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THE WATER DEMAND PROJECTION AND DISTRIBUTION METHODOLOGY OF THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT FOR THE 2008 DISTRICT WATER SUPPLY ASSESSMENT AND THE 2010 DISTRICT WATER SUPPLY PLAN

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by

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The St. Johns River Water Management District
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CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

The St. Johns River Water Management District (SJRWMD) developed water demand projections to satisfy the need to determine "existing legal uses, anticipated future needs, and existing and reasonably anticipated sources of water and conservation efforts." This directive is based on the requirements of Subparagraph 373.036(2)(b)4a, *Florida Statutes* (*F.S.*). SJRWMD's goal in projecting water demands was to develop estimates of projected need that appeared to be reasonable based on the best information available and that were mutually acceptable to the water users and SJRWMD. The Water Demand Protection Subcommittee (WDPS), a subcommittee of the Water Planning Coordination Group (WPCG) (WDPS 1998) WPCG, developed the currently used definitions of the water use categories (WDPS 1998). WDPS was composed of representatives of Florida's five water management districts and FDEP (WDPS 1998). The six water use categories as defined by WDPS are:

1. Public supply
2. Domestic self-supply and small public supply systems
3. Agricultural irrigation self-supply
4. Recreational self-supply
5. Commercial/Industrial/Institutional self-supply
6. Thermoelectric power generation self-supply

SJRWMD projected water use demands for all of these water use categories for 2030 at five–year intervals starting at 2005. The projections were made to support the Draft 2008 District Water Supply Assessment 2008 (WSA 2008). This document provides a detailed description of methods and techniques developed and applied for projecting future water demands for SJRWMD for the 2030 planning horizon. The water demand projection methodologies were developed by GIS Associates, Inc. (GISA), contractor to SJRWMD. These water demand projection methodologies are consistent with the recommendations of WDPS (WDPS 1998).

For SJRWMD's 1998 District Water Supply Assessment (WSA 1998), 1995 water use served as the base year for the 2025 projections. Although 1995 remains the base year in the groundwater modeling portion of WSA 2008, SJRWMD used the average of annual historic water use from 1995-2005 as the basis for future water use projections. This approach accounted for annual variations in water use with respect to climatic variations. The following historical water use data sources were utilized.

1. Water use estimates reported by utilities collected by the Florida Department of Environmental Protection (FDEP), commonly called Monthly Operating Reports (MORs)
2. Water use estimates reported by utilities collected by SJRWMD through the EN50 form, commonly called EN50 data
3. District annual water use inventory data, commonly called District annual water use survey data
4. Water use reported in consumptive use permits (CUP)

The exception to using the average of annual historic water use from 1995-2005 as the basis of projections was the agricultural irrigation self-supply category for which a spatial database of irrigated acres for the years 1995 and 2005 was used. A detailed description concerning the agricultural irrigation self-supply methodology is provided in the Agricultural irrigation self-supply section of this report.

While the average historical water use data for the period 1995-2005 served as the basis for projections, future population projections and spatial distribution served as the critical drivers of change and provided the conceptual framework in formulating the future water demand projection methodology. A detailed description of SJRWMD's population projection methodology can be found in special publication SJ2009-SP7 titled *The small area population projection and distribution methodology of the St. Johns River Water Management District for the 2008 District Water Supply Assessment and the 2010 District Water Supply Plan* (Doty 2009). Population projections can be found in SJRWMD's WSA 2008.

The water demand projections for the public supply, and domestic self-supply and small public supply systems water use categories were made using the Public Water Utility Service Area Boundaries[1] (PWSABs). Water demand projections for the remaining four water use categories were made based on population projections at the county level. However, spatial population projection distribution was still required to be able to apply methodologies of population growth to project future water use in these categories.

SJRWMD made a considerable effort to develop water demand projections that were consistent with the specific plans of major water users at the time these projections were made. For the purposes of WSA 2008, SJRWMD assumed that projected increases in supply will come from currently used sources, which are primarily groundwater sources, unless water suppliers made a final commitment to the development and use of other sources of supply. Public water supply utilities in east-central Florida are in varying stages of transition from groundwater sources only to diversified sources, which include reclaimed water, surface water, and seawater. Future water supply assessments will include water use projections based on commitments to develop alternative sources as the transition to diversified sources progresses.

In addition, SJRWMD has assumed that current levels of water conservation will continue through the 2030 projection horizon. If the water conservation efforts of SJRWMD and water users are effective in reducing demands, then 2030 water use should be less than projected, under average climatic conditions.

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

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[1] Public Water Utility Service Area Boundary (PWSAB) is an area where water is currently provided, or might reasonably be provided in the future, according to adopted plans and future amendments to adopted plans of the water utility companies or respective local governments within which they operate.

Demand for water to meet the general needs of the public is reported in two categories—in the public supply category for users withdrawing at least 0.1 million gallons per day (mgd) and in the domestic self-supply and small public supply category (domestic self-supply category). This combined water use is referred to as public use water. An analysis of projected change in public use water was performed based on demand in both categories, because changes in one category may be partially offset by changes in another.

Public meetings detailing the projection methodology were held during the WSA 2008 and 2010 District Water Supply Plan (DWSP 2010) public review process. SJRWMD shared its projections with major water users and, if appropriate, revised these projections in response to comments received from these users. Consensus between actively participating water suppliers and SJRWMD was sought before projections were finalized. Projections are not necessarily consistent with permit allocations. SJRWMD recognizes that these are planning-level projections and that the projections may be subject to change in subsequent evaluations, including SJRWMD consumptive use permit (CUP) evaluations.

WATER DEMAND PROJECTION METHODOLOGY

PUBLIC SUPPLY

Public supply water use refers to water demand from publicly and privately owned public water supply utilities that had a 2005 annual average daily flow of at least 0.1 mgd. Public supply water use includes any uses of water from a public supply system. SJRWMD projected water demand in five-year increments from year 2005 to 2030 based on projections of population growth within public water supply utility service area boundaries (PWSAB) (Figure 1). SJRWMD maintains a spatial database (GIS shapefile) of the PWSABs provided to SJRWMD by respective public water supply utilities. Proposed service area boundaries included in SJRWMD's PWSAB database as of August 31, 2006, were used for projecting public supply population.

Although SJRWMD did not formally solicit water use projections, if a supplier provided them, SJRWMD compared them to its own and then attempted to reconcile any significant discrepancies. Supplier projections were not relied upon exclusively because of the different methodologies used to develop these estimates.

The projections were made available for comment, via email or internet download, to each utility. If requested, SJRWMD provided the suppliers with all information used to make its projections. In the majority of cases, the suppliers agreed that SJRWMD projections were reasonable. If not, GISA and SJRWMD staff worked with the suppliers to reach a consensus regarding the projections.

Water demands were projected for each public supply utility by multiplying the utility's 11-year average gross per capita (GPC) water use (in gallons per day) by its projected served population for each of the five-year projection periods (2010, 2015, 2020, 2015, and 2030). The period for calculating the 11-year average was 1995–2005.

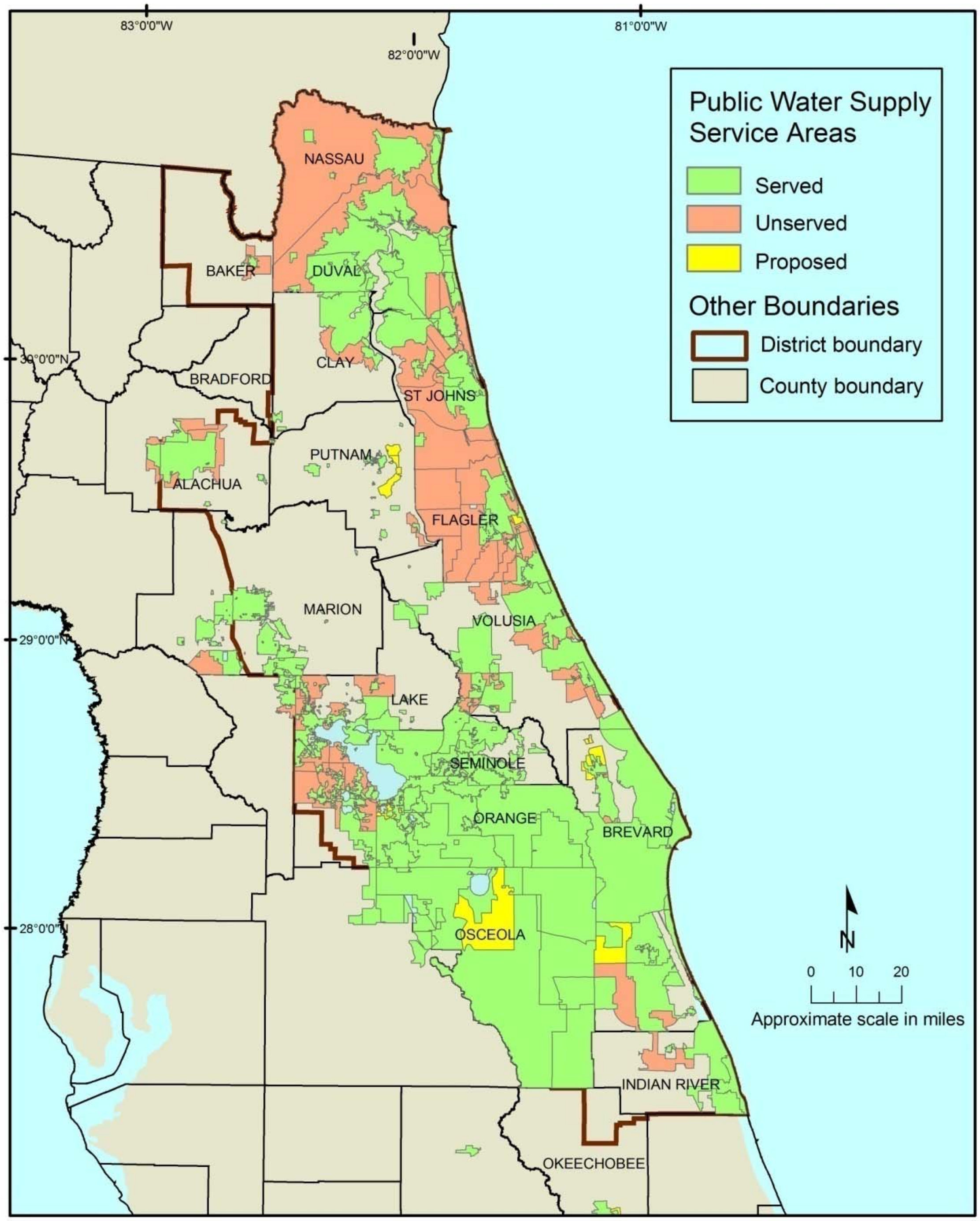

Figure 1. Public water supply utility service areas in the SJRWMD

The average GPC use is defined as the total water use (including residential and non-residential uses) for each public supply utility divided by its served population. The GPC values were made available to the utilities. In cases where historical water use data were missing or suspect, those years were omitted from the 11-year average. The following other information, when available, was also considered and, in some cases resulted in GPC adjustments.

1. Utility meter data (sometimes resulted in reducing historical served population estimates)
2. Exclusion of data for years with unexplained variances in water use data

Consistent with the WSA 2003 methodology, projections for a 1-in-10-year drought event were calculated using an average-to-drought year factor of +6% (SJ2006-1). This factor was agreed to by the 1-in-10-Year Drought Subcommittee of the WPGC. The rationale for use of the +6% factor is addressed in the subcommittee's report (1-in-10-Year Drought Subcommittee1998).

DOMESTIC SELF-SUPPLY AND SMALL PUBLIC SUPPLY SYSTEMS

Domestic self-supply and small public supply systems (DSS) water use refers to water use by individuals not served by public water supply utilities, i.e. a residential population using water drawn from a privately owned well. Small public supply utility systems with average daily flows under 0.1 mgd as of 2005 were included in this category.

Whether current or projected population was considered self supplied or publicly supplied was determined based on PWSABs. Adjustments were made in cases when data provided by a public supply utility indicated the presence of a self-supplied population within that utility's service area boundaries. For estimating DSS population, PWSABs in SJRWMD's GIS library as of August 2008 were used.

Projected population for the DSS category was calculated by subtracting the projected population supplied by public supply utilities (not including small public supply systems) from SJRWMD's portion of the total county population as projected by GIS Associates, Inc., for SJRWMD. The projected DSS water use was calculated by multiplying the projected DSS population by each respective county's average residential (also referred to as household) per capita (RPC) use for the period 1995 to 1999 (Table 1). Average RPC values were calculated on a county-wide basis from existing information contained in the files for consumptive use permits in support of the development of WSA 2003. The use of RPC values excluded the non-residential portion of GPC water use, which should not be included in domestic self-supply use (Appendix A).

For public supply service areas, projected population growth was typically included in the public supply category, even though there may be existing self-supplied populations. Much of the projected DSS demand outside current public supply service areas may ultimately be supplied by a public supply utility. Historically, public supply service areas have been developed or expanded to serve populations with sufficient densities to make this service economically justifiable. However, it is not feasible to accurately predict when and by what utility these areas will be served. For that reason, all population and calculated water use outside public service areas remain in the DSS category.

Table 1. County average residential per capita used for calculating DSS water use

County FIPS* Code	County	Average residential per capita (gallons per day)	County FIPS Code	County	Average Residential per capita (gallons per day)
001	Alachua	109.39	083	Marion	192.28
002	Baker	166.04	089	Nassau	271.90
007	Bradford	93.94	093	Okeechobee	-
009	Brevard	80.09	097	Osceola	-
019	Clay	129.72	095	Orange	150.62
031	Duval	126.49	107	Putnam	145.34
035	Flagler	106.33	109	St. Johns	136.89
061	Indian River	90.04	117	Seminole	147.47
069	Lake	196.22	127	Volusia	87.33

*Federal Information Processing Standard (FIPS) code

As in WSA 2003, projected water use by domestic self-supply and small public supply utility systems in a 1-in-10-year drought event was calculated by increasing the total projection for an average rainfall year by +6%, based on the guidance of the 1-in-10-Year Drought Subcommittee of the WPCG (1-in-10 Year Drought Subcommittee 1998).

AGRICULTURAL IRRIGATION SELF-SUPPLY

Agricultural irrigation self-supply water use projections were based on changes in irrigated acreage of agricultural crops between the years 1995 and 2005. SJRWMD created GIS spatial databases of 1995 and 2005 irrigated agricultural acreage for its entire jurisdictional area. Based on the information in this database, irrigated agricultural acreage declined by 13% between 1995 and 2005; this trend is expected to continue.

The 2005 agricultural spatial database was intersected with all parcels (from county property appraisers' data) projected to grow in population between 2005 and 2030. The population model was also used to determine the maximum carrying capacity, in population, for a parcel that would be built-out (fully developed) by a certain future year. A build-out ratio was calculated by dividing a parcel's projected population by its build-out population, which can be expressed as:

[parcel growth build-out ratio] = ([2030 population] - [2005 population]) ÷ [build-out population]

As stated previously, parcels projected to grow in population were intersected with the agricultural lands database. Agricultural (AG) acreage loss was calculated by multiplying the intersecting (area common to both growth parcels and agricultural acreage) area acreage by the growth to build-out ratio for each growth parcel. This can be expressed as:

[AG acres lost] = acres ([AG intersect growth parcel]) x [parcel growth build-out ratio]

For each county (or portion thereof) in SJRWMD, the proportional decline in irrigated agricultural acreage between 2005 and 2030 was calculated as follows (see Appendix B).

[county AG 2030 acres] = [2005 county AG acres] – [county AG acres lost]

Projected 2030 agricultural irrigation self-supply water use was calculated by multiplying the percentage decline in acreage by the 2005 agricultural self-supply water use as reported in SJRWMD Technical Fact Sheet SJ2006-FS2.

Data from consumptive use permitting records regarding future agricultural irrigation was taken into account in situations where agricultural irrigation was increasing significantly; but the typical assumption was that agricultural acreage would decline in the future. Water demand for a 1-in-10-year drought was calculated by multiplying the projected 2030 water use by the county change ratio reported in WSA 2003 for 2025 projected water use (SJRWMD 2006).

RECREATIONAL SELF-SUPPLY

The recreational self-supply water use category included only golf course irrigation. Reliable estimates of acreage and/or water use for self-supplied recreational irrigation uses other than golf course irrigation have not been developed by SJRWMD because recreational water uses other than golf course irrigation are generally considered by SJRWMD to be insignificant in comparison to golf course irrigation.

SJRWMD maintains a districtwide spatial database (in the form of a GIS polygon shapefile) of golf courses. The dataset was created using SJRWMD's 2000 and 2005 aerial imagery to delineate the irrigated portions of golf courses. Only portions of golf courses that appeared to be irrigated were included in defining each golf course's irrigated acreage. Therefore, acreages of surface water bodies, forested and shrub areas, and large paved areas were not included in the irrigated acreage values (Appendix C).

Water use estimates for all years between 1995 and 2005, if available for individual golf courses, were used as the basis of calculating an average water use per acre for each golf course in SJRWMD. The same approach was used to calculate countywide average golf course water use per acre for each county in SJRWMD (Appendix C). For courses where historic water use data was incomplete, an estimation of the course's water use was calculated by multiplying the course's irrigated acreage by the respective countywide golf course irrigation water use average. Water use projections (i.e. projected development of new golf courses) for each county were calculated by multiplying the irrigated acreage in each county in 1995 by the respective county population growth rates between 1995 and 2030. The 2005 golf course acreage and water use was interpolated from the acreage and water use estimates from the projected increase between 1995 and 2030.

It is expected that in the future a significant portion of the projected water use will be supplied by reclaimed water and storm water. SJRWMD, through its consumptive use permitting program, routinely requires the use of reclaimed water and storm water when such use is technically, environmentally, and economically feasible. Water use for a 1-in-10-year drought was calculated by multiplying the projected 2030 water use by the county change ratio reported for 2025 projected water use in WSA 2003 (SJRWMD 2006).

COMMERCIAL/INDUSTRIAL/INSTITUTIONAL SELF-SUPPLY

All permitted commercial / industrial / institutional (CII) self-suppliers listed in SJRWMD's consumptive water use permitting (CUP) database with an average daily use of at least 0.10 mgd in 2005 were included in the projection calculations. The base period used for the projections was 1995–2005, and the historic water use values were calculated by averaging data over this base period. The use of average values compensated for climatic variations and missing or anomalous annual flow values. The commercial/industrial/institutional self-supply entities were divided into two groups based on entity type: those that are likely to increase in the future (e.g., educational), and those that are not (e.g., military). Historical water use for entities that are likely to increase in the future were summarized at the county level, and the total water use was multiplied by the population growth rate from 2005 to 2030. Historical water use for entities that are not likely to increase in the future was also summarized at the county level, but the 2030 projections were held at the historic levels because water use for those entities is not expected to increase in the future. The 2030 projection summaries for both types were then summarized by county to compute CII water use projections.

It should be noted that only 5% of surface water used for mining purposes was considered consumptive, and this value was held constant for the projection years. All groundwater used for mining was considered consumptive. The rationale behind this was that SJRWMD estimates that approximately 95% of surface water used in mining is returned to the source. Also, in cases where permit information significantly contradicted the projected future water use (e.g., showing a decline rather than an increase), those values were used in place of the original projected values.

THERMOELECTRIC POWER GENERATION SELF-SUPPLY

All permitted thermoelectric power generation self-suppliers listed in the SJRWMD CUP database and the facilities within SJRWMD groundwater model domains were inventoried. For WSA 2008, a GIS database of the facilities was created. Each facility was attributed with historical water use, historical power production capacity (megawatts), planned capacity expansion, planned expansion date, type (turbine, combined cycle, steam), fuel source (coal, petroleum coke, natural gas, oil), and water source (ground, surface or reclaimed). Attribute data was compiled from the CUP database, interviews with suppliers, and information from the U.S Department of Energy, Energy Information Administration, and the Florida Public Service Commission. The average daily water use per power generation capacity unit or gallons per megawatt, for various power generation types and fuel sources were calculated (power plant capacity and water use at 2005 is a combination of 2000-2005 data). The 1995 power generation capacity (megawatts) was estimated by average statewide increase in peaking demand from 1995-2005 obtained from the Florida Public Service Commission. The gallons per megawatt calculation was used as a proxy to project future water use. For power plant types that lacked comparable examples, proxies were developed from the Department of Energy Published values (Stiegel 2005).

The Florida Public Service Commission requires that each electric power generating utility produce detailed 10-year site plans for each of its facilities. These plans include planned facilities and generating capacity expansion. The 2006 10-year site plans for each electric utility in the state were downloaded from the Florida Public Service Commission website (*http://www.psc.state.fl.us/utilities/electricgas/10yrsiteplans.aspx*). Most utilities detailed the exact locations and capacities of their planned expansions in these site plans. However, some plans lacked details and additional research was required.

For each thermoelectric power generation facility with a planned capacity expansion, power generating capacity projections (in megawatts) were interpolated between the existing capacity and the planned capacity, as detailed in the 10-year site plans. Power plant capacity data was taken from Schedule 1 of the 10-year site plans. To meet the 25-year requirement for WSA 2008, the projection of power generation capacity (megawatts) beyond planned expansion was calculated for each facility using a linear extrapolation of the existing and planned expansion dates.

Water use was projected using gallons per megawatt in 2005 (Stiegel 2005). Power plant water use data was taken from SJRWMD CUP data and from groundwater models. Water use was calculated for all projection years by multiplying each facility's future capacity (in megawatts) by the ratio of historic water use to historic capacity (in megawatts). For those facilities for which water use data was unavailable, the average gallons per megawatt was used for facilities of the same type and fuel source. In cases where facilities of similar type and fuel source were unavailable, or unsuitable for use, values published by the Department of Energy were used. Water use values for facilities with no planned expansion were kept constant at 2005 levels (Appendix D).

SJRWMD distinguished between water used for once-through cooling and recirculation and for all other uses associated with thermoelectric power generation. This distinction was made because the use of water for once-through cooling and recirculation is considered to be non-consumptive, because it is typically returned to the same source from which it was withdrawn without a noticeable water resource impact. Only uses other than those for once-through cooling and recirculation were considered in the total water use estimates.

METHODOLGY FOR DISTRIBUTION OF WATER DEMAND TO GROUNDWATER MODEL CELLS

SJRWMD currently maintains eight groundwater flow models (Figure 2). These models, developed by and for SJRWMD, incorporate the McDonald and Harbaugh (1988) modular, three-dimensional, finite-difference, groundwater flow model (MODFLOW) developed for the USGS. The model domains encompass SJRWMD and portions of the South Florida (SFWMD), Southwest Florida (SWFWMD), and Suwannee River (SRWMD) water management districts, as well as parts of the State of Georgia.

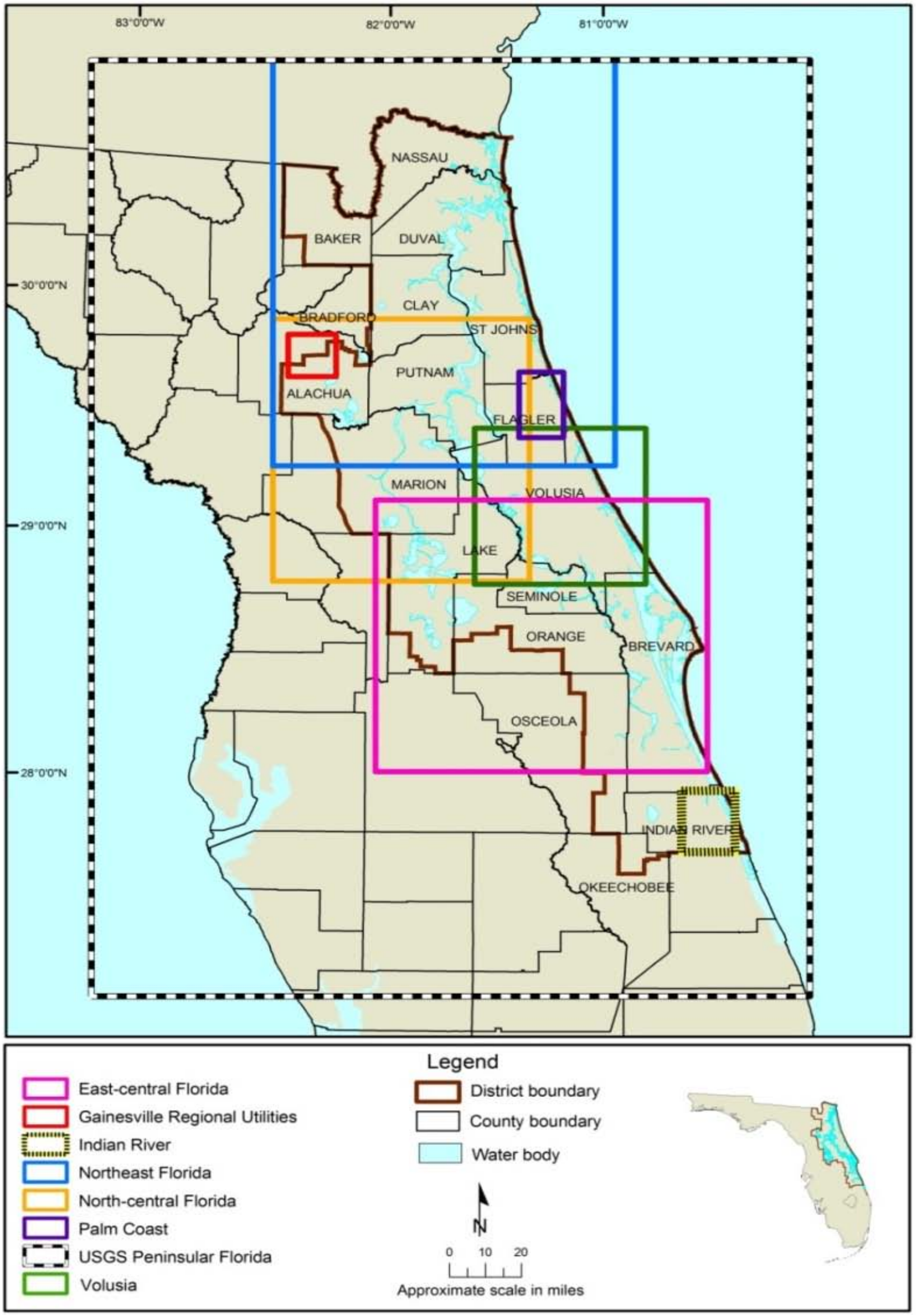

Figure 2. St. Johns River Water Management District groundwater flow model boundaries

As part of WSA 2008, SJRWMD assessed potential impacts to water resource and related natural systems. SJRWMD utilized these groundwater flow models with projections of average 2030 water use as the basis for projecting these impacts. The modeling effort required that groundwater withdrawals associated with projected 2030 water demands be located spatially within the cells of each model domain.

PUBLIC SUPPLY

Projected public supply water use was not aggregated to be distributed to groundwater model cells. Instead, the 1995-2030, rate of change of water use by PWSAB was calculated for each groundwater model domain. SJRWMD then applied these rates of change to the appropriate model cells. This ensured consistency with the 1995 calibrated values of the groundwater models.

DOMESTIC SELF-SUPPLY AND SMALL PUBLIC SUPPLY SYSTEMS

Estimation of current and projected future water use based on projected DSS population had several prerequisites. Most critical was the determination of self-supply population based on which DSS water use was to be determined. This required several GIS geoprocessing steps. These included determinations of self-supplied population from outside PWSABs and from within existing PWSABs. Finally, the self-supply population needed to be aggregated based on groundwater model cells. The methodology adopted to determine self-supply population and ultimately distribute DSS water use is presented below.

Determination of self-supply population

As mentioned above, determination of self-supplied population involved population from outside PWSABs, from within PWSABs, and from within proposed PWSABs. DSS population outside PWSABs was identified by locating the existing and projected population outside current public supply service area boundaries (PWSABs). All known existing self-supplied population within PWSABs boundaries was also added to the DSS population. The projected DSS water use was calculated by multiplying the DSS population by respective county's residential per capita use average between 1995 and 2000. Residential per capita use is based on residential use only.

There are large fractions of self-supplied population within a number of PWSABs. However, in the majority of cases the magnitude and locations of these self-supplied populations could not be determined. In these cases, the quantities of groundwater identified as DSS water use inside PWSABs in the 1995 water use data sets of SJRWMD's groundwater flow models were used as a proxy for these populations. Some utility providers did provide detailed information on the distribution of the served versus unserved populations in their service areas. In such cases, that distribution was reflected in the DSS population in the PWSABs.

DSS population was also identified by locating existing DSS water use populations within proposed public supply service area boundaries. It was assumed that these DSS populations would remain self-supplied even after the area became a public supply service area. That is, the DSS water users would not elect to connect to the public water supply system. Certain county/municipal ordinances require utility connections when the infrastructure is within a prescribed distance from the self-supplied property. SJRWMD did not attempt to make these predictions; this population are assumed to remain in the DSS water use category through the year 2030 in WSA 2008.

Aggregation of self-supply population to groundwater model cells

All the identified DSS population projections were transferred to the groundwater model grid cells based on the two-dimensional surface grid representing the three-dimensional flow models. SJRWMD determined the aquifer from which water for DSS water use would be withdrawn in the models.

A composite of all groundwater model grids was created (Figure 3a). Where model domains overlapped, selection of DSS population and intersections with model cells were performed simultaneously for all models (Figure 3b). For each county, all residential parcels outside PWSABs with current or projected 2030 populations were identified. The public water use for these parcels was assumed to be from self-supply wells and was therefore accounted for as DSS water use (Figure 3b). It was assumed that all parcels with an existing (2005) self-supplied population within proposed PWSABs will remain self-supplied after the proposed area is publicly supplied. When currently vacant residential parcels were projected to be developed (2010 – 2030), it was assumed that they will be served with water by a public water supply utility (Figure 3c). All DSS parcel centroids[2] were intersected with groundwater model grid cells (Figure 3d). Total DSS population intersecting the model grid cell was summarized. County RPCs were used to calculate DSS water use for the cells (Figure 3e). Table 2 shows the DSS water use calculations for model grid cell 11425 (North-central Florida model).

[2] Centroid is the term given to the center of an area, region, or polygon. It is also be defined as the mathematical or geographical center point of a polygon.

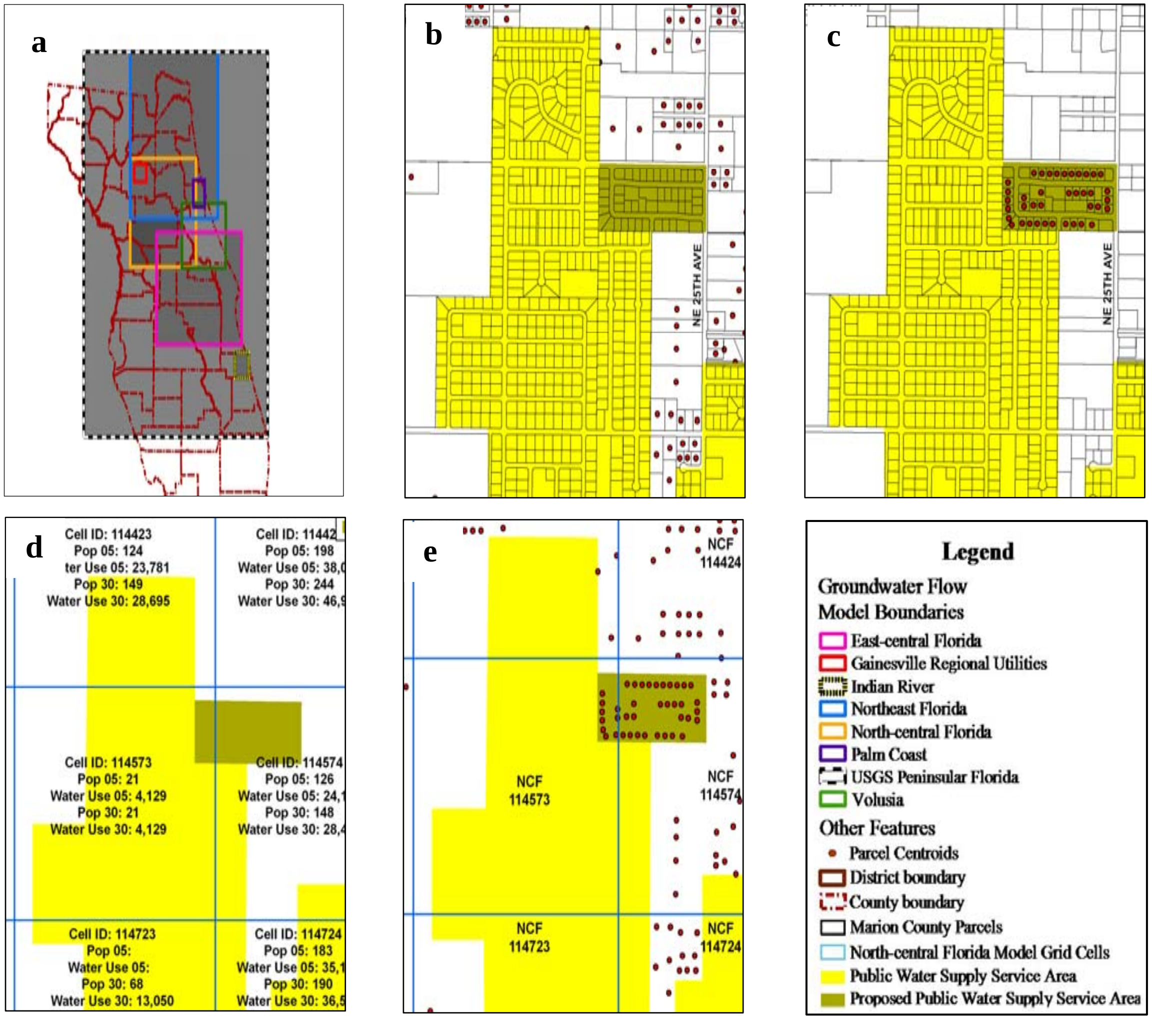

Figure 3. Process methodology for distributing DSS water demand to groundwater model cells
a) Composite of all SJRWMD model domains; b) Selected parcels with current or projected residential population;
c) Developed residential parcels in proposed service areas that are currently self-supplied; d) DSS parcel centroids intersected with groundwater models cells (here North-central Florida model) and; e) 2005 and 2030 population and water use by grid cell

Table 2. Summary of calculations of DSS population and water use

Model Cell ID	Parcel Alt Key	Year Built	Current Land Use	Future Land Use	Parcel Acres	Parcel Population 2005	2010	2015	2020	2025	2030
114425	0281531	2003	Cropland Class 3	Rural Res.	5.31	0.00	0.05	0.12	0.20	0.31	0.31
114425	0281590	1987	Grazing Class 4	Agriculture	3.02	2.50	8.07	14.72	22.57	31.65	31.65
114425	0281603	1978	Improved SF Residential	Low Density Res.	1.79	2.50	2.50	2.50	2.50	2.50	2.50
114425	0281611	1979	Improved SF Residential	Low Density Res.	1.99	2.50	2.50	2.50	2.50	2.50	2.50
114425	0281859	1996	Improved SF Residential	Low Density Res.	6.34	2.50	2.50	2.50	2.50	2.50	2.50
114425	1792452	1983	Improved SF Residential	Low Density Res.	1.31	2.50	2.50	2.50	2.50	2.50	2.50
114425	1888751	1985	Grazing Class 4	Rural Res.	3.68	0.00	1.33	2.92	4.80	6.97	6.97
114425	1898455	1984	Grazing Class 4	Rural Res.	7.55	0.00	1.78	3.89	6.40	9.29	9.29
114425	2031522	1978	Improved SF Residential	Low Density Res.	3.40	2.50	2.50	2.50	2.50	2.50	2.50
114425	2061286	1987	Improved SF Residential	Low Density Res.	2.06	2.50	2.50	2.50	2.50	2.50	2.50
114425	2377313	1988	Grazing Class 4	Agriculture	9.50	0.00	1.05	2.30	3.77	5.48	5.48
114425	2678542	0	Vacant Residential	High Density Res.	0.05	0.00	0.54	1.21	2.04	2.26	2.26
114425	2678542	0	Vacant Residential	High Density Res.	0.05	0.00	0.54	1.21	2.04	2.26	2.26
114425	3051459	2002	Improved SF Residential	Low Density Res.	4.25	2.50	2.50	2.50	2.50	2.50	2.50
114425	3051467	2002	Improved SF Residential	Low Density Res.	7.33	2.50	2.50	2.50	2.50	2.50	2.50
114425	3051475	2002	Grazing Class 4	Rural Res.	5.30	0.00	1.78	3.89	6.40	9.29	9.29
114425	3051483	2003	Improved SF Residential	Low Density Res.	4.68	2.50	2.50	2.50	2.50	2.50	2.50
114425	3051491	0	Cropland Class 3	Rural Res.	4.29	0.00	1.78	3.89	6.40	9.29	9.29
114425	3051505	0	Cropland Class 3	Rural Res.	5.95	2.50	3.83	5.42	7.30	9.47	9.47
114425	3051513	2002	Cropland Class 3	Rural Res.	6.68	0.00	1.78	3.89	6.40	9.29	9.29
114425	3051521	0	Cropland Class 3	Rural Res.	7.30	0.00	1.78	3.89	6.40	9.29	9.29
114425	3051530	2002	Improved SF Residential	Low Density Res.	4.33	2.50	2.50	2.50	2.50	2.50	2.50
114425	3051548	2002	Improved SF Residential	Low Density Res.	4.36	2.50	2.50	2.50	2.50	2.50	2.50
114425	3051556	0	Vacant Residential	Low Density Res.	4.41	0.00	1.94	4.25	6.99	10.15	10.15
114425	3051564	2000	Improved SF Residential	Low Density Res.	3.83	2.50	2.50	2.50	2.50	2.50	2.50
114425	3108396	0	Acreage/Non Classified	Not Classified	9.93	2.50	3.10	3.83	4.68	5.66	5.66
114425	3229703	0	Vacant Residential	Low Density Res.	3.60	0.00	0.04	0.10	0.18	0.27	0.27
114425	3229720	2003	Improved SF Residential	Agriculture	3.56	2.50	2.50	2.50	2.50	2.50	2.50
					Total Cell Population	**40.0**	**61.9**	**88.1**	**119.1**	**153.4**	**153.4**
					Residential Per Capita Water Use (gpd)	**192.28**	**192.28**	**192.28**	**192.28**	**192.28**	**192.28**
					Total Cell DSS Water Use (gpd)	**7,694**	**11,902**	**16,934**	**22,895**	**29,503**	**29,503**

AGRICULTURAL IRRIGATION SELF-SUPPLY

Currently, SJRWMD's groundwater flow models are calibrated to 1995 conditions including 1995 groundwater withdrawals to support agricultural irrigation. The model-cell level withdrawal values represent the sum of 1995 SJRWMD well level water use data for all wells located in groundwater model cells. The projected 2030 withdrawals were calculated by removing cells with 1995 agricultural water withdrawals if residential growth was projected to occur in that cell (see growth cells in following section; Recreational Self-Supply). The projected 2030 cell withdrawals therefore represent the 1995 withdrawal value for each cell for which residential growth was not projected. The assumption was that, overall, agricultural acreage and water use would decline in the future.

RECREATIONAL SELF-SUPPLY

Projected recreational self-supply water use was distributed to groundwater model cells in which new golf courses were projected to be developed. For modeling purposes, it was assumed that new golf courses would be located in new residential areas outside existing public water supply service areas (Figure 1).

Parcel centroids (and population) were intersected with groundwater model cells. For each cell the absolute population growth and the percentage change between 2005 and 2030 was calculated. Those cells for which either the absolute population growth or percentage change was greater than the average for all cells in the same county were tagged as areas for possible new golf course locations (Figure 4).

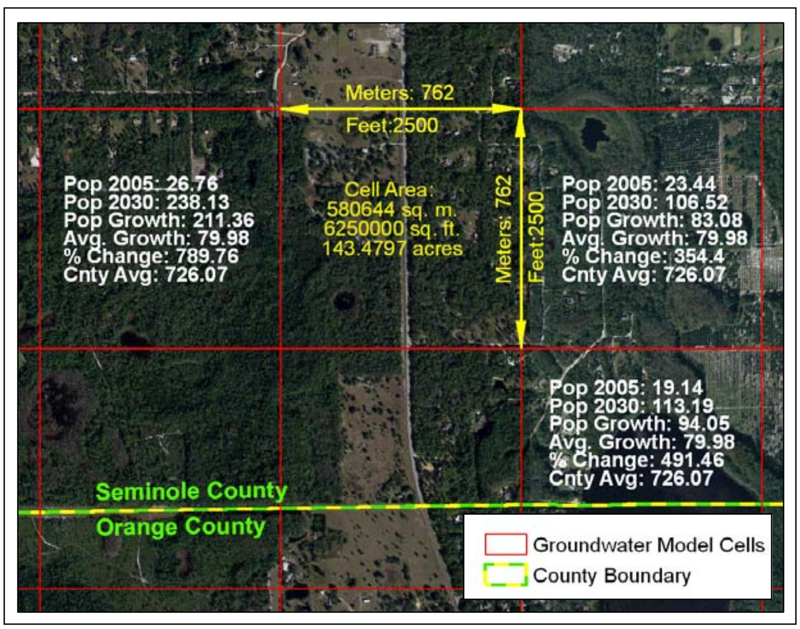

Figure 4. Cells selected for possible new golf course sites

For each county, the total area of the tagged cells was calculated. The projected recreational self-supply water use increase was dispersed equally to all cells (Figure 5).

COMMERCIAL/INDUSTRIAL/INSTITUTIONAL SELF-SUPPLY

As with recreational self-supply water use, projected increased commercial/industrial/institutional self-supply (CII) water use was distributed to locations where new facilities were projected to be developed. Similarly, areas for possible new CII locations were selected from the tagged areas (see above). However, a further restriction was placed on the possible locations for new CII facilities and the associated projected 2030 water use. The tagged areas for new CII were restricted to only those cells intersecting roads identified by the Florida Department of Transportation (2005) **Functional Classification System** (FCS) database as:

1. Principal Arterial
2. Minor Arterial
3. Manor Collector
4. Minor Collector
5. Local/Urban

SJRWMD believed that restricting new CII development to areas in close proximity to these classes of roads was the most reasonable approach to identify potential development in this category. For each county, the total area of the subset of the tagged cells that intersected the FCS roads was calculated. The projected 2005 – 2030 increase in CII water use was dispersed equally to all cells. The distinction and methodology for cell selection between recreational self-supply and CII can be seen in Figure 5.

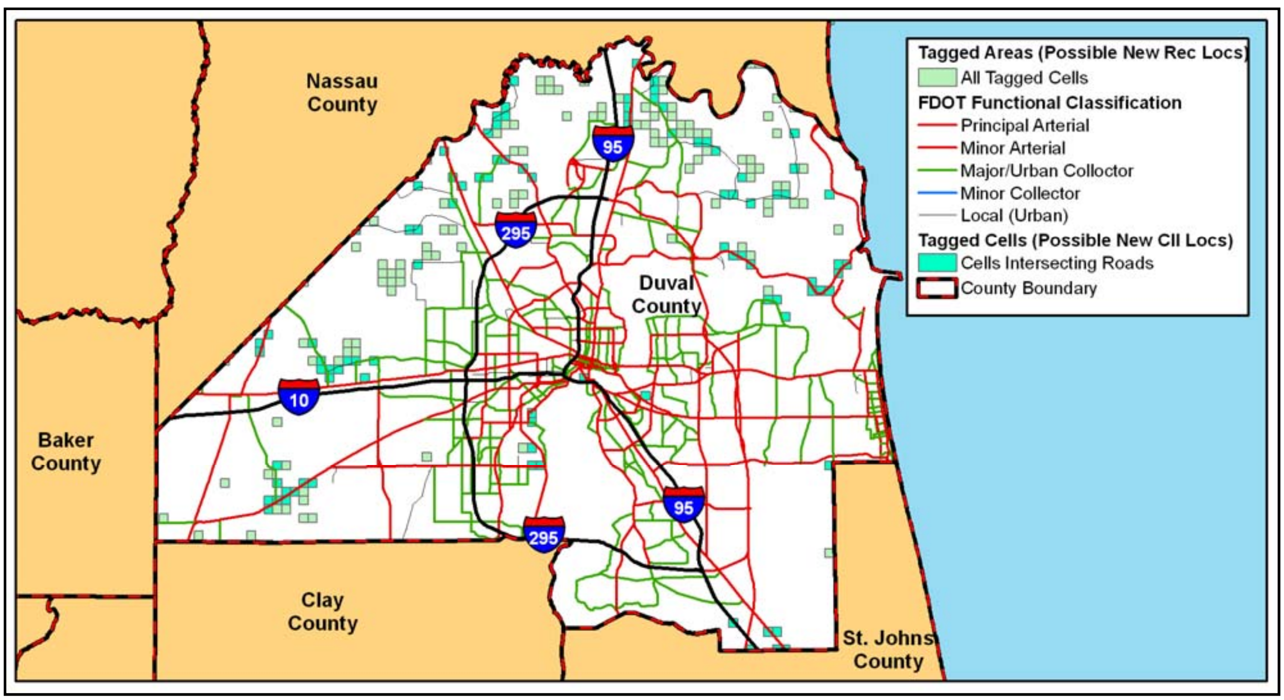

Figure 5. RSS and CII model cell selection for water demand distribution

THERMOELECTRIC POWER GENERATION SELF-SUPPLY

Water demand for thermoelectric power generation self-supply water use was distributed to the well(s) location(s) for each thermoelectric power generation water user. The wells and water demand values were intersected with the groundwater model cells. A summary of total water use per cell was calculated and distributed to the appropriate cells.

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APPENDIX A

Calculation of Domestic Self-Supply County Residential Per Capita

SJRWMD calculated county average residential per capita (RPC) water use based on water use and population for the years 1995-1999. These were initially calculated as part of the WSA 2003. These averages were used to estimate DSS water use for the WSA 2008. The average gross per capita for each public supply service area was calculated for each county. Gross per capita (GPC) included water uses from all categories: household, commercial/industrial/institutional, agricultural, recreational and power generation. Table A-1 shows GPC calculation for a public supply service area of Gainesville Regional Utilities of Alachua County.

Table A-1. GPC calculation for Gainesville Regional Utilities (GRU) water use and population

	1995	1996	1997	1998	1999
Water demand (million gallons per day)	21.515	22.153	22.089	24.578	24.792
Service area population	146,237	149,058	151,880	154,701	157,523
Gross per capita* (gallons per day) = Water demand/Service area population	147.12	148.62	145.44	158.87	157.39
Gross per capita average	151.49				

*Gross per capita (GPC) includes water use from all categories

The RPC was calculated by multiplying the GPC by the residential percentage use (Table A-2), which is determined by the SJRWMD (and the applicant) through the consumptive use permitting process or can be found in the Consumptive Use Technical Staff Report.

Table A-2. Water use types and percentages from total water use for GRU

Use Classification / Type	Percent of Total
Residential	63.0%
Water Utility	5.6%
Commercial/Industrial/Institutional	31.5%

For Gainesville Regional Utilities:

RPC = GPC x residential use percentage = 151.49 x .63 = 95.44

The county average represents an average of all public supply service areas RPC (Table A-3). Table A-4 shows average public supply gross and residential per capita water demand for all utilities in SJRWMD.

Table A-3. Average residential per capita for Alachua County

	Average Population	Average Residential Per Capita (gallons per day)
Gainesville Regional Utilities	151,880	95.44
City of Hawthorne	1,447	127.93
Kincaid Hills	801	104.81
Residential per capita average	109.39	

Table A-4. Public supply gross and residential per capita water demand (average of 1995 - 99)

County	Utility	Gross Per Capita* (gpd)†	Residential Use Percent	Residential Per Capita (gpd)
Alachua	Gainesville Regional Utilities	151.49	63.00	95.44
Alachua	City of Hawthorne	139.51	91.70	127.93
Alachua	Kincaid Hills	131.01	80.00	104.81
Baker	City of MacClenny	184.49	90.00	166.04
Bradford	Keystone Club Estates	156.56	60.00	93.94
Brevard	Brevard County Utilities	108.81	100.00	108.81
Brevard	North Brevard County Utilities	50.63	100.00	50.63
Brevard	City of Cocoa	153.49	60.10	92.25
Brevard	City of Melbourne	124.15	84.90	105.41
Brevard	Palm Bay Utilities	67.25	63.00	42.37
Brevard	City of Titusville	100.79	80.45	81.09
Clay	Clay County Utility Authority	170.33	95.00	161.82
Clay	Florida Water Services Corporation	94.01	93.00	87.43
Clay	Town of Green Cove Springs	238.92	48.20	115.16
Clay	Town of Orange Park	169.38	91.20	154.48
Duval	Atlantic Beach Utility	137.81	87.00	119.89
Duval	Baldwin	89.38	92.00	82.23
Duval	Florida Water Services Corp.	151.19	91.50	138.34
Duval	Jacksonville Beach	159.88	78.00	124.71
Duval	Jacksonville Electrical Authority	149.50	89.30	133.50
Duval	Neptune Beach	184.34	93.90	173.10
Duval	Normandy Villages Utilities	121.53	93.50	113.63
Flagler	City of Bunnell	124.33	48.60	60.42
Flagler	Dunes Community Development District	262.64	77.00	202.23
Flagler	City of Flagler Beach	118.64	74.10	87.91
Flagler	City of Palm Coast	130.66	57.20	74.74
Indian River	City of Fellsmere	79.81	71.90	57.39
Indian River	Indian River County Utilities	101.29	59.80	60.57
Indian River	City of Vero Beach	266.95	57.00	152.16
Lake	Aquasource Utility Inc.	184.00	88.50	162.84
Lake	Astor - Astor Park Water Assoc Inc.	117.35	84.00	98.58
Lake	Chateau Land Development Co.	216.68	77.00	166.84
Lake	Clerbrook Golf & RV Resort	465.36	61.00	283.87
Lake	City of Clermont	246.29	75.00	184.72
Lake	City of Eustis	128.36	78.10	100.25
Lake	Florida Water Services Corporation	305.11	52.00	158.65
Lake	Aqua Utilities Florida	265.64	77.30	205.34
Lake	Florida Water Services Corporation.	201.88	76.00	153.43
Lake	City of Fruitland Park	237.41	83.30	197.76
Lake	City of Groveland	150.61	79.00	118.98

County	Utility	Gross Per Capita* (gpd)†	Residential Use Percent	Residential Per Capita (gpd)
Lake	Harbor Hills Utilities LP	882.49	49.00	432.42
Lake	Hawthorne At Leesburg	276.65	73.30	202.78
Lake	Town of Howey In The Hills	221.14	75.00	165.86
Lake	Town of Lady Lake	110.83	89.00	98.63
Lake	City of Leesburg	238.84	58.30	139.24
Lake	Mid Florida Lakes MHP	225.67	86.00	194.07
Lake	City of Mascotte	121.28	94.20	114.25
Lake	City of Minneola	147.60	74.00	109.22
Lake	Town of Montverde	167.11	70.00	116.98
Lake	City of Mount Dora	211.24	80.00	168.99
Lake	Oak Springs MHP	270.52	87.00	235.35
Lake	Pennbrooke Utilities Inc.	423.70	100.00	423.70
Lake	Southlake Utilities Inc.	132.55	99.00	131.23
Lake	Sunlake Estates	882.31	55.30	487.92
Lake	City of Tavares	183.90	82.00	150.80
Lake	City of Umatilla	172.98	80.80	139.77
Lake	Utilities Inc of Florida	270.13	69.50	187.74
Lake	Lake Utility Services Inc.	199.99	91.40	182.79
Lake	Village Center Community Development District	243.23	80.90	196.77
Lake	Water Oak Country Club Estates	337.58	82.20	277.49
Lake	Wedgewood Homeowners Assoc Inc.	347.40	84.00	291.82
Marion	Aquasource Utility Inc.	115.53	100.00	115.53
Marion	City of Belleview	82.22	72.30	59.45
Marion	Marion County Utilities – Spruce Creek Golf And Country Club (82064)	476.47	77.90	371.17
Marion	Marion County Utilities – Spruce Creek South	444.80	74.00	329.15
Marion	Marion County Utilities – Stonecrest	398.64	41.00	163.44
Marion	Marion County Utilities – Silver Spring Shores	118.74	73.00	86.68
Marion	Marion Utilities Inc. – Fore Acres	130.00	100.00	130.00
Marion	Marion Utilities Inc. – Greenfields	168.10	100.00	168.10
Marion	City of Ocala	167.64	48.70	81.64
Marion	Ocala East Villas	368.70	55.00	202.78
Marion	Sunshine Utilities Inc.	430.79	94.50	407.09
Nassau	Florida Public Utilities Corp.	256.36	87.00	223.03
Nassau	Florida Water Services Corp.	378.57	94.50	357.74
Nassau	JEA (Formerly United Water Florida Inc.)	255.36	92.00	234.93
Orange	City of Apopka	210.79	80.00	168.63
Orange	Chateau Land Development Co.	152.30	77.00	117.27

County	Utility	Gross Per Capita* (gpd)†	Residential Use Percent	Residential Per Capita (gpd)
Orange	Town of Eatonville	201.20	51.00	102.61
Orange	City of Maitland	302.93	57.00	172.67
Orange	Town of Oakland	151.96	74.40	113.06
Orange	City of Ocoee	200.00	69.00	138.00
Orange	Orange County Public Utilities	186.35	76.30	142.18
Orange	Orlando Utilities Commission	228.59	52.80	120.69
Orange	Rock Springs MHP	189.09	86.80	164.13
Orange	Shadow Hills MHP	94.81	92.00	87.23
Orange	Utilities Inc. of Florida	134.02	95.40	127.86
Orange	City of Winter Garden	157.86	80.00	126.29
Orange	City of Winter Park	209.20	66.50	139.12
Orange	Zellwood Station Utilities	361.18	100.00	361.18
Orange	Zellwood Water Association	178.43	100.00	178.43
Putnam	Crescent City	179.73	79.00	141.99
Putnam	City of Palatka	252.21	58.95	148.68
St. Johns	Intercoastal Utilities Inc	264.62	85.20	225.46
St. Johns	Jacksonville Electrical Authority	151.96	88.00	133.73
St. Johns	North Beach Utilities Inc.	130.70	88.00	115.01
St. Johns	City of St Augustine	83.57	90.00	75.21
St. Johns	St. Johns County Utilities – Tillman (Mainland & St. Aug Bch to Marineland)	142.15	82.00	116.56
St. Johns	St. Johns County Utilities – Northwest (NW / World Golf Village / Six Mile Creek / Harmony Village)	135.14	91.00	122.97
St. Johns	St. Johns County Utilities – Walden Chase / Marshall Creek / Eagle Creek / Marsh Harbor	125.00	91.00	113.75
St. Johns	St. Johns Service Co. Inc.	199.61	96.40	192.43
Seminole	City of Altamonte Springs	138.32	51.00	70.54
Seminole	City of Casselberry	132.27	88.30	116.79
Seminole	Florida Water Services Corp. – Apple Valley	184.65	83.00	153.26
Seminole	Florida Water Services Corp. – Chuluota	193.30	87.00	168.17
Seminole	Florida Water Services Corp. – Druid Hills/Bretton Woods	184.95	77.00	142.41
Seminole	Florida Water Services Corp. – Meredith Manor	233.24	69.00	160.94
Seminole	City of Lake Mary	257.56	42.00	108.18
Seminole	City of Longwood	149.29	78.90	117.79
Seminole	City of Oviedo	158.78	78.00	123.85

County	Utility	Gross Per Capita* (gpd)†	Residential Use Percent	Residential Per Capita (gpd)
Seminole	Palm Valley MHP	193.96	82.40	159.82
Seminole	City of Sanford	146.30	70.00	102.41
Seminole	Seminole County Environmental Services – Indian Hills / Consumer / Hays	210.87	81.00	170.80
Seminole	Seminole County Environmental Services – Lynwood/ Belaire	143.83	76.00	109.31
Seminole	Seminole County Environmental Services – Country Club/ Greenwood	151.47	72.00	109.06
Seminole	Seminole County Environmental Services – Hanover/ Heathrow/ Monroe	381.34	85.00	324.14
Seminole	Utilities Inc. of Florida – Sanlando Utilities Corp.	282.63	82.00	231.75
Seminole	Utilities Inc. of Florida – Oakland Shores	313.87	94.00	295.04
Seminole	Utilities Inc. of Florida – Ravenna Park	102.64	85.00	87.24
Seminole	Utilities Inc. of Florida – Weathersfield	112.27	90.00	101.05
Seminole	City of Winter Springs	138.36	70.00	96.85
Volusia	Lake Beresford Water Assoc. Inc.	143.70	83.00	119.27
Volusia	City of Lake Helen	121.00	76.00	91.96
Volusia	City of New Smyrna Beach	171.47	61.40	105.28
Volusia	Orange City	130.74	41.80	54.65
Volusia	City of Ormond Beach	128.98	68.20	87.97
Volusia	Town of Pierson	52.18	87.00	45.39
Volusia	City of Port Orange	98.49	62.40	61.46
Volusia	Volusia County Utilities	153.52	86.40	132.64

All values in gallons per day (gpd)
Utilities with missing or questionable residential use percentages were not included in county averages.
† Gross per capita: total water use / population

APPENDIX B

ESTIMATION OF LOSS OF AGRICULTURAL ACREAGE AND PROJECTION OF AGRICULTURAL IRRIGATION SELF-SUPPLY WATER DEMAND

SJRWMD created a spatial database of agricultural irrigation acreage (polygon features) to project change in agricultural irrigation self-supply water use. The spatial database was developed using 2005 aerial imagery, land use / land cover, parcel data, and SJRWMD's consumptive use permitting (CUP) spatial database. The acreage of irrigated agricultural land features represented in the database was used as a means to calculating future projected agriculture irrigation self-supply water use through agricultural acreage lost to population growth. The steps involved in the process are described below:

Estimation of irrigated agricultural land acreage loss.

Loss of agricultural acreage was estimated based on population growth projected using the population projection model (Doty 2009). For this, a parcel growth build-out ratio was calculated. The process involved several geoprocessing steps and is described below.

All parcels with projected growth between 2005 and 2030 were selected in each county. These were called growth parcels (Figure B-b). From these 'growth parcels' a subset was obtained by selecting only those parcels that intersected agricultural parcels (Figure B-e).

For each growth parcel that intersected an irrigated agriculture parcel, a build-out ratio was calculated that represented the parcel's 2030 projected population against the build-out population. The build-out population is the population that the parcel would carry if it were totally "built out." For example, a platted single-family lot would be considered built-out when a single home is built.

Build-out ratio = ([2030 Pop] – [2005 Pop]) / [Build-out pop]

The Build-out ratio for Parcel 3 (Figure B-d), assuming all parcels have no (zero) population in 2005 can be expressed as:

Build-out ratio = (10.31 – 0) ÷ 13.75 = 0.749

For calculation of loss of irrigated agriculture area, irrigated agriculture parcels were interested with the growth parcels. Only areas common to both were preserved. Agriculture (AG) area (acreage) loss was calculated by multiplying the parcel growth build-out ratio by the intersecting area. The same can be expressed as shown below:

[AG acres lost] = Acres ([AG intersect growth parcel]) x [Growth build-out ratio]

Sample calculation for loss of irrigated agriculture acreage for intersect # 5 (Figure Bf) is shown below.

Acreage lost = Intersect acres x Growth build-out ratio
Acreage lost = 4.885 x 0.75
Acreage lost = 3.664

Estimation of projected agricultural irrigation self-supply water use

Based on the agricultural acreage loss calculated for each county, projected 2030 water use was estimated by multiplying the 2005 water use by projected percentage of decline in agricultural acreage (Table B). For example, in Seminole County the reported 2005 water use was 8.39 mgd. The 2030 projected water use based on the agricultural acreage lost calculated above would be calculated as:

(1 - (% Projected decline 2005-2030 / 100)) x 2005 Water Use
= (1 - (61.20 ÷ 100) x 8.39
= (1 – 0.612) x 8.39
= 0.388 x 8.39
= 3.24 mgd

Note: “1” is utilized to convert the AG acreage lost to the acreage remaining

Figure B. Methodology for estimating agricultural acreage loss and water demand projections.
a) agricultural parcels; b) parcels developed between 2005-2030; c) agricultural and non-agricultural growth parcels; d) agricultural parcel development and build-out ratio calculation; e) intersection of growth parcels and agricultural parcels to estimate agricultural acreage loss; f) agricultural acreage loss calculated by intersected agriculture area and growth build-out ratio.

Table B. Summary of loss of irrigated agricultural acreage (2005-2030) in SJRWMD

S. No.	County	Irrigated Acres 2005	Irrigated Acres 2030	Acreage Lost	Projected Decline 2005 – 2030 (%)	Projected Acreage Remaining in 2030 (%)
1.	Alachua*	3,383	3,274	109	3.23	96.77
2	Baker*	1,099	1,038	62	5.60	94.40
3.	Bradford*	25	25	0	1.34	98.66
4.	Brevard	43,102	40,676	2,426	5.63	94.37
5.	Clay	2,355	2,258	97	4.13	95.87
6.	Duval	2,199	1,195	1,004	45.65	54.35
7.	Flagler	10,343	7,694	2,649	25.61	74.39
8.	Indian River	94,962	81,792	13,171	13.87	86.13
9.	Lake*	31,830	27,852	3,978	12.50	87.50
10.	Marion*	14,762	13,818	944	6.39	93.61
11.	Nassau	1,785	1,549	235	13.19	86.81
12.	Okeechobee	8,399	8,399	0	0.00	100.00
13.	Orange*	10,043	5,785	4,258	42.40	57.60
14.	Osceola*	4,942	4,902	41	0.83	99.17
15.	Putnam	11,926	11,881	45	0.37	99.63
16.	Saint Johns	24,553	20,170	4,384	17.85	82.15
17.	Seminole	5,231	2,029	3,201	61.20	38.80
18.	Volusia	14,778	11,971	2,807	18.99	81.01
	TOTAL	**285,717**	**246,307**	**39,410**	**13.79**	**86.21**

* Counties not wholly in the SJRWMD, only represents agricultural area lost for the portion of county in the SJRWMD

APPENDIX C

ESTIMATION OF GOLF COURSE IRRIGATED ACREAGE AND PROJECTION OF RECREATIONAL IRRIGATION WATER DEMAND

Projection of water demand for recreational irrigation self supply required estimation of irrigated acres of golf courses and determination and distribution of irrigation water use for new golf courses to be developed in the future.

Delineation of golf courses

SJRWMD maintains a spatial dataset (GIS shapefile) of irrigated portions of golf courses in the District. Irrigated area was needed to calculate average water use per acre. The consumptive water use permits for golf courses maintained by SJRWMD include the irrigated acres for a golf course. The average water use per acre for all golf courses in a county was used when historical water use data for a golf course was not available. Irrigated acreage computed from the spatial dataset and that recorded in the golf course CUP were often different. For example, Haile Plantation golf course in Alachua County (Figure C) digitized from 2005 aerial image measured 129 irrigated acres as opposed to 79 acres recorded for the same in CUP database. This had implications in computing average water use per acre for golf courses.

Figure C. Haile Plantation golf course digitized from 2005 aerial image

The different acreages recorded in the permit and those in the digitized spatial database resulted in different average water use per acre (Table C-1). As stated above, where golf course water use was not available, the county average water use per acre was used. This average was calculated using the acreage in the spatial database. If the acreage in the spatial database consistently differed with the acreage in the CUP database, and further, consistently reported less acreage than the CUP database, the county average water use per acre would be markedly higher than that calculated from CUP acreage. For those golf courses where water use data was not available, application of the county water use average to estimate water use may over estimate the water use significantly. For example, with a golf course digitized acreage of 100 acres, water use calculated from the CUP average for Haile for the year 2005, would yield 0.076 mgd. However if the average from the spatial database was used, the water use would be 0.124 mgd (Table C-1).

The spatial database was created because many golf course water use permits had varying total irrigated acres listed in the permit. It was felt that digitization would more accurately reflect actual irrigated acreage. Maintenance of the database, with an eye to permitted acreage should resolve the discrepancy.

Table C-1. Average water use per acre: differences based on digitized irrigated acres and permitted irrigated acres

Golf Course Water Use Averages						Estimates Based on Averages		
Water Use (mgd)	**Permitted Irrigated acres**	**Water Use Per Acre (gpd)**	**Digitized Irrigation acres**	**Water Use Per Acre (gpd)**	**Percent Difference**	**Golf Course Acres Digitized**	**Estimated Water Use with Permit Average (mgd)**	**Estimated Water Use with Digitized Average (mgd)**
0.098	129	759.69	79.25	1236.64	62.78%	100	0.076	0.124

Projection and distribution of recreational irrigation water use

Determination of recreational self-supply water use increase was based on population growth. 2030 recreational water use was projected from 1995 water use based on population growth between 1995 and 2030. For example, if the projected county growth rate for a given county was 50% then the golf course water use was estimated to increase by 50% between 1995 and 2030. Seminole county population growth from 1995-2030 is shown in Table C-2.

Table C-2. Seminole County population growth, 1995-2030

County	1995 Population	2030 Population	Percent Change	1995-2030 Water use Multiplier
Seminole	326,360	516,655	58.31%	1.5831

The projected water use increase was calculated based on 1995 water use because the District's groundwater models are calibrated to 1995, which required the calculation of a projected change since 1995. However, 2005 golf course locations and water use data were provided to the groundwater modelers to capture golf course locations and flows added between 1995 and 2005. For that reason, the increase in golf course water use from 1995-2005 was subtracted from the total projected increase from 1995-2030 (Table C-3). This value (reflecting only the projected increase from 2005-2030), when added to the 2005 flows from existing locations, was equal to the 2030 projected golf course water use.

Table C-3. Seminole County projected recreational irrigation self-supply, 1995-2030

COUNTY	1995 Water Use	2005 Water Use	2030 Projected Water Use†	Increase 1995–2030	Increase 1995–2005	Remaining (New) Water Use Increase to Distribute to Cells
Seminole	1.932	2.303	3.058	1.126	0.371	0.755

Water use in million gallons per day
† 1.932 x 1.5831 (refer to multiplier in Table C-2)

APPENDIX D

PROJECTED ESTIMATES OF THERMOELECTRIC POWER GENERATION SELF-SUPPLY WATER DEMAND

Table D. Estimates of thermoelectric power generation water demand

Plant ID	Utility Name	Plant Name	County	Fuel Type †	1995 MW ††	1995 Water Use	2005 MW	2005 Water Use	2005 Gallons per MW	2010 MW	2010 Water Use
663	Gainesville Regional Utilities	Deerhaven	Alachua	FO	422	**2.13**	427	2.15	5041.03	***499***	***2.51***
664	Gainesville Regional Utilities	J.R. Kelly	Alachua	NG	180	0.40	182	0.40	2201.43	***159***	***0.35***
683	Reliant Energy	Indian River Power Plant	Brevard	NG	309	**0.19**	312	0.21	673.29	312	**0.21**
609	FP&L	Cape Canaveral	Brevard	FO	793	**0.20**	801	0.25	312.11	***806***	**0.25**
55286	Southern Power Co	Oleander Power Project LP	Brevard	FO	591	**0.00**	597	0.00	*0.00*	597	**0.00**
207	JEA / FP&L	St. Johns River Power Park	Duval	FO	1051	3.57	1248	4.24	3397.44	***1381***	**4.69**
667	JEA	Northside	Duval	FO	1325	**0.99**	1338	1.00	747.38	***1338***	**1.00**
10672	US Operating Services Company	Cedar Bay	Duval	PCSUB	258	**0.97**	258	0.97	3759.69	258	**0.97**
208	JEA	Brandy Branch	Duval	NG	716	**0.00**	724	2.73	3773.32	724	**2.73**
10202	Jefferson Smurfit Corp	Fernandina Beach	Nassau	BIO	44		44		0.00	***44***	**0.00**
10562	Plummer Forest Products Inc	Rayonier Fernandina Mill	Nassau	BIO	20		20		0.00	***20***	**0.00**
10202	Jefferson Smurfit Corp	Fernandina Beach	Nassau	BIO	74		74		0.00	***74***	**0.00**
10562	Plummer Forest Products Inc	Rayonier Fernandina Mill	Nassau	BIO	13		13		0.00	***13***	**0.00**
564	OUC	Stanton Energy Center	Orange	PCSUB	808	**0.75**	816	0.76	931.26	***958***	**0.89**
637	Progress Energy Florida Inc	Rio Pinar	Orange	FO	15		15		0.00	***15***	**0.00**
8049	Progress Energy Florida Inc	Intercession City	Osceola	FO	1077	**0.50**	1088	0.50	459.56	1088	**0.50**
676	Lakeland City of / OUC	C D Macintosh	Polk	PCSUB	912	**1.33**	921	1.34	1454.94	921	**1.34**
7997	Lakeland City of	Winston/Larsen (Wheelabrator)	Polk	FO	183	**0.42**	185	0.42	2276.42	185	**0.42**
6048	Progress Energy Florida Inc	Hines	Polk	NG	0	**0.00**	1558	2.78	1783.17	***2181***	**3.89**
6049	Progress Energy Florida Inc	Tiger Bay	Polk	NG	0	**0.00**	223	0.96	4304.93	***223***	**0.96**
7727	TECO	Polk Power Plant	Polk	NG	0	**0.00**	620	1.41	2274.19	***930***	**2.12**
12766	Seminole/Hardee	Payne Creek	Polk	FO	849	**1.04**	858	1.05	1223.78	***1079***	**1.73**
12767	Auburndale Power Partners	Plant 1	Polk	PCSUB	267	**1.02**	270	1.03	3814.81	270	**1.03**
12768	Polk Power Partners	Plant 1	Polk	PCSUB	109	**0.34**	110	0.34	3090.91	110	**0.34**
12769	Orange Cogen	Plant 1	Polk	NG	0	**0.00**	102	0.37	3578.43	102	**0.37**
12771	Vandolah	Plant 1	Polk	NG	0	**0.00**	680	0.02	23.53	680	**0.02**
12772	Calpine	Osprey Energy	Polk	PCSUB	0	**0.00**	600	1.20	2000.00	600	**1.20**
136	Seminole Electric Co-op	Seminole	Putnam	PCSUB	1310	0.60	1323	0.61	458.10	***1573***	**0.72**
6246	FP&L	Putnam	Putnam	NG	531	0.45	531	0.45	847.46	***532***	**0.45**
629	Progress Energy Florida Inc	G E Turner	Volusia	FO	174	**0.13**	176	0.13	*750.50*	176	**0.13**
620	FP&L	Sanford	Volusia	NG	2230	**0.20**	2253	0.20	88.77	***2260***	**0.20**

† Fuel Types: FO (Fuel Oil), NG (Natural Gas) and PCSUB (Pulverized Coal)
†† MW (Megawatts)
*** Polk County power generation capacity and water use data (Source: Said Abusada, SWFWMD)
Values in **bold** are estimates or projections based on the average water use per megawatt of facilities of the same type and fuel source.
Values in *italics* area estimated from Department of Energy average values by plant type.
Values in ***bold italics*** area interpolated or extrapolated.

Table D. continued

Plant ID	Utility Name	Plant Name	County	Fuel Type †	2015 MW	2015 Water Use	2020 MW	2020 Water Use	2025 MW	2025 Water Use	2030 MW	2030 Water Use
663	Gainesville Regional Utilities	Deerhaven	Alachua	FO	***571***	**2.88**	644	**3.24**	***716***	**3.61**	***788***	**3.97**
664	Gainesville Regional Utilities	J.R. Kelly	Alachua	NG	***159***	**0.35**	159	**0.35**	***159***	**0.35**	***159***	**0.35**
683	Reliant Energy	Indian River Power Plant	Brevard	NG	312	**0.21**	312	**0.21**	312	**0.21**	312	**0.21**
609	FP&L	Cape Canaveral	Brevard	FO	***811***	**0.25**	816	**0.25**	***820***	**0.26**	***825***	**0.26**
55286	Southern Power Co	Oleander Power Project LP	Brevard	FO	597	**0.00**	597	**0.00**	597	**0.00**	597	**0.00**
207	JEA / FP&L	St. Johns River Power Park	Duval	FO	***1515***	**5.15**	1648	**5.60**	***1781***	**6.05**	***1915***	**6.50**
667	JEA	Northside	Duval	FO	***1338***	**1.00**	1338	**1.00**	***1338***	**1.00**	***1338***	**1.00**
10672	US Operating Services Company	Cedar Bay	Duval	PCSUB	258	**0.97**	258	**0.97**	258	**0.97**	258	**0.97**
208	JEA	Brandy Branch	Duval	NG	724	**2.73**	724	**2.73**	724	**2.73**	724	**2.73**
10202	Jefferson Smurfit Corp	Fernandina Beach	Nassau	BIO	***44***	**0.00**	44	**0.00**	***44***	**0.00**	***44***	**0.00**
10562	Plummer Forest Products Inc	Rayonier Fernandina Mill	Nassau	BIO	***20***	**0.00**	20	**0.00**	***20***	**0.00**	***20***	**0.00**
10202	Jefferson Smurfit Corp	Fernandina Beach	Nassau	BIO	***74***	**0.00**	74	**0.00**	***74***	**0.00**	***74***	**0.00**
10562	Plummer Forest Products Inc	Rayonier Fernandina Mill	Nassau	BIO	***13***	**0.00**	13	**0.00**	***13***	**0.00**	***13***	**0.00**
564	OUC	Stanton Energy Center	Orange	PCSUB	***1100***	**1.02**	1243	**1.16**	***1385***	**1.29**	***1527***	**1.42**
637	Progress Energy Florida Inc	Rio Pinar	Orange	FO	***15***	**0.00**	15	**0.00**	***15***	**0.00**	***15***	**0.00**
8049	Progress Energy Florida Inc	Intercession City	Osceola	FO	1088	**0.50**	1088	**0.50**	1088	**0.50**	1088	**0.50**
676	Lakeland City of / OUC	C D Macintosh	Polk	PCSUB	921	**1.34**	921	**1.34**	921	**1.34**	921	**1.34**
7997	Lakeland City of	Winston/Larsen (Wheelabrator)	Polk	FO	185	***0.53***	185	***0.63***	185	***0.74***	185	**0.84**
6048	Progress Energy Florida Inc	Hines	Polk	NG	2804	**5.00**	2804	**5.00**	2804	**5.00**	2804	**5.00**
6049	Progress Energy Florida Inc	Tiger Bay	Polk	NG	***223***	**0.96**	***224***	**0.96**	***224***	**0.96**	224	**0.96**
7727	TECO	Polk Power Plant	Polk	NG	1240	**2.82**	1240	**2.82**	1240	**2.82**	1240	**2.82**
12766	Seminole/Hardee	Payne Creek	Polk	FO	1300	**1.73**	1300	**1.73**	1300	**1.73**	1300	**1.73**
12767	Auburndale Power Partners	Plant 1	Polk	PCSUB	270	**1.03**	270	**1.03**	270	**1.03**	270	**1.03**
12768	Polk Power Partners	Plant 1	Polk	PCSUB	110	***0.43***	110	***0.51***	110	***0.60***	110	**0.68**
12769	Orange Cogen	Plant 1	Polk	NG	102	***0.44***	102	***0.51***	102	***0.59***	102	**0.66**
12771	Vandolah	Plant 1	Polk	NG	680	***0.06***	680	***0.11***	680	***0.16***	680	**0.21**
12772	Calpine	Osprey Energy	Polk	PCSUB	600	***1.50***	600	***1.80***	600	***2.09***	600	**2.39**
136	Seminole Electric Co-op	Seminole	Putnam	PCSUB	***1823***	**0.84**	2073	**0.95**	***2323***	**1.06**	***2573***	**1.18**
6246	FP&L	Putnam	Putnam	NG	***534***	**0.45**	535	**0.45**	***536***	**0.45**	***538***	**0.46**
629	Progress Energy Florida Inc	G E Turner	Volusia	FO	176	**0.13**	176	**0.13**	***176***	**0.13**	176	**0.13**
620	FP&L	Sanford	Volusia	NG	***2266***	**0.20**	2273	**0.20**	***2280***	**0.20**	***2286***	**0.20**

† Fuel Types: FO (Fuel Oil), NG (Natural Gas) and PCSUB (Pulverized Coal)
†† MW (Megawatts)
*** Polk County power generation capacity and water use data (Source: Said Abusada, Permit reviewer at SWFWMD)
Values in **bold** are estimates or projections based on the average water use per megawatt of facilities of the same type and fuel source.
Values in *italics* area estimated from Department of Energy average values by plant type.
Values in ***bold italics*** area interpolated or extrapolated.