRWMD's commitment to establish MFLs for at least 15 new lakes during 1998. Any lakes on this priority list that are not completed in 1998 due to substitution of other priority lakes will be completed in 1999.

- **Lake Washington**

In conjunction with the establishment of MFLs for the St. Johns River downstream of Lake Washington, SJRWMD intends to establish MFLs for Lake Washington in Brevard County.

Aquifers

Consistent with the recommendations of the Groundwater Availability Conventions Committee Report and the SJRWMD District Water Management Plan, minimum groundwater levels are being addressed on a comprehensive basis through the impact threshold analysis included in the WSNSA. This analysis evaluates the impact of proposed groundwater pumping scenarios with the objective of preventing unacceptable impacts to existing legal users, groundwater quality (saltwater intrusion), wetlands and established minimum flows and levels. Where a minimum groundwater level is required at a specific location under any pumping scenario to prevent significant harm, MFLs for the aquifer are being established.

The following aquifer MFLs will be established during 1998:

- **Blue Springs, Volusia County**

Technical studies on Blue Springs are essentially complete and will be voluntarily peer reviewed. Following peer review, SJRWMD intends to adopt minimum levels for the Upper Floridan aquifer at Blue Springs during FY 98.

The following work will also be undertaken during the next year to support establishment of MFLs within the next three years:

- **Apopka Springs (also known as Gourdneck Springs)**

SJRWMD is planning to adopt MFLs for Apopka Springs, which is a significant component of the Lake Apopka water budget. Current fiscal year efforts will concern collection of additional flow data from the spring.

- **Additional springs in the Priority Water Resource Caution Area**

Following completion of Blue Springs and Apopka Springs, SJRWMD will establish MFLs for at least one additional spring in the Priority Water Resource Caution Area. Potential springs include Clifton and Green Springs.

Attachment: SJRWMD Priority List and Schedule for Establishment of Minimum Flows and Levels in 1998

(proposed to be published in FAW)

Stream or River	*County*	*Activity*
Taylor Creek	Osceola & Brevard	Complete peer review & establish minimum flows
St. Johns River @ Lk Washington	Brevard	Complete peer review & establish minimum flows

Lake	*County*	*Activity*
Bel-Air	Seminole	Establish minimum levels (including all lakes listed below)
Bird Pond	Putnam	
Cowpen	Putnam	
Davis	Volusia	
Deep	Putnam	
Deforest	Seminole	
Dias	Volusia	
Disston	Flagler	
East Crystal	Seminole	
Echo	Putnam	
Gore	Flagler	
Hokey	Volusia	
Johnson	Clay	
McGrady	Putnam	
McKasel	Putnam	
Melrose	Putnam	
North Como Park	Putnam	
Orio	Putnam	
Pam	Putnam	
Pebble	Clay	
Prevatt	Orange	
Prior	Putnam	
Sand	Putnam	
South Como Park	Putnam	
Sunset Lake	Lake	
Swan	Putnam	
Sylvan	Seminole	
Wauberg	Alachua	
Weir	Marion	
West Crystal	Seminole	
Winona	Volusia	
Washington	Brevard	Complete peer review & establish minimum levels

Lake *	County	Activity
Apshawa North	Lake	Complete recommendations and establish minimum levels (including all lakes listed below)
Banana	Seminole	
Bear Gully	Seminole	
Black	Orange	
Brantley	Seminole	
Burkett	Orange	
Flat	Lake	
Horseshoe	Seminole	
Howell	Seminole	
Indian	Volusia	
Irma	Orange	
Louisa	Lake	
McGarity	Volusia	
Mills	Seminole	
Pearl	Orange	

* Note: SJRWMD intends to establish minimum levels for each of the lakes listed above during the next year. However, should SJRWMD determine that minimum levels are required for other lake(s) not on the above list, those lakes may be substituted for lakes on this list. Any of the above lakes not completed during 1998 will be completed in 1999.

Aquifers:

Location	County	Activity
Blue Springs	Volusia	Complete peer review & establish minimum aquifer levels and spring flows

Fig. 1 Priority Water Resource Caution Areas

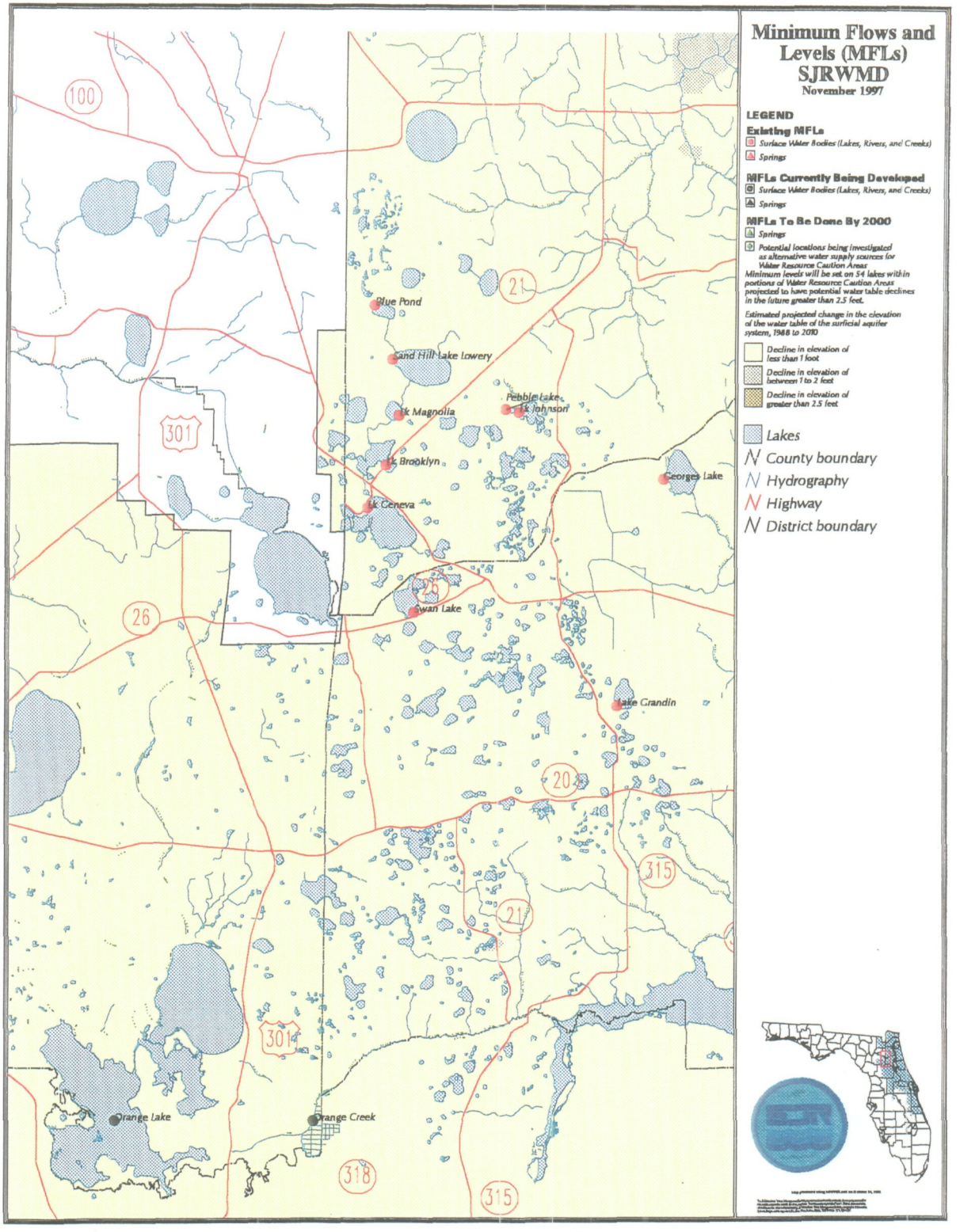

Fig. 2 Keystone Heights Area

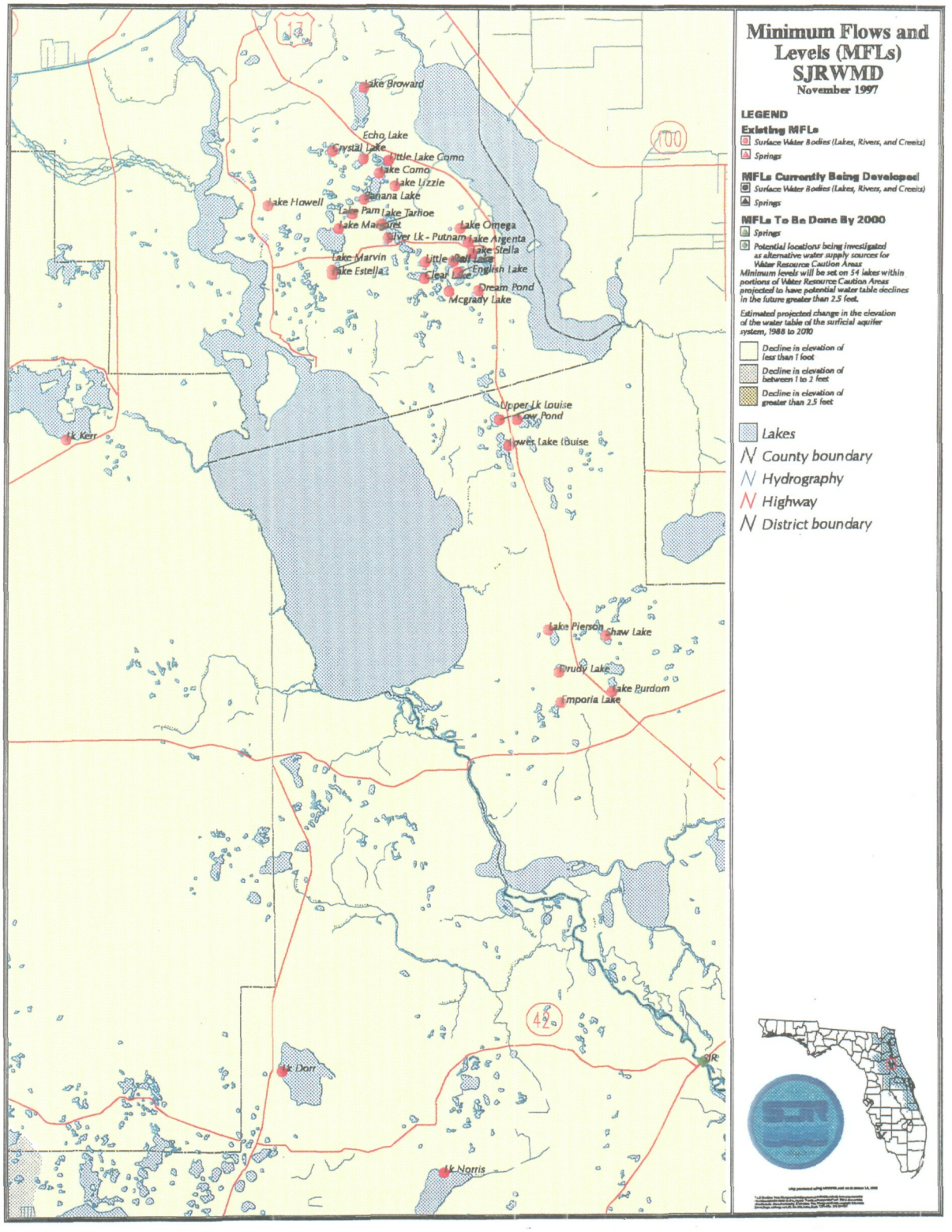

Fig. 3 Crescent and Deland Ridge Area

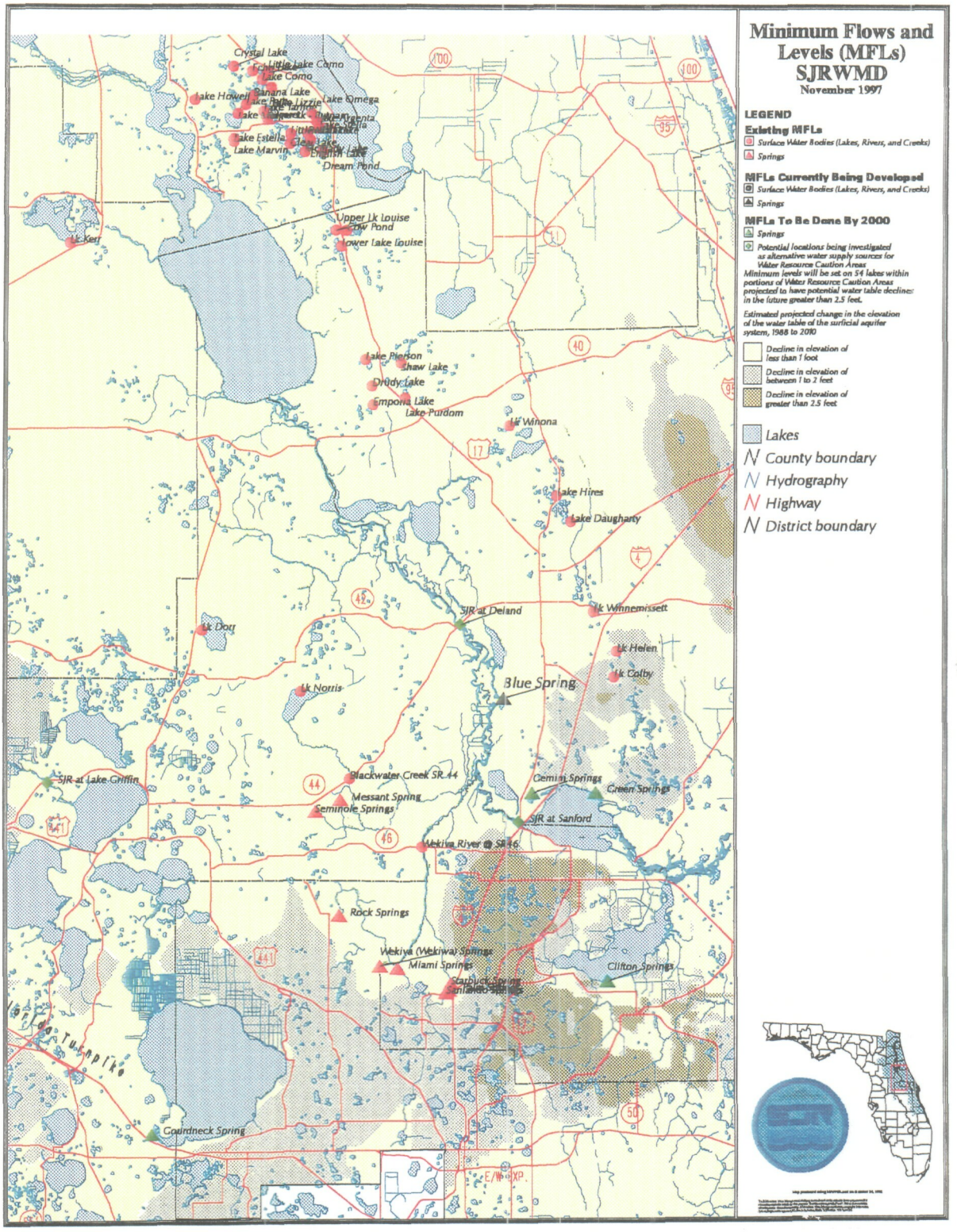

Fig. 4 Central Florida Area

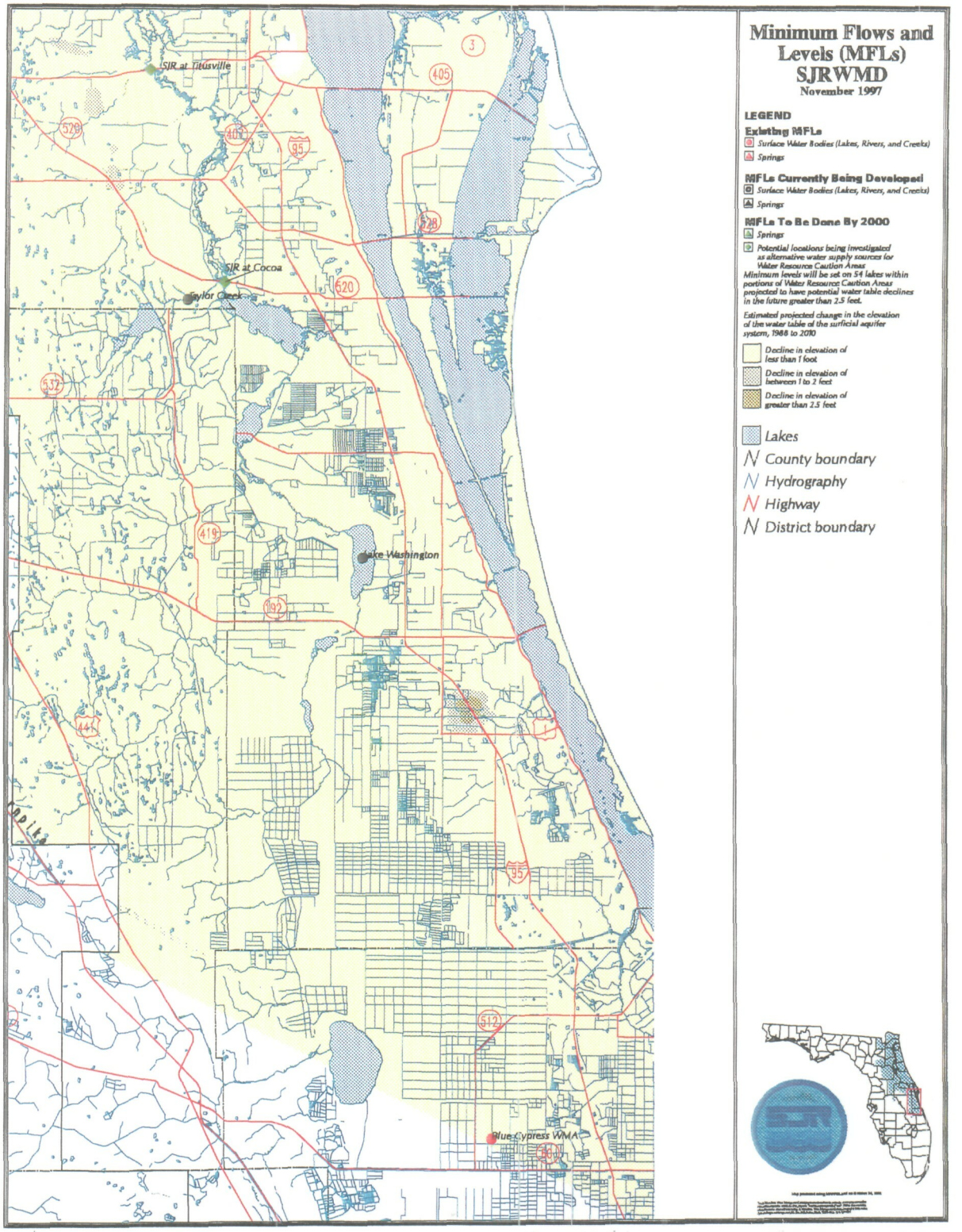

Fig. 5 Upper St. Johns Basin