2008 WATER SUPPLY ASSESSMENT UPDATE

WATER FOR INDUSTRY

WATER FOR AGRICULTURE

WATER FOR DRINKING

WATER FOR HABITAT

WATER FOR RECREATION

WATER FOR POWER GENERATION

NORTHWEST FLORIDA WATER MANAGEMENT DISTRICT

Water Resources Assessment 08-02

DECEMBER 2008

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Acknowledgements

Numerous individuals at the District and elsewhere provided invaluable assistance, information, and guidance throughout the development of this report. The contributions are the following staff are gratefully acknowledged: Paul Thorpe, Director, Resource Planning Section; Angela Chelette, Bureau Chief, Division of Resource Regulation; Duncan Cairns, Chief, Bureau of Environmental and Resource Planning; and Nick Wooten, Chief, Bureau of Surface Water. This Water Supply Assessment update was prepared under the supervision and oversight of Ron Bartel, Director, Division of Resource Management.

In addition, we thank Rich Marella from the U.S. Geological Survey for compiling much of the water use data used in this report, as well as for his collaboration and guidance regarding the data analysis. Several University of Florida IFAS Extension Agents also contributed their expertise including: Les Harrison and David Marshall with Leon County, Libbie Johnson with Escambia County, Dr. Henry Grant with Gadsden County and Mike Donahoe with Santa Rosa County. Sue Patterson at Agency for Workforce Innovation provided employment statistics for this report.

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EXECUTIVE SUMMARY

This second update to the 1998 Water Supply Assessment (WSA) is intended to determine whether existing and reasonably anticipated water sources and conservation efforts in each of the District's seven water supply planning regions are adequate to meet projected future water demands for reasonable-beneficial uses through the year 2030, while sustaining water resources and related natural systems. If existing and reasonably anticipated water sources are not anticipated to be sufficient to meet future needs within a particular region, the Governing Board may determine that a Regional Water Supply Plan is needed. When the Governing Board determines that a Regional Water Supply Plan is needed, the District shall conduct water supply planning pursuant to Section 373.0361(1), F.S. In three regions covering Santa Rosa, Okaloosa, Walton (Region II), Bay (Region III), and Gulf and Franklin (Region V) counties, the District has developed water supply plans to successfully meet future demands.

The WSA is part of the District Water Management Plan (DWMP) required by Section 373.036(2), F.S., and as such, is subject to updates every five years. These regular updates provide an opportunity to reassess current and future water needs as well as the condition of existing water supply sources and related natural systems. If water demands are increasing faster than anticipated in the previous WSA, adjustments can be made to ensure that sufficient water is identified from sustainable sources. In accordance with statutory requirements, this second WSA update will be incorporated into the DWMP (NWFWMD 2005) when it is revised in 2010.

This document is largely organized around the seven water supply planning regions, which are comprised of either single counties or multiple counties that have similar water supply issues and water resource conditions (Figure 1.1). The first district-wide WSA, prepared in 1998, included water demand projections through 2020. The WSA was subsequently updated to extend water demand projections through the 2025 (Bonekemper et al. 2003). This second update to the WSA provides water demand projections through 2030 and provides a review of new data or new conditions identified since the first WSA to reconsider the adequacy of surface and ground water resources within each planning region to meet future needs.

For this WSA update, water use was estimated for 2005 and future water needs were projected for 2010 through 2030 at the user or county level at five year intervals for the following use categories: public supply; domestic self-supply and small public water systems; agricultural self-supply; recreational self-supply; industrial, commercial, and institutional self-supply; and thermoelectric power generation. Average water demands were projected and, as in the past, water demands associated with a 1-in-10 year drought event were also estimated from simple literature-based multipliers.

In 2005, water use within the District's jurisdictional boundaries totaled approximately 347 mgd (Table ES.1). The largest use category in 2005 was public supply, which accounted for 164 mgd or 47 percent of all water use in the District. The second largest use category was the combined category of industrial/commercial/institutional water use, which accounted for 66 mgd or 19 percent of the total water use. Agricultural irrigation was the third largest category and accounted for 49 mgd or 14 percent of the total water use. The county with the largest water use was Escambia County (92 mgd), followed by Bay County (66 mgd), Leon County (44 mgd), and Jackson County (39 mgd) (Table ES.2). In 2005, the district-wide average uniform gross per capita water use for the public supply water use category was 145 gallons per capita per day (gpcd).

Table ES.1 Estimated and Projected Change in Total Water Use by Category, 2005 -2030

Water Use Category	Water Use 2005 (mgd)	% of Total	Water Use 2030 (mgd)	% of Total	Increase 2005-2030	% Increase 2005-2030
Public Supply	163.50	47%	258.40	52%	94.91	58%
Domestic Self-Supply	22.39	6%	30.78	6%	8.38	37%
Commercial-Industrial-Institutional	66.16	19%	91.14	18%	24.99	38%
Recreational Irrigation	17.34	5%	21.92	4%	4.59	26%
Agricultural Irrigation	48.63	14%	54.69	11%	6.06	12%
Power Generation	28.53	8%	39.50	8%	10.97	38%
Total	**346.55**	**100%**	**496.44**	**100%**	**149.89**	**43%**

Table ES.2 Estimated Water Use and Population for 2005 and 2030 in the NWFWMD

Region		Population 2005	Population 2030	Total Average Water Use (mgd) 2005	Total Average Water Use (mgd) 2030	Primary Water Sources
I	Escambia	303,600	382,000	92.22	125.43	Sand-and-Gravel Aquifer
	Total	**303,600**	**382,000**	**92.22**	**125.43**	
II	Santa Rosa	136,400	229,000	20.71	30.74	Floridan Aquifer/ Sand-and-Gravel Aquifer
	Okaloosa	188,900	267,700	31.67	42.81	
	Walton	53,500	106,900	15.91	26.54	
	Total	**378,800**	**603,600**	**68.29**	**100.10**	
III	Bay	161,700	224,200	65.77	101.65	Deer Point Lake Reservoir
	Total	**161,700**	**224,200**	**65.77**	**101.65**	
IV	Calhoun	13,900	17,500	3.82	5.90	Floridan Aquifer
	Holmes	19,200	23,300	3.15	3.98	
	Jackson	49,700	61,400	38.81	43.98	
	Liberty	7,600	9,700	1.98	2.83	
	Washington	23,100	31,500	3.77	4.91	
	Total	**113,500**	**143,400**	**51.53**	**61.60**	
V	Gulf	16,500	20,400	3.36	6.53	Floridan & Surficial Aquifers/ Gulf County Canal
	Franklin	10,800	14,700	2.44	3.26	
	Total	**27,300**	**35,100**	**5.80**	**9.79**	
VI	Gadsden	47,700	56,900	12.36	20.55	Floridan Aquifer/ Surface Water
	Total	**47,700**	**56,900**	**12.36**	**20.55**	
VII	Jefferson	8,520	10,320	2.33	2.74	Floridan Aquifer
	Leon	271,100	363,700	43.80	65.69	
	Wakulla	26,900	49,600	4.45	8.90	
	Total	**306,520**	**423,620**	**50.58**	**77.33**	
	District Total	**1,339,120**	**1,868,820**	**346.55**	**496.44**	

Total water use is projected to increase by 43 percent during the 2005-2030 planning horizon to approximately 496 mgd by 2030 (Table ES.1 and Figure ES.1). An additional 150 million gallons per day will be required to meet the future needs in the District through 2030. Most of the increase is attributable to a 40 percent increase in population that is projected to occur - from approximately 1.3 million people in 2005 to nearly 1.9 million people by 2030 (Table ES.2) (BEBR 2007).

Water needs for public supply are estimated to increase by 95 mgd, or 58 percent, from 164 mgd in 2005 to 258 mgd in 2030 and will continue to be the largest use category. Water used for commercial, industrial, and institutional purposes is projected to increase by 25 mgd, reaching approximately 91 mgd by 2030. Water use for power generation is anticipated to increase by 11 mgd. Increases in water demands for the remaining use categories are each less than 10 mgd (Table ES.1).

Table ES.3 summarizes the total wastewater flow, total reuse flow, and the amount of beneficial reuse in 2005. A total of 102.9 mgd of domestic wastewater was generated district-wide in 2005 and approximately 58.1 mgd or 56% was of reuse quality. Of the 58.1 mgd, approximately 37.2 mgd was beneficially reused for golf course irrigation, residential lawn irrigation, agricultural irrigation, and industrial uses. Beneficial reuse includes quantities that offset ground and surface water withdrawals or are used for wetland augmentation or aquifer recharge. Region II generated the largest quantity of wastewater (29.5 mgd) and had the largest reuse flow (27.10 mgd) followed by Region VII where nearly all wastewater generated (21.5 mgd) was reused, primarily at the City of Tallahassee's Southeast Farm spray field facility. The District encourages beneficial reuse and has provided financial support for reuse system development from the Water Protection and Sustainability Program Trust Fund. To date, the District has granted $7.85 million in funding for reuse projects that will create an estimated 8.6 mgd of reclaimed water for Regions II and VII.

Table ES.3 Reuse of Domestic Wastewater in 2005 (mgd)
(Facilities with a permitted treatment plant capacity of 0.1 mgd or greater.)

Region	Total Wastewater Flow	Total Reuse Flow	Beneficial Reuse
Region I	26.89	5.50	5.50
Region II	29.47	27.10	9.65
Region III	15.67	1.60	1.60
Region IV	6.07	1.14	0.00
Region V	1.06	0.60	0.00
Region VI	2.19	0.59	0.31
Region VII	21.56	21.54	20.16
Total	102.91	58.07	37.22

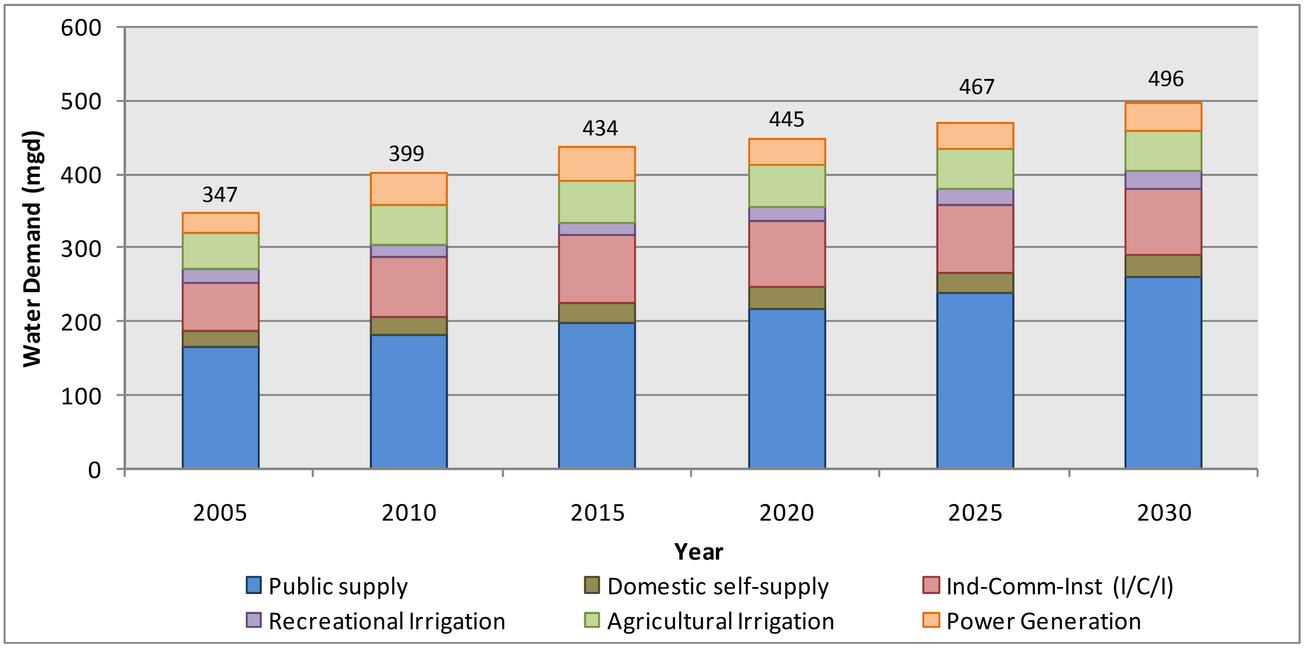

Figure ES.1 Total Water Use by Category for the NWFWMD, 2005-2030

The availability of existing and reasonably anticipated future water supply sources to meet projected demands through 2030 was evaluated for each water supply planning region to the extent possible using the best available information and analyses. On a regional basis, existing water supply sources are sufficient to meet projected future water needs while sustaining water resources and associated natural systems throughout much of northwest Florida. However, regional water supply plans have been developed and will continue to be implemented for Region II (Santa Rosa, Okaloosa, and Walton counties), Region III (Bay County), and Region V (Franklin and Gulf counties). **No new regional water supply plans are recommended at this time.**

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

ADR	Average daily rate
AFB	Air Force Base
ASC(s)	Area(s) of Special Concern
AFSIRS	Agricultural Field Scale Irrigation Requirements Simulation (Model)
AWT	Advanced wastewater treatment
BEBR	Bureau of Economic and Business Research, University of Florida
District	Northwest Florida Water Management District
FDEP	Florida Department of Environmental Protection
F.S.	Florida Statutes
ft^2/day	Feet squared per day
gpcd	Gallons per capita per day
gpm/ft	Gallons per minute per foot
IFAS	Institute of Food and Agricultural Studies, University of Florida
in/yr	Inches per year
MFL	Minimum Flows and Levels
mgd	Million of gallons per day
mg/L	Milligrams per liter
NWFWMD	Northwest Florida Water Management District
RWSP	Regional Water Supply Plan
SWIM	Surface Water Improvement and Management
USGS	U.S. Geological Survey
WMLTF	Water Management Lands Trust Fund
WRCA	Water Resource Caution Area
WRF	Water reclamation facility
WSA	Water Supply Assessment
WPSPTF	Water Protection and Sustainability Program Trust Fund
WWTF	Wastewater treatment facility
WWTP	Wastewater treatment plant

1 INTRODUCTION

In 1997, the Florida Legislature established requirements for the State of Florida's five water management districts to conduct district-wide water supply assessments and, where appropriate, to subsequently develop regional water supply plans. Specifically, water management districts were required to identify one or more water supply planning regions within their respective jurisdictions and to conduct a water supply assessment to examine, by region, future water supply demands for a 20-year planning horizon and the ability of existing and reasonably anticipated sources to meet the projected demands. If the Governing Board determines that for a particular region a regional water supply plan is needed, it shall be prepared for that region pursuant to Chapter 97-160, Laws of Florida and 373.036, F.S. Regional water supply plans (RWSPs) are prepared to analyze and present various alternatives for meeting the anticipated future water needs (Section 373.0361(1), F.S.).

The Northwest Florida Water Management District completed its first Water Supply Assessment (WSA) in 1998 (Ryan et al. 1998). Updates to the WSAs are required every five years. These updates help water managers identify potential problems far enough in advance to allow for the development and implementation of strategies to prevent water shortages and unacceptable impacts to water resources and associated natural systems. The first update to the WSA was prepared in 2003 and extended water demand projections through year 2025 (Bonekemper 2003). This second WSA update provides updated demand projections and reviews new data or changed conditions to consider the sustainability of water sources and associated natural systems for the 2010-2030 planning horizon. This second WSA update has been prepared to meet the requirements of and is consistent with Chapter 373.0361, F. S.

1.1 Water Supply Planning Framework

Figure 1.1 illustrates the seven water supply planning regions that were delineated in 1998. These regions are:

I. Escambia County
II. Okaloosa, Santa Rosa, and Walton counties
III. Bay County
IV. Calhoun, Holmes, Jackson, Liberty and Washington counties
V. Franklin and Gulf counties
VI. Gadsden County
VII. Jefferson, Leon and Wakulla counties

The primary factors considered in delineation of the regions were county boundaries and the similarity of water supply conditions. Additionally, information needed for estimating and projecting water use is typically available at the county level.

Also identified on Figure 1.1 are "Areas of Special Concern" (ASC), which are sub-regional areas that were identified in the first WSA as having a water supply problem or are considered to be susceptible to development of future problems. This susceptibility is based upon rapidly increasing demands, decreasing availability of existing water sources, or a combination of issues. It should be noted that the ASC designation is a planning-level, non-regulatory delineation.

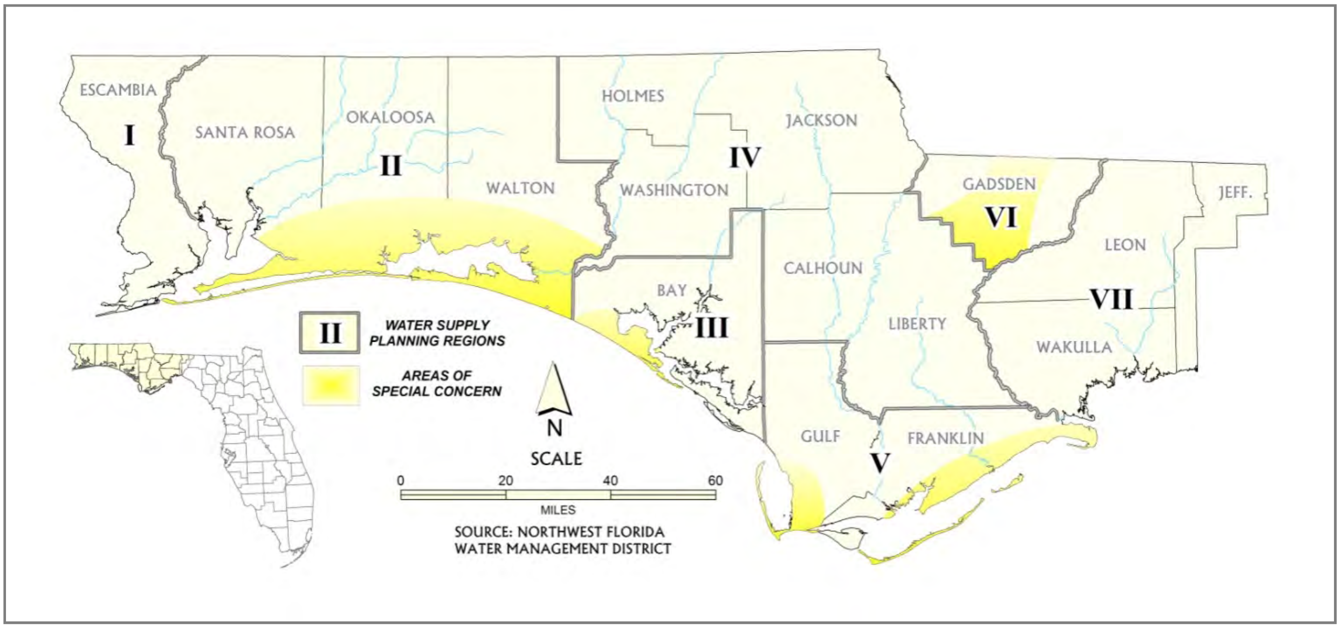

Figure 1.1 NWFWMD Planning Designations

1.2 Regulatory Framework

Consumptive Use Permitting Program

The Consumptive Use Permitting program allocates water supplies in a manner that is reasonable and beneficial, that is in the public interest and that does not have a deleterious impact on existing users or natural resources. The permitting thresholds vary based on the type of water use and the location of the withdrawal. In May 1992, the District established three consumptive use permitting areas for ground water withdrawals based on resource availability and demand: Permit Area A, B, and C. The permitting thresholds for these areas are as follows:

- Permit Area A: Permit required for all non-exempt withdrawals, per Chapter 40A-2.051, Florida Administrative Code.
- Permit Area B: Permit required for average daily use of greater than 0.1 mgd or a combined well capacity of greater than 1.0 mgd or a well diameter of six inches or greater.
- Permit Area C: Permit required for maximum daily use of greater than 1.44 mgd or a well diameter of 10-inches or greater.

For surface water, all areas have the same consumptive use permitting thresholds: average daily use of greater than 0.1 mgd or maximum daily use of greater than 1.0 mgd or greater than 10% of the base flow of the surface water. Also, all public supply and bottled water uses require a permit regardless of size and location. A map of the consumptive use permit areas can be found at:
http://www.nwfwmd.state.fl.us/permits/images/21.pdf.

Water Resource Caution Areas

In response to existing and anticipated water supply issues, the NWFWMD Governing Board has designated two Water Resource Caution Areas (WRCAs) and set more stringent water use permitting criteria in these areas. The two designated WRCAs include the coastal area of Santa Rosa, Okaloosa and Walton counties and the Upper Telogia Creek drainage basin in Gadsden County (Figure 1.2). The WRCA designation subjects all non-exempt withdrawals to more rigorous scrutiny to ensure that the proposed withdrawal does not result in unacceptable impacts to the resource. Permittees within a WRCA have increased water use reporting requirements, must implement water conservation measures, and must maximize water use efficiencies. They are also required to perform an evaluation of the technical, environmental and economic feasibility of providing reclaimed water for reuse. The WRCA designation in the coastal areas of Santa Rosa, Okaloosa and Walton counties also prohibits use of the Floridan Aquifer for nonpotable purposes.

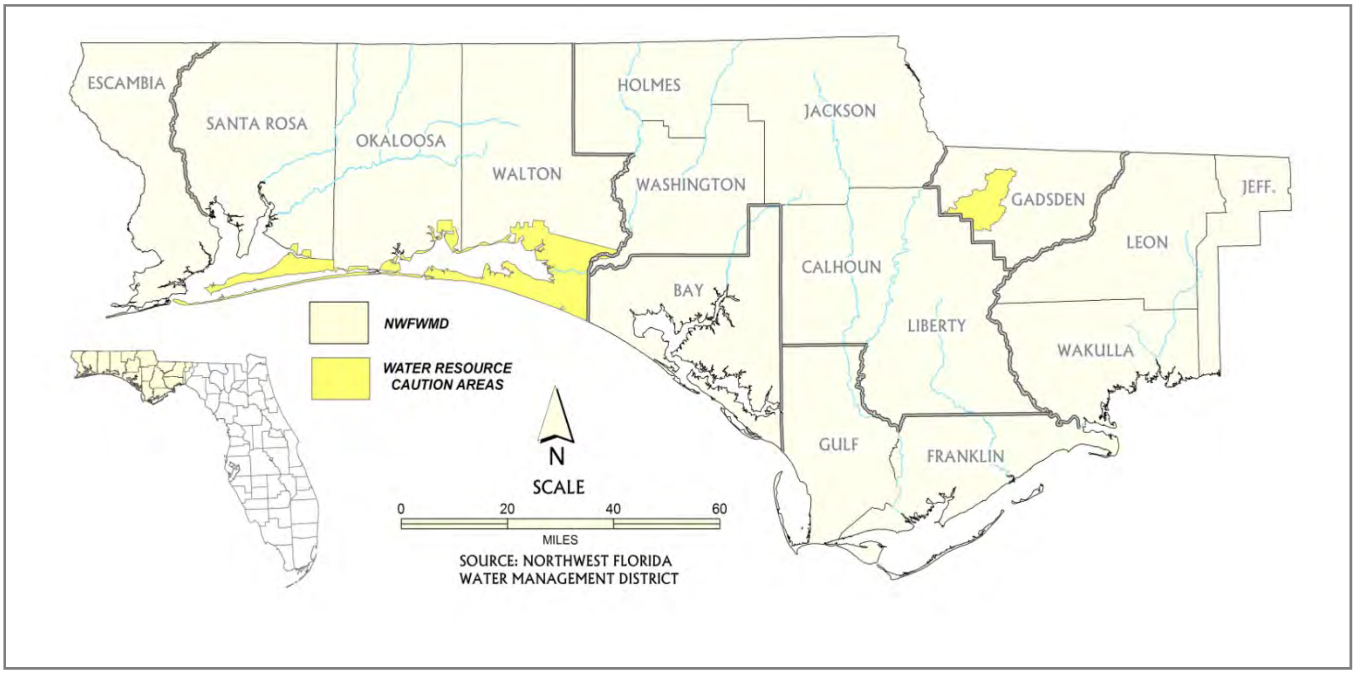

Figure 1.2 NWFWMD Water Resource Caution Areas

1.3 History and Accomplishments

The NWFWMD has supported local and regional water supply activities through planning, water resource investigations, cooperatively funded projects and public education. Prior to the legislation requiring water supply assessments, the NWFWMD worked extensively in coastal areas, particularly within Region II. The District's first water supply planning document was completed in the early 1980s for Bay, Escambia, Okaloosa, Santa Rosa and Walton Counties (Barrett, Daffin & Carlan, Inc. 1982). The District has also performed numerous ground water and surface water evaluations in other areas, many of which were performed in support of local water supply planning efforts.

The first Water Supply Assessment required by s.373.036 F.S. was completed in June 1998 (Ryan et al. 1998). The areas identified as the highest priorities for water supply planning and for the development of alternative supplies were the coastal areas of Region II, which includes Okaloosa, Santa Rosa and Walton counties. The first RWSP for Region II was approved in 2001 and subsequently updated in October 2006 (Bartel et al. 2000; NWFWMD 2006). Additionally, Areas of Special Concern (ASCs) were identified for the coastal portions of Region II, Region III and Region V, as well as the Upper Telogia Creek drainage basin in Region VI. An update to the water demand projections component of the WSA was completed in June 2003 (Bonekemper 2003). It was determined that no additional regional water supply plans were required at that time.

Since 2003, the District has continued to perform water resource evaluations, particularly in coastal areas. In June 2006, the Governing Board determined, based on a staff recommendation, that the potential for saltwater intrusion to the Floridan Aquifer in the coastal areas of Region V (Gulf and Franklin counties) substantiated the need for a RWSP. This plan was approved by the District Governing Board in January 2007 (NWFWMD 2007). In February 2008, the Board directed staff to begin developing a RWSP for Region III, Bay County. This plan was approved by the District Governing Board in August 2008.

The Water Protection and Sustainability Program Trust Fund (WPSPTF) established by the 2005 Florida Legislature provides a significant, dedicated source of revenue for alternative water supply development and water resource development projects. This funding source enables the District to provide cost-share funding for the construction of alternative water supply development projects. Additionally, priority water resource development and springs protection activities may be funded given sufficient annual appropriations. To date, the District has awarded over $21 million in funding for local governments and utilities while leveraging over $57 million in cost-sharing contributions.

The District also provided water supply development assistance to local governments and utilities prior to enactment of the WPSPTF. This assistance included facilitation of a $3.1 million federal grant for the development of an inland wellfield with a regional utility and funding assistance provided to local governments for repairs and upgrades to existing water supply infrastructure in Region II. Additional water resource development activities and other support functions are funded with the Water Management Lands Trust Fund (WMLTF), grant funds and other sources as available. The District has set aside reserves that may be necessary to fund water resource development efforts and water supply assistance, including possible funding for other regions in future years. Additionally, the District has acquired approximately 41,000 acres in the Econfina recharge area and will continue to focus on land acquisition expenditures for watershed protection.

In addition to funding water supply and water resource development projects, the District promotes the use of reclaimed water and water conservation, especially in those regions with RWSPs. Efforts include the distribution of brochures on water conservation and drought-tolerant landscaping techniques to local governments, utilities, extension offices and the public as well as participation in the Water Conservation Hotel and Motel Program (Water CHAMP). District staff also continues to encourage water reuse and conservation in both resource regulation activities and when reviewing proposed comprehensive plan amendments and developments of regional impact. In response to regulatory and cooperative planning efforts, significant investments in water reuse system infrastructure have been made, particularly in coastal areas.

For annual updates to the District's water supply related activities, please view the Consolidated Annual Report located at http://www.nwfwmd.state.fl.us/pubs/consolidatedAR/consolAR.html.

1.4 *Recent Water Supply Planning Legislation*

In 2005, the Legislature amended Chapters 163 and 373, F.S., to enhance the coordination between regional water supply planning and local comprehensive planning. The legislation requires local governments in areas subject to RWSPs to cooperate with the District in the development of alternative water supplies. It also reemphasizes the need for local governments to implement water conservation and reuse programs.

Each local government located in a RWSP area must now prepare a water supply facilities work plan for a minimum 10-year period that describes the public, private and regional water supply facilities that will be developed to address future water needs, including alternative water supply projects, and water reuse and conservation. Water use estimates and projections for water supply providers can be found in the appropriate regional water supply planning area chapter.

Current statutes and rules authorize or direct the District to provide substantive input during the local government comprehensive planning process and thereby participate in and shape the integration of regional water supply planning and local land use planning. Chapter 163, F.S., provides opportunities for the District to review local governments' comprehensive plan amendments and plan updates and to provide comments and recommendations on provisions related to water supply and public infrastructure to the Department of Community Affairs.

1.5 *Report Organization*

Section 2 presents the approach and methods used in this Water Supply Assessment update. Section 3 provides the resource assessments for each water supply planning region, including water demand projections, descriptions of the water resources, and an evaluation of the adequacy and ability of the water resources to meet future needs through 2030. Finally, Section 4 presents the summary and conclusions.

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2 METHODOLOGIES

This section describes the methods used to estimate 2005 water use and to project future annual average water demands for the 2010-2030 planning period. Also described are the methods used to estimate water needs during a 1-in-10 year drought event. It is important to note that water demand projections do not account for future opportunities to reduce demands by implementing additional water reuse or water conservation measures.

An overview of the approach used to assess the availability of water sources to meet future needs while sustaining water resources and related natural systems is also provided.

2.1 Water Use Estimates & Projections

For the purposes of water supply planning, water use is divided into six categories:

- Public Supply
- Domestic Self-Supply, including Small Public Water Systems
- Industrial, Commercial, and Institutional Self-Supply
- Agricultural Irrigation
- Recreational Irrigation Self-Supply
- Thermoelectric Power Generation Self-Supply

Water use estimates and projections were prepared using methods similar to those used in the 1998 WSA (Ryan et al. 1998) and the 2003 update of water demand projections (Bonekemper 2003). Drought-year projections are included to address the level-of-certainty planning goal outlined in Chapter 373, F.S.:

> *"The level-of-certainty planning goal associated with identifying the water supply needs of existing and future reasonable-beneficial uses shall be based upon meeting those needs for a 1-in-10 year drought event*." (Section 373.0361(2)(a)1., F.S.)

During drought events, multiple factors come into play that can affect determinations made regarding the availability of water to meet the needs of both permitted users and the natural systems. Under drought conditions water demands will increase for certain uses such as recreational irrigation and outdoor water use (landscape irrigation). Drought conditions also can reduce the amount of water that is available for withdrawal from a given source without causing harm to natural systems. This condition tends to be most applicable to surface water sources (rivers and lakes/reservoirs) and aquifers that, because of their geologic characteristics, tend to fluctuate widely in response to short-duration climatic events.

Specific methodologies for estimating and projecting average year and 1-in-10 year drought water demands are described below. For all methodologies, 2005 was used as a base year. When this WSA update was initiated, 2005 was the most recent year for which water use data were available. It is anticipated that future water demands will vary somewhat from current projections due to uncertainties and changes in patterns of development and population growth, market conditions, and changes in technology that affect water use. Rainfall variability, including long-term multidecadal oscillations, short-term variability, and spatial patterns also will have significant but difficult to predict effects on future water demands.

2.1.1 *Public Supply*

The public supply water use category includes public water systems with a permitted average daily withdrawal rate of 0.1 mgd or greater. Permittees that were withdrawing greater than 0.05 mgd in 2005 and that were thought to approach the 0.1 mgd threshold over the planning period were also included. A public water system, as defined by the Florida Safe Drinking Water Act, provides piped water for human consumption and either has at least 15 service connections or regularly serves at least 25 individuals daily at least 60 days out of the year.

2005 Water Use Estimates

To determine water use for 2005, a list of public supply utilities was compiled from the NWFWMD permitting database. The reported annual average withdrawals for 2005 were totaled and reported as the estimated water use. Note that water use, as reported in this assessment, represents the quantity of water withdrawn from ground or surface water sources or the quantity of water purchased from other utilities prior to distribution to retail customers. As a result, the water use estimates generally do not account for subsequent treatment or distribution systems losses.

Projections for 2010-2030

Water demand projections were developed for five-year increments from year 2010 to 2030 and are intended to represent annual average water needs. The curve fitting and extrapolation method was used to project demands for each public supply utility. This mathematical method is based on fitting a curve to historical water use data and then extending this curve to arrive at future values. Six of the most widely used curves for this type of process are: linear, geometric, parabolic, modified exponential, Gompertz and logistic (Klosterman 1990). These curves all rely on the assumption that the variable (water use) and time are related in some manner. The first three curves are based on assumptions about the growth or growth rate of the variable. The linear curve assumes a constant increase in the variable, the geometric curve assumes a constant growth rate over time, and the parabolic curve assumes a constant change in the growth rate over time. The remaining three curves are all asymptotic; they all change in relation to a fixed value that they do not exceed nor fall below, but continually approach. The assumption inherent in these three curves is that there is a resource limit which confines the variable's growth above a particular number or that there is a lower limit to the variable. All six curves were generated for each public supply utility.

Several techniques were used to determine which of the six curves best fit the historical trend in water use. These techniques include 1) visual examination, 2) evaluative statistics, and 3) review of ancillary data for the utility. The first step was to visually examine the graphs produced. Generally, only a few of the curves looked reasonable and fit the past trends well, thereby eliminating those curves that produced extreme or unrealistic results. The next step was to analyze the evaluative statistics of the remaining curves. The evaluative statistics include the Coefficient of Relative Variation (CRV), Mean Error (ME) and the Mean Absolute Percentage Error (MAPE), which are produced for each curve. The CRV is an input statistic, which means that it only compares the historic, known data (inputs) to each curve. It is the standard deviation divided by the mean of the assumptions behind each curve (see above). In this manner, the CRV is standardized without regard to units so the curves can be easily compared (Klosterman 1990). While input criteria measure discrepancies between the changes in the predicted values, output criteria measure the discrepancy between the actual values and predicted values. The output statistics include the ME and the MAPE. Both the ME and the MAPE measure how well the predicted values correlate to the actual values. Like the CRV, the MAPE is also devoid of units and allows for easy comparison between curves (Klosterman 1990).

Generally, the curves with the best CRV or MAPE values were chosen. The third step was used if the first or second steps did not produce a clear choice. This step involved comparing the data from the curves to information provided by the water user, published information, or other sources to compare and select an appropriate curve. In some cases, none of the curves produced statistically-significant results, and in these instances projections were made using information from the water user or other sources.

1-in-10 Year Drought Projections

The 1-in-10 year drought water demands for public supply utilities are estimated to be 6% to 10% higher than the demand during an average year (Vergara 1998; Water Planning Coordination Group 2005). Water demand increases during a drought year are largely the result of short-term increases in outdoor irrigation. The 1-in-10 year drought demands for public supply water use were estimated by applying a multiplication factor of 1.06 to the projected demands during an average year. Although 6% is on the low end of range, the curve fitting and extrapolation approach uses historical water use values that have been influenced by past drought events. The period of 1998 – 2008, which includes much of the available historical water use data, was a period of low rainfall. Thus, the water demand projections resulting from curve fitting and extrapolation approach implicitly incorporate some of the variability associated with fluctuating rainfall conditions.

Population Served by Public Supply Utilities in 2005

The population served by large public supply utilities in 2005 was derived largely from estimates obtained from the U.S. Geological Survey (USGS) (Marella, personal communication 2008). The USGS estimates are generally calculated as the number of utility service connections multiplied by the average number of persons per household within a county. In some cases, the USGS population estimates were revised. Revised estimates generally were based either on information provided by utilities as part of a consumptive use permit application or were based on the number of service connections reported by the Florida Department of Environmental Protection.

2.1.2 *Domestic Self-Supply and Small Public Supply Water Systems*

Domestic self-supply and small public supply water users include individual residences supplied by their own well or by small public water systems having an annual average water withdrawal of less than 0.1 mgd. Water use for this category is aggregated and reported at the county level.

2005 Water Use Estimates

Because limited data are available regarding domestic self-supply and small public water systems, it was necessary to estimate the aggregated water use and population associated with this use category. The 2005 population served by domestic self-supply and small public water systems was estimated as the total county population (BEBR 2007) minus the population served by large public supply utilities. The 2005 water use for domestic self-supply and small public water systems was calculated as the population served multiplied by 106 gallons per capita per day (gpcd). The value of 106 gpcd is a statewide average for domestic self-supplied water users in year 2000 (Marella 2004) and is the standard that was recommended by the Water Planning Coordination Group (2005).

Projections for 2010-2030

The population served by domestic self-supply and small public supply utilities was assumed to be a constant fraction of the total county population. For each county, the fraction of the total county population served by domestic self-supply and small public water systems was calculated for 2005. This fraction was then applied to the total population projected for each county during 2010-2030 to estimate the number of people served by small public water systems and domestic self-supply in future years. The medium range population projections (BEBR 2007) were used for each county unless otherwise noted. To estimate the future domestic self-supplied water use, the future population served was multiplied by 106 gpcd.

1-in-10 Year Drought Projections

The 1-in-10 year drought demands for domestic self-supply were estimated to be the same as the increase in public supply demands: 6% higher than the demand during an average year (Vergara 1998; Water Planning Coordination Group 2005).

2.1.3 *Industrial, Commercial, and Institutional (I/C/I) Self-Supply*

Industrial/commercial/institutional (I/C/I) self-supplied water users include manufacturing plants, chemical processing plants, office buildings, hospitals, prisons, military bases, and other facilities. The consumptive use permitting thresholds for I/C/I water users vary among regions and counties. The I/C/I water users included in this assessment are consumptive use permit holders with a permitted average daily rate of 0.1 mgd or greater.

2005 Water Use Estimates

The 2005 I/C/I water use values reflect the annual average withdrawal rates reported by each permittee.

Projections for 2010-2030

Future I/C/I water use can be influenced by factors that are difficult to predict such as economic conditions, changes in facility operations, and unanticipated facility closures, expansions, or relocations. Due to the inherent difficulties in projecting water use for this category, water demand projections for the 2010-2030 planning period were requested directly from the consumptive use permit holders.

For those permittees that did not provide projections, their historical water use was reviewed. Water users typically fell into one of two groups. The first group includes permittees whose historical water use was 10% to 50% of the permitted average daily rate (ADR) and whose use did not increase significantly between 2004 and 2006. For these permittees, the 2005 water use was assumed to be a reasonable projection of the future water demand. The second group of permittees includes users whose 2005 water use exceeded 50 percent of the permitted ADR or whose use increased significantly between 2004 and 2006. For these permittees, the permitted ADR was assumed to be a reasonable projection of the future water demand.

1-in-10 Year Drought Projections

Drought-year water demand projections for I/C/I water users are not anticipated to differ from water demands during an average rainfall year.

2.1.4 *Agricultural Irrigation*

Agricultural irrigation use consists of water withdrawn for the irrigation of crops and non-irrigation uses associated with farming operations. This includes water withdrawn for irrigating field, fruit, and vegetable crops, ornamental plants, and grasses or pasture. Non-irrigation uses include water withdrawn for livestock, fish farming (water for augmenting ponds), and other uses associated with agricultural operations.

<u>2005 Water Use Estimates</u>

To estimate agricultural water use for 2005, several methods and data sources were utilized. First, data from the District's consumptive use permit files was gathered and summed to obtain the reported average annual water use within each county. The permit categories included: agricultural irrigation, aquaculture, freeze protection, livestock, and nursery irrigation. However, due to spatial differences in permitting thresholds (described in Chapter 1) and differences in reporting requirements among permittees, many agricultural users either may not require a consumptive use permit or may not be required to report their water use[1]. As a result, using only reported regulatory data may underestimate agricultural water use on the regional level. Thus, with the exception of Gadsden County, the total permitted average daily rate (ADR) within each county was used as an estimate of the total 2005 water use. This quantity represents the portion of the water resource that has been allocated.

For those counties without any agricultural permits or with less than 0.1 mgd in permitted use, an estimate of the water use by crop type was developed. District staff obtained irrigated acreage by crop type and irrigation method for 2005 from the National Agriculture Statistical Service, USGS, and the University of Florida IFAS Extension Offices. The rates of water necessary to grow each crop were calculated using the Agricultural Field Scale Irrigation Requirements Simulation (AFSIRS) model. This model uses several variables (crop type, soils, irrigation systems, growing seasons, and climate) to estimate irrigation requirements. The result is the amount of water that must be applied to meet a crop's evapotranspiration requirement without significant reduction in yield (Smajstrla 1990). The irrigation rates by crop type were multiplied by the estimated irrigated acreages for each crop type, and then summed to arrive at the estimated water use by county.

<u>Projections for 2010-2030</u>

Several methods can be used to determine future agricultural water demands. Agricultural production is affected by several economic, climatic and political factors. The District considered many alternatives, including econometric modeling, land cover analysis, evaluation of permit data, and curve fitting/extrapolation methods. After reviewing the availability of data and the limitations of each of these approaches, it was decided to generally hold constant the 2005 use estimates throughout the planning period. Exceptions include the projections for Gadsden County, which increase to the permitted ADR as well as Calhoun County, which includes possible new permitted users. Methods for estimating and projecting agricultural water use will be reevaluated in future updates to the Water Supply Assessment.

<u>1-in-10 Year Drought Projections</u>

The agricultural irrigation rates for each crop grown in the District were generated by the AFSIRS model (Smajstrla 1990), using Orangeburg soil (typical for northwest Florida agriculture) and typical climactic conditions for inland areas of northwest Florida. The District uses the model's output data

[1] Any use or withdrawal of water is regulated; however, uses lower than permitting thresholds are issued a general permit consistent with 40A-2.041 (3)(a) and 40A-2.302, Florida Administrative Code.

from the 80th percentile, or a 2-in-10 year drought probability as the basis for consumptive use permitting. Although water needs for a 2-in-10 year drought are somewhat less than water needs for a 1-in-10 year drought, both reflect less than average rainfall conditions. Both the permitted ADRs and the irrigation rates used for each crop type account for the 2-in-10 year drought conditions. Thus, 2-in-10 year drought conditions are reflected in the 2005 water use estimates and the projections for 2010-2030.

2.1.5 *Recreational Irrigation*

The recreational self-supplied water use category is comprised of golf course and landscape irrigation. Water use was estimated for all golf courses, including those that are not required to have a consumptive use permit. For landscape irrigation, this assessment includes permit holders with an ADR of 0.1 mgd or greater.

2005 Water Use Estimates

The 2005 recreational water use for each county is the sum of the estimated golf course irrigation plus the reported landscape irrigation. A list of golf courses was compiled for each county using the District's permit database and the National Golf Course Directory (National Golf Foundation 2006). For golf courses with a consumptive use permit, the reported ground and surface water withdrawals were summed for 2005. Some golf courses that withdraw ground or surface water also used reclaimed water or stormwater. Because stormwater and reclaimed water generally are exempt from District reporting requirements, these quantities were estimated. Where possible, reclaimed water use was obtained from the Florida Department of Environmental Protection's 2005 Annual Reuse Inventory (FDEP 2006a).

For golf courses without a permit, water use was estimated by multiplying a turf grass irrigation rate by the number of irrigated acres. Irrigated acreage was estimated as the number of golf course holes multiplied by five irrigated acres per hole (Marella, personal communication 2008). The average of five irrigated acres per hole is consistent with data in the District's permit database. The turf grass irrigation rates applied were 30 inches per acre in coastal counties (Bay, Escambia, Franklin, Gulf, Okaloosa, Santa Rosa, Walton and Wakulla) and 21 inches per acre in inland counties (Calhoun, Gadsden, Holmes, Jackson, Jefferson, Leon, Liberty, and Washington). These rates were generated by the AFSIRS model (Smajstrla 1990) and reflect average rainfall conditions.

Projections for 2010-2030

The projected recreational water demand is the sum of golf course irrigation and landscape irrigation needs. Landscape irrigation was held constant at 2005 levels across the 2010 - 2030 planning period. Golf course irrigation demands were projected at the county level. Future irrigated golf course acreage was estimated using a relationship between the total county population and the number of golf course holes. First, the total number of golf course holes within a county was determined for 2005. Next, a ratio of the number of golf course holes per person was calculated by dividing the total number of holes by the total county population in 2005. This ratio was multiplied by the projected total county population (BEBR 2007) to estimate the number of golf course holes in future years. The number of golf course holes was rounded to increments of nine to reflect potential golf course development and then multiplied by five irrigated acres per hole. The irrigated acreage within a county was then multiplied by the irrigation rate (21 or 30 inches per year) to generate the projected golf course irrigation demand.

1-in-10 Year Drought Projections

Recreational irrigation demands during a 1-in-10 year drought were estimated using the AFSIRS model to be 20% higher than the demands during an average rainfall year. The turf grass irrigation rates for a 1-in-10 year drought condition are approximately 36 inches per year in coastal counties and 25 inches per year in inland counties.

2.1.6 *Power Generation*

Water use estimates and projections for power generation reflect the amount of water that is consumptively used. Fresh water and saline water withdrawn for power generation is frequently used for once-through cooling and most of this water is returned to its source. The amount of water consumptively used (i.e. not returned to the source) was estimated for 2005 and projected for 2010 - 2030.

2005 Water Use Estimates

Water use estimates for 2005 reflect the annual average withdrawals reported by each permittee multiplied by the fraction that was consumptively used. For example, if a power generation facility withdrew 10 mgd of surface water and 10% was consumptively used, the 2005 water use was estimated to be 1.0 mgd.

Projections for 2010-2030

Water use projections for power generating facilities were provided directly by the users. Projections for each facility include demands for both fresh and saline water; however, only the freshwater demands that are anticipated to be consumptively used (i.e. not returned to the source) are included in the tables.

1-in-10 Year Drought Projections

Drought-year water demand projections for power generation are not anticipated to differ from water demands during an average rainfall year.

2.2 Water Resource Assessments

The approach used to assess the ability of water sources to meet future water needs varies by region and source type. For ground water resources, the assessment criteria generally included the evaluation of long-term declines in the potentiometric surface and impacts to ground water quality. Where appropriate, the potential for ground water pumpage to reduce ground water discharge to surface water features (springs, rivers, bays) was evaluated qualitatively by comparing the relative magnitudes of withdrawals to surface water flows. To further assess the magnitude of ground water withdrawals, the regional scale ground water budgets that were developed in support of the 1998 Water Supply Assessment were reevaluated. The water budgets were based on output from calibrated steady-state ground water flow models. Although steady-state models do not account for seasonal or annual variation in flow, they do provide a means to estimate the relative magnitude of the various inflows to and outflows from an aquifer.

For surface water resources, the assessment criteria involved evaluating the sustainability of surface water resources and associated natural systems. The assessments were typically made by comparing the relative magnitudes of withdrawals and surface water flows. In Region III, hydrodynamic modeling also was performed to assess the freshwater needs and the effects of surface water withdrawals from Deer Point Lake Reservoir on salinity levels in North Bay (Crowe et al. 2008).

3 SOURCE ASSESSMENTS BY REGION

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3.1 Region I: Escambia County

Region I is within the Pensacola Bay and Perdido Bay watersheds and is comprised of Escambia County, including the municipalities of Century and Pensacola. The largest water use sectors are public supply and industrial, commercial and institutional (I/C/I) water use. Historically, Pensacola has had a large military and industrial economy. In recent years the area has worked to revitalize and diversify this economy, including the beginning of development for the Escambia County Mid-West Sector Plan, covering approximately 16,000 acres along the I-10 corridor. Approximately 80% of the population resides outside of incorporated areas in the county. The Sand-and-Gravel aquifer is the primary water source for this region.

Region I Snapshot		
	2005	2030
Population	303,600	382,000
Water Use (MGD)	~92	~125
Primary Source	Sand-and-Gravel Aquifer	
RWSP Status	No RWSP Recommended	

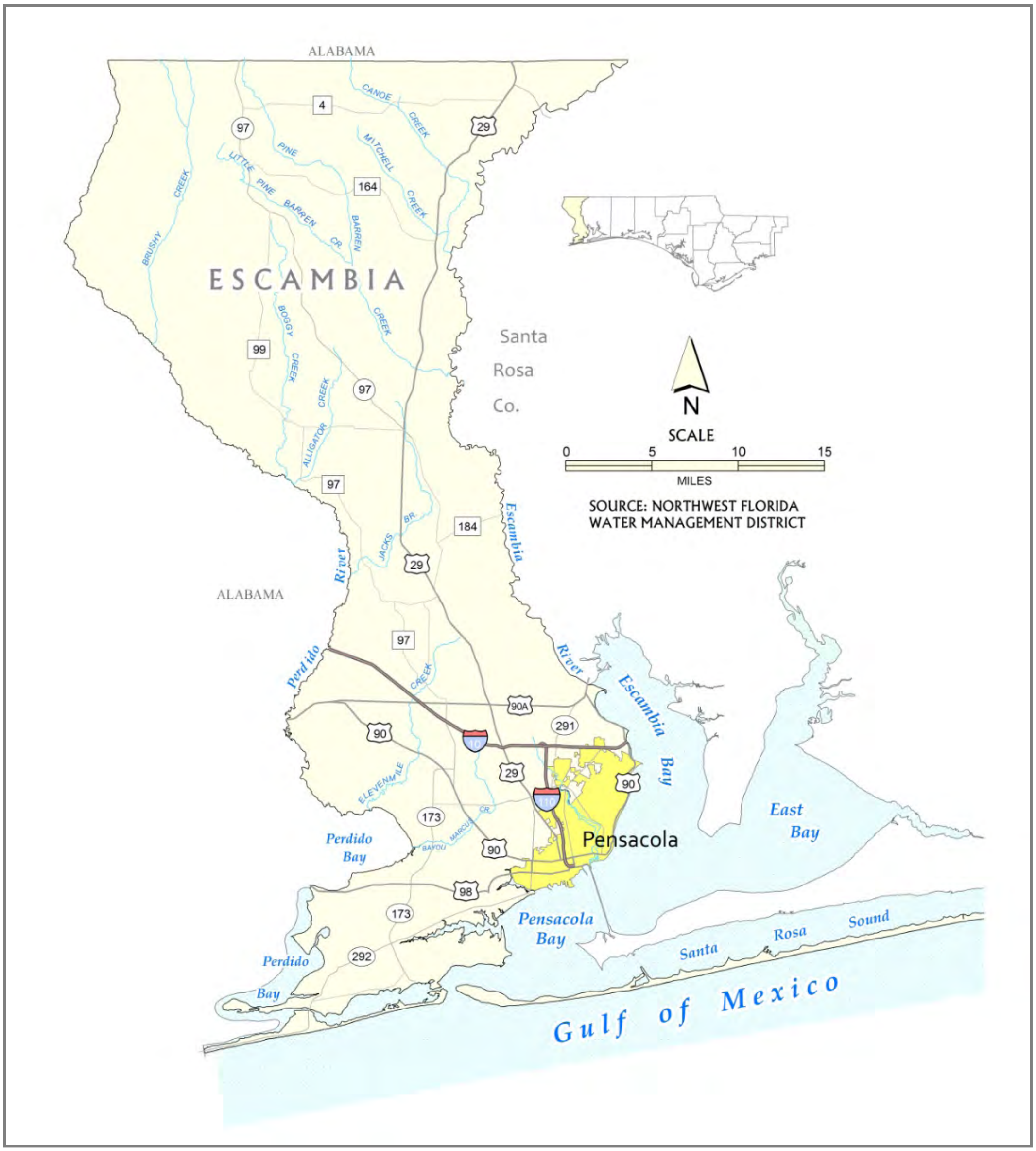

Figure 3.1 Map of Region I, Escambia County

3.1.1 Water Use Estimates and Projections

Public Supply

The Emerald Coast Utilities Authority (ECUA) is the largest public water system in Escambia County (Table 3.1). The utility has approximately 30 active wells that withdraw water from the Sand-and-Gravel Aquifer. The ECUA withdrew 34.6 mgd in 2005 and served nearly 80% of the total county population, which is concentrated in Pensacola and surrounding areas. Withdrawals by the ECUA are anticipated to increase by approximately 10.9 mgd to 45.5 mgd by 2030.

Peoples Water Service Company serves customers in southwestern Escambia County and is the region's second largest public supply utility. The utility withdrew 2.6 mgd from the Sand-and-Gravel Aquifer in 2005 (Table 3.1). Withdrawals are projected to increase to approximately 3.0 mgd by 2015 and 3.7 mgd by 2030. Because projections are based on historical trends in water use, future water needs for Peoples Water Service Company may be lower than projected if the rate of development slows or is limited by the amount of developable land.

The remaining eight public water systems serve central and northern Escambia County. These utilities collectively used 3.3 mgd in 2005. Future water demands for these utilities are projected to increase to a total of 5.3 mgd by 2030.

Table 3.1 Escambia County Public Supply Water Use Projections, 2005 – 2030 (mgd)

	Estimated			Projected		
Utility	2005	2010	2015	2020	2025	2030
Bratt-Davisville Water System, Inc.	0.24	0.23	0.24	0.25	0.27	0.30
Central Water Works, Inc.	0.29	0.36	0.39	0.42	0.46	0.49
Century, town of	0.44	0.54	0.58	0.63	0.68	0.72
Cottage Hill Water Works, Inc.	0.39	0.44	0.48	0.52	0.57	0.62
Emerald Coast Utilities Authority	34.56	38.20	40.01	41.83	43.64	45.46
Farm Hill Utilities, Inc.	0.51	0.54	0.61	0.68	0.75	0.82
Gonzalez Utilities Association, Inc.	0.51	0.60	0.67	0.73	0.79	0.86
Molino Utilities, Inc.	0.71	0.86	0.96	1.06	1.15	1.25
People's Water Service Company of Florida	2.63	2.83	3.05	3.27	3.48	3.70
Walnut Hill Water Works	0.17	0.17	0.18	0.19	0.20	0.20
Total	**40.45**	**44.78**	**47.17**	**49.58**	**51.99**	**54.42**

Domestic Self-Supply and Small Public Water Systems

The estimated population served by domestic wells and small public water systems was 14,300 in 2005, which is approximately 5% of the total county population. This population used an estimated 1.5 mgd of water in 2005 and future needs are anticipated to increase to 1.9 mgd by 2030 (Table 3.2).

Industrial, Commercial, and Institutional (I/C/I) Self-Supply

In 2005, I/C/I consumptive water use totaled 32.2 mgd (Table 3.2). Sources for I/C/I water include the Escambia River and the Sand-and-Gravel Aquifer. The largest water users were International Paper (23.1 mgd in 2005) and Solutia, Inc. (6.2 mgd in 2005). Solutia, Inc. also withdraws some surface water from the Escambia River that is returned to its source and is therefore not included in the consumptive use totals. Future I/C/I water demands are projected to increase to 48.8 mgd by 2030.

Recreational Irrigation

In 2005, 1.8 mgd was used for golf course irrigation (Table 3.2). Sources of irrigation water include the Sand-and-Gravel Aquifer, streams and bayous, and golf course ponds. There was no reclaimed water used for golf course irrigation in Escambia County in 2005 (FDEP 2006a). Recreational water demands are anticipated to increase to 2.8 mgd by 2030 and future demands will likely be met by a combination of reclaimed water, surface water, and ground water sources.

Agricultural Irrigation

The estimated agricultural water use was 1.6 mgd in 2005 (Table 3.2). Agriculture in Escambia County consists largely of cotton, peanuts, soybeans, and field corn in the northern and central portions of the county. There is also some irrigation of fruit crops and ornamentals. Due to the difficulties inherent in projecting the mix of future crops and associated acreages, water demands for agriculture are projected to remain constant at permitted quantities through the planning period.

Power Generation

Gulf Power Company's Crist Electrical Generating Plant (Crist Plant) currently relies on ground water from the Sand-and-Gravel Aquifer and surface water from the Escambia River and Governor's Bayou. Consumptive water use at the Crist Plant totaled 14.6 mgd in 2005 (Table 3.2). Due to various changes in operations and plant processes, water use at the Crist Plant will fluctuate during the planning period. The consumptive use is projected to reach 21.5 mgd in 2020 and then decrease to 16.0 mgd by 2030.

Total Water Use and Population

Average annual water use in Escambia County totaled 92.2 mgd in 2005 (Table 3.2). The largest use categories were public supply (44% of total) and I/C/I (35%). Power generation accounted for 16% of the 2005 total use. Domestic self-supply, agriculture, and recreation collectively accounted for the remaining 5% (Figure 3.2).

The population in Escambia County was 303,600 in 2005 (BEBR 2007). Population and public supply water use are both projected to increase over the planning period. The medium-range population projection for Escambia County in 2030 is 382,000 persons and represents a 26% increase from 2005 (BEBR 2007).

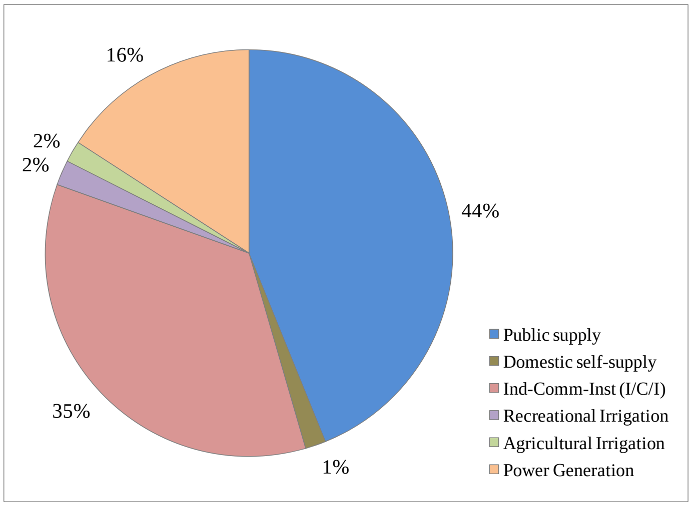

Figure 3.2 Region I Water Use by Category, 2005

The total water demand in Region I is projected to increase by 36%, or by 33.2 mgd, between 2005 and 2030 (Table 3.2). The total 2030 water demand is projected to reach approximately 125.4 mgd. Increases in I/C/I water demands are estimated at 16.5 mgd and increases in public supply water demands are estimated at 14.0 mgd. Water demand increases for the remaining use categories are relatively small.

Table 3.2 Region I Water Use Estimates and Projections by Category, 2005-2030 (mgd)

	Estimated	Projected				
Water Use Category	2005	2010	2015	2020	2025	2030
Public supply	40.45	44.78	47.17	49.58	51.99	54.42
Domestic self-supply	1.52	1.62	1.70	1.78	1.84	1.91
Ind-Comm-Inst (I/C/I)	32.24	39.21	48.65	48.69	48.73	48.77
Recreational Irrigation	1.84	2.37	2.47	2.57	2.67	2.77
Agricultural Irrigation	1.56	1.56	1.56	1.56	1.56	1.56
Power Generation	14.62	17.50	21.50	12.50	12.50	16.00
Total	**92.22**	**107.04**	**123.06**	**116.68**	**119.30**	**125.43**

1-in-10 Year Drought Projections

Projected water demands for a 1-in-10 year drought event are shown in Table 3.3. The 2030 total water demand for a 1-in-10 year drought is about 3% higher than the 2030 total average year water demand.

Table 3.3 Demand Projections for a 1-in-10 Year Drought Event, by Category, 2010-2030 (mgd)

	Estimated	Projected				
Water Use Category	2005	2010	2015	2020	2025	2030
Public supply	42.88	47.47	50.00	52.55	55.11	57.69
Domestic self-supply	1.61	1.71	1.80	1.88	1.95	2.02
Ind-Comm-Inst (I/C/I)	32.24	39.21	48.65	48.69	48.73	48.77
Recreational Irrigation	2.20	2.85	2.97	3.09	3.21	3.33
Agricultural Irrigation	1.56	1.56	1.56	1.56	1.56	1.56
Power Generation	14.62	17.50	21.50	12.50	12.50	16.00
Total	**95.11**	**110.30**	**126.48**	**120.27**	**123.06**	**129.36**

3.1.2 Assessment of Water Resources

Escambia County is dependent upon both surface and ground water, with ground water supplying the vast majority of all fresh water used in the region. Due to highly mineralized water in the Floridan Aquifer System, the Sand-and-Gravel Aquifer is the principal source of ground water for Escambia County. Given the high availability of good quality water, it is anticipated that this use pattern will continue through the year 2030. Local rivers and bays in the region are part of large watersheds that extend into Alabama and other areas of northwest Florida. The estuaries in the region are highly dependent upon surface water inflows, with only minor ground water contributions.

Ground Water Resources

In order of depth, the hydrogeologic units which describe the ground water flow system are the Surficial Aquifer System, the Intermediate System, the Floridan Aquifer System and the Sub-Floridan System.

In Region I, the Surficial Aquifer System is referred to as the Sand-and-Gravel Aquifer. It ranges in thickness from 350 to 530 feet. In southern Escambia County, the Sand-and-Gravel Aquifer includes the surficial zone, the low-permeability zone, and the main-producing zone (Wagner 1987). The surficial zone consists of fine to medium-grained sand, with gravel beds and lenses (Randazzo and Jones 1997). The low-permeability zone is 20 to 100 feet thick. The relatively leaky nature of the low permeability zone enables water from the surficial zone to readily recharge the underlying main-producing zone. The main-producing zone is comprised of highly productive sand and gravel layers interbedded with clayey layers. Well yields often exceed 1,000 gpm and may reach 2,500 gpm.

The potentiometric surface of the main-producing zone reaches a height of approximately 220 feet above sea level in the northern Escambia County (Figure 3.3). From this high point, water levels decline to the east, west, and south. The Escambia and Perdido rivers, along with some wells, are major discharge points for the aquifer in the northern half of the region. South of Cantonment, water levels in the main-producing zone increase, reaching an elevation of about 60 feet above sea level near the intersection of Interstate 10 and Highway 29. From here, ground water elevations decline in all directions (Figure 3.3). Ground water moves to points of discharge, including wells, the Perdido and Escambia rivers, small streams, Perdido Bay, and the Pensacola Bay System.

The Intermediate System is an effective, regional confining unit, which significantly restricts ground water flow between the Sand-and-Gravel Aquifer and the underlying Floridan Aquifer System. The Intermediate System does contain a minor aquifer, the Escambia Sand. However, poor water quality, limited thickness, and depths of 600 to 900 feet make the Escambia Sand an unviable ground water source.

The Bucatunna Clay, a highly effective confining unit, separates the upper and lower carbonate units of the Floridan Aquifer System. The top of the upper unit ranges from approximately 350 feet below sea level in northeast Escambia County to approximately 1,450 feet below sea level in the southwest. Due to the depth of the upper Floridan Aquifer and the poor quality of water, it is not used as a ground water source.

<u>Assessment Criteria</u>

The criteria used to assess the impacts of ground water withdrawals on water resources and associated natural systems include long-term depression of the potentiometric surface of the main-producing zone of the Sand-and-Gravel Aquifer and attendant alteration of ground water quality and reductions in ground water discharge to streams (e.g. reductions in base flow). A ground water budget was also used to evaluate the relative magnitude of ground water withdrawals. Because the majority of the regional population and water use occur in the southern half of Region I, this assessment focuses primarily on that area.

<u>Impacts to Ground Water Resources and Related Natural Systems</u>

The Sand-and-Gravel Aquifer is recharged by local rainfall. The duration and magnitude of rainfall directly affects water level trends. Hydrographs for two wells show examples of long-term water level trends in the Sand-and-Gravel Aquifer in the southern half of the region (Figure 3.4). Data are presented for a well in Pensacola (USGS TH2) and a well near Beulah (USGS 032-7241A). Both wells are open to the main-producing zone of the Sand-and-Gravel Aquifer.

Overall, the long-term fluctuation of water levels in these two wells appears to be primarily related to, and coincide with, rainfall variations. Both hydrographs show seasonal water level variations. The Beulah well exhibits a negative water level trend between 1959 and 1967. Both hydrographs depict a positive trend between 1975 and 1980. A regional drought between 1980 and 1983 caused ground water levels to drop between five and seven feet. The hydrographs show recovering water levels throughout the rest of the decade as above normal rainfall occurred. Through most of the 1990s, alternating wet and dry years resulted in modest variations in annual water levels, with a slight negative trend.

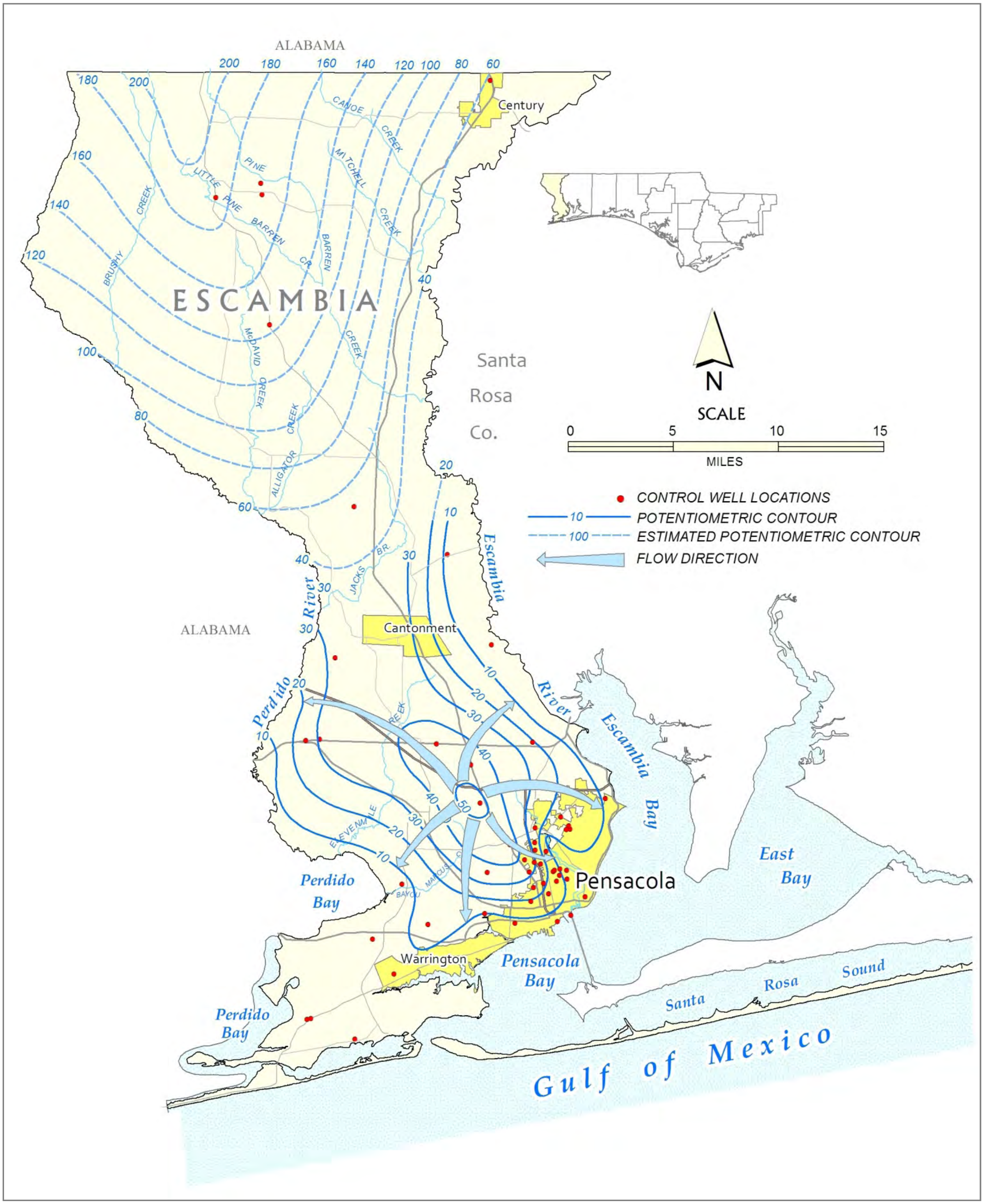

Figure 3.3 Observed Potentiometric Surface of the Main-producing Zone of the Sand-and-Gravel Aquifer, Escambia County, Florida, May 2007

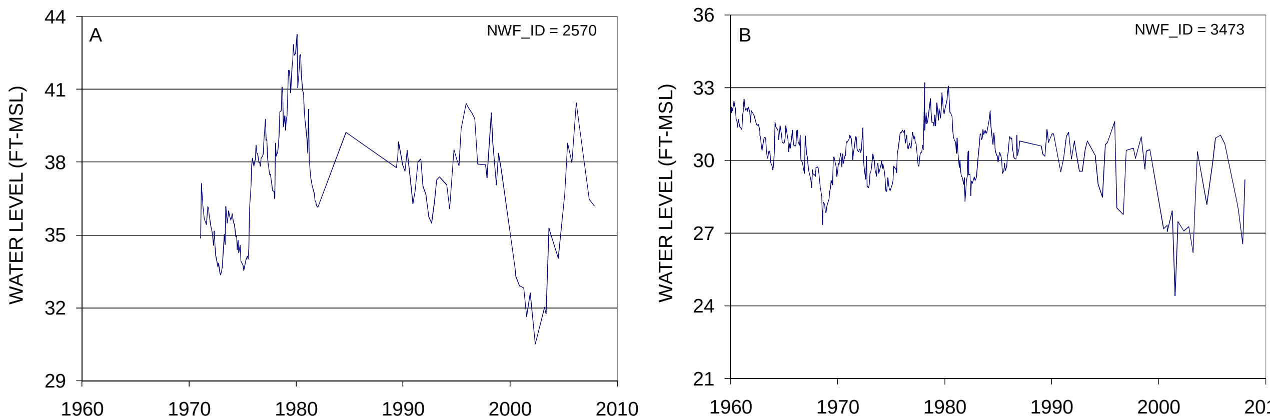

Figure 3.4 Hydrographs of Sand-and-Gravel Wells: A) USGS TH2, and B) USGS 032-7241A

Northwest Florida experienced an extended drought starting in 1999 and continuing through the spring of 2001. Between March 2000 and February 2001, drought conditions within Region I varied from moderate to exceptional according to the National Drought Mitigation Center. During this time water levels in the main producing zone declined as can be seen in the hydrographs (Figure 3.4). Although normal rainfall returned in mid-2001, ground water levels continued to drop to historic levels as infiltrating ground water had yet to reach the water table in areas of higher elevation. By late 2002, ground water levels had dropped about seven feet. Water levels recovered over the next three years as Region I experienced above average rainfall. In 2006, rainfall was again below normal and ground water levels again began to steadily fall. By late 2007, water levels had declined four to five feet from 2006 levels. The magnitude of the water level response to rainfall variations and the expression of long-term trends are due, in part, to each well's location relative to recharge/discharge areas: larger responses are observed in wells located near the center of recharge areas and away from discharge areas.

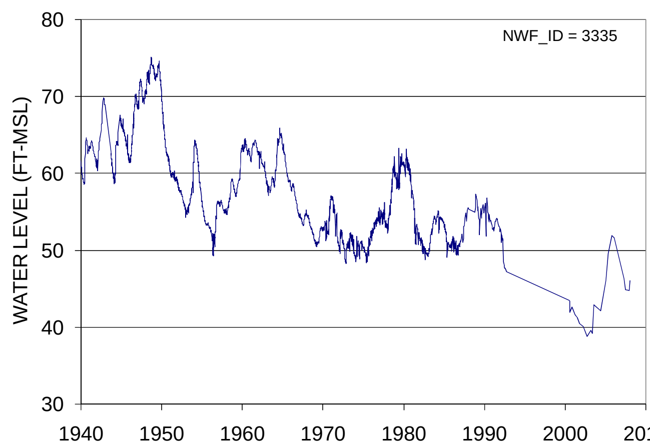

Figure 3.5 Hydrograph of Sand-and-Gravel Well USGS 031-716-1

A second example of water level trends in southern Escambia County is shown in the hydrograph for USGS 031-716-1 (Detroit Blvd) (Figure 3.5). This well is also open to the main-producing zone. Large fluctuations in water level are observed in this well due to its location near the ground water high in center of the recharge area and its proximity to several major supply wells. Seasonal variations and a long-term negative trend exist throughout the period of record. Water levels experienced a maximum decline of approximately 35 feet. This decline, although notable, is exaggerated by extreme climatic conditions that existed at the beginning and end of the record period. The 1940s were an extremely wet period, elevating water levels to historic highs. By contrast, drought conditions during the last ten years have reduced water levels to historic lows. Extended and more frequent dry periods combined with increased ground water development appear to be the primary cause of long-term water level declines. Continued water level monitoring in Region I is needed to evaluate future water resource sustainability.

In 2005, withdrawals from the Sand-and-Gravel Aquifer were estimated at approximately 76 mgd. Even at this pumping level, most impacts to the potentiometric surface are limited due to well spacing and the substantial aquifer recharge rate. More significant impacts are limited to areas of concentrated withdrawals in the southern half of Region I. These areas include Cantonment, areas adjacent to the Escambia River southeast of Cantonment, and areas adjacent to Pensacola Bay in Warrington. Pumpage effects on water levels in the northern half of the region are significantly less due to limited pumpage in that area. Localized depression of the potentiometric surface due to pumping can potentially reduce the ground water contribution to surface water features and induce intrusion of salt water.

Impacts to ground water levels due to pumping, although limited, are persistent. The impact of localized, concentrated pumping has resulted in the periodic measurement of water levels below sea level within the main-producing zone. Water levels below sea level have been measured adjacent to the Escambia River in the vicinity of the Crist Plant and Solutia, Inc. and along Pensacola Bay in Warrington. Depressed water levels have been observed since the 1970s. These drawdowns are of concern to water quality due to their close proximity to the saltwater interface, as discussed below. Water level and water quality monitoring are typically required of permitted users in these areas.

Hydraulic heads in the Sand-and-Gravel Aquifer in south/central Escambia County are currently 50 to 60 feet above sea level (Figure 3.3). This positive head gradient holds the saltwater interface just beyond the coastline beneath the bay system. Careful placement of major supply wells has prevented the salt water from migrating inland. However, the fresh water within the Sand-and-Gravel Aquifer is in close hydraulic connection with salt water beneath the coastal bays and estuaries. Since excessive pumping would result in saltwater intrusion problems, continued careful planning in the coastal fringe is required.

Evidence of this potential problem can be seen in water quality data from a public supply well located approximately 2,000 feet from Pensacola Bay in Warrington. Water levels in the well between July 2003 and December 2006 averaged between six and 14 feet below sea level. Water quality data for the same time period indicate that sodium, chloride, and total dissolved solids concentrations have almost doubled (Figure 3.6).

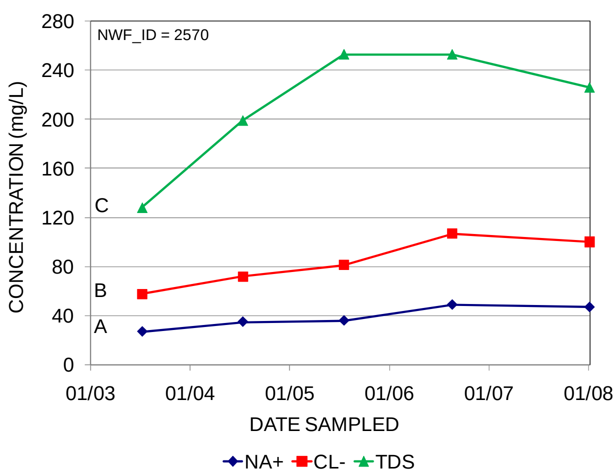

Figure 3.6 Peoples #4 Water Quality A) Sodium (Na^+), B) Chloride (Cl^-), and C) TDS

The Sand-and-Gravel Aquifer is highly susceptible to contamination from surface spills and waste disposal practices. Anthropogenic impacts have historically polluted the surficial zone of the Sand-and-Gravel Aquifer in the southern half of the region. Because the main-producing zone is readily recharged by leakage from the surficial zone, contamination has spread to the main-producing zone (Roaza et al. 1991). Numerous public supply wells in the region have documented the presence of chlorinated solvent, petroleum hydrocarbon and pesticide contamination (Ma et al. 1999). Water from these wells is treated to remove these contaminants prior to being introduced into the water distribution systems.

The District, ECUA, and other local utilities have worked together to limit future contamination of public supply wells (Richards et al. 1997). Wellhead protection areas (WHPA) have been incorporated into the Escambia County Land Development Code. The regional ground water flow model (Roaza et al. 1993) on which the existing WHPAs are based is currently being updated by ECUA and will allow for the delineation of WHPAs for recent and future public supply wells as well as for the evaluation of potential saltwater intrusion and wetland impacts due to pumping. Much of this ongoing effort is supported with new as well as existing data provided by the District.

Ground Water Budget

The water budget developed in support of the 1998 Water Supply Assessment (Ryan et al. 1998) presents an order-of-magnitude approximation of the major sources and discharges to the main-producing zone of the Sand-and-Gravel Aquifer in Region I (Figure 3.7). The recharge rate to the main-producing zone (165.8 mgd) equates to approximately 5.3 in/yr over the region (Ryan et al. 1998). Major discharges from the main producing zone include discharge to surface water features and ground water withdrawal via wells. The simulated discharges to the Escambia and Perdido rivers were 40.4 mgd and 10.6 mgd, respectively.

Although not explicitly simulated, the 2005 ground water use of 78 mgd represents 47 percent of the water budget of the main-producing zone. The projected 2030 ground water demand (93 mgd) represents 56 percent of the water budget of the main producing zone in Region I. The ground water demand for a 1-in-10 year drought event (96 mgd) represents 58 percent of the water budget of the main producing zone. Although the projected ground water demands appear to represent a large percentage of the water budget, the ground water budget does not account for flow within the surficial zone or recharge induced by the increase in pumpage.

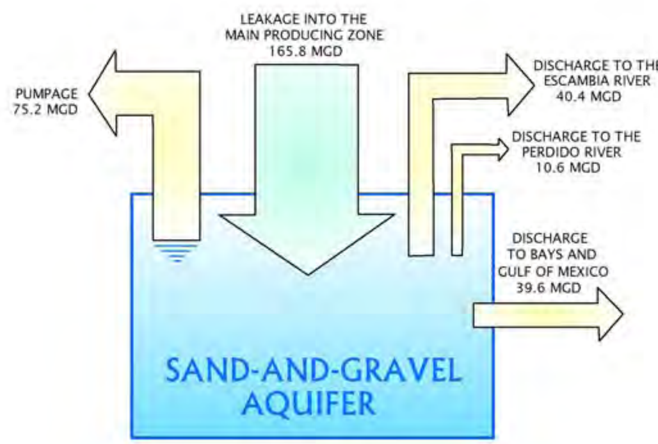

Figure 3.7 Region I Sand-and-Gravel Aquifer Ground Water Budget for 1991 Calibration Period

Because this simulated water budget is only for the main-producing zone, the projected water demand was also compared to the estimated inflow for the entire Sand-and-Gravel Aquifer in Region I. Vecchioli et al. (1990) calculated the total recharge to the Sand-and-Gravel Aquifer (including the surficial zone) for nearby Okaloosa County and portions of Santa Rosa and Walton counties to be approximately 20 in/yr. This recharge rate can generally be applied to Region I, based on the similarity of topography and the Sand-and-Gravel Aquifer between regions. Given an estimated recharge rate of 20 in/yr to the entire aquifer within Escambia County, the 2005 ground water withdrawals of 78 mgd represent approximately 12 percent of the total Sand-and-Gravel Aquifer water budget (629.4 mgd). The projected 2030 ground water demand (93 mgd) represent approximately 15 percent of the total Sand-and-Gravel Aquifer water budget. The 2030 demand for a 1-in-10 year drought event (96 mgd) is 15.5 percent of the total ground water budget.

Given the close hydraulic connection between the Sand-and-Gravel Aquifer and surface waters, ground water withdrawals are expected to reduce discharge to surface waters by an amount somewhat less than the amount withdrawn. For the conservative (worst-case) scenario in which ground water pumpage reduces discharge to surface waters by an amount equal to the pumping, the maximum reduction in the total combined ground water discharge to all rivers, streams, and bays in Region I would be 93 mgd in 2030 or 96 mgd for a 1-in-10 year drought event.

The Escambia and Perdido rivers have significant total flows and are not likely to be adversely impacted by relatively small changes in baseflow even under low flow conditions. The median flow and the Q_{90} flow in the Escambia River at Molino are estimated to be 2,863 mgd (4,430 cfs) and 1,150 mgd (1,780 cfs), respectively, for the 1983-2007 period of record. The median flow and the Q_{90} flow in the Perdido River at Barrineau Park are estimated to be 328 mgd (508 cfs) and 184 mgd (290 cfs), respectively, for the 1941-2008 period of record. Relatively small changes in bay discharge are also not likely to have an adverse impact. There is, however, a potential for localized impacts to small streams and wetlands. Such impacts are evaluated and addressed through the District's consumptive use permitting process.

Given the relative magnitude of projected 2030 demands compared to the ground water budget for the entire Sand-and-Gravel Aquifer in Region I, significant regional impacts to water resources and related natural systems as a result of ground water withdrawals are not anticipated. However, localized impacts may be of concern and continued monitoring of water levels and water quality is necessary for future evaluations of resource sustainability.

Water Quality Constraints on Availability

Ground water from the Sand-and-Gravel Aquifer has a low mineral content and is suitable for all uses. However, water quality constrains the availability of water from the Sand-and-Gravel Aquifer in localized areas. The high permeability of the Sand-and-Gravel Aquifer, which contributes to the high ground water availability, also facilitates the movement of contaminants.

The major water quality constraint is surface contamination which migrates into the aquifer and contaminates wells. Nearly half of the major supply wells located in southern Escambia County have been impacted by contaminants. Although treatment facilities successfully remove the contaminants prior to distribution, the cost of treatment is driving consideration of developing new ground water sources in northern Escambia County. The potential for saltwater intrusion also constrains pumping near saline surface waterbodies. Excessive withdrawals in the coastal fringe will induce the movement of salt water towards these wells.

Adequacy of Ground Water Resources

In Region I, the existing and reasonably anticipated ground water sources are currently considered to be adequate to meet the projected 2030 average and 1-in-10 year drought event demands, while sustaining water resources and related natural systems. Observed water level impacts and water quality issues are currently localized. Data indicates that the Sand-and-Gravel Aquifer is capable of sustaining projected withdrawals; however, continued water level and water quality monitoring are needed. To ensure ground water resource sustainability, future water supply development in the coastal fringe areas should not be expected (Roaza et al. 1996).

Surface Water Resources

Surface water in Region I is used primarily for industrial use and as cooling water for power production. The primary sources used are the Escambia River and Governor's Bayou.

The Escambia River is 240 miles long and has its headwaters in Alabama. The watershed area is 4,233 mi^2 (Fernald and Purdum 1998). Near the Town of Century, the median stream flow is 2,385 mgd (3,690 cfs), based on 74 years of data from the USGS. The low flow (Q_{90}) for the same period is 856 mgd (1,325 cfs). As discussed previously, the USGS gauging station further south near Molino has data from 1983 through 2007. The median and Q_{90} flows estimated for this site are 2,863 mgd

(4,430 cfs) and 1,150 mgd (1,780 cfs), respectively. Thus, the median flow for the Escambia River increases 478 mgd between these two sites.

Governor's Bayou is located just north of the Crist Plant approximately seven miles south of the Molino gage site. The bayou is formed by a diversion from the Escambia River that rejoins the main channel further downstream.

<u>Assessment Criteria</u>

The primary assessment criterion for surface water availability is the sustainability of surface water resources and associated natural systems.

<u>Impacts to Surface Water Resources and Related Natural Systems</u>

Although approximately 247 mgd of surface water was withdrawn from the Escambia River and Governor's Bayou for industrial use and power production in 2005, only about 14.6 mgd was consumptively used. The remainder was returned to its source. This consumption represents only one percent of the Q_{90} flow at the Molino gage for the 1983 through 2007 period. By 2030, consumptive surface water withdrawals from the Escambia River area projected to increase to 28 mgd. This quantity represents 1.6 percent of the Q_{90} flow at the Molino gage.

<u>Water Quality Constraints on Availability</u>

Surface water quality is suitable for all intended uses and there are no current water quality constraints.

<u>Adequacy of Surface Water Resources</u>

In Region I, the existing and reasonably anticipated surface water sources are considered adequate to meet the projected 2030 demands, while sustaining water resources and related natural systems.

Reclaimed Water and Conservation

The implementation of additional reuse and conservation measures in Escambia County could reduce future demands on ground and surface water resources. In 2005, approximately 5.5 mgd or 21% of the wastewater generated in Escambia County was of reuse quality and was beneficially reused (FDEP 2006a). Beneficial reuse includes quantities that offset ground and surface water withdrawals or are used for wetland augmentation. Approximately 5.2 mgd of reclaimed water was used for wetland augmentation at Bayou Marcus and 0.3 mgd of water was reused at wastewater treatment facilities (Table 3.4). ECUA is in the process of building a new wastewater treatment plant to replace the Main Street facility. The new wastewater plant may provide up to 17 mgd of reclaimed water for power generation and industrial uses at the Gulf Power Crist Facility and International Paper, respectively. Additional opportunities may exist for local governments and utilities to further develop reuse systems to meet future industrial and irrigation water needs.

Table 3.4 Region I Reuse of Domestic Wastewater, 2005 (mgd)

Facility Name	Plant Capacity	Total Wastewater Flow	Reuse Capacity	Reuse Flow	Beneficial Reuse
Bayou Marcus WRF	8.20	5.15	8.20	5.15	5.15
ECUA-Main Street	20.00	18.75	5.00	0.32	0.32
Pensacola Beach	2.40	0.81	0.05	0.03	0.03
Century, town of	0.45	0.38	0.00	0.00	0.00
US NAS Pensacola	4.00	1.80	0.00	0.00	0.00
Total	**35.05**	**26.89**	**13.25**	**5.50**	**5.50**

Source: FDEP (2006a)

3.1.3 Determination of the Need for a Regional Water Supply Plan

The ground and surface water resources in Region I are anticipated to be adequate to meet the projected average water demands and demands for a 1-in-10 year drought event through 2030 without causing adverse impacts to water resources and related natural systems. Therefore, no RWSP is recommended at this time.

3.2 Region II: Okaloosa, Santa Rosa and Walton Counties

Region II is within the Pensacola Bay System and the Choctawhatchee River and Bay watersheds. The three-county region contains fifteen municipalities and several large public supply utilities, including two regional water supply providers. The population is concentrated in the coastal area, which also has the highest growth rate in the region. Large public landholdings include Eglin Air Force Base (AFB), which covers approximately 464,000 acres in the center of the region, and the Blackwater State Forest, which covers approximately 206,000 acres in northern Okaloosa and Santa Rosa counties. The State of Florida also owns 19,931 acres in southern Walton County, including the Point Washington State Forest, as well as several state parks and recreation areas, and a state preserve. Additionally, the NWFWMD owns and manages 71,281 acres in the Blackwater River, Escambia River, Choctawhatchee River, Garcon Point and Yellow River Water Management Areas.

Region II Snapshot		
	2005	2030
Population	378,800	603,600
Water Use (MGD)	~68	~100
Primary Source	Floridan Aquifer/ Sand-and-Gravel Aquifer	
RWSP Status	Implementation	

All three counties rely primarily upon ground water from the Sand-and-Gravel and the Floridan aquifers. In the coastal area, the movement of the saltwater interface limits ground water withdrawals from the Floridan Aquifer. During the past ten years, District initiatives have successfully reduced Floridan Aquifer withdrawals along the coast enabling water level recovery in coastal areas. Surface water is not currently used to any significant degree in the region.

Figure 3.8 Map of Region II

3.2.1 Water Use Estimates and Projections

Public Supply

Public supply water use in Region II totaled 44.9 mgd in 2005 (Table 3.5 through Table 3.8). Within Region II, there are numerous public supply utilities, many of which buy, sell, or transfer water to other utilities or municipalities. Because of issues regarding the availability and consistency of data for water transfers, it is difficult to calculate the net water use for some utilities. However, the largest utilities with respect to raw water withdrawals were Okaloosa County Water and Sewer (7.8 mgd in 2005), Pace Water System (3.8 mgd in 2005), South Walton Utility Company (3.8 mgd in 2005), and Fairpoint Regional Utility System (3.4 mgd in 2005). The Fairpoint Regional Utility System provided water to the City of Gulf Breeze/South Santa Rosa Utility System and supplied a portion of the water used by Holley-Navarre, Navarre Beach, and Midway Water System. The South Walton Utility Company provided water to Destin Water Users. Florida Community Water System (aka "Regional Utilities") withdraws ground water from the Owls Head/Rockhill wells and also purchased water from the City of Freeport. Public supply water demands are anticipated to increase by 25.7 mgd to approximately 70.6 mgd by 2030.

Domestic Self-Supply and Small Public Water Systems

The estimated population served by domestic self-supply and small public water systems was 23,774 in 2005. This population used an estimated 2.5 mgd of water in 2005. Demands are anticipated to increase to 4.4 mgd by 2030 (Table 3.8).

Table 3.5 Okaloosa County Public Supply Water Use Projections, 2005 – 2030 (mgd)

	Estimated	Projected				
Okaloosa County	2005	2010	2015	2020	2025	2030
Auburn Water System	1.31	1.41	1.54	1.67	1.79	1.92
Baker Water System	0.23	0.26	0.29	0.32	0.35	0.38
Crestview, city of	2.54	2.82	3.12	3.42	3.72	4.03
Destin Water Users	3.59	3.76	4.06	4.36	4.66	4.97
Fort Walton Beach, city of	2.98	3.24	3.39	3.53	3.68	3.82
Holt Water Works, Inc.	0.12	0.15	0.17	0.19	0.21	0.23
Laurel Hill, city of	0.12	0.14	0.15	0.16	0.16	0.17
Mary Esther, town of	0.58	0.62	0.65	0.67	0.70	0.72
Milligan Water System	0.14	0.15	0.16	0.17	0.18	0.20
Niceville, city of	2.71	3.14	3.33	3.53	3.72	3.92
Okaloosa Co. Water & Sewer, total	7.77	8.21	8.79	9.36	9.93	10.50
OCWS - Bluewater	1.18	1.28	1.35	1.43	1.51	1.59
OCWS - Main Water System	5.15	4.97	5.10	5.24	5.37	5.50
OCWS - Mid-County	0.72	1.19	1.52	1.85	2.18	2.51
OCWS - West	0.72	0.78	0.82	0.85	0.88	0.90
Seminole Community Water System	0.09	-	-	-	-	-
Valparaiso, city of	0.55	0.69	0.71	0.74	0.76	0.79
Total	**22.73**	**24.60**	**26.36**	**28.12**	**29.88**	**31.64**

Note: Seminole Community Water System will consolidate into OCWS – Bluewater during 2008-2009.

Table 3.6 Santa Rosa County Public Supply Water Use Projections, 2005-2030 (mgd)

Santa Rosa County	Estimated 2005	Projected 2010	2015	2020	2025	2030
Bagdad-Garcon Point Water System	0.55	0.61	0.68	0.76	0.83	0.90
Berrydale Water System	0.27	0.27	0.30	0.32	0.35	0.38
Chumuckla Water System	0.28	0.33	0.36	0.40	0.43	0.46
East Milton Water System	1.09	1.47	1.73	1.98	2.23	2.49
Fairpoint Regional Utility System						
Holley-Navarre Water System, Inc.	1.25	1.43	1.52	1.60	1.69	1.77
Navarre Beach Water System	0.28	0.41	0.46	0.52	0.57	0.62
Midway Water System	1.56	2.05	2.21	2.37	2.53	2.69
Gulf Breeze/South Santa Rosa Utilities System*	1.47	1.34	1.50	1.65	1.80	1.95
Jay, city of	0.18	0.20	0.22	0.24	0.27	0.29
Milton, city of	2.13	2.32	2.48	2.66	2.85	3.05
Moore Creek-Mt. Carmel Utilities, Inc.	0.42	0.41	0.45	0.50	0.54	0.59
Pace Water System, Inc.	3.82	4.26	4.82	5.38	5.95	6.51
Point Baker Water System, Inc.	0.77	0.94	1.06	1.19	1.35	1.52
Total	**14.07**	**16.04**	**17.79**	**19.57**	**21.38**	**23.22**

**Note: The City of Gulf Breeze and South Santa Rosa Utilities System are permitted under the Fairpoint Regional Utility System permit.*

Table 3.7 Walton County Public Supply Water Use Projections, 2005-2030 (mgd)

Walton County	Estimated 2005	Projected 2010	2015	2020	2025	2030
Argyle Water System	0.09	0.10	0.12	0.13	0.15	0.16
DeFuniak Springs, city of	1.38	1.43	1.62	1.83	2.06	2.33
FCSC of Walton Co. / Regional Utilities	2.34	2.80	3.47	4.14	4.82	5.49
Freeport, city of	0.56	0.76	0.91	1.07	1.23	1.39
Freeport - North Bay	0.15	0.16	0.17	0.19	0.21	0.23
Inlet Beach	0.08	0.10	0.11	0.12	0.13	0.14
Mossy Head Water Works, Inc.	0.20	0.25	0.30	0.35	0.40	0.45
Paxton, city of	0.19	0.22	0.24	0.26	0.27	0.30
South Walton Utility Company	3.11	3.22	3.73	4.23	4.74	5.25
Total	**8.10**	**9.04**	**10.67**	**12.33**	**14.02**	**15.74**

Industrial, Commercial, and Institutional (I/C/I) Self-Supply

The I/C/I water use in Region II totaled 5.7 mgd in 2005 (Table 3.8). The Sand-and-Gravel Aquifer and the Floridan Aquifer System are the primary sources for this category. Large I/C/I water users include Taminco Methylamines, Inc., Eglin AFB, Cytec, and Okaloosa Correctional Facility. Projected I/C/I water demands for these users are anticipated to increase to 7.8 mgd by 2030.

Recreational Irrigation

Recreational water use was the second largest use category in 2005 and accounted for 9.7 mgd or 14% of the total water use in Region II (Table 3.8). Recreational water use consists primarily of golf course irrigation. Recreational water demands are anticipated to increase by approximately 1.2 mgd to 11.9 mgd in 2030. Future demands will continue to be met by a combination of reclaimed water, surface water, and ground water sources.

Agricultural Irrigation

The estimated water use for agricultural irrigation was 5.4 mgd in 2005 (Table 3.8). Agriculture in Region II consists largely of container ornamentals, field crops, sod, and aquaculture. Some hay, cotton, peanuts, and fruit crops are also grown. Due to the difficulties inherent in projecting the mix of future agricultural crops and associated acreages, water demands for agriculture are projected to remain constant at permitted quantities through the planning period.

Power Generation

There are no power generation facilities in Region II and no plans for power generation facilities have been submitted for regulatory review at this time.

Total Water Use and Population

In 2005, average annual water use in Region II totaled 68.3 mgd (Table 3.8). The largest use categories were public supply (66%) and recreational irrigation (14%). The remaining use categories collectively accounted for the remaining 20 percent (Figure 3.9).

The total population in Region II was 378,800 in 2005 (BEBR 2007). Population and public supply water use are both projected to increase over the planning period. The medium-range population projections indicate that the 2030 total population will reach 603,600 persons, which represents a 59 percent increase from 2005 (BEBR 2007).

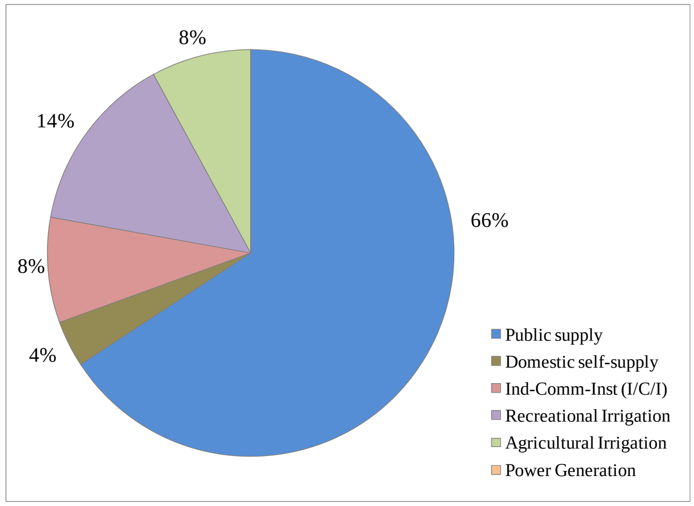

Figure 3.9 Region II Water Use by Category, 2005

The total water demand in Region II is projected to increase by 47%, or by 31.8 mgd, between 2005 and 2030 (Table 3.8). The projected total 2030 water demand is approximately 100.1 mgd. Public supply water demands are estimated to grow by 25.7 mgd and account for the majority of the increase. Water demand increases for the remaining use categories are relatively small.

Table 3.8 Region II Water Use Estimates and Projections by Category, 2005-2030 (mgd)

	Estimated	Projected				
Water Use Category	2005	2010	2015	2020	2025	2030
Public supply	44.91	49.68	54.82	60.02	65.28	70.60
Domestic self-supply	2.52	2.97	3.38	3.76	4.11	4.43
Ind-Comm-Inst (I/C/I)	5.71	7.79	7.79	7.79	7.79	7.79
Recreational Irrigation	9.72	8.44	9.44	10.35	11.15	11.85
Agricultural Irrigation	5.42	5.42	5.42	5.42	5.42	5.42
Power Generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**68.29**	**74.30**	**80.86**	**87.34**	**93.74**	**100.10**

1-in-10 Year Drought Projections

Projected water demands for a 1-in-10 year drought event are shown in Table 3.9. The total 2030 water demand for a 1-in-10 year drought is seven percent higher than the 2030 total average year water demand.

Table 3.9 Demand Projections for a 1-in-10 Year Drought Event, by Category, 2010-2030 (mgd)

	Estimated			Projected		
Water Use Category	2005	2010	2015	2020	2025	2030
Public supply	47.61	52.66	58.11	63.62	69.19	74.84
Domestic self-supply	2.67	3.14	3.58	3.99	4.35	4.70
Ind-Comm-Inst (I/C/I)	5.71	7.79	7.79	7.79	7.79	7.79
Recreational Irrigation	11.67	10.13	11.33	12.42	13.38	14.22
Agricultural Irrigation	5.42	5.42	5.42	5.42	5.42	5.42
Power Generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**73.08**	**79.15**	**86.24**	**93.23**	**100.14**	**106.97**

3.2.2 Assessment of Water Resources

The hydrogeologic system, especially in the coastal area in Region II, has been heavily affected by ground water withdrawals. Historic ground water development along the coast has resulted in the depression of the Floridan Aquifer potentiometric surface and has induced saltwater intrusion. Based on the results of the 1998 Water Supply Assessment, a Regional Water Supply Plan was developed for Region II (Bartel et al. 2000) and was updated in 2006 (NWFWMD 2006). Although surface water is being evaluated as an alternative water supply, it is reasonable to anticipate that significant reliance on ground water will continue through the year 2030. Accordingly, the water resources evaluation presented here summarizes the results of the RWSP implementation and presents an updated evaluation of ground water sustainability.

Ground Water Resources

In order of depth, the hydrogeologic units which describe the ground water flow system are the Surficial Aquifer System, the Intermediate System, the Floridan Aquifer System and the Sub-Floridan System (Figure 3.17). In Region II, the Surficial Aquifer System is specifically referred to as the Sand-and-Gravel Aquifer. The Sand-and-Gravel Aquifer is the primary water source for Santa Rosa County while the Floridan Aquifer is the primary source for Okaloosa and Walton counties. In 2005, ground water from the Sand-and-Gravel Aquifer System provided about 35 percent of the water used in the region and the Floridan Aquifer provided the remaining 65 percent.

The Sand-and-Gravel Aquifer consists of unconsolidated quartz sand, gravel, silt and clay ranging in thickness from less than 50 feet in Walton County to more than 400 feet in Santa Rosa County. The Sand-and-Gravel Aquifer exists under unconfined to semi-confined conditions. Recharge originates as rainfall. Based on hydrograph separation techniques, recharge in and around Okaloosa County averages approximately 20 in/yr (Vecchioli et al. 1990). Because the Intermediate System acts as a confining unit, most recharge to the Sand-and-Gravel Aquifer discharges to local streams forming the stream base flow component. Sand-and-Gravel Aquifer wells in Santa Rosa County yield as much as 1,440 gpm. East of Santa Rosa County, the Sand-and-Gravel Aquifer is less productive and is generally utilized for nonpotable purposes. In coastal Okaloosa County, the Sand-and-Gravel Aquifer has been evaluated as an alternative water supply. As much as 2.4 mgd may be available within the Ft. Walton Beach area (DeFosset 2004).

The Intermediate System forms an effective confining unit, restricting the vertical flow of water between the overlying Sand-and-Gravel Aquifer and the underlying Floridan Aquifer. The Intermediate System consists of fine-grained clastic sediments along with clayey limestone and shells, ranging in thickness from about 50 feet in northeast Walton County to over 1,000 feet in southwestern Santa Rosa County. Withdrawals from the Intermediate System are mostly limited to the coastal area of southeastern Walton County and well yields are quite low.

In Santa Rosa County and the western and coastal portions of Okaloosa County, the Floridan Aquifer System is split into the upper and lower Floridan Aquifer by the Bucatunna Clay. The Bucatunna Clay is a highly effective confining unit. To the east, where the Bucatunna Clay is not present, the Floridan Aquifer is one hydraulic unit (Figure 3.17). Where the Bucatunna is present, the upper Floridan Aquifer thickness varies from about 50 feet in northern Santa Rosa County to more than 400 feet in southern Okaloosa and Walton counties. Where the Bucatunna is absent, the Floridan Aquifer reaches a total thickness of over 700 feet. Well yields for the Floridan Aquifer are highly variable; the most productive areas are the central portions of Okaloosa and Walton counties, the Midway area, and the Destin area while poor well yields occur in the coastal fringe of Okaloosa and Walton counties.

Figure 3.10 shows the estimated Floridan Aquifer potentiometric surface under pre-development and May/June 2006 conditions. In northwest Walton County, the potentiometric surface reaches an elevation of 210 feet above sea level. From this point, water levels decline in all directions. Under non-pumping, pre-development conditions, ground water flow was downgradient to discharge areas in southern Okaloosa and Walton counties, as well as to the Choctawhatchee River. Floridan Aquifer water levels in the Fort Walton Beach area were historically about 50 feet above sea level. Under current pumping conditions, water levels have declined below sea level throughout the coastal area. Much of the coastal area, which was once a discharge area for the Floridan Aquifer, is now a recharge area.

<u>Assessment Criteria</u>

Two criteria were used to assess impacts to the Sand-and-Gravel Aquifer and the Floridan Aquifer System: long-term depression of the potentiometric surface and impacts to ground water quality.

<u>Impacts to Ground Water Resources and Related Systems</u>

The 1998 Water Supply Assessment (WSA) describes the history of water supply development in Region II and the resulting impacts to the water resources (Ryan et al. 1998). Significant ground water development along the coast began in the early 1940s and has resulted in the depression of the Floridan Aquifer potentiometric surface and movement of the saltwater interface towards these coastal wells. Since 1998, major water supply initiatives implemented and led by the District have successfully stabilized the coastal Floridan Aquifer water levels and reduced the saltwater intrusion threat to coastal Floridan Aquifer wells. These initiatives have included the development of an inland Sand-and-Gravel Aquifer wellfield in Santa Rosa County and the development of inland Floridan Aquifer wells in Okaloosa and Walton counties. These inland facilities have provided an alternative source of water to meet the increasing demand in coastal areas, while also enabling a reduction in coastal withdrawals. This updated assessment focuses on the results of these initiatives and ongoing regulatory actions to manage the ground water resources.

Sand-and-Gravel Aquifer

The Sand-and-Gravel Aquifer provides about 85% of the ground water used in Santa Rosa County. In 2004, the inland Sand-and-Gravel Aquifer wellfield in Santa Rosa County (Fairpoint Regional Utility System - FRUS) began operation and provides an average of 3.4 mgd to coastal utilities, thus reducing coastal Floridan Aquifer withdrawals. In 2005, a total of approximately 17 mgd was withdrawn from the Sand-and-Gravel Aquifer in Santa Rosa County. These withdrawals take place with little impact to the water resources due to high Sand-and-Gravel Aquifer recharge rates and adequate well spacing. No significant regional water level declines have occurred in Santa Rosa County. Drawdown impacts are generally limited to the immediate vicinity of individual pumping wells.

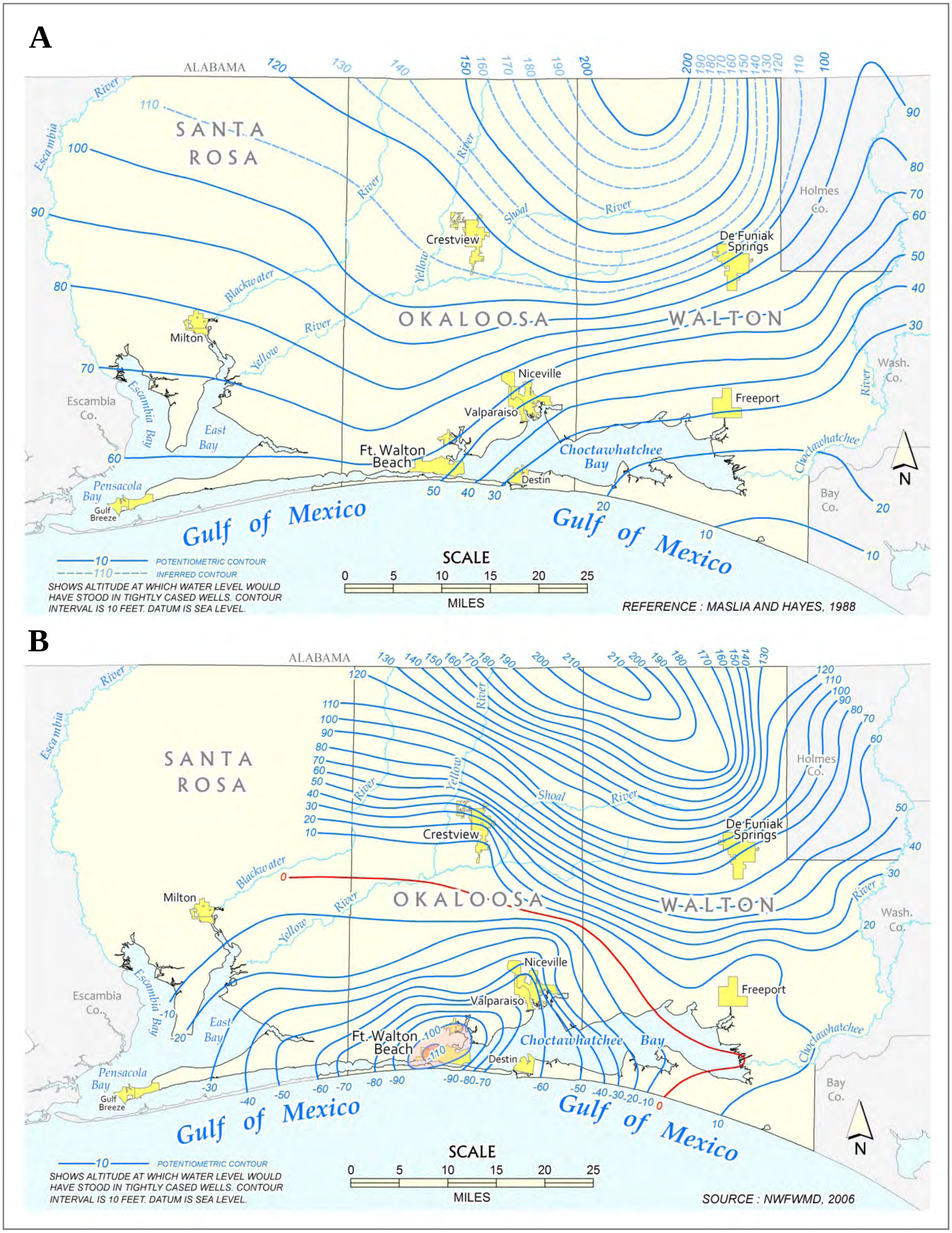

Figure 3.10 Potentiometric Surface of the Upper Floridan Aquifer in Region II for A) Estimated Conditions Prior to 1940 (Predevelopment) and B) May/June 2006

The highly productive nature of the Sand-and-Gravel Aquifer is illustrated in Figure 3.11. Hydrographs are presented for monitoring wells P3A (NWFID 7416) and P5A (NWFID 7422). Nine public supply wells that are part of the East Milton Water System and FRUS wellfield surround and are within 2.5 miles of well P3A. Monitoring well P5A is located approximately five miles northeast of well P3A (more than three miles from the nearest supply well) and is not influenced by pumping.

A comparison of the hydrographs for P3A, which is within the wellfield zone of influence, and P5A, removed from the influence of pumping, indicates water levels in the Sand-and-Gravel Aquifer are more strongly affected by variations in recharge than current pumping levels. Between 2000 and 2004, the East Milton Water System pumped approximately 0.8 mgd. During this time the region was experiencing a drought and ground water levels declined until late summer 2002. The water levels rose during 2003 in response to increased recharge from above average rainfall. In February 2004, the FRUS wellfield came online and by June 2004 their withdrawals increased to 3.8 mgd. Despite the increased pumping, water levels in both wells increased by about 10 feet during 2005 due to above normal rainfall. Declining water levels in 2006 are associated with another low rainfall period. Water levels in both P3A and P5A follow very similar trends in response to recharge and show no significant water level response to the increased pumping.

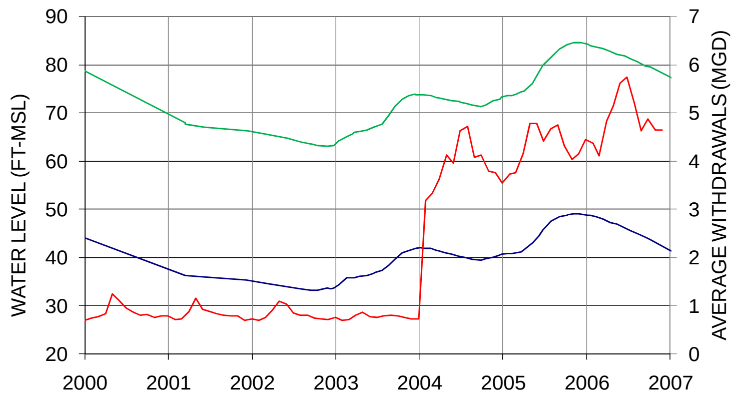

Figure 3.11 Water Levels in Sand-and-Gravel Aquifer Wells P3A (Blue) and P5A (Green) vs. Monthly Pumpage from Nearby Public Supply Wells (Red)

Floridan Aquifer System

Increased Floridan Aquifer ground water withdrawals since the early 1940s have resulted in the formation of a significant cone of depression in the Floridan Aquifer (Figure 3.10). The withdrawals are concentrated in the coastal area with about half of the withdrawals occurring in coastal Okaloosa County. The cone of depression centered under coastal Okaloosa County results from a region-wide Floridan Aquifer withdrawal of about 38 mgd (in 2007). Water levels within the cone of depression are drawn down as much as 110 feet below sea level. This feature has developed over the past 60 years as water demands and Floridan Aquifer withdrawals have increased.

Water level trends over the past two decades have been positively affected by District initiatives to limit Floridan Aquifer withdrawals along the coast and stabilize the cone of depression. Initiatives include the 1989 designation of coastal Santa Rosa, Okaloosa, and Walton counties as a Water Resource Caution Area. This designation, in part, prohibits the use of the Floridan Aquifer for nonpotable purposes, mandates water conservation measures and requires permittees to evaluate the feasibility of using reclaimed water. In the early 1990s, public supply withdrawals on Santa Rosa Island were eliminated. The major water supply initiatives implemented since 1998 are designed to reduce coastal withdrawals and provide for some water level recovery in coastal areas while also providing for increased water demands.

Figure 3.12 shows the effect of these initiatives on coastal withdrawals. In 1998, coastal withdrawals averaged 28 mgd and accounted for 78% of the Floridan Aquifer pumping in the region. By 2007, coastal withdrawals were reduced 20 percent to 22.4 mgd. The reduction was enabled by the development of the inland Sand-and-Gravel Aquifer wellfield in Santa Rosa County (2004) and development of inland Floridan Aquifer wells in both Okaloosa County (2006) and Walton County (2001). During this period inland withdrawals increased to 15.2 mgd and accounted for 40% of the Floridan Aquifer withdrawals in the region.

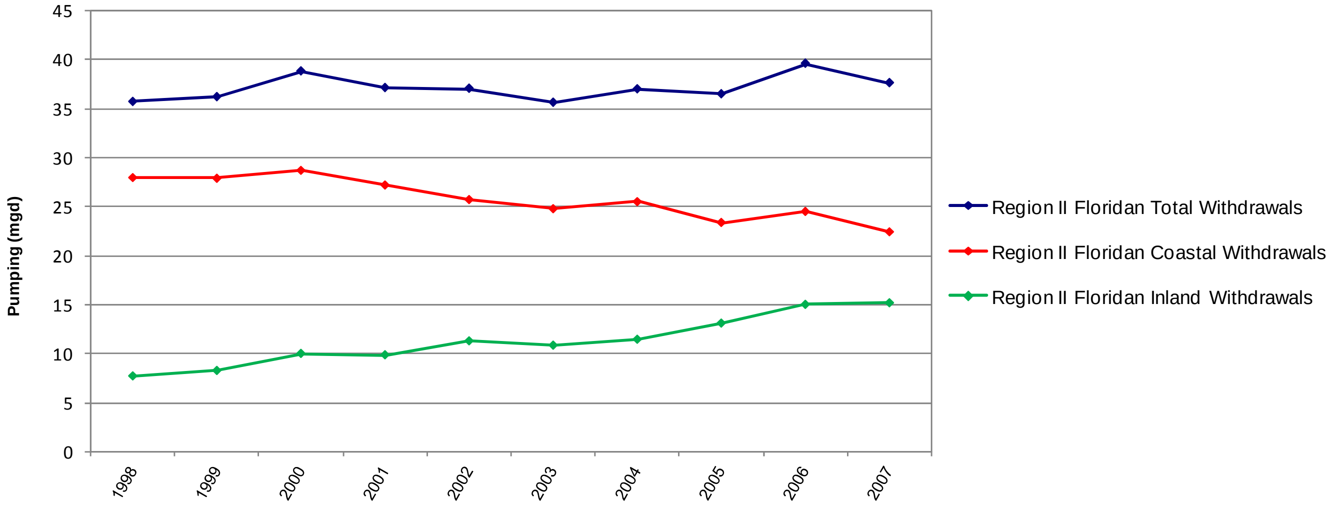

Figure 3.12 Withdrawals from the Floridan Aquifer in Region II

Hydrographs from Region II show the history of development of the cone of depression and the beneficial effect of reducing the coastal withdrawals. Water level trends along coastal Santa Rosa County are represented by the hydrograph for the Navarre Cement Plant well (Figure 3.13), which shows a significant water level decline over thirty years of ground water development. This well was located just north of Santa Rosa Sound and was abandoned in the early 1990s. However, the negative trend is seen to continue through 2002 in the hydrograph for the nearby Midway #1 well. The additional utilization of the Sand-and-Gravel Aquifer in coastal Santa Rosa County and the inland wellfield eliminated some of the coastal Floridan pumping in the area and reversed the trend. Currently, water levels in coastal Santa Rosa County have recovered about 25 feet.

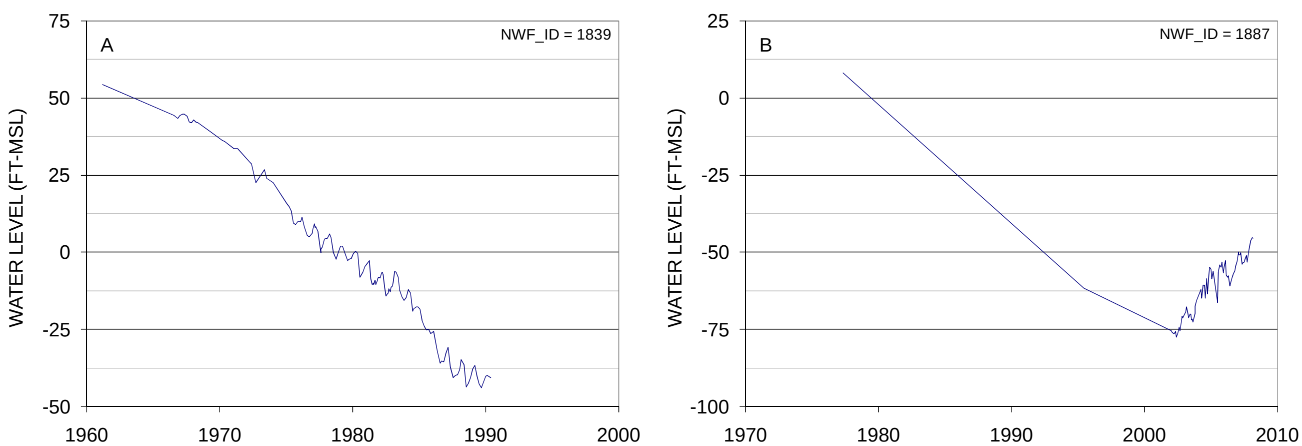

Figure 3.13 Hydrographs of the A) Navarre Cement Plant and B) Midway #1 Floridan Aquifer Wells in Southern Santa Rosa County

In Okaloosa County, hydrographs also show the mitigating effect of reduced withdrawals along the coast as Floridan Aquifer pumping is moved inland. Hydrographs are presented for wells along a south to north transect from the coast to the mid-county area (Figure 3.14). The Mary Esther #2 well is located just west of Ft. Walton Beach, near the center of the potentiometric surface cone of depression. Water levels have been observed in this well as low as 140 feet below sea level. However, remediating measures have increased water levels nearly 40 feet since 1998. Water levels in the Wright Upper Floridan well (Figure 3.14B), located approximately two miles north of Ft. Walton Beach, and the Okaloosa County School Board well in Ft. Walton Beach have increased about 25 feet over the same period of time. The recovery of water levels in these coastal areas has reduced the threat of saltwater intrusion.

Further north, the mitigating effect of reductions in coastal pumping is lessened by the effects of increased pumping further inland. Well #2 at Field #5 on Eglin AFB is located about halfway between the reduced pumping along the coast and the increased pumping in the mid-county region. Water level declines have stabilized in this well. As anticipated, the hydrograph for the Crestview #4 well shows the continued decline in Floridan Aquifer water levels in the Crestview area. Since 1998, Crestview #4 water levels have declined an additional 10 feet in response to increased inland withdrawals used to reduce coastal pumping as well as increased withdrawals by central Okaloosa County Utilities.

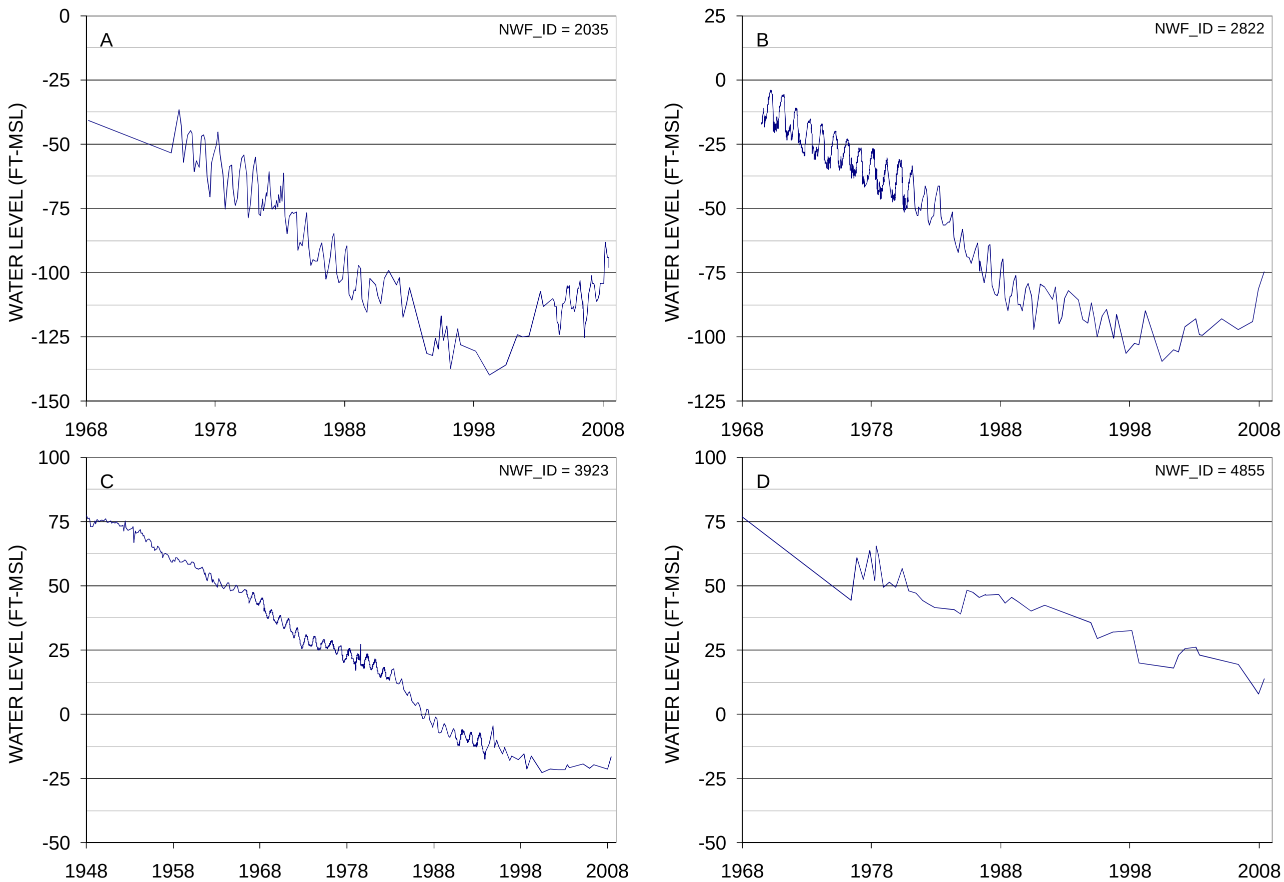

Figure 3.14 Hydrographs of the A) Mary Esther #2, B) Wright Upper Floridan, C) EAFB Field #5/Well #2, and D) Crestview #4 in Southern and Central Okaloosa County

A similar shifting of impacts is observed in Walton County. Regional Utilities has abandoned all of their coastal Floridan Aquifer wells and moved their pumping north of Freeport. Destin Water Users and South Walton Utilities are also obtaining some of their supply from inland wells and are committed to further reduce their coastal withdrawals over the next decade. Hydrographs are presented for a well located less than two miles east of South Walton Utility's coastal wells (West Hewett Street), a well approximately five miles to the northeast along the south side of Choctawhatchee Bay (S.L. Matthews), a well north of Choctawhatchee Bay in Freeport (USGS Freeport #17), and a monitor well at the former First American Farms (FAF #47) site north of Freeport (Figure 3.15).

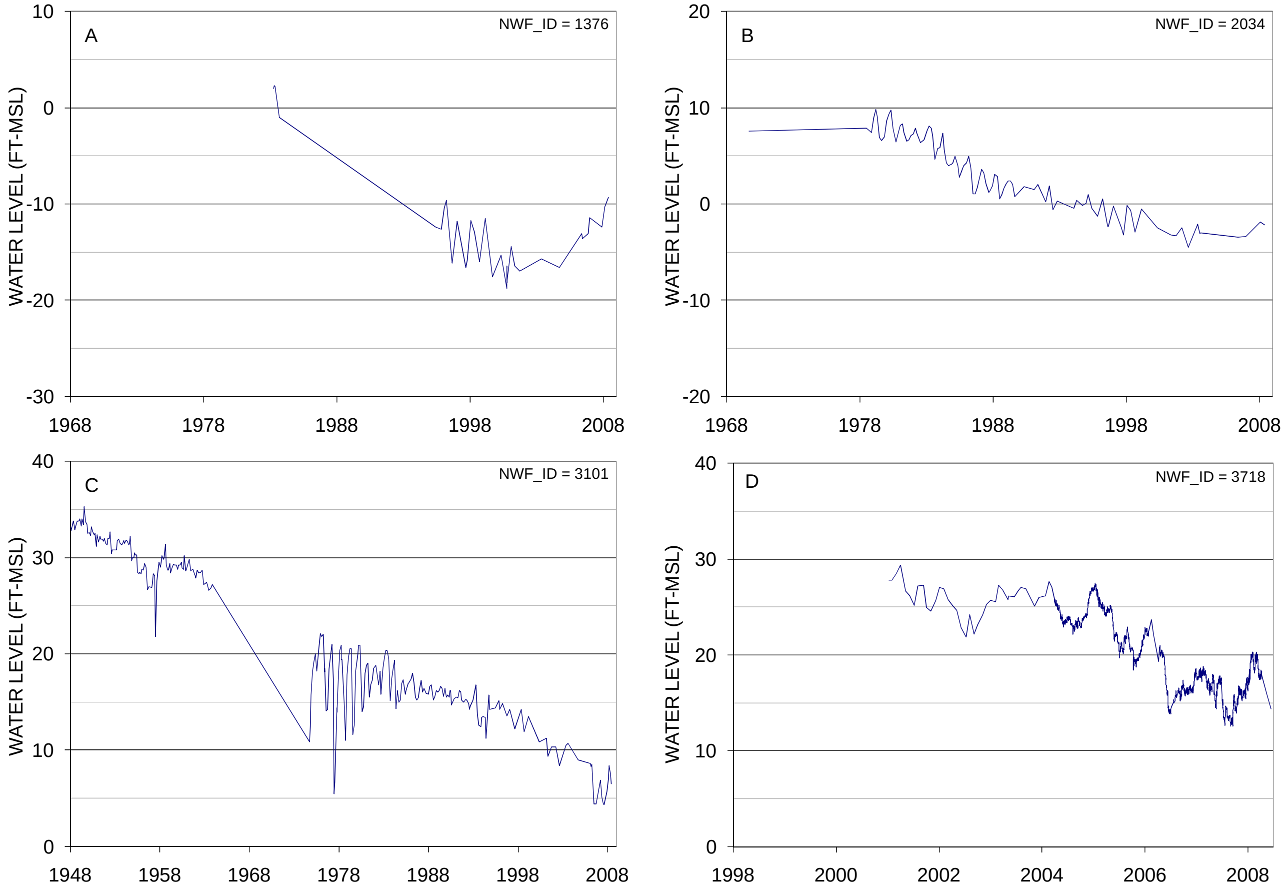

Figure 3.15 Hydrographs of the A) West Hewett Street, B) S.L. Matthews, C) USGS Freeport 17, and D) FAF #47 Floridan Aquifer Wells in Southern Walton County

A loss in potentiometric head is historically evident in the West Hewett Street and S.L. Matthews wells. These drawdowns are not as great as observed in the western part of Region II due to the thinner, leakier Intermediate System along the eastern end of Choctawhatchee Bay. However, since coastal pumping has been reduced, water levels in the West Hewett Street well have recovered almost ten feet and water levels in the S.L. Mathews well appear to be stabilizing.

Water levels in the USGS Freeport #17 well show seasonal fluctuations in the 1960s and 1970s due to the large-scale agricultural irrigation at the First American Farms located approximately five miles to the north. The long-term decline in water levels, due to the pumpage concentrated in coastal Okaloosa County, is evident in the Freeport area. Since 1948, about 30 feet of head has been lost in the Floridan Aquifer at this well location. Declines in the potentiometric surface in the Freeport area have increased over the last ten years due to increased withdrawals by Freeport and the development of the inland Floridan Aquifer wellfield about six miles north of Freeport (at the location of the former First American Farms). The drawdown in the potentiometric surface around Freeport is also evident in Figure 3.10. The FAF #47 well is located north of Freeport, about one mile east of the inland wellfield. This hydrograph (see below) shows the effect of the inland wellfield withdrawals which began in 2001. Water levels in the immediate vicinity of the wellfield have declined between 10 and 15 feet. Although additional water level declines have occurred in inland areas where pumpage has increased, these areas are not threatened by saltwater intrusion and water level declines are manageable.

Along the northern boundary of Region II, far from the coast, two separate responses to historical pumping are evident in the hydrographs for the Paxton and Camp Henderson wells (Figure 3.16). The Paxton well is located in northernmost Walton County on the region's potentiometric high and shows no observable long-term water level decline; it is not affected by the coastal pumpage occurring approximately 40 miles to the south. In this area, recharge rates are expected to be somewhat greater than elsewhere in the region due to the Intermediate System being relatively thin.

By contrast, the Camp Henderson well, located approximately 40 miles due west in Santa Rosa County and slightly further from the coastal pumping center, lost more than 20 feet of head between 1968 and the present. As is the case with the Paxton well, essentially no pumping from the Floridan Aquifer occurs in this area. Effects of coastal pumping have propagated nearly 40 miles to the state line, due to the presence of a thick, effective confining unit and low rate of Floridan Aquifer recharge in Santa Rosa County.

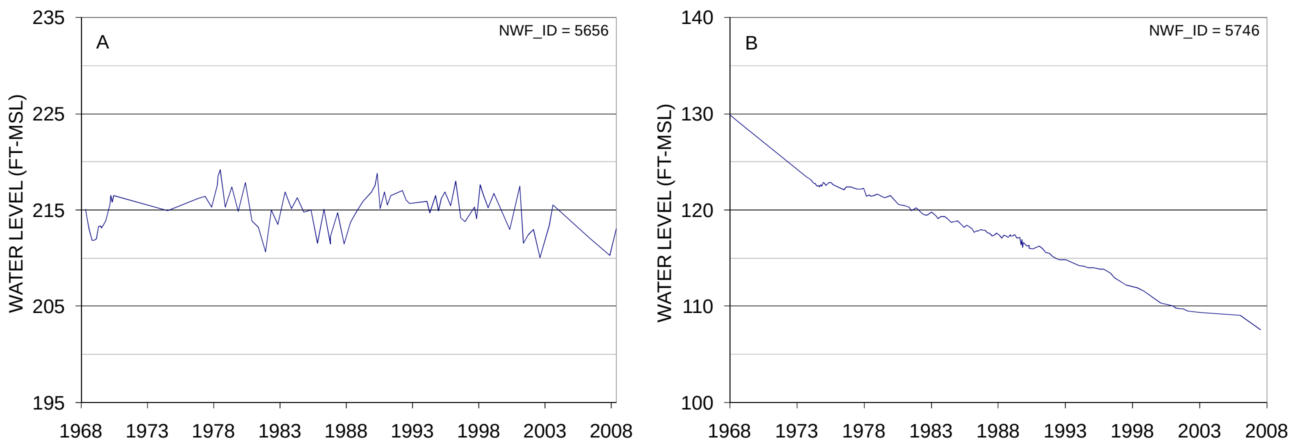

Figure 3.16 Hydrographs of the A) Paxton and B) Camp Henderson Floridan Aquifer Wells

Coupled with concerns about the potentiometric surface decline are concerns about the quality of Floridan Aquifer water withdrawn in the coastal area. The water level declines illustrated in the above hydrographs also extend over an unknown area offshore beneath the Gulf of Mexico. Water quality data shows poor quality, nonpotable water present in the Floridan Aquifer in southern Santa Rosa County and in south Walton County near the eastern extent of Choctawhatchee Bay (Pratt 2001). Nonpotable, saline water also occurs offshore beneath the Gulf of Mexico. Figure 3.17 shows sodium and chloride concentrations in the Floridan Aquifer along the coast from southeast Santa Rosa County to Bay County. The figure presents average chloride and sodium concentration data collected during the 1990s.

Floridan Aquifer water becomes increasingly more mineralized to the west. Sodium and chloride concentrations exceed the drinking water standard just west of the Midway area and in the vicinity of Navarre Beach. Moving east across the Santa Rosa-Okaloosa County line, the quality of water in the Floridan Aquifer improves. Further east (in the Destin area), water quality continues to be good. The best water quality in the Floridan Aquifer, along the coastal fringe, is found east of Destin in the South

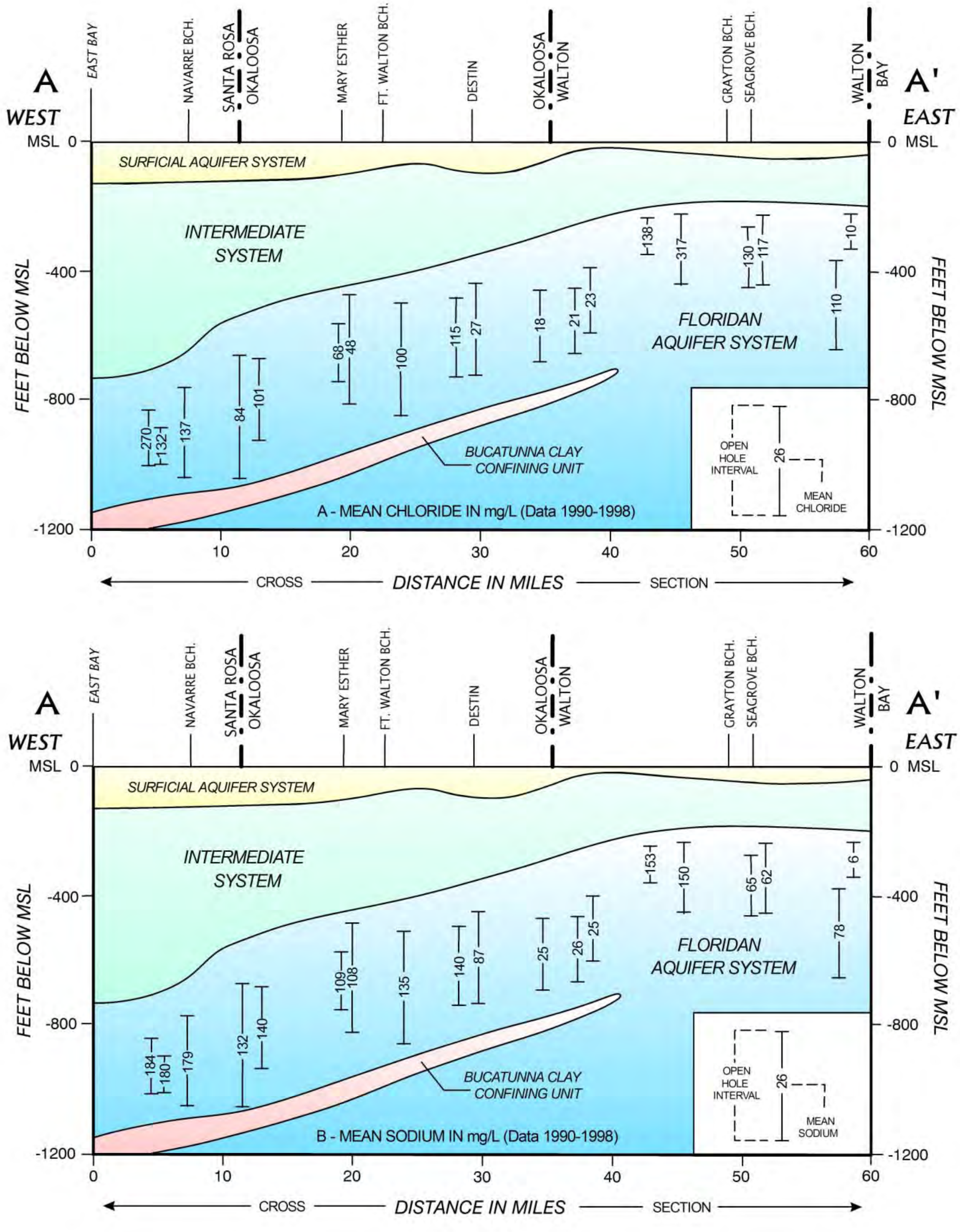

Figure 3.17 Coastal Cross-Section of Floridan Aquifer System Chloride and Sodium Concentration Data

Walton Utility Company service area. However, immediately east of the South Walton Utility Company area, the Floridan Aquifer water quality deteriorates. This area of naturally-occurring poor quality water is extensive, covering much of coastal Walton County near the eastern extent of Choctawhatchee Bay. The average concentrations for the 1990s are also representative of conditions prior to development of the ground water resource. Throughout most of the coastal area, the quality of water withdrawn has remained stable over time. Data, beginning in the 1950s and 1960s, shows no significant change in water quality in most areas. Data indicates increasing concentrations of sodium and chloride in Floridan Aquifer ground water is generally limited to wells located in or very near the saltwater interface. These areas include southeast Santa Rosa County and the eastern extent of Choctawhatchee Bay.

Lower Floridan Aquifer Water Quality

The Lower Floridan Aquifer is non potable and has been previously summarized in the Region II Water Supply Plan, as well as the 1998 WSA (Ryan et al. 1998).

Ground Water Budget

To further assess withdrawals from the Floridan Aquifer, a ground water budget was prepared using output from an updated calibrated steady-state regional ground water flow model (HydroGeoLogic, 2000). Model updates included: 1) expansion of the model domain to the entire Region II area, 2) conversion to a fully 3-dimensional flow model with active layers representing the principal hydrogeologic units down to the sub-Floridan, and 3) modified calibration and hydraulic property fields. The water budget presents an order-of-magnitude approximation of the major Floridan Aquifer System sources and discharges for Santa Rosa, Okaloosa and Walton counties.

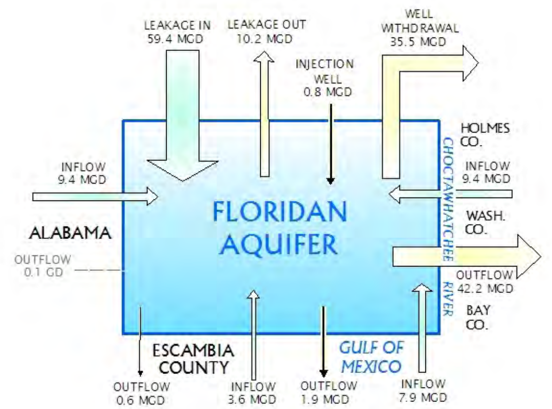

Figure 3.18 Region II Floridan Aquifer Ground Water Budget for 1998 Conditions

The updated model water budget, which covers a larger area than the previous model (Ryan et al. 1998), indicates that approximately 40 percent of the ground water flowing into the Floridan Aquifer in Region II was withdrawn by wells (36 mgd) in 2005. As previously discussed, both the magnitude and the spatial distribution of Floridan Aquifer withdrawals are important within this region. Although pumpage accounts for a relatively large fraction of the water budget, District initiatives have successfully shifted Floridan Aquifer withdrawals away from the coast and lessened the threat of saltwater intrusion. Efforts to manage ground water withdrawals and develop alternative water sources in Region II will continue.

Inflow to the Floridan Aquifer from beneath the Gulf of Mexico remains a concern. Although the exact distribution of salt water in the Floridan Aquifer beneath the Gulf of Mexico is uncertain, salt water is certainly present. The simulated inflow of 7.9 mgd from the Gulf of Mexico can potentially have a significant effect on the quality of ground water withdrawn from the aquifer (HydroGeoLogic, 2000). This is a continued concern, as raised in the initial WSA, regarding the sustainability of current withdrawal practices.

Model results indicate that approximately 1 mgd of the approximately 59.4 mgd leakage into the Floridan Aquifer through the Intermediate System may represent induced saltwater recharge. This induced recharge is due to the aquifer drawdown beneath Choctawhatchee Bay. Although the induced recharge is only a small fraction of the total leakage into the aquifer, it has the potential to degrade the quality of water being withdrawn. This issue is of greatest concern in the Choctawhatchee Bay area of Walton County where the Intermediate System is leakier.

Recharge to the Sand-and-Gravel Aquifer is estimated to average about 20 in/yr (Vecchioli et al. 1990). Local streams and rivers are the primary discharge areas for the Sand-and-Gravel Aquifer. Other discharge components include leakage (recharge) to the underlying Floridan Aquifer, pumpage, and outflow to surrounding areas such as the Choctawhatchee Bay. Pumpage from the Sand-and-Gravel Aquifer in Region II totaled approximately 23 mgd in 2005, with 17 mgd of this pumpage occurring in the northern two-thirds of Santa Rosa County. Withdrawals in this sub-region account for nearly all of the public supply and I/C/I water use and most of the domestic self-supply and agricultural irrigation use of the Sand-and-Gravel Aquifer in Region II. Based on a model-simulated recharge of 584 mgd in this sub-region, the pumpage (17 mgd) represents approximately 3% of the Sand-and-Gravel Aquifer water budget.

<u>Water Quality Constraints on Availability</u>

High recharge rates and the leaky nature of the Sand-and-Gravel Aquifer make it susceptible to anthropogenic contamination which may constrain use locally or require treatment. Deterioration of Floridan Aquifer water quality within the cone of depression constrains water availability from the Floridan Aquifer along the coast. Water quality has very slowly degraded where the saltwater interface has been identified as a transition zone from freshwater to salt water: near Navarre Beach and Midway to the west; in the coastal area to the south of the easternmost Choctawhatchee Bay, to the east; and the lower Floridan Aquifer near north Ft. Walton Beach where the underlying Bucatunna Clay confining unit tapers. However, model predictions indicate that no significant change in water quality at predicted pumping rates (HydroGeoLogic, 2007b and 2007c) is expected.

<u>Adequacy of Ground Water Resources</u>

The Sand-and-Gravel Aquifer in Santa Rosa County is an extremely productive aquifer system and is, due to its high rate of recharge, capable of providing regionally-significant quantities of water. In southern Okaloosa and Walton counties, the Sand-and-Gravel Aquifer is capable of meeting a portion of the growing local nonpotable demand. The potential for a hydraulic connection between the Sand-and-Gravel Aquifer and the local streams and wetlands requires careful planning and analysis of proposed withdrawals in order to avoid significant local impacts to natural systems located near production wells. However, rainfall and/or direct recharge to surficial wetlands tend to have a much greater influence on these systems than pumping.

District-led water supply initiatives have successfully reduced coastal pumping in the Floridan Aquifer along the coast. This reduction in pumpage has enabled water levels to recover over much of the area and has slowed but not eliminated the threat of saltwater intrusion. A significant cone of depression is still present and concerns related to saltwater intrusion and water quality degradation remain. Continued utilization of Floridan Aquifer ground water will need to continue to be closely monitored if current levels of use are to be maintained at sustainable levels into the future.

As part of the Regional Water Supply Plan for Region II, saltwater intrusion modeling was performed to analyze the effect of Floridan Aquifer pumping on the movement of the saltwater interface and water quality (HydroGeoLogic 2005 and 2007a). Forecast simulations were performed which included increasing Floridan Aquifer withdrawals to approximately 62 mgd by the year 2025 with slightly more than half of the projected pumping (32 mgd) assigned to inland areas. Pumping was held constant at that rate from 2025 to 2100, thus assuming the development of surface water sources to provide for additional demands beyond the simulated 2025 withdrawals of 62 mgd (HydroGeoLogic 2007b and 2007c). These model forecasts show the withdrawals to be sustainable through the simulation period. District efforts to stabilize or reduce coastal withdrawals and develop alternative water sources will continue along with efforts to better understand the uncertainty regarding movement of the saltwater interface. Thus, the initiatives outlined in the RWSP will continue to be implemented in Region II.

Surface Water Resources

Historically, surface water has not played a major water supply role in Region II. Surface water withdrawals totaled approximately 4.2 mgd in 2005 (Appendix B) and largely reflect water withdrawn from streams and ponds for golf course and agricultural irrigation. However, with the implementation of the RWSP, surface water is being evaluated as an alternative to future increased use of the Floridan Aquifer.

The primary fresh surface water sources to be considered for regional water supply purposes are the Blackwater River, Yellow River, Shoal River, Choctawhatchee River, and Escambia River. Feasibility analysis of surface water alternatives in Okaloosa County was conducted by the District in 2006 (PBS&J 2006). Analyses of the flow and water quality of the rivers in Okaloosa County indicate these waterbodies have the greatest potential to meet this county's future demands. The adequacy of using such alternatives as direct withdrawals, direct withdrawals in conjunction with small offline surface water supply reservoirs, or river bank filtration show the greatest promise beyond the 2025 planning horizon. Potential impacts of proposed surface water withdrawals have been evaluated at specific sites for water resource development and will continue to be identified and further evaluated under the Regional Water Supply Plan for Region II.

Reclaimed Water and Conservation

The implementation of additional reuse and conservation measures in Region II could reduce future demands on ground and surface water resources. In 2005, approximately 57% or 27.1 mgd of the wastewater generated in Region II was of reuse quality (Table 3.10) (FDEP 2006a). However, more than half of the reuse (approximately 17.5 mgd) was discharged to spray fields and infiltration ponds rather than being used to directly offset surface or ground water withdrawals. Beneficial reuse totaled 9.7 mgd and included golf course irrigation (5.6 mgd), residential lawn irrigation (1.8 mgd), landscape irrigation (1.4 mgd), wetland augmentation (0.8 mgd) and water reuse at wastewater treatment facilities (0.1 mgd).

There are several ongoing projects to develop and expand reuse systems in Region II. With $2 million in funding assistance from the District, Okaloosa County is expanding the Bob Sikes Water Reclamation Facility to provide up to 1 mgd of reclaimed water for public access irrigation. The South Walton Utility Company plans to develop a reuse system to provide water to two subdivisions and a condominium in south Walton County and the City of Freeport is developing a reuse system to provide 0.4 mgd for landscape and golf course irrigation. For both of these Walton County projects, the District has provided funding support from the Water Protection and Sustainability Program Trust Fund and other funding sources. The City of Fort Walton Beach is working to potentially provide reclaimed water for irrigation at a cemetery, schools, and an industrial park. Destin is developing an Aquifer Storage and Recovery (ASR) system to provide storage capacity for their reclaimed water. The Niceville, Valparaiso, Okaloosa County Regional Sewer Board (NVOC) has expanded its Niceville wastewater treatment facility. This reuse system currently supplies water to the Rocky Bayou Golf Course, Heritage

Gardens Cemetery, the Rocky Bayou Christian School, and the Swift Creek residential subdivision. Two residential apartment complexes may be added.

Although the potential water savings have not been quantified, there are also likely to be additional opportunities for water conservation in Region II. Examples of water conservation measures include public education, water-conservation rate structures, leak detection and repair, retrofitting of older buildings with low flow toilets and showerheads, the installation of efficient irrigation systems and the use of drought-tolerant plants in landscapes. Many of these measures have been and will continue to be implemented in Region II.

Table 3.10 Region II Reuse of Domestic Wastewater, 2005 (mgd)

Facility Name	County	Plant Capacity	Total Wastewater Flow	Reuse Capacity	Reuse Flow	Beneficial Reuse
Crestview, city of	Okaloosa	2.10	1.35	2.10	1.35	0.00
Destin Water Users/George French	Okaloosa	5.00	3.20	5.26	3.21	2.24
Eglin AFB Aux Field #3	Okaloosa	0.13	0.02	0.13	0.02	0.00
Eglin AFB Main Base	Okaloosa	1.00	0.42	1.00	0.42	0.00
Eglin AFB Plew	Okaloosa	1.50	0.56	1.50	0.56	0.00
Ft. Walton Beach	Okaloosa	4.65	3.75	4.65	3.76	0.57
Hurlburt Field AFB	Okaloosa	1.00	0.78	1.00	0.78	0.78
Mary Esther, town of	Okaloosa	1.10	0.74	1.10	0.74	0.00
Niceville/Valparaiso Regional	Okaloosa	3.35	2.73	4.52	2.73	0.52
Okaloosa County/Bob Sikes	Okaloosa	0.10	0.04	0.10	0.04	0.00
Okaloosa Correctional Institution	Okaloosa	0.23	0.14	0.23	0.14	0.00
Okaloosa Water & Sewer (Garniers)	Okaloosa	6.50	5.11	6.50	5.11	0.00
Russell F.W. Stephenson	Okaloosa	1.00	0.62	1.00	0.62	0.00
Avalon Utilities	Santa Rosa	0.10	0.02	0.12	0.02	0.02
South Santa Rosa Utilities	Santa Rosa	2.00	1.51	3.64	1.71	1.46
Holley-Navarre Wastewater System	Santa Rosa	2.00	0.94	1.24	0.93	0.93
Navarre Beach	Santa Rosa	0.93	0.25	0.03	0.00	0.00
Pace Water System #1	Santa Rosa	2.00	1.08	0.55	0.26	0.26
Milton, city of	Santa Rosa	2.50	1.50	0.00	0.00	0.00
Highway 191 WWTP	Santa Rosa	0.15	*	0.00	0.00	0.00
Jay, town of	Santa Rosa	0.12	*	0.00	0.00	0.00
DeFuniak Springs, city of	Walton	0.75	0.71	0.75	0.71	0.00
Freeport, city of	Walton	0.30	0.14	0.30	0.14	0.00
Point Washington WWTF	Walton	2.00	0.91	2.54	0.90	0.60
Sandestin Utility Company	Walton	2.00	1.14	3.29	1.14	1.14
Seacrest WWTF	Walton	0.50	0.18	1.95	0.18	0.08
South Walton Utility Company	Walton	3.65	1.47	6.86	1.47	1.05
Walton Correctional Institution	Walton	0.23	0.16	0.23	0.16	0.00
Total		**46.89**	**29.47**	**50.59**	**27.10**	**9.65**

Source: FDEP 2006a.
*flow data unavailable or no flows during 2005

3.2.3 Determination of the Need for a Regional Water Supply Plan

Regulatory action and RWSP implementation over the last ten years have successfully mitigated impacts to coastal ground water resources. Strategies have included shifting ground water pumping away from the coastline and implementing stringent reuse and conservation measures. Given ongoing concerns regarding the sustainability of Floridan Aquifer ground water production along the coast, future demands are now being met through development and District funding support of alternative inland ground water sources. Future alternative sources that continue to be evaluated under the RWSP include surface water and expanded use of the Sand-and-Gravel Aquifer. Continued implementation of the RWSP pursuant to Section 373.0361, F. S., is recommended for Region II.

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3.3 Region III: Bay County

Region III is within the St. Andrew Bay watershed and is comprised of Bay County, including the municipalities of Callaway, Lynn Haven, Mexico Beach, Panama City, Panama City Beach, Parker and Springfield. Most of these municipalities purchase their potable water from Bay County Utilities Department, which holds a permit to withdraw water from the Deer Point Lake Reservoir. The reservoir is the source of water for nearly 90% of the county's population. The City of Lynn Haven is the only municipality not entirely served by the county's utility; however, future increases in demand for the city will likely be provided from the reservoir.

Region III Snapshot		
	2005	2030
Population	161,700	224,200
Water Use (MGD)	~66	~102
Primary Source	Deer Point Lake Reservoir	
RWSP Status	Implementation	

Figure 3.19 Map of Region III, Bay County

3.3.1 Water Use Estimates and Projections

Public Supply

Bay County Utilities withdrew 26.9 mgd of surface water from the Deer Point Lake Reservoir for public supply use in 2005 (Table 3.11). The utility also withdraws surface water and provides it to industrial users, as indicated in the I/C/I water use section. Public supply withdrawals for Bay County Utilities are projected to increase by approximately 27 mgd to nearly 54 mgd in 2030. The fitting of a mathematical curve to the historical public supply water use and the extrapolated projections for Bay County Utilities reflect a high growth scenario. A high growth scenario was selected in light of the West Bay Sector Plan and proposed residential development in other areas of the county. If growth and development occur more slowly than anticipated, the 2030 water needs may be lower than projected.

Other large public supply utilities in Bay County are the City of Lynn Haven and Sandy Creek Utilities. Water demands for the City of Lynn Haven are projected to increase from 1.9 mgd in 2005 to approximately 3.2 mgd in 2030.

Table 3.11 Region III Public Supply Water Use Projections, 2005-2030

	Estimated			Projected		
Utility	2005	2010	2015	2020	2025	2030
Bay County Utilities	26.91	27.47	32.48	38.39	45.38	53.65
Lynn Haven, city of	1.94	2.22	2.46	2.71	2.95	3.19
Sandy Creek Utilities, Inc.	0.07	0.07	0.08	0.08	0.09	0.10
Total	**28.92**	**29.77**	**35.02**	**41.18**	**48.42**	**56.94**

Domestic Self-Supply and Small Public Water Systems

The estimated population served by domestic self-supply and small public water systems was 15,515 in 2005. This population used an estimated 1.6 mgd of water in 2005 and water demands are anticipated to increase to 2.3 mgd by 2030 (Table 3.12) .

Industrial, Commercial, and Institutional (I/C/I) Self-Supply

I/C/I was the second largest use category in 2005 and accounted for 24.2 mgd or 37% of the water use in Bay County (Table 3.12). Large I/C/I water users include Arizona Chemical Company, Stone Container Corporation and Tyndall Air Force Base. Although these three water users pump small quantities of ground water, they obtain the majority of their water from Deer Point Lake Reservoir via Bay County Utilities. Projected I/C/I water demands are anticipated to increase slightly to 25.7 mgd by 2030.

Recreational Irrigation

The 2005 recreational water use of 2.7 mgd consists primarily of water used for golf course irrigation (Table 3.12). Sources of irrigation water include the Floridan Aquifer, the Surficial Aquifer, reclaimed water and golf course ponds. Recreational water demands are anticipated to increase by 0.9 mgd to approximately 3.6 mgd in 2030. Future demands will continue to be met by a combination of water sources.

Agricultural Irrigation

The estimated water use for agricultural irrigation was approximately 2.5 mgd in 2005 (Table 3.12). Agriculture in Bay County consists largely of sod farming, and also includes some irrigation for hay and fruit crops. Due to the difficulties inherent in projecting the mix of future agricultural crops and acreages, agricultural irrigation demands are projected to remain constant at permitted quantities through the planning period.

Power Generation

Consumptive water use for power generation in Bay County totaled 5.8 mgd in 2005 (Table 3.12). The two power generation facilities are the Gulf Power Company Lansing Smith Electric Generating Plant (Lansing Smith Plant) and the Montenay Bay Resource Recovery Plant. In 2005, the Lansing Smith facility consumptively used 0.84 mgd of ground water from the Floridan Aquifer and 4.8 mgd of surface water from Alligator Bayou. The Montenay Bay plant relies solely on ground water and consumptively used 0.17 mgd in 2005. Due to changes in operations at the Lansing Smith Plant, consumptive water use for power generation is anticipated to increase to 12.5 mgd by 2010 and then decrease to 10.7 mgd after 2020. Future sources of water for the Lansing Smith plant are anticipated to include ground water, surface water and reclaimed water.

Total Water Use and Population

In 2005, the average annual water use in Bay County totaled 65.7 mgd (Table 3.12). The largest use categories were public supply (44% of total) and industrial/commercial/institutional (37%). The other use sectors collectively accounted for the remaining 19% (Figure 3.20).

The total population of Bay County was 161,700 in 2005 (BEBR 2007). Population and public supply water use are both projected to increase over the planning period. The high-range population projection for Bay County in 2030 is 274,700 persons and represents a 66% increase from 2005 (BEBR 2007).

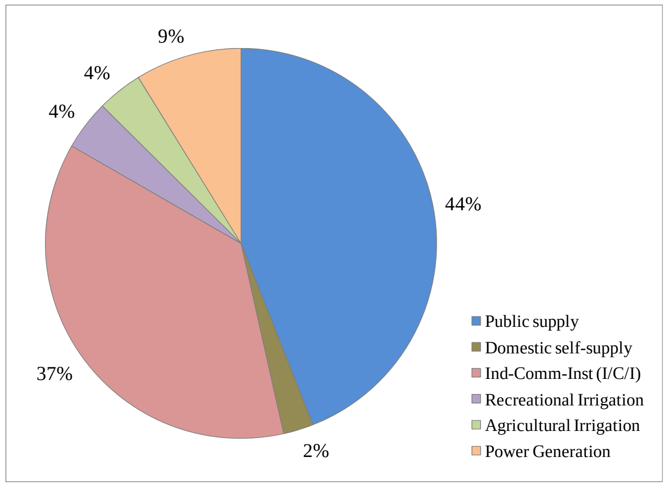

Figure 3.20 Region III Water Use by Category, 2005

The total water demand in Region III is projected to increase by 55%, or by 35.9 mgd, between 2005 and 2030 (Table 3.12). Public supply water demands are estimated to grow by 28 mgd and account for the majority of this increase. Water consumptively used for power generation is anticipated to increase by about 4.9 mgd. Water demand increases for the remaining use categories are relatively small.

Table 3.12 Region III Water Use Estimates and Projections by Category, 2005-2030 (mgd)

	Estimated	Projected				
Category	2005	2010	2015	2020	2025	2030
Public supply	28.92	29.77	35.02	41.18	48.42	56.94
Domestic self-supply	1.64	1.80	1.94	2.06	2.18	2.28
Ind-Comm-Inst (I/C/I)	24.20	25.68	25.68	25.68	25.68	25.68
Recreational Irrigation	2.71	2.82	3.02	3.22	3.42	3.62
Agricultural Irrigation	2.46	2.46	2.46	2.46	2.46	2.46
Power Generation	5.80	12.48	12.88	10.67	10.67	10.67
Total	**65.74**	**75.00**	**80.98**	**85.27**	**92.82**	**101.64**

1-in-10 Year Drought Projections

Projected demands for a 1-in-10 year drought are shown in Table 3.13. The 2030 total water demand for a 1-in-10 year drought is approximately 4% higher than the 2030 total average year water demand.

Table 3.13 Demand Projections for a 1-in-10 Year Drought Event, by Category, 2010-2030 (mgd)

	Estimated	Projected				
Water Use Category	2005	2010	2015	2020	2025	2030
Public supply	30.66	31.55	37.12	43.65	51.33	60.35
Domestic self-supply	1.74	1.91	2.05	2.19	2.31	2.42
Ind-Comm-Inst (I/C/I)	24.20	25.68	25.68	25.68	25.68	25.68
Recreational Irrigation	3.29	3.38	3.62	3.86	4.10	4.34
Agricultural Irrigation	2.46	2.46	2.46	2.46	2.46	2.46
Power Generation	5.80	12.48	12.88	10.67	10.67	10.67
Total	**68.15**	**77.46**	**83.80**	**88.51**	**96.54**	**105.92**

3.3.2 Assessment of Water Resources

Prior to 1961, Bay County was dependent on ground water for potable and industrial water supplies (Ryan et al. 1998). Following the construction of the Deer Point Lake Reservoir in 1961, many water users reduced ground water pumpage and began using surface water. Surface water is now the principal source of supply and is anticipated to remain the principal source through 2030.

Surface Water Resources

From a water supply perspective, Deer Point Lake Reservoir and its tributaries comprise the principal surface water resources within Region III. Deer Point Lake Reservoir covers between 4,500 to 5,500 acres, depending on the lake stage. The four principal tributaries contributing to Deer Point Lake Reservoir are Econfina, Bear, Bayou George, and Big Cedar creeks. Between 1998 and 2008, these four tributaries contributed an average 423 mgd (654 cfs) to the lake, based on data collected by the NWFWMD. These data are representative of a low flow period. During this decade, two distinct droughts occurred resulting in a rainfall deficit of approximately 70 inches. Normal rainfall for Region III is approximately 64.8 in/yr based on a 30-year average (1971-2000). Figure 3.21 shows the cumulative departure from normal rainfall for a station located along Bear Creek, approximately seven miles east of Deer Point Lake Reservoir.

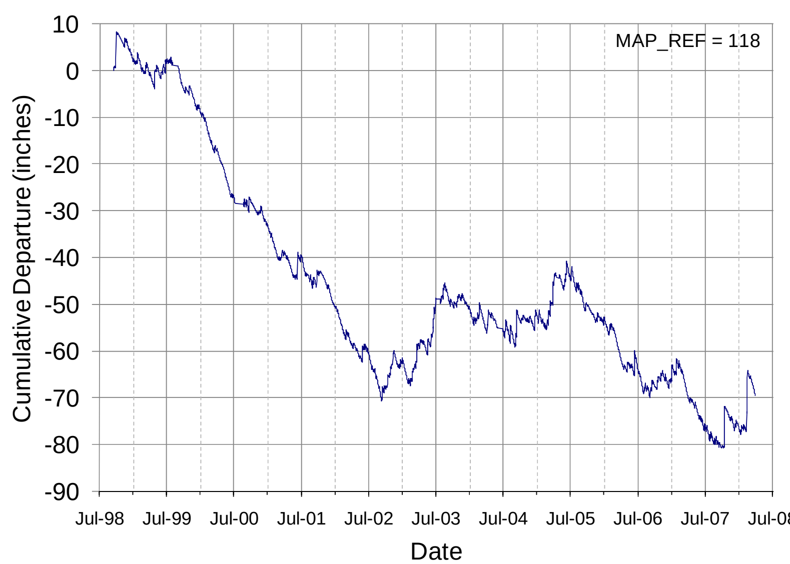

Figure 3.21 Cumulative Departure from Normal Rainfall along Bear Creek at US 231

Econfina Creek contributes approximately 60 percent of the average annual inflow into Deer Point Lake Reservoir. During low flow conditions, Econfina Creek contributes almost 80 percent of the inflow

(Richards 1997). The large stream flow results, in part, from significant Floridan Aquifer spring discharge along the middle Econfina Creek. The long-term average flow (1935 to 2008) for Econfina Creek at Highway 388 is 345 mgd (534 cfs). Because of the high percentage of spring inflow, discharge from Econfina Creek into Deer Point Lake Reservoir is relatively stable over the year. The average flow for the 10-year period of drought (1998 to 2008) is 308 mgd (477 cfs), or 11 percent below the long-term average, reflecting the stable contribution of ground water. Flow-duration curves for Econfina Creek for the 10-year drought period and the full period of record are shown in Figure 3.22. It is apparent that even under dry conditions, Econfina Creek contributes a significant quantity of fresh water to Deer Point Lake Reservoir. In addition, ground and surface waters from the Econfina watershed are presently of high quality. In order to protect the future use and quality of the reservoir, the NWFWMD, as of 2006, has purchased over 41,000 acres of land along the Econfina Creek and in the Econfina Recharge Area.

Deer Point Lake Reservoir is the largest contributor of fresh water to the St. Andrew Bay estuary system. The system consists of four interconnecting waterbodies: West, North, East, and St. Andrew Bays. Based on a 1994-2004 water budget prepared by the NWFWMD, an average of approximately 550 mgd (851 cfs) of fresh water flows over the Deer Point dam into North Bay (Crowe et al. 2008).

Information regarding the hydrologic and ecologic characteristics of the St. Andrew Bay system can be found in the recent assessment of freshwater inflows to North Bay from the Deer Point Lake watershed (Crowe et al. 2008). Additional information may be found in the original WSA (Ryan et al. 1998) and the St. Andrew Bay Watershed SWIM Plan (NWFWMD 2000).

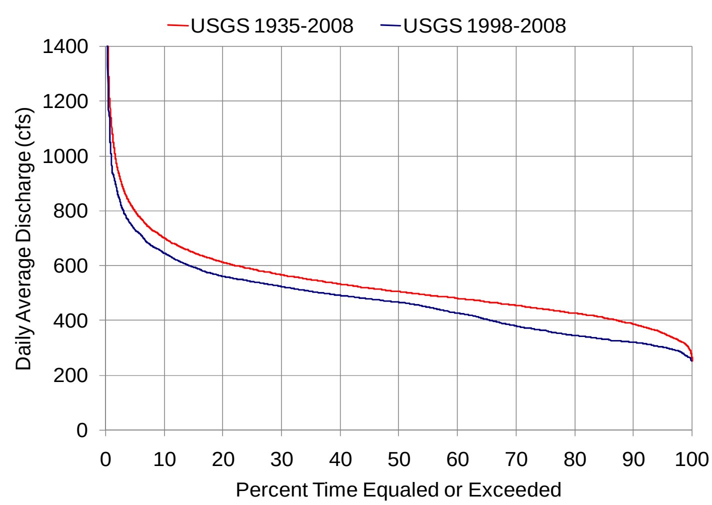

Figure 3.22 Flow Duration Curve for Econfina Creek at Highway 388

Assessment Criteria

The primary assessment criterion for surface water availability is the sustainability of surface water resources and associated natural systems. Reductions in surface water flows relative to discharges needed to sustain the downstream estuarine and bay environments have recently been assessed (Crowe et al. 2008). For water supply purposes, reduced surface water inflows to the reservoir during droughts or the increased probability of such were also considered.

Impacts to Surface Water Resources and Related Natural Systems

Drought conditions may cause potential impacts to water resources as a result of increased demand and reduced supply. The ability of the natural system to sustain surface water demands during periods of drought can be assessed, in part, by comparing current use and drought year water demands to Q_{90} flows into Deer Point Lake Reservoir and the St. Andrew Bay system. Hydrologic and hydrodynamic modeling also was performed to assess the impact of reservoir withdrawals on the North Bay estuary of the St. Andrew Bay System.

Surface water withdrawals from Deer Point Lake Reservoir were approximately 45 mgd in 2005. Between 1998 and 2008, the Q_{90} inflow from the four principal tributary streams is estimated to be 244 mgd. The 2005 surface water demands were equivalent to about 18 percent of the reservoir inflow for this low rainfall period. The 2005 surface water demands equate to approximately 14 percent of the total inflow to the St. Andrew Bay system under low flow conditions (316 mgd, Musgrove et al. 1965). The current Bay County Utilities' allocation of 69.5 mgd is permitted through 2010. An extension of the allocation agreement through 2040 allows increased withdrawals, not to exceed 98 mgd. If existing use trends continue, surface water demands for the region are projected to reach approximately 84 mgd by 2030. Projected 2030 surface water demands for a 1-in-10 year drought event (87 mgd) are equivalent to 36 percent of the Q_{90} inflow to Deer Point Lake Reservoir under low rainfall conditions and 28 percent of the estimated freshwater low-flows to St. Andrew Bay. The NWFWMD has prepared a Regional Water Supply Plan (RWSP) for Bay County to identify alternative water supplies, in part, to supplement projected surface water use during periods of drought.

The construction of Deer Point Lake Reservoir has altered the natural estuarine system of North Bay. A new salinity regime was established in North Bay as the system adapted to the regulated fresh water flows from Deer Point Lake Reservoir. As discussed above, the NWFWMD has recently completed an assessment of current and long-term fresh water inflows into Deer Point Lake Reservoir and potential impacts of additional water supply withdrawals from the reservoir on the salinity of North Bay (Crowe et al. 2008). As part of the assessment, the NWFWMD evaluated "no-flow" periods associated with winter drawdowns. Bay County performs short duration winter drawdowns as a means to control and eliminate aquatic weeds that have been a problem in the reservoir since the late 1970s. The assessment included a characterization of the Deer Point Lake watershed and North Bay system, a hydrologic model of the Deer Point Lake Reservoir, and a hydrodynamic model of North Bay. The results of the study concluded that the permitted increases in withdrawals from the reservoir up to 98 mgd and periodic drawdowns of lake levels will not adversely impact the salinity of the North Bay estuarine system. Proper management, monitoring, and protection of fresh water flows ensure that the North Bay estuary continues to be a healthy, productive, and diverse ecosystem. Deer Point Lake Reservoir and North Bay of the St. Andrews Bay watershed are included on the District's Minimum Flows and Levels (MFL) priority list for further consideration in 2015. An MFL or reservation may be established if future demands are much greater than currently anticipated.

<u>Water Quality Constraints on Availability</u>

Deer Point Lake Reservoir and its tributary creeks are classified as Class I Waters of the State due to their designation as the major potable water supply for Bay County. Water quality within the system has thus far been adequate for the designated uses; however, there have been indications of less than ideal water quality.

Consumption advisories have been issued for Deer Point Lake Reservoir due to elevated concentrations of mercury in largemouth bass (FDEP 2006a). There also has been a history of problematic aquatic plants within the lake (Hardin 1980, Kobylinski et al. 1980). These problems may be a result of nutrients within the system prior to the impoundment of fresh water and/or the addition of nutrients associated with development within the watershed. As a relatively shallow impounded system, Deer Point Lake Reservoir is highly susceptible to sedimentation, to the point that too much accumulation could reduce the storage capacity needed for water supply. Areas of oxygen depletion and reduction in biological diversity have been noted within the impoundment, which contribute to concern for the overall health of the system (Young 1987, Wolfe et al. 1988). Water clarity reductions and turbidity increases have been documented throughout the lake, but particularly within the Bayou George area (Hardin 1980).

Growth in Bay County not only increases the demand for water but also creates the potential for land use activities that could impact water quality. Of particular concern is residential development that uses individual septic systems near the reservoir or its tributaries. To help prevent water quality degradation, Bay County enacted the Deer Point Lake Protection Zone Ordinance in 1994. The ordinance expanded the protection zone boundary established by the State in 1967 and requires low-density development, a 75-ft natural vegetation setback, stringent stormwater runoff requirements, and prohibits certain incompatible land uses. Presently, the quality of ground and surface water in the Deer Point Lake watershed is sufficiently high that the water can be used with minimal treatment. To safeguard the present condition of the lake, future land uses in the watershed should continue to be carefully managed.

In addition to anthropogenic concerns, the 2004 and 2005 hurricane seasons emphasized existing concerns over the susceptibility of the reservoir to storm surge. Based on the National Hurricane Center's Tropical Cyclone Reports, the Gulf Coast experienced a 10 to 15 foot storm surge from Hurricane Ivan (2004) and a 24 to 28 foot storm surge from Hurricane Katrina (2005). These two storms were Category 3 hurricanes when they made landfall. Storm surge predictions were made for the Deer Point Lake Dam using the SLOSH model (USACE 1998). The elevation of the dam spillway is 4.5 ft above mean sea level. The predicted surge heights ranged from 11.3 feet (Cat 3) to 17.5 feet (Cat 5) above sea level. Storm surge from hurricanes of these magnitudes could inundate the lake with moderately to highly saline water. Under average inflow conditions (723 cfs), it has been estimated it would take about 22 days to replace the reservoir volume (Toler 1964). During the initial filling of the reservoir, it took several months to reduce chloride levels to drinking water standards. The salinity of the lake at the time the dam was completed was about 39% that of seawater. As a worst case scenario lake flushing time could be extended if it became more saline than previous estimates. As a result, the availability of water from the Deer Point Lake Reservoir is constrained by the possibility of a storm surge event or anthropogenic impact that temporarily degrades water quality.

Adequacy of Surface Water Resources

In Region III, the existing and reasonably anticipated surface water sources are adequate to meet the requirements of existing and reasonably anticipated future average water demands and demands for a 1-in-10 year drought through 2030, while sustaining water resources and related natural systems. However, the major concern for potential water quality impacts is that resulting from hurricane storm surge. A Regional Water Supply Plan (NWFWMD 2008) has recently been prepared for Region III to address concerns associated with existing surface water sources.

Ground Water Resources

Ground water is significant in Region III from two perspectives. First, a significant fraction of the surface water discharged into the Deer Point Lake Reservoir originates as discharge from the Floridan Aquifer outside of Region III. This discharge is conveyed to Deer Point Lake Reservoir via Econfina Creek. Second, the Floridan Aquifer as an inland ground water source is being evaluated as a supplemental alternative water supply for Deer Point Lake Reservoir.

In order of depth, the hydrogeologic units which describe the ground water flow system are the Surficial Aquifer System, the Intermediate System, the Floridan Aquifer System and the Sub-Floridan System.

The Surficial Aquifer typically consists of unconsolidated quartz sand. Ground water generally exists under unconfined conditions. The thickness of the Surficial Aquifer ranges between 40 feet and 80 feet in coastal Bay County and is typically 40 feet or less in inland areas. In low-lying areas along Econfina Creek, the Surficial Aquifer is absent. Along the coastal fringe, the saturated thickness and permeability are sufficient to form a locally important source of ground water that is used to meet some water needs, particularly for nonpotable uses. Well yields range from 200 to 500 gpm.

The Intermediate System consists of fine-grained low permeability sediments and functions primarily as a confining or leaky confining unit. In central and northern Bay County, the thickness of the Intermediate System is typically 100 feet or less. Along Econfina Creek, this unit is very thin to absent. In coastal Bay County, this unit reaches a thickness of 200 to 300 feet and includes a locally significant aquifer. Well yields are on the order of 200 to 300 gpm and although not as productive as the Surficial Aquifer, the Intermediate System in coastal Bay County is capable of yielding significant quantities of water.

The Floridan Aquifer System is the source of most of the ground water pumped in Region III. It consists of a sequence of carbonate sediments ranging in thickness from about 600 feet in northeast Bay County to more than 1,400 feet in the extreme southeast part of the county. The hydraulic conductivity is quite variable. In northwest Bay County, results of aquifer performance testing were on the order of 45,000 ft^2/day and specific capacity values averaged 120 gpm/ft. This is an area of active recharge, flow and dissolution of the Floridan Aquifer System.

The Floridan Aquifer System's zone of contribution for Region III extends into southern Washington, and eastern Calhoun and Gulf counties (Richards 1997). On the east side of Econfina Creek in the Bay County panhandle, the potentiometric surface reaches a maximum elevation of approximately 140 feet above sea level (Figure 3.23). From this high point, water levels decline in all directions. Along the Bay-Washington County line, the potentiometric surface is lower; reaching an average elevation of about 50 feet above sea level. From here, water levels decline toward Econfina Creek and the Gulf of Mexico. Significant spring discharge occurs along the Econfina Creek in northern Bay and southern Washington Counties.

Assessment Criteria

The long-term depression of the potentiometric surface of the Floridan Aquifer System was the primary criteria used to assess ground water availability. A ground water budget was also used to examine the relative magnitude of ground water withdrawals.

Impacts to Ground Water Resources and Related Natural Systems

Data are presented in Figure 3.24 showing historical Florida Aquifer water levels near the coast. Hydrographs include a well near the Panama City Airport (Fannin Airport well), a well at Tyndall AFB (Tyndall #10), and a well in Panama City Beach (Argonaut Street well). A fourth well (Eddie Barnes well) is located north of Deer Point Lake Reservoir, away from the historical pumping centers.

The Fannin Airport and Tyndall wells depict water level declines that persisted from the late 1930s to late 1960s, largely due to industrial withdrawals. Larger declines are evident in the Tyndall well, which was closer to and downgradient from the former wellfields used prior to the industrial supply switch to surface water. With the reduction in Floridan Aquifer pumping, water levels in both wells rebounded in 1967. Subsequent to this recovery, water levels began to drift down again. This downward trend largely

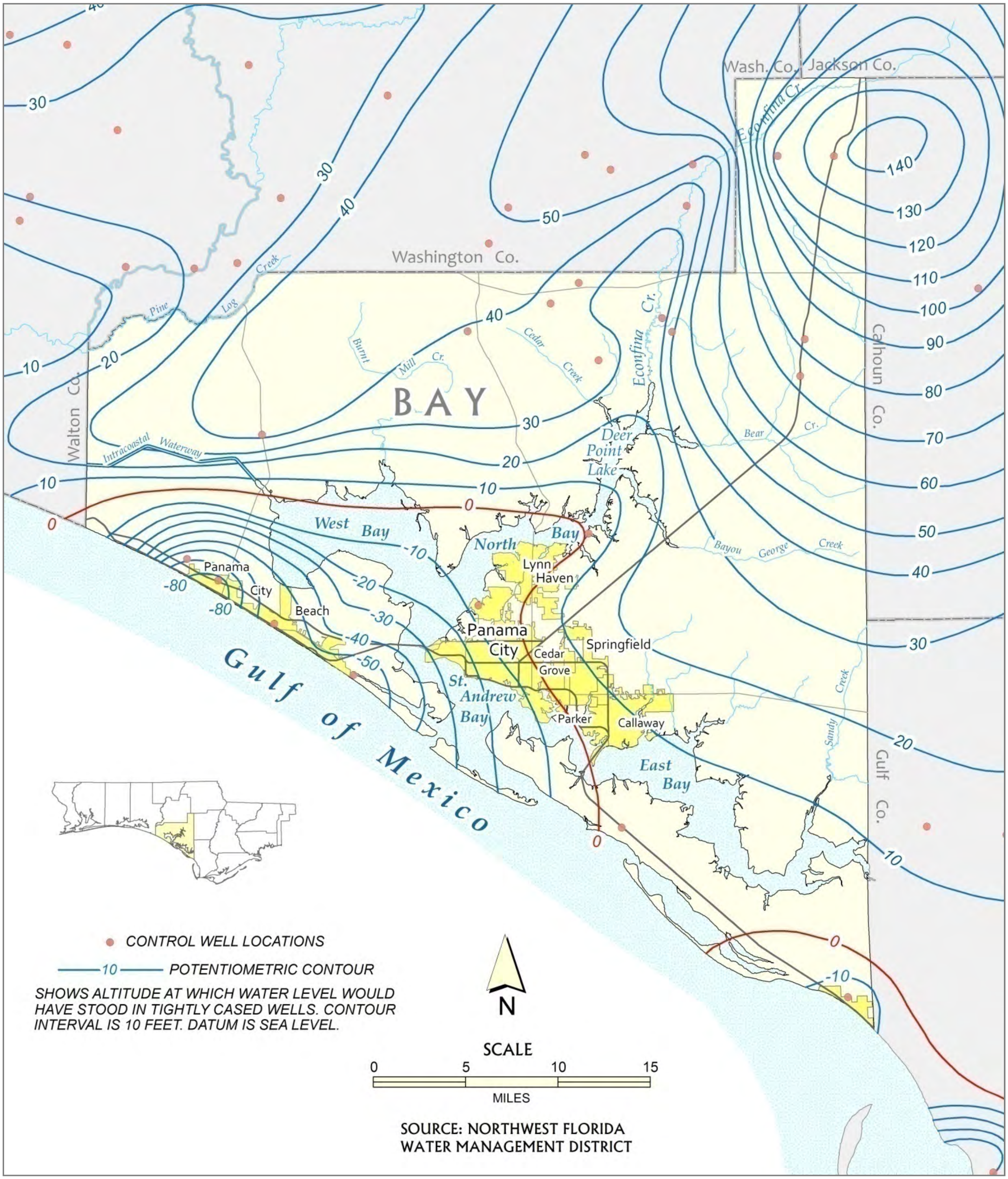

Figure 3.23 Potentiometric Surface of the Floridan Aquifer System in Bay County, May 2000

represents increased withdrawals in the Panama City Beach area. As a result, a significant cone of depression again formed in the Floridan Aquifer. The Argonaut Street hydrograph indicates that the Panama City Beach cone of depression has existed since at least 1990. Water levels in the Argonaut Street well ranged between 90 and 30 feet below sea level during the 1990s. Water levels were depressed as much as 80 feet below sea level around Panama City Beach as recently as 2000 (Figure 3.24).

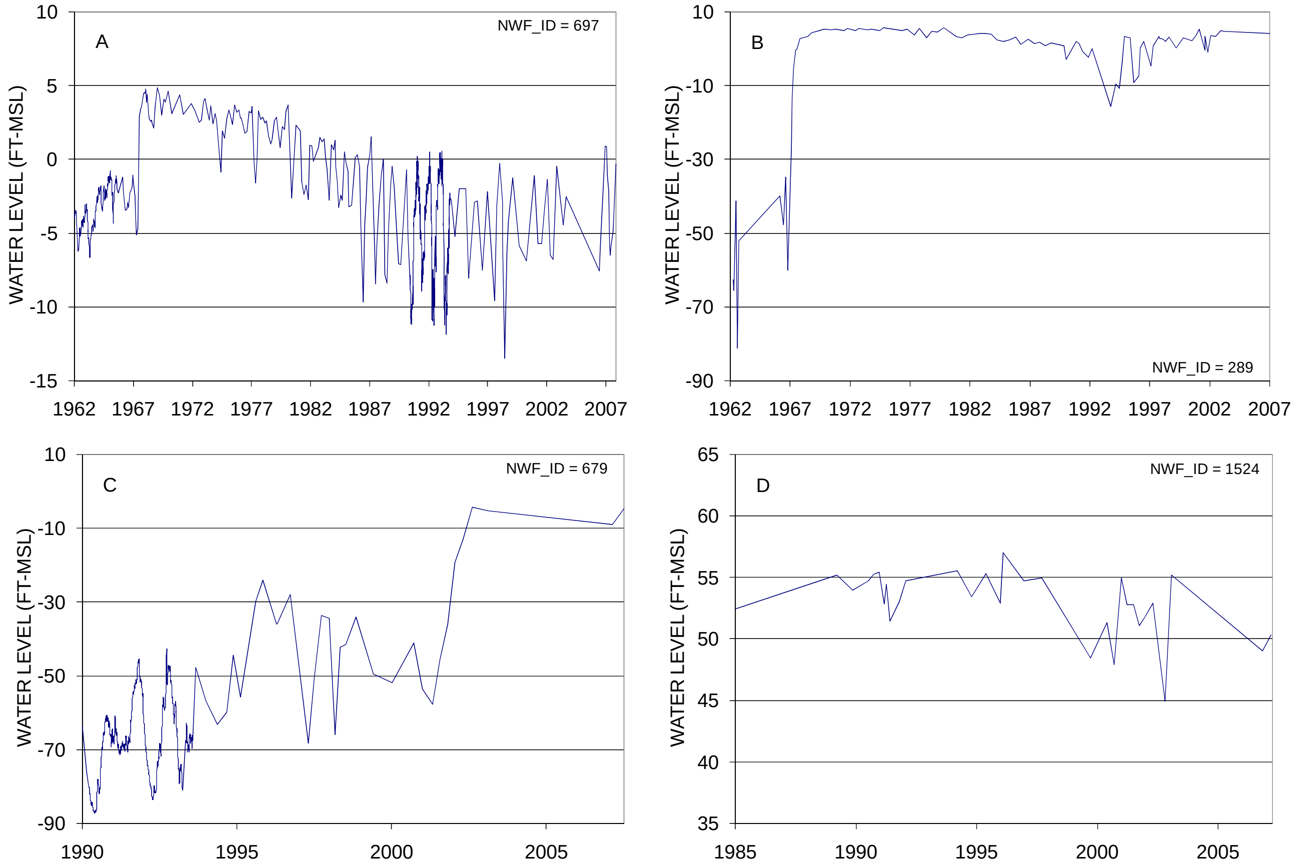

Figure 3.24 Hydrographs of the A) Fannin Airport, B) Tyndall #10, C) Argonaut Street, and D) Eddie Barnes Floridan Aquifer Wells

In 2002, deteriorating water quality associated with the local cone of depression prompted Panama City Beach to abandon their supply wells and begin purchasing all of their water from Bay County Utilities. Following the cessation of pumping, water levels in the Floridan Aquifer recovered approximately 50 feet, as shown in the Argonaut Street well. Water levels are currently just below sea level in the Panama City Beach area (Argonaut and Tyndall wells) due to the continued limited use (approximately 6 mgd) of the Floridan Aquifer for public supply, industrial, irrigation, and domestic self-supply water use.

By contrast, the Eddie Barnes well, located in northeast Bay County just east of Econfina Creek, appears to have been unaffected by withdrawals (Figure 3.24D). Based on results from a calibrated, steady-state ground water flow model (Richards 1997), the simulated potentiometric surface of the Floridan Aquifer at this location differed by approximately 0.01 feet between pumping and non-pumping conditions. Water levels have fluctuated approximately ten feet between 1985 and 2008. The lowest water levels are associated with the two droughts experienced over the last ten years. This well indicates that the ground water levels that control stream baseflow are relatively stable and only moderately affected by drought.

Ground Water Budget

The water budget presents an order-of-magnitude approximation of the major Floridan Aquifer System sources and discharges for Bay County (Ryan et al. 1998) (Figure 3.25). The most active part of the flow system is in the northern part of the region along the Bay-Washington County line where a new and alternative ground water supply source is being developed. The projected 2030 Floridan Aquifer demand of approximately 10 mgd represents four percent of the ground water budget.

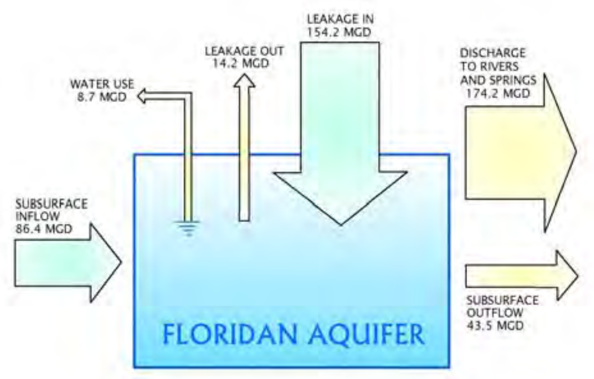

Figure 3.25 Region III Floridan Aquifer Water Budget for 1996 Conditions

<u>Water Quality Constraints on Availability</u>

Concerns regarding water quality and potentiometric surface declines constrain the availability of the Floridan Aquifer in coastal Bay County. However, over most of Region III, the quality of ground water in all three aquifer systems is suitable for most uses.

<u>Adequacy of Ground Water Resources</u>

The 2030 projected ground water demand is a small percentage of the regional water budget and regional ground water resources are adequate to provide for the projected average annual withdrawals and the 1-in-10 year drought event withdrawals of 11.2 mgd and 11.8 mgd, respectively.

In February 2008, the NWFWMD Governing Board directed the development of a Regional Water Supply Plan (RWSP) to identify additional alternative water supply sources for Region III. Use of the inland Floridan Aquifer is currently being evaluated as an alternative water source to the Deer Point Lake Reservoir. Lake and wetland impacts, reduced stream discharge, and movement of the saltwater interface, due to inland ground water development, are being considered as part of the evaluation. The impacts and constraints of inland ground water development on the adequacy of ground water resources will be determined through implementation of the water supply plan in cooperation with Bay County. Currently a detailed ground water model to evaluate and assess this new source of supply is under development.

Reclaimed Water and Conservation

The implementation of additional reuse and conservation measures in Bay County could reduce demands on ground and surface water resources. Approximately 1.6 mgd or 10% of the wastewater generated in Bay County in 2005 was of reuse quality (Table 3.14). In 2005, 1.6 mgd of reclaimed water was beneficially used at golf courses, parks, industrial use, and lawn irrigation. Potential reuse opportunities in Bay County exist with the proposed increased capacity of the Panama City Beach plant, as well as at the Military Point WWTP/Bay County Regional WWTP system. Although the feasibility of reuse will depend on economic considerations, facility locations, storage options, and other factors, local governments and utilities are exploring opportunities to meet future water use needs with reclaimed water.

There are also additional opportunities for water conservation in Bay County. Examples of water conservation measures include leak detection and repair, water-conservation rate structures for public supply utilities, retrofitting older buildings with low flow toilets and showerheads, hotel/motel water conservation programs, use of efficient irrigation systems, best management practices for agriculture, and the use of drought-tolerant plants in landscapes.

Table 3.14 Region III Reuse of Domestic Wastewater, 2005 (mgd)

Facility Name	Plant Capacity	Total Wastewater Flow	Reuse Capacity	Reuse Flow	Beneficial Reuse
Bay Point WWTF	0.50	0.29	0.50	0.29	0.29
Lynn Haven, city of	2.50	1.71	0.08	0.31	0.31
Military Point	7.00	4.15	1.61	0.54	0.54
St. Andrews WWTP	5.00	3.02	5.00	0.46	0.46
Millville AWT	5.00	2.70	0.00	0.00	0.00
Panama City Beach, city of	7.00	3.80	0.00	0.00	0.00
Southport WWTP	1.50	*	0.00	0.00	0.00
Fanning Bayou WWTP	0.18	*	0.00	0.00	0.00
Lake Merial WWTP	0.10	*	0.00	0.00	0.00
Total	**28.77**	**15.67**	**7.19**	**1.60**	**1.60**

Source: FDEP 2006a
*flow data unavailable or no flows during 2005

3.3.3 Determination of the Need for a Regional Water Supply Plan

Currently surface water resources are anticipated to be sufficient to meet the projected demands through 2030 while sustaining water resources and associated natural systems. However, this source of supply is vulnerable to coastal storm surge and severe drought. The District's Governing Board determined in March 2008 that a Regional Water Supply Plan is needed for Region III and the plan was subsequently adopted in August 2008. Development of an alternative inland ground water supply will diversify long-term public supply sources and make them drought-resistant and minimize any vulnerability to public water supplies resulting from potential major hurricane storm surge effects on the surface water reservoir.

3.4 Region IV: Calhoun, Holmes, Jackson, Liberty and Washington Counties

Region IV consists of five rural counties, with over 77 percent of the population residing in unincorporated areas. Government, retail trade, service and manufacturing are the region's major employment sectors. A significant portion of land in the region is devoted to forestry, agriculture and conservation. The District manages over 95,000 acres within Region IV, including tracts in the Holmes Creek, Econfina Creek, Choctawhatchee, Upper Chipola and Apalachicola River water management areas. The majority of Liberty County lies within the Apalachicola National Forest. Water demands in Region IV are primarily met with ground water from the Floridan Aquifer.

Region IV Snapshot		
	2005	2030
Population	113,500	143,400
Water Use (MGD)	~51	~62
Primary Source	Floridan Aquifer	
RWSP Status	No RWSP Recommended	

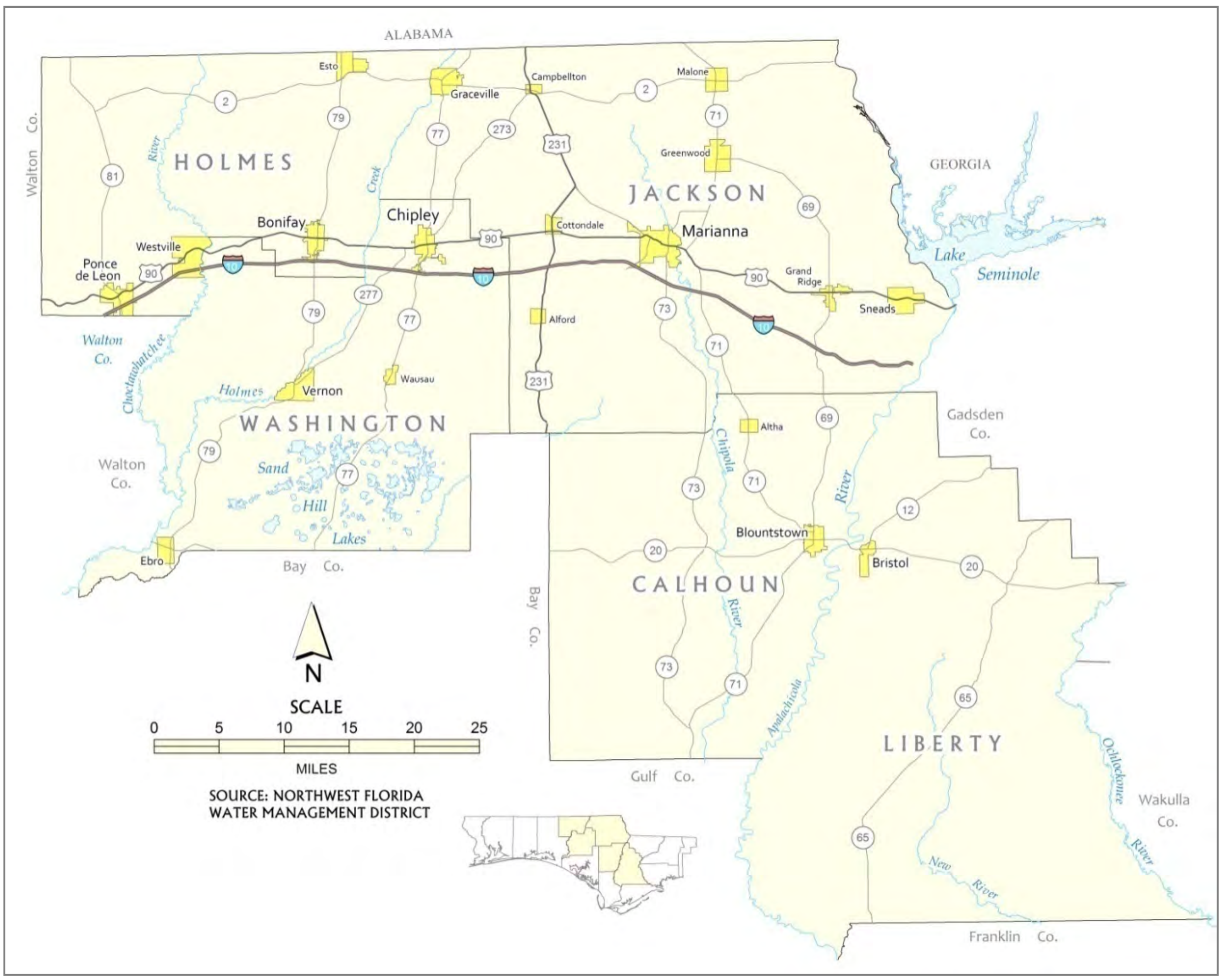

Figure 3.26 Map of Region IV

3.4.1 Water Use Estimates and Projections

Public Supply

Large public water systems collectively withdrew approximately 5.3 mgd of ground water in 2005 (Table 3.15 through Table 3.20) and supplied approximately 31% of the population. The largest withdrawals were by the City of Marianna (1.1 mgd), the City of Bonifay (0.9 mgd), the City of Chipley (0.6 mgd), and the City of Blountstown (0.6 mgd). All of the remaining utilities used less than 0.5 mgd. Total withdrawals for public supply use are anticipated to increase to 7.2 mgd by 2030.

Domestic Self-Supply and Small Public Water Systems

The majority of the population (78,315 persons) was served by small public water systems or domestic self-supply in 2005. The estimated domestic self-supply water use was 8.3 mgd in 2005 and demands are anticipated to increase to 10.5 mgd in 2030 (Table 3.20).

Table 3.15 Calhoun County Public Supply Water Use Projections, 2005–2030 (mgd)

	Estimated			Projected		
Calhoun County	2005	2010	2015	2020	2025	2030
Altha, town of	0.07	0.10	0.10	0.11	0.11	0.12
Blountstown, city of	0.56	0.66	0.70	0.75	0.79	0.83
Total	**0.56**	**0.66**	**0.70**	**0.75**	**0.79**	**0.83**

Table 3.16 Holmes County Public Supply Water Use Projections, 2005–2030 (mgd)

	Estimated			Projected		
Holmes County	2005	2010	2015	2020	2025	2030
Bonifay, city of	0.94	0.89	0.94	1.03	1.16	1.33
Joyce E. Snare Waterworks (Dogwood)	0.04	0.05	0.05	0.05	0.05	0.05
Esto Water Works	0.04	0.05	0.05	0.05	0.05	0.05
Noma, town of	0.05	0.07	0.08	0.08	0.09	0.10
Ponce de Leon, town of	0.10	0.10	0.11	0.13	0.14	0.15
Westville, town of	0.03	0.03	0.04	0.04	0.04	0.05
Total	**1.20**	**1.19**	**1.27**	**1.38**	**1.53**	**1.72**

Table 3.17 Jackson County Public Supply Water Use Projections, 2005 – 2030 (mgd)

	Estimated			Projected		
Jackson County	2005	2010	2015	2020	2025	2030
Cottondale, city of	0.13	0.13	0.14	0.15	0.15	0.16
Graceville, town of	0.39	0.40	0.44	0.47	0.50	0.53
Grand Ridge, town of	0.13	0.12	0.13	0.14	0.15	0.17
Greenwood, city of	0.08	0.09	0.10	0.10	0.11	0.12
Marianna, city of	1.13	1.17	1.18	1.19	1.19	1.20
Sneads, town of	0.26	0.29	0.31	0.33	0.35	0.37
Total	**2.12**	**2.22**	**2.29**	**2.38**	**2.46**	**2.55**

Table 3.18 Liberty County Public Supply Water Use Projections, 2005 – 2030 (mgd)

Liberty County	Estimated 2005	2010	Projected 2015	2020	2025	2030
Bristol, city of	0.21	0.22	0.26	0.30	0.34	0.38
Hosford-Telogia Water System	0.12	0.14	0.17	0.19	0.22	0.24
Rock Bluff Water System	0.01	0.05	0.06	0.07	0.08	0.09
Total	**0.33**	**0.41**	**0.48**	**0.56**	**0.63**	**0.71**

Table 3.19 Washington County Public Supply Water Use Projections, 2005 – 2030 (mgd)

Washington County	Estimated 2005	2010	Projected 2015	2020	2025	2030
Aqua Utilities Florida, Inc.	0.18	0.17	0.18	0.19	0.20	0.21
Caryville, city of	0.08	0.10	0.10	0.10	0.11	0.11
Chipley, city of	0.62	0.70	0.71	0.73	0.74	0.75
Vernon, city of	0.14	0.13	0.14	0.14	0.15	0.15
Total	**1.02**	**1.10**	**1.13**	**1.16**	**1.19**	**1.23**

Industrial, Commercial, and Institutional (I/C/I) Self-Supply

I/C/I users accounted for 2.1 mgd or about 4% of the Region IV water use in 2005 (Table 3.20). Water users in this category include several correctional facilities, two water bottling plants and a sawmill operation. The projected water demands for existing I/C/I users are anticipated to increase slightly to 4.3 mgd by 2030.

Recreational Irrigation

The 2005 recreational water use of approximately 1.0 mgd represents water used for golf course irrigation (Table 3.20). The Floridan Aquifer and golf course ponds were the sources of irrigation water. Recreational irrigation is anticipated to remain fairly constant from 2010 through 2030.

Agricultural Irrigation

Agricultural irrigation was the largest water use category in 2005. Agriculture accounted for approximately 29.7 mgd or 58% of the total estimated water use in Region IV (Table 3.20). Agricultural crops include peanuts corn, cotton, hay, sod and other field crops, vegetables, and fruit crops. Future agricultural water use for the region is projected to increase by 2010 and then remain constant at permitted quantities through the planning period. As indicated in Chapter 2, the estimated and projected amounts of agricultural irrigation reflect the quantity of water currently allocated to existing permittees under the District's Consumptive Use Permitting program. Future agricultural water use may differ from projected values due to changes in economic conditions, climate or other factors that affect agricultural production.

Power Generation

The two power generation facilities that have consumptive water use permits are the Telogia Power facility in Liberty County and Gulf Power Company's Scholz Electric Generating Plant in Jackson County. Sources of water for power generation include the Floridan Aquifer System, the Apalachicola River, and a tributary of Telogia Creek. Most of the surface water and some of the ground water are used for once-through cooling and discharged to surface water sources. Consumptive water use for power generation totaled 5.1 mgd in 2005 and is anticipated to increase to 7.5 mgd by 2030 (Table 3.20).

The Jim Woodruff hydroelectric plant, located 0.2 mi from the confluence of the Chattahoochee and Flint rivers on the border between Gadsden and Jackson counties, generates electricity by passing water through turbines; it requires no consumptive use of water to operate the turbines.

Total Water Use and Population

Average annual water use in Region IV totaled approximately 51.5 mgd in 2005 (Table 3.20). The largest use categories were agricultural irrigation (58% of total) and domestic self-supply (16%) (Figure 3.27). Among the five counties, Jackson County used the largest amount of water (Appendix A). The total water use for Jackson County was 38.8 mgd in 2005 and agricultural irrigation accounted for the majority of this amount (27 mgd in 2005).

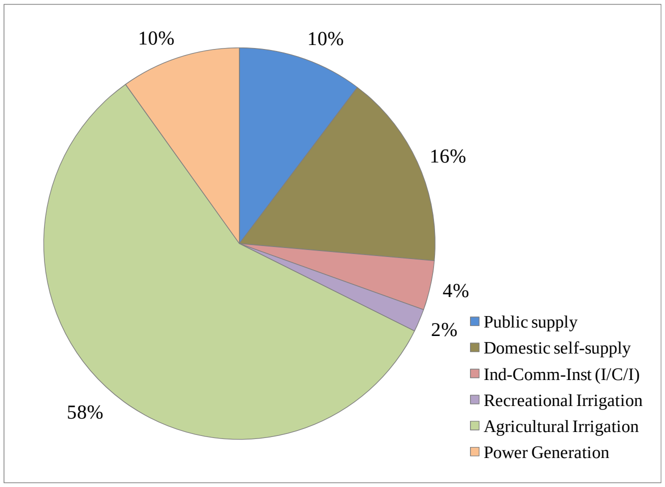

Figure 3.27 Region IV Water Use by Category, 2005

The total population in Region IV was 113,500 persons in 2005 (BEBR 2007). Population and public supply water use are both projected to increase over the planning period. The medium-range projections indicate that the total Region IV population will increase by 26% to 143,400 in 2030 (BEBR 2007).

The total water demand in Region IV is projected to increase by 20%, or by 10.1 mgd, between 2005 and 2030 (Table 3.20). By 2030, total water demand for the five-county region is projected to be 61.6 mgd. Public supply water demands are estimated to grow by 1.8 mgd and demands for domestic self-supplied water are projected to grow by 2.2 mgd. Water consumptively used for power generation is anticipated to increase by about 2.4 mgd and water demands for I/C/I uses are projected to increase by 2.2 mgd.

Table 3.20 Region IV Water Use Estimates and Projections by Category, 2005-2030 (mgd)

Water Use Category	Estimated 2005	Projected 2010	2015	2020	2025	2030
Public supply	5.31	5.68	5.99	6.33	6.72	7.15
Domestic self-supply	8.27	8.99	9.41	9.79	10.13	10.45
Ind-Comm-Inst (I/C/I)	2.10	4.25	4.25	4.25	4.25	4.25
Recreational Irrigation	1.04	1.00	1.00	1.00	1.00	1.00
Agricultural Irrigation	29.72	31.22	31.22	31.22	31.22	31.22
Power Generation	5.10	7.53	7.53	7.53	7.53	7.53
Total	**51.53**	**58.68**	**59.39**	**60.12**	**60.85**	**61.60**

1-in-10 Year Drought Event Projections

Projected demands for a 1-in-10 year drought event are shown in Table 3.21. The 2030 total demand for a 1-in-10 year drought is approximately 2% higher than the 2030 total average year water demand.

Table 3.21 Demand Projections for a 1-in-10 Year Drought Event, Region IV, 2010-2030 (mgd)

	Estimated	Projected				
Water Use Category	2005	2010	2015	2020	2025	2030
Public supply	5.63	6.02	6.34	6.71	7.12	7.58
Domestic self-supply	8.77	9.53	9.97	10.38	10.73	11.07
Ind-Comm-Inst (I/C/I)	2.10	4.25	4.25	4.25	4.25	4.25
Recreational Irrigation	1.25	1.20	1.20	1.20	1.20	1.20
Agricultural Irrigation	29.72	31.22	31.22	31.22	31.22	31.22
Power Generation	5.10	7.53	7.53	7.53	7.53	7.53
Total	**52.56**	**59.76**	**60.52**	**61.29**	**62.06**	**62.85**

3.4.2 Assessment of Water Resources

The vast majority of ground water in Region IV is obtained from the Floridan Aquifer System. Given the high availability of ground water from the Floridan Aquifer and good water quality, it is reasonable to anticipate that this use pattern will continue through the year 2030. Accordingly, the water source evaluation presented here emphasizes ground water resources.

Ground Water Resources

Region IV includes two distinct hydrogeologic settings, the Dougherty Karst area and the Apalachicola Embayment area (Pratt et al. 1996a). Holmes, Washington, Jackson and northern Calhoun counties lie within the Dougherty Karst area, while southern Calhoun and Liberty counties lie within the Apalachicola Embayment area (Figure 3.28). The Dougherty Karst area has a very dynamic ground water flow system characterized by a strong hydraulic connection between ground and surface waters and high aquifer recharge rates. Compared to the Dougherty Karst area, the Apalachicola Embayment is characterized by a poor connection between ground and surface waters, low recharge rates, and ground water quality that deteriorates with depth. In both areas, the ground water flow system consists of four hydrogeologic units: the Surficial Aquifer System, the Intermediate System, the Floridan Aquifer System and the Sub-Floridan System.

The Surficial Aquifer is negligible as a source of water supply within Region IV. Its significance to the region derives from its role as a source of recharge water for the underlying aquifers. The Surficial Aquifer is absent in portions of all five counties in this region.

The Intermediate System is between 50 and 100 feet thick in most of the Dougherty Karst area, is breached by sinkholes, and functions as a semi-confining unit. In parts of the Dougherty Karst area, the Intermediate System is effectively absent, placing the Floridan Aquifer at or near the land surface. Within the Apalachicola Embayment area of Region IV, the Intermediate System is generally 100 to 200 feet thick and forms an effective confining unit which significantly restricts recharge to the underlying Floridan Aquifer.

Directly beneath the Intermediate System (where it is present) or immediately beneath land surface (where it is absent) is the Floridan Aquifer. The Floridan Aquifer consists of a carbonate sequence that ranges in thickness from less than 100 feet in the northern part of the region to approximately 2,000 feet in southeastern Liberty County. In the Dougherty Karst area, there is substantial recharge to the Floridan Aquifer and a strong hydraulic connection between the ground and surface waters. The recharge has caused extensive dissolution and the development of a very active ground water flow system, with wells yielding up to 1,500 gpm.

The potentiometric surface is strongly influenced by ground water discharging to springs, creeks and rivers (Figure 3.28). The potentiometric surface reaches a maximum elevation of approximately 160 feet above sea level in the northern Holmes and Jackson counties. From here, ground water flows south towards discharge areas. Major discharge features include the Chipola, Choctawhatchee and Apalachicola rivers and Holmes and Econfina creeks, one first magnitude spring (Jackson Blue), 17 second magnitude springs, and 12 third magnitude springs (Barrios 2005; Barrios and Chelette 2004). Ground water quality is generally good throughout the Dougherty Karst area; however highly mineralized water occurs in a limited area where Holmes Creek joins the Choctawhatchee River.

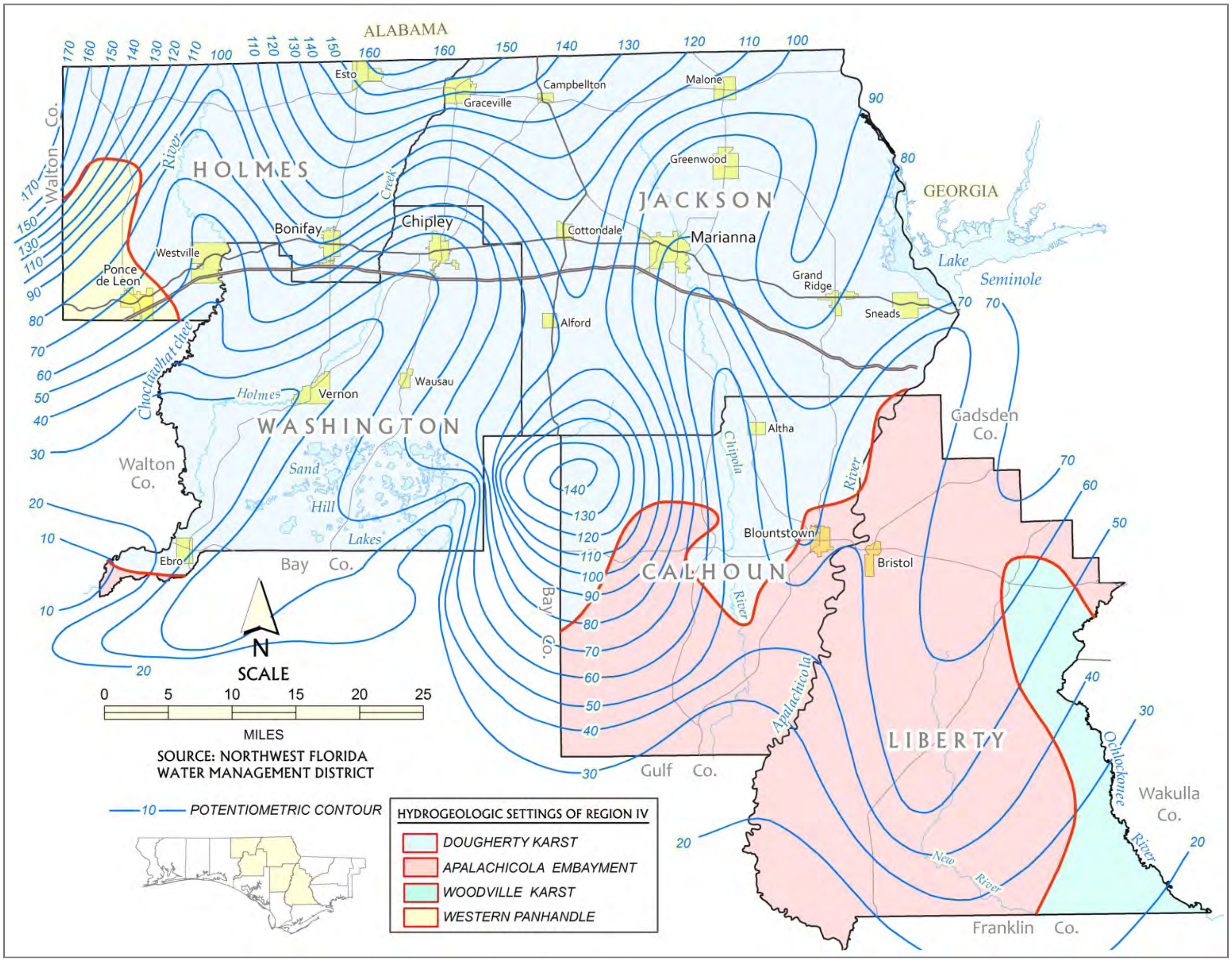

Figure 3.28 Potentiometric Surface of the Floridan Aquifer in Region IV, May/June 2000

Ground water conditions in southern Calhoun and Liberty counties are typical of the Apalachicola Embayment. The Intermediate System is relatively thick and forms an effective confining unit which restricts recharge to the Floridan Aquifer. The low aquifer recharge has resulted in limited dissolution within the aquifer, lower transmissivities, and poor water quality at depth. Only the upper few hundred feet of the Floridan Aquifer is utilized in Liberty County and well yields are generally less than 250 gpm. The potentiometric surface declines from about 70 feet above sea level in northern Liberty County to within 30 feet of sea level in southern Calhoun and Liberty counties. Limited ground water discharge occurs along the Apalachicola and lower Chipola rivers. Ground water flow is generally southerly towards Gulf and Franklin counties.

Assessment Criteria

Because of the significant differences between the ground water flow system in the Dougherty Karst area and Apalachicola Embayment area, different assessment criteria are used to assess the impacts of ground water withdrawals. Within the Dougherty Karst area, the assessment criteria used are the reduction of discharge to surface water features (streams and springs) and the long-term depression of the potentiometric surface of the Floridan Aquifer. In the Apalachicola Embayment area, the criteria used are the long-term depression of the potentiometric surface and the attendant alteration of ground water quality. A ground water budget was also used to evaluate the relative magnitude of ground water withdrawals.

Impacts to Ground Water Resources and Related Natural Systems

Hydrographs for three wells are presented to illustrate long-term trends of the Floridan Aquifer potentiometric surface. Data are presented for a well located near Marianna, Florida (International Paper well), a well located near Wausau, Florida (USGS 422A well), and a well located near Bristol, Florida (St. Joe Tower well) (Figures 3.29 and 3.30).

The International Paper and USGS 422A wells are located in the Dougherty Karst area. Between 1961 and 2007, water levels have fluctuated considerably in these wells. The two severe droughts of the past decade are evident but neither well shows any significant long-term water level trend (Figure 3.29). Water levels have risen and fallen through time in response to seasonal variations in rainfall and aquifer recharge. Due to high recharge and high aquifer transmissivity in the Dougherty Karst area, the current ground water withdrawals of approximately 45 mgd have not resulted in large scale depression of the potentiometric surface of the Floridan Aquifer.

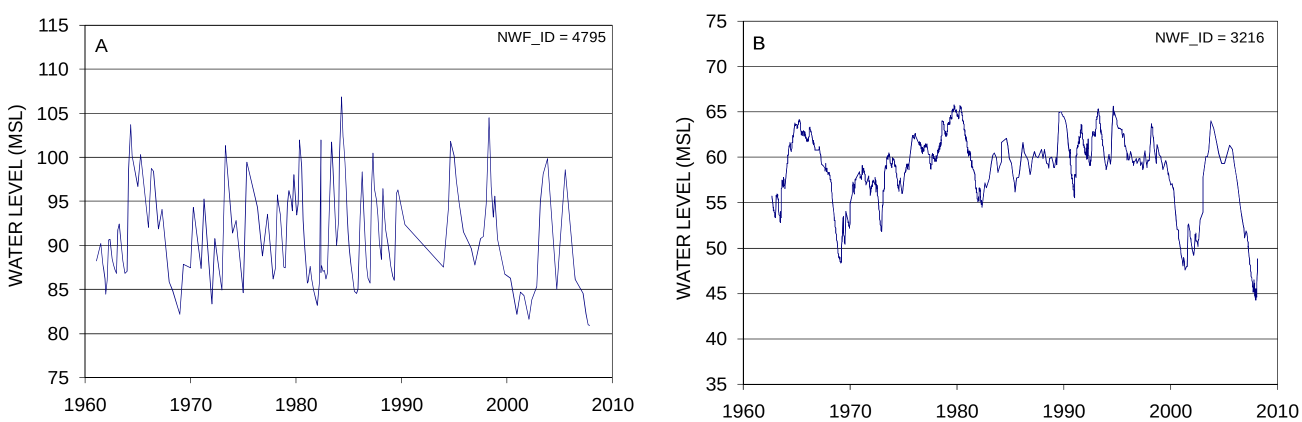

Figure 3.29 Hydrographs of Wells Located in the Dougherty Karst Area at A) International Paper Company Well, Jackson County and B) USGS-422A Well, Washington County

Given the strong hydraulic connection between ground and surface waters in the Dougherty Karst area, ground water withdrawals should be expected to reduce discharge to surface waters by an amount equal to or somewhat less than the amount withdrawn. Some of the factors which may mitigate the effect of withdrawals on ground water discharge include aquifer recharge generated by irrigation practices and land application of treated wastewater, recharge induced by the withdrawals, and a change in the zone of contribution caused by the withdrawals.

The potentially affected major surface water features include the Chipola, Choctawhatchee and Apalachicola rivers, the Holmes and Econfina creeks and the numerous springs. The flow of these rivers and creeks is substantial. Flow of the Econfina Creek at Highway 388 in Bay County exceeds 393 cfs 90% of the time. Flow of the other creeks and rivers is substantially greater. The range of spring flow is quite large. The first magnitude Jackson Blue Spring which is located in the Chipola River basin, averages 130 cfs and exceeds 51 cfs 90% of the time. At least nine second magnitude springs and seven third magnitude springs also occur in the Chipola River basin. The first magnitude Gainer Springs Group and numerous second magnitude springs occur along the middle Econfina Creek. Gainer Springs Group and some of the second magnitude springs along the Econfina Creek are located in northernmost Bay County, but the Econfina Recharge Area extends into and includes much of southeastern Washington County. Numerous other second and third magnitude springs occur along the Holmes Creek and the Choctawhatchee River.

The St. Joe Tower Well is located within the Apalachicola Embayment in northern Liberty County. This well does show a small gradual decline in water levels of approximately one foot per decade (Figure 3.30). This decline is largely attributable to the combined withdrawals by the City of Bristol (located 3.5 miles to the southwest) and by the Liberty Correctional Institute (located four miles to the east). Their combined withdrawals for 2005 averaged 0.4 mgd. This modest withdrawal has resulted in discernable drawdown due to the low recharge and low aquifer transmissivity characteristic of the embayment area. However, monitoring has indicated no change in water quality in their wells.

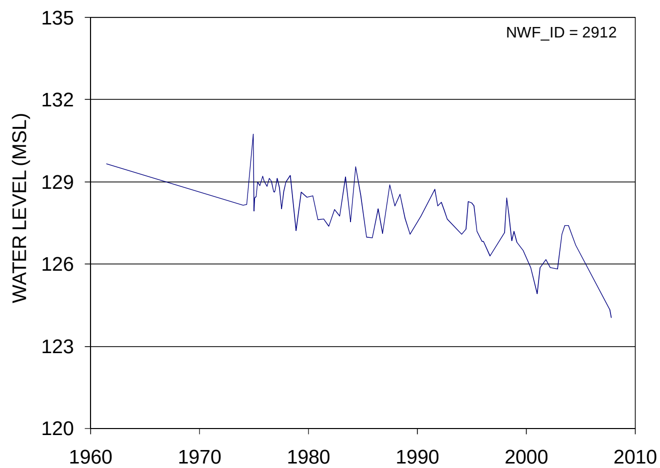

Figure 3.30 Hydrograph of St. Joe Tower Well Located in the Apalachicola Embayment Area

Ground Water Budget

A region-wide ground water budget was prepared in support of the 1998 Water Supply Assessment to estimate the relative magnitude of the various inflows to and outflows from the Floridan Aquifer (Figure 3.31). Estimated major inflows to the Floridan Aquifer reflect recharge from the Surficial Aquifer (1,278 mgd), which equates to an annual rate of 7.9 in/yr. Estimated major discharges from the Floridan Aquifer reflect the discharge to rivers and springs (1,194 mgd).

Region IV ground water withdrawals for 2005 averaged 45 mgd, which assuming no factors which mitigate the reduction of ground water discharge, would be estimated to reduce discharge to rivers and springs on average by about 70 cfs region wide. Based on the ground water budget and the aforementioned assumption, the 2005 withdrawals of 45 mgd would represent 3.7 percent of the estimated ground water discharged to rivers and springs.

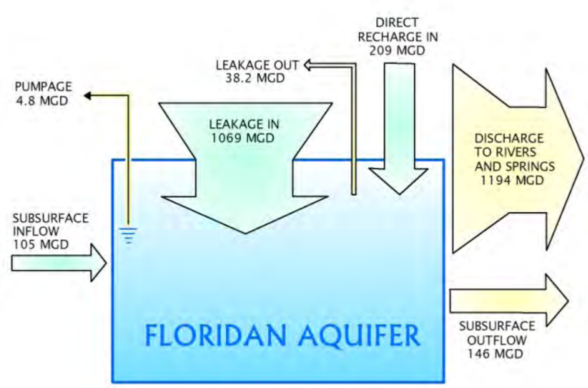

Figure 3.31 Region IV Floridan Aquifer Ground Water Budget

The projected 2030 ground water demand of approximately 54 mgd represents 3.9 percent of the estimated ground water budget.

Water Quality Constraints on Availability

Water quality issues constrain ground water availability in Region IV in two ways. The first constraint is upconing of mineralized water associated with excessive drawdown or excessive depth of penetration for wells located in the embayment area of Calhoun and Liberty counties. This problem can be avoided by using appropriate spacing between wells, limiting withdrawal rates, and restricting well depths.

The second potential water quality constraint exists in the Dougherty Karst area where the karst topography and high recharge rate makes the Floridan Aquifer susceptible to contamination by land use practices. The ground water in the area has been affected by agrichemical contamination, primarily ethylene dibromide (EDB). Contamination is generally of low constituent concentrations and is primarily limited to portions of northeast Jackson County (Roaza 1989). However, in some areas water treatment may be necessary for potable use.

Adequacy of Ground Water Resources

Within Region IV, ground water resources are anticipated to be adequate to meet the projected 2030 Floridan Aquifer demands for average conditions (54 mgd) and a 1-in-10 year drought event (55 mgd) without significant impacts to the water resources and related natural systems. The projected demands are not expected to affect the potentiometric surface of the aquifer. Ground water withdrawals will, however, reduce ground water discharge to the surface water features, but projected 2030 demands are small compared to the total regional ground water discharge. Consequently no significant widespread impacts are expected. However, localized impacts are possible in the vicinity of concentrated pumping.

Within the Apalachicola Embayment, ground water availability is limited due to low aquifer transmissivities and poor water quality at depth. Prudent well spacing, and limited withdrawal rates and well depths will be required to ensure a sustainable supply of good quality water. Through careful planning and management, the resource is anticipated to be adequate to meet the projected 2030 demands.

Surface Water Resources

The surface water resources in Region IV are significant. As previously noted, major surface waters features include the Apalachicola, Chipola and Choctawhatchee rivers, Econfina and Holmes creeks, one first magnitude spring (Jackson Blue) and 17 second magnitude springs.

In terms of annual flow, the Choctawhatchee and Apalachicola rivers are two of the five largest rivers in the state. The average flow of the Choctawhatchee River at Bruce is 7,063 cfs and the average flow of the Apalachicola River at Chattahoochee is 21,970 cfs. Their basins include significant areas of Alabama and Georgia. The average flows of Econfina Creek at Bennett, Holmes Creek at Vernon and the Chipola River at Altha are 538 cfs, 658 cfs and 1,493 cfs respectively, and include large ground water inflow components. The Apalachicola, Chipola and Choctawhatchee rivers are designated as SWIM priority waterbodies of the District and Outstanding Florida Waters by the Florida Department of Environmental Protection. Jackson Blue Spring is one of five first magnitude springs in the District and has an average discharge of 130 cfs. The 17 second magnitude springs discharge between 10 and 100 cfs.

Assessment Criteria

The criteria for assessing impacts of surface water withdrawals are the sustainability of the surface water flow regime and associated natural systems.

Impacts to Surface Water Resources and Related Natural Systems

Within Region IV, approximately 6.5 mgd of surface water was used for golf course irrigation, agricultural irrigation, and power generation uses in 2005. Power generation is the largest user of surface water in the region, with approximately 4.1 mgd withdrawn from the Apalachicola River and consumptively used at Plant Scholz in 2005. This withdrawal quantity represents less than one tenth of one percent of the average daily flow in the Apalachicola River at Chattahoochee. No impacts associated with these surface water withdrawals have been detected or reported.

Surface water resources are considered to be adequate to meet the projected 2030 surface water demands of 7.6 mgd within Region IV. Of this quantity, approximately 5.2 mgd is surface water that is projected to be withdrawn from the Apalachicola River for power generation consumptive use. The remainder represents the use of local streams and ponds for golf course and agricultural irrigation. Because the majority of surface water is used for power generation, water demands under average conditions do not differ significantly from water demands for a 1-in-10 year drought event.

A surface water quality concern within Region IV is the high nutrient load of the ground water discharging to Jackson Blue Spring. There is also the potential for ground water withdrawals within the Jackson Blue springshed to significantly reduce the Jackson Blue Spring discharge during periods of extreme drought. Jackson Blue Spring is included on the District's MFL Priority List and research in the spring basin is currently ongoing to consider an MFL or reservation for the spring. A reservation has been developed for the Apalachicola River whereby all surface water within the basin has been reserved for the river system. The District's MFL Priority List is updated annually and may be found at http://www.nwfwmd.state.fl.us/rmd/mfl/mfl.htm.

Adequacy of Surface Water Resources

Surface water resources are considered to be adequate to meet the projected 2030 surface water demands within Region IV while sustaining the water resources and associated natural systems.

Reclaimed Water and Conservation

The implementation of additional reuse and conservation measures in Region IV could reduce future demands on ground and surface water resources. As shown in Table 3.22, approximately 2.1 mgd or 19% of the wastewater generated in 2005 in Region IV was of reuse quality (FDEP 2006a). However, this water was discharged to spray fields and infiltration ponds in 2005 rather than used to directly offset ground or surface water withdrawals. The City of Chipley is developing a reuse system to offset ground water withdrawals and provide reclaimed water for irrigation at a golf course, industrial park, and agricultural lands. Although the feasibility of reuse system development may be limited by economic considerations, facility locations, storage options, and other factors, additional opportunities to meet future irrigation and industrial water needs with reclaimed water may be available and feasible. Although the potential water savings are not likely to be substantial, there are also additional opportunities for water conservation in Region IV. Examples of water conservation measures include leak detection and repair, water-conservation rate structures, the installation of efficient irrigation systems, best management practices for agriculture, and the use of drought-tolerant plants in landscapes.

Table 3.22 Region IV Reuse of Domestic Wastewater, 2005 (mgd)

Facility Name	County	Plant Capacity	Total Wastewater Flow	Reuse Capacity	Reuse Flow	Beneficial Reuse
Blountstown, city of	Calhoun	1.50	0.77	0.00	0.00	0.00
Bonifay, city of	Holmes	1.40	0.89	0.00	0.00	0.00
Cottondale, city of	Jackson	0.30	0.08	0.30	0.08	0.00
Jackson Correctional Institution	Jackson	0.24	0.17	0.24	0.17	0.00
Sneads, town of	Jackson	1.10	0.55	1.10	0.55	0.00
Graceville, town of	Jackson	1.10	0.65	0.00	0.00	0.00
Marianna, city of	Jackson	2.70	1.60	0.00	0.00	0.00
Liberty Correctional Institution	Liberty	0.20	0.15	0.20	0.15	0.00
Washington Co. Correctional Inst.	Washington	0.27	0.19	0.27	0.19	0.00
Chipley, city of	Washington	1.20	1.02	0.00	0.00	0.00
Total		**10.01**	**6.07**	**2.11**	**1.14**	**0.00**

Source: FDEP 2006a.

3.4.3 Determination of the Need for a Regional Water Supply Plan

The existing and reasonably anticipated ground water and surface water sources in Region IV are anticipated to be adequate to meet the projected demands through 2030, while sustaining the water resources and associated natural systems. Therefore, no regional water supply plan is recommended at this time.

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3.5 Region V: Franklin and Gulf Counties

Region V is within the Apalachicola River and Bay and the St. Andrew Bay watersheds and is comprised of Gulf and Franklin counties, including the cities of Apalachicola, Carrabelle, Port St. Joe and Wewahitchka. The region is predominantly rural, with extensive conservation lands including the Tate's Hell State Forest, Apalachicola National Forest, and the state parks located on the St. Joseph Peninsula and St. George Island. Population and development are concentrated in the coastal areas. The economy is highly dependent upon tourism and natural resources, with leading activities being forestry, commercial and sport fishing, and seafood processing.

Region V Snapshot		
	2005	2030
Population	27,300	35,100
Water Use (MGD)	~6	~10
Primary Source	Floridan Aquifer/St. Joe Canal	
RWSP Status	Implementation	

Historically, most water consumption occurred in Gulf County with significant industrial use. With the closing of the Port St. Joe paper mill in 1998, public supply is now the largest use category. The region depends on ground water and surface water sources. Both the Floridan and Surficial Aquifers are used in Gulf County. Franklin County depends primarily on the Floridan Aquifer for potable supply and the Surficial Aquifer is used for domestic irrigation on the barrier islands. However, ground water availability is limited due to poor water quality at depth and the potential for saltwater intrusion in coastal areas. Coastal Gulf and Franklin counties were designated as Areas of Special Concern in 2005 and a Regional Water Supply Plan (RWSP) was developed for this area in 2007 (NWFWMD 2007).

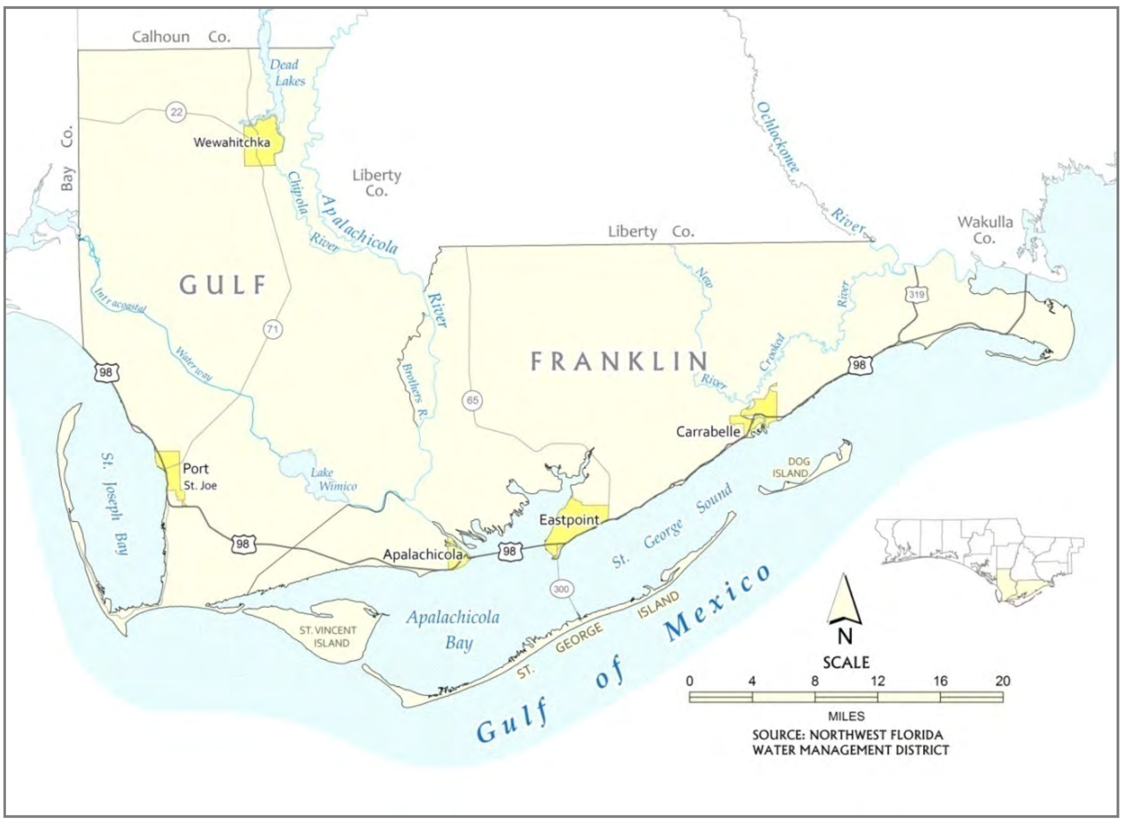

Figure 3.32 Map of Region V

3.5.1 Water Use Estimates and Projections

Public Supply

Public supply water use totaled approximately 3.9 mgd in 2005 (Tables 3.23 though 3.25). The largest public supply water systems in Region V are the City of Port St. Joe, (1.3 mgd in 2005), the City of Apalachicola (0.7 mgd in 2005), and Water Management Services, which serves St. George Island (0.6 mgd in 2005). The City of Carrabelle has recently purchased the Lanark Village utility and the water demands for these two utilities will be consolidated in future reports. St. James Island Utility was permitted in 2004 to serve the Summer Camp/St. James Island planned unit development. Public supply water demands in Franklin and Gulf counties are anticipated to increase by 2.5 mgd to 6.3 mgd in 2030.

Table 3.23 Franklin County Public Supply Water Use Projections, 2005-2030 (mgd)

Franklin County	Estimated 2005	2010	2015	Projected 2020	2025	2030
Alligator Point Water Resources District	0.08	0.10	0.12	0.13	0.15	0.17
Apalachicola, city of	0.72	0.70	0.70	0.71	0.72	0.73
Carrabelle, City of	0.31	0.33	0.36	0.40	0.43	0.46
Lanark Village Water & Sewer District	0.07	0.11	0.12	0.14	0.15	0.17
Eastpoint Water & Sewer District	0.26	0.30	0.32	0.35	0.38	0.40
St. James Island Utility Company	-	0.04	0.05	0.06	0.07	0.08
Water Management Services, Inc.	0.59	0.68	0.73	0.77	0.80	0.82
Total	**2.03**	**2.25**	**2.42**	**2.56**	**2.70**	**2.82**

Table 3.24 Gulf County Public Supply Water Use Projections, 2005-2030 (mgd)

Gulf County	Estimated 2005	2010	2015	Projected 2020	2025	2030
Lighthouse Utilities Company, Inc.	0.31	0.39	0.49	0.58	0.67	0.77
Port St. Joe, city of	1.34	1.48	1.69	1.91	2.13	2.35
Wewahitchcka, town of	0.17	0.23	0.27	0.30	0.34	0.37
Total	**1.82**	**2.10**	**2.45**	**2.79**	**3.14**	**3.49**

Domestic Self-Supply and Small Public Water Systems

The population served by domestic self-supply and small public water systems was estimated at 2,850 persons in 2005. This represents approximately 26% of the total population in Gulf and Franklin counties. The estimated water use for domestic self-supply and small public water systems was 0.3 mgd in 2005 and water demands are anticipated to increase slightly to 0.4 mgd in 2030 (Table 3.20).

Industrial, Commercial, and Institutional (I/C/I) Self-Supply

I/C/I water users accounted for about 0.7 mgd or 12% of the 2005 water use in Region V (Table 3.25). Large I/C/I water users include Arizona Chemical, Premier Chemical, and the Gulf County Correctional Institution. Premier Chemical receives surface water from the City of Port St. Joe. The remaining I/C/I water users rely on ground water from the Floridan Aquifer System. Projected I/C/I water demands are anticipated to increase by 1.4 mgd to 2.1 mgd in 2030. The majority of this increase in demand (1.3 mgd) is anticipated to be met by surface water withdrawals from the Chipola River and Gulf County Fresh Water Supply Canal.

Recreational Irrigation

The 2005 recreational water use of 0.5 mgd reflects water used for golf course irrigation (Table 3.25). Sources of irrigation water include stormwater ponds and water purchased from public supply utilities. Recreational water demands are anticipated to increase to 0.7 mgd by 2030.

Agricultural Irrigation

The estimated agricultural water use totaled 0.5 mgd in 2005 (Table 3.25). Agricultural water use reflects water used for aquaculture in Gulf County. Some water was also used for fruit crops and ornamentals. Due to the difficulties inherent in projecting the mix of future agricultural commodities and acreages, water demands for agriculture are projected to remain constant at permitted quantities through the planning period.

Power Generation

There are currently no power generation facilities in Gulf or Franklin counties.

Total Water Use and Population

In 2005, the average annual water use in Region V totaled 5.8 mgd (Table 3.25). The largest use category was public supply (66% of total). Other significant use categories included I/C/I, recreation, and agriculture, although the 2005 water use was less than 1 mgd for each of these use categories (Figure 3.33).

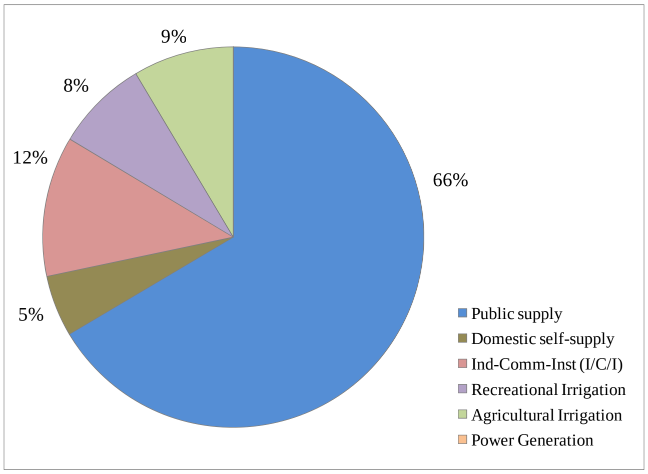

Figure 3.33 Region V Water Use by Category, 2005

The total 2005 population in Region V was 27,300 (BEBR 2007). Population and public supply water use are both projected to increase over the planning period. The medium-range projections for 2030 indicate a combined Gulf and Franklin county population of 35,100 persons. This represents a 29% increase from 2005 (BEBR 2007).

Total water demands are projected to increase by 67%, or 4.0 mgd, to approximately 9.8 mgd in 2030. Increases in public supply (2.5 mgd) and I/C/I (1.4 mgd) demands account for the majority of this increase. Water use for the remaining categories is anticipated to remain relatively constant.

Table 3.25 Region V Water Use Estimates and Projections by Category, 2005-2030 (mgd)

	Estimated	Projected				
Water Use Category	2005	2010	2015	2020	2025	2030
Public supply	3.85	4.35	4.86	5.35	5.83	6.31
Domestic self-supply	0.30	0.32	0.34	0.36	0.37	0.38
Ind-Comm-Inst (I/C/I)	0.69	2.13	2.11	2.09	2.07	2.05
Recreational Irrigation	0.45	0.55	0.55	0.55	0.55	0.55
Agricultural Irrigation	0.50	0.50	0.50	0.50	0.50	0.50
Power Generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**5.80**	**7.85**	**8.36**	**8.85**	**9.32**	**9.79**

1-in-10 Year Drought Projections

Projected demands for a 1-in-10 year drought event are shown in Table 3.26. The 2030 total Region V demand for a 1-in-10 year drought is approximately 5% higher than the 2030 total average year demand.

Table 3.26 Demand Projections for a 1-in-10 Year Drought Event, by Category, 2010-2030 (mgd)

	Estimated	Projected				
Water Use Category	2005	2010	2015	2020	2025	2030
Public supply	4.08	4.62	5.15	5.67	6.18	6.69
Domestic self-supply	0.32	0.34	0.36	0.38	0.39	0.40
Ind-Comm-Inst (I/C/I)	0.69	2.13	2.11	2.09	2.07	2.05
Recreational Irrigation	0.55	0.66	0.66	0.66	0.66	0.66
Agricultural Irrigation	0.50	0.50	0.50	0.50	0.50	0.50
Power Generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**6.14**	**8.25**	**8.78**	**9.30**	**9.80**	**10.30**

3.5.2 Assessment of Water Resources

Historically, Gulf County was dependent on ground water for both public and industrial water supplies. Withdrawals began in the 1930s to supply water to the St. Joe Paper Company Mill and associated industries. By the early 1950s ground water was being withdrawn at an approximate rate of 9 mgd. Most of this water was pumped from the Floridan Aquifer. As a result of this pumping, the potentiometric surface of the Floridan Aquifer became substantially depressed in the vicinity of the City of Port St. Joe. Recognizing that sufficient ground water was not available to meet the expanding needs of the paper mill, an 18.5 mile long canal was constructed in 1953 between the City of Port St. Joe and the Chipola River to provide a surface water supply. The surface water pumping capacity was 51.48 mgd before the mill closed in 1998. Prior to the mill closing, surface water provided an average of 28 mgd for industrial use. In June 2001 the District awarded a grant to the City of Port St. Joe to assist in the acquisition of the canal for public water supply. The City of Port St. Joe currently owns the canal.

Franklin County has been historically dependent on water from the Floridan Aquifer. In 2005, 2.0 mgd of ground water was withdrawn to meet public supply needs. Due to increases in population, water demand in the area has increased rapidly in recent years and has heightened concerns about resource sustainability. Saltwater intrusion into the upper portion of Floridan Aquifer is a threat to supply wells located along the coastline of Franklin County.

Based on these concerns, the District developed a RWSP for Region V (NWFWMD 2007). The RWSP identified surface water from the Gulf County Fresh Water Supply Canal (formerly referred to as the Port St. Joe Canal) as the preferred alternative water source for Gulf County. The primary water supply option identified for Franklin County is the development of an inland Floridan Aquifer wellfield.

Ground Water Resources

Geographically, Region V lies within the Apalachicola Embayment region of the Florida panhandle. Accordingly, water availability from the Floridan Aquifer is constrained by factors that are typically associated with the embayment's hydrogeology, i.e. the presence of an effective confining unit overlying the Floridan Aquifer, very low aquifer recharge, low aquifer transmissivities and poor water quality at depth. In order of depth, the hydrogeologic units that comprise the ground water flow system are the Surficial Aquifer, the Intermediate System, the Floridan Aquifer System and the Sub-Floridan System.

The Surficial Aquifer consists of undifferentiated sands and clays. Ground water typically exists under unconfined conditions, with some areas being semi-confined by local sandy clay layers. In Gulf County, the saturated thickness and permeability of the Surficial Aquifer are sufficient to form a locally important water source. Ground water from the Surficial Aquifer tends to be less mineralized than water from the underlying Floridan Aquifer. The City of Port St. Joe obtains approximately 25% of their ground water from the Surficial Aquifer. The average well yield is approximately 200 gpm. In Franklin County, the only known use of the Surficial Aquifer is on the barrier islands where wells yielding up to 50 gpm are utilized for landscape irrigation.

This Intermediate System functions largely as a confining unit and consists of soft, fossiliferous limestone overlain by a thin layer of sandy clay and clayey sand. The Intermediate System is approximately 400 feet thick near Port St. Joe and thins toward the north and the east, reaching a thickness of less than 50 feet thick in eastern Franklin County. As the Intermediate System thins, leakage across it increases and causes it to function as a semi-confining unit. The Intermediate System has some capacity to serve as a water source. The City of Mexico Beach previously used two Intermediate System wells, each producing about 300 gpm. Limited testing suggests that the Intermediate System in southern Gulf County may be a viable water source.

The Floridan Aquifer is the main source for ground water pumped in Region V. The aquifer is a sequence of carbonate sediments ranging in thickness from about 1,000 feet in the northwestern Gulf County to more than 2,800 feet in southern Franklin County. Aquifer transmissivity is variable and is highest in eastern Franklin County, which is the southernmost extension of the Woodville Karst Plain and an area of active recharge, flow, and dissolution. Test wells in Tate's Hell State Forest yielded transmissivities of 20,000 to 40,000 ft^2/d. In coastal Franklin County and in Gulf County, transmissivities and well yields are lower. Testing has yielded transmissivities of 6,000 ft^2/d in Apalachicola, 2,000 ft^2/d in coastal Gulf County (Wagner et al. 1980), and 6,500 ft^2/d 15 miles north of Port St. Joe (Barr and Pratt 1981). Water levels in the Floridan Aquifer range from about 30 feet above sea level in northern Gulf County to about 35 feet below sea level near the center of pumping at Port St. Joe. Elsewhere, water levels near the coast are generally between sea level and 10 feet above sea level. Ground water flows south towards the coast.

Ground water quality degrades with increasing depth and proximity to the coast. Only in the northernmost part of Gulf County does the portion of the aquifer containing potable water approximately equal the entire thickness of the aquifer. The fresh water portion of the Floridan Aquifer thins towards the coast where the aquifer discharges to the Gulf of Mexico. This places a significant constraint on the long-term viability of water production from the Floridan Aquifer in the immediate proximity of the coast. Total dissolved solids (TDS) concentrations from the upper portion of the Floridan Aquifer range from 250 mg/L in northern Gulf County to over 400 mg/L in northern and central Franklin County (Maddox et al. 1992). Along the coast, TDS concentrations range from 250 mg/L to 650 mg/L. The drinking water standard for TDS is not to exceed 500 mg/L.

Figure 3.34 shows the hydrogeologic units and the approximate thickness of the potable water interval of the Floridan Aquifer along the coastline of Franklin County. The thickness of the potable interval is based on chloride data. TDS and other analytes may further limit the thickness of the potable interval. Data show the thickness of the potable interval increases along the coast towards the west where the aquifer is better confined. Data suggest that the vertical transition zone between potable and saline water is a sharp interface. For example, at Alligator Point, chloride concentrations increase from 124 mg/L at 180 feet to 1,800 mg/L at 200 feet.

Coastal Gulf County also has naturally-occurring, elevated levels of fluoride and iron in the Floridan Aquifer. Drinking water standards require a fluoride concentration of less than 4 mg/L and an iron concentration of less than 0.3 mg/L. Floridan Aquifer water in this area can have fluoride levels as high as 10 mg/L (Ryan et al. 1998) and iron levels between 1 and 7 mg/L.

<u>Assessment Criteria</u>

Two criteria were used to assess impacts on ground water resources: long-term depression of the potentiometric surface of the Floridan Aquifer and impacts on ground water quality.

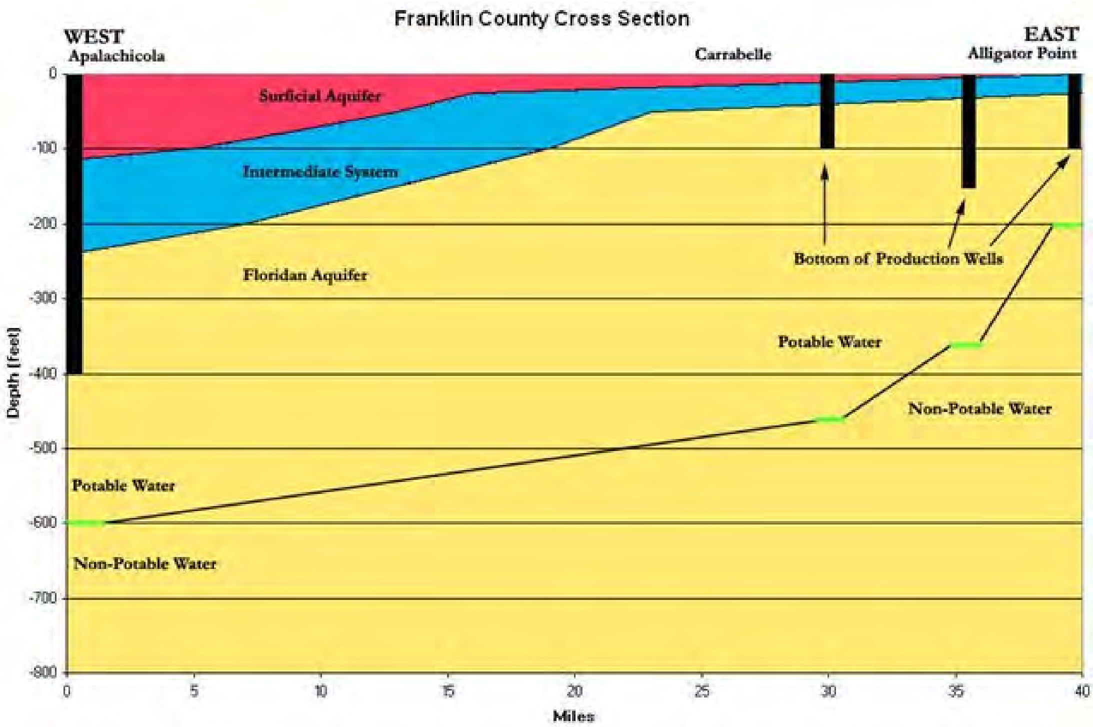

Figure 3.34 Hydrogeologic Cross-Section of Coastal Franklin County

<u>Impacts to Ground Water Resources and Related Natural Systems</u>

Figure 3.35 presents hydrographs for two Floridan Aquifer wells. Hydrographs are presented for a monitor well in Port St. Joe and the Ice Plant well in Carrabelle. The Port St. Joe well is located about one mile from the center of pumping. The well shows a 10-foot water level fluctuation over the past 23 years. Much of this fluctuation is attributed to local pumping. Water levels average 10 feet below sea level and reflect the estimated 15 to 20 feet of drawdown caused by withdrawals of about 1.5 mgd in this area of low transmissivity. The Ice Plant well in Carrabelle shows no water level trend during the 50 year period of record. Withdrawals in the vicinity of Carrabelle are relatively small and increased from about 0.2 mgd to 0.3 mgd between 1996 and 2005.

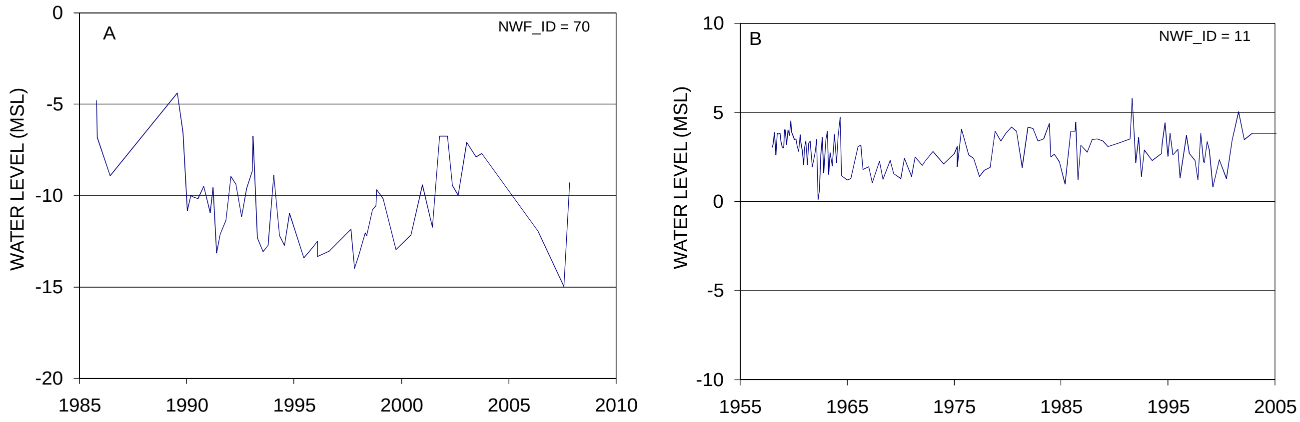

Figure 3.35 Hydrographs of the A) Port St. Joe and the B) Ice Plant wells

The intrusion or upconing of salt water associated with the depression of the potentiometric surface is a threat to ground water quality and limits ground water availability throughout the coastal portion of Region V. Figure 3.36 shows the Floridan Aquifer chloride concentrations for the Pavilion well in Apalachicola (casing depth 422 feet, total depth 551 feet). The well was used for monitoring, but is no longer available for sampling. Between 1964 and 1991, water levels in the well declined about two feet while the chloride concentration rose from 630 mg/L to over 1,000 mg/L. This well is somewhat deeper than the City of Apalachicola production wells and is located closer to the coast. The Apalachicola public supply wells are located about 2.5 miles from the Pavilion well. The increase in chloride concentrations appears to be related to withdrawals in Apalachicola. The declining water quality in the aquifer raises concerns regarding the intrusion of salt water and the long-term sustainability of coastal withdrawals. Alligator Point currently limits withdrawal rates from their wells due to the upconing of salt water.

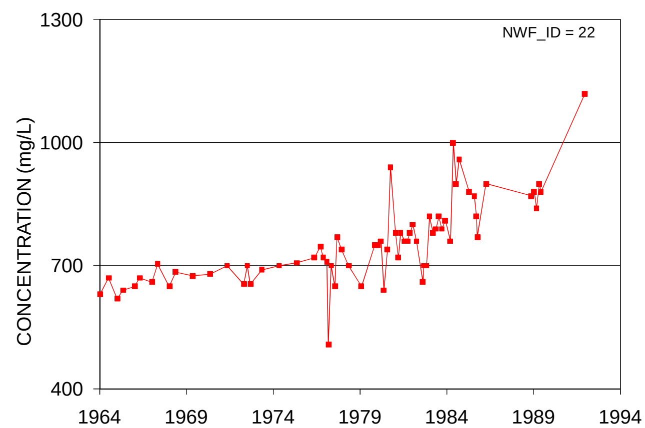

Figure 3.36 Chloride Concentration Data for the Pavilion Well, Apalachicola

Despite the long-term depression of the potentiometric surface at Port St. Joe, monitoring has indicated no significant change in ground water quality at this location. The depressed potentiometric surface and the potential for saltwater intrusion do, however, pose a threat to the long-term sustainability of their ground water withdrawals.

Ground Water Budget

A regional scale ground water budget was prepared in support of the 1998 Water Supply Assessment to estimate the relative magnitude of the various inflows to and outflows from the aquifer (Figure 3.37). The ground water budget indicates low ground water availability within the region. This limitation arises primarily from the low inflow to the Floridan Aquifer (recharge and subsurface inflow). The recharge rate to the Floridan Aquifer is very low and equates to less than 0.5 inches per year. The 2005 Floridan Aquifer ground water use of 4.7 mgd represents 25% of the estimated Floridan Aquifer ground water budget. The projected 2030 ground water demand of 5.5 mgd represents 29% of the estimated Floridan Aquifer ground water budget.

Water Quality Constraints on Availability

The major water quality constraints on increased withdrawals include upconing of poor quality water from deeper portions of the Floridan Aquifer and intrusion of salt water from offshore areas. High levels of fluoride may limit availability for potable use or require costly treatment.

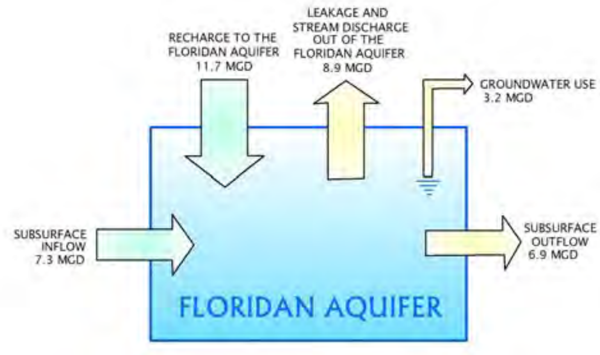

Figure 3.37 Region V Floridan Aquifer Ground Water Budget

Adequacy of Ground Water Resources

Ground water resources are not considered adequate to meet the projected 2030 average water demands or water demands for a 1-in-10 year drought event. The potential for water quality to degrade due to upconing and saltwater intrusion associated with current and projected withdrawals led to the development of the RWSP for Region V (NWFWMD 2007). The RWSP was approved in 2007 and continues to be implemented.

Surface Water Resources

Significant use of surface water is limited to withdrawals from the Chipola River. The withdrawal location is 2.5 miles above the confluence of the Chipola and Apalachicola rivers. The Chipola and Apalachicola rivers flow into the region from the north. Long-term records (1913 to 2005) from the USGS for a station near Altha in Calhoun County indicate that the mean flow in the Chipola River is 1,493 cfs and the 7-day minimum flow is 336 cfs. The data also indicate that the flow exceeds 612 cfs 90% of the time. The station at Altha includes about 65% of the basin or 781 mi^2. Further downstream in Region V, the Chipola River flow increases as the contributing drainage area increases.

At Wewahitchka, about 12 miles above the confluence of the Chipola and Apalachicola rivers, a natural floodplain channel (the Chipola Cutoff) connects the two rivers and diverts flow from the Apalachicola River to the Chipola River. At the Chipola Cutoff, the flow of the Chipola River increases significantly due to the flow diverted from the Apalachicola River. The drainage basin for the Chipola River is approximately 1,200 mi^2.

The flow in the Apalachicola River at Sumatra, which is located seven miles below the confluence of the Apalachicola River and the Chipola River, is much higher due to its large contributing basin (19,200 mi^2) which extends into Alabama and northern Georgia. At Sumatra, the flow of the Apalachicola River includes the flow of the Chipola River. USGS records (1978 to 2005) show the mean flow at Sumatra is over 25,000 cfs and the 7-day minimum flow is 5,240 cfs. The data also show that flow exceeds 9,120 cfs 90% of the time.

Assessment Criteria

The criteria for assessing impacts to surface water withdrawals are the sustainability of the surface water flow regime and associated natural systems.

Impacts to Surface Water Resources and Related Natural Systems

Prior to 1998, the average daily withdrawal from the Chipola River was 28 mgd or about 43 cfs. This is less than 1% of the 7-day minimum flow in the Apalachicola River at Sumatra and no impacts were noted or reported as a result of this withdrawal. Surface water withdrawals from the Chipola River via the freshwater canal totaled 0.03 mgd in 2005. The projected 2030 surface water demands are approximately 4.3 mgd for average conditions and 4.5 mgd for a 1-in-10 year drought event. The current permitted maximum daily withdrawal is 5.1 mgd. This rate is much lower than historical withdrawal rates and is not anticipated to cause adverse impacts to surface waters or associated natural systems.

Adequacy of Surface Water Resources

Due to the very large flow of the Chipola and Apalachicola rivers and the lack of impact from the previously permitted withdrawal quantities, the resources of the Chipola and Apalachicola rivers are anticipated to be adequate to meet the projected 2030 surface water demands in Region V.

Reclaimed Water and Conservation

The implementation of additional reuse and conservation measures in Region V could help to reduce future demands on ground and surface water resources. As shown in Table 3.27, approximately 0.6 mgd or 57% of the wastewater generated in Region V was of reuse quality. This water was applied to spray fields rather than being used to directly offset surface or ground water withdrawals (FDEP 2006a). Although the feasibility of reuse systems in Region V may be limited by financial feasibility, facility locations, storage options, and other factors, opportunities may exist for water users to meet some of their future water needs with reclaimed water.

Table 3.27 Region V Reuse of Domestic Wastewater, 2005 (mgd)

Facility Name	County	Plant Capacity	Total Wastewater Flow	Reuse Capacity	Reuse Flow	Beneficial Reuse
Apalachicola, city of	Franklin	1.00	0.30	0.00	0.00	0.00
Carrabelle, city of	Franklin	0.30	0.13	0.30	0.13	0.00
Lanark Village Water & Sewer District	Franklin	0.11	0.02	0.11	0.02	0.00
Eastpoint Water & Sewer District	Franklin	0.30	0.17	0.30	0.17	0.00
Summer Camp WWTF	Franklin	0.12	*	0.00	0.00	0.00
Gulf Correctional Institution	Gulf	0.35	0.28	0.35	0.28	0.00
Wewahitchka, city of	Gulf	0.20	0.16	0.00	0.00	0.00
Total		**2.38**	**1.06**	**1.06**	**0.60**	**0.00**

Source: FDEP 2006a.
*Flow data unavailable or no flows during 2005.

3.5.3 Determination of the Need for a Regional Water Supply Plan

As indicated previously, the District has developed and continues to implement a RWSP for Region V (NWFWMD 2007).

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3.6 Region VI: Gadsden County

Region VI lies within the Apalachicola and Ochlockonee River watersheds and consists of Gadsden County, including the municipalities of Chattahoochee, Greensboro, Gretna, Havana, Midway and Quincy. The region is relatively rural, with over half of the population residing in unincorporated areas, and has slow population growth. Agriculture is the primary component of the region's economy and is the largest water use category. Predominant crops include vegetables, nurseries, and sod. The largest employment sectors are government, agriculture and retail trade. Although ground water provided approximately three quarters of all water used in 2005, availability is limited due to the low water yielding properties of the Floridan Aquifer. The majority of surface water in the region is used for agricultural irrigation.

Region VI Snapshot		
	2005	2030
Population	47,700	56,900
Water Use (MGD)	~12	~21
Primary Source	Floridan Aquifer	
RWSP Status	No RWSP Recommended	

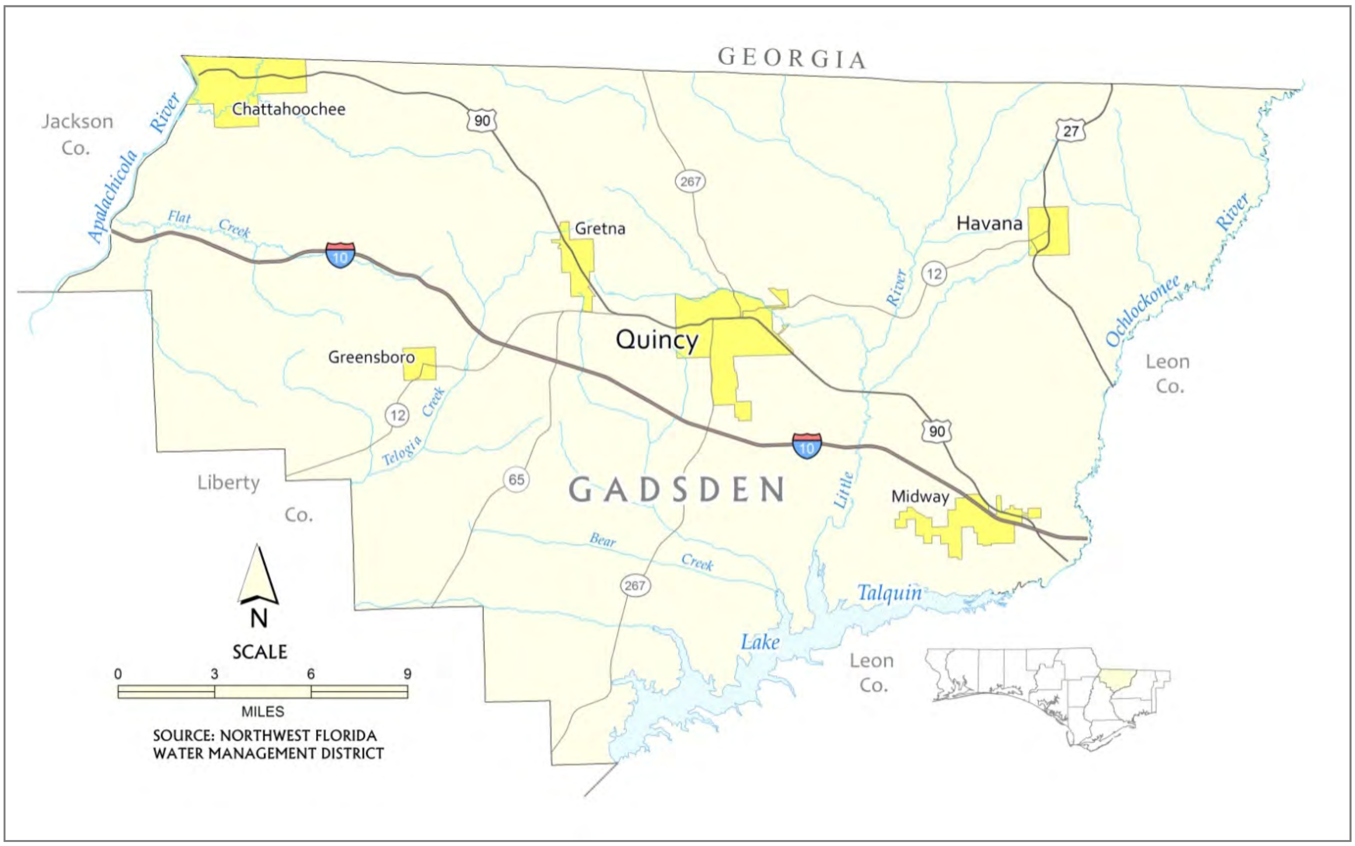

Figure 3.38 Map of Region VI

3.6.1 Water Use Estimates and Projections

Public Supply

The largest public supply utilities are the City of Quincy (1.4 mgd in 2005) and Talquin Electric (1.3 mgd in 2005) (Table 3.28). Water withdrawals for the remaining utilities were less than 0.5 mgd. Public supply water use in Gadsden County totaled 4.0 mgd in 2005 and is the second largest use category next to agriculture (Table 3.29). All public supply utilities currently rely on ground water from the Floridan Aquifer. Public supply water demands for Gadsden County are projected to increase by 2.7 mgd to approximately 6.7 mgd in 2030 (Table 3.28), mainly due to the expansion of Talquin Electric to serve existing domestic self-supply users.

Table 3.28 Region VI Public Supply Water Use Projections, 2005-2030 (mgd)

Utility	Estimated 2005	Projected 2010	2015	2020	2025	2030
Chattahoochee, city of	0.48	0.43	0.50	0.57	0.64	0.71
Greensboro, town of	0.08	0.08	0.08	0.08	0.08	0.08
Gretna, town of	0.25	0.35	0.37	0.39	0.41	0.43
Havana, town of	0.48	0.57	0.59	0.62	0.64	0.67
Talquin Electric Cooperative, Inc.*	1.28	1.61	1.92	2.23	2.54	2.85
Quincy, city of	1.43	1.54	1.64	1.73	1.83	1.93
Total	**4.01**	**4.57**	**5.09**	**5.62**	**6.14**	**6.67**

**Includes Gadsden County Regional, Hammock Creek, Jamieson, Longleaf Hills, and St. James Water Systems*

Domestic Self-Supply and Small Public Water Systems

The estimated population served by domestic self-supply and small public water systems was 15,844 persons in 2005 and represented about one-third of the total county population. The estimated 2005 water use for this population was 1.7 mgd and demands are anticipated to increase slightly to 2.0 mgd by 2030 (Table 3.29).

Industrial, Commercial, and Institutional (I/C/I) Self-Supply

The 2005 I/C/I water use totaled 0.3 mgd (Table 3.29). The two I/C/I water users are the BASF Corporation and the Florida State Hospital. Quincy Creek is the primary water source for the BASF Corporation and the Floridan Aquifer is the source of water for the Florida State Hospital. Water demands for these two users are projected to increase slightly, reaching a total of 0.9 mgd by 2030.

Recreational Irrigation

Irrigation at the Golf Club of Quincy and the Havana Golf and Country Club totaled 0.2 mgd in 2005 (Table 3.29). The Golf Club of Quincy withdrew water from English Branch and the Havana Golf and Country Club withdrew water from a tributary of Salem Creek. The Floridan Aquifer serves as a backup water source. Golf course irrigation demands are anticipated to remain relatively constant over the 2010-2030 planning period.

Agricultural Irrigation

Agricultural irrigation in Gadsden County totaled 6.2 mgd in 2005 (Table 3.29). Because Gadsden County is a Water Resource Caution Area, water withdrawals for agricultural use are metered and use quantities are believed to be relatively accurate. The primary crops in Gadsden County are container nurseries, tomatoes, vegetables, and sod. Sources of irrigation water include several streams and the Floridan Aquifer System. Although future demands for agricultural irrigation are somewhat uncertain, water use could increase to 10.8 mgd if permit holders use their allocated quantities.

Power Generation

The Jim Woodruff hydroelectric plant, located 0.2 miles from the confluence of the Chattahoochee and Flint rivers on the border between Gadsden and Jackson counties, generates electricity by passing water through turbines; it requires no consumptive use of water to operate.

Total Water Use and Population

Average annual water use in Gadsden County totaled approximately 12 mgd in 2005 (Table 3.29). The largest use categories were agricultural irrigation (50% of total) and public supply (33%). Domestic self-supply, I/C/I, and recreational uses collectively accounted for the remaining 17% (Figure 3.39).

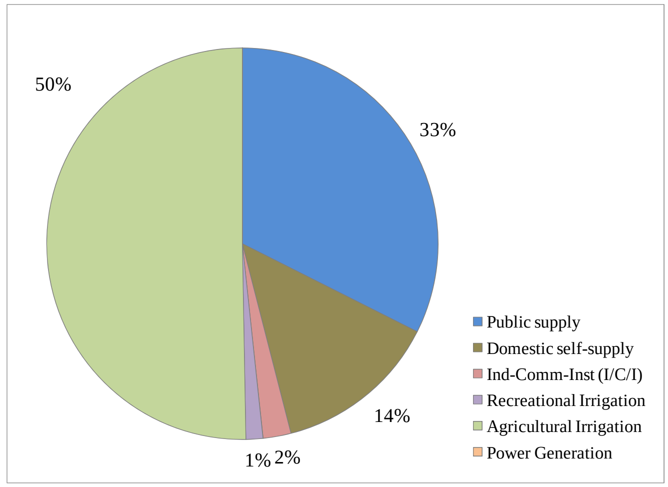

Figure 3.39 Region VI Water Use by Category, 2005

The total population in Gadsden County was 47,700 in 2005 (BEBR 2007). Population and public supply water use are both projected to increase over the planning period. The medium-range population projection for Gadsden County in 2030 is 56,900 persons. This represents a 19% increase from 2005 (BEBR 2007).

The total water demand in Region VI is projected to increase by 66%, or by 8.2 mgd, between 2005 and 2030, reaching a total of 20.6 mgd by 2030 (Table 3.29). Potential increases in agricultural irrigation are 4.6 mgd. Public supply water needs are projected to increase by approximately 2.7 mgd. Increases for the remaining water use categories are small.

Table 3.29 Region VI Water Use Estimates and Projections by Category, 2005-2030 (mgd)

Water Use Category	Estimated 2005	Projected 2010	2015	2020	2025	2030
Public supply	4.01	4.57	5.09	5.62	6.14	6.67
Domestic self-supply	1.68	1.77	1.84	1.90	1.95	2.00
Ind-Comm-Inst (I/C/I)	0.29	0.89	0.89	0.89	0.89	0.89
Recreational Irrigation	0.17	0.21	0.21	0.21	0.21	0.21
Agricultural Irrigation	6.22	10.77	10.77	10.77	10.77	10.77
Power Generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**12.36**	**18.21**	**18.81**	**19.39**	**19.98**	**20.55**

1-in-10 Year Drought Projections

Projected demands for a 1-in-10 year drought event are shown in Table 3.30. The 2030 total water demand for a 1-in-10 year drought is about 3% higher than the 2030 total average year water demand.

Table 3.30 Demand Projections for a 1-in-10 Year Drought Event, by Category, 2010-2030 (mgd)

	Estimated	Projected				
Water Use Category	2005	2010	2015	2020	2025	2030
Public supply	4.25	4.84	5.40	5.96	6.51	7.07
Domestic self-supply	1.78	1.88	1.95	2.01	2.07	2.12
Ind-Comm-Inst (I/C/I)	0.29	0.89	0.89	0.89	0.89	0.89
Recreational Irrigation	0.21	0.25	0.25	0.25	0.25	0.25
Agricultural Irrigation	6.22	10.77	10.77	10.77	10.77	10.77
Power Generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**12.74**	**18.64**	**19.27**	**19.89**	**20.50**	**21.11**

3.6.2 Assessment of Water Resources

Ground water availability is very limited throughout most of the region due to the low water-yielding properties of the Floridan Aquifer and poor water quality at depth. Ground water accounted for approximately 73% of the total water used in 2005. Since 2003, ground water is the only source utilized for public supply. Prior to 2003, the City of Quincy relied on surface water withdrawn from Quincy Creek. Virtually all of the current surface water withdrawals in the region are used for agricultural or recreational irrigation. Surface water currently provides about half of the agricultural irrigation demand.

Because of concerns over the availability of surface water and ground water in the upper Telogia Creek Basin, the District designated this area as a Water Resource Caution Area (WRCA) (Figure 1.2). In addition to this WRCA, the central portion of Region VI is designated an Area of Special Concern (ASC) (Figure 1.1). This water supply planning designation was established as part of the 1998 WSA and applies to areas with the potential for water supply problems.

Ground Water Resources

In order of depth, the hydrogeologic units that comprise the ground water flow system are the Surficial Aquifer System, the Intermediate System, the Floridan Aquifer System and the Sub-Floridan System.

The Surficial Aquifer consists primarily of interbedded layers of clayey sand and sandy clay and is negligible as a source of water supply in Region VI. The significance of the Surficial Aquifer to the regional hydrology is its discharge to streams throughout the region, which sustains stream flow during periods of drought.

The Intermediate System consists of low permeability sediments which form an effective confining unit that significantly restricts recharge to the underlying Floridan Aquifer. The Intermediate System is between 200 and 300 feet thick in central Gadsden County and thins to less than 150 feet in the extreme northwestern and eastern portions of the county. Thin carbonate beds within the Intermediate System form minor water-bearing zones which are occasionally utilized for domestic water supply.

The thickness of the Floridan Aquifer ranges from 600 to 1,200 feet across the region. The Apalachicola Embayment is a geological structural trough which is deepest along the axis that runs through central Gadsden County from the northeast to southwest. Within the embayment, the Floridan Aquifer is overlain by a thick confining unit which results in very low aquifer recharge, poor quality water at depth and limited ground water availability. Throughout the central portion of the region, including the upper Telogia Creek WRCA, wells typically exhibit specific capacities of less than 3 gpm/ft. Deeper wells

(400 feet below sea level) may show specific capacities of up to 15 gpm/ft. Although maximum well yields range from 100 to 300 gpm, considerable drawdown is associated with these withdrawal rates.

The far eastern and northwestern corners of Gadsden County are transition zones between the embayment and the Dougherty Karst region to the northwest and the Woodville Karst region to the east. Due to the significantly increased permeability of the Floridan Aquifer in these areas, well yields are higher. Specific capacities increase sharply between the Mt. Pleasant community and Chattahoochee. Near Chattahoochee, transmissivities increase to about 100,000 ft^2/d. To the east near the Ochlockonee River, aquifer testing resulted in a transmissivity of 40,000 ft^2/d (Richards and Dalton 1987).

Figure 3.40 presents data from the City of Quincy Well #2 which shows the deteriorating water quality with depth (Wagner 1982). Throughout the region, water quality data from wells with total depths below approximately 400 feet below sea level show an increase in mineralization and total dissolved solids (TDS) and are more likely to induce upconing of poor quality water. At the Apalachicola River near Chattahoochee, saline water (chloride concentration>1,000 mg/L) has been encountered at an elevation of 200 feet below sea level.

In north-central Gadsden County, the potentiometric surface is at an elevation of approximately 70 feet above sea level. From this potentiometric high, ground water flow is primarily towards the Apalachicola River to the west and towards Leon County to the southeast. Principal discharge areas include the Apalachicola River, Wakulla Spring, and other springs in the Woodville Karst plain.

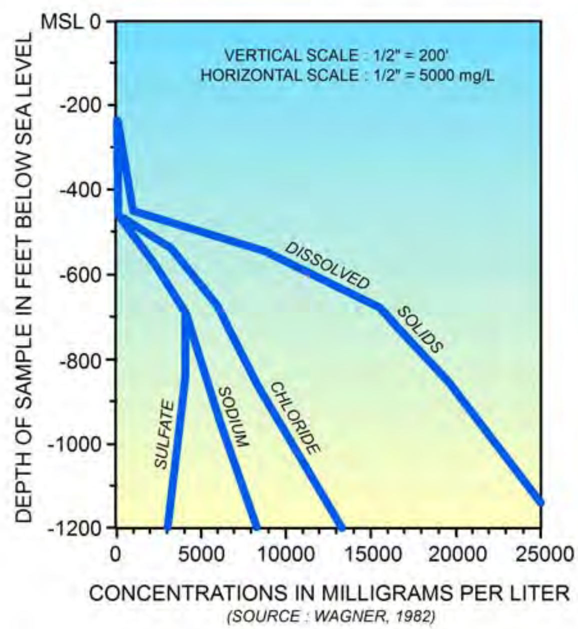

Figure 3.40 Variations of Floridan Aquifer Water Quality with Increasing Depth

Assessment Criteria

Two criteria were used to assess impacts on ground water resources: long-term depression of the potentiometric surface of the Floridan Aquifer and attendant alteration of ground water quality. A ground water budget was also used to evaluate the relative magnitude of ground water withdrawals.

Impacts to Ground Water Resources and Related Natural Systems

Hydrographs for two wells are presented to depict long-term trends in Floridan Aquifer water levels (Figure 3.41): data are presented for a well located in Quincy (Quincy #3) and for a well located in Greensboro (Greensboro #3).

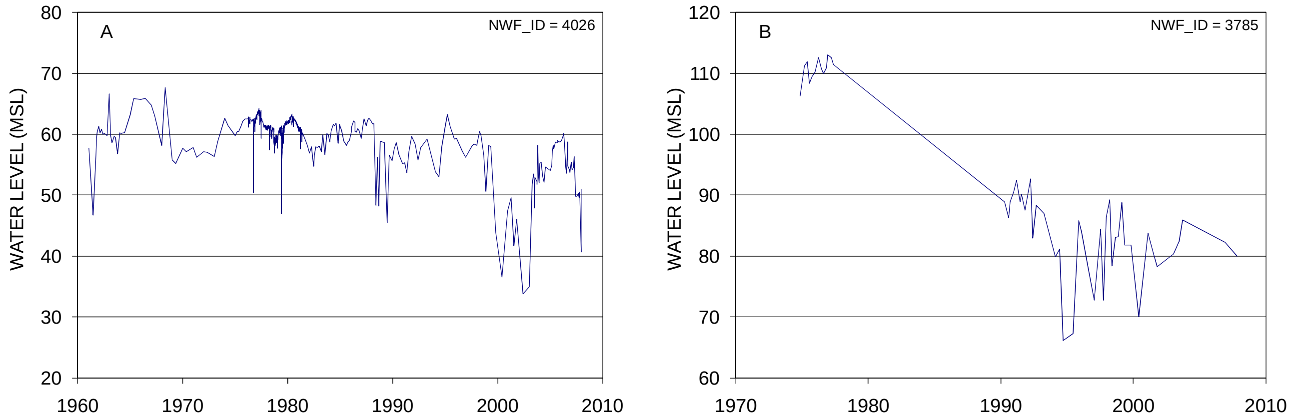

Figure 3.41 Hydrographs of the A) Quincy (AAA0368) and B) Greensboro (AAA0377) Wells

The Quincy well is constructed in the more productive middle portion of the Floridan Aquifer. The hydrograph is affected by a City of Quincy back-up supply well located nearby. A decline in the water level of about five feet is noted since 1961. This decline can likely be attributed to use of the nearby well and recent droughts. Use of the middle portion of the Floridan Aquifer is limited due to poor quality water and the potential for upconing.

The Greensboro well is completed in the upper portion of the Floridan Aquifer and is representative of the primary interval utilized in the vicinity of Greensboro. In the mid 1970s, water levels were about 110 feet above sea level. Existing records indicate this level is relatively unaffected by withdrawals. Between 1974 and the late 1980s the hydrograph shows a decline of about 20 feet despite only a modest increase in ground water use in the vicinity of Greensboro. Due to the very low transmissivities and low aquifer recharge, modest withdrawals can result in the propagation of significant aquifer drawdown. Similar water level decline is also noted elsewhere in the Telogia Creek basin. Somewhat larger water level declines have been recorded near sites of significant withdrawal. Since the early 1990s, water levels have stabilized due to monitoring, careful permitting of new withdrawal locations, optimizing water use efficiencies for both ground and surface water resources, and planning associated with the designation of the upper Telogia Creek WRCA.

Significant water level declines are generally limited to areas of greater ground water withdrawals. In the northwest and eastern areas of higher aquifer transmissivities, little or no water level decline has occurred despite increased withdrawals. Although demand on the Floridan Aquifer is limited in Region VI, it is apparent that modest withdrawals in the central portion of Gadsden County can result in significant local water level declines.

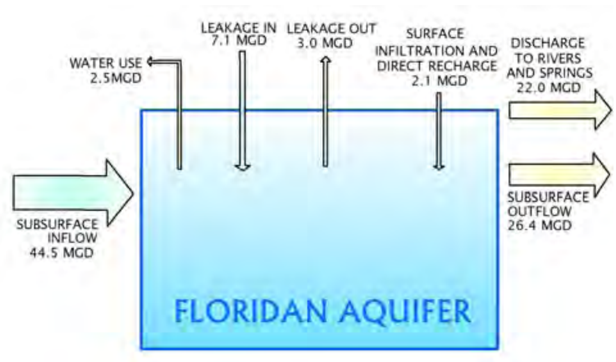

Figure 3.42 Region VI Floridan Aquifer Water Budget for 1991 Calibration Period

Ground Water Budget

A ground water budget was estimated to present an order-of-magnitude approximation of the water flow into and out of the Floridan Aquifer in Region VI (Figure 3.42) (Ryan et al. 1998). The ground water budget indicates low ground water availability within the region. This limitation arises primarily from the low permeability of the Intermediate System, which restricts recharge to the Floridan Aquifer.

Recharge to the Floridan Aquifer (9.2 mgd) equates to an annual rate of less than 0.5 inches per year. The 2005 ground water use of approximately 9 mgd is 17 percent of the estimated Floridan Aquifer ground water budget in Region VI. The projected 2030 ground water demand of 12.5 mgd represents approximately 23 percent of the ground water budget.

Water Quality Constraints on Availability

Despite water level declines, upconing of poor quality water has not occurred. Ongoing water quality monitoring has shown no impact to the quality of ground water within Region VI. However, naturally occurring highly mineralized water in the lower portion of the Floridan Aquifer System does represent a constraint to the development of ground water resources in the region. Long-term depression of the potentiometric surface of the Floridan Aquifer may result in upconing of this poor quality water and affect the quality of ground water withdrawn.

Adequacy of Ground Water Resources

Ground water resources in Region VI are limited, particularly in the central part of Region VI. Through careful planning and permitting, the ground water resources of the region are anticipated to be adequate to meet the projected 2030 demands for average conditions and a 1-in-10 year drought event; however, this will require adequate well spacing and limited withdrawals in the central portion of the region. In addition, although upconing of poor quality water is not currently a problem in central Gadsden County, higher capacity wells will need to be located in the more transmissive areas in northwest and eastern Gadsden County. The adequacy of the ground water resources also assumes the projected 4.6 mgd increase in agricultural irrigation will be met using surface water sources.

Surface Water Resources

The surface water resources of Region VI consist of a well-developed network of streams, natural wetlands and manmade impoundments. The impoundments were constructed primarily for agricultural irrigation and are highly regulated. No natural lakes occur in the region. The well-developed stream network is typical of areas with clayey sub-soils which limit infiltration rates and aquifer recharge. The soil characteristics result in high runoff rates and relatively high average total stream flow compared to base flow. These characteristics limit the availability of surface water during periods of low rainfall or drought.

To assess surface water flow conditions in the Telogia Creek basin, the District maintains a gauging station on Telogia Creek at County Road 65D. This is the most upstream, long-term station in the watershed and it is located downstream from where most of the agricultural surface water withdrawals occur. Figure 3.43 shows the stream flow hydrograph for this station, which includes approximately 36.4 mi^2 of an intensely-farmed contributing watershed area. Flows at this location range from zero (no flow) to 1,815 cfs. The mean annual flow is 38.5 cfs (24.8 mgd) and is equivalent to a basin runoff of about 14 inches per year. The minimum annual flow of 13.8 cfs (8.9 mgd) was recorded during the drought year of 2000 and is equivalent to a basin runoff of about 5 inches per year.

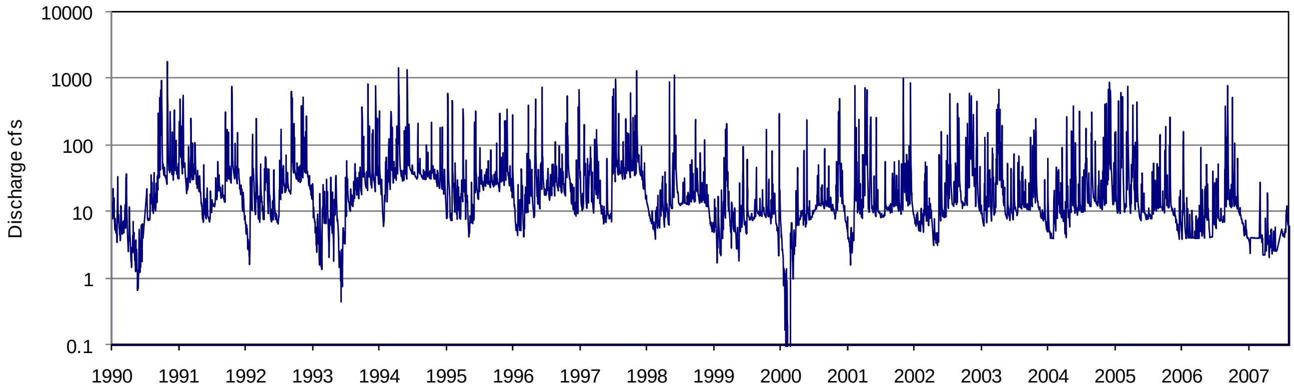

Figure 3.43 Telogia Creek Average Daily Discharge (cfs)

The USGS maintained a gauging station on Quincy Creek at SR 267 from 1974 to 1992. The drainage area for this station is 16.8 square miles. The Quincy Creek basin is similar to the Telogia Creek basin in that they are both relatively small basins with their headwaters located within the region. Approximately 20 years of nearly continuous stage and flow data are available for the upper portion of each of these basins. Table 3.31 provides summary flow statistics. All historic and current flow records for these stations are affected by withdrawals.

The period of record for the Telogia Creek includes the two record droughts experienced in 2000 and in 2007. In addition, irrigation withdrawals in Telogia Creek basin are more seasonal than the combined public supply, industrial and agricultural withdrawals from Quincy Creek during 1974 to 1992. The instantaneous low flow exhibited by these two creeks is quite low and is typical of streams in Region VI during low rainfall periods and times of drought.

Table 3.31 Flow Statistics for Quincy Creek and Telogia Creek

Summary Statistic	Quincy Creek (at SR 267: 16.8 mi^2) Oct 1974 to Sept 1992	Telogia Creek (at CR 65D: 36.4 mi^2) May 1990 to Dec 2007
Average Annual Runoff (in)	22.70	14.40
Annual Mean (cfs)	28.00	38.50
Q_{90} (cfs)	9.30	4.90
Highest Annual Mean (cfs)	47.20	76.10
Lowest Annual Mean (cfs)	17.30	13.80
Instantaneous Peak Flow (cfs)	2,910.00	1,815.00
Instantaneous Low Flow (cfs)	2.30	0.00

<u>Assessment Criteria</u>

The general assessment criterion for surface water availability is the sustainability of the surface water flow regime and associated natural systems. For Telogia Creek, the assessment is based upon a guiding principle that the historic flow regime should be maintained to the extent that the natural systems present today are sustainable. The flow regime and natural systems in the Telogia Creek basin have been highly altered by the construction of farm ponds, in-stream impoundments, and a long history of agricultural water withdrawals.

Impacts to Surface Water Resources and Related Natural Systems

During periods of drought, low stream flows typically occur in this region. Because of the natural variability of stream flows under drought conditions and the intensive historic use of the resource, no widespread impairment, relative to historic flows, has been identified. Since the declaration of the Upper Telogia Creek WRCA, no significant increase of surface withdrawals has been authorized and any impact on the frequency of low flows due to pumping activity has been stabilized.

Water Quality Constraints on Availability

Surface water quality is suitable for current uses and does not constrain availability; however, large amounts of runoff which result from high rainfall events can cause local increases in turbidity in the creeks. Turbidity levels usually returns to normal within several days.

Adequacy of Surface Water Resources

Because most surface water use in Region VI is for agriculture and agricultural water demand projections are based on allocated permit quantities, the projected 2030 surface water demands for average conditions (8.03 mgd) do not differ significantly from the projected water demands for a 1-in-10 year drought (8.07 mgd). Although surface water resources can be very limited during periods of drought, continued careful management of the resource should provide available quantities sufficient to meet future demands.

The adequacy of the surface water resources requires that permit thresholds on water withdrawals not be exceeded. In addition, practices to lower demand from streams during low flow and drought periods may be required. These include increasing the reuse of water for agricultural purposes, installing runoff recovery systems, and increasing the use of offline storage facilities. These practices combined with increasing water use efficiencies and the implementation of other water conservation measures should ensure adequate availability during times of drought and locally reduce the stress of withdrawals on the natural system.

Reclaimed Water and Conservation

The implementation of additional reuse and conservation measures in Gadsden County could lessen future demands on ground and surface water resources. As shown in Table 3.32, approximately 27% or 0.6 mgd of the wastewater generated in Gadsden County in 2005 was of reuse quality (FDEP 2006a). More than half of this reuse was applied to percolation trenches or spray fields rather than being used to directly offset surface or ground water withdrawals. Some reclaimed water was beneficially used by the City of Havana at the wastewater treatment plant and the City of Gretna provides reclaimed water for nursery irrigation. The City of Quincy is developing of a reuse system to offset existing ground water withdrawals. Opportunities may exist for other users or utilities in Gadsden County to use reclaimed water to meet their future water needs.

Table 3.32 Region VI Reuse of Domestic Wastewater, 2005 (mgd)

Facility Name	Plant Capacity	Total Wastewater Flow	Reuse Capacity	Reuse Flow	Beneficial Reuse
Gadsden East WWTP	0.25	0.06	0.25	0.06	0.00
Gretna, town of	0.35	0.23	0.35	0.23	0.23
Havana, town of	0.40	0.22	0.80	0.30	0.08
Quincy, city of	1.50	0.99	0.02	0.00	0.00
Chattahoochee, city of	0.50	0.32	0.00	0.00	0.00
Florida State Hospital	1.30	0.37	0.00	0.00	0.00
Total	**4.30**	**2.19**	**1.42**	**0.59**	**0.31**

Source: FDEP 2006a.

3.6.3 Determination of the Need for a Regional Water Supply Plan

The ground water and surface water resources in Region VI should be adequate to meet the projected average and 1-in-10 year drought event demands through 2030, while sustaining the water resources and associated natural systems. Therefore, no regional water supply plan is recommended at this time. However, continued careful management of the water resources is required. Additional development of ground water resources will necessitate adequate well spacing and limited withdrawals in the central portion of the region. In addition, higher capacity wells will need to be located in the more transmissive areas found in the northwest and eastern portions of Gadsden County. The adequacy of the surface water resources, which are primarily used for agricultural irrigation, may locally require measures to lower demand from streams during low flow and drought conditions. Practices such as increasing the reuse of wastewater for agricultural irrigation, installing additional runoff recovery systems, and increasing the use of offline storage facilities should continue to be implemented in these areas.

3.7 Region VII: Jefferson, Leon and Wakulla Counties

Region VII consists of the three easternmost counties of the District, including the cities of Monticello, Tallahassee, Sopchoppy and St. Marks. Note that only a portion of Jefferson County falls within the District's jurisdiction; the data and analyses reflect a 60 percent share that is estimated for planning purposes.

Region VII Snapshot		
	2005	2030
Population	306,520	423,620
Water Use (MGD)	~51	~77
Primary Source	Floridan Aquifer	
RWSP Status	No RWSP Recommended	

Except for the Tallahassee metropolitan area, most of Region VII is relatively rural, a result of large public landholdings (St. Marks National Wildlife Refuge and the Apalachicola National Forest) and large private ownerships such as plantations and timber landholdings. The dominant employers within the planning region are government, retail trade and service sectors, with many residents of the region commuting to Tallahassee to work. The majority of water used in the region is withdrawn from the Floridan Aquifer System, a relatively prolific source of good quality water. The water resources of this region sustain the St. Marks, Wakulla, and Ochlockonee rivers; Apalachee Bay; and the many lakes and freshwater springs.

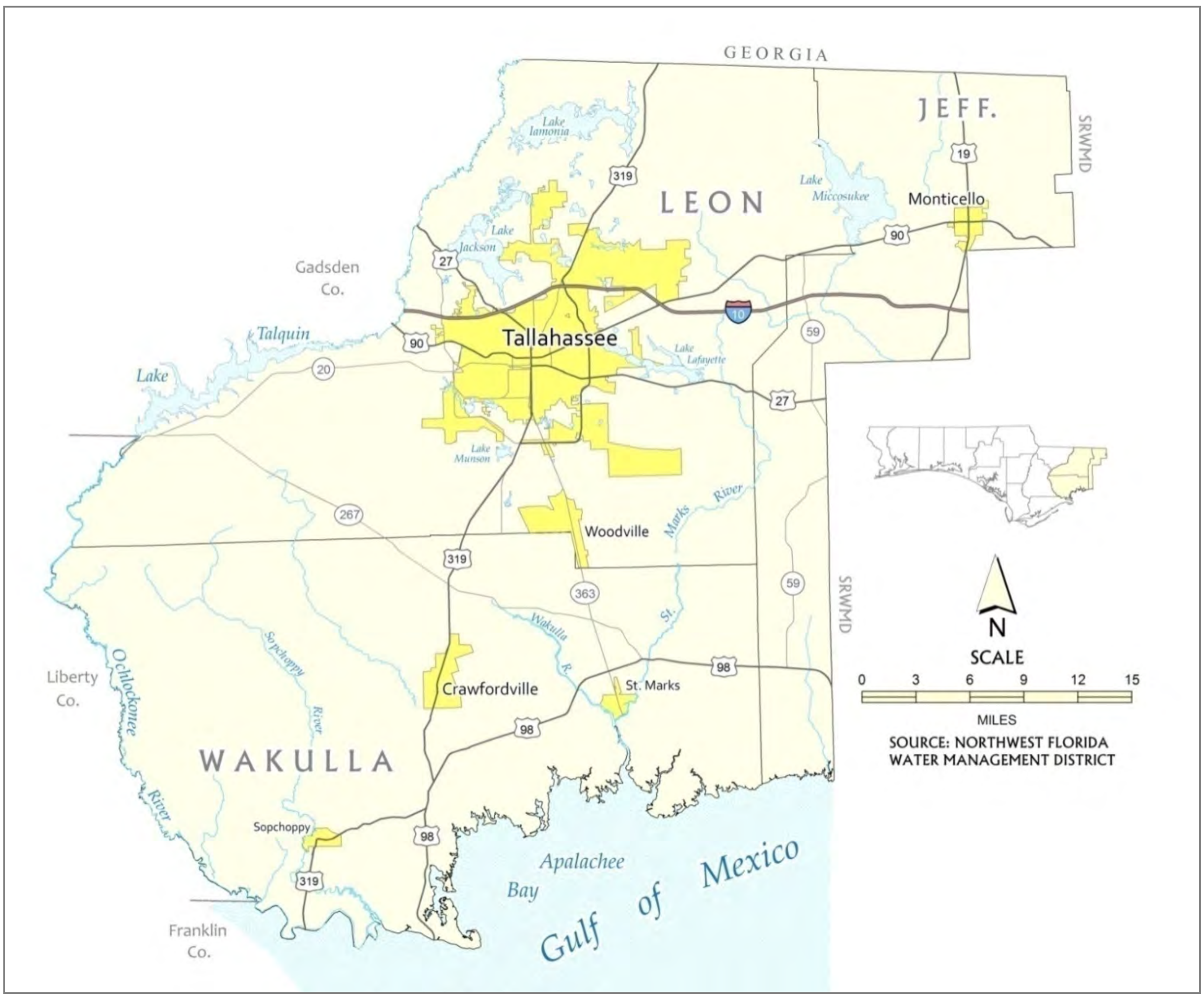

Figure 3.44 Map of Region VII

3.7.1 Water Use Estimates and Projections

Public Supply

Public supply water use in Region VII totaled 36.1 mgd in 2005 (Table 3.33 through 3.36). Approximately 80% of the population is served by large public supply utilities. The two largest public supply utilities are the City of Tallahassee and Talquin Electric Cooperative, Inc. Public supply withdrawals in Region VII are projected to increase by 20.3 mgd and reach 56.3 mgd by 2030. The Floridan Aquifer System is anticipated to remain the primary source of water through 2030.

Domestic Self-Supply and Small Public Water Systems

Domestic self-supply is the second largest use category and accounted for 6.5 mgd or 13% of the total water use in Region VII in 2005 (Table 3.36). The population served by domestic self-supply and small public water systems was estimated at 60,917 persons in 2005. Water demands for domestic self-supply and small public water systems are anticipated to increase to approximately 9.3 mgd in 2030.

Table 3.33 Jefferson County Public Supply Water Use Projections, 2005-2030 (mgd)

	Estimated			Projected		
Jefferson County	2005	2010	2015	2020	2025	2030
Jefferson Communities Water System, Inc.	0.09	0.12	0.17	0.21	0.26	0.30
Monticello, city of	0.64	0.71	0.72	0.73	0.74	0.75
Total	**0.73**	**0.83**	**0.89**	**0.94**	**1.00**	**1.05**

Table 3.34 Leon County Public Supply Water Use Projections, 2005-2030 (mgd)

	Estimated			Projected		
Leon County	2005	2010	2015	2020	2025	2030
Tallahassee, city of	29.87	33.77	36.39	39.02	41.64	44.26
Talquin Electric Cooperative, Inc., total	3.48	4.31	4.85	5.40	5.96	6.53
Bradfordville Regional Utility System	1.62	2.02	2.42	2.82	3.22	3.62
Lake Jackson Regional Water System	1.01	1.20	1.23	1.25	1.28	1.30
Leon County East Regional Water System	0.20	0.21	0.22	0.24	0.26	0.28
Leon County South Regional Water System	0.09	0.11	0.12	0.14	0.15	0.17
Leon County West Regional Water System	0.30	0.36	0.40	0.44	0.49	0.53
Meadows at Woodrun	0.27	0.41	0.46	0.51	0.57	0.64
Rowe Drilling Company, Inc.*	0.22	0.24	0.27	0.30	0.33	0.36
Total	**33.57**	**38.32**	**41.52**	**44.72**	**47.93**	**51.14**

**Includes Brewster Estates, Bucklake Estates, Meadow Hills, North Lake Meadows, Plantation Estates and Sedgefield Water Systems*

Table 3.35 Wakulla County Public Supply Water Use Projections, 2005-2030 (mgd)

	Estimated			Projected		
Wakulla County	2005	2010	2015	2020	2025	2030
Panacea Area Water System, Inc.	0.28	0.35	0.39	0.43	0.46	0.50
Sopchoppy, town of	0.79	1.07	1.27	1.47	1.66	1.86
Talquin Electric Cooperative, Inc.	0.69	0.94	1.15	1.35	1.55	1.76
Total	**1.76**	**2.37**	**2.80**	**3.24**	**3.68**	**4.12**

Industrial, Commercial, and Institutional (I/C/I) Self-Supply

Current I/C/I water demands total 0.9 mgd and comprise only 2% of the water use in Region VII (Table 3.36). The two large I/C/I water users are Primex, Inc. (formerly St. Marks Powder) and Winco Utilities. Winco Utilities provides water to Wakulla County Correctional Institution and a commercial park. Future Winco Utilities water users will include residential customers and that portion of the use will be accounted for in future public supply projections. Projected I/C/I water demands for Primex and Winco Utilities are anticipated to increase from 0.9 mgd in 2005 to 1.7 mgd by 2030.

Recreational Irrigation

The 2005 recreational water use of 1.4 mgd represents water used for golf course irrigation (Table 3.36). Sources of irrigation water in Region VII include the Floridan Aquifer, golf course ponds, and municipal water purchased from the City of Tallahassee. Reclaimed water was not available in 2005. Water demands for golf course irrigation are anticipated to increase to 1.9 mgd in 2030. Future demands will be met by a combination of reclaimed water, stormwater, and ground water sources.

Agricultural Irrigation

Based on currently permitted quantities, agricultural water use in Region VII was estimated at 2.8 mgd in 2005 (Table 3.36). Agricultural commodities include ornamentals, hay, sod, corn, peanuts and other field crops. Due to the difficulties inherent in projecting the mix of future agricultural crops and acreages, water demands for agriculture are projected to remain constant at permitted quantities through the planning period.

Power Generation

The three power generation facilities in Region VII are the Sam O. Purdom Generating Station (Purdom Plant), the Arvah B. Hopkins Generating Station (Hopkins Plant), and the C. H. Corn Hydroelectric Plant, all of which are operated by the City of Tallahassee. The Purdom Plant uses surface water from the St. Marks River and reclaimed water obtained from the City of St. Marks and Primex, Inc. The Hopkins Plant uses ground water from the Floridan Aquifer System. The Corn Hydro Plant operates at the Lake Talquin dam in western Leon County and generates electricity by passing water through turbines; it requires no consumptive use of water to operate. Consumptive water use for power generation totaled about 3.0 mgd in 2005 (Table 3.36).

Total Water Use and Population

In 2005, average annual water use in Region VII totaled 50.6 mgd (Table 3.36). The largest use categories were public supply (71% of total) and domestic self-supply (13%). Agriculture, recreation, I/C/I, and power generation collectively accounted for the remaining 16 percent (Figure 3.45).

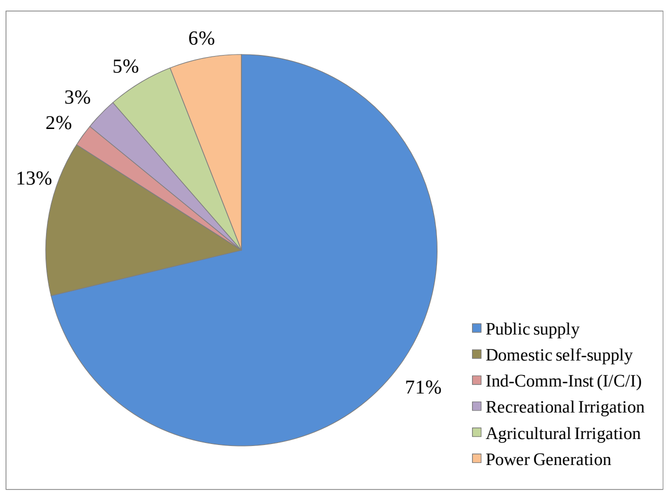

Figure 3.45 Region VII Water Use by Category, 2005

The population in Region VII was 306,520 in 2005 (BEBR 2007). Population and public supply water use are both projected to increase over the planning period. The medium-range population projections for the three counties total 423,620 persons in 2030. This represents a 38% increase from 2005 (BEBR 2007).

The total water demand in Region VII is projected to increase by 53%, or by 26.8 mgd, between 2005 and 2030, reaching 77.3 mgd in 2030 (Table 3.36). Public supply demands account for the majority of this increase (20 mgd). Water use by domestic self-supply and small public water systems is anticipated to increase by 2.5 mgd. Water consumptively used for power generation is anticipated to increase by 2.3 mgd. Projected water demand increases for the remaining use categories are small.

Table 3.36 Region VII Water Use Estimates and Projections by Category, 2005-2030 (mgd)

Water Use Category	Estimated 2005	2010	2015	Projected 2020	2025	2030
Public supply	36.05	41.52	45.21	48.90	52.60	56.32
Domestic self-supply	6.46	7.21	7.82	8.37	8.86	9.33
Ind-Comm-Inst (I/C/I)	0.93	1.33	1.71	1.71	1.71	1.71
Recreational Irrigation	1.37	1.54	1.61	1.78	1.85	1.92
Agricultural Irrigation	2.76	2.76	2.76	2.76	2.76	2.76
Power Generation	3.01	5.30	5.30	5.30	5.30	5.30
Total	**50.58**	**59.66**	**64.41**	**68.81**	**73.09**	**77.33**

1-in-10 Year Drought Projections

Projected water demands for a 1-in-10 year drought event are shown in Table 3.37. The 2030 total demand for a 1-in-10 year drought is about 6% higher than the 2030 average year total water demand.

Table 3.37 Demand Projections for a 1-in-10 Year Drought Event, by Category, 2010-2030 (mgd)

Water Use Category	Estimated 2005	2010	2015	Projected 2020	2025	2030
Public supply	38.21	44.01	47.92	51.84	55.76	59.69
Domestic self-supply	6.84	7.64	8.29	8.87	9.40	9.89
Ind-Comm-Inst (I/C/I)	0.93	1.33	1.71	1.71	1.71	1.71
Recreational Irrigation	1.64	1.84	1.93	2.13	2.22	2.30
Agricultural Irrigation	2.76	2.76	2.76	2.76	2.76	2.76
Power Generation	3.01	5.30	5.30	5.30	5.30	5.30
Total	**53.40**	**62.89**	**67.91**	**72.61**	**77.14**	**81.65**

3.7.2 Assessment of Water Resources

Ground water from the Floridan Aquifer is the traditional source of supply within Region VII. Given the high availability of ground water and its excellent quality, it is reasonable to anticipate that this use pattern will continue through the year 2030. Consequently, the assessment presented here emphasizes the continued use of ground water resources.

Ground Water Resources

The hydrogeology of Region VII is strongly influenced by karst geology. Ground water recharge has resulted in dissolution within the Floridan Aquifer and the widespread development of sinkholes and an extensive underground network of conduits. The region is characterized by a strong hydraulic connection between ground and surface waters, high aquifer recharge and high ground water availability. In descending order, the hydrogeologic units that comprise the ground water flow system are the Surficial Aquifer System, the Intermediate System, the Floridan Aquifer System and the Sub-Floridan System.

The Surficial Aquifer is absent in southeast Leon County, eastern Wakulla County and southern Jefferson County, and is negligible as a source of water supply in Region VII. Its significance derives from its role as a source of recharge water for the underlying aquifers.

Throughout most of Leon County and northern Jefferson County, the Intermediate System is generally less than 100 feet thick, breached by sinkholes and primarily functions as a semi-confining unit. In southeast Leon, eastern Wakulla and southern Jefferson counties, the system has been eroded by natural geologic processes, leaving the Floridan Aquifer at land surface. In southwest Leon and northwestern Wakulla counties, the Intermediate System increases in thickness to about 150 feet and functions as a confining unit. In the northern portion of the region, carbonate units of the Intermediate System form minor water-bearing zones that are occasionally used for domestic water supply.

Beneath the Intermediate System (where it is present) or immediately beneath land surface (where the Intermediate System is absent) is the Floridan Aquifer. The Floridan Aquifer ranges from 1,000 feet thick in northwestern Leon County to over 2,000 feet thick in the southern part of the region. High ground water recharge to the Floridan Aquifer occurs where the Intermediate System is thin, breached or absent. This has resulted in a very active ground water flow system and the development of karst features including sinkholes, springs and an extensive network of conduits in the aquifer. Transmissivities are some of the highest in the panhandle ranging from 5,000 to more than 1,000,000 ft^2/day. The upper several hundred feet of the Floridan Aquifer are utilized for water supply, with well yields ranging from several hundred to 2,500 gpm.

In northernmost Leon and Jefferson counties, the Floridan Aquifer potentiometric surface is approximately 60 feet above sea level. From here, water levels gradually decline as the ground water flows south and discharges to the Gulf of Mexico and numerous springs. Regional discharge features include at least 51 springs (Barrios 2006). This includes the first magnitude and world-renowned Wakulla Spring, the St. Marks River Rise and the submarine Spring Creek Group.

Assessment Criteria

The criteria used to assess impacts of ground water withdrawals include the long-term depression of the potentiometric surface of the Floridan Aquifer and the attendant alteration of ground water quality and the reduction of ground water discharge to rivers and springs. A ground water budget previously developed for the WSA (Ryan 1998) was also used to illustrate the relative magnitude of ground water withdrawals although, as discussed below, other more complex numerical models have more recently been developed and continue to be developed to simulate ground water flow in the region.

Impacts to Ground Water Resources and Related Natural Systems

The City of Tallahassee withdrew approximately 30 mgd of ground water from the Floridan Aquifer in 2005, which represented 59 percent of the total water use in Region VII. City of Tallahassee withdrawals are concentrated in and around the city. Hydrographs for two wells are presented to depict examples of long-term trends in the Floridan Aquifer potentiometric surface. Figure 3.46 shows the hydrograph (blue line) for the Olson Road well (northeast Tallahassee) within two miles of several major supply wells. The graph also shows the cumulative departure from normal (red line) for a rainfall station located approximately one mile from the Olson Road well. Normal rainfall was calculated from a 30 year period-of-record (1971-2000) for the Tallahassee Regional Airport station.

Between 1977 and 2007, water levels in the Olson Road well varied between 23 and 44 feet above sea level. Between 1975 and 2005, total water use in Region VII increased from approximately 28 mgd to about 50 mgd. The Olson Road well indicates no significant downward water level trend attributable to the pumping increase. Rather, levels have risen and fallen through time in response to seasonal variations in recharge and clearly show the response of the aquifer level to the significant droughts of 2000 and 2007. Daily cycling of nearby public supply wells results in a drawdown of approximately 2.5 feet that quickly recovers once pumping has ceased. Due to the highly transmissive nature of the Floridan Aquifer, the drawdowns in the potentiometric surface as a result of pumping are local in nature and dissipate quickly with increasing distance from the well.

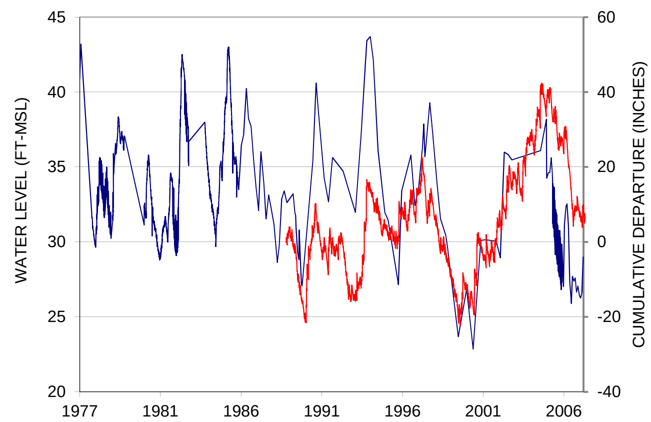

Figure 3.46 Hydrograph of the Olson Road Floridan Aquifer Well (Blue) and the Cumulative Departure from Normal Rainfall for Station 628 (Red)

The second hydrograph (Figure 3.47) is for the Newport Recreation well located in Wakulla County near Newport, Florida. Wakulla is a relatively rural county with an estimated 2005 total water use of 4.5 mgd. There are no significant ground water withdrawals in the vicinity of the Newport Recreation well. During 1961 to 2007, the Newport Recreation well showed a smaller fluctuation in water levels, ranging between four and eight feet above sea level. Water level fluctuations in this well are moderated because of its proximity to the Gulf of Mexico discharge boundary. This well shows no observable downward trend attributable to the considerable pumping to the north in Leon County. No significant decline in the potentiometric surface and no upconing of poor quality water have been reported as a result of regional withdrawals.

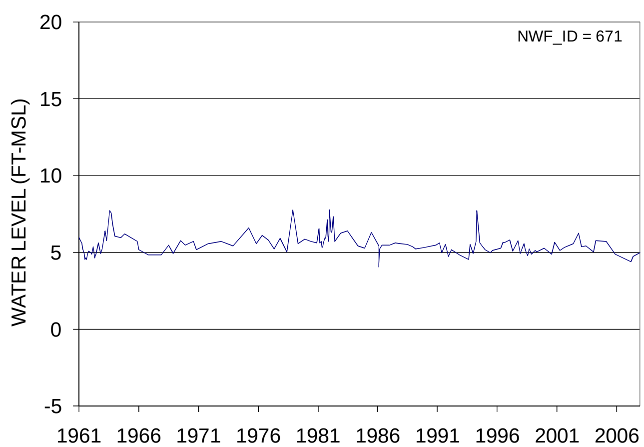

Figure 3.47 Hydrograph of the Newport Recreation Floridan Aquifer Well

To further evaluate the magnitude of potential water level declines associated with regional pumping, a calibrated, steady-state ground water model (Davis 1996) was applied to compare the water levels at the Olson Road and Newport Recreation well sites under pumping and non-pumping (predevelopment) conditions. The simulated pumping in Region VII for the 1991 steady-state calibration period is 42 mgd (see water budget below) and represents approximately 83 percent of the 2005 total water use (50.6 mgd). To simulate pre-development conditions, all pumping was shut off. The differences in potentiometric head between the pumping and non-pumping simulations at the Olson Road well and Newport Recreation well are 4.26 feet and 0.01 foot, respectively. This approximates the water level decline over a period of ground water development spanning at least sixty years (pre-development to 1991). The potential impacts due to the 2005 withdrawals would be expected to be slightly larger. However, only the portion of the simulated declines, attributable to the change in pumping over the period of water level record, would be present in the above hydrographs. The seasonal variability in recharge and associated seasonal water level fluctuations mask declines of these magnitudes.

Given the strong hydraulic connection between ground and surface waters, ground water withdrawals should be expected to reduce discharge to surface waters by an amount equal to or somewhat less than the amount withdrawn. Some of the factors which may mitigate the effect of ground water withdrawals include aquifer recharge generated by land application of treated wastewater, recharge generated by irrigation practices, recharge induced by the withdrawals, recharge generated by septic tanks, or a change in the zone of contribution caused by the withdrawals. The potentially affected major surface water features include the Wakulla Spring and River and the St. Marks River.

Region VII ground water withdrawals for 2005 averaged 50.6 mgd (78 cfs). Land application of treated wastewater returns a potion of this withdrawal to the ground water system as recharge. The Region VII wastewater flows for all permitted treatment plants with a capacity of more than 0.1 mgd totaled 21.6 mgd in 2005. Wastewater flow from the City of Tallahassee accounts for about 90% of this amount and was applied to their Southeast Farm to irrigate agricultural crops. Application rates of approximately 125 in/yr and the high permeability of the soils result in significant local ground water recharge. The recharge fraction assumed state-wide for agricultural irrigation is 35% (FDEP 2006a) and the recharge fraction assumed for spray fields is 50% (FDEP 2003). The recharge fraction associated with the City of Tallahassee Southeast Farm is likely to be higher than the statewide values used by FDEP. In 2005, the reclaimed water applied at the Southeast Farm totaled 19.5 mgd.

If, for example, 50% to 75% of the reclaimed water applied in 2005 recharged the ground water system, the net regional ground water withdrawal in Region VII would be approximately 36 to 41 mgd (56 cfs to 63 cfs). Based on this assumption, and considering no other factors which may further limit the reduction of ground water discharge to rivers and springs, it is expected that the net ground water withdrawals would potentially reduce discharge to rivers and springs by this same amount. A reduction of 36 to 41 mgd represents approximately 4.5% of the combined average river and spring estimated discharge in Region VII, assuming that river and spring discharge is the only regional outflow component impacted by ground water withdrawals. To date, no effects related to the reduced ground water discharge attributable to pumping have been reported. As required by Florida Statutes, Wakulla Spring, a first-order magnitude spring, is included on the District's MFL Priority List. The District is continuing to perform the monitoring, data analysis, and modeling to develop an understanding of the freshwater needs of the Wakulla-St. Marks river ecosystem.

Ground Water Budget

The flow system components were estimated using output from a steady-state, three dimensional ground water flow model developed by the USGS (Davis 1996) and a water budget approach developed for the 1998 Water Supply Assessment. Major ground water inflows are infiltration and direct recharge to the Floridan Aquifer, leakage into the Floridan Aquifer through the overlying Intermediate System, and subsurface inflow from areas hydraulically upgradient (southeast Georgia and Gadsden County). Direct recharge and leakage to the Floridan Aquifer total 600 mgd and includes 25 mgd of treated wastewater returns. This equates to an average region wide recharge rate of approximately 5.3 inches per year. The steady state total Region VII inflow to the Floridan Aquifer was estimated at 1,080 mgd.

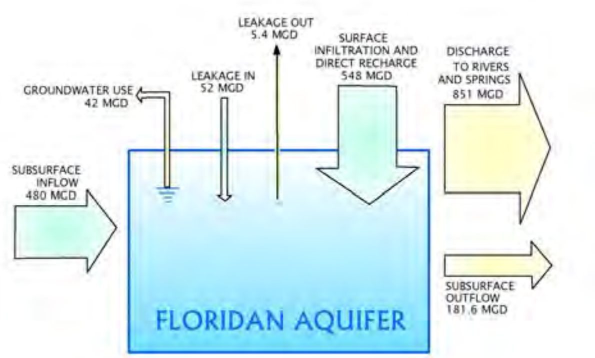

Figure 3.48 Region VII Floridan Aquifer Ground Water Budget Based on USGS Ground Water Model

Major ground water discharges from the Floridan Aquifer include discharge to rivers and springs, upward leakage into the Intermediate System, subsurface outflow to areas hydraulically downgradient (Gulf of Mexico), and ground water withdrawal via wells. Since the ground water flow model is steady state, inflow equals outflow (1,080 mgd).

Not considering the return of some of the ground water withdrawals as recharge, total withdrawal is still only a small fraction of the water budget. The 2005 withdrawal of 50.6 mgd represents 5% of the total water budget or 6% of the combined river and spring discharge. The projected 2030 ground water demand of 76 mgd represents 7% of the total water budget or 9% of the combined river and spring discharge. The projected 2030 ground water demand for a 1-in-10 year drought event of 82 mgd represents 7.9 % of the total water budget or 9.6% of the modeled ground water discharge to the rivers and springs.

<u>Water Quality Constraints on Availability</u>

Water quality constraints on ground water availability include the intrusion of saline water in coastal areas, upconing of naturally occurring poor quality water from deeper within the Floridan Aquifer, the presence of high iron or manganese concentrations, and local organic chemical contamination. None of these pose a significant constraint on water availability on a regional scale. Although there are localized exceptions, the water quality is generally good and suitable for all uses. To avoid these local water quality concerns, appropriate well locations, depths, and pumping rates should be considered. These constraints can be minimized by proper planning and management of current and future ground water withdrawals.

<u>Adequacy of Ground Water Resources</u>

The ground water sources are adequate to meet the projected 2030 average and 1-in-10 year drought event demands for Region VII while sustaining the water resources and related natural systems.

Surface Water Resources

The first magnitude Wakulla Spring, St. Marks River rise, five second magnitude springs, and numerous smaller springs occur within the St. Marks River and Wakulla River basins (Barrios 2006). The St. Marks River, Wakulla River, and Apalachee Bay have each been designated as Outstanding Florida Waters (OFW), and their combined watershed is the fifth highest priority on the NWFWMD Surface Water Improvement and Management (SWIM) Priority List (NWFWMD 2006). A large portion (450,000 acres) of Apalachee Bay has been designated as the Big Bend Seagrasses Aquatic Preserve. The rivers and bay provide habitat for a number of endangered and threatened species such as the Bald Eagle, Atlantic Ridley turtle and West Indian manatee.

The natural systems associated with the St. Marks and Wakulla Rivers are highly adapted to and dependent upon freshwater flows from the spring systems. The natural systems are generally in good condition with respect to flow quantity; although water quality issues associated with an increasing population have been a long standing concern for these unique high quality ecosystems.

There is little surface water use in Region VII. Surface water withdrawals totaled 0.9 mgd in 2005 and included withdrawals from streams and ponds for agriculture (< 0.1 mgd) and recreational water use (0.3 mgd), along with a consumptive water withdrawal of 0.5 mgd from the St. Marks River for power generation. Surface water demands are projected to increase to 1 mgd in 2030. Average surface water demands do not differ significantly from surface water demands for a 1-in-10 year drought event.

Currently, the most significant water resource concern is the nutrient load of the ground water discharging to Wakulla Spring and the quality of the water needed to sustain the ecosystem.

Reclaimed Water and Conservation

In 2005, nearly all of the 21.6 mgd of wastewater generated in Region VII was of reuse quality (FDEP 2006a) (Table 3.38). Nearly 0.1 mgd of reclaimed water was beneficially reused at the Jefferson Correctional Institution for toilet flushing and Laundromat uses in 2005. The City of Monticello used 0.5 mgd of reclaimed water for wetland augmentation and the City of Tallahassee applied 19.5 mgd of reclaimed water at the Southeast Farm facility. The City of Tallahassee recently constructed the 1.2 mgd Tram Road Reuse Facility to provide reclaimed water to the Southwood Golf Club, an office complex, and for irrigation of medians and athletic fields. The City of Tallahassee also has a $160 million plan to implement advanced wastewater treatment to protect the area's ground water resources. Wakulla County is also developing a reuse system to provide water for golf course irrigation. It is anticipated that local governments and utilities in Region VII will continue to pursue the use of reclaimed water to meet their future industrial and irrigation water needs and, in the case of the City of Tallahassee, provide higher quality effluent for aquifer recharge.

The City of Tallahassee has several water conservation programs available to utility customers, including free energy/water home audit, efficient appliance rebate programs and public education and outreach.

Table 3.38 Region VII: Reuse of Domestic Wastewater, 2005 (mgd)

Facility Name	County	Plant Capacity	Total Wastewater Flow	Reuse Capacity	Reuse Flow	Beneficial Reuse
Jefferson Correctional Institution	Jefferson	0.25	0.17	0.30	0.16	0.09
Monticello, city of	Jefferson	1.00	0.54	1.00	0.54	0.54
Killearn Lakes WWTP	Leon	0.70	0.48	0.70	0.48	0.00
Lake Jackson WWTF	Leon	0.56	0.29	0.56	0.29	0.00
T.P. Smith WRF	Leon	22.81	16.23	27.39	19.53	19.53
Lake Bradford WWTF	Leon	4.50	3.31	0.00	0.00	0.00
Fallschase WWTP	Leon	0.17	0.00	0.00	0.00	0.00
Wakulla Co./Otter Creek WWTF	Wakulla	0.50	0.32	0.50	0.32	0.00
Winco Utilities, Inc.	Wakulla	0.50	0.22	0.50	0.22	0.00
Total		**30.99**	**21.56**	**30.95**	**21.54**	**20.16**

Source: FDEP 2006a.

3.7.3 Determination of the Need for a Regional Water Supply Plan

The ground water resources in Region VII are adequate to meet the projected average and 1-in-10 year drought demands through 2030, while sustaining the water resources and associated natural systems. Therefore, no regional water supply plan is recommended at this time.

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4 SUMMARY AND CONCLUSIONS

The first WSA required by s.373.036 F.S. was completed in June 1998 for the 1995-2020 planning horizon (Ryan et al. 1998). The WSA was updated in 2003 to extend demand projections through 2025 (Bonekemper 2003). This second WSA update provides water demand projections for the 2010-2030 planning horizon and reevaluates the ability of existing and reasonably anticipated future water sources and conservation to meet projected future demands, while sustaining water resources and associated natural systems.

For each of the seven planning regions, water demand projections were developed at five-year increments for the 2010-2030 planning period. Water use estimates for 2005 were also developed. Water use estimates and projections were made at the county or user level for six use categories: public supply; domestic self-supply and small public water systems; agricultural self-supply; recreational self-supply; industrial, commercial and institutional (I/C/I) self-supply; and thermoelectric power generation. For each use category, water demands were projected for average conditions and a 1-in-10 year drought event.

For the categories of public supply, I/C/I, and power generation, all water users with permitted ADRs of 0.1 mgd or greater were included. For agriculture, the estimates and projections relied on various methodologies in an attempt to capture both permitted users and those users whose individual water use falls below permitting thresholds, but that cumulatively contribute to water use in the District. For recreational self-supply and domestic self-supply, demand projections rely on per capita-based methods which include all water users within a particular county, regardless of permitting thresholds.

In 2005, water use in the District totaled approximately 347 mgd (Table 4.1). Public supply was the largest use sector and accounted for 164 mgd or 47 percent of all water use. The district-wide average gross per capita water use in 2005 for public supply use was 145 gpcd. The second largest use category was I/C/I water use, which accounted for 66 mgd or 19 percent of the total. Agricultural irrigation accounted for 49 mgd or 14 percent of the total water use. The other three use categories accounted for the remaining 20 percent. The county with the largest total water use was Escambia County (92 mgd), followed by Bay County (66 mgd), Leon County (44 mgd), and Jackson County (38 mgd).

Table 4.1 Estimated and Projected Change in Total Water Use by Category, 2005 -2030

Water Use Category	Water Use 2005 (mgd)	% of Total	Water Use 2030 (mgd)	% of Total	Increase 2005-2030	% Increase 2005-2030
Public Supply	163.50	47%	258.40	52%	94.91	58%
Domestic Self-Supply	22.39	6%	30.78	6%	8.38	37%
Commercial-Industrial-Institutional	66.16	19%	91.14	18%	24.99	38%
Recreational Irrigation	17.34	5%	21.92	4%	4.59	26%
Agricultural Irrigation	48.63	14%	54.69	11%	6.06	12%
Power Generation	28.53	8%	39.50	8%	10.97	38%
Total	**346.55**	**100%**	**496.44**	**100%**	**149.89**	**43%**

Total water use in the Northwest Florida Water Management District is projected to increase by 43 percent over the 2005-2030 planning period to approximately 496 mgd by 2030 (Figure 4.1). An additional 150 mgd will be required to meet the needs of the seven planning regions. The use category projected to experience the greatest change over time is public supply, both in terms of the quantity of water (95 mgd) and the share of the total water use (increasing from 52% to 58% of total). Water used for I/C/I purposes will remain the second largest use category and is projected to increase by 38 percent to 91 mgd by 2030. Although agricultural water use demands are projected to increase by 12 percent, the percentage of the District's total water use accounted for by agricultural irrigation is decreasing.

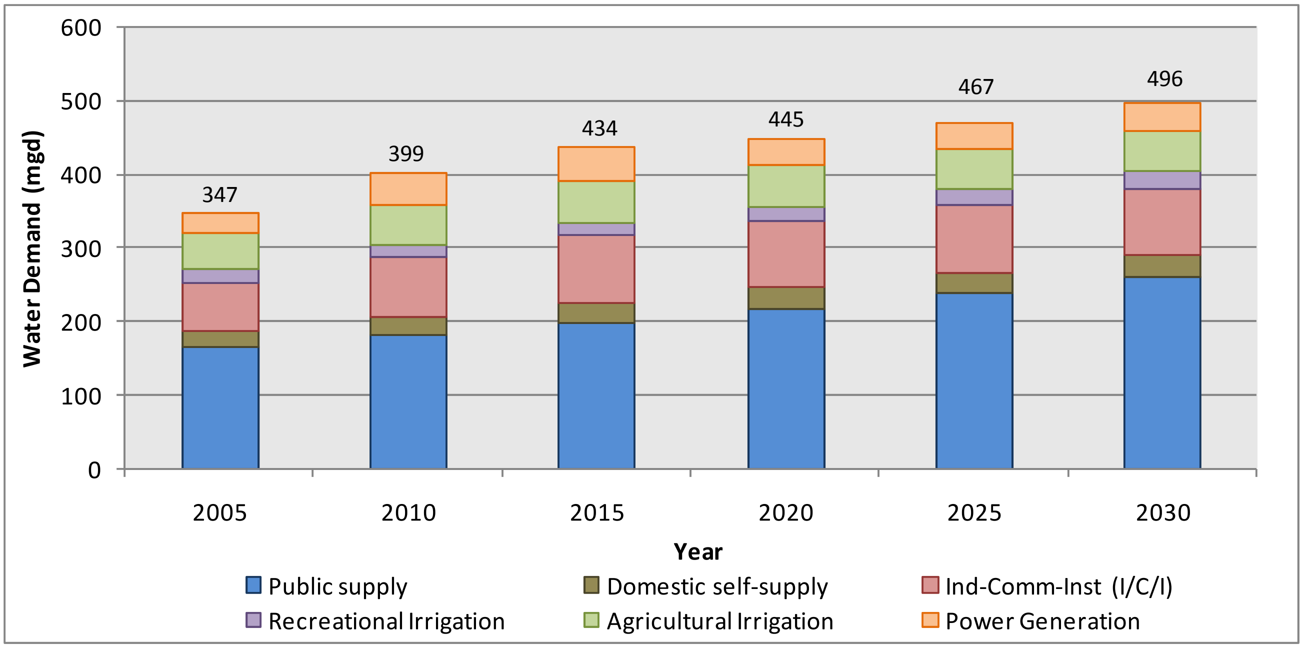

Figure 4.1 Total Water Use by Category for the NWFWMD, 2005-2030

Table 4.2 summarizes the total wastewater treatment plant flows and reuse in 2005. A total of 102.9 mgd of domestic wastewater was generated district-wide in 2005. Of this amount, approximately 58.1 mgd or 56% was of reuse quality. Approximately 37.2 mgd was beneficially reused for golf course irrigation, residential lawn irrigation, agricultural irrigation, and industrial uses. Region II generated the largest quantity of wastewater (29.5 mgd) and had the largest reuse flow (27.10 mgd), followed by Region VII where nearly all wastewater generated (21.5 mgd) was reused, primarily at the City of Tallahassee's Southeast Farm. Local governments and utilities throughout the District are continuing to explore the use of reclaimed water to meet future industrial and irrigation needs. The District encourages beneficial reuse and has provided financial support for reuse system development from the Water Protection and Sustainability Program Trust Fund. To date, the District has granted $7.85 million in funding for reuse projects that will create an estimated 8.6 mgd of reclaimed water for Regions II and VII.

Table 4.2 Reuse of Domestic Wastewater in 2005 (mgd)

Region	Total Plant Capacity	Total Wastewater Flow	Total Reuse Capacity	Total Reuse Flow	Beneficial Reuse
Region I	35.05	26.89	13.25	5.50	5.50
Region II	46.89	29.47	50.59	27.10	9.65
Region III	28.77	15.67	7.19	1.60	1.60
Region IV	10.01	6.07	2.11	1.14	0.00
Region V	2.38	1.06	1.06	0.60	0.00
Region VI	4.30	2.19	1.42	0.59	0.31
Region VII	30.99	21.56	30.95	21.54	20.16
Total	158.39	102.91	106.57	58.07	37.22

Source: FDEP 2006(a). Facilities included are those with a permitted treatment plant capacity of 0.1 or greater.
Notes: (1) Reflects 5.5 mgd used for wetland augmentation.
(2) Includes 19.53 mgd of reclaimed water used at City of Tallahassee's Southeast Farm.

The availability of water from existing and anticipated water supply sources to meet projected demands and the sustainability of water resources and associated natural systems were evaluated for each planning region to the extent possible using the best available information. Regional water supply plans are in place for Regions II, III and V and will continue to be implemented to address ongoing water resource concerns in these areas. **No additional regions are recommended for the development of a RWSP at this time.**

Efforts to monitor, regulate, and coordinate with local and regional water users will continue. Any new assessments of the water resources within a RWSP area discussed in this document will also be incorporated in the next update of the respective RWSP. Table 4.2 summarizes the conclusions for each of the seven planning regions. These conclusions will be integrated into the District Water Management Plan during the next update in 2010. This Water Supply Assessment will be updated again in 2013.

Table 4.2 Summary of Water Supply Assessment Update Conclusions

Region	Average and Drought Year Water Needs Met?	Water Resource Limitations and Concerns	2030 Alternative Water Sources
I	All	- Saltwater intrusion in coastal areas - Localized water quality problems in the Sand-and-Gravel Aquifer	Reuse
II	All, with RWSP	- Potentiometric surface declines and saltwater intrusion in coastal areas	Inland ground water, surface water and reuse
III	All, with RWSP	- Saltwater intrusion in the Floridan Aquifer in coastal Bay County - Alternative sources are needed to increase supply reliability	Inland ground water and reuse
IV	All	- Limited ground water availability in the Apalachicola Embayment area	Reuse
V	All, with RWSP	- Potentiometric surface declines and saltwater intrusion in the Floridan Aquifer in coastal areas	Surface water, inland ground water and reuse
VI	All	- Limited ground water resources in central Gadsden County - Limited surface water resources for agriculture during drought periods	Reuse
VII	All	- Wakulla Spring and St. Marks River Ecosystem	Reuse

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6 APPENDICES

Appendix A

Water Use Estimates and Projections by County

Appendix A (Tables A.1 through A.13) provides the total water use estimates and projections by category at the county level for Regions II, IV, V and VII. The counties in these regions include: Calhoun, Franklin, Gulf, Holmes, Jackson, Jefferson, Leon, Liberty, Okaloosa, Santa Rosa, Wakulla, Walton, and Washington. Water use data for Escambia, Bay and Gadsden Counties can be found in the appropriate sections of the text for Regions I, III, and VI, respectively.

Table A.1 Okaloosa County Water Use Estimates and Projections by Category, 2005-2030 (mgd)

	Estimated			Projected		
Category	2005	2010	2015	2020	2025	2030
Public supply	22.73	24.60	26.36	28.12	29.88	31.64
Domestic self-supply	0.80	0.88	0.96	1.02	1.08	1.14
Ind-Comm-Inst (I/C/I)	2.93	4.86	4.86	4.86	4.86	4.86
Recreational Irrigation	4.66	3.72	3.92	4.22	4.42	4.62
Agricultural Irrigation	0.55	0.55	0.55	0.55	0.55	0.55
Power Generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**31.67**	**34.61**	**36.65**	**38.77**	**40.79**	**42.81**

Table A.2 Santa Rosa County Water Use Estimates and Projections by Category, 2005-2030 (mgd)

	Estimated			Projected		
Category	2005	2010	2015	2020	2025	2030
Public supply	14.07	16.04	17.79	19.57	21.38	23.22
Domestic self-supply	0.43	0.51	0.57	0.63	0.68	0.73
Ind-Comm-Inst (I/C/I)	2.78	2.93	2.93	2.93	2.93	2.93
Recreational Irrigation	2.23	1.87	2.17	2.37	2.57	2.67
Agricultural Irrigation	1.19	1.19	1.19	1.19	1.19	1.19
Power Generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**20.71**	**22.54**	**24.65**	**26.69**	**28.75**	**30.74**

Appendix A (continued)

Table A.3 Walton County Water Use Estimates and Projections by Category, 2005-2030 (mgd)

Category	Estimated 2005	Projected 2010	2015	2020	2025	2030
Public supply	8.10	9.04	10.67	12.33	14.02	15.74
Domestic self-supply	1.28	1.58	1.85	2.11	2.34	2.56
Ind-Comm-Inst (I/C/I)	0.00	0.00	0.00	0.00	0.00	0.00
Recreational Irrigation	2.84	2.85	3.36	3.76	4.16	4.56
Agricultural Irrigation	3.68	3.68	3.68	3.68	3.68	3.68
Power Generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**15.91**	**17.15**	**19.56**	**21.88**	**24.20**	**26.54**

Table A.4 Calhoun County Water Use Estimates and Projections by Category, 2005-2030 (mgd)

Category	Estimated 2005	Projected 2010	2015	2020	2025	2030
Public supply	0.63	0.76	0.81	0.85	0.90	0.95
Domestic self-supply	1.02	1.09	1.14	1.20	1.24	1.28
Ind-Comm-Inst (I/C/I)	0.00	0.00	0.00	0.00	0.00	0.00
Recreational Irrigation	0.00	0.00	0.00	0.00	0.00	0.00
Agricultural Irrigation	2.17	3.67	3.67	3.67	3.67	3.67
Power Generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**3.82**	**5.52**	**5.62**	**5.72**	**5.81**	**5.90**

Table A.5 Holmes County Water Use Estimates and Projections by Category, 2005-2030 (mgd)

Category	Estimated 2005	Projected 2010	2015	2020	2025	2030
Public supply	1.20	1.19	1.27	1.38	1.53	1.72
Domestic self-supply	1.42	1.49	1.56	1.61	1.67	1.72
Ind-Comm-Inst (I/C/I)	0.00	0.00	0.00	0.00	0.00	0.00
Recreational Irrigation	0.28	0.28	0.28	0.28	0.28	0.28
Agricultural Irrigation	0.26	0.26	0.26	0.26	0.26	0.26
Power Generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**3.15**	**3.22**	**3.36**	**3.53**	**3.74**	**3.98**

Table A.6 Jackson County Water Use Estimates and Projections by Category, 2005-2030 (mgd)

Category	Estimated 2005	Projected 2010	2015	2020	2025	2030
Public supply	2.12	2.22	2.29	2.38	2.46	2.55
Domestic self-supply	3.70	4.03	4.18	4.33	4.45	4.57
Ind-Comm-Inst (I/C/I)	1.39	2.95	2.95	2.95	2.95	2.95
Recreational Irrigation	0.28	0.28	0.28	0.28	0.28	0.28
Agricultural Irrigation	26.95	26.95	26.95	26.95	26.95	26.95
Power Generation	4.36	6.68	6.68	6.68	6.68	6.68
Total	**38.81**	**43.10**	**43.33**	**43.56**	**43.77**	**43.98**

Appendix A (continued)

Table A.7 Liberty County Water Use Estimates and Projections by Category, 2005-2030 (mgd)

Category	Estimated 2005	Projected 2010	2015	2020	2025	2030
Public supply	0.33	0.41	0.48	0.56	0.63	0.71
Domestic self-supply	0.51	0.55	0.57	0.60	0.63	0.65
Ind-Comm-Inst (I/C/I)	0.41	0.62	0.62	0.62	0.62	0.62
Recreational Irrigation	0.00	0.00	0.00	0.00	0.00	0.00
Agricultural Irrigation	0.00	0.00	0.00	0.00	0.00	0.00
Power Generation	0.73	0.85	0.85	0.85	0.85	0.85
Total	**1.98**	**2.43**	**2.53**	**2.63**	**2.73**	**2.83**

Table A.8 Washington County Water Use Estimates and Projections by Category, 2005-2030 (mgd)

Category	Estimated 2005	Projected 2010	2015	2020	2025	2030
Public supply	1.02	1.10	1.13	1.16	1.19	1.23
Domestic self-supply	1.63	1.85	1.95	2.06	2.14	2.23
Ind-Comm-Inst (I/C/I)	0.29	0.68	0.68	0.68	0.68	0.68
Recreational Irrigation	0.48	0.43	0.43	0.43	0.43	0.43
Agricultural Irrigation	0.34	0.34	0.34	0.34	0.34	0.34
Power Generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**3.77**	**4.41**	**4.54**	**4.68**	**4.80**	**4.91**

Table A.9 Franklin County Water Use Estimates and Projections by Category, 2005-2030 (mgd)

Category	Estimated 2005	Projected 2010	2015	2020	2025	2030
Public supply	2.03	2.25	2.42	2.56	2.70	2.82
Domestic self-supply	0.06	0.07	0.08	0.08	0.08	0.09
Ind-Comm-Inst (I/C/I)	0.00	0.00	0.00	0.00	0.00	0.00
Recreational Irrigation	0.34	0.35	0.35	0.35	0.35	0.35
Agricultural Irrigation	0.00	0.00	0.00	0.00	0.00	0.00
Power Generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**2.44**	**2.68**	**2.84**	**2.99**	**3.13**	**3.26**

Table A.10 Gulf County Water Use Estimates and Projections by Category, 2005-2030 (mgd)

Category	Estimated 2005	Projected 2010	2015	2020	2025	2030
Public supply	1.82	2.10	2.45	2.79	3.14	3.49
Domestic self-supply	0.24	0.25	0.26	0.27	0.28	0.29
Ind-Comm-Inst (I/C/I)	0.69	2.13	2.11	2.09	2.07	2.05
Recreational Irrigation	0.11	0.20	0.20	0.20	0.20	0.20
Agricultural Irrigation	0.50	0.50	0.50	0.50	0.50	0.50
Power Generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**3.36**	**5.17**	**5.51**	**5.85**	**6.19**	**6.53**

Appendix A (continued)

Table A.11 Jefferson County Water Use Estimates and Projections by Category, 2005-2030 (mgd)

	Estimated			Projected		
Category	2005	2010	2015	2020	2025	2030
Public supply	0.73	0.83	0.89	0.94	1.00	1.05
Domestic self-supply	0.40	0.42	0.44	0.46	0.47	0.49
Ind-Comm-Inst (I/C/I)	0.00	0.00	0.00	0.00	0.00	0.00
Recreational Irrigation	0.07	0.07	0.07	0.07	0.07	0.07
Agricultural Irrigation	1.13	1.13	1.13	1.13	1.13	1.13
Power Generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**2.33**	**2.45**	**2.53**	**2.60**	**2.67**	**2.74**

Note: Only reflects those water use within the within the NWFWMD.

Table A.12 Leon County Water Use Estimates and Projections by Category, 2005-2030 (mgd)

	Estimated			Projected		
Category	2005	2010	2015	2020	2025	2030
Public supply	33.57	38.32	41.52	44.72	47.93	51.14
Domestic self-supply	4.63	4.98	5.35	5.66	5.95	6.21
Ind-Comm-Inst (I/C/I)	0.00	0.00	0.00	0.00	0.00	0.00
Recreational Irrigation	1.10	1.27	1.34	1.41	1.48	1.55
Agricultural Irrigation	1.49	1.49	1.49	1.49	1.49	1.49
Power Generation	3.01	5.30	5.30	5.30	5.30	5.30
Total	**43.80**	**51.36**	**54.99**	**58.58**	**62.14**	**65.69**

Table A.13 Wakulla County Water Use Estimates and Projections by Category, 2005-2030 (mgd)

	Estimated			Projected		
Category	2005	2010	2015	2020	2025	2030
Public supply	1.76	2.37	2.80	3.24	3.68	4.12
Domestic self-supply	1.43	1.81	2.04	2.25	2.45	2.63
Ind-Comm-Inst (I/C/I)	0.93	1.33	1.71	1.71	1.71	1.71
Recreational Irrigation	0.20	0.20	0.20	0.30	0.30	0.30
Agricultural Irrigation	0.14	0.14	0.14	0.14	0.14	0.14
Power Generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**4.45**	**5.84**	**6.89**	**7.64**	**8.27**	**8.90**

Appendix B

Appendix B provides water use estimates and demand projections by water source type, for both average demand conditions and water demands for a 1-in-10 year drought event.

Table B.1 Water Use Estimates and Projections by Region and Source Type (mgd)

Water Supply Planning Area	2005 ADR	2005 1-in-10	2030 ADR	2030 1-in-10
Region I	**92.22**	**95.11**	**122.93**	**126.86**
Ground Water	78.57	81.23	92.88	96.41
Surface Water	13.65	13.88	30.05	30.46
Region II	**63.85**	**67.75**	**94.42**	**100.16**
Ground Water	59.69	63.35	89.96	95.40
Surface Water	4.16	4.40	4.46	4.75
Region III	**64.35**	**66.44**	**95.39**	**99.29**
Ground Water	8.27	8.67	11.18	11.76
Surface Water	56.08	57.77	84.21	87.53
Region IV	**51.53**	**52.56**	**61.59**	**62.84**
Ground Water	45.03	46.00	54.01	55.21
Surface Water	6.50	6.56	7.58	7.64
Region V	**5.77**	**6.10**	**9.76**	**10.26**
Ground Water	4.74	5.00	5.47	5.75
Surface Water	1.03	1.10	4.29	4.51
Region VI	**12.36**	**12.74**	**20.55**	**21.11**
Ground Water	8.99	9.33	12.52	13.04
Surface Water	3.37	3.41	8.03	8.07
Region VII	**50.51**	**53.31**	**77.23**	**81.53**
Ground Water	49.65	52.40	76.27	80.49
Surface Water	0.86	0.92	0.96	1.04
Total	**340.58**	**354.01**	**481.87**	**502.07**

Note: Does not include reclaimed water used for golf course irrigation.
ADR = average daily rate
1-in-10 = 1-in-10 year drought event

Appendix C

Appendix C provides the estimated uniform gross per capita water use for each county during 2005.

Table C1. Public Supply Population and Per Capita Water Use

County	2005 Total County Population [(1), (4)]	2005 Population served by Large Public Supply Utilities [(1), (4)]	2005 Public Supply Water Use (gpd)[(2)]	Average Uniform Gross Per Capita Water Use (gpcd) [(4)]
Bay	161,700	146,185	28.92	198
Calhoun	13,900	4,282	0.63	148
Escambia	303,600	289,300	40.45	140
Franklin	10,800	10,194	2.03	199
Gadsden	47,700	31,856	4.01	126
Gulf	16,500	14,256	1.82	128
Holmes	19,200	5,848	1.20	205
Jackson	49,700	14,797	2.12	143
Jefferson[(3)]	8,520	4,734	0.73	153
Leon	271,100	227,432	33.57	148
Liberty	7,600	2,824	0.33	118
Okaloosa	188,900	181,327	22.73	125
Santa Rosa	136,400	132,300	14.07	106
Wakulla	26,900	13,437	1.76	131
Walton	53,500	41,399	8.10	196
Washington	23,100	7,686	1.02	133
Total	**1,339,120**	**1,127,857**	**163.50**	
Average				**145**

(1) Source: USGS, 2008
(2) Based on raw water withdrawn.
(3) Reflects the estimated 60% of the county that resides within the NWFWMD.
(4) Does not include seasonal residents.

Appendix D

Appendix D provides additional information on the specific curve and base period used to make future water use projections for each utility.

Table D1. Public Supply Utility Curve Selection and Base Period

	Utility	Curve	Base Period Used	Annual % Change 2005-2030
Escambia	Bratt-Davisville	Parabolic	1991-2005	0.87%
	Central Water Works	Linear	1991-2005	2.07%
	Century, city of	Linear	1991-2005	1.99%
	Cottage Hill	Geometric	1985-2005	1.90%
	ECUA	Linear	1985-2005	1.10%
	Farm Hill	Linear	1985-2005	1.92%
	Gonzalez	Linear	1985-2005	2.12%
	Molino	Linear	1991-2005	2.28%
	People's Water System	Linear	1991-2005	1.37%
	Walnut Hill Water Works	Linear Step Increase	2006	0.82%
Okaloosa	Auburn Water System	Linear	1985-2005	1.54%
	Baker Water System	Linear	1985-2005	2.08%
	Crestview, city of	Linear	1991-2005	1.86%
	Destin Water Users	Linear	1985-2005	1.31%
	Fort Walton Beach, city of	Linear Step Increase	2007	1.00%
	Holt Water Works, Inc.	Linear	1991-2005	2.60%
	Laurel Hill, city of	Linear Step Increase	2006	1.40%
	Mary Esther, town of	Linear Step Increase	2006	0.87%
	Milligan Water System	Linear	1991-2005	1.34%
	Niceville, city of	Linear	1985-2005	1.48%
	Okaloosa Co. Water & Sewer, total			1.21%
	OCWS - Bluewater	Geometric	1991-2005	1.18%
	OCWS - Main Water System	Linear Step Increase	2006	0.26%
	OCWS - Mid-County	Linear	1998-2006	5.14%
	OCWS - West	Modified Exponential	1985-2005	0.90%
	Seminole Community Water System	n/a	n/a	n/a
	Valparaiso, city of	Linear	1991-2005	1.46%
Santa Rosa	Bagdad-Garcon Point Water System	Linear	1991-2005	2.01%
	Berrydale Water System	Linear	1991-2005	1.34%
	Chumuckla Water System	Linear	1985-2005	1.96%
	East Milton Water System	Linear	1991-2005	3.36%
	Fairpoint Regional Utility System	n/a	n/a	n/a
	Holley-Navarre Water System, Inc.	Linear Step Increase	1991-2005	1.41%
	Navarre Beach	Linear	2007	3.26%
	Midway Water System	Linear	1991-2005	2.20%
	Gulf Breeze/South Santa Rosa Utilities System	Linear	1991-2005	1.13%
	Jay, city of	Linear Step Increase	2006	1.93%
	Milton, city of	Geometric	1985-2005	1.45%
	Moore Creek-Mt. Carmel Utilities, Inc.	Linear	1991-2005	1.36%
	Pace Water System, Inc.	Linear	1991-2005	2.16%
	Point Baker Water System, Inc.	Geometric	1991-2005	2.75%

Appendix D (continued)

	Utility	Curve	Base Period Used	Annual % Change 2005-2030
Walton	Argyle Water System	Geometric	1991-2005	2.43%
	DeFuniak Springs, city of	Geometric	1986-2006	2.10%
	FCSC of Walton Co. / Regional Utilities	Linear	1992-2006	3.47%
	Freeport, city of	Linear	1991-2005	3.69%
	Freeport - North Bay	Geometric	1991-2005	1.79%
	Inlet Beach	Linear	1991-2005	2.40%
	Mossy Head Water Works, Inc.	Linear	1991-2005	3.31%
	Paxton, city of	Geometric	1991-2005	1.78%
	South Walton Utility Company	Linear	1991-2005	2.12%
Bay	Bay County Utilities	Geometric	1985-2005	2.80%
	Lynn Haven, city of	Linear	1991-2005	2.00%
	Sandy Creek Utilities, Inc.	Geometric	1991-2005	1.44%
Calhoun	Altha, town of	Linear	1991-2005	2.11%
	Blountstown, city of	Linear	1991-2005	1.55%
Holmes	Bonifay, city of	Parabolic	1997-2005	1.41%
	Snare Waterworks (Dogwood)	Modified Exponential	1991-2005	0.74%
	Esto, town of	Logistic	1991-2005	0.67%
	Noma, town of	Linear	1991-2005	2.77%
	Ponce de Leon, town of	Linear	1997-2005	1.73%
	Westville, town of	Linear Step Increase	2005	1.76%
Jackson	Cottondale, city of	Linear Step Increase	2005	0.90%
	Graceville, town of	Linear	1997-2005	1.22%
	Grand Ridge, town of	Geometric	1985-2005	1.07%
	Greenwood, city of	Parabolic	1991-2005	1.38%
	Marianna, city of	Geometric	1991-2005	0.26%
	Sneads, town of	Linear	1985-2005	1.39%
Liberty	Bristol, city of	Linear Step Increase	2006	2.44%
	Hosford-Telogia	Linear	1991-2005	2.91%
	Rock Bluff Water System	Linear Step Increase	2006	9.55%
Washington	Aqua Utilities Florida, Inc.	Geometric	1997-2005	0.67%
	Caryville, city of	Linear	1985-2005	1.14%
	Chipley, city of	Linear Step Increase	2006	0.78%
	Vernon, city of	Geometric	1985-2005	0.22%
Franklin	Alligator Point Water District	Linear Step Increase	2006	2.99%
	Apalachicola, city of	Linear	1985-2005	0.04%
	Eastpoint Water & Sewer District	Linear	1991-2005	1.81%
	Water Management Services	Modified Exponential	1991-2005	1.30%
	Carrabelle, city of	Linear	1991-2005	1.59%
	Lanark Village Water & Sewer District	Linear	1999-2007	3.53%
	St. James Island Utility Company	Linear Step Increase	2006	n/a
Gulf	Lighthouse Utilities, Inc.	Linear	1991-2005	3.69%
	Port St. Joe, city of	Linear	1998-2006	2.26%
	Wewahitchcka, town of	Linear	1991-2005	3.18%

Appendix D (continued)

	Utility	Curve	Base Period Used	Annual % Change 2005-2030
Gadsden	Chattahoochee, city of	Linear Step Increase	2006	1.52%
	Greensboro, town of	Linear	1985-2005	0.19%
	Gretna, town of	Linear	1985-2005	2.17%
	Havana, town of	Linear Step Increase	2006	1.33%
	Talquin Electric Cooperative, Inc.*	Linear	1991-2005	3.25%
	Quincy, city of	Linear Step Increase	2006	1.21%
Jefferson	Jefferson Community Water System	Linear Step Increase	2006	4.99%
	Monticello, city of	Geometric	1991-2005	0.67%
Leon	Tallahassee, city of	Linear	1985-2005	1.59%
	Talquin Electric Cooperative, Inc.			2.97%
	Bradfordville Regional Utility System	Linear	1991-2005	3.27%
	Lake Jackson Regional Water System	Linear Step Increase	2006	1.03%
	Leon County East Regional Water System	Linear	1997-2005	1.44%
	Leon County South Regional Water System	Linear	1991-2005	2.40%
	Leon County West Regional Water System	Linear Step Increase	2006	2.32%
	Meadows at Woodrun	Geometric	1991-2005	3.48%
	Rowe Well Drilling, Inc.			1.94%
	Brewster Estates	Linear Step Increase	2006	0.97%
	Bucklake Estates	Linear Step Increase	2006	2.16%
	Meadow Hills	Linear Step Increase	2006	0.89%
	North Lake Meadows Water System	Linear Step Increase	2006	1.76%
	Plantation Estates	Linear	1991-2005	2.66%
	Sedgefield Water System	Linear Step Increase	2006	1.33%
Wakulla	Panacea Area Water System, Inc.	Linear	1993-2007	2.37%
	Sopchoppy, town of	Linear	1993-2007	3.50%
	Talquin Electric Cooperative, Inc.	Linear	1993-2007	3.81%

**Includes Gadsden County Regional, Hammock Creek, Jamieson, Longleaf Hills, and St. James Water Systems*

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