Annual Assessment of Florida's Water Resources: Supply and Demand

2023 Edition

Chapter 3

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3. Modeling Future Water Demand and Supply

Abstract

The expenditures associated with ensuring that future water supplies are available to meet the increase in water demands are projected to be $2.04 billion over the 2020 through 2040 planning horizon, with a projected state expenditure of $382.83 million over that period. These expenditures are based on each water management district's water demand projections and existing supply estimates as further developed by the Office of Economic and Demographic Research (EDR). If the separate water demand forecast produced by EDR's pilot model is considered, it points to considerably lower future expenditures needed to meet the increase in the future water demand, partially because it assumes greater conservation efforts. The future demand not met with existing supply assumes average weather conditions and that the demand which has been met in the past will continue to be met in the future. An overview of the expenditures needed to maintain and replace existing infrastructure required for current demand is discussed in Chapter 5. In addition, regarding the expenditures necessary to ensure that sufficient water is available for the natural systems, EDR examined projects implementing the recovery and prevention strategies for minimum flows and minimum water levels of water courses, water bodies, and aquifers, as well as additional projects expected to primarily benefit the natural systems. Excluding Everglades expenditures, the estimated cost of these projects has been modestly revised to $884.75 million, of which the state's share is projected to be $131.96 million. These estimates will continue to evolve as methodologies and the accompanying data sources are further refined. Additional research will be undertaken to provide more complete and more precise cost estimates for future editions of this annual report.

In Chapter 2, the historical expenditures related to water supply and demand management, and spending for the protection and restoration of natural systems, are discussed. The objective of Chapter 3 is to determine whether the expenditure level is sufficient to meet the Legislature's intent. Specifically, section 403.928(1)(b), Florida Statutes, requires the Office of Economic and Demographic Research (EDR) to estimate future expenditures necessary to achieve the Legislature's intent that sufficient water is available for all existing and future reasonable-beneficial uses and the natural systems, and that the adverse effects of competition for water supplies be avoided.[1] The historical level of expenditures discussed in Chapter 2 differ from the expenditures necessary to achieve this intent because they have yet to be cleanly linked.

This chapter starts with a review of the existing water supply planning framework in Florida. It continues with the analysis of water demand and supply, inferred supply shortage, and expenditure estimates. The final section of this chapter discusses future steps to further improve the expenditure forecast.

3.1 Water Supply Planning in Florida

Florida law provides a comprehensive framework for water supply planning. Water supply assessments (WSAs) and regional water supply plans (RWSPs) developed by the water

[1] This section also requires EDR to compile water supply and demand projections developed by each water management district (WMD), documenting any significant differences between the methods used by WMDs.

management districts (WMDs) are the primary tools for long-term water demand and supply planning in Florida.[2] Under section 373.036, Florida Statutes, the governing board of each WMD must develop a district water management plan.[3] Every district water management plan must be prepared for at least a 20-year planning period and is required to address water supply, water quality, flood protection and floodplain management, and natural systems. For water supply specifically, all district water management plans include WSAs. The assessments determine whether existing and reasonably anticipated sources of water and conservation efforts are adequate to supply water for all existing legal uses and reasonably anticipated future needs and to sustain water resources and related natural systems over the next 20 years.

Furthermore, in cases where it is determined that existing water sources are inadequate to meet the needs over the next 20 years, RWSPs must be developed. Each RWSP contains water supply development project options and water resource development projects and programs.[4] The total capacity of the projects included in the regional water supply plans must exceed the water supply needs for all existing and future reasonable-beneficial uses within the 20-year planning horizon. An RWSP should also take into account water conservation and other demand management measures, as well as water resource constraints, including adopted minimum flow and minimum water levels and water reservations. Both RWSPs and districtwide WSAs are required to be updated at least once every five years.[5]

Florida Statutes require "[t]he planning must be conducted in an open public process, in coordination and cooperation with local governments, regional water supply authorities, government-owned and privately owned water and wastewater utilities, multijurisdictional water supply entities, self-suppliers, reuse utilities, the Department of Environmental Protection, the Department of Agriculture and Consumer Services, and other affected and interested parties" (§ 373.709(1), Fla. Stat.). While developing RWSPs, the WMDs share information about planning results and solicit comments from interested stakeholders via meetings, public workshops, webpage updates, and other means.

The Department of Environmental Protection (DEP) is in charge of providing the Governor and Florida Legislature an annual status summary of regional water supply planning activities in each WMD.[6] The most recent status summary (for calendar year 2022) published in December 2022 is

[2] For a map of the five WMDs, see Figure 3.0.1.

[3] According to § 373.036, Florida Statutes, a governing board may substitute an annual strategic plan for the requirement to develop a district water management plan and the district water management plan annual report. The strategic plan should meet "the following minimum requirements:

1. The strategic plan establishes the water management district's strategic priorities for at least a future 5-year period.
2. The strategic plan identifies the goals, strategies, success indicators, funding sources, deliverables, and milestones to accomplish strategic priorities.
3. The strategic plan development process includes at least one publicly noticed meeting to allow public participation in its development.
4. The strategic plan includes separately, as an addendum, an annual work plan report on the implementation of the strategic plan for the previous fiscal year, addressing success indicators, deliverables, and milestones."

[4] Based on § 373.709, Fla. Stat.

[5] § 373.036, Fla. Stat. For more details on the water supply planning process in Florida, see pages 66-70 of the 2018 Edition of this report, available online at: http://edr.state.fl.us/Content/natural-resources/index.cfm (accessed December 2022).

[6] § 373.709, Fla. Stat.

referred to in this chapter as "DEP (2022a)."[7] Florida is divided into 19 mutually exclusive water supply planning regions (Table 3.1.1; Figure 3.1.1). For presentation purposes, the DEP (2022a) report combines six of the seven water supply planning regions in the Northwest Florida Water Management District (NWFWMD), reducing the number of regions statewide from 19 to 14. Water supply is projected to meet the demand throughout the planning period in all six of those NWFWMD regions, so they do not require RWSPs. For all 14 regions, DEP includes data for "Base Year Total Water Use," "Net Demand Change," and "Water Needed," from which EDR infers available supply data. The WMDs use different schedules for their 5-year updates of the water supply assessments and plans. Specifically, 11 of the areas currently use the 2020-2040 planning horizon, while two areas (Area outside NFRWSP and North Florida Regional Water Supply Partnership) still have a 2015-2035 planning horizon and one area (SF – UEC) has a 2019-2045 planning horizon based on a 2021 update to its 1998 water supply plan. Table 3.1.1 summarizes the RWSPs/WSAs used in the "Annual Status Report on Regional Water Supply Planning" in DEP (2022a).

[See table on following page]

[7] DEP. 2022a. Regional Water Supply Planning 2021 Annual Report, available online at: https://floridadep.gov/water-policy/water-policy/content/water-supply.

Table 3.1.1 Water Supply Planning Regions

Water Management District	Water Supply Planning Region	Counties	Abbreviation	Water Supply Planning Document Referenced in DEP (2022a)	Base Year for Water Use Estimates	Planning Horizon	
						2015-2035	2020-2040
Northwest Florida Water Management District (NWFWMD)	I	Escambia	**NW – Oth**	2018 Water Supply Assessment Update (2018)	2015		√
	III[a]	Bay[a]					
	IV	Calhoun, Jackson, Holmes, Liberty, Washington					
	V[b]	Franklin and Gulf[b]					
	VI	Gadsden					
	VII	Jefferson (part), Leon, Wakulla					
	II	Okaloosa, Santa Rosa, and Walton	**NW – II**	2019 Region II Regional Water Supply Plan (2020)[c]	2015		√
Suwannee River Water Management District (SRWMD)	Area outside NFRWSP	Dixie, Jefferson (part), Lafayette, Levy (part), Madison, and Taylor	**SR – West**	Water Supply Assessment 2015-2035 (2018)	2010	√	
St. Johns River Water Management District (SJRWMD)	Central Springs and East Coast (Region 2, formerly Regions 2, 4, and 5)	Brevard, Indian River Marion (part), Lake (part), Okeechobee (part), and Volusia	**SJR – CSEC**	2022 Regional Water Supply Plan (2022)[d]	2015		√
Southwest Florida Water Management District (SWFWMD)	Northern Planning Region (partially in Central Florida Water Initiative)[e]	Citrus, Hernando, Lake (part), Levy (part), Marion (part), and Sumter[e]	**SW – N**[e]	2020 Regional Water Supply Plan; partially in CFWI Regional Water Supply Plan 2020	2015		√
	Tampa Bay Planning Region	Hillsborough, Pasco, and Pinellas	**SW – TB**	2020 Regional Water Supply Plan	2015		√
	Heartland Planning Region (partially in Central Florida Water Initiative)[e]	Hardee, Highlands (part), Polk (part)[e]	**SW – H**[e]	2020 Regional Water Supply Plan; partially in CFWI Regional Water Supply Plan 2020	2015		√
	Southern Planning Region	Charlotte (part), DeSoto, Manatee, and Sarasota	**SW – S**	2020 Regional Water Supply Plan	2015		√
South Florida Water Management District (SFWMD)	Lower Kissimmee Basin	Glades (part), Highlands (part), and Okeechobee (part)	**SF – LKB**	Regional Water Supply Plan Update (2019)	2017[f]		√
	Upper East Coast	Martin, Okeechobee (part), and St. Lucie	**SF – UEC**	Regional Water Supply Plan Update (2021)	2019[f]		√
	Lower East Coast	Broward, Collier (part), Hendry (part), Miami-Dade, Monroe (part), and Palm Beach	**SF – LEC**	Regional Water Supply Plan Update (2018)	2016[f]		√
	Lower West Coast	Charlotte (part), Collier (part), Glades (part), Hendry (part), Monroe (part), and Lee	**SF – LWC**	Regional Water Supply Plan Update (2017)	2014[f]		√
SRWMD and SJRWMD	North Florida Regional Water Supply Partnership	Alachua, Baker, Bradford, Clay, Columbia, Duval, Flagler, Gilchrist, Hamilton, Nassau, Putnam, St. Johns, Suwannee, and Union	**NFRWSP**	NFRWSP Regional Water Supply Plan (2017)	2010[g]	√[h]	
SJRWMD, SWFWMD, and SFWMD	Central Florida Water Initiative	Lake (part), Orange, Osceola, Seminole, and Polk	**CFWI**	CFWI Regional Water Supply Plan 2020	2015		√

[a] The RWSP for Region III was first approved in 2008 and updated in 2014. This plan was discontinued in December 2018.
[b] The Region V RWSP was approved in 2007 and discontinued in 2014.
[c] The 2018 WSA is incorporated by reference, with the 2018 WSA containing the technical data, modeling tools, and methods used to develop the 2019 RWSP.
[d] The demand estimates and projections are available in DEP (2022a)[8]. The final RWSP (published 02/07/2022) is available on the SJRWMD's website at https://www.sjrwmd.com/water-supply/planning/csec-rwsp/#documents (accessed December 2022).
[e] In this report, the portion of the region outside Central Florida Water Initiative is mentioned, with the abbreviations SW – N (for the Northern Region) and SW – H (for the Heartland Region). The RWSPs are available on the SWFWMD's website at https://www.swfwmd.state.fl.us/resources/plans-reports/rwsp (accessed December 2022)
[f] Water demand estimates for 2015 are available in DEP (2021a). Most recent RWSP for SF – UEC was updated in November 2021 (see https://www.sfwmd.gov/our-work/water-supply/upper-east-coast, accessed December 2022).
[g] SR – West planning region was created following the recommendations in SRWMD WSA (2018). SRWMD is developing the first regional WSA and RWSP for SR – West and is currently in the stakeholder review process (see https://www.srwmd.org/1605/Water-Supply-Assessment-Plan, accessed December 2022).
[h] RWSP for the 2020-2045 planning horizon is expected to be approved in Fall 2023 (see https://www.northfloridawater.com/watersupplyplan/index.html, accessed December 2022).

[8] DEP. 2022a. Regional Water Supply Planning 2021 Annual Report, available online at https://floridadep.gov/water-policy/water-policy/content/water-supply

Figure 3.1.1 Florida's WMDs and Water Supply Planning Regions

Note: WMD coloring applies only to regions that have a regional water supply plan. The hatching identifies the planning regions that cross the borders between the WMDs and where regional water supply plans were developed through collaboration by two or three WMDs.
Source: Provided by DEP, Office of Water Policy & Ecosystems Restoration.

3.2 The Expenditure Forecast: Role of EDR

Section 403.928, Florida Statutes, directs EDR to estimate future expenditures necessary to provide sufficient water for all existing and future reasonable-beneficial uses and the natural systems. To meet these requirements, EDR's expenditure analysis focuses on synthesizing a single statewide forecast using data from other state agencies, the plans developed by the WMDs, and the most recent economic and demographic projections adopted by the Consensus Estimating Conferences. Note that the Economic Estimating Conferences develop official projections related to the national and state economy while the Demographic Estimating Conference develops official information concerning the population (§ 216.136, Fla. Stat.). In developing its official estimates, the Demographic Estimating Conference uses additional materials provided by EDR (§§ 216.136 and 186.901, Fla. Stat.).[9] As part of this process, EDR contracts with the University of Florida's Bureau of Economic and Business Research (BEBR) to produce the longer-term and more granular population projections. The goal for future editions of this report is to link the water expenditure forecast with the official economic and demographic forecasts for purposes of the state planning and budgeting system.

Even so, the information in DEP's annual status report (DEP 2022a[10]) provides an important basis for the EDR expenditure forecast presented in this edition. Demand estimates and projections for at least a 20-year planning horizon are developed by the WMDs using mostly standardized techniques with region-specific information. Importantly, the WMDs analyze water supply availability by simulating future demands through the use of hydrogeological models. They also fulfill the statutory requirements of water supply planning for each district as a whole and within the sub-regions.

According to WMD staff, economic conditions are considered in developing their water demand projections. Still, results combined from the regions are unlikely to be consistent with the official Florida Economic forecast or share the same overarching economic outlook, since the Florida Economic forecast is updated more frequently than the WMDs' projections. The annually updated long-term population forecast adopted by the Demographic Estimating Conference, along with the most recent economic forecasts used by EDR, need to serve as the basis for EDR's water demand projections intended for statewide expenditure modeling.[11] This is largely because the WMDs' projections are not required to be annual.[12] In contrast, as Florida's legislative budgeting process is completed annually, EDR must develop annual estimates of future expenditures in support of the budgeting process. Further, for the EDR forecast, adjustments can be made each year. Alternative scenarios can be explored, such as drought, fluctuations in tourism (if the seasonal population is incorporated in the demand projections), and economic cycles. Eventually, a water

[9] General provisions for the Consensus Estimating Conferences are defined in § 216.134, Fla. Stat. Specifically, the Consensus Estimating Conferences are within the legislative branch. The membership of each consensus estimating conference consists of principals and participants. The principals of each conference shall be the professional staff of the Executive Office of the Governor designated by the Governor, the coordinator of EDR, professional staff of the Senate designated by the President of the Senate, and professional staff of the House of Representatives designated by the Speaker of the House of Representatives.

[10] DEP. 2022a. Regional Water Supply Planning 2021 Annual Report, available online at: https://floridadep.gov/water-policy/water-policy/content/water-supply.

[11] EDR focuses on statewide water demand and expenditure modeling. In contrast, the WMDs focus on region-specific water demand projections, which is more appropriate for the WMDs' mission.

[12] Water demand projections are required to be developed for 5-year intervals during the planning period, see subparagraph 62-40.531(1)(a), F.A.C.

demand forecast produced by EDR could also extend beyond the 20-year planning horizon used by the WMDs in the attempt to account for long-term trends, such as weather and climate patterns.[13]

Note that EDR's forecast should only be considered at the statewide level for the purposes identified in section 403.928, Florida Statutes, and is not appropriate for any regional regulatory or permitting use. This difference between the WMD's projections and EDR's forecast is partly because EDR is more focused on developing a reliable statewide expenditure forecast. Further, EDR currently does not intend to tailor its predictions to reflect specific regional-level drivers unless they later prove to be important to the statewide forecast.

3.3 Water Use Projections Based on WMD Data

While the most recent WSAs and RWSPs were developed or updated in different years, estimated or projected water uses are available for most regions for 2020 to 2040, based on 5-year intervals. The exceptions are two regions — SR – West and NFRWSP — where demand estimates and projections are available for 2015-2035 only.[14] For these regions, EDR estimates the 2040 use with a linear trend (see Appendix A.1).[15]

Based on the WMDs' data, between 2020 and 2040, the total statewide water use is projected to increase by about 899.34 million gallons per day (mgd), or approximately 14% (Table 3.3.1). Roughly two-thirds of the statewide water use increase (655.78 mgd) can be attributed to four regions: NFRWSP, CFWI, SF – LEC, and SF – LWC. Projected statewide water demand is slightly lower than that discussed in the DEP and EDR reports last year (DEP 2021a, EDR 2022[16]). Specifically, for 2035, statewide WMDs' water demand projections were at 7,181.07 mgd last year compared with 7,141.76 mgd reported this year (DEP 2022a). The revised water use projection for SF – UEC region leads to the reduction. In the most recent SF – UEC water supply plan update, projected water demand was considerably lower (approximately 20%) than that in the previous plan.

Overall, all but one planning region expect an increase in water use at the end of the planning period. The exception is the SW – H (outside the CFWI), where a slight reduction in total water use is projected by 2040 largely due to a projected decrease in agricultural irrigation.

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[13] For example, the Texas 2022 State Water Plan focuses on the 2020-2070 planning period (available online at: https://www.twdb.texas.gov/waterplanning/swp/index.asp; accessed December 2022.) California also considers a 50-year planning horizon, with projected state funding needs for their State Water Plan Goal 2 "Strengthen Resiliency and Operational Flexibility of Existing and Future Infrastructure" estimated at $59.0 billion by 2068 (available online at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/California-Water-Plan/Docs/Update2018/Final/California-Water-Plan-Update-2018.pdf; accessed December 2022.)

[14] Throughout this chapter, we use the terms "water use" and "water demand" interchangeably. However, in economic literature, the word "demand" refers to the quantity of water used given a specific price level, and "demand function" refers to the relationship between the quantity of water used and the price of water.

[15] This projection is being used to create a single 20-year timeframe. For the two regions, extending the WMDs' projections in a linear trend is a simple forecasting approach. It does not account for the myriad factors the WMDs must incorporate into their predictions.

[16] EDR. 2022. Annual Assessment of Florida Water Resources and Conservation Lands – 2022 Edition available at: http://edr.state.fl.us/Content/natural-resources/index.cfm

DEP. 2021a. Regional Water Supply Planning 2020 Annual Report, available online at: https://floridadep.gov/water-policy/water-policy/content/water-supply.

Table 3.3.1 Water Use Projections by WMDs

Region	Estimates or Projections (mgd)	Projections (mgd)					Difference between 2020 and 2040 water use projections	
	2015	2020	2025	2030	2035	2040	mgd	%
NW – II	69.74	76.88	82.25	87.03	91.19	94.88	18	23.40%
NW – Oth	254.16	273.72	287.12	296.92	304.58	311.9	38.18	14.00%
SR – West*	100.55	106.53	110.92	116.69	122.35	127.54*	21.01	19.7%*
SJR – CSEC	353.17	383.47	395.62	406.11	416.72	427.87	44.4	11.60%
SW – N**	131.08	142.49	153.55	163.54	173.09	181.73	39.24	27.50%
SW – TB	385.71	413.34	432.77	436.96	450.56	461.85	48.51	11.70%
SW – H**	94.91	91.52	89.45	96.17	94.96	89.15	-2.38	-2.60%
SW – S	234.95	245.02	254.22	265.77	272.99	279.33	34.31	14.00%
SF – LKB	245.29	249.9	251.83	253.68	253.83	257.49	7.59	3.00%
SF – UEC	272.95	289.26	289.7	287.84	286.07	283.96	-5.3	-1.83%
SF – LEC	1,739.61	1,813.99	1,863.91	1,923.28	1,963.65	2,006.54	192.55	10.60%
SF – LWC	980.33	1,030.31	1,073.57	1,113.64	1,170.36	1,210.68	180.37	17.50%
NFRWSP*	555.29	585.06	612.7	641.36	667.47	695.57*	110.51	18.9%*
CFWI	667.12	735.24	789.49	836.65	873.94	907.59	172.35	23.40%
State	**6,084.86**	**6,436.73**	**6,687.10**	**6,925.64**	**7,141.76**	**7,336.08**	**899.34**	**13.99%**

* For the SR – West and NFRWSP, 2040 projections are developed by EDR using a linear trend and 2015-2035 estimates and projections available from the WMDs. A detailed analysis of the linear trend can be found in Appendix A.1

** Portion of the region outside the CFWI.

In each water supply planning region, the demand projections are developed for six use-type categories defined in part through water supply means (*i.e.*, public supply or self-supply). The names of the categories vary slightly among the WMDs, and therefore, EDR adopts the names suggested in the 2019 regional water supply planning guidelines:[17]

a) *Public Supply (PS)* — such as water utilities supplying water for various uses, including household and community purposes, as well as commercial, industrial, institutional, mining, power generation, and recreational landscaping uses. According to the Format and Guidelines for the RWSP (DEP et al. 2019[18]), public supply uses with a current allocation greater than or equal to 0.1 mgd should be listed individually. Small public supply systems (*i.e.*, public supply systems with an allocation of less than 0.1 mgd) and individual residential irrigation wells may also be included in the PS category (DEP et al. 2019). Note that in their RWSPs, the SWFWMD combines public supply and domestic self-supply into one group, together with the estimated water use for residential irrigation wells. This group is then split into PS and Domestic Self-Supply (DSS) in DEP's report (DEP 2022a[19]) to make the categories more consistent with those used by the other WMDs.

[17] Note that these names are slightly different from that used in § 62-40.531(1)(b), Florida Administrative Code. These names also differ from those used in the 2018 and 2019 Editions of this EDR report and from those used in some of the WSAs/RWSPs. The names are consistent with the 2019 Format and Guidelines document (DEP et al. 2019).
Reference: DEP, NWFWMD, SFWMD, SWFWMD, SJRWMD, and SRWMD. 2019. Format and Guidelines for Regional Water Supply Planning. 42pp.

[18] DEP, NWFWMD, SFWMD, SWFWMD, SJRWMD, and SRWMD. 2019. Format and Guidelines for Regional Water Supply Planning. 42pp.

[19] DEP. 2022a. Regional Water Supply Planning 2021 Annual Report, available online at: https://floridadep.gov/water-policy/water-policy/content/water-supply. (Accessed December, 2022.)

b) *Domestic Self-Supply (DSS)* — such as domestic wells providing for both indoor and outdoor household uses.[20] Note that a WMD may consider individual residential irrigation wells, including those both within and outside a public supply service area, in either the DSS or the landscape / recreational use categories (DEP et al. 2019[21]). Also, the WMDs may choose to include small public supply systems in the DSS category (DEP et al. 2019).

c) *Agriculture (AG)* — includes self-supplied agricultural irrigation, livestock watering, aquaculture, and frost-freeze protection. DEP et al. (2019) suggest that all known self-supplied agriculture irrigation should be included based on the best available data. In determining the best available data, the WMDs are required to consider the DACS's future agricultural water supply demands data (§§ 373.709 and 570.93, Fla. Stat.).

d) *Landscape/Recreational (L/R)* — includes, but is not limited to, self-supplied golf courses, parks (including water parks), and commercial center irrigation (DEP et al. 2019). Note that a WMD may consider individual residential irrigation wells, including those both within and outside a public supply service area, in either the DSS or the L/R use categories (DEP et al. 2019).

e) *Commercial/Industrial/Institutional (CII)* — includes various self-supplied commercial, industrial, and institutional activities that are not supplied with water through PS. Self-supplied commercial, industrial, and institutional uses equal to or greater than 0.1 mgd may be listed individually or in the aggregate. The WMDs may exclude appropriate quantities of recirculated water from demand projections for planning purposes (DEP et al. 2019).

f) *Power Generation (PG)* — includes power generation facilities that rely on self-supplied groundwater or fresh surface water. According to DEP et al. (2019), self-supplied power generation uses with an individual water use permit or Site Certification issued by the DEP should be listed individually. Other known self-supplied power generation uses may be listed individually or in the aggregate. The WMDs should exclude recirculated water from demand projections for planning purposes.

According to DEP et al. (2019), the WMDs must account for reclaimed water[22] when analyzing and projecting demand for all water use categories except for DSS. Therefore, although category names may include the reference to "self-supply," a share of water use in these categories can be met by reclaimed water from domestic wastewater treatment plants.

As mentioned above, the WMDs' projections for the water use categories depend on local and regional data availability. While the general approach to estimating and projecting the water

[20] As stated above, the SWFWMD combines public supply and domestic self-supply into one group, together with the estimated water use for residential irrigation wells. SWFWMD's 2020 Regional Water Supply Planning reports are available at: https://www.swfwmd.state.fl.us/resources/plans-reports/rwsp. This group is then split into the PS and DSS categories in the DEP (2022a) to make the categories more consistent with those used by the other WMDs.

[21] DEP, NWFWMD, SFWMD, SWFWMD, SJRWMD, and SRWMD. 2019. Format and Guidelines for Regional Water Supply Planning. 42pp.

[22] "Reclaimed water" is defined in Chapter 62-610.200, Florida Administrative Code, as "water that has received at least secondary treatment and basic disinfection and is reused after flowing out of a domestic wastewater treatment facility."

demand is consistent among the regions, differences were identified in the specifics. A detailed analysis of the differences among the WMDs' methods can be found in Appendix A.2 of this report. Significant differences include:

- *The definition of the population used to forecast PS water use*. For each water utility included in PS, all WMDs project water demand as a product of the per capita water use rate (based on the last year or last several years) and the projected population. The definitions of the population, however, differ between the WMDs. Some WMDs explicitly base their projections on the permanent and non-permanent populations, combined.

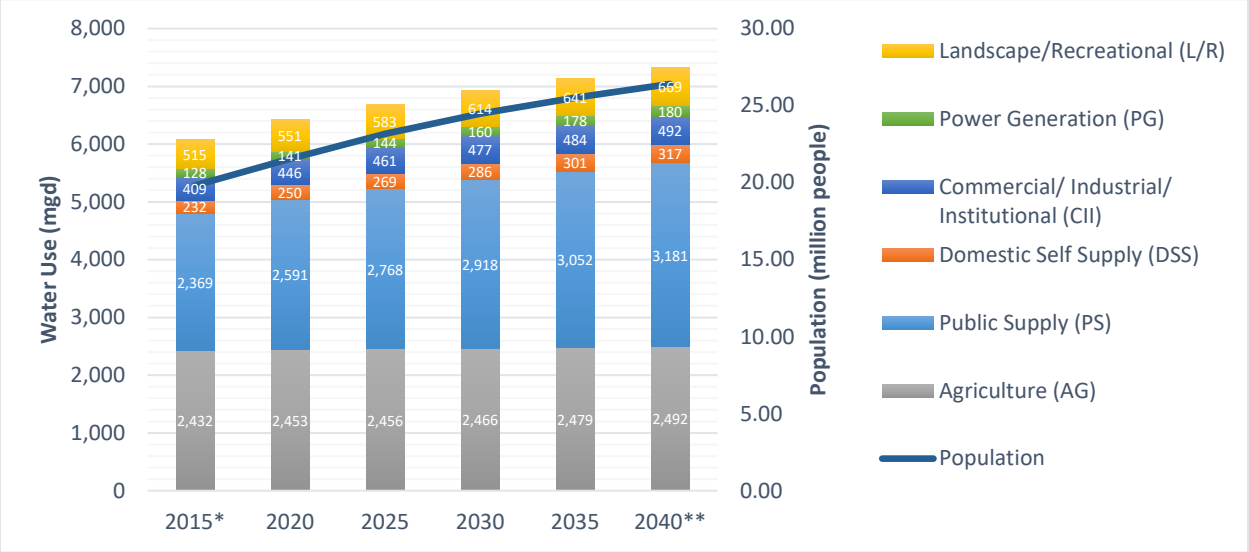
- *County population projections utilized in PS and DSS projections.* All WMDs reconcile their county population projections (*i.e.*, the total of PS and DSS populations) to that of BEBR.[23] However, the publication years for the annual BEBR projections used by the WMDs range from 2014 to 2020. Therefore, the population considered in all the WSAs/RWSPs does not add up to the most recent statewide population projections adopted by the Demographic Estimating Conference. Note that the BEBR's population projections are prepared under a contractual agreement with the Florida Legislature to support the Conference and EDR.

- *Agricultural water use projection.* Districts are required to consider irrigated agricultural acreage and demand data published in the most recent FSAID Geodatabase released by DACS (§ 373.709, Fla. Stat.). While some WMDs apply agricultural water use projections developed by DACS, others develop their projections independently (*e.g.*, using FSAID acreage data), based on suitability within specific planning regions.

Water use is projected to grow in all categories, but public supply accounts for most of the total growth (*i.e.*, 655.78 mgd out of the total increase of 899.34 mgd). While the finalized statewide water use data for 2020 are not yet fully incorporated into regional plans, the WMDs have estimated that public supply finally surpassed agriculture to become the largest water use category. The rates of water use expansion in public supply (22.81%), domestic self-supply (26.75%), and landscape / recreational (21.11%) generally match the rate of population growth (22.60% in 2020-2040, based on the EDR population forecast). While water use in agriculture is also forecasted to increase, the combined use across districts only grows 1.62% over the 20-year period, a lower percentage than reported last year (3.65%). A graph summarizing this data is provided in Figure 3.3.1.

[23] Overall, according to Section 373.709(2)(a)1.a, Florida Statutes, "Population projections used for determining public water supply needs must be based upon the best available data. In determining the best available data, the district shall consider the University of Florida Bureau of Economic and Business Research (BEBR) medium population projections and population projection data and analysis submitted by a local government pursuant to the public workshop described in subsection (1) if the data and analysis support the local government's comprehensive plan. Any adjustment of or deviation from the BEBR projections must be fully described, and the original BEBR data must be presented along with the adjusted data."

Figure 3.3.1 WMDs' Water Use Projections (mgd)



Source: DEP (2022a), with adjustments for 2040 demand in NFRWSP and SR-West
* For most regions, water use in 2015 is estimated based on available data; for selected regions with older RWSPs, the use was projected using 2010 data.
** For two regions–NFRWSP and SR-West – 2040 projections were not available in DEP 2021; as with the 2022 Edition of this report, EDR estimated the water use based on a linear trend. Note that for all water use categories in both regions, linear trend represented 2015-2035 data extremely well (R-squared for Ordinary Least Squares regressions above 0.99, estimated in Microsoft Excel). A detailed analysis of the linear trends can be found in Appendix A.1.

Alternative Water Use Scenarios: Impacts of Water Conservation and Droughts

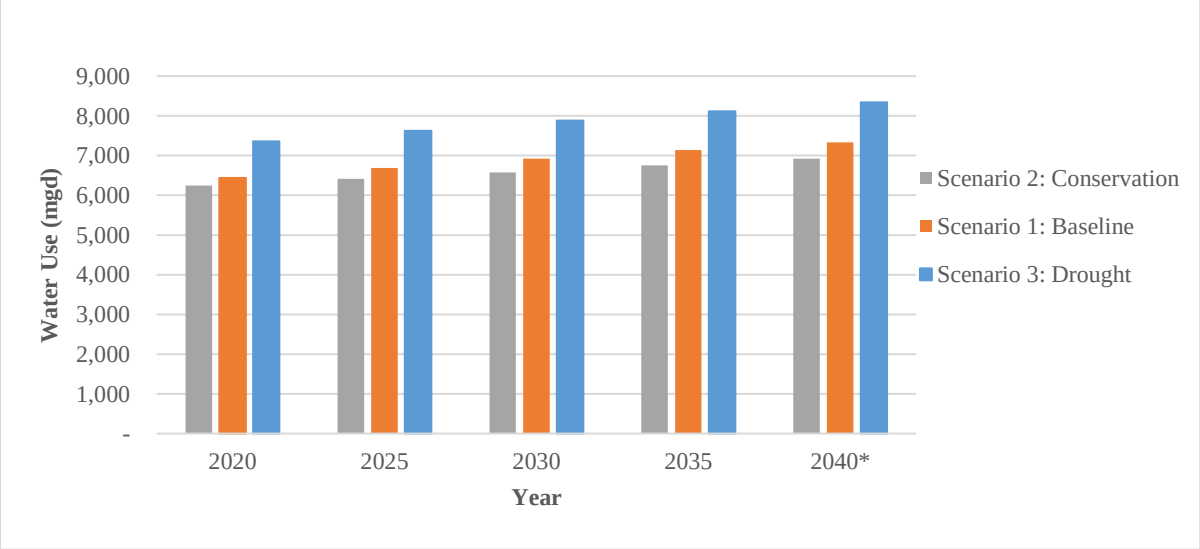
The projected 2020-2040 increase in statewide water use is significant – 13.99%. EDR refers to the scenario discussed above as "Scenario 1" or "baseline scenario." The EDR expenditure forecast is based on this "baseline scenario." However, it is important to realize that part of the water use increase projected for Scenario 1 can be offset by improving water use efficiency and water conservation, which is not explicitly accounted for in the water demand projection. Conversely, the demand can exceed the projections, especially given drought conditions.

The conservation projections are intended to represent "reasonably expected demand reduction at the end of the planning period due to conservation activities" (DEP et al. 2019, p. 30).[24] According to district projections compiled by DEP, conservation could offset 417.15 mgd by 2040 statewide.[25] This would reduce the projected statewide 2040 water demand by 5.69%, from 7,336.08 mgd to 6,918.99 mgd (Figure 3.3.2). In terms of the projected 2020-2040 demand

[24] An alternative water use scenario accounts for conservation potential. This scenario is referred to as Scenario 2, conservation. For planning purposes, water conservation is defined as "the prevention and reduction of wasteful, or unreasonable uses of water to improve the efficiency of use" (p. 30, DEP et al. [2019]).
Reference: DEP, NWFWMD, SFWMD, SWFWMD, SJRWMD, and SRWMD. 2019. Format and Guidelines for Regional Water Supply Planning. 42pp.
[25] In DEP (2022a), the value is 399.29; however, the projection stops at 2035 for two regions (i.e., NFRWSP and SR – West).

increase, the conservation scenario could, with appropriate investments, reduce this increase by 25.49% compared to the baseline scenario (from 899.34 mgd to 670.12 mgd).[26] This alternative scenario is referred to as Scenario 2, conservation. Note that the WMDs emphasize that any potential conservation should not be directly removed from water demand estimates since actual savings are based on endorsement and implementation of conservation measures by public supply utilities and other users, as well as being highly contingent on specific user participation rates. Substantial investments may be needed to realize these savings. As a result, conservation projections are developed by the WMDs separately from the baseline water demand projections.

Figure 3.3.2 Statewide Water Use Projections Based on WMDs Data



* For two regions–NFRWSP and SR-West–2040 projections were not available in DEP 2021; EDR estimated the water use based on a linear trend. Note that for all water use categories in both regions, linear trends represented 2015-2035 data extremely well (R-squared for Ordinary Least Squares regression above 0.99, estimated in Microsoft Excel).

The WMDs are required to incorporate a level-of-certainty planning goal associated with demand for a 1-in-10-year drought event.[27] The 1-in-10-year drought event is defined as "a year in which below normal rainfall occurs with a 10% probability of occurring in any given year" (DEP et al. 2019).[28] For the final year of their current planning horizons (*i.e.*, 2035 or 2040), all WMDs calculate the drought year water demand. These estimates are summarized in DEP (2022a). Some WMDs also provide drought demand projections for the 5-year intervals. EDR relied on these projections to develop 5-year drought demand estimates, along with a review of individual WSAs

[26] The calculations of the conservation potential for 2020-2040 are discussed in Section 3.7 of this report and Appendix A.3. This report generally includes the estimates presented in DEP (2022a), accounting for both "Conservation Projection" and "Additional Conservation Projection" from DEP (2022a).
Reference: DEP. 2022a. Regional Water Supply Planning 2021 Annual Report, available online at: https://floridadep.gov/water-policy/water-policy/content/water-supply . (Accessed December 28, 2022.)

[27] Specifically, the Florida Statutes require the level-of-certainty planning goal associated with identifying the water supply needs of existing and future reasonable-beneficial uses to be based upon meeting those needs for a 1-in-10-year drought event (§ 373.709(2)(a)1, Fla. Stat.).

[28] Reference: DEP, NWFWMD, SFWMD, SWFWMD, SJRWMD, and SRWMD. 2019. Format and Guidelines for Regional Water Supply Planning.

and RWSPs[29]. Statewide, the drought demand is expected to be approximately 14% higher than the demand in the baseline scenario. The scenario that accounts for the 1-in-10-year drought but does not explicitly consider the conservation potential is referred to as Scenario 3 (see Figure 3.3.2).

3.4 WMDs' Sufficiency Analysis and EDR's Inferred Water Supply and Inferred Water Shortage Values

The EDR expenditure forecasts must rely on the estimates of the difference between the projected demand and the existing water supply. If the difference is negative or zero, no investments in increasing the water supply are needed. In this case, only expenditures for maintaining or replacing existing infrastructure and investments for natural system restoration are needed (see Chapter 5 in this report). In contrast, if the projected demand is greater than the existing supply, additional water supplies should be identified, and invested in, to meet water demand growth.

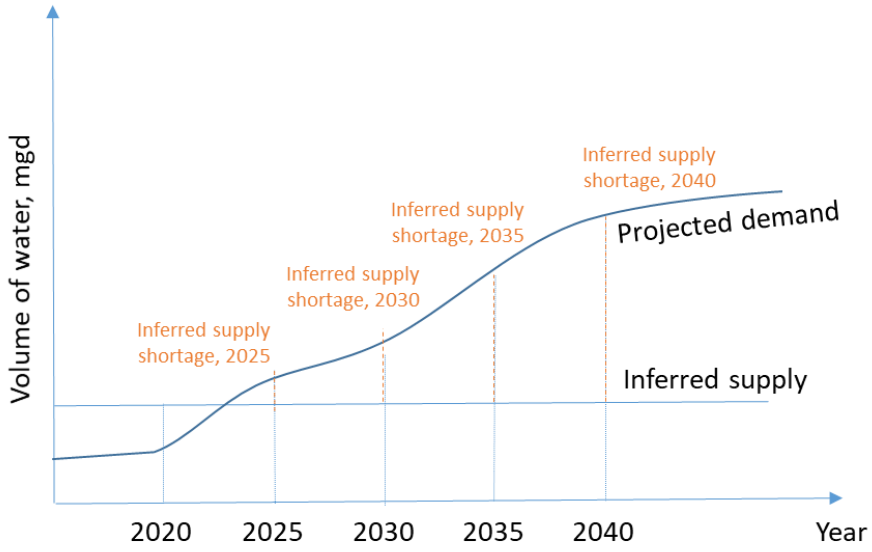
As required by Section 373.709(2), Florida Statutes, water management districts include "sufficiency analysis" in their WSAs/RWSPs. The analyses must identify "sufficient water resource and water supply development project options to meet projected water demands while preventing the loss of natural resources (…)" (SJRWMD 2022[30]). Districts' sufficiency analyses rely on models of potential effects on groundwater resources and natural systems from increased groundwater withdrawals. The Districts' studies focus on sub-regions (e.g., counties or their portions) and incorporate population and withdrawal projections and hydrologic analysis for those relatively small geographical areas. WMDs then examine the potential effects of increased withdrawals and identify the needs for alternative water supply and conservation to offset the withdrawals and ensure future water demands can be met without losing natural systems. DEP summarizes the WMD's estimates of alternative water supply and conservation needs in the "Water Needed" column of the Annual Status Report on Regional Water Supply Planning. EDR utilizes the data from DEP's "Water Needed" column in calculating the "inferred water supply" and "inferred water supply shortage" values.

EDR defines the "inferred water supply shortage" as the projected water demand's exceedance over the existing inferred supply. This "inferred water supply shortage" should not be considered an actual water shortage emergency as defined in the Florida Administrative Code.[31] An "inferred water supply shortage" should instead be seen as a potential future imbalance between the projected demand and the currently existing inferred supply. For the purposes of this assessment, EDR's conceptual supply shortage is more related to a condition of water scarcity and should be first addressed by proactively investing in additional water supplies. For each planning region listed in DEP (2022a)[32] and for each period, the inferred water supply shortage is calculated as the

[29] See Appendix A.5 of this report for a summary of EDR drought demand calculations, by region.
[30] Quoted from page 47 of the following document:
SJRWMD. 2022. Central Springs/East Coast Regional Water Supply Plan (2020–2040). February 07, 2022. Available at: https://www.sjrwmd.com/water-supply/planning/csec-rwsp/#documents (Accessed October 28, 2022.)
[31] The "inferred water supply shortage" is developed for EDR's expenditure forecasts only and it is not the same as "water shortage" as defined in Chapter 40A-21.051, Florida Administrative Code, which describes water shortage as a situation that "usually occurs as a result of a drought." (A similar description is presented in 40A-21, 40B-21, 40C-21, 40D-21 and 40E-21, Florida Administrative Code.)
[32] DEP. 2022a. Regional Water Supply Planning 2021 Annual Report, available online at: https://floridadep.gov/water-policy/water-policy/content/water-supply .

difference between the projected demand in that period and the 2020 inferred water supply (see Figure 3.4.1).

Figure 3.4.1 Schematic Illustration of Inferred Water Supply Shortage Calculations



Any shortage calculation is, of course, dependent on supply. To infer the existing water supply, EDR subtracts "water needed" as reported in DEP (2022a)[33] from the demand projected for the last year of the WMDs' planning horizon (*i.e.*, 2035 or 2040, depending on the region).[34] Note that this inferred supply does not necessarily represent the total water volume available for withdrawals or a precise measurement of the supply of water.[35] The dynamic nature of hydrogeology and water quality do not easily lend themselves to calculating a specific static water supply. The inferred supply described, however, is the best proxy for the total water supply that EDR can use to calculate the expenditure forecasts.

[33] DEP. 2022a. Regional Water Supply Planning 2021 Annual Report, available online at: https://floridadep.gov/water-policy/water-policy/content/water-supply .

[34] Based on DEP et al. (2019), water needed can be interpreted as the amount of water a WMD identifies as needed to meet future demands.
Reference: DEP, NWFWMD, SFWMD, SWFWMD, SJRWMD, and SRWMD. 2019. Format and Guidelines for Regional Water Supply Planning. 42pp.

[35] For example, in the NWFWMD, water resources are examined using methods such as potentiometric surface mapping, long-term hydrograph trend analysis, generalized groundwater budget evaluation, and groundwater quality analysis. Determining the total water supply is not the goal of such analysis; instead, the focus is on whether the projected demand can impact and potentially harm water resources. In addition to this general determination, the NWFWMD uses the currently permitted volumes of water for public supply to estimate the total demand that can be met, as well as related "water needed." Therefore, as long as projected demand can be met with the permitted water volumes, no other determinations of the total water supply are made by the NWFWMD. The approach is different in selected other regions, where the WMDs identify the total water availability. For example, in the CFWI, it was determined that "the CFWI Planning Area could potentially sustain up to 760 mgd of fresh groundwater withdrawals, but local management strategies will be needed (...) to address unacceptable impacts" (CFWI 2020, p. iv) . For the description of the methods used by the WMDs to identify supplies, see Appendix A.5 of this report.
Reference: CFWI. 2020. 2020 Central Florida Water Initiative (CFWI) Regional Water Supply Plan (RWSP). Available at: https://cfwiwater.com/RWSP.html (Accessed September 22, 2022.)

Table 3.4.1 summarizes the water demand at the end of each WMD's planning period and related water needed information provided by the WMDs and reported in DEP (2022a)[36]. Note that these water demand projections focus on demand Scenario 1 (baseline); that is, they do not account for potential drought nor do they explicitly consider conservation potential. The projected water demand in the last year of the region's planning horizon minus "water needed" is equal to the inferred water supply, as shown in Figure 3.4.2 below.

Figure 3.4.2 Inferred Water Supply Equation

Table 3.4.1 Inferring Water Supply

Planning Region	Data from DEP (2022a)			Calculations by EDR
	2035 Water Use Projection	2040 Water Use Projection	Water Needed (mgd)	Inferred Water Supply*
NW – II	91.19	94.88	5.00	89.88
NW – Oth	304.58	311.90	0.00	311.90
SF – LKB	253.83	257.49	0.01	257.48
SF – UEC	286.07	283.96	6.00	277.96
SF – LEC	1,963.65	2,006.54	49.55	1,956.99
SF – LWC	1,170.36	1,210.68	9.27	1,201.41
SJR – CSEC	416.72	427.87	51.10	376.77
SR – West	122.35	N/A	0.00	122.35
SW – N (excluding CFWI)	173.09	181.73	11.55	170.18
SW – TB	450.56	461.85	0.00	461.85
SW – H (excluding CFWI)	94.96	89.15	0.00	96.17**
SW – S	272.99	279.33	0.00	279.33
CFWI	873.94	907.59	95.00	812.59
NFRWSP	667.47	N/A	112.20	555.27

* Estimated as 2040 water use minus water needed. If 2040 water use is not available in DEP (2022a), 2035 water use is applied (except for SW – H region). The latter region is estimated as 2030 water use minus water needed because 2030 water use is projected to be the highest. This inferred supply does not necessarily represent the total water volume available for withdrawals and/or existing water supply. However, this is the best proxy for the total water supply that EDR can use to develop the expenditure forecasts.

To calculate the inferred supply shortage, water demand information reported in DEP (2022a) is compared with the inferred supply. The inferred supply shortage is the difference between the WMD-projected water demand and the inferred water supply reported in Table 3.4.1. For all regions, except NFRWSP and SR−West, inferred supply shortage is equal to the "water needed" values summarized in DEP (2022a). Note that no water availability determinations, groundwater or otherwise, are performed by EDR. Further, the analysis of regional inferred supply shortages is not an indicator of water availability on an individual permit basis.

[36] DEP. 2022a. Regional Water Supply Planning 2021 Annual Report, available online at: https://floridadep.gov/water-policy/water-policy/content/water-supply .

The inferred supply and inferred supply shortage calculations contain four assumptions:

- It is assumed that the estimated demand in the base year was met with the inferred supply and that this base year quantity will continue to be met decades into the future. It does not account for the investments needed to maintain aging infrastructure, relocate wellfields due to saltwater intrusion in coastal areas, or address other impacts on the existing supply.

- It is assumed that the inferred supply in a region does not change over time without investments in alternative water supplies. In the future, EDR plans to refine this assumption. It is recognized that "Water Needed" reported above is based on the specific approaches to estimating the existing supplies used by WMDs, and in some cases, part of the "Water Needed" can still be met by the traditional groundwater sources. For example, based on feedback from SWFWMD, traditional groundwater resources are anticipated to be the primary sources to meet a majority of the projected additional water demands in SW – N through 2040.[37] Groundwater can be a less expensive water supply source as compared with the alternative water supplies, and therefore, the expenditure forecast for SW – N presented in this report may exceed the actual expenditure needs. Another issue to be addressed in the future is the potential change in the inferred existing supply due to the saltwater intrusion, drought, or other issues that could potentially require additional future investments not addressed in this report.

- Regions reported as having zero "water needed" in DEP (2022a)[38] are assumed by EDR to have an inferred supply equal to their highest projected water use. Realistically, it is highly unlikely that the existing sources[39] are precisely the same as the future demand in all of these regions; however, this assumption is still reasonable given the limited data available.

- Although somewhat implausible, natural system restoration needs are assumed to be accounted for in the "water needed" field in DEP (2022a). Taking account of the water necessary to restore or protect natural systems is integral to EDR's statutorily required expenditure calculations. However, water for natural systems is not explicitly identified as a water demand, and it is unclear to what degree natural system restoration is accounted for in the "water needed" field in DEP (2022a). The differences in methodologies used by the WMDs exacerbate this uncertainty (see Appendix A.2 in this report for further explanation).

Regardless of these assumptions and due to the complex nature of quantifying water supply across the state, EDR relies on the WMDs' water demand and water needed data to infer supply. The demand, inferred supply, and inferred supply shortage data are shown in Tables 3.4.2 and 3.4.3. Approaches used by the WMDs to evaluate existing supplies are discussed in Appendix A.5 in this report.

[37] SWFWMD also continues to support the development of reclaimed water and conservation projects within the Region.
[38] DEP. 2022a. Regional Water Supply Planning 2021 Annual Report, available online at: https://floridadep.gov/water-policy/water-policy/content/water-supply .
[39] Existing sources include both traditional and alternative sources already built or proposed to be built during the 20-year planning horizon.

Table 3.4.2 Water Demand and Inferred Supply Based on WMD Data

Planning Regions	Demand																											Inferred Supply[i]
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	
NW – II	69.74					76.88					82.25					87.03					91.19					94.88	89.88
NW – Oth	254.16					273.72					287.12					296.92					304.58					311.9	311.9
SR - West[ii]	100.55					106.53					110.92					116.69					122.35					127.54**	122.35
SJR – CSEC	353.17					383.47					395.62					406.11					416.72					427.87	376.77
SW – N (excluding CFWI)	131.08					142.49					153.55					163.54					173.09					181.73	170.18
SW – TB	385.71					413.34					432.77					436.96					450.56					461.85	461.85
SW – H (excluding CFWI)	94.91					91.52					89.45					96.17					94.96					89.15	96.17
SW – S	234.95					245.02					254.22					265.77					272.99					279.33	279.33
SF – LKB	245.29					249.9					251.83					253.68					253.83					257.49	257.48
SF – UEC	272.95					289.26					289.7					287.84					286.07					283.96	277.96
SF – LEC	1,739.61					1,813.99					1,863.91					1,923.28					1,963.65					2,006.54	1,956.99
SF – LWC	980.33					1,030.31					1,073.57					1,113.64					1,170.36					1,210.68	1,201.41
NFRWSP[ii]	555.29					585.06					612.7					641.36					667.47					695.57**	555.27
CFWI	667.12					735.24					789.49					836.65					873.94					907.59	812.59
Statewide	6,084.85					6,436.73					6,687.10					6,925.64					7,141.76					7,336.08	6,970.13

[i]The supply data are inferred by subtracting the region's "water needed" from the highest water demand projected by WMDs for their current planning period, based on DEP (2022a). Green highlighted cells indicate the year of the RWSP/WSA publication for that region which is identified in DEP (2022a). In reality, the availability of sufficient water for all existing and future reasonable-beneficial uses and natural systems while avoiding the adverse effects of competition for water supplies is location-specific.

[ii] The 2040 water demand is projected by EDR using the WMDs' data for 2010-2035, as discussed in Appendix A.1 in this report.

Table 3.4.3 Cumulative Inferred Supply Shortages to Be Met through Investments

Planning Regions	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
NWF – II			-					-					1.31					5.00
NWF – Oth			-					-					-					-
SR – West			-					-					-					5.19
SJR – CSEC			18.85					29.34					39.95					51.10
SW – N (excluding CFWI)			-					-					2.92					11.55
SW – TB			-					-					-					-
SW – H (excluding CFWI)			-					-					-					-
SW – S			-					-					-					-
SF – LKB			-					-					-					0.01
SF – UEC			11.74					9.88					8.11					6.00
SF – LEC			-					-					6.66					49.55
SF – LWC			-					-					-					9.27
NFRWSP			57.43					86.09					112.20					141.30
CFWI			-					24.06					61.35					95.00
Statewide (sum of regions)			**88.02**					**149.37**					**232.49**					**372.97**

Note: These values are calculated by subtracting the inferred supply from Table 3.4.2 from the demand in each year of the same table and only display a value when the demand is higher than the inferred supply.

3.5 Water Supply and Water Resource Development Projects: Dataset Used in the EDR Expenditure Analysis

For the expenditure analysis, EDR utilizes the information about project capacity and funding available in Appendix C of DEP (2022a)[40], referred to below as "the project appendix." Overall, the DEP project appendix includes the projects identified in the RWSPs and RPSs (recovery or prevention strategies), the projects implemented and funded by the WMDs or state agencies in the past, and the projects currently being designed or constructed (and funded or co-funded by agencies) in order to meet the RWSP and MFL (Minimum Flows and Minimum Water Levels) RPS goals.[41] Noteworthy differences exist between DEP (2022a) and the previous year's project appendix.

As part of the RWSPs developed pursuant to section 373.709, Florida Statutes, the WMDs are required to compile a list of project options for water supply development and water resource development. For the water supply development component, the project options include traditional and alternative water supply projects. The available water after incorporating these project options (*i.e.*, the total capacity) must exceed the water supply needs for all existing and future reasonable-beneficial uses within the 20-year planning horizon and take into account water conservation. Local governments, public and private utilities, regional water supply authorities, multi-jurisdictional water supply entities, self-suppliers, *etc*., can either choose among the options or develop their own projects when additional supplies are needed. Because the identified projects are statutorily required to be "technically and financially feasible," EDR relies on the appendix for part of its expenditure forecasting.

The water resource development component must support the water supply development component and the natural systems under certain circumstances. While the recovery or prevention strategies (RPSs) for adopted Minimum Flows and Minimum Water Levels (MFLs) are specifically required as part of the water resource development component, section 373.0421, Florida Statutes, requires the WMDs to include in each RWSP any water supply development or water resource development project that is identified in an RPS. Further, the RPS must include a phased-in approach for the development of additional water supplies, implementation of conservation measures, and other actions to achieve recovery to an established minimum flow (for rivers, streams, estuaries, and springs) or minimum water level (for lakes, wetlands, and aquifers), or to prevent the existing flow or water level of such water resources from falling below the established minimum levels.

The project appendix is the most comprehensive statewide dataset of the Florida water supply and water resource development projects currently available. Nevertheless, EDR recognizes that this dataset has two limitations that could influence the expenditure estimates. First, the project appendix primarily includes projects that are eligible for district or state cost-share funding. Such projects can differ from those carried out solely by local entities. Second, the project appendix can

[40] DEP. 2022a. Regional Water Supply Planning 2021 Annual Report, available online at: https://floridadep.gov/water-policy/water-policy/content/water-supply . (Accessed December, 2022.)

[41] See the complete list of the columns and project characteristics in DEP (2022a). Regional Water Supply Planning 2021 Annual Report, available online at https://floridadep.gov/water-policy/water-policy/content/water-supply . (Accessed December, 2022.)

include projects implemented or planned for multiple benefits, with water supply or MFL RPS goals being only a secondary benefit. For example, reclaimed water projects can be primarily constructed to dispose of treated wastewater, rather than offset potable water use. Some projects can also be intended to ensure water supply reliability (*e.g.*, at the time of peak demand), diversify water supply sources, and reduce demands on traditional sources rather than to meet new water demand. In addition, projects can be constructed to replace aging infrastructure, providing limited water conservation benefits. EDR assumes, however, that since the project appendix is part of DEP's RWSP Annual Status Update, most of the projects are intended to meet water demand or MFL RPS goals.

The DEP project appendix currently includes 1,807 project items. For each project item, the "Project Status" column indicates whether the item is canceled, completed, in construction or underway, in design, on hold, or an "RWSP or RPS option only." When canceled project items are removed 1,733 project items remain for further analysis.

The "Project Total" column in the DEP project appendix provides information about the total project funding (if any) by the state, district, and cooperating entity. Cooperative entities in the appendix include counties, municipalities, water utilities, or private entities such as farms, homeowner associations, or golf clubs. The funding information is not always reflective of the project's total implementation cost since it generally does not include information about land purchases[42] or the costs of project components ineligible for funding. This information also excludes funding provided by federal agencies, if any. EDR assumes, however, that the funding from the state, district, and cooperating entity accounts for most of the implementation cost.[43]

Further, for the projects that are listed as RWSP or RPS option only, the "Projected Total Funding (for RWSP/RPS Options Only)" column summarizes information about potential funding requirements (*i.e.*, planning-level cost estimates). This "Projected Total Funding" is an estimate only and is not verified until the project is submitted for cost-share funding to begin design or implementation. Still, this projected funding level represents the best available information regarding the future funding needs and, therefore, EDR includes it in the analysis. Below, the combined "Project Total" and "Projected Total Funding (for RWSP/RPS Options Only)" is referred to as the "project total ($)." EDR indexes "project total ($)" to state fiscal year 2021-2022 (referred to as $2022 throughout this chapter).[44]

EDR also examines whether a project item on the list is a phase of a larger project. For example, the project appendix may list the construction of a water treatment facility and the construction of wells providing water to that facility as separate project items. Further, to evaluate the water or reuse flow made available by the projects (*i.e.*, the project capacity), the columns "Quantity of Water Made Available on Completion (mgd)" and "Reuse Flow Made Available on Project Completion (mgd)" are generally used.[45] For the purposes of this Edition, EDR groups the

[42] For most projects, "No" is reported for the "Land Acquisition Component" spreadsheet column.
[43] See additional discussion of infrastructure cost and funding in Chapter 5.
[44] See DEP (2022a) for details. Regional Water Supply Planning 2021 Annual Report, available online at https://floridadep.gov/water-policy/water-policy/content/water-supply
[45] "Quantity of Water Made Available to Date (mgd)" and "Reuse Flow Made Available to Date (mgd)" were also reviewed. This information was used to evaluate project capacity for projects from SWFWMD that had more than one phase. Quantities available today (as opposed to "upon project completion") were also applied to estimate capacity for the following projects: SRWS00003A,

appendix's projects into more general categories in Table 3.5.1. Of particular note, after this year's review, the projects categorized as additional water supply to meet growing demand declined by 10.1% relative to last year's review, although the total number of projects slightly increased.

Table 3.5.1 General Project Categories Defined by EDR

EDR Project Category	Project Description	Number of Projects in DEP Project Appendix*
Additional water supply to meet growing demand	Projects in the regions with positive 2040 inferred supply shortages, given that the projects are not associated with any MFL RPS. Specifically, the following project types are considered: • Reclaimed Water (for potable offset) • Brackish Groundwater • Surface Water • Surface Water Storage • Groundwater Recharge • Aquifer Storage and Recovery (ASR) • Stormwater • Other Project Type • Other Non-Traditional Source • Desalination • Distribution / Transmission Capacity	863
Water demand management and conservation	• PS and CII Conservation • Agricultural Conservation	635
Water for natural systems	• All projects that are not yet completed and that are associated with specific MFL RPS • Reclaimed water projects for groundwater recharge or natural system restoration, if the project status is listed as in design, in construction / underway, or on hold • All project types if the projects are in the regions with no inferred shortage, if the project status is in design, in construction/underway, or on hold	216
Other	• Flood Control Works • Data Collection and Evaluation • Water Resources Management Programs	81

* The total is greater than the total number of the projects in the dataset since some projects fall into more than one category.

3.6 Expenditure Projections to Meet the Future Demand

To forecast the expenditures needed to increase existing supply and meet the future demand, EDR considered (a) capacity for the projects completed since relevant WSA/RWSPs were finalized; (b) capacity and expenditures for the projects currently in design, in construction/underway, or on hold, and (c) potential additional projects currently in RWSP/RPS Options Only status.

To forecast the expenditures needed for projects in design, in construction/underway, or on hold, EDR assumes that 50% of a project's total funding had yet to be spent if the project status is in construction/underway. However, 100% of the expenditures for projects with an on hold or in design status are included in the expenditure forecast (*i.e.*, none of the recorded funding for on hold or in design projects has been spent). Upon completion, projects that are in design, in

SRWS00007A, SJWS00340A, and SFWS00208A. This decision was made due to discrepancies between quantities reported "today" vs. "upon completion," based on the other project details.

construction/underway, or on hold are expected to reduce the 2040 inferred water shortage from 372.97 to 254.18 mgd (see Table 3.6.1). The total expenditures forecasted for these projects is $617.56 million $2022 (see Table 3.6.1). These expenditures are comparable to the expenditures identified in the previous edition of this EDR report ($647.18 million $2021). However, the total expenditure forecast for the regions with no inferred shortage are estimated to be $686.64 million $2022 compared to $220.02 million $2021 in the previous edition of this EDR report. The difference is attributable to: (1) updates to previously recorded projects in the DEP project appendix, and (2) additional projects added to the project list.

The projects in design, construction/underway, or on hold are estimated to completely eliminate the inferred water supply shortage in the NWF – II, SF – UEC, and SF – LWC. In the remaining regions that still have water supply shortages, EDR assumes that additional investments in water supply or water conservation projects will be made.

[See table on following page]

Table 3.6.1 Analysis of the Projects in Construction, in Design, and On Hold, by Region Where Water is Needed*

Planning Regions	Inferred Supply Shortage by 2040, mgd (end of planning period)	Water by the Projects in Design, Construction, and On Hold, mgd	Remaining Inferred Supply Shortage by 2040, mgd**	Project Expenditures in EDR Forecast (million, $2022)***
(1)	(2)	(3)	(4) = (2) – (3)	(5)
NWF – II	5.00	7.15	-	$69.37
SR – West	5.19	1.10	4.09	$3.20
SJR – CSEC	51.10	31.99	19.11	$179.36
SW – N****	11.55	3.09	8.46	$33.90
SF – UEC	6.00	45.24	-	$151.56
SF – LEC	49.55	0.65	48.90	$2.99
SF – LWC	9.27	9.90	-	$27.40
NFRWSP	140.30	9.38	130.92	$10.36
CFWI	95.00	52.30	42.70	$139.44
Statewide (sum of regions)	**372.97**	**160.79**	**254.18**	**$617.56**

* The table focuses on the regions with "Water Needed" identified in DEP (2022a). Five regions are not listed because they have no inferred supply shortage: NWF – Other, SW – H (excluding CFWI), SW – TB, SW – S, and SF – LKB. Projects considered to be for the natural system restoration and Everglades restoration are excluded. These are the projects associated with MFL RPS, reclaimed water (for groundwater recharge or natural system restoration), and most of the projects described as restoration (in the "Project Description" field). Projects in RWSP/RPS Options Only "Project Status" field are also excluded.
** Negative values of the inferred shortage are not reported.
*** Total expenditure forecast for the regions with no inferred shortage are estimated to be $686.64 million, bringing the statewide total to $1,304.20 million ($2022).
**** Excluding CFWI.

To develop scenarios for supplying the remaining inferred supply shortage of 254.18 mgd, for each planning region, EDR identified suitable project types that have project total and project capacity. From those project types, EDR retained only those ranked as "highly" or "moderately likely" to be viable in an undated DEP report on alternative water supplies.[46] EDR used this selection as a basis for estimating the cost of closing the remaining inferred water supply shortage. These project types are summarized in Table 3.6.2.[47]

[See table on following page]

[46] DEP. Undated. An Assessment of Viable Alternative Water Supply Resources and Critical Funding Needs. Presented by the FDEP pursuant to Executive Order 19-12 and Chapter 2019-115, Laws of Florida.
[47] See Appendix A.6 for additional details.

Table 3.6.2 Project Types Identified for Each Region to Meet the Inferred Water Supply Shortage

Planning Regions where	Brackish Groundwater	Groundwater Recharge	Reclaimed Water	Surface Water Storage
SR – West			✓	
SJR – CSEC	✓		✓	
SW – N (excluding CFWI) *			✓	
NFRWSP		✓	✓	
CFWI	✓		✓	
SF – LEC	✓		✓	✓

* The portion of the region excluding CFWI. Discussions with SWFWMD staff indicated that the future water demand is expected to be met with groundwater, though the District will continue implementing reclaimed water projects as well.

Reclaimed water is expected to play an essential role in meeting the increase in water demand in all regions. In addition, brackish groundwater is likely to be crucial in south and central Florida, while groundwater recharge can be a vital project type in the NFRWSP. EDR identified more than two project types to meet the future increase in demand in SF – LEC. For this region, EDR's expenditure projections only consider the most and least costly project types.

Further, expenditures per-mgd can vary widely on project capacity, prompting EDR to select the median capacity for each project type (see Table 3.6.3). For reclaimed water projects, the median project capacity is varied among regions to reflect the differences in project sizes identified by EDR in the DEP project appendix.[48]

Table 3.6.3 Project Capacity, mgd of water or beneficial offset

Project Type	Median Project Capacity, mgd of water or beneficial offset
Brackish Groundwater	
SJR – CSEC	4.00
CFWI	4.20
SF – LEC	3.00
Groundwater Recharge	1.85
Reclaimed Water (for potable offset):	
NW – II	0.33
SR– West	0.28
SJR – CSEC	0.27
NFRWSP	0.28
SW – N*	0.29
SF – UEC	1.21
CFWI	0.78
SF – LWC	4.35
SF – LEC	1.10
Surface water storage	1.01

* The portion of the region excluding CFWI.

[48] Appendix A.9 discusses alternative project capacity assumptions.

Project expenditures depend on project capacity, type, and location. EDR developed a multivariate regression model to examine this relationship. The dependent variable in the model is the natural logarithm of "project total ($)" (million dollars). Various combinations of the independent variables were tested, and the final model used in the analysis is described in Appendix A.9. The model includes project capacity (i.e., the natural logarithm of water or beneficial offset for the projects), the region of project implementation, project type, and project status. The model is estimated in the "R" software environment using Fitting Generalized Linear Models (*glm)*, and it explains approximately 75% of the variability in the dependent variable. EDR will continue testing alternative model specifications to improve the model predictive capacity for the 2024 Edition of this report.

The regression model is then used to estimate the project expenditures (per mgd of water or beneficial offset).[49] Note that the estimated expenditures for reclaimed water projects account for the beneficial offset being only 0.55[50] of the actual project capacity. This assumption makes this project type especially expensive (Table 3.6.4). In contrast, brackish groundwater and groundwater recharge projects are relatively inexpensive, but they are only relevant to selected regions.

Table 3.6.4 Estimated Project Expenditures per Unit of Capacity (million $2022 per mgd)

Planning Regions	Brackish Groundwater	Groundwater Recharge	Reclaimed water	Surface Water Storage
SR – West			$25.53	
SJR – CSEC	$9.54		$8.72	
SW – N***			$7.17	
NFRWSP		$0.99	$8.95	
CFWI	$2.05		$3.83	
SF – LEC	$5.20		$8.41	$4.17

Note: Values in this table assume the median project capacity. For reclaimed water projects, the beneficial offset is assumed to be 55 percent of each project's capacity, based on the average of the beneficial offset values reported in DEP (2021).
* Excluding CFWI.

These estimated per-mgd expenditures are then used to forecast the investments needed to meet the remaining inferred supply shortage in each region summarized in Table 3.6.1. EDR uses the most and least expensive project types in these calculations (see columns 6 and 7 in Table 3.6.5). These expenditures are then combined with the costs of the projects currently in construction, in design, and on-hold. As shown in columns 8 and 9 in Table 3.6.5, the total projected expenditures to meet the inferred supply shortage by 2040 are between $1.370 and $2.711 billion (with an average of $2.041 billion). Note that "less expensive" and "more expensive" scenarios show the same costs for several regions since the inferred shortage is expected to be met with the projects already in construction, in design, or on hold. These expenditures are considerably higher than the expenditures identified in the 2022 Edition of this EDR report − $1.491 million $2021. The

[49] Median capacity is assumed for each project type, see Table 3.6.3.
[50] This assumption is based on the average of the beneficial offset values reported in DEP (2021), available online at https://floridadep.gov/water/domestic-wastewater/documents/2021-reuse-inventory-all-appendices-excel. In future editions of this report, EDR plans to explore alternative methods of modeling the beneficial offset provided by reclaimed water projects.

difference is caused by updates to the DEP project appendix and methodological changes governing how EDR estimates the timing of project expenditures.

Table 3.6.5 Expenditures Forecast for the Additional Water Supply

Planning Regions	Inferred Supply Shortage by 2040, mgd	Water and Beneficial Offset* for the Projects in Design, Construction, and On Hold, (mgd)	"Project Total" for the Projects in Design, Construction, and On Hold (million, $2021)	Remaining Inferred Supply Shortage By 2040, Mpg***	"Project Total" to Meet Remaining Inferred Shortage (million, $2022)		Total Forecasted Expenditure to meet 2040 Inferred Supply Shortage (million $2022)		
					Less expensive	More expensive	Less expensive	More expensive	Average
(1)	(2)	(3)	(4)	(5)	(6)	(7)	**(8)**	**(9)**	**((8) + (9)) / 2**
NWF – II	5.00	7.15	$69.37	0.00	0	0	$69.37	$69.37	$69.37
SR – West	5.19	1.10	$3.20	4.09	$104.37	$104.37	$107.56	$107.56	$107.56
SJR – CSEC	51.1	31.99	$179.36	19.11	$166.66	$182.33	$346.02	$361.70	$353.86
SW – N**	11.55	3.09	$33.90	8.46	$60.69	$60.69	$94.58	$94.58	$94.58
SF – UEC	6.00	45.24	$151.56	0.00	0	0	$151.56	$151.56	$151.56
SF – LEC	49.55	0.65	$2.99	48.90	$203.91	$411.25	$206.90	$414.23	$310.56
SF – LWC	9.27	9.90	$27.40	0.00	0	0	$27.40	$27.40	$27.40
NFRWSP	140.3	9.38	$10.36	130.92	$129.61	$1,171.71	$139.97	$1,182.07	$661.02
CFWI	95.00	52.30	$139.44	42.70	$87.53	$163.54	$226.98	$302.98	$264.98
Statewide (sum of regions)	**372.97**	**160.79**	**$617.56**	**254.18**	**$752.77**	**$2,093.88**	**$1,370.33**	**$2,711.44**	**$2,040.88**

* Accounting for 0.55 beneficial offset coefficient for reclaimed water projects.
** Excluding CFWI.
***Negative values of the inferred shortage are not reported.

To calculate the state's funding contributions toward the total expenditures, EDR considers 186 projects from the DEP project appendix that were completed in the past. These projects are selected because the total of their state, district, and cooperating entity(ies) funding is exactly equal to "project total ($).", and the district funding is greater than zero. The state's funding share differed among the planning regions, with the average share being the highest in the NW – II and the lowest in the SF – LEC as shown in Table 3.6.6. Statewide, the state funding share is 12.54 percent and the district funding share is 31.87 percent, demonstrating that the cooperative entity or entities cover(s) most of the project expenditures.

Table 3.6.6 Share of State's Funding in the "Project Total ($2022)"

	N	Share
NW – II	2	0.37
NFRWSP and SR – West	21	0.26
SJR – CSEC	16	0.09
CFWI	43	0.09
SW – N (excluding CFWI)	2	0.10
SF – UEC	12	0.05
SF – LEC	35	0.03
SF – LWC	26	0.04

Note: Total expenditure forecast for the regions with no inferred shortage are estimated to be $686.64 million. Based on past projects, the average share of state funding for such projects is relatively small – just 0.0687 (i.e., approximately 6.87%). Therefore, EDR expects that the future state funding for the projects in the regions with no inferred water supply shortage is $47.14 million.

The share estimated funding contributions of the state's expenditures in each region are used to forecast the total state expenditures needed to address the inferred water supply shortage (Table 3.6.7). By 2040, the total is forecasted to range between $229.49 million and $536.18 million, with an average of $382.83 million. These amounts are significantly higher than last year's report, primarily due to higher overall project costs but also due to methodological refinements in the calculation of the state's share. Note that this forecast does not explicitly account for the increased state funding share for the projects in the Rural Economic Development Initiative (REDI) areas.[51]

Table 3.6.7 Estimated State Expenditures (million $2022)

Region	Less expensive	More expensive	Average
NWF – II	$25.67	$25.67	$25.67
SR – West	$27.97	$27.97	$27.97
SJR – CSEC	$31.14	$32.55	$31.85
SW – N (excluding CFWI)	$9.46	$9.46	$9.46
SF – UEC	$7.58	$7.58	$7.58
SF – LEC	$6.21	$12.43	$9.32
SF – LWC	$1.10	$1.10	$1.10
NFRWSP	$36.39	$307.34	$171.86
CFWI	$83.98	$112.10	$98.04
Statewide (sum of regions)	**$229.49**	**$536.18**	**$382.83**

3.7 Expenditure Forecast, Water Conservation, and Drought

The expenditures discussed above focus on the baseline scenario for water use and related inferred shortage calculations. These expenditures do not account for the water use efficiency improvements and water conservation. The overall inferred water supply shortage can be reduced by 70% if water use efficiency improvements and conservation are accounted for (see Table 3.7.1). Given this water use scenario, the inferred water supply shortage would continue only in CFWI and NFRWSP.

[See table on following page]

[51] As stated in DEO (2020), "Section 288.0656, Florida Statutes, establishes the Rural Economic Development Initiative (REDI) to better serve Florida's economically distressed rural communities by providing a more focused and coordinated effort among state and regional agencies that provide programs and services for rural areas. An 'economically distressed' county/community is eligible to request a 'Waiver or Reduction of Match' of jobs or wage requirements, eligible company criterion, inducement requirement and grants. Each state agency determines which grant programs will allow for a waiver of match based on their annual budget and federal and state guidelines" (quoted from the webpage available at: https://floridajobs.org/community-planning-and-development/community-partnerships/rural-economic-development-initiative; accessed November 2022.)

Table 3.7.1 The 2040 Inferred Water Supply Shortage Given Three Water Demand Scenarios

Regions	Inferred Water Supply, mgd	Baseline Water Demand (Scenario 1)		Water Demand with Conservation (Scenario 2)		Drought Demand (Scenario 3)	
		2040 Water Demand, mgd	Inferred shortage, mgd	2040 Water Demand, mgd	Inferred shortage, mgd	2040 Water Demand, mgd	Inferred shortage, mgd
NW – II	89.88	94.88	5.00	88.88	-	105.89	16.01
NW – Oth	311.9	311.9	-	308.1	-	345.07	33.17
SR – West	122.35	127.54	5.19	116.64	-	137.15	14.80
NFRWSP	555.27	695.57	140.30	626.31	71.04	753.87	198.60
SJR – CSEC	376.77	427.87	51.1	389.65	-	508.56	131.79
CFWI	812.59	907.59	95.00	851.59	39.00	1011	198.41
SW – N*	170.18	181.73	11.55	167.65	-	201.4	31.22
SW – TB	461.85	461.85	-	416.88	-	501.24	39.39
SW – H*	96.17	89.15	-	80.85	-	119.74	23.57
SW – S	279.33	279.33	-	258.11	-	335.32	55.99
SF – LKB	257.48	257.49	0.01	257.49	-	303.36	45.88
SF – UEC	277.96	283.96	6.00	271.34	-	329.74	51.78
SF – LEC	1,956.99	2,006.54	49.55	1,904.14	-	2,329.11	372.12
SF – LWC	1,201.41	1,210.68	9.27	1,184.38	-	1,356.84	155.43
Statewide (sum of the region)			**372.97**		**110.04**		**1,368.16**

* Excluding CFWI.

Despite the inferred shortage decrease in Scenario 2, EDR expects limited reductions in the projected expenditures unless most of the water use reduction is achieved through passive conservation. Specifically, for active conservation, the DEP project appendix includes 130 agricultural water conservation projects and 389 PS and CII conservation projects for which both "project total ($)" and project capacity (mgd) are provided. Median costs for these projects are $5.02 and $5.15 million per mgd, respectively. These expenditures are comparable with that for the alternative water supply projects. Therefore, implementation of the identified water conservation strategies is not expected to materially reduce projected expenditures. The only strategy to reduce the costs is to rely on inexpensive passive water conservation (such as households purchasing more efficient appliances or new urban developments implementing more stringent construction standards).

Table 3.7.2 Expenditure for Water Conservation Projects, million $2022 per mgd of Project Capacity

Project Type	Number of Observations	Mean	Median
Agricultural Conservation	130	15.11	5.02
PS and CII Conservation	389	22.76	5.15

While the water conservation scenario reduces the inferred shortage, the drought scenario can expand the inferred shortage. For example, if a 1-in-10 year drought occurs in 2040, the inferred supply shortage can increase approximately four times, from 372.97 mgd to 1,368.16 mgd (Table

3.7.1). Today, much of the increase in water demand under drought conditions is addressed by available surplus or managed by government-imposed, short-term restrictions on demand. Changing climate conditions may lead to more frequent, prolonged, or severe droughts, requiring significantly higher expenditures to meet water demand in such conditions.

3.8 Expenditures to Ensure That Sufficient Water Is Available for Natural Systems

Part of section 403.928, Florida Statutes, requires EDR to estimate the expenditures necessary to achieve the legislature's intent that sufficient water is available for the natural systems. While the WMDs may use a variety of tools to protect the natural systems, EDR primarily focuses on projects included in recovery or prevention strategies (RPSs) for the implementation of minimum flows and minimum water levels (MFLs); [52] however, there are a few additional conditions under which projects are assumed to benefit the natural systems.

Projects Associated with MFL Recovery or Prevention Strategies

Sections 373.042 and 373.0421, Florida Statutes, provide requirements for the WMDs with regard to the establishment and implementation of MFLs for water courses, water bodies, and aquifers. The MFLs are intended to define "the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area."[53] These limits are relevant to water supply planning, permitting decisions, and the declaration of water shortages.[54]

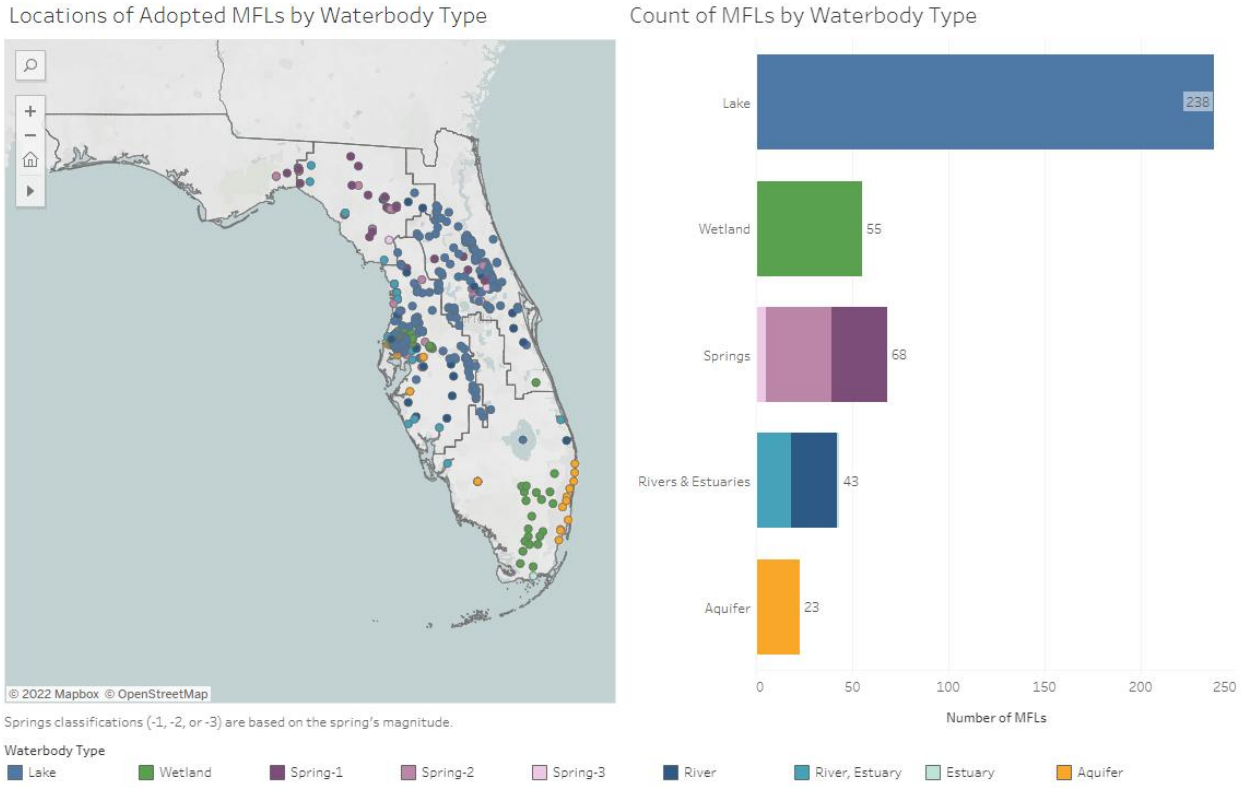
The WMDs are required to adopt (or revise) and implement recovery or prevention strategies to achieve recovery to an MFL as soon as practicable or prevent a future violation of an MFL if it is expected to occur within 20 years.[55] When developing the recovery or prevention strategy, the WMDs must include a phased-in approach or timetable to allow for the provision of water supplies for all existing and projected reasonable-beneficial uses.[56] Once the recovery or prevention strategy is adopted by the appropriate WMD, the applicable RWSP must be amended to include any water supply or water resource development projects.[57] For a visual of all currently adopted MFLs and RPSs by type and status, see Figures 3.8.1 and 3.8.2.

In 2016, the Florida Legislature strengthened the implementation of MFLs for Outstanding Florida Springs (OFSs).[58] The WMDs, excluding NWFWMD, were required to adopt MFLs for all OFSs within their jurisdictions by July 1, 2017.[59] A recovery or prevention strategy for an OFS must identify a prioritized list of projects to implement the plan and include the estimated cost and date of completion for each project, the estimated benefit from each project, and the source and amount

[52] These are the projects associated with MFL RPS, reclaimed water (for groundwater recharge or natural system restoration), and most of the projects described as restoration (in the "Project Description" field)
[53] § 373.042, Fla. Stat.
[54] §§ 373.705 and 373.709, Fla. Stat.; Fla. Admin. Code R. 62-40.473(3)-(4);
[55] § 373.0421(2), Fla. Stat.
[56] *Ibid.*
[57] *Ibid.*
[58] *See* 2016-1, §§ 5 and 25, Laws of Fla. (amending section 373.042, Florida Statutes, and creating section 373.805, Florida Statutes, to establish additional MFL requirements for Outstanding Florida Springs).
[59] The deadline for NWFWMD is July 1, 2026.

of financial assistance available by the applicable WMD.[60] Unlike recovery or prevention strategies for other water resources, those for OFSs must be designed to achieve the MFLs no later than 20 years after adoption of the strategy and must contain a schedule establishing 5-year, 10-year, and 15-year targets to inform future planning and funding decisions.[61]

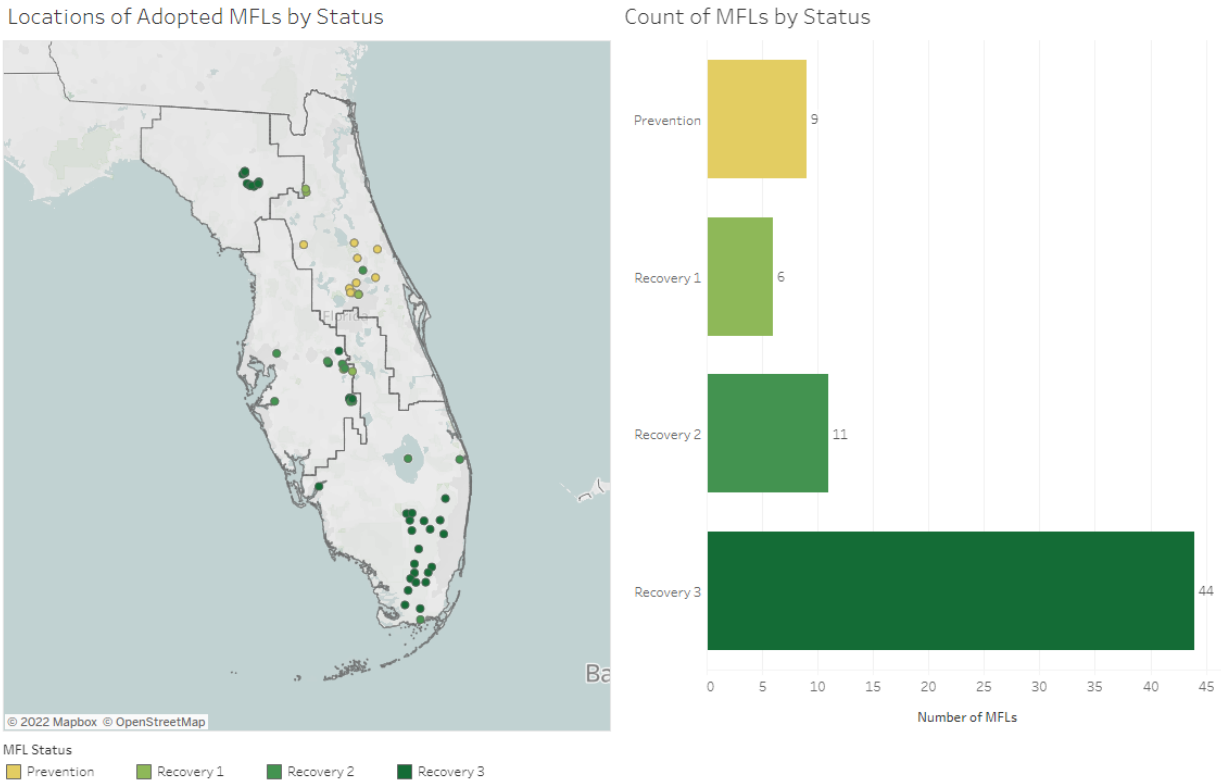
Figure 3.8.1 Locations of Adopted MFLs by Waterbody Type



Source: DEP. 2022b. 2021 Statewide Annual Report (STAR Report). Available online at: https://floridadep.gov/dear/water-quality-restoration/content/statewide-annual-report (Accessed November 2022).

[60] § 373.805(4), Fla. Stat.
[61] § 373.805(4), Fla. Stat.

Figure 3.8.2 Locations of Adopted MFLs with RPSs by Status



Source: DEP. 2022b. 2021 Statewide Annual Report (STAR Report). Available online at: https://floridadep.gov/dear/water-quality-restoration/content/statewide-annual-report (Accessed November 2022).

EDR analyzed "project total ($)" information for the 77 projects directly associated with the natural system restoration for which all information was available. These projects were assumed to include those related to specific MFL RPSs, reclaimed water (for groundwater recharge or natural system restoration), and most of those described as restoration (in the "Project Description" field). EDR also assumed that 50% of the expenditures for the projects in construction/underway statuses would be incurred in the future and, therefore, should be included in the EDR expenditure forecast. EDR assumes that 100% of the expenditures for projects with an on hold or in design status should be part of the expenditure forecast (i.e., none of the recorded funding for on hold or in design projects has been spent yet). In addition, EDR also accounted for the total expenditures for the projects identified as "RWSP or RPS Option Only" (in the "Project Status" field) and associated with a specific MFL RPS. In total, it is expected that the natural system restoration projects would cost $536.80 million (see Table 3.8.1).

For comparison, the last edition of this EDR report projected a needed expenditure of $626.14 million. The difference between the two projections is caused by updates to the DEP project database, more granular identification of natural system restoration projects, and methodological changes governing how EDR estimates the timing of project expenditures.

For the projects associated with MFL RPSs and implemented in the past, the average percentage of the state funding is approximately 14.65%, and the average percentage of district funding is

27.76% (based on a sample of 74 projects). Therefore, the forecasted state expenditure for the MFL RPS projects is $78.64 million (or 0.1465 x $536.80 million).

Note that these estimates may be too low since it is unclear whether the projects in the appendix are sufficient to meet the MFL target for the related natural systems. Further, it does not account for Everglades restoration which is discussed in Chapter 6, as these projects are largely part of the Comprehensive Everglades Restoration Plan (CERP). Conversely, some of the projects considered by EDR as natural system restoration projects may in fact address the needs of the growing water demand in the region, leading to an overlap between the estimated expenditures for water supply and the natural systems.

While the DEP's Water Resource Implementation Rule states that the WMDs must expeditiously implement all adopted recovery or prevention strategies,[62] there is no generally applicable target date mandated by law to achieve the adopted MFL. Only recovery or prevention strategies for Outstanding Florida Springs (OFSs)[63] are required to contain 5-year, 10-year, and 15-year targets, with achievement of the adopted MFL to occur no later than 20 years after adoption of the strategy.[64] Without a required timeframe to achieve MFLs, the timing of the nearly $79 million in state expenditures is a decision for policy makers.

[See table on following page]

[62] Fla. Admin. Code R. 62-40.473(7).
[63] An "Outstanding Florida Spring" is defined as "all historic first magnitude springs, including their associated spring runs, as determined by the department using the most recent Florida Geological Survey springs bulletin, and the following additional springs, including their associated spring runs: (a) De Leon Springs; (b) Peacock Springs; (c) Poe Springs; (d) Rock Springs; (e) Wekiwa Springs; and (f) Gemini Springs. § 373.802(4), Fla. Stat.
[64] § 373.805(4), Fla. Stat.

Table 3.8.1 Projects Associated with Natural System Restoration

Regions	MFL RPS Supported, if Applicable	Project Status	Number of Projects	Project Total (million $2022)	Project Total in EDR Expenditure Forecast (million $2022)
CFWI	Restoration outside MFL RPS	RWSP or RPS Option Only	1	$7.92	$7.92
		Total for the region	**1**	**$7.92**	**$7.92**
NFRWSP	Brooklyn and Geneva Recovery Strategy	Construction/Underway	2	$68.20	$34.10
	Brooklyn and Geneva Recovery Strategy	Design	2	$8.86	$8.86
	Brooklyn and Geneva Recovery Strategy	RWSP or RPS Option Only	3	$61.06	$61.06
	LSFIR Recovery Strategy	Construction/Underway	4	$14.94	$7.47
	LSFIR Recovery Strategy	Design	3	$8.38	$8.38
	LSFIR Recovery Strategy	On Hold	1	$1.14	$1.14
	LSFIR Recovery Strategy	RWSP or RPS Option Only	34	$175.18	$175.18
	Silver Springs Prevention Strategy	Construction/Underway	1	$0.07	$0.03
	LSFIR Recovery Strategy	RWSP or RPS Option Only	2	$17.82	$17.82
	Restoration outside MFL RPS	RWSP or RPS Option Only	1	$3.02	$3.02
		Total for the region	**53**	**$358.67**	**$317.06**
SJR – CSEC	Silver Springs Prevention Strategy	Construction/Underway	2	$18.10	$9.05
	Silver Springs Prevention Strategy	Design	2	$2.26	$2.26
	Silver Springs Prevention Strategy	RWSP or RPS Option Only	2	$50.06	$50.06
	Volusia Recovery and Prevention Strategy	Construction/Underway	4	$26.58	$13.29
	Volusia Recovery and Prevention Strategy	Design	1	$0.86	$0.86
	Volusia Recovery and Prevention Strategy	RWSP or RPS Option Only	6	$130.32	$130.32
	Volusia Recovery and Prevention Strategy	RWSP or RPS Option Only	1	$5.98	$5.98
		Total for the region	**18**	**$234.16**	**$211.82**
Statewide (sum of the region)			**72**	**$600.74**	**$536.80**

Note: This Table does not include Everglades Restoration projects since the Comprehensive Everglades Restoration Plan (CERP) is discussed in Chapter 7.

Other Projects Potentially Intended for Natural System Protection and Restoration

In addition to the projects linked to the MFL RPS, EDR assumed that the natural system protection and restoration goals can be met with the following projects that are currently in design, construction / underway, or on hold: (a) projects classified as "Reclaimed Water (for groundwater recharge or natural system restoration)", and (b) projects where existing supplies are already sufficient for meeting projected future demands (*i.e.*, projects in the regions with no inferred water supply shortage identified in Table 3.8.3).

Seven "Reclaimed Water (for groundwater recharge or natural system restoration)" projects are currently being implemented in three planning regions, with the total project expenditures of $15.81 million (Table 3.8.2). Based on the completed groundwater recharge or natural system

restoration projects, the state funds, on average, account for 29.47% of the project expenditures (with WMDs covering 35.26%). Therefore, for the projects currently in design, construction/underway, and on hold, the state funding can be estimated at $4.66 million (or $15.81 x 0.2947).

Table 3.8.2 Expenditures for "Reclaimed Water (for groundwater recharge or natural system restoration)" Projects Currently in Design, in Construction / Underway, or on Hold

Regions	Number of Observations	Project Total in EDR Expenditure Forecast (million $2022)
CFWI	2	$0.89
SR – West	1	$3.35
SW – TB	4	$11.58
Statewide (sum of the regions)	**7**	**$15.81**

Next, the projects currently being implemented in the regions that have sufficient existing supply are considered. The total implementation expenditure for these projects is $332.14 million. Based on past projects, the average share of state funding for such projects is 14.65%. Therefore, EDR expects that the future state funding for the projects in the regions with no inferred water supply shortage is $48.66 million.

Table 3.8.3 Expenditures for Projects Currently in Design, in Construction / Underway, or on Hold in the Regions with No Inferred Water Supply Shortage

Regions	Number of Observations	Project Total in EDR Expenditure Forecast (million $2022)
NW – Other	1	$4.53
SW – TB	4	$327.61
Statewide (sum of the regions)	**5**	**$332.14**

3.9 Total Projected Expenditure

Overall, ensuring that sufficient water is available for natural systems is projected to require an investment of $884.75 million, with $131.96 million (approximately 14.92 percent) being covered by the state funds (Table 3.9.1). In addition, the expenditure to address the 2040 inferred water supply shortage is projected at $2.041 billion, with the estimated state share being $382.83 million. Between the two initiatives, by 2040, $2.926 billion is needed,[65] with the state covering $514.79 million (Table 3.9.2). In the 2022 Edition, the total for both initiatives was reported as $2.333 billion with a state share of $217.57 million. The difference between the forecasts is caused by updates to the DEP project database, more granular identification of natural system restoration projects, and methodological changes governing how EDR estimates the timing of project expenditures.

[65] Assuming that the MFL RPS projects are implemented by 2040.

Table 3.9.1 Projected Expenditures to Ensure that Sufficient Water Is Available for Natural Systems (million $2022)

Expenditure	MFL RPS projects	Reclaimed water for groundwater recharge or natural system restoration	Projects in the regions with no inferred water supply shortage	Total
Total expenditures	$536.80	$15.81	$332.14	**$884.75**
State share	$78.64	$4.66	$48.66	**$131.96**

Table 3.9.2 Total Projected Expenditures by 2040, million $2022

Expenditures	Addressing Inferred Water Supply Shortage*	Providing Water for Natural Systems	Overall Total
Total expenditures	$2,040.88	$884.75	**$2,925.63**
State share of expenditures	$382.83	$131.96	**$514.79**

* Considering the average between the less and more expensive scenarios.

3.10 Development of EDR's Pilot Model

To facilitate the expenditure forecast, EDR is in the process of producing an independent statewide water use forecasting model that reflects the official consensus estimating conference results[66] as well as continually updated EDR outlooks on Florida's demographics and economic conditions. This will enable on-demand fiscal simulations of various economic, demographic, and climate scenarios using the latest data. With significant updates to the demand model since the previous Edition of this report, EDR's water use projections by region differ considerably from last year. However, EDR's results statewide are similar to the previous Edition. These results are compared to the WMDs' projections to identify significant differences that may prompt additional research prior to submitting EDR's pilot model for peer-review. Submission of peer-review is still expected in the 2023-24 fiscal year, with more robust results first being reported in this Edition.

The following improvements in EDR's pilot model have been implemented relative to the model described in the 2022 Edition:

- *Inclusion of a more extensive county-level water use history*: EDR now populates the pilot model with the annual 1991 through 2020 history of water withdrawals, as opposed to the annual 1991 through 2018 dataset used for the previous edition of this report.
- Since the water use did not follow the same pattern among counties, separate models were developed for like groups (clusters) of counties. In this report, EDR used the Clustering approach to group the county-level *PS, DSS, L/R, and CII* water use history into seven groups. Each group has a unique forecasting model to better reflect its water use pattern. Second, EDR used a Fixed Effects (FE) technique for modeling water use, as opposed to

[66] The Economic Estimating Conference develops official projections related to the national and state economy, while the Demographic Estimating Conference develops official information concerning the population (§ 216.136, Fla. Stat.). General provisions for the Consensus Estimating Conferences are defined in § 216.134, Fla. Stat. Specifically, the Consensus Estimating Conferences are within the legislative branch. The membership of each estimating conference consists of principals and participants. The principals of each conference are the professional staff of the Executive Office of the Governor designated by the Governor, the coordinator of EDR, the professional staff of the Senate designated by the President of the Senate, and the professional staff of the House of Representatives designated by the Speaker of the House of Representatives.

the Ordinary Least Square (OLS) technique used for the 2022 Edition. The FE technique was used to control for unobservable or unmeasurable factors such as cultural, economic, and demographic effects or differences in water use patterns across counties due to regulations and climate conditions. That is, the FE technique allows users to account for individual (county) heterogeneity. Appendix A.7 provides a thorough and detailed explanation of EDR's current pilot model.

Other adjustments made by EDR, as compared with the 2022 Edition:

a. Water withdrawals and reclaimed water use are combined for each county to develop beneficial offset coefficients. Reclaimed water sources currently supply a relatively small share of the total water use in the state; therefore, the effect of the beneficial offset coefficient on the total water demand forecast is small. Still, EDR combined the total reclaimed water flow reported in DEP's Reuse Inventory Database and Annual Report[67] with the history of WMDs' and USGS's water use in order to capture any long-term changes in water use.
b. EDR updated the PG water use forecast using the most recent release of water use data from WMDs.
c. EDR updated the AG water use forecast to incorporate ninth and most recent release of the Florida Statewide Agricultural Irrigation Demand (FSAID) developed by DACS.[68]

EDR's pilot water use model can now help explore the effects of weather, demographic, and economic variables on water demand and assist in the development of the expenditure forecast. However, EDR emphasizes that further refinements and peer-review of the model are still needed.

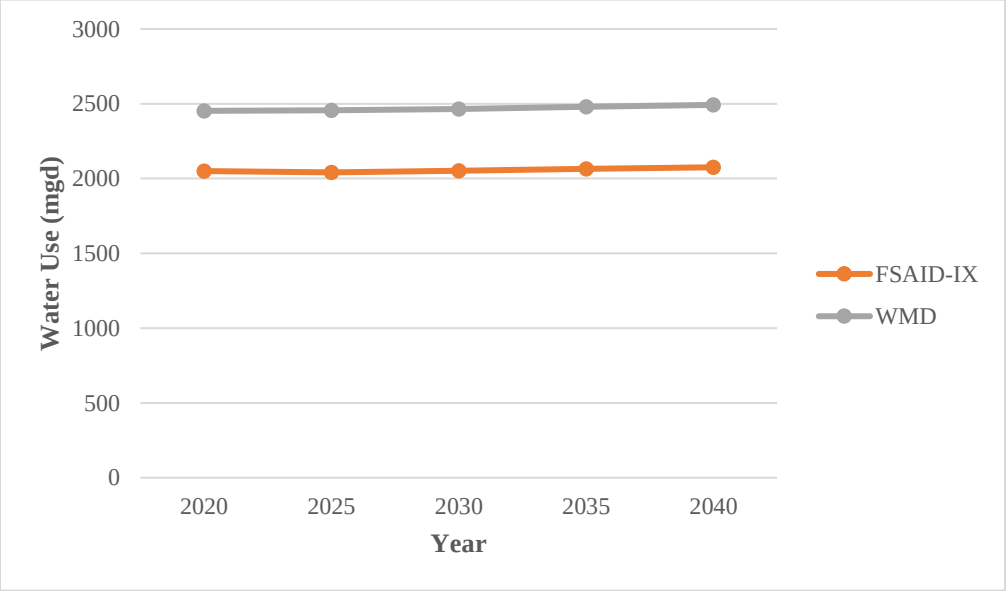
EDR's Pilot Model Treatment of Statewide Agricultural Water Use

For the AG water use forecast, EDR relied on the latest release of agricultural water demand projections developed by DACS. The DACS geodatabase, referred to as the Florida Statewide Agricultural Irrigation Demand (FSAID), was developed in response to Section 570.93, Florida Statutes, which requires DACS to establish an agricultural water supply planning program. WMDs must consider the data provided by DACS as indicative of future water demands (Section 373.709, Florida Statutes). Referred to as FSAID-IX, the current FSAID model "…incorporates both agronomic and economic factors that affect irrigation water demand. The model's ability to capture the variation in water use by profitability across crops and within crops over time provides an enhanced estimate of future irrigation demands" (The Balmoral Group, 2022[69]). In addition to supplemental agricultural irrigation, FSAID also projects freeze protection irrigation, aquaculture, and livestock water use. Further, it differentiates the demand between average- and drought-year conditions.

[67] The definitions of the use categories differ between the USGS water withdrawal and DEP reclaimed water use databases, making the water use estimates from the two databases not entirely comparable.
[68] DACS. 2022. Agricultural Water Supply Planning. Available online at: https://www.fdacs.gov/Agriculture-Industry/Water/Agricultural-Water-Supply-Planning (Accessed November 2022.)
[69] The Balmoral Group. 2022. Florida Statewide Agricultural Irrigation Demand. Estimated Agricultural Water Demand, 2021 – 2045. Available online at: https://www.fdacs.gov/Agriculture-Industry/Water/Agricultural-Water-Supply-Planning (Accessed December 2022.)

The FSAID forecast meets EDR's needs by being annually updated, consistent among the water supply planning regions, and reliant on the most recent economic projections. For each water supply planning region, EDR uses average-year supplemental irrigation, freeze protection irrigation, aquaculture, and livestock water use reported in FSAID-IX for 2020, 2025, 2030, 2035, and 2040. The potential effect of conservation reported in FSAID is not accounted for by EDR, since for many regions, FSAID projections without conservation were already well below the projections available from the WMDs (see Fig 3.10.1).[70]

Figure 3.10.1 Statewide Agricultural Water Use Projections (mgd)



EDR's Pilot Model Treatment of PS, DSS, L/R, and CII Water Use

EDR's pilot model incorporates historical water use and economic and demographic indicator values to forecast water use for each county. These county forecasts are then allocated to the water supply planning regions using the population shares[71] for those counties split between water supply planning regions. However, the model's intended use is statewide expenditure projections, and, therefore, county forecasts are not presented in the main text of this report.

[70] Comparison of the water demand forecasts from WMDs and FSAID for various water supply planning regions is presented in Appendix A.7.

[71] Uses the methodology developed for EDR in BEBR's "An Analysis of Methods to Allocate BEBR's County Population Estimate and Projections to Water Management District Boundaries" (available from EDR upon request). The shares are based on Census Block population data from 2010. For blocks that are divided by a supply planning region's boundary, land area shares were used to split the block's population. See Appendix A.8 for additional details.

Historical Water Use

County-level ground and surface water withdrawals are available from the USGS for selected years between 1985 and 2015.[72] The USGS water use data is supplemented by data provided by the WMDs: NWFWMD (2016-2020), SRWMD (2015-2019), SWFWMD (1985-2020), SFWMD (2014-2020), and SJRWMD (1997-2021).[73] Further, EDR assumes that some of the reclaimed water flows reported in the DEP's Reuse Inventory Database and Annual Report[74] meets the demand in the categories traditionally classified as PS, DSS, CII, or L/R, and, should be accounted for in the historical water use dataset. The DEP Reuse Inventory Database and Annual Report, however, classifies water use categories differently than WSAs/RWSPs. EDR's approach to integrating the two water use classifications is summarized in Table 3.10.1. Overall, reclaimed water flow is estimated to account for a relatively small proportion of water use. Therefore, while it is important to address reclaimed water use, these assumptions likely have a small effect on the forecast, given that most of the water demand is still met by surface water or groundwater.

[See table on following page]

[72] USGS publishes statewide summary water withdrawal reports and related county data every five years. However, for selected counties, water withdrawal data are also available for the years between the 5-year summaries. EDR used the data from Microsoft Excel spreadsheets entitled "Historical Public Supply Data for 1950-2010" and entitled "Historical Water-Use in Florida" (available online at: https://www.usgs.gov/centers/car-fl-water/science/historical-water-use-florida; accessed January 2021.) These data were supplemented with the USGS report "Water Withdrawals, Uses, and Trends in Florida, 2015" by Richard Marella (available online at: https://pubs.usgs.gov/sir/2019/5147/sir20195147.pdf; accessed October 2021.) Note that for PS water use, the USGS identifies transfers for each county. Whether the transfer is import or export is described for 1985, 1990, 1995, 2000, 2005, 2010, and 2015 in summary reports published by the USGS. The transfers among counties were allocated to import or export following the pattern specified in the reports. It must be pointed out that there are slight differences in the definitions of water-use categories between USGS and WMDs, for example, in the threshold used to separate water suppliers into the PS or DSS categories. Since EDR models water demand in PS, DSS, L/R, and CII in the aggregate, these differences become irrelevant.

[73] For the counties split between WMDs, the water use from each WMD was summed for each year for which the data was available. If data were available from only one WMD, total county water use was treated as "missing." For counties partially or completely in SJRWMD, historical water withdrawals were based on the USGS data only. Further, for SRWMD, NWFWMD, and SFWMD, it was assumed that PS water transfers between counties are either accounted for or insignificant in the WMDs' data. For the SWFWMD, PS water transfers are explicitly identified in the district's data.

[74] EDR uses "Appendix D – Utilization" data from DEP's 1996-2021 reuse inventory database. The database is public information; however, EDR acknowledges that the database was initially requested from DEP by a University of Florida Research-Extension team to develop an extension publication.

Table 3.10.1 Assumptions Applied to Reuse Inventory Types and Subtypes

Reuse Inventory Type	Assumed Water Use Category	Notes
Residential irrigation	PS	-
Toilet flushing	PS	-
Fire protection	PS	-
Public Access Areas & Landscape Irrigation	PS and L/R	Specifically, EDR allocated to the PS category 60% of reuse water flow from "other public access areas" and "other" reuse subtypes.* In addition, 100% of the "Golf Course Irrigation" reuse subtype was assumed to be used for L/R.
Industrial	PS and CII	Within the Industrial type, only the "At Treatment Plant" subtype was considered. It was assumed to be equally split between the commercial-industrial-institutional self-supplied, public supply, and the water use internal for the treatment plants (*e.g.*, water to spray foam formed as a part of the treatment process). The internal water use was then disregarded from the analysis.
* "Other public access areas" subtype can include parks, athletic fields, schools, decorative water features, and cleaning roads and sidewalks. "Other" reuse subtype can include "decorative fountains, commercial laundries, cleaning of roads and sidewalks, vehicle washing, concrete making, and other permitted uses" (DEP 2022). Some of these activities may be met by either public supply or self-supply; they also may serve as treated wastewater disposal mechanisms. EDR attributed 60% of this reuse flow to the public supply category, rounded average of offset value reported for "Other public access areas" in Reuse Coordinating Committee and the Water Conservation Initiative Water Reuse Work Group (2003). References: (1) DEP. 2022. 2021 Reuse Inventory (available online at: https://floridadep.gov/water/domestic-wastewater/content/reuse-inventory-database-and-annual-report; Accessed October 2022); and (2) Reuse Coordinating Committee and the Water Conservation Initiative Water Reuse Work Group. 2003. Water Reuse for Florida Strategies for Effective Use of Reclaimed Water. Available online at: https://floridadep.gov/sites/default/files/valued_resource_FinalReport_508C.pdf (Accessed October 2022.)		

Economic and Demographic Indicators

EDR produces and updates multiple economic and demographic indicators characterizing the state's economy and population trends, and these indicators are used to develop the state's official forecasts. EDR also maintains a comprehensive database of the historical indicator values. Many of these indicators are significant predictors of water use, such as population, economic structure (*e.g.*, characterized by employment in various industries), and the total economic activity (*i.e.*, Florida's gross domestic product). EDR produces these forecasts for a 10-year planning period, and therefore, for this report, these forecasts are expanded using a linear trend to match the 20-year water supply planning horizon.

Many of EDR's economic forecasts are produced for the state as a whole. Water use, however, must be forecasted on the regional level to match the geography used for the existing water supply inferred from the WMDs' data. Therefore, for this report, EDR distributed the total statewide values of various economic indicators to individual counties. For this task, the counties' relative shares were estimated for each economic indicator using county historical and forecasted data from Woods and Poole Economics (2022).[75]

EDR used regression analysis to develop a model that can reasonably reproduce the Florida counties' historical water use variability. The model includes the following variables:[76]

[75] Woods and Poole Economics. 2022. Data Pamphlets for Any State, Region, or the U.S. Total. Available online at: https://www.woodsandpoole.com/our-databases/counties-metro-areas/data-pamphlets-state-region-us-totals/ (Accessed October 2022.)

[76] Various specifications of the model were examined, and the predictive powers for these specifications were compared using the adjusted R-squared values. Predicted water use was also visually compared with each county's historical water use to ensure the model does not materially misrepresent the history. Forecasted water use was also examined to ensure the model does not result in forecasted exponential growth in water use on the statewide or county levels. The statistical models described in this report are those that were judged as the best using these criteria. See Appendix A.7 for additional details.

- County population: population growth is a critical determinant of water use;[77]

- The proportion of the county population employed in accommodation and food services: tourists and visitors can significantly increase water use, especially in the PS and CII categories that include hotels and motels and other lodging and food service locations. While county historical visitor numbers are not available, employment in accommodation and food service sector can serve as a proxy reflecting fluctuation in visitation;

- The proportion of the county population employed in mining, manufacturing, and utility sectors: this value reflects the importance of industrial and mining activities in a county, which can be an important driver of CII water use;

- Total precipitation in spring months (i.e., March-May): the weather is a decisive determinant of water use, particularly in PS and L/R categories. Reduction in precipitation, especially in warm and relatively dry spring months, can increase total water use;[78]

- Time trend: this variable is intended to capture the effect of conservation and improving efficiency. For example, while the water use is expected to grow with population, this growth is expected to decelerate over time due to water use efficiency improvements.

Note that water demand can be related to these variables in a nonlinear fashion. EDR used log-transformation to transform this relationship into the form that can be captured by a linear regression analysis.

Comparison of Water Use Results in PS, DSS, L/R and CII

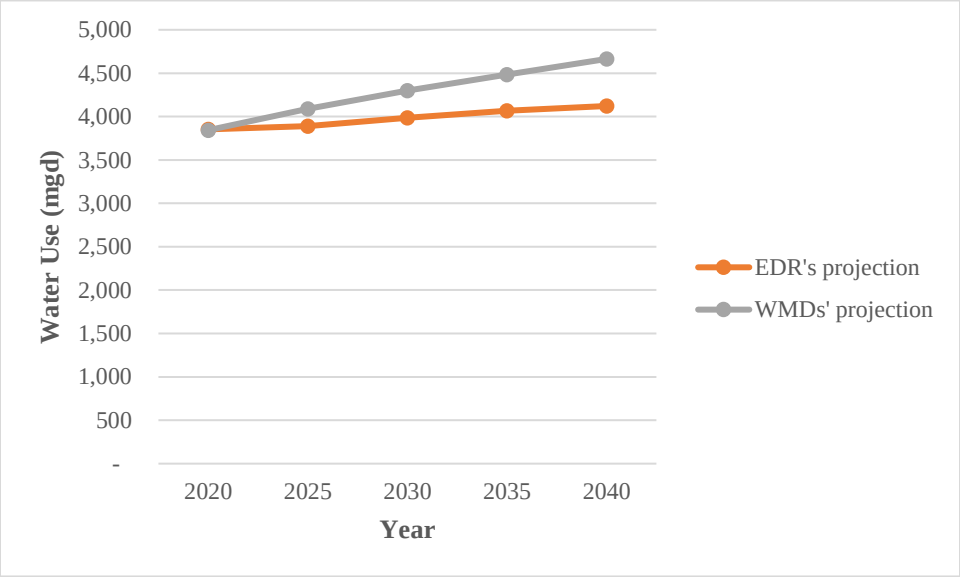
The WMD's projection and the EDR forecast are presented in Figure 3.10.2. EDR forecasts a continued increase in statewide water use; however, the rate of increase is lower than that projected by WMDs. One explanation can be the effect of water conservation included in the EDR forecast but not in the WMDs' demand Scenario 1 ("Baseline").

[See figure on following page]

[77] EDR also considered county population specifically in incorporated areas. The water use correlation with that population was smaller than seen for the total population in a county.

[78] EDR also examined the potential effect on water use of the total summer precipitation (June-August) and the average temperature in spring and summer months. However, neither of these variables had a statistically significant effect on the water use.

Figure 3.10.2 Statewide Projected Water Use in PS, DSS, L/R, and CII (mgd)



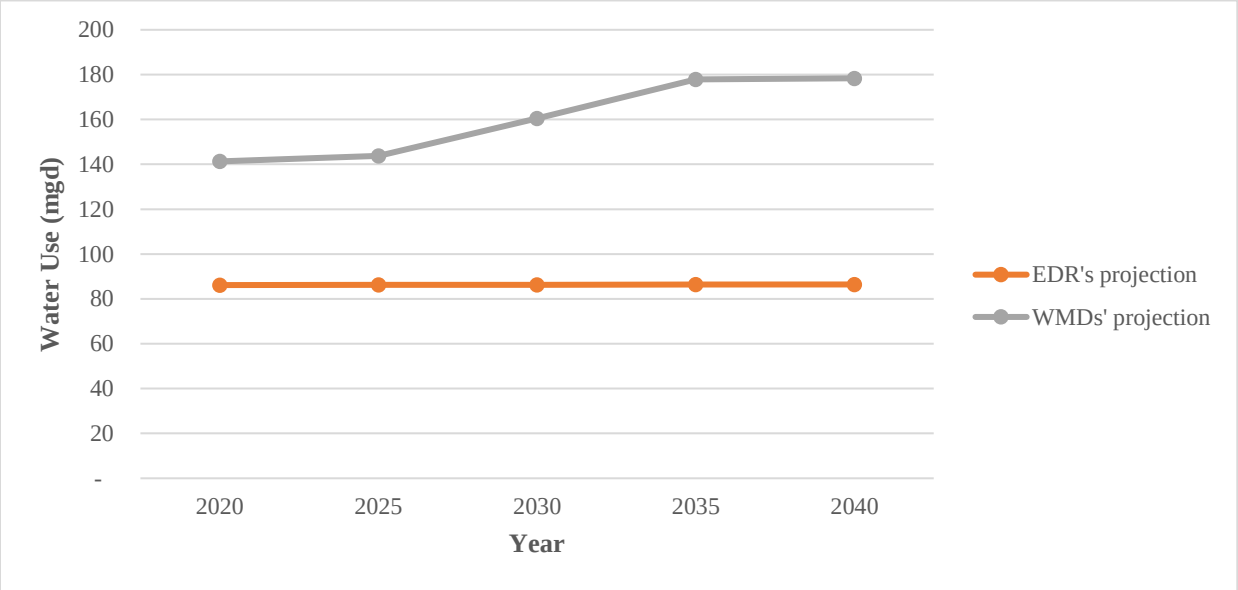
EDR's Pilot Model Treatment of PG Water Use

The discrepancy in the PG water use data from the USGS relative to the WMDs creates a significant barrier for developing EDR's PG water use model. The data provided by the NWFWMD, SRWMD, and SFWMD span two to three recent years only, and therefore, are insufficient for developing a 20-year water use projections for the EDR expenditure model. To cure this issue, EDR supplements the WMDs' data with information available from the USGS periodic water use reports; however, the data are not entirely compatible. WMDs focus on consumptive use, while the USGS reports water withdrawals that can include both consumptive use and withdrawal returned to the water source. To make the two data sources more compatible, EDR uses only freshwater withdrawals for closed-loop systems from the USGS reports (as opposed to the total freshwater withdrawals also reported by USGS). Still, for a sample of counties for which both the WMDs' and USGS' data were available, the water use reported by the two sources differed significantly, implying that additional data verification and clarification should be implemented.

An analysis of the USGS and WMD data shows zero PG water use in most counties.[79] The exceptions are 26 counties: Alachua, Bay, Citrus, DeSoto, Duval, Escambia, Hardee, Hernando, Jackson, Lake, Lee, Leon, Liberty, Manatee, Martin, Miami-Dade, Orange, Osceola, Palm Beach, Pasco, Polk, Putnam, St. Lucie, Suwannee, Volusia, and Wakulla. For these counties, water use is assumed to stay at the average historical use or is modeled using regression analysis.[80] A statewide forecast of PG water use is presented in Figure 3.10.3.

[79] These counties can still report water withdrawals for the PG category; however, these withdrawals are deemed to be irrelevant for the water supply planning process. For example, these counties may report significant volumes of saline water withdrawals. Since these withdrawals have a limited value in any alternative water use, EDR disregards these withdrawals from the analysis.
[80] For more details, see Appendix A.7.

Figure 3.10.3 Statewide Projected Water Use in PG (mgd)



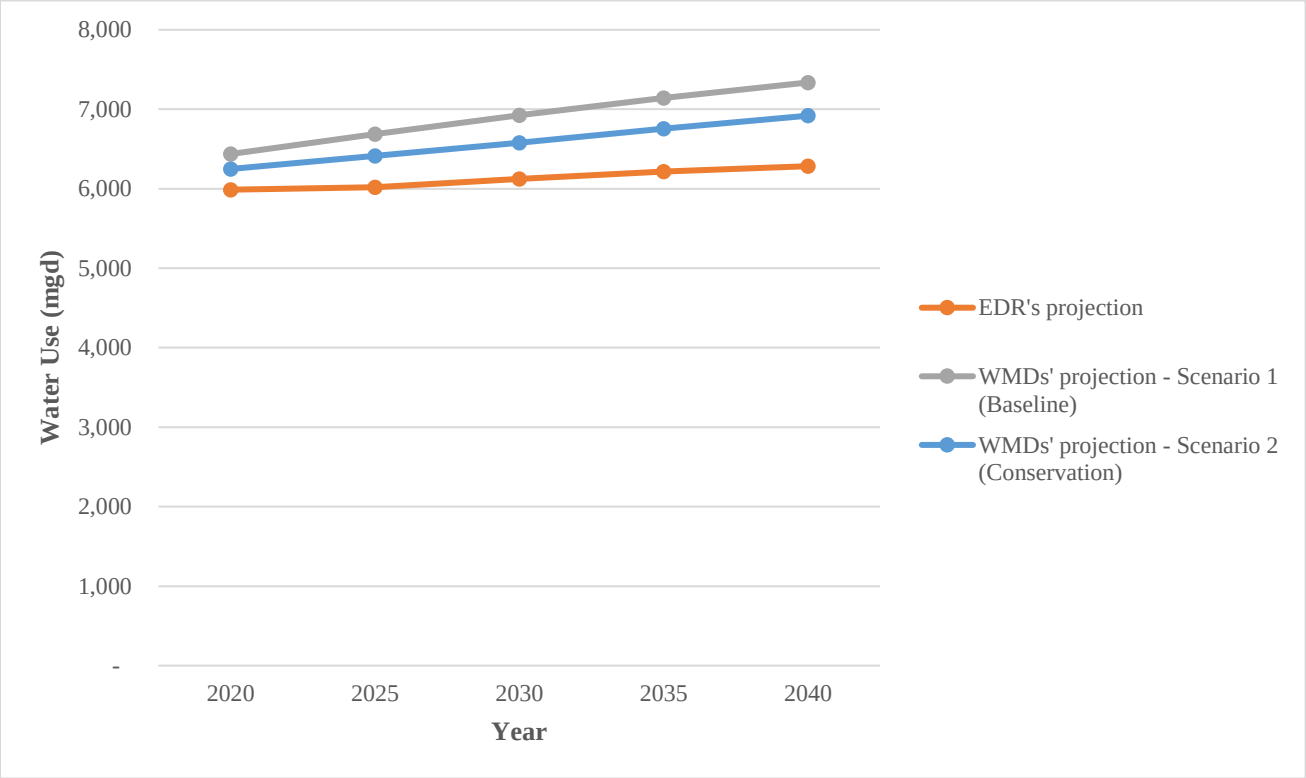
EDR's Pilot Model Water Use Summary

As presented in Figures 3.10.1, 3.10.2, and 3.10.3, the water use forecasts projected with EDR's pilot model are below those produced by the WMDs for the baseline scenario (Scenario 1) and the scenario with conservation (Scenario 2), as shown in Figure 3.10.4. Possible explanations for these differences include:

- Historical trends in water use efficiency improvements and water conservation are higher than those considered by the WMDs;
- EDR's forecast is based on updated population projections, which may be lower than those used in the WMDs' projections;
- Historical PG water use data used by EDR to develop the forecasting model are not adequate, and therefore, they do not allow accurate projections of the future water use;
- The AG water use forecast from FSAID-IX incorporated into the EDR statewide forecast is significantly below those developed by the WMDs.

Overall, while the EDR model and forecast presented in this edition is a significant improvement compared to the 2022 Edition, additional work and peer-review of the model are needed before EDR makes the decision to rely solely on this model to forecast expenditures. In the interim, both EDR's model based on the WMD projections and EDR's pilot model will run concurrently to produce expenditure forecasts.

Figure 3.10.4 Statewide Projected Water Use (mgd)



At a minimum, two issues need to be addressed to improve the forecast:

a. Analysis of both average year and drought water use scenarios (currently, only the average year conditions are considered); and

b. Examination of the determinants of water use efficiency improvements and water conservation (current forecast incorporates historical time trend for water use efficiency improvements, without considering potential investments needed to maintain or accelerate this trend).

[See table on following page]

Table 3.10.2 Total Water Use Forecast Produced by EDR's Pilot Statewide Water Use Model

Region	2020	2025	2030	2035	2040
NW – II	88.45	77.57	81.81	85.17	87.46
NW – Oth	291.46	250.88	252.94	254.47	254.88
SR – West	105.97	102.27	105.70	109.87	113.50
NFRWSP	581.62	601.33	614.40	625.98	632.67
SJR – CSEC	368.89	361.14	364.76	365.62	363.34
SW – N (excluding CFWI)	168.45	158.66	163.48	168.08	171.28
SW – TB	465.75	450.35	456.04	459.02	457.16
SW – H (excluding CFWI)	116.31	118.05	118.11	116.80	114.56
SW – S	314.46	334.92	344.86	352.04	356.96
CFWI	761.73	765.79	793.86	814.69	830.41
SF – LKB	120.08	122.27	124.60	127.62	130.87
SF – UEC	203.68	212.35	208.56	204.66	199.09
SF – LEC	1,776.07	1,793.06	1,816.52	1,842.07	1,872.13
SF – LWC	625.31	669.40	679.46	691.13	699.40
Statewide	**5,988.23**	**6,018.03**	**6,125.08**	**6,217.21**	**6,283.71**

EDR's Pilot Model Future Supply Shortage

EDR's pilot model uses inferred existing supply to estimate future supply shortages that should be addressed through new investments. The results confirm the conclusion made from the WMDs' water demand projections that additional water supply will need to be developed, although, the pilot model projects a smaller difference of 192.33[81] mgd between the forecasted demand and estimated water supply by 2040. In contrast, the results based on the WMDs' 2040 water use projections suggest a larger shortage of 372.97 mgd. The difference is due to the lower water use forecasted by EDR's pilot model, as compared to the WMDs' projections. EDR's pilot model indicates that water supply investments are needed in North Florida (NFRWSP) and SWFWMD (the Heartland and Southern regions). There are several additional regions with inferred supply shortages, but after accounting for water projects in design, construction and on-hold, those issues are resolved. The potential 2040 supply shortages using both methodologies can be found in Table 3.10.3.

[See table on following page]

[81] See Appendix A.7 for a comparison of the EDR's forecast with the WMDs' estimates and projections.

Table 3.10.3 2040 Supply Shortage Estimates – EDR's Pilot Model and EDR Results based on WMD Data (mgd)

Regions	Inferred Supply Shortage		Water by the Projects in Design, Construction, and On Hold, mgd	Remaining Inferred Supply Shortage by 2040, mgd**	
	Using WMD	Using EDR Pilot		Using WMD	Using EDR Pilot
(1)	(2)	(3)	(4)	(5)=(2)-(4)	(6)=(3)-(4)
NW – II	5.00	-	7.15	-	-
NW – Oth	-	-	54.68	-	-
SR – West	5.19	-	1.10	4.09	-
NFRWSP	140.3	77.40	9.38	130.92	68.01
SJR – CSEC	51.10	-	31.99	19.11	-
SW – N (excluding CFWI)	11.55	1.10	3.09	8.46	-
SW – TB	-	-	12.07	-	-
SW – H (excluding CFWI)	-	18.39	0.08	-	18.31
SW – S	-	77.63	25.81	-	51.82
CFWI	95	17.82	52.30	42.70	-
SF – LKB	0.01	-	0.05	-	-
SF – UEC	6.00	-	45.24	-	-
SF – LEC	49.55	-	0.65	48.90	-
SF – LWC	9.27	-	9.90	-	-
Statewide	**372.97**	**192.33**	**253.48**	**254.18**	**138.15**

EDR's Pilot Model Expenditure Forecast

In order to develop an expenditure forecast that addresses the remaining inferred supply shortage, certain assumptions regarding the projects must be made. These assumptions include the choice of project types and sizes for each region where water use is projected to exceed existing supplies. As discussed in Appendix A.9, water supply development scenarios can be derived from the past projects and future project options included in the DEP project appendix and a recent DEP assessment[82] of this issue. In that assessment, reclaimed water is ranked as a "high confidence" water source for all of the relevant regions. A similarly high rating is assigned to surface water and brackish groundwater in the SW – S and SW – H, and to groundwater recharge in the NFRWSP.

[82] DEP. Undated. An Assessment of Viable Alternative Water Supply Resources and Critical Funding Needs. Presented by the FDEP pursuant to Executive Order 19-12 and Chapter 2019-115, Laws of Florida.

Implementation Costs per Unit of Project Capacity

The EDR model presented in Appendix A.9 can predict the project costs, given specific project types, sizes, implementation region, and status. Assessment of the unit project costs for the NFRWSP are discussed in the previous sections. Following a similar approach, reclaimed water project costs for SW – H (outside CFWI) are estimated at $19.59 million per mgd. Reclaimed water projects in the SWFWMD (outside CFWI) tend to be more expensive because the average size of the reclaimed water projects in the SW – H is small, which increases the cost per unit of project capacity. In turn, in the SW – S, surface water projects are large (on the median), and with an average cost estimated at $4.20 million per mgd. Brackish groundwater projects are generally more expensive (estimated at $5.48 million per mgd, on average), and reclaimed water projects are even more so (estimated at $11.85 million per mgd, on average).

Statewide Expenditure Forecast to Ensure Sufficient Water is Available

The unit cost for various project types and regions is combined with the estimates of the potential future supply expansion needs (from the pilot model) and the cost of projects already in design, construction/underway, and on hold to generate low − and high − cost expenditure scenarios. At the statewide level, the project expenditures estimated using EDR's pilot model (*i.e.*, $1,360.61 million by 2040) are considerably lower than those estimated using the WMD's water demand projections ($2,040.88 million by 2040). Greater differences appear among the expenditure projections at the regional level, with EDR's pilot model projecting needed expenditures for SW – H (outside CFWI) and SW – S where the WMD's demand estimates do not. In contrast, the WMD's demand estimates point to potential supply expansion needs in SR – West, SJR – CSEC, SW – N (excluding CFWI), SF – LEC and CFWI where EDR's pilot model does not. Since EDR focuses on the statewide expenditure forecast, the pilot model's accuracy regarding specific regional expenditure predictions needs further discussion with the WMDs and DEP. These results are shown in Table 3.10.4 below.

As a placeholder, the expenditure forecast for the natural systems from Section 3.8 is included in Table 3.10.4 below. While EDR's pilot water use model is not expected to affect the general approach to the natural system expenditure estimates (which is based on the sum of the expenditures for the projects identified by the WMDs), several issues still need to be addressed. Most importantly, how do supply estimates relate to the needs of the natural system restoration? EDR's pilot model seems to project water demand exceedance in regions considered by the WMD as having sufficient water supply. Does this mean that the projects currently in design, construction/underway, or on hold in these regions are intended for natural system restoration? In many regions, MFLs have already been developed. In the absence of corresponding RPSs, it is not clear if MFLs should be used by EDR to indicate that the existing demand in the region already exceeds (or will likely exceed) the existing supply. Overall, the link between the demand projections, existing supply estimates, and the water needs for the natural systems must be further discussed and clarified.

[See table on following page]

Table 3.10.4 Statewide Expenditures forecast, Total for 2020-2040, Pilot Model (million $2022)

Planning Regions	Projects in Design, Construction, and On Hold (million, $2022)**	Project Meet Remaining Inferred Shortage (million, $2022)		All Projects (million $2022)		
		Less expensive	More expensive	Less expensive	More expensive	Average
(1)	(2)	(3)	(4)	(5)	(6)	((5) + (6)) / 2
NFRWSP	$10.36	$67.33	$608.73	$77.69	$619.09	$348.39
SW – H*	$0.64	$358.73	$358.73	$359.36	$359.36	$359.36
SW – S	$236.98	$217.65	$614.09	$454.63	$851.07	$652.85
Statewide (sum of regions)	$247.98	$643.71	$1,581.54	$891.69	$1,829.52	$1,360.61
Natural Systems				$884.75	$884.75	$884.75
Total Expenditure				**$1,776.44**	**$2,714.27**	**$2,245.36**

* excluding CFWI. ** Total expenditure forecast for the regions with no inferred shortage are estimated to be $1,056.22 million, bringing the statewide total to $1,304.20 million ($2022).

3.11 Next Steps and Recommendations

In the future, EDR plans to continue enhancing the water use forecasting model. Yet, even the current pilot model allows for the following insights:

- EDR's pilot model results in a total expenditure forecast that is, on the whole, lower than the forecast reported in Table 3.9.2 (*i.e.*, the forecast based on the WMDs' demand projections). The key difference is which regions are predicted to have inferred future supply shortages because the project costs vary significantly between regions (see Tables 3.6.4 and 3.6.5). While EDR is required to produce a statewide expenditure forecast, differences at the regional level determine the magnitude of the statewide expenditures.

- The EDR pilot model calls for making investments in alternative water supplies sooner than the forecast based on the WMD data. In fact, for the regions with potential future supply shortages, the bulk of the water supply expenditures are needed in the 2020s.

- Significant improvements in water use efficiency and conservation are forecasted by EDR's pilot model. While some of these improvements can be costless (*i.e.*, passive conservation), others will require significant investments. In the future, the expenditures needed to maintain or accelerate water use efficiency improvements and water conservation should be further explored.

- A critical area for improvement is a better understanding of "beneficial use volume for the total reclaimed water flow" as used in DEP's reclaimed water use inventory and database. Furthermore, EDR's pilot model forecast is based on the assumption that the existing reclaimed water use is precisely equal the available reclaimed water supply. Additional analysis is needed to verify the assumption and strengthen the evaluation of existing reclaimed water supply.

- Expenditures for natural system protection and restoration should be better integrated into EDR's pilot model in the future. An initial step in this process is a discussion of the projects currently in design, construction/underway, or on hold in the regions with no "Water Needed" identified in DEP (2022a).

- The 2023 Edition includes a limited discussion of drought preparedness expenditures. The discussion of drought impacts on future water demand, existing supplies, and natural systems should be expanded in future editions.

Overall, EDR will continue enhancing the water use and expenditure forecasting model in preparation for submission for peer-review.

Appendix A: Additional Resources Regarding Water Supply and Demand Modelling and Expenditures Forecasts

The following are the appendices related to Chapter 3.

A.1 Linear Trend for 2040 Water Supply Projections for the SR – West and NFRWSP Regions

Figure A.1.1 Linear Trend for 2040 Water Supply Projections for NFRWSP

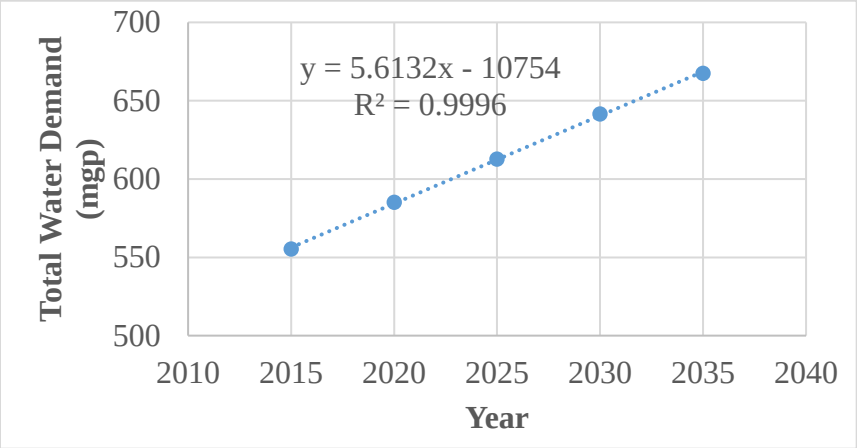
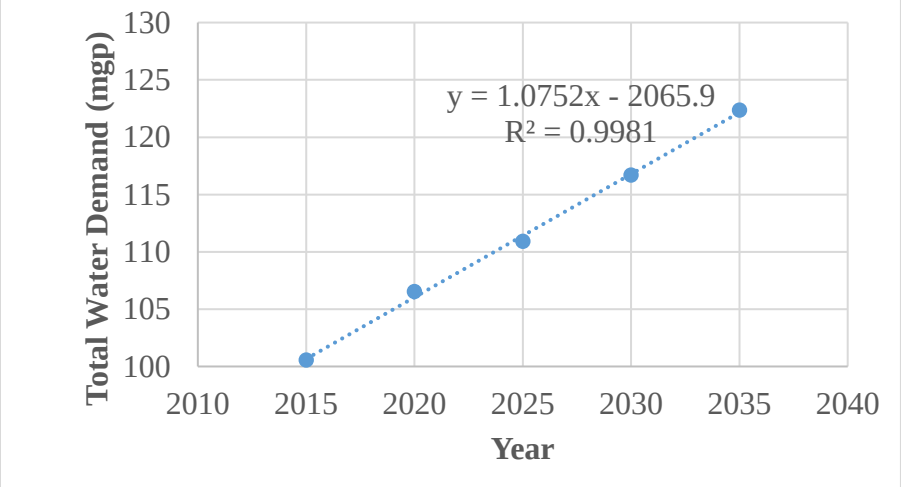


Figure A.1.2 Linear Trend for 2040 Water Supply Projections for SR – West



A.2 Methods Used by WMDs to Project Water Use

Section 403.928, Florida Statutes, requires EDR to include a compilation of projected water supply and demand data developed by each water management district (WMD) and to note any significant differences among the methods used by the WMDs to calculate the data.

The DEP and WMDs collaborate to ensure statewide consistency in the approaches used in long-term water supply planning. A vital example of this collaboration is the statewide Format and Guidelines for Regional Water Supply Planning (DEP et al. 2019[83]). The Guidelines define the water use categories, describe various water use estimation and projection methods, and discuss the indicators presented on the statewide level in the DEP's 2018 Annual RWSP Summary. Furthermore, the SJRWMD, SFWMD, SWFWMD, DEP, and other agencies and stakeholders collaboratively develop the regional water supply plan for the CFWI, emphasizing the coherence in planning methods among the three participating WMDs. Another example of collaboration between the WMDs is the NFRWSP planning, with consistent estimation and planning approaches applied by the SRWMD and SJRWMD. Despite these efforts to increase the planning approaches' coherence, differences in the specific methodologies used by WMDs remain. These differences are driven by the historical practices in each WMD, including the availability of relevant data and stakeholder collaboration processes established in each planning region. Similarities and differences in the approaches used by the WMDs are discussed in the subsections below.

Public Supply (PS)

As discussed in DEP et al. (2019, p. 25), "Districts should use their best professional judgment to utilize the best available method and data to develop demand projections. Actual methodologies used are documented in each RWSP."

For the PS category, the WMDs estimate water use for the suppliers' service area with an allocation above 0.1 mgd.[84] The estimated base year water use is typically equivalent to a utility's reported pumpage. For future demand projections, the WMDs rely on the "unit water demand" approach where a "unit water demand coefficient" is multiplied by the number of users.[85] For public supply, "the number of users" is the number of people served by the water utilities, and the "unit water demand coefficient" is the per capita use:[86]

[83] DEP, NWFWMD, SFWMD, SWFWMD, SJRWMD, and SRWMD. 2019. Format and Guidelines for Regional Water Supply Planning. 42pp.
[84] The NWFWMD includes selected small public supply systems, as discussed below.
[85] For a description of various long-term water demand forecasting methods, see Rinaudo (2015). https://link.springer.com/chapter/10.1007/978-94-017-9801-3_11
[86] Note that in the SFWMD, this approach is modified. SFWMD is the only district that relies on net per capita water use, rather than the gross per capita. The net per capita use excludes the water losses in the treatment process. As a result, in the SFWMD, the total water use in PS is estimated as a product of three terms: net per capita water use, the number of people, and a ratio to account for the treatment losses.

Figure A.2.1 Total Water Use in PS Service Area Equation

While this general approach is similar among all the WMDs, the specifics vary as follows:

- The WMDs use different definitions of the population served by water suppliers: the SWFWMD (excluding CFWI portion) and NWFWMD explicitly account for non-permanent populations. The other WMDs focus on the permanent population only.

- All of the WMDs utilize the BEBR county population projections in developing the PS forecasts; however, since the WMDs develop WSAs/RWSPs at different times, the population estimates utilized by WMDs also vary. The publication years for the population estimates utilized by the WMDs range from 2015 to 2020 (with the base population year being 2014 through 2019).

- The methods used to allocate the BEBR county population projections to the future utility service areas vary among the WMDs, with some districts utilizing simple percent-share methods. In contrast, others rely on complex parcel-level models of future development.

- Although each WMD does it differently, most of them account for treatment losses in PS water use projections. An exception is SWFWMD, which excludes the treatment losses from their per capita water use calculations.[87]

- All of the WMDs estimate per-capita water use based on the average for the past year(s). However, the number of years considered ranges from one to five years.

- In line with DEP et al. (2019), the WMDs include the public suppliers that allocate 0.1 mgd or more in the PS category. There are, however, important variations with two districts including certain systems with smaller allocations (see Table A.2.1).

Below, each component of the PS estimation formula is discussed in detail, including public suppliers included in the category, per capita use rate calculations, population served analysis and utilities' population forecasting methods.

[87] As discussed in SWFWMD (2014, p. 4), "water withdrawn for public supply goes through treatment procedures that cause water losses" (p. 7). For example, for the desalination system, water treatment losses "may range from 15 to 50 percent" (SWFWMD 2020, p. 15).

References:
SWFWMD. 2014. Southwest Florida Water Management District 2012 Estimated Water Use Report.
SWFWMD. 2020. Southwest Florida Water Management District 2018 Estimated Water Use Report.

PS: Public Suppliers Included in the Category

The WMDs are generally consistent in considering the systems with at least 0.1 mgd of permitted quantity or average pumpage in PS. One key difference is that the SWFWMD includes all public suppliers (even those smaller than 0.1 mgd), as well as domestic self-supply and residential irrigation wells, in the PS category. This SWFWMD aggregate category is broken down in DEP (2020a) to be more consistent with the other WMDs. Additionally, the NWFWMD includes some small public suppliers in the PS category. Specific definitions used by the WMDs are presented in Table A.2.1 below.

Table A.2.1 Definitions of the Public Supply Category

Region	Definition
NWFWMD	Utility systems that have 0.1 mgd and above annual average daily rate. Systems below the 0.1 mgd threshold are included if included in regulatory audits, if water use may meet the threshold during the future planning horizon, or if multiple small systems within a county collectively meet the 0.1 mgd threshold.
SRWMD and NFRWSP	All large municipal, public, and private systems supply potable water to the public from a central water supply system for human consumption and other uses and have average annual permitted quantities of 0.1 mgd or more.
SWFWMD (excluding CFWI)	DSS, water supply permittees supplying residential homes, and residential irrigation wells are included. Specifically, DSS is defined as residential dwellings systems provided water from a dedicated, on-site well and are not connected to a central utility. Water supply permittees with permitted water use for residential single-family, multi-family, and mobile homes are also included in the PS category. Finally, residential irrigation wells are on-site wells that serve the outdoor needs of individual residential dwellings connected to a central water utility system for their indoor needs.
SFWMD (excluding CFWI)	The category includes potable water supplied by water treatment plants with projected average pumpage of 0.1 million gallons per day (mgd) or greater.
CFWI	The category includes water provided by any municipality, county, regional water supply authority, special district, public or privately-owned water utility, or multijurisdictional water supply authority for human consumption and other purposes with average annual permitted quantities 0.1 mgd or greater.

Calculation of Per Capita Water Use

Four key differences are identified among the WMDs' approaches to calculating the per capita use. The first difference concerns the calculation method. Specifically, all but one of the WMDs utilize gross per capita use rates in their PS demand projections. The gross per capita rate (in gallons per capita per day, gpcd) is calculated as the utility's gross water use divided by the population served. Gross utility water use is equal to water withdrawals minus export plus import. The exception is the SFWMD, where the per capita use rate is based on net (finished) water volume and corresponding service area populations. Net (finished) water is the volume delivered to end-users after accounting for treatment losses. Once the net (finished) demand is forecasted for each PS service area, the SFWMD projects the gross water withdrawals by multiplying the net (finished) demand by the related raw-to-finished ratios.

The second difference among the WMDs also relates to the consideration of treatment losses. The SWFWMD excludes treatment losses from the utility's gross water use when calculating the per

capita rate, while all the other WMDs include treatment losses. Third, the definitions of the population in utility service areas differ among the WMDs. The NWFWMD and SWFWMD account for the non-permanent population, while the other WMDs only focus on the permanent population. Finally, WMDs use a different number of data years to calculate the per capita use. While most of the WMDs utilize the five-year average gross per capita use rate, the NWFWMD applied a one-year rate. Both plan to apply a five-year average rate in the future (see Table A.2.2).

Table A.2.2 Periods Used by WMDs to Calculate the Per Capita Use Rates for PS

Region	Period of Estimation	
	Number of years	Time period
NW – II*	1	2015
NW – Oth*	1	2015
SR – West	5	2010-2014
SWFWMD	5	2011-2015
SF – LKB	5	2013-2017
SF – UEC	5	2015-2019
SF – LEC	5	2012-2016
SF – LWC	5	2010-2014
NFRWSP	5	2010-2014
CFWI	5	2011-2015
CSEC	5	2011-2015

* The WMD is planning to use 5-year average in the future.

Definition of the Population Served by Public Suppliers

As mentioned above, the "population served" definition is critical for estimating the per capita water use rate. While the SFWMD, SJRWMD, and SRWMD focus on the permanent population only, the NWFWMD and SWFWMD explicitly account for the permanent and non-permanent populations. Explicit modeling of the non-permanent population can allow the WMDs to analyze the effect of significant tourism and seasonal population fluctuations and have more accurate per capita rates at the utility, county, and regional levels. For example, such a model would capture the changes in tourism in coastal areas due to prolonged harmful algal bloom events.

In the future, it will be essential to identify the areas where the non-permanent population can have a significant impact on the water use projections. For example, for the SWFWMD, the permanent population is projected to be 6.672 million people in 2040, while the total functional population is estimated at 7.400 million people (*i.e.*, the non-permanent population accounts for approximately 11% of the entire functional population). The share of the non-permanent population in the NWFWMD districtwide is lower than that in the SWFWMD. Overall, the relative difference can be significant for specific utilities, urban areas, counties, and water supply planning regions. For a summary of non-permanent population treatment, see Table A.2.3.

Table A.2.3 Treatment of Non-Permanent Population in RWSPs and WSAs, by WMD

WMD	Non-Permanent Population
NWFWMD	The *seasonal population* is accounted for by adjusting the permanent county population (from BEBR medium estimates) with seasonal rates. In 2014, a study commissioned by the NWFWMD produced seasonal population rates for each public supply utility, the DSS use category in each county, and countywide averages. The seasonal population rates are then estimated as one-half of the seasonal population ratio to the permanent population (to account for the length of stay of seasonal residents in the area). Seasonal population rates were sometimes refined following a review of public supply utility outreach results. The resulting seasonal rates adjust the BEBR medium county 2015 population estimates and 2020-2040 future population projections.
SWFWMD (except CFWI)	Seasonal, tourist, and commuter populations are estimated, and in combination with the permanent population, they comprise the "functional population," which is then used to calculate the per-capita water use. The seasonal population is calculated from the average emergency room admission rate for 2009-2011 (third quarter compared with the first quarter of the year) for the ages 45-74 years old cohort, given the average likelihood of being admitted to the emergency room of 2.23%. These estimates of the seasonal population are then adjusted to represent a typical amount of time spent by seasonal residents in Florida (from 44% to 57% of the year, depending on beach destination). Next, the tourist population, based on the 1997-2016 county-level lodging room data from the Florida Department of Business and Professional Regulation, is combined with the county-level unit occupancy and party size data, with short-term unit rentals also taken into account. The tourism population projections are based on the average of two methods: (1) extrapolating linear trend and (2) county employment projections from Woods and Poole Economics. Finally, to estimate commuters' ratio to permanent population, the 2006-2010, American Community Survey data are used. Adjustments are made for the hours and days per week spent by commuters in the area (note that only a positive commuter population was included in the analysis). The commuter and tourist population estimates were adjusted to account for their water use, as compared with the full-time residents, assuming 132 gal/day for residential water use, but only 69.3 gal/day for indoor use.
Other WMDs	The non-permanent population is not explicitly considered in the per capita use estimates.

Estimation of the Permanent Population for Utility Service Areas

Section 373.709, Florida Statutes, contains guidance for the population projections to be used in the RWSPs. The WMDs are required to consider the medium population projections data produced by BEBR. Any adjustment of or deviation from the BEBR projections must be fully described, and the original BEBR data must be presented along with the adjusted data.

As summarized in Table A.2.4, all of the WMDs rely on the BEBR's medium county population estimates and projections. Due to the stacked schedule for the WSA/RWSP updates, the annual BEBR projections represent snapshots of the state's demographics taken during different economic circumstances and times. They do not add up to the current statewide population projections. For example, the BEBR projections published in 2020 and used for the SF – UEC may differ from later BEBR projections and the most recent forecast adopted by the Florida Demographic Estimating Conference. Annual updates and changes in the state population projections can be significant. For example, in 2017, a notable increase in the statewide population was incorporated due to the influx of Puerto Ricans migrating to the state after Hurricane Maria.[88]

[88] EDR. 2017. Demographic Estimating Conference Executive Summary. December 5, 2017. Available online at: http://edr.state.fl.us/Content/conferences/population/archives/171205demographic.pdf (Accessed December 2022.)

Table A.2.4 BEBR Population Projections Used in WSAs/RWSPs

Region[i]	Publication Year	Base Year for the Population Projections	Reference
NWFWMD (all regions)[ii]	2016	2015	BEBR, 2016. *Projections of Florida Population by County, 2020-2045, with Estimates for 2015.* UF/BEBR, Florida Population Studies. Volume 49, Bulletin 174, January 2016.
SR – West[iii]	2015	2014	Rayer S. and Y. Wang. 2015. *Projections of Florida Population by County, 2015–2040, with Estimates for 2014.* UF/BEBR, Florida Population Studies. Volume 48, Bulletin 171.
SWFWMD (except CFWI)[iv]	2017	2016	Rayer, S. and Y. Wang. 2017. *Projections of Florida Population by County, 2020-2040, with Estimates for 2016.* UF/BEBR, Florida Population Studies, Volume 50, Bulletin 177.
SF – LKB	2018	2017	Rayer, S. and Y. Wang. 2018. *Projections of Florida Population by County, 2020-2045, with Estimates for 2017.* UF/BEBR, Florida Population Studies Bulletin 180.
SF – UEC	2020	2019	Rayer, S. and Y. Wang. 2020. *Projections of Florida Population by County, 2020-2045, with Estimates for 2019.* Florida Population Studies Bulletin 186. University of Florida, Bureau of Economic and Business Research.
SF – LEC	2017	2016	Rayer, S. and Y. Wang. 2017. *Projections of Florida Population by County, 2020-2040, with Estimates for 2016.* UF/BEBR, Florida Population Studies, Volume 50, Bulletin 177.
SF – LWC	2015	2014	Rayer S. and Y. Wang. 2015. *Projections of Florida Population by County, 2015–2040, with Estimates for 2014.* UF/BEBR, Florida Population Studies. Volume 48, Bulletin 171.
NFRWSP	2015	2014	Rayer S. and Y. Wang. 2015. *Projections of Florida Population by County, 2015–2040, with Estimates for 2014.* UF/BEBR, Florida Population Studies. Volume 48, Bulletin 171.
CFWI	2017	2016	BEBR. 2017. Central Florida Water Initiative Small Area Estimates and Projections. Prepared for the Central Florida Water Initiative, under contract to Southwest Florida Water Management District. Agreement 17UN0000448. UF/BEBR, Gainesville, FL.

[i] For the SJR – CSEC region, the data are not available. The RWSP is expected to be available for public review in the spring of 2021.
[ii] As noted in 2018 WSA, incorporated by reference.
[iii] The Water Supply Assessment references the following publication: "Smith, S.K. 2015. *Projections of Florida Population by County, 2015 – 2040. Volume 48, Bulletin 171*. BEBR, University of Florida. Gainesville, FL." However, Volume 48, Bulletin 171, is co-authored by Rayer S. and Y. Wang, as referenced in the table above.
[iv] Incomplete reference in the RWSP's draft (available for public review in April).

Population in the Counties Split Between WMDs

Six counties are split between WMD jurisdictions that follow different schedules for WSAs/RWSPs updates.[89] Given the stacked schedule of WSAs/RWSPs development, the sum of the populations used by the different WMDs may not equal the officially published county total. Only the NWFWMD's WSA discusses the topic of population projections for such a split county. The WSA document states that the Jefferson County population estimates in the NWFWMD were coordinated and compared with the SRWMD estimated share of Jefferson County. The combined total of both WMDs population estimates and projections is within about two percent of the

[89] These are Jefferson (NWFWMD and SRWMD), Levy (SRWMD and SWFWMD), Lake (SWFWMD and SJRWMD, also in CFWI), Highlands (SWFWMD and SFWMD), Charlotte (SWFWMD and SFWMD), and Okeechobee (SFWMD and SJRWMD). Note that Orange, Osceola, and Polk counties are also split between two WMDs; however, the counties are part of the CFWI, where the WMDs collaborate on RWSP development. The counties split between the SJRWMD and SRWMD are also modeled collaboratively by the WMDs, and they are not included in the listing of the "split" counties.

BEBR's Jefferson County estimates and forecasts. The discussion of the population in split counties was not found for the other WSAs/RWSPs.

Methods for Allocating BEBR County Population to PS Service Areas

Based on DEP et al. (2019, p. 4)[90], the base year is "the year that acts as the starting point for water demand projections and is based on the best available data of reported and estimated water use. Water use in the base year is not a projection, but rather actual or estimated use. This is typically between one and five years prior to the first year of the planning period." To relate BEBR's county population estimates to the population in the utility service areas in the base year, the WMDs generally use data provided by water utilities, county-level estimates and, in the case of the SFWMD, Traffic Analysis Zone (TAZs) data. Utilities with permitted quantities of 0.1 mgd are required to report population and submit service area information.[91] These data can be supplemented with the Basic Facility Report information submitted to the DEP, district Customer Use Survey reports, comparison of PS service area maps and census block population, and other data. The domestic self-supply portion is then estimated as a difference between the total county population and the population served by water utilities.

The methods used to project the population for each utility service area differ among the WMDs, in part, due to the varying availability of data. The SRWMD and SJRWMD apply a percent-share method that assumes that the county population's split among utility service areas remains the same in all years of the planning horizon. The SWFWMD relies on a model to project the development parcel-by-parcel. Most regions in the SFWMD utilize projections developed by the local planning councils. All the methods are summarized in Table A.2.5.

[See table on following page]

[90] DEP, NWFWMD, SFWMD, SWFWMD, SJRWMD, and SRWMD. 2019. Format and Guidelines for Regional Water Supply Planning. 42pp.

[91] Based on the description in the SWFWMD's RWSP.

Table A.2.5 Population Projection Methods

Region	Method
NWFWMD	**BEBR's low, medium, and high population projections for incorporated areas** are used if a PS service area has a significant correlation with a BEBR-identified incorporated area. If a service area is in an unincorporated area of a county, aerial photography and land use review, the municipal population shares of total county populations, historical trends, and data submitted by local entities are analyzed. All of the above are considered to select one set of best-fit growth rates (low to high) for each PS utility for 2020-2040. BEBR medium projections are the default selection unless the analyses and utility-provided data support an alternative growth rate. If a negative growth rate appears to be most statistically appropriate, a no-growth (0.0%) scenario is used. BEBR county estimates and medium projections, seasonally adjusted, control the total county population projections.
SRWMD and NFRWSP	The **percent-share method** is utilized. First, a percentage of the 2010 county population for each public supply and small public supply system is calculated. These respective percentages are assumed to remain constant in the future, and they are used to allocate the BEBR's projected population to utility service areas. The WMDs cross-verified the estimates against a "build-out" (i.e., maximum) population for each public supply system using current land use and zoning information. Also, 1% per year conversion of domestic-self-supply to public supply systems is added to viable public supply systems in selected counties based on discussions with stakeholders. Note that the SJRWMD is developing a Population Distribution Model, which will distribute the population to the parcel level using growth drivers and growth inhibitors.
SWFWMD (except CFWI)	The **Growth Drivers Model** is used to forecast the population increase parcel by parcel. The Model uses logistic regression to predict a parcel's likelihood of being developed based on various parcel characteristics, such as proximity to roads and existing developments. The Model predictions are supplemented by the analysis of historical development trends and the consideration of physical constraints (e.g., wetlands). The projections are controlled by (a) the current population (low bound) and (b) a county-wide buildout model developed by GIS Associates (the maximum population growth at the parcel level). The buildout model utilizes future land use data from the counties' comprehensive plans and medium density data from recent 20-year development in incorporated places.
SF – LKB	The **county growth rates from BEBR's medium projections** are applied to each PWS service area and DSS area.
SF – UEC	A **general linear trend based on BEBR projections** is used. Maps of PS service areas in 2019 for the base year and 2040 were developed using data from water supply facilities' work plans, growth plans, and other information. Five-year incremental projections for each PS utility were based on a general linear interpolation of the population change from the 2010 census and 2015-2019 to 2040 projections (BEBR 2020), keeping each county controlled to the high BEBR projection for St. Lucie County and medium BEBR projections for the other counties in the region.
SF – LEC and SF – LWC	**Projections published by county planning departments or metropolitan planning organizations** are utilized. These projections allocate BEBR medium county projections to hundreds of traffic analysis zones (TAZs). Local planning departments consider local Comprehensive Plans, transportation infrastructure, remaining developable land, employment opportunities, and local development objectives to establish population growth rates for different areas. In the SF – LEC, the SFWMD added to these projections the forecast for group quarter population (such as correctional facilities, nursing homes, college dorms, military barracks, group homes, missions, and shelters). Group quarter populations were assumed to grow at the countywide population growth rate. After distributing the projected TAZ populations to all PWS service areas and DSS areas in the SF – LEC, the 2040 county population totals were less than the BEBR's totals. These discrepancies resulted from inconsistency in the publication date and the source data used for the TAZ projections developed by local planning departments. Adjustments to the PWS service area and the DSS population totals were made proportional to their unadjusted 2040 share of the total county population.
CFWI	This region relies on **BEBR's Geospatial Small-Area Population and Forecasting Model**. BEBR estimated parcel-level historical (2010-2016) permanent residential population, future permanent residential population, and a build-out scenario as a part of this Model. The WMDs then aggregated the parcel level population to each PS service area.

Domestic Self-Supply (DSS) Water Use

DSS category includes: (a) small public supply systems (*i.e.*, those smaller than 0.1 mgd in the permitted capacity or pumpage), and (b) residential dwellings systems that are provided water from a dedicated, on-site well and are not connected to a central utility[92] (SWFWMD 2020). Note that the SWFWMD combines PS, DSS, and residential irrigation wells into one category, which is then split between PS and DSS by the DEP for the statewide summary developed for each use category.

For small public supply systems, the forecasting methods follow those discussed above for large systems included in PS. For residential dwellings not connected to a central utility, a "unit water demand" method is also used, with the per capita water use multiplied by the estimated population:

Figure A.2.2 Total DSS Water use in a County Equation

In all the WMDs, the domestic self-supplied population is determined as the difference between the BEBR medium county population and the county population served by the public supply.[93] This approach is used for the base year estimate and the 5-year interval projections in the WMDs' planning horizons.

The per capita water use is assumed to be equal to the county median or average public supply per-capita usage rates (adjusted to account for PS uses not relevant to DSS, as described below). If county-specific information is unavailable, then the estimates from other areas are applied. For example, districtwide average public supply per-capita usage rates can be used. Another example is the SRWMD which utilizes the county averages estimated by the SJRWMD (for counties split between the WMDs) or SJRWMD districtwide averages. The NWFWMD relies on the USGS's estimates for the DSS rates. The period used to calculate the per capita differs among the regions, corresponding to the differences observed in the PS category.

Note that the PS per capita rate includes all types of uses served by the public supply, including household use, commercial use, and others. Many of the uses are not relevant to DSS, and therefore, the *residential* per-capita rate is estimated for the PS sector and then it is applied to DSS. Residential per-capita also referred to as *household water use rate*, is generally based on the

[92] This definition is based on that in SWFWMD (2020).
Reference:
SWFWMD. 2020. 2020 Regional Water Supply Plan: Northern Planning Region. Public Review Draft. April, 2020.
[93] Note that in the NWFWMD, all population estimates (total county, public supply, and DSS) are seasonally adjusted.

residential water use allocation from relevant consumptive use permits (CUPs) or water use permits (WUPs).[94]

In the SFWMD, many of the PS utilities rely on brackish groundwater sources characterized by significant losses in the treatment process. Therefore, the SFWMD excludes the treatment losses from calculating per capita use to be applied for DSS. Similarly, the SWFWMD also excludes treatment losses (see Table A.2.6).

Table A.2.6 PS Per Capita Rate Calculations Used in DSS Projections

Region*	Per capita rate	Exclude CII use from PS per capita?	Comments
NW – II	2010 districtwide average domestic per capita use rates from USGS**	Yes	-
NW – Oth			
SR – West	5-year county-wide average domestic water use, based on data from PS	Yes	-
SWFWMD (excluding CFWI)	5-year countywide residential per capita estimated by SWFWMD from utilities' data	Yes	Exclude treatment losses
SF – LKB	5-year countywide median (with some places mentioning average) use rates for PS populations	No	Finished water use only (*i.e.*, exclude treatment losses)
SF – UEC	5-year countywide PS weighted average Net (finished) water volumes for 2015 through 2019 were obtained from the PS utility monthly operating reports	No	Finished water use only (i.e., exclude treatment losses)
SF – LEC	5-year median PS use rate	No	Finished water use only (*i.e.*, exclude treatment losses)
SF – LWC	5-year median usage rates from each county's PWS population (2010 statewide average from USGS is used for Charlotte County)	No	Finished water use only (*i.e.*, exclude treatment losses)
NFRWSP	5-year county-wide average from PS and SPSS	Yes	-
CFWI	5-year county-wide average from PS and SPSS	Yes	-

* For the SJR – CSEC region, the data are not available. The RWSP is expected to be available for public review in the spring of 2021.

** During the preparation of the 2018 WSA, available data was insufficient to generate residential per capita rate(s). Therefore, the NWFWMD relied on the USGS for DSS rates.

The SWFWMD also estimates residential irrigation well water use in the DSS category. The estimated number of wells less than 5 inches in diameter is estimated from the SWFWMD well construction GIS map layer and cross-verified with utility billing data. This number was multiplied by 332 gallons per day to estimate the baseline water use. The projected number of residential irrigation wells then follows the applicable county population growth rate.

[94] *Consumptive use permits*: Unless otherwise exempt, all water withdrawals in Florida are regulated through a system of consumptive use/water use permits (CUPs/WUPs) granted by the WMDs. According to section 373.223, Florida Statutes, each permit applicant must establish that the proposed use of water is reasonable-beneficial, consistent with the public interest, and will not interfere with any existing legal uses. In addition, withdrawals may not be harmful to the water resources in the area. The information available for individual CUP/WUP holders differs among the WMDs. For example, the information regarding residential water use allocation is included in CUPs issued to public water suppliers in the SJRWMD, but not in the SRWMD. In some RWSPs/WSAs, the domestic self-supplied per-capita use is estimated from the per-capita use of large public supply utilities only (*i.e.*, utilities with average annual permitted quantities greater than 0.1 mgd). In other regions, the analysis also includes smaller public supply utilities.

The other WMDs either include residential irrigation well water use as part of recreational-landscape irrigation (NWFWMD) or do not account for this use (SFWMD, SJRWMD, and SRWMD). While it is important to improve the estimation methods for residential well water use, this use is relatively small on a districtwide or statewide level. For example, in the SWFWMD (including the CFWI portion), the total residential irrigation well withdrawals are estimated at 31.22 mgd in 2015, which is 6.22% of the aggregate water use in PS (*i.e.*, 501.53 mgd); however, there are sub-regions where more significant volumes of water are withdrawn from residential irrigation wells that should be taken into consideration.

Landscape/Recreational (L/R) Water Use

The Landscape/Recreational (L/R) category includes such users as self-supplied golf courses, parks (including water parks), and commercial center irrigation (DEP et al. 2019)[95]. The WMDs are generally consistent in their approaches to estimating and projecting water use in this category. However, some differences among the WMDs are also observed. Specifically, NWFWMD is the only WMD that includes residential irrigation wells in this category.[96] In some regions, golf course irrigation accounts for a large proportion of the L/R water use, necessitating separate modeling. For golf courses that use reclaimed water, data limitations preclude the NWFWMD from projecting the quantity of reclaimed water used.[97] Finally, like the PS and DSS use calculations, for L/R, the WMDs rely on the BEBR-medium population projections published in different years and not equal to the most current officially adopted population estimates and projections. Below, the methods used by the WMDs are discussed in more detail.

Base Year Total Water Use

The WMDs use available data to estimate the total base year water use, as summarized in Table A.2.7. Note that some L/R users are not required to report their water use because they withdraw small amounts of water. In addition, some of the WMDs separately estimate the irrigation for golf courses, while others focus on the category's total water use.

[95] DEP, NWFWMD, SFWMD, SWFWMD, SJRWMD, and SRWMD. 2019. Format and Guidelines for Regional Water Supply Planning. 42pp.
[96] Note that the SWFWMD accounts for this in DSS, while the other WMDs do not account for this use at all.
[97] These courses are, however, still considered in the analysis.

Table A.2.7 Base Year Water Use Methods

Region	*Estimation Methods*
NWFWMD	Base year water use is estimated from *reported and audited pumpage. Additional calculations* are used for individual WUP (IWUP) holders with no water use reporting requirements, and the wells with a general WUP (GWUP). Historical data for IWUPs (with reporting requirements) are used to determine that water use averaged a 60% share. This share of actual water use to the permitted use is applied to permitted allocation for IWUPs without reporting requirements. Overall, water use is estimated in aggregate at the county level.
SRWMD and NFRWSP	A historic average gallon per capita per day rate for each county is estimated using the Districts' recreational-landscape irrigation data and BEBR's county population for 2010-2014.
SWFWMD (except CFWI)	Historical metered and estimated water use is considered. The average for 2011-2015 is calculated and used as the baseline.
SFWMD (except CFWI)	The acreage is estimated using the SFWMD's Water Use Regulatory Database. Most permits in the database contain information that allows for the disaggregation of landscape and golf course acres. For those that do not, golf course data from the University of Florida GeoPlan Center provided estimates of all active golf courses (at least in the LEC Planning Area). The water use is calculated using the AFSIRS model.
CFWI	The county-specific L/R average gallon per capita per day (gpcd) was calculated from the L/R average water use for 2011-2015, obtained from the ECFTX calibration dataset and the BEBR estimates of county population for 2011-2015 (BEBR, 2017).

Water Use Projections

The methods used to project future water use are summarized in Table A.2.8. In the areas where golf course irrigation is extensive, this use is modeled separately. It is assumed to remain steady or grow at a slow rate (either as suggested by the industry and local planning councils or as estimated using a golf course irrigation model). All non-golf demand is assumed to grow at the rate of increase for the BEBR-medium population. Note that the WMDs rely on the BEBR-medium population projections published in different years (see discussion in the PS description).

Table A.2.8 Methods Used to Project L/R Water Use

Method	NWFWMD	SRWMD and NFRWSP	CFWI	SWFWMD (excluding CFWI)		SF – LKB		SF – UEC		SF – LEC		SF – LWC	
				non-golf	golf	non-golf	golf	non-golf	golf	non-golf	golf	non-golf	golf
Water use is calculated as a product of the base year water use and BEBR Medium population growth rates.	X	X	X	X		X		X		X		X	
Water use is assumed to remain steady.					X		X				X		
Water use is based on a demand model for an 18-hole golf course, combined with the previous year's pumpage rate estimates.					X*								
Water use is assumed to grow at a slow rate as suggested by the industry and local planning estimates.									X				X

* In the SW – TB region only.

Residential Irrigation Wells
Only NWFWMD accounts for residential irrigation wells in the L/R category. In part, this is due to the location and quantity of residential irrigation wells in areas of resource concern. SWFWMD accounts for this in the PS category, while the other WMDs do not account for this use at all.

In NWFWMD, nearly all wells covered by the general WUPs with well construction permits are small (primarily 2 inches to 4 inches, but up to 6 inches diameter), and they are intended for residential outdoor irrigation. Non-residential general WUP wells include a small number of wells used for golf courses, aesthetics, or water-based recreation purposes. The analysis supporting the North Florida-Southeast Georgia (NFSEG) groundwater model produced a districtwide, weighted average, outdoor water use for residential parcels of 76 gallons per day (gpd). The gpd was multiplied by the number of wells as follows:

Estimated Water Use (ADR) = No. of Wells x 76 gpd

This analysis is done for the base year only. The base year use is projected to grow by the same trend factor as the other uses described below.

Reclaimed Water Use for Golf Course Irrigation
Supplying reclaimed water for golf course irrigation blurs the category's definition (which was initially identified as "self-supply"). In the NWFWMD, the L/R water demand that is met with reclaimed water in the base year is limited, only marginally reducing the total water use in the category. In the SFWMD, the substitution of groundwater by reclaimed water is explicitly modeled. Specifically, in the SF-LEC, data from DEP's Reuse Inventory report are compared to permitted areas to determine the portion of reclaimed water used under the L/R category. The anticipated share of future L/R use met with reclaimed water is calculated from the historical relationship of expanding reclaimed water supply and population growth.[98]

Commercial/Industrial/Institutional (CII) Water Use

The category comprises all reporting commercial, industrial, and institutional (CII) self-supplied permittees (including mining and dewatering uses). Only consumptive uses are included (*i.e.*, recycled surface water and non-consumptive uses excluded). The base year water use is estimated from the CUPs/WUPs information (such as reported pumpage). To forecast the future water use, three separate water use projection methods are used by the WMDs. The first method is to request the projections from the permittees directly. In the NWFWMD, over 40% of CII permittees responded to an outreach survey request sent by the NWFWMD about the future demand projections. These responses were incorporated into the WSA and RWSP unless the projections exceeded the permitted allocation or other anomalies in the provided responses were observed. Historical water use, water use trends, and share of water use to the permitted allocations were also reviewed and considered to determine total future demands in the category.

The second method is used by the SWFWMD (excluding the portion in the CFWI). The district determined that the water use is generally correlated with the county one-year cross-regional

[98] As stated in the SF – LEC RWSP, the L/R use met with reclaimed water could be much larger if ocean outfall targets from the Ocean Outfall Law are met by 2025. See § 403.086(10), Fla. Stat.

product (GRP) growth rate from Woods and Poole (2017). The only exception is Mosaic water use, for which the company provided growth projections for its processing facilities and mining operations.

The SFWMD, SJRWMD, and SRWMD employ the third method, and it is also applied for the CFWI RWSP. CII water use is assumed to follow population trends. For example, in the CFWI, NFRWSP, and SRWMD, the county-specific five-year average gallon per capita per day is based on the USGS data or the calibration dataset from the East-Central Florida Transient (ECFTX) groundwater model. This per capita rate is then multiplied by the BEBR-medium population projection growth rate. Similar to the categories discussed above, the BEBR projections published in different years were used in different regions.

Power Generation (PG) Water Use

In all the WMDs, this category includes water used for power generation facilities not supplied by the PS (primarily, thermoelectric power). For thermoelectric power generation, net water use for thermoelectric power generation may include on-site potable uses, as well as water loss due to evaporation, blowdown, drift, and leakages. Note that fresh surface water or brackish water is used for recirculation and cooling, and since this water is then returned to its source, it is not, for planning purposes, considered a consumptive use.

Water use projection methods differed among the WMDs. The water use in the sector is small, however, and therefore, the difference in the methods does not significantly alter the overall statewide water demand projections. In NWFWMD and SFWMD, water use projections were established in consultation with permittees. The projections were requested directly from the permittees in NWFWMD, and nearly all of them responded. The responses were supplemented with data from electric utility ten-year site plans (submitted to the Florida Public Service Commission) and historical water use. In SFWMD, the water use forecast is established in consultation with the power generation facilities owners and managers (such as Florida Power and Light).

In turn, in SRWMD and NFRWSP, the forecasts are based on the ten-year site plans and the BEBR population projections. For each PG facility, its 10-year site plan was reviewed to identify any planned expansions. Water use beyond the 10-year site plan horizon was projected using the BEBR medium population growth rates and the average daily gallon per megawatt use estimated for 2010-2014.

Finally, in the SWFWMD[99] and CFWI, water use forecasts are based on 10-year site plans and electricity demand projections. First, historical water use and the 10-year site plan for each PG facility were reviewed. Next, a 5-year average for water use per megawatt was calculated (in some cases, only the last year data were used). This value is then applied to the projected megawatt production reported in the 10-year site plan for each PG facility. This forecast is extended beyond the ten years by considering the 20-year (2008-2027) average customer growth rate and then

[99] In the RWSP for the SW – TB, it is discussed that water use forecasts are based on the GRP growth rate. However, discussions with SWFWMD staff indicated that all the RWSPs rely on a consistent methodology. Therefore, EDR does not identify the potential difference in the method for the SW – TB region.

forecasting the customers through 2040. The number of customers was multiplied by the megawatt use per customer and the water use per megawatt to project future water use.

Water Demand for Agriculture (AG)

For agriculture, section 570.93, Florida Statutes, enacted in 2013, directs DACS to establish an agricultural water supply planning program that includes "the development of data indicative of future agricultural water supply demands," based on at least a 20-year planning period. Section 373.709(2)(a), Florida Statutes, requires the WMDs to "consider the data indicative of future water supply demands provided by the Department of Agriculture and Consumer Services." Any adjustments or deviations from the projections published by DACS "must be fully described, and the original data must be presented along with the adjusted data." DACS's Florida Statewide Agricultural Irrigation Demand (FSAID) geodatabase provides the agricultural acreage and water use projections for each WMD and planning region. This information is updated annually.[100]

For forecast purposes, the agricultural self-supplied use is generally split by the WMDs into agricultural irrigation and other water applications (*e.g.*, livestock watering, frost-freeze protection, and aquaculture). While all the WMDs utilize acreage or water use information from the FSAID, the FSAID versions and information type differ among the WMDs, as summarized in Table A.2.9.

[See table on following page]

[100] The Balmoral Group. 2022. Florida Statewide Agricultural Irrigation Demand: Estimated Agricultural Water Demand, 2021 – 2045. Produced for the Florida Department of Agriculture and Consumer Services. The Balmoral Group, 35pp. Available online at: https://www.fdacs.gov/Agriculture-Industry/Water/Agricultural-Water-Supply-Planning . (Accessed December 2022.)

Table A.2.9 FSAID Version and Information Type Used in WMDs' WSAs/RWSPs

Region	FSAID			Data used by WMDs to supplement FSAID
	Version	Year of Release*	Information Used in WSA/RWSP	
NWFWMD	IV	2017	Total AG water use forecast	None
SR – West	IV	2017	Total AG water use forecast	Agricultural water use in 2010 (*i.e.*, base year) is based on FSAID-II
NFRWSP	II	2015	Total AG water use forecast	None
CFWI	IV	2017	Total AG water use forecast	North Ranch Sector Plan information in Osceola County
SWFWMD	V	2018	AG acreage; Projected trends in non-irrigation AG water use	Per-acre irrigation rate was calculated by SWFWMD (often on the permit-by-permit basis to account for crop rotations and other factors). FSAID's aquaculture and livestock base year water use was adjusted using metered water use data for individual permits.
SF – LKB	V	2018	AG acreage (adjusted with local data); Water demand projections for livestock and aquaculture production	AFSIRS irrigation rate per acre for individual crops was used to forecast irrigation water demand.
SF – UEC	VII	2020	FSAID is used as a reference only. Acreage and demand projections already completed prior to FSAID	Agricultural acreage projections by crop type were prepared by SFWMD using the land use maps (2018 acres in FSAID VII), historical data, marketing information, etc. These projections run to 2045 in 5-year increments. AFSIRS model was utilized to estimate per-acre irrigation rates.
SF – LEC	IV	2017	AG acreage (adjusted with local data); Water demand projections for livestock and aquaculture production	AFSIRS irrigation rate per acre for individual crops was used to forecast irrigation water demand.
SF – LWC	III	2016	AG acreage (adjusted with local data); Water demand projections for livestock and aquaculture production	AFSIRS irrigation rate per acre for individual crops was used to forecast irrigation water demand.
SJR – CSEC	IV	2017	SJRWMD used the FSAID IV agricultural acreage and water demand projections	None
* The water use data used in the development/calibration of FSAID can be one or two years older than the FSAID release date.				

A.3 Conservation Potential

Definitions

Water conservation is defined as "the efficient use of water. Water conservation does not include water supply source switching, which, though valuable in reducing the use of traditional water supplies, does not improve the efficiency of use" (DEP 2019, p. 5)[101]. The conservation projection is "the projected conservation savings of all water users or a subset of water users that could be achieved during the planning horizon. Districts develop this projection using the best available information and methodologies … Districts may present these quantities as a range, with the low end of the range being likely to be achieved and the high end of the range being the conservation potential or some portion of it" (DEP 2019, p. 7).[102]

Note that the WMDs emphasize that potential conservation should not be directly removed from water demand estimates. The actual savings are based on the endorsement and implementation of conservation measures by public supply utilities and other users and are highly contingent on specific user participation rates. Nevertheless, for this analysis, EDR subtracted the conservation projections from the demand projections to evaluate the potential impact of the water use efficiency

[101] DEP, NWFWMD, SFWMD, SWFWMD, SJRWMD, and SRWMD. 2019. Format and Guidelines for Regional Water Supply Planning. 42pp.
[102] DEP, NWFWMD, SFWMD, SWFWMD, SJRWMD, and SRWMD. 2019. Format and Guidelines for Regional Water Supply Planning. 42pp.

improvements and to recognize the conservation improvements evident in the historical data. EDR acknowledges that conservation investments, potentially substantial in magnitude, are likely needed for these efficiency improvements to be realized.

2020-2040 Water Use Forecast with Conservation

DEP (2022a) summarizes the WMDs' conservation projections for the WMDs' current planning period. Since the planning period differs among the WMDs, no consistent statewide conservation projection is available for 2020-2040. The conservation potential is also presented as the total for the planning period, with no specific dates for the use reduction.

To derive a statewide 2020-2040 water use forecast that accounts for the conservation potential, EDR first considered the regions planning for 2020-2040. For these regions, the alternative 2040 water use forecast was estimated as the difference between the 2040 water use and conservation projections. For 2020, 2025, 2030, and 2035, the regional water use forecast with conservation was estimated by interpolating the 2015 water demand (*i.e.*, the base year use) and the 2040 forecast with conservation (Table A.4.1).

Table A.3.1 Water Use Forecast with Conservation (Regions with 2020-2040 Planning Horizons)

Region	Data from DEP (2022a)			EDR Calculations (mgd)				
	Base Year Water Use (mgd)	Projected 2040 Water Use	Conservation Projection*	2020	2025	2030	2035	2040
NW - II	69.73	94.88	6.00	73.56	77.39	81.22	85.05	88.88
NW - Oth	254.16	311.90	3.80	264.95	275.74	286.52	297.31	308.10
SF - LKB	245.42	257.49	0.00	247.73	250.17	252.61	255.05	257.49
SF - UEC	291.11	283.96	12.62	272.63	272.31	271.98	271.66	271.34
SF - LEC	1,757.29	2,006.54	102.40	1,772.52	1,805.42	1,838.33	1,871.23	1,904.14
SF - LWC	970.68	1,210.68	26.30	1,021.14	1,061.95	1,102.76	1,143.57	1,184.38
SJR - CSEC	353.17	427.87	38.22	360.47	367.76	375.06	382.35	389.65
SWF – N	131.08	181.73	14.08	138.39	145.71	153.02	160.33	167.65
SWF - TB	385.71	461.85	44.97	391.95	398.18	404.41	410.65	416.88
SWF – H**	94.91	89.15	8.30	92.10	89.28	86.47	83.66	80.85
SWF - S	234.95	279.33	21.22	239.58	244.21	248.85	253.48	258.11
CFWI	667.12	907.59	56.00	704.01	740.91	777.80	814.70	851.59

* The total of "Conservation Projection" and "Additional Conservation Projection" in DEP (2022a). ** Portion of the region outside the CFWI.

Next, for the two regions that use the 2015-2035 planning period (*i.e.*, SR – West and NFRWSP), EDR derived the alternative 2035 water use by subtracting the conservation projections from the 2035 water use reported in DEP (2020a). For 2015, 2020, 2025, and 2030, the regional water use was then estimated by interpolating between the base year's water use (*i.e.*, 2010) and the alternative 2035 forecast. Finally, the 2040 water use was extrapolated from the 2010-2035 estimated use with conservation (Table A.3.2).

Table A.3.2 Water Use Forecast with Conservation (Regions with 2015-2035 Planning Horizons)

Region	Data from DEP (2022a)			EDR Calculations (mgd)				
	Base Year Water Use (mgd)	Projected 2040 Water Use	Conservation Projection*	2020	2025	2030	2035	2040
SR - West	97.96	127.54	10.90	102.73	104.91	107.09	111.45	113.63
NFRWSP	550.75	695.64	53.00	567.13	578.96	590.80	614.47	626.31

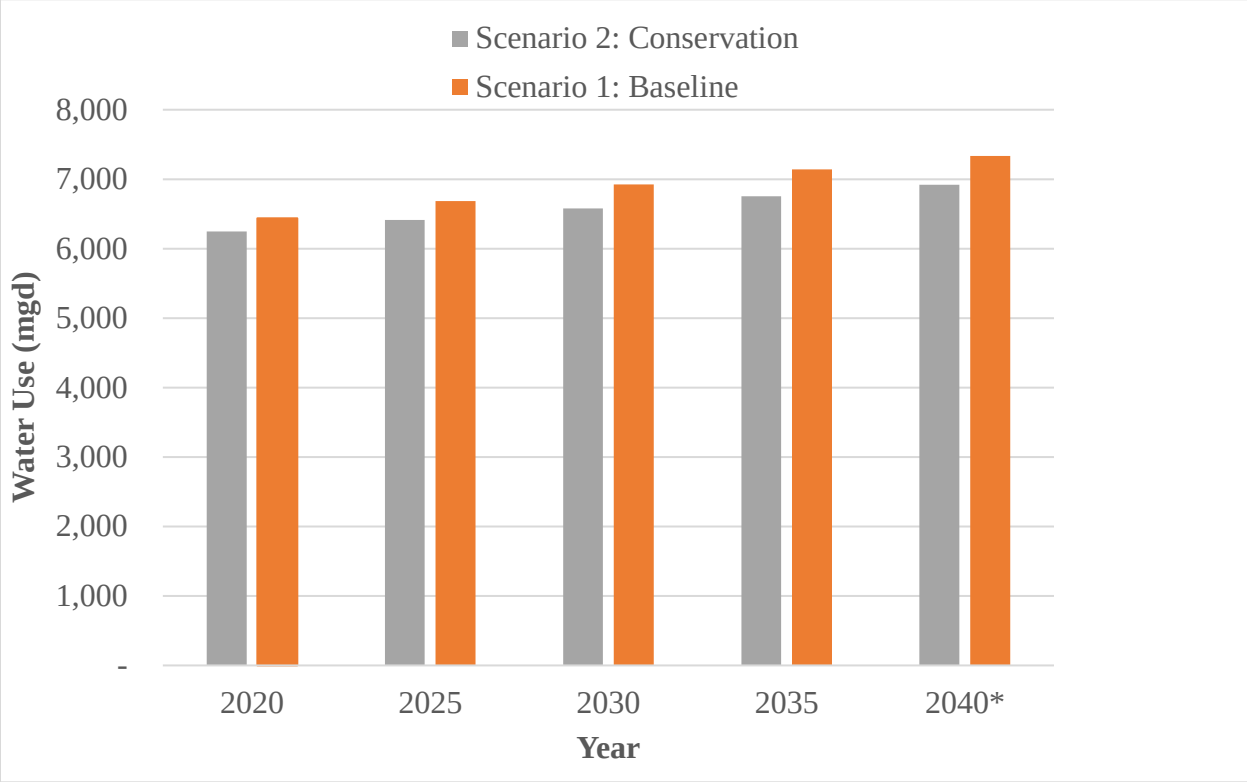
* The total of "Conservation Projection" and "Additional Conservation Projection" in DEP (2022a)

The statewide water demand forecasts for the two scenarios – with and without accounting for the conservation potential – are shown in Table A.3.3 and Figure A.3.1. By 2040, conservation can potentially reduce statewide water use by 417.15 mgd. This volume is slightly lower than the total conservation potential reported in DEP (2021a) since water conservation for SF – UEC was revised from 14.10 mgd in DEP (2021a) to 12.62 mgd in DEP (2022a).

Table A.3.3 Comparison of the Statewide Water Use Forecasts

Scenario	2020	2025	2030	2035	2040	2020-2040 difference	
						mgd	%
With conservation	4,248.87	6,412.90	6,576.93	6,754.97	6,918.99	670.12	10.72%
Without conservation	6,436.74	6,687.10	6,925.64	7,141.76	7,336.15	899.41	13.97%

Figure A.3.1 Statewide Water Demand Projections With and Without Conservation

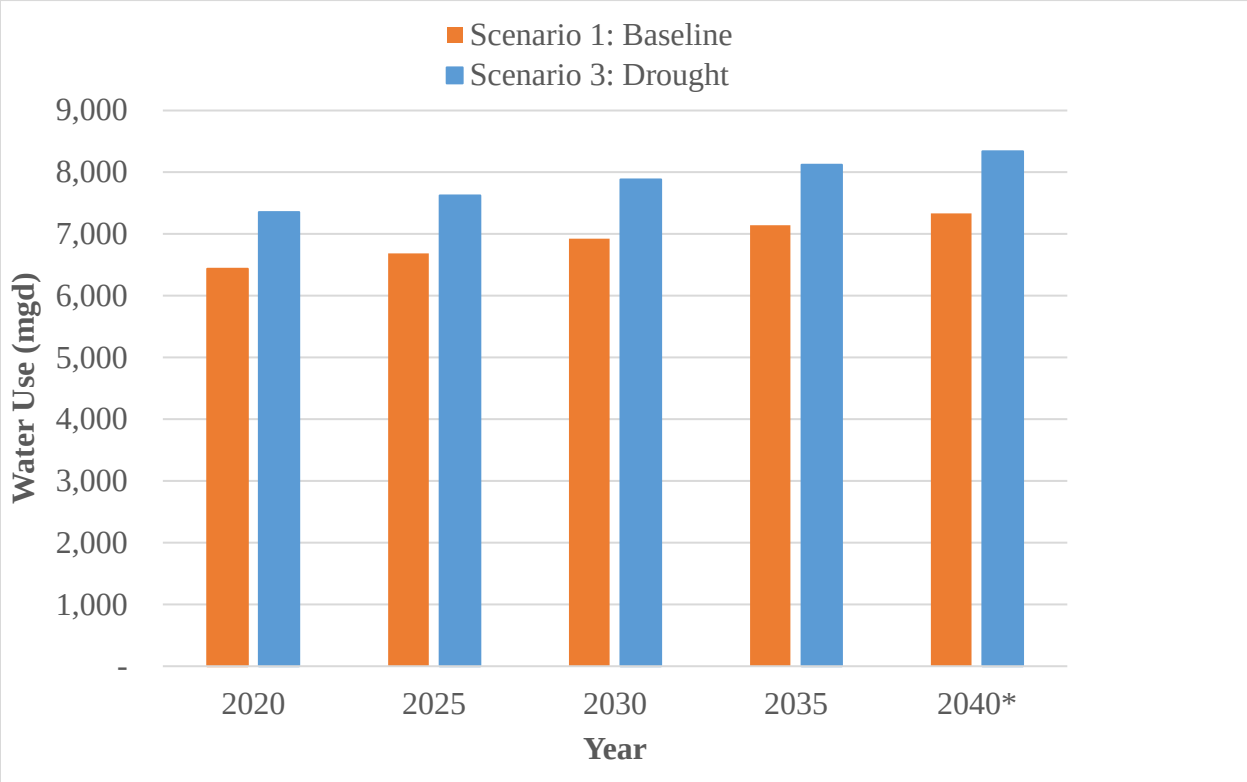


Note: * For two regions–NFRWSP and SR-West–2040 projections were not available in DEP 2021; EDR estimated the water use based on a linear trend. Note that for all water use categories in both regions, the linear trend represented 2015-2035 data extremely well (R-squared for Ordinary Least Squares regression above 0.99, estimated in Microsoft Excel).

A.4 Drought-Year Water Use Estimates

This appendix summarizes EDR's calculations of water use given a scenario of recurring droughts. The calculations are based on the WMDs' projections of drought demand for the last year of the WMDs' water supply planning horizon. For most of the WMD's water supply planning regions, this appendix follows a similar format. First, a table with each WMD's projections is presented. The projections are used to calculate the percent increase in water use during a drought year, focusing on the planning horizon's last year. In the second table, this percentage and each WMD's water use estimates and projections for the baseline scenario are utilized to calculate the drought water use for the 5-year periods. At the end of the appendix, EDR summarizes the WMDs' methods to account for drought in their water use projections.

Figure A.4.1 Statewide Water Demand Projections With and Without Drought



NWFWMD

Table A.4.1 Projections of 2040 Water Use

Region	Baseline Scenario (Average Rainfall): Water Use (mgd)*	Drought Scenario	
		Water Use (mgd)	% (compared with the baseline scenario)
NWF-II	94.88	105.89	111.61%
NWF-Oth	311.90	345.07	110.63%
Total	406.78	450.96	110.86%

* Source: DEP (2022a).

Table A.4.2 Water Use Estimates and Projections for 2020-2040, Baseline and Drought Scenarios (mgd)

Region	Baseline Scenario (Data from DEP 2022a)					Drought Scenario (Using % increase from Table A.4.1)				
	2020	2025	2030	2035	2040	2020	2025	2030	2035	2040
NWF-II	76.88	82.25	87.03	91.19	94.88	85.80	91.80	97.12	101.77	105.89
NWF-Oth	273.72	287.12	296.92	304.58	311.90	302.83	317.65	328.49	336.97	345.07
Total	350.60	369.37	383.94	395.77	406.78	388.63	409.45	425.62	438.74	450.96

SRWMD: SR – West Water Supply Planning Region

Table A.4.3 Projections of 2035 Water Use

Region	Baseline Scenario (Average Rainfall): Water Use (mgd)*	Drought Scenario	
		Water Use (mgd)	% (compared with the baseline scenario)
SR – West	122.35	131.57	111.61%

* Source: DEP (2022a).

Table A.4.4 Water Use Estimates and Projections for 2020-2040, Baseline and Drought Scenarios (mgd)

Region	Average Demand (Data from DEP 2022a)					Demand during Drought (Using % increase from Table A.4.3)				
	2020	2025	2030	2035	2040*	2020	2025	2030	2035	2040
SR – West	106.53	110.92	116.69	122.35	127.54	114.78	119.51	125.73	131.83	137.42

* Calculated by EDR based on a linear trend of 2015-2035 data provided by the SRWMD.

SRWMD and SJRWMD: NFRWSP Planning Region

Table A.4.5 Projections of 2035 Water Use

Region	Baseline Scenario (Average Rainfall): Water Use (mgd)*	Drought Scenario	
		Water Use (mgd)	Water Use (mgd)
NFRWSP	667.47	722.38	108.23%

* Source: DEP (2022a).

Table A.4.6 Water Use Estimates and Projections for 2020-2040, Baseline and Drought Scenarios (mgd)

Use Category	Average Demand (Data from DEP 2022a)					Demand during Drought (Using % increase from Table A.4.5)				
	2020	2025	2030	2035	2040	2020	2025	2030	2035	2040
Total for NFRWSP	585.06	612.70	641.36	667.47	696.57*	633.19	663.10	694.12	722.38	*753.88*

* Calculated by EDR based on a linear trend of 2015-2035 data summarized in DEP (2022a).

SWFWMD: All Planning Regions

The SWFWMD provides drought demand estimates for each of the 5-year intervals in its planning horizon. However, some of the SWFWMD's regions are partially in the CFWI. Therefore, EDR

calculated water use for the portions of the regions outside the CFWI. These calculations are described in the tables below.

Table A.4.7 Drought Water Use Estimates and Projections: SWFWMD Regions not in CFWI

Region	2015	2020	2025	2030	2035	2040
SW – TB	422.08	450.52	470.79	475.59	489.7	501.24
SW – S	286.62	297.54	307.69	320.17	328.19	335.32

Source: SWFWMD's RWSPs.

Table A.4.8 SWFWMD's Projections of 2040 Drought Water Use for the Regions Partially in CFWI

Region	Drought Water Use: Total for the region (mgd)*	Drought Water Use: Portion of the Region outside CFWI	
		Volume (Mgd)**	% of the total demand in the region
SW – N	202.54	201.81	99.64
SW – H	418.72	119.74	28.60

* Source: SWFWMD's RWSPs.
** Source: DEP (2022a).

Table A.4.9 EDR Calculations of Drought Water Use in SWFWMD's regions partially in CFWI

Region	2015	2020	2025	2030	2035	2040	Notes
SW – N	145.85	158.6	170.94	181.89	192.74	202.54	Source: SWFWMD's RWSPs
SW – N (excluding CFWI)	145.32	158.03	170.32	181.23	192.05	201.81	Drought use estimated or projected for SW – N by SWFWMD multiplied by 0.9964 (see Table A.4.8)
SW – H	383.14	397.05	400.99	417.09	420.04	418.72	Source: SWFWMD's RWSPs
SW – H (excluding CFWI)	119.20	123.53	124.75	129.76	130.68	130.27	Drought use estimated or projected for SW – H by SWFWMD multiplied by 0.286 (see Table A.4.8)

Table A.4.10 Drought Water Use Projections: All SWFWMD Regions outside CFWI

Region	2015	2020	2025	2030	2035	2040
SW – N (excluding CFWI)*	145.32	158.03	170.32	181.23	192.05	201.81
SW – TB**	422.08	450.52	470.79	475.59	489.7	501.24
SW – H (excluding CFWI) *	109.57	113.54	114.67	119.27	120.12	119.74
SW – S**	286.62	297.54	307.69	320.17	328.19	335.32

* Source: SWFWMD's RWSPs
** See Table A.4.9.

SFWMD: All Planning Regions

SFWMD provides drought demand estimates for each 5-year interval in its planning horizon, as summarized in Table A.4.11 below.

Table A.4.11 SFWMD Projections of Drought Water Use

From RWSPs	2015	2020	2025	2030	2035	2040
SF – LKB	290.05	294.98	297.01	299.35	299.24	303.36
SF – UEC	383.89	337.15	335.87	334.66	332.71	329.74
SF – LEC	2,048.23	2,128.28	2,176.09	2,239.18	2,282.87	2,329.11
SF – LWC	1,108.81	1,163.39	1,209.49	1,252.45	1,312.74	1,356.84

Source: SFWMD's RWSPs.

SJRWM, SWFWMD, and SFWMD: CFWI Planning Region

Table A.4.12 Projections of 2040 Water Use

Region	Baseline Scenario (Average Rainfall): Water Use (mgd)*	Drought Scenario	
		Water Use (mgd)	% (compared with the baseline scenario)
CFWI	907.59	1,011.00	111.39%

* Source: DEP (2022a).

Table A.4.13 Water Use Estimates and Projections for 2020-2040, Baseline and Drought Scenarios (mgd)

Region	Average Demand (Data from DEP 2022a)					Demand during Drought (Using % increase from Table A.4.12)				
	2020	**2025**	**2030**	**2035**	**2040**	**2020**	**2025**	**2030**	**2035**	**2040**
CFWI	735.24	789.49	836.65	873.94	907.59	819.01	879.44	931.98	973.52	1,011.00

SJRWMD: SJR – CSEC Planning Region

Table A.4.14 Projections of 2040 Water Use

Region	Baseline Scenario (Average Rainfall): Water Use (mgd)*	Drought Scenario	
		Water Use (mgd)	% (compared with the baseline scenario)
SJR – CSEC	427.87	508.56	118.86%

** Source: DEP (2022a).

Table A.4.15 Water Use Estimates and Projections for 2020-2040, Baseline and Drought Scenarios (mgd)

Region	Baseline Scenario (Data from DEP 2020a)					Drought Scenario (Using % increase from Table A.4.14)				
	2020	**2025**	**2030**	**2035**	**2040**	**2020**	**2025**	**2030**	**2035**	**2040**
SJR – CSEC	383.47	395.62	406.11	416.72	427.87	455.79	470.23	482.70	495.31	508.56

Statewide Water Use Projections for a Scenario of Recurring Droughts

Table A.4.16 summarizes water use estimates and projections for the scenario of recurring droughts. EDR calculates these estimates using the WMDs' data reported in their WSAs/RWSPs. Calculation details are presented in the series of tables above.

Table A.4.16 Projected Statewide Water Use for a Scenario of Recurring Droughts (mgd)

Region	2020	2025	2030	2035	2040
NWFWMD	388.63	409.45	425.62	438.74	450.96
SR – West	114.56	119.28	125.48	131.57	137.15
NFRWSP	633.19	663.1	694.12	722.38	753.88
SJR – CSEC	455.79	470.23	482.7	495.31	508.56
SWFWMD (excluding CFWI)	1019.63	1063.47	1096.27	1130.05	1158.11
SFWMD (excluding CFWI)	3923.8	4018.46	4125.64	4227.56	4319.05
CFWI	819.01	879.44	931.98	973.52	1,011.00
Statewide Water Use – Drought Scenario	***7,354.61***	***7,623.43***	***7,881.81***	***8,119.13***	***8,338.71***
For comparison:					
Statewide Water Use – Baseline Scenario (average rainfall)	*6,436.74*	*6,687.10*	*6,925.64*	*7,141.76*	*7,336.15*
Drought Demand as % from Average Year Demand	*114.26%*	*114.00%*	*113.81%*	*113.69%*	*113.67%*

Methods Used by WMDs to Develop the Drought Water Use Projections

NWFWMD. Annual average streamflow and precipitation data were analyzed for over 30 years, with 2011 selected as a dry year compared to the average year of 2015. An increase in PS water usage during 2011 generated the drought event multiplier of 1.07, or a 7% increase over an average year. The same factors were also presumed to affect DSS. Therefore, the drought year projections for PS and DSS both use a 1.07 multiplier.

The FSAID IV generated dry year estimates by crop. The dry-to-average year ratio in northwest Florida ranges from a low of 1.17 for greenhouse/nursery crops to a high of 1.72 for hay. These estimates generated agricultural drought demand by the NWFWMD's planning regions. The AFSIRS simulations in the FSAID IV were accepted for the L/R category, with the estimated dry-to-average year multiplier for sod or perennial grass being 1.34. Finally, the water use in the CII and PG sectors is assumed to remain unchanged during droughts.[103]

SRWMD and SJRWMD. Water demand in PS and DSS is assumed to increase by 6% given the 1-in-10 year drought, based on the recommendations of the 1-in-10-Year Drought Subcommittee of the Water Planning Coordination Group (WDPS 1998[104]). For AG drought demand, the FSAID II forecast was utilized. For the L/R category, a 1-in-10-year drought factor was developed for each county, using the highest year water use from 2006-2014 and the percent increase from the average 2006-2014 L/R water use. For example, if water use in 2007 was 5 percent higher than

[103] To clarify, the FSAID IV data was accepted and used in the 2018 WSA. Except for the sod/perennial grass 1.34 multiplier for the L/R category, the NWFWMD did not exercise any tools, applications, or calculations.

[104] WDPS. 1998. Final Report: 1-in-10-Year Drought Requirement in Florida's Water Supply Planning Process. SJRWMD, Palatka, FL.

the 2006-2014 average, 5 percent was applied to the average 2035 water demand to project the 2035 1-in-10 year water demand. Finally, the 1-in-10-Year Drought Subcommittee of the Water Planning Coordination Group, as stated in their final report, determined that drought events do not significantly impact water use in the CII and PG self-supply categories.

SWFWMD (excluding CFWI). Water demand in PS and DSS was assumed to increase by 6% during the 1-in-10 drought year (WDPS 1998). For the L/R category, the 1-in-10-year drought water use factor was assumed to be 1.3 for golf course irrigation, and 1.26 for non-golf uses. Based on Water Planning Coordination Group (1998), drought events are not expected to impact the CII and PG self-supply use. Finally, for the AG irrigation drought-year demand, crop-specific scaling factors from the FSAID V forecast were derived and then applied for individual WUPs, accounting for the relevant surface water and groundwater split. Aquaculture and livestock water uses were assumed not to be affected by drought.

SFWMD (excluding CFWI). Drought water use for PS and DSS categories was calculated using drought demand factors for each county. For example, a 1.03 multiplier was utilized for Monroe County, and a coefficient of 1.10 was applied for Palm Beach and Broward Counties. In turn, for the AG and L/R categories, crop- and basin-specific irrigation rates from the Agricultural Field Scale Irrigation Requirements Simulation (AFSIRS) were the basis for the drought use forecast. AFSIRS is a water budget model for calculating irrigation demands that estimate demand based on basin-specific data. Finally, drought demand for CII and PG was assumed to be equal to that for the average year.

CFWI. Water demand in PS and DSS was assumed to increase by 6% during the 1-in-10 drought year (WDPS 1998). For AG, the FSAID IV drought demand projections were utilized. For L/R, each county was characterized by a drought factor, using the highest year of water use from 2011-2015 and the average use from the same period. Finally, drought demand for CII and PG was assumed to be equal to that for the average year.

The methods used by various WMDs are summarized in Table A.4.17 below.

[See table on following page]

Table A.4.17 Statewide Drought Demand Projection Method

Region	PS and DSS	AG	L/R	CII and PG
NWFWMD	1.07 multiplier	FSAID IV	Sod or perennial grass multiplier of 1.34 (from FSAID IV)	Water use is assumed to remain unchanged during the drought year
SRWMD and SJRWMD	1.06 multiplier	FSAID II	Drought factor was developed for each county, using the highest year water use from 2006-2014 and the percent increase from the average 2006-2014 L/R water use	
SWFWMD (except CFWI)	1.06 multiplier	FSAID V and WUP information	Drought water use factor was assumed to be 1.3 for golf course irrigation, and 1.26 for non-golf uses	
SFWMD (except CFWI)	County-specific drought demand multipliers	AFSIRS	AFSIRS	
CFWI	1.06 multiplier	FSAID IV	Drought factor was developed for each county, using the highest year water use from 2011-2015 and the percent increase from the average 2011-2015 L/R water use	
SJR – CSEC	1.06 multiplier	FSAID IV	Drought factor was developed for each county, using the highest year water use from 2007-2015 and the percent increase from the average 2007-2015 L/R water use. For example, if water use in 2012 was X percent higher than the 2007–2015 annual average, X percent was applied to the 2040 water demand to project a 2040 1-in-10 year water demand.	

A.5 Description of the Methods Used By the WMDs to Identify Supplies

Different estimation methods are used to quantify "Estimated Existing Sources Available to Meet Future Demands," which makes it difficult to compare the values reported for the various supply planning regions. The following estimation methods to quantify "Estimated Existing Sources Available to Meet Future Demands" are utilized:[105]

•***Permitted but unused water (SWFWMD)*:** This value represents the permitted but unused quantities of surface water, brackish groundwater, and Upper Floridan Aquifer groundwater within each of the District's four planning regions.[106] In general, the SWFWMD calculates this as the difference between total permitted allocations, which have been determined to not cause harm to the water resources of the area or interfere with existing legal uses, and the currently reported withdrawals of those permittees at the time of RWSP development.[107]

•***Permitted but unused water and unused DEP permitted treatment capacity (SFWMD)***: For the SFWMD planning regions, the public supply category is projected to grow, while the other water use categories, such as agricultural self-supply, are expected to remain relatively stable or to decline. Therefore, the assessment of the existing water supply focuses only on the sources available for public supply. To estimate "Existing Sources Available to Meet Future Demand," with the exception of the Upper Kissimmee Basin Planning Area which is included in the CFWI, the SFWMD considers the permitted but unused water and unused DEP permitted

[105] For the SJR – CSEC region, the data are not available. The RWSP is expected to be available for public review in the spring of 2021.
[106] Potential water supplies from the surficial aquifer, seawater desalination, and reclaimed water are accounted for among the alternative water supply options.
[107] For each permittee, the SWFWMD evaluates the level of water use as either a five-year average of reported withdrawals or a single year estimate.

treatment capacity. For each supplier, projects are then identified to meet the difference between the projected demand[108] and the permitted allocation or existing treatment capacity.[109]

•***Currently permitted water for public supply (NWFWMD)***: The NWFWMD uses the currently permitted volumes of water for public supply to estimate demand that can be met. This districtwide data is used in the DEP's annual metrics submission.

•***Hydrogeological computer models of planning-level groundwater withdrawal scenarios (CFWI and NFRWSP)***: Hydrogeologic computer models are used to examine groundwater withdrawal scenarios corresponding to the projected demands at the planning-region level for public supply (PS), domestic self-supply (DSS), commercial-industrial-institutional-mining self-supply (CII), recreational landscape irrigation self-supply (L/R), agricultural self-supply (AG), and power generation self-supply (PG) categories. The models are used to determine the estimated maximum withdrawal levels after which further increases in withdrawals may be constrained by at least one natural system (*e.g.*, a violation of a minimum flow or minimum water level).[110] For the CFWI, their model[111] indicated that, on a water supply planning level, alternative sources or conservation would be needed to meet all "Net Demand Change." For the NFRWSP, several groundwater withdrawal scenarios were assessed using a hydrogeological model.[112] For all the scenarios considered, water withdrawals were constrained by at least one natural system. Therefore, "Estimated Existing Sources Available to Meet Future Demands" for the NFRWSP were listed as "Not Quantified." It is possible that water projects must be completed in the NFRWSP area to meet the base year water demand in addition to the "Net Demand Change."

A.6 Project Scenarios to Meet Future Demand Increase

To develop future project scenarios, EDR examines the volume of water or beneficial offset for the projects listed as "RWSP/RPS Options Only" in the DEP project appendix.[113] EDR focuses on the regions with inferred water supply shortages. "RWSP/RPS Options Only" projects in each region are examined, and their types are summarized in Table A.6.1.

For future project expenditure projections, EDR further narrowed the list of project types for each region. To accomplish this, "means to meet future demand" identified in DEP (undated) were

[108] Utilities apply various methodologies to forecast future demand based on the number of people per connection, the number of connections, and other characteristics of their service areas. The SFWMD has its own methodology to project demand (based on BEBR population projections, five-year average per capita use, etc.). As a part of the RWSP development process, the SFWMD and utilities discuss and agree to the amount of water needed for the region.

[109] Note that the utilities are planning and reporting based on their peak capacity. The projects identified by the public supply companies also focus on projected peak capacity since utilities need to meet peak future demand. Unless utility-specific coefficients are estimated, the average capacity is approximately 80 percent of the peak capacity.

[110] While water may be available on a permit-by-permit basis, the hydrogeological modeling provides a planning-level estimate of how much water the WMDs must identify through conservation or AWS project options.

[111] The East Central Florida Transient Groundwater Flow Model.

[112] The North Florida-Southeast Georgia regional groundwater flow model, with groundwater being the traditional water source for the region.

[113] The only exception is NW – II, where all projects are considered, since no "RWSP/RPS Options Only" projects are identified.

considered.[114] DEP (undated) classified potential alternative sources to meet future water demand based on the likelihood the source will be utilized.[115] This likelihood (aka "confidence rating") reflected expectations for the source meeting all or a portion of the region's future needs. This likelihood was reported as "high" (likely to be used regionally and locally), "moderate" (may be used regionally and likely to be used locally), and low (unlikely to be used regionally, but may be used locally). (see Table A.6.1).

To summarize, EDR selected only the project types that have "high" or "moderate" likelihood (based on DEP, undated), and which were also present among "RWSP/RPS Options Only" in the DEP project appendix. These project types are summarized in Table A.6.2.

[114] DEP. Undated. An Assessment of Viable Alternative Water Supply Resources and Critical Funding Needs. Presented by the FDEP pursuant to Executive Order 19-12 and Chapter 2019-115, Laws of Florida.
[115] DEP (undated) also states the quantity each source is estimated to produce; these estimates are not used in the EDR analysis.

Table A.6.1 Project Types Identified in "RWSP/RPS Options Only" in DEP Project Appendix and in "Means to Meet Future Demands" in DEP (undated)

Regions	ASR	Brackish Groundwater	Groundwater Recharge	Other Non-Traditional Sources	Other Project Type	Reclaimed water	Seawater Desalination	Stormwater	Surface Water	Surface Water Storage
NW – II										
NFRWSP										
SW – N*										
CFWI										
SF – LWC										
SF – LEC										

* excluding CFWI

Legend:

Confidence rating from DEP (undated):

high (likely to be used locally and regionally)

medium (likely to be used locally; may be used regionally)

low (may be used locally, unlikely to be used regionally)

EDR rating:

project type is present in "RWSP/RPS Options Only" (exception for NW – II applies)

Table A.6.2 Project Types Selected for EDR Expenditure Scenarios

	ASR	Brackish Groundwater	Groundwater Recharge	Other Non-Traditional Sources	Other Project Type	Reclaimed water	Seawater Desalination	Stormwater	Surface Water	Surface Water Storage
NW – II										
NFRWSP										
SW – N										
CFWI										
SF –LWC										
SF – LEC										

* excluding CFWI

A.7 EDR's Water Demand/Use Pilot Model and Comparison of EDR and WMD Statewide Water Use Projections

A summary of the differences between EDR's projections and WMD's projections are presented in Table A.7.1 to Table A.7.5

Agricultural Water Use Projections

Table A.7.1 Agricultural Water Use Projections

	2020	2025	2030	2035	2040
FSAID-9 Projection					
NW – II	2.92	3.34	3.90	4.46	5.03
NW – Other	46.96	48.30	49.29	50.32	51.61
SR – West	61.33	64.68	68.66	73.42	77.85
NFRWSP	156.46	160.39	164.34	169.21	174.03
SJR – CSEC	90.43	90.31	90.03	89.14	88.49
SW – N (excluding CFWI)	26.65	28.13	29.85	32.55	35.06
SW – TB	50.54	48.76	47.76	46.40	44.87
SW – H (excluding CFWI)	101.17	101.30	101.52	100.29	98.31
SW – S	165.88	168.54	171.66	173.51	175.35
CFWI	130.56	131.35	131.74	130.09	128.22
SF – LKB	111.41	113.32	115.71	118.74	122.13
SF – UEC	123.38	118.20	113.55	108.99	103.54
SF – LEC	654.12	633.41	632.44	631.88	630.26
SF – LWC	327.52	331.24	331.06	335.34	340.79
Statewide	**2,049.33**	**2,041.28**	**2,051.52**	**2,064.34**	**2,075.23**
Water Management Districts' Projections					
NW – II	3	3.24	3.52	3.77	3.97
NW – Other	42.35	45.33	47.84	50.74	53.53
SR – West*	49.3	52.31	56.65	61.07	64.79*
NFRWSP*	139.41	142.95	148.8	153.58	156.80*
SJR – CSEC	119.12	119.46	120.71	121.6	122.91
SW – N (excluding CFWI)	19.58	21.14	22.87	24.64	26.43
SW – TB	46.12	44.18	42.35	40.45	38.16
SW – H (excluding CFWI)	71.53	68.99	66.26	65.2	62.18
SW – S	105.58	106.48	107.52	108.55	109.65
CFWI	157.19	157.89	159.66	161.72	163.49
SF – LKB	241.31	243.01	244.66	244.63	248.14
SF – UEC	169.98	162.45	154.16	146.24	138.31
SF – LEC	653.25	643.51	637.51	631.06	625.27
SF – LWC	634.93	644.66	653.01	665.92	678.83
Statewide	**2,452.65**	**2,455.60**	**2,465.52**	**2,479.17**	**2,492.46**
Difference between WMDs' and FSAID-9 projections**					
NW – II	0.08	-0.10	-0.38	-0.69	-1.06
NW – Other	-4.61	-2.97	-1.45	0.42	1.92
SR – West	-12.03	-12.37	-12.01	-12.35	-13.06
NFRWSP	-17.05	-17.44	-15.54	-15.63	-17.23
SJR – CSEC	28.69	29.15	30.68	32.46	34.42
SW – N (excluding CFWI)	-7.07	-6.99	-6.98	-7.91	-8.63
SW – TB	-4.42	-4.58	-5.41	-5.95	-6.71
SW – H (excluding CFWI)	-29.64	-32.31	-35.26	-35.09	-36.13
SW – S	-60.30	-62.06	-64.14	-64.96	-65.70
CFWI	26.63	26.54	27.92	31.63	35.27
SF – LKB	129.90	129.69	128.95	125.89	126.01
SF – UEC	46.60	44.25	40.61	37.25	34.77
SF – LEC	-0.87	10.10	5.07	-0.82	-4.99
SF – LWC	307.41	313.42	321.95	330.59	338.04
Statewide	**403.32**	**414.32**	**414.00**	**414.83**	**416.93**

* This value was projected by EDR using a trend from the WMDs' 2015-2035 estimates and projections.

** Positive numbers indicate WMD's projections are higher than FSAID-9's projections

PS, DSS, L/R, and CII Water Use: Data and Model Estimation

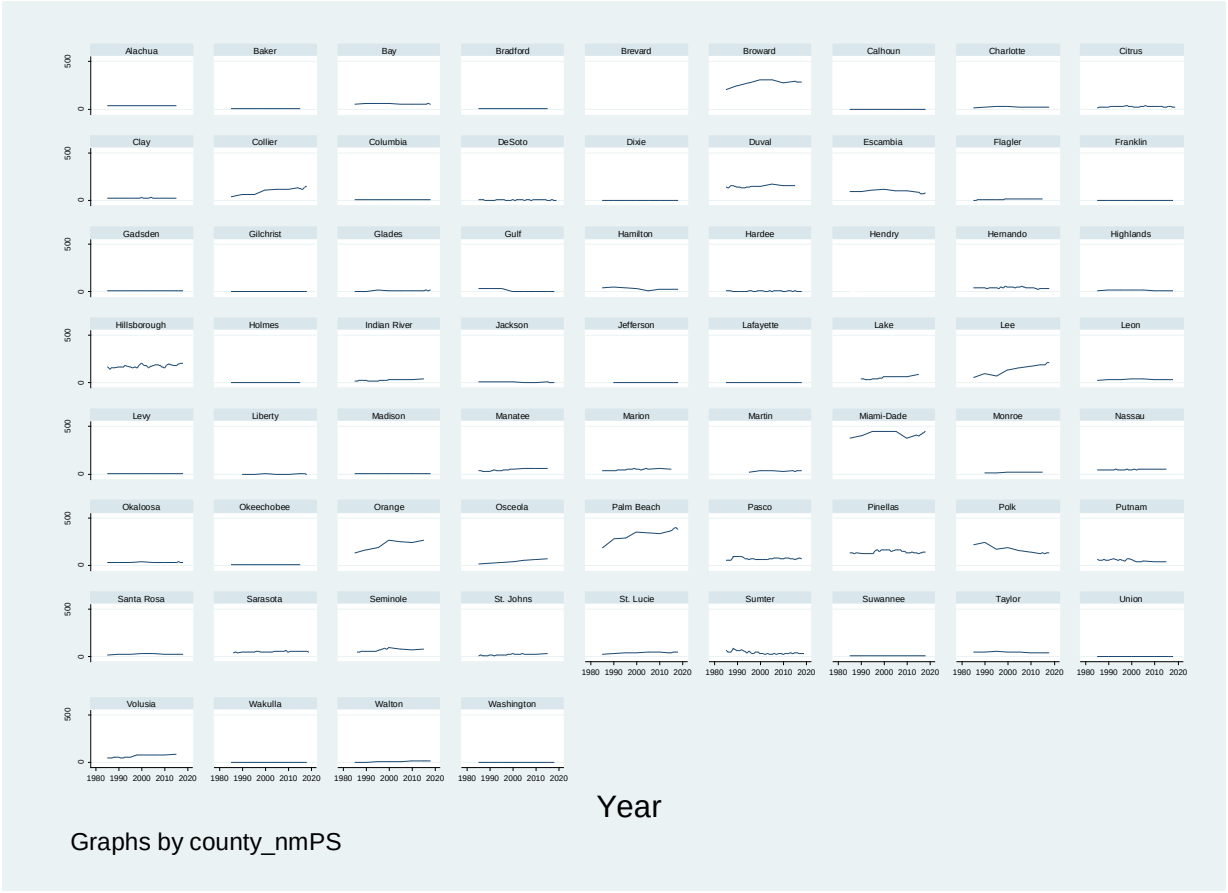
Data

The data used to develop the combined PS, DSS, L/R, and CII forecast are summarized in the graphics below. First, historical water use data are presented in Figure A.7.1. Broward, Hillsborough, Miami-Dade, Orange, and Palm-Beach stand out as counties with exceptionally high use. Also, while in most counties, water use is stable or growing, in a few counties, the use decreases (*e.g.*, Polk, Putnam, and Escambia). It is also observed that for Gulf, Hamilton, and Sumter counties, water use follows different trends before and after 2000. This observation was verified by separately examining the trends in each use category for these counties (*i.e.*, independently examining PS, DSS, L/R, and CII). Therefore, for the regression analysis, different models were developed for each group of counties, which share similarities in water usage patterns (see Figure A 7.11). In this report, EDR used the Clustering approach to group the county-level PS, DSS, L/R, and CII water use history into seven groups. Each group has a seperate forecasting model to better reflect its water use pattern[116]. Second, EDR used Fixed Effects (FE) technique for modeling the water use, as opposed to the Ordinary Least Square (OLS) technique used for the report's 2022 Edition. The FE technique was used to control for unobservable or unmeasurable factors such as cultural, economic, and demographic factors or differences in water use patterns across the counties due to regulations and climate conditions. That is, the FE technique allows users to account for individual (county) heterogeneity. EDR intends to continue improving the forecasting model.

[See figure on following page]

[116] Rondinel-Oviedo (2020) provides additional explanations of internal and external factors affecting water consumption. Available online at: https://doi.org/10.1080/02508060.2020.1830360
Avni et al. (2015) presents an approach for water consumption data clustering. Available online at: https://doi.org/10.1002/2014WR016662

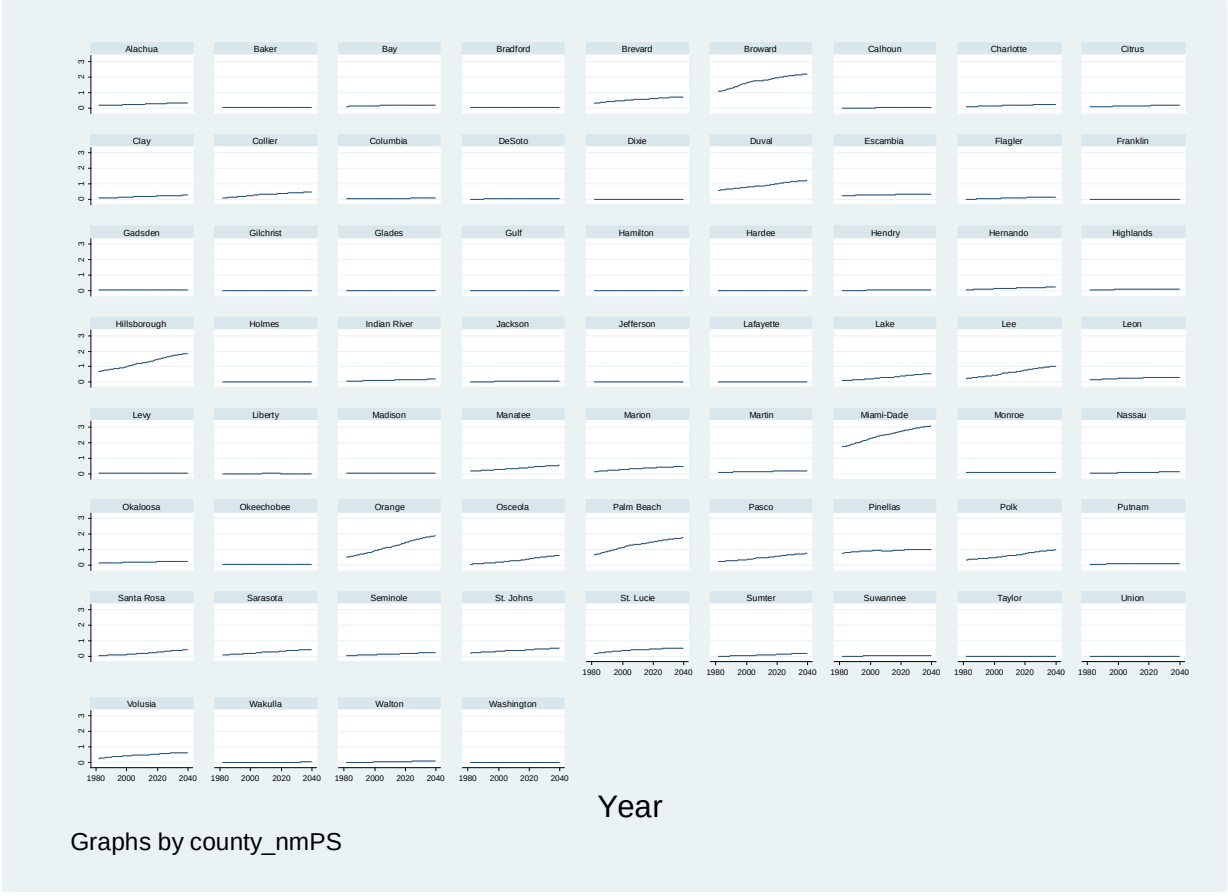
Figure A.7.1 Total Estimated PS, DSS, L/R, and CII Water Use, by County (mgd)



The next series of graphs displays the historical and forecasted values of the economic and demographic variables used in the EDR water use models. These values are developed from (a) an EDR database of historical and forecasted statewide economic and county demographic data, and (b) county-level history and projections available from Woods and Poole Economics (2022)[117]. In other words, EDR state-level economic values are "distributed" to the individual counties based on the proportion values estimated by EDR from Woods and Poole Economics (2022).

Figure A.7.2 shows county population, both historical data and the forecast (EDR 2022)[118]. Similar to the water use shown in the previous Figure, the population in Broward, Hillsborough, Miami-Dade, Orange, and Palm-Beach counties stands out as exceptionally high compared with the other counties. The population in these and other counties is projected to continue growing.

Figure A.7.2 Population, by County (million people)

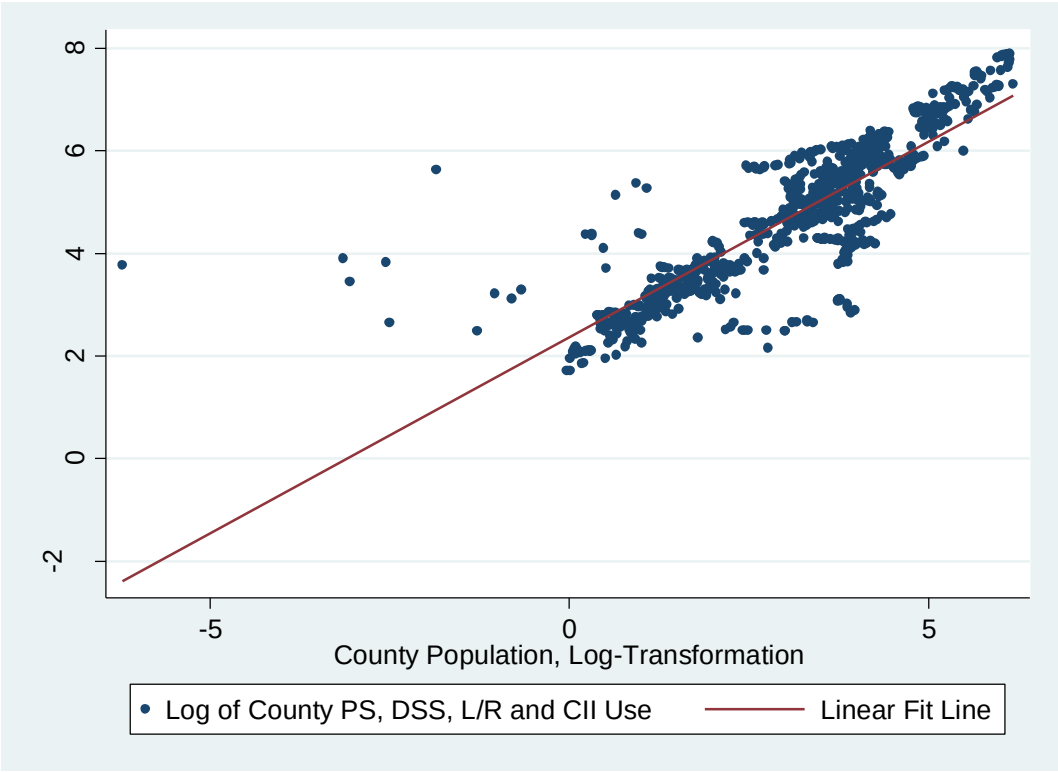


The total county water use in PS, DSS, L/R, and CII categories was correlated with the county population. Specifically, the relation between (a) the natural logarithm of water use and (b) the natural logarithm of the population is close to linear. See Figure A.7.3 for an illustration.

[117] Woods and Poole Economics Data. Available online at: https://www.woodsandpoole.com/our-databases/

[118] EDR Population and Demographic Data. Available online at: http://edr.state.fl.us/Content/population-demographics/data/index.cfm

Figure A.7.3 Scatter Plot for Total PS, DSS, L/R, and CII Water Use (mgd) and Total County Population (thousand people), Log-Transformations



Next, Florida employment in accommodation and food services (NAICS 72) demonstrates the relative share of tourism-related activities in the county economy. Statewide data for 1990 – 2031 are obtained from EDR's database of Florida's economic and demographic indicators. EDR's state forecast is extended to 2032 – 2040, assuming a linear trend. Historical and forecasted county Accommodation & Food Services Employment (TT051) levels are examined (Woods and Poole Economics 2022)[119] and used as a model to allocate EDR's state employment figures to the individual counties. In other words, each county's employment as a share of the state's total employment is calculated. These proportions from Woods and Poole Economics (2022) are then applied to the EDR statewide forecast to estimate county employment. To assess the share of tourism-related activities in the county economy, EDR calculated the ratio of accommodation and food services employment to the county population. The final result is displayed in Figure A.7.4. In most counties, the proportion of the population employed in accommodation and food services is less than 0.1 (*i.e.*, 10% of the population). The exception is Monroe County, where the share fluctuates between 0.1 and 0.2. The proportion is also relatively high in the Bay, Okaloosa, Orange, and Walton Counties (which may reflect the importance of tourism associated with Destin-Panama City and Orlando).

[See figure on following page]

[119] Woods and Poole Economics Data. Available online at: https://www.woodsandpoole.com/our-databases/

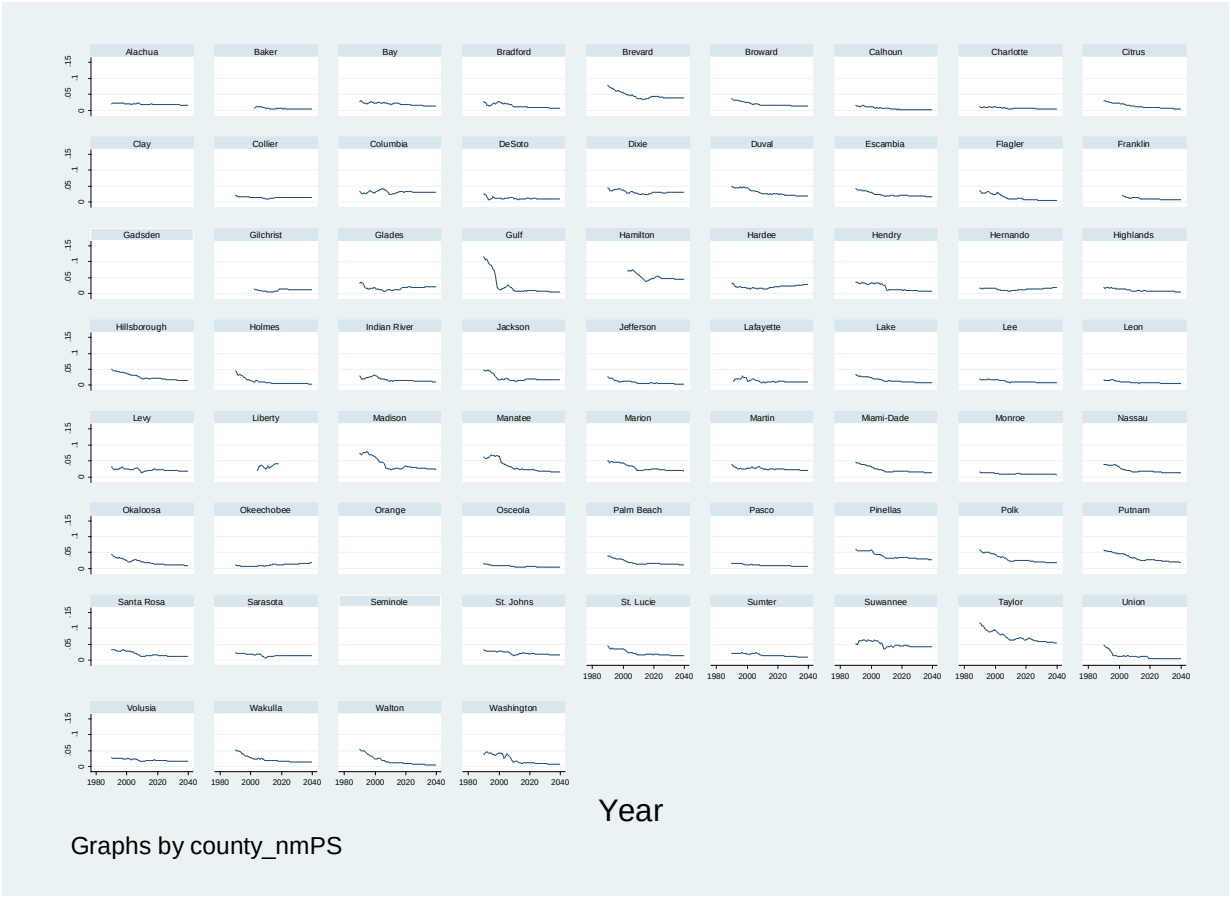
Figure A.7.4 Estimated Ratio of Accommodation and Food Services Employment in the Total County Population

Note: Population is in thousand.

The proportion of the population employed in mining, manufacturing, and utility sectors is also calculated. The state employment in the following industries was identified in the EDR state dataset for 1990 through 2031: mining (NAICS 21), utilities (NAICS 22), and manufacturing (NAICS 31-33). Next, EDR's state forecasts for the industries were extended to 2032 – 2040 using a linear trend. To allocate the state forecast to individual counties, historical and forecasted values for mining (TT035), utilities (TT036), and manufacturing (TT038) were examined (Woods and Poole Economics 2022). Each county's employment as a share of the state's total employment is calculated for every year, aggregating the three sectors. These proportions are then applied to the EDR statewide forecasts to derive counties' employment from EDR's state employment values. This derivation process ensures that the sum of the county employment is equal to the official state forecast. The proportion of the population employed in mining, manufacturing, and utility sectors is very low for most counties–less than 0.03 (or 3% of the population) and it dropped significantly over time, see Figure A.7.5.

[See figure on following page]

Figure A.7.5 Estimated Ratio of Mining, Utilities, and Manufacturing Employment in the Total County Population

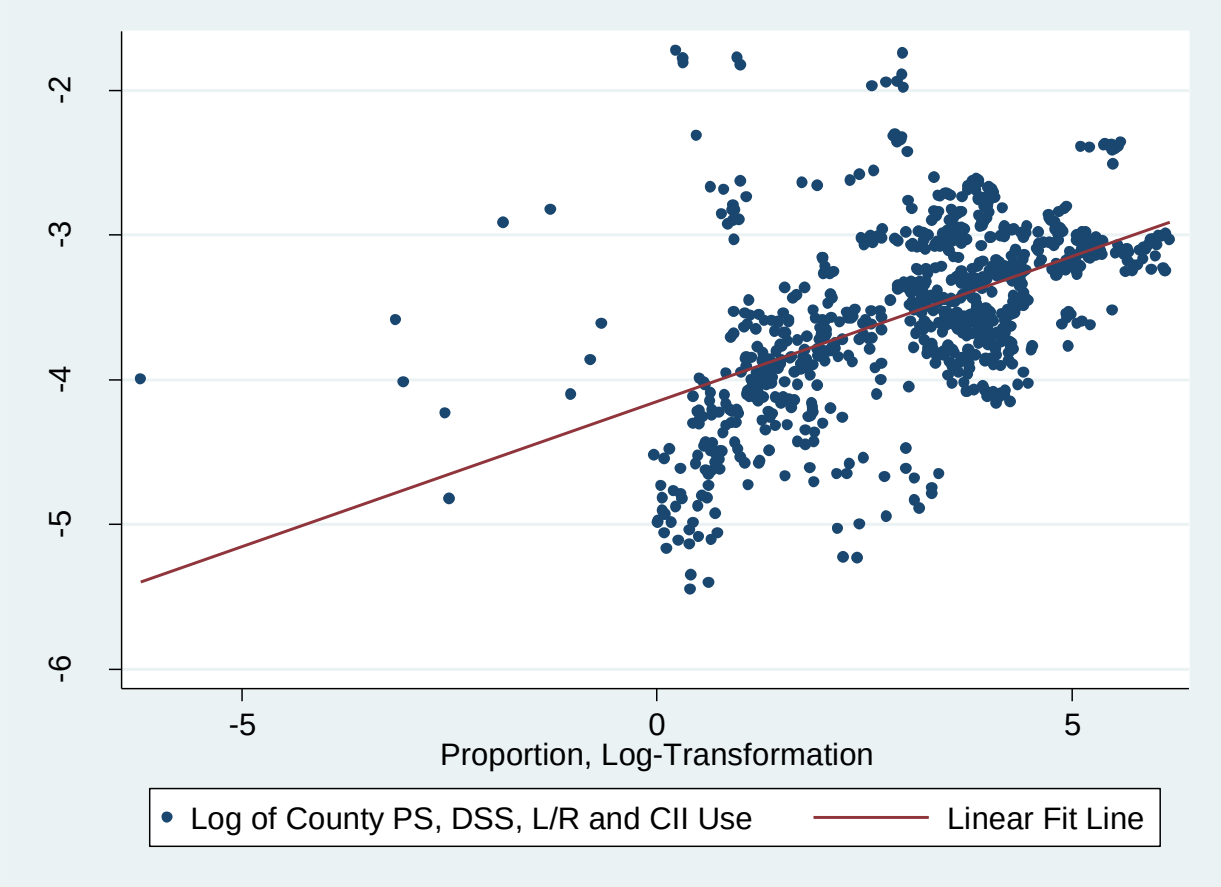


Note: Population is in thousand.

As shown in Figures A.7.6 and A.7.7, county water use is positively correlated with the proportion of the county population employed in accommodation and food services, as well as with the proportion employed in mining, manufacturing, and utilities. The correlation is smaller than that with the county population, and the dispersion of the water use observations around the linear fit line is large. The potential effect on water use is likely small for the proportion of the population employed in mining, manufacturing, and utilities (see the slope of the linear fit line in Figure A.7.7).

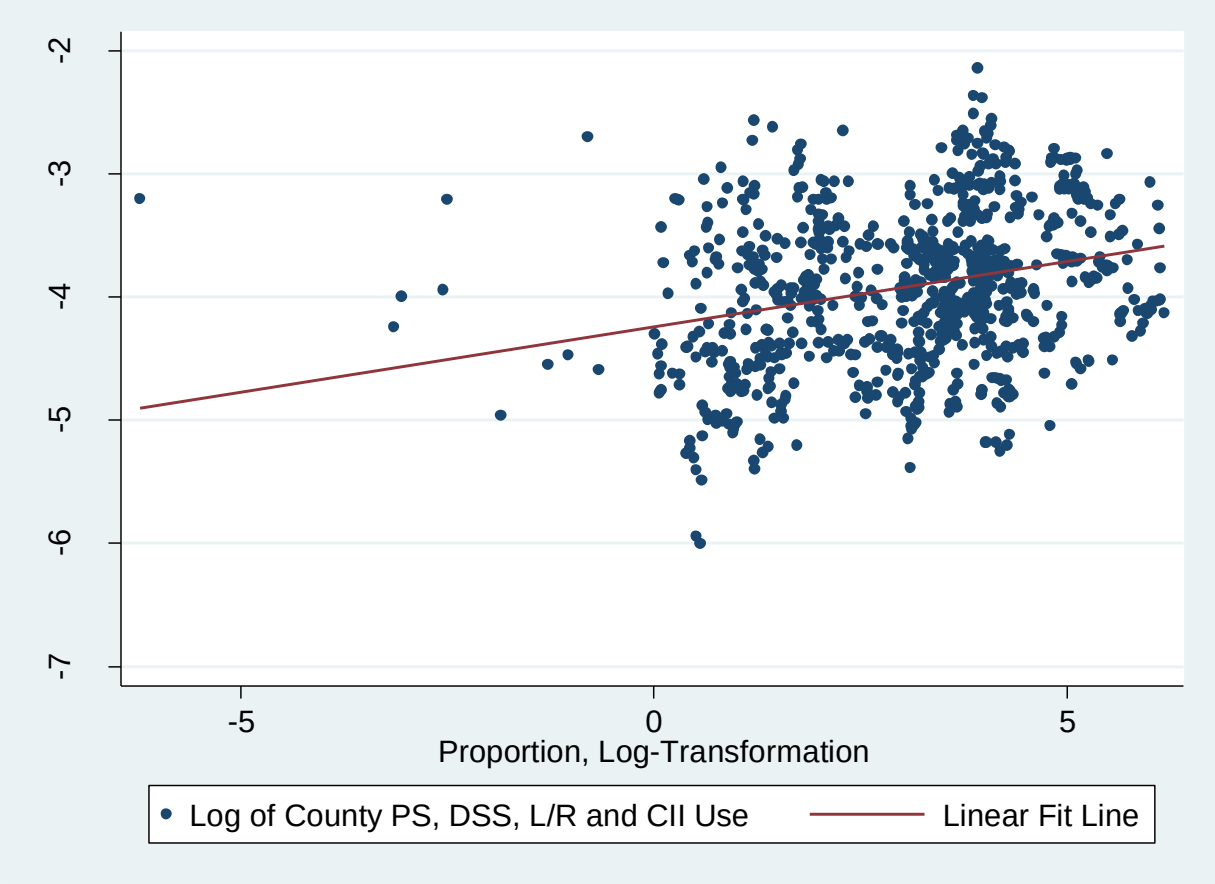
[See figure on following page]

Figure A.7.6 Scatter Plot for Total County PS, DSS, L/R, and CII Water Use (mgd) and the Proportion of County Population Employed in Accommodation and Food Services, Log-Transformations



[See figure on following page]

Figure A.7.7 Scatter Plot for Total County PS, DSS, L/R, and CII Water Use (mgd) and the Proportion of County Population Employed in Mining, Manufacturing, and Utilities, Log-Transformations

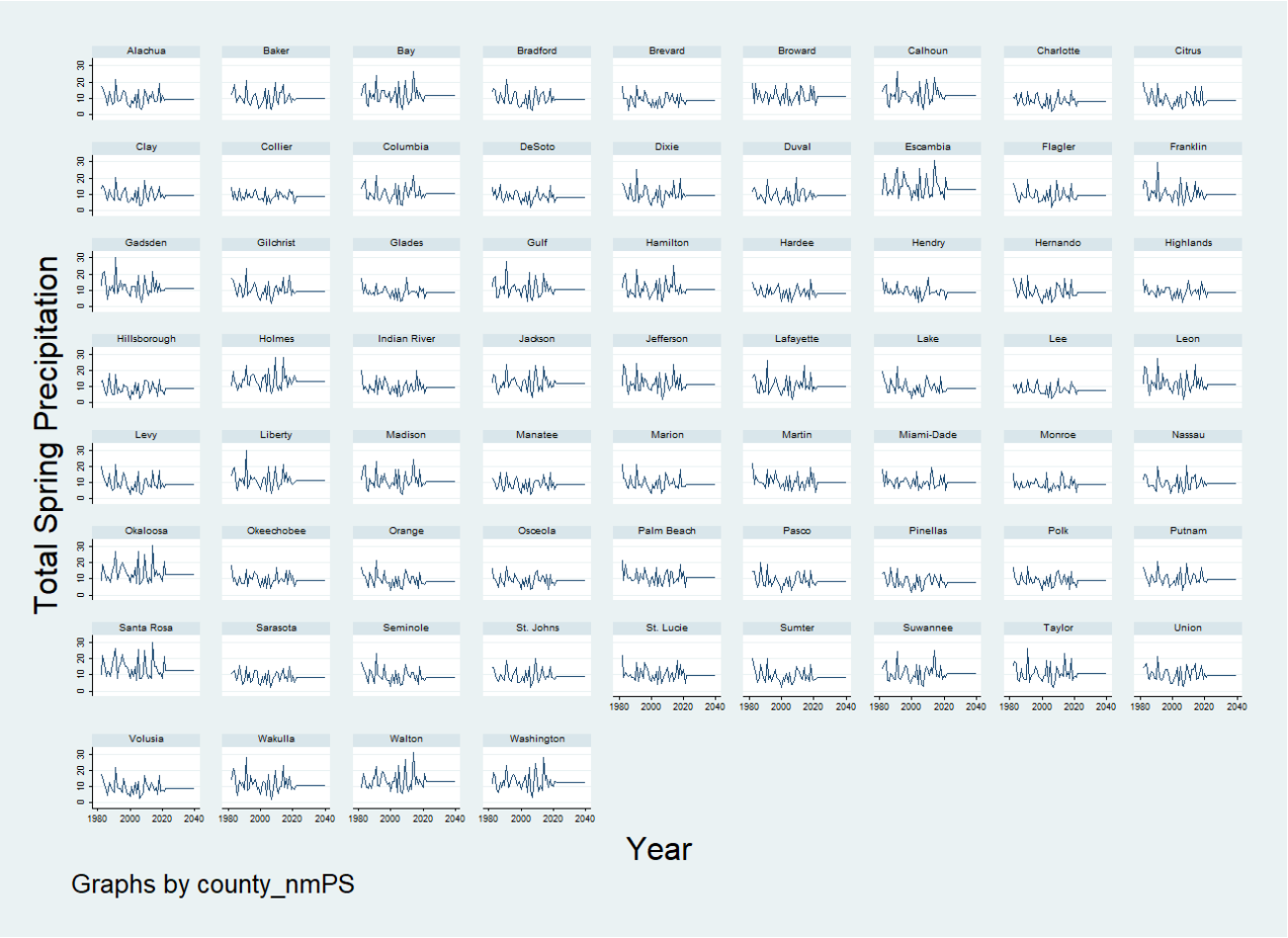


In addition to demographic and economic variables, weather and climate variability can also impact water use. EDR obtained total precipitation and average temperature for March-May and June-August periods for each county from NOAA (2022[120]). Among the weather variables, total spring precipitation was included in the final water use model. For the water use forecast, 2000-2021 average precipitation is assumed for each county (see Figure A.7.8). Water use shows a (weak) negative correlation with March-May county precipitation (Figure A.7.9).

[See figure on following page]

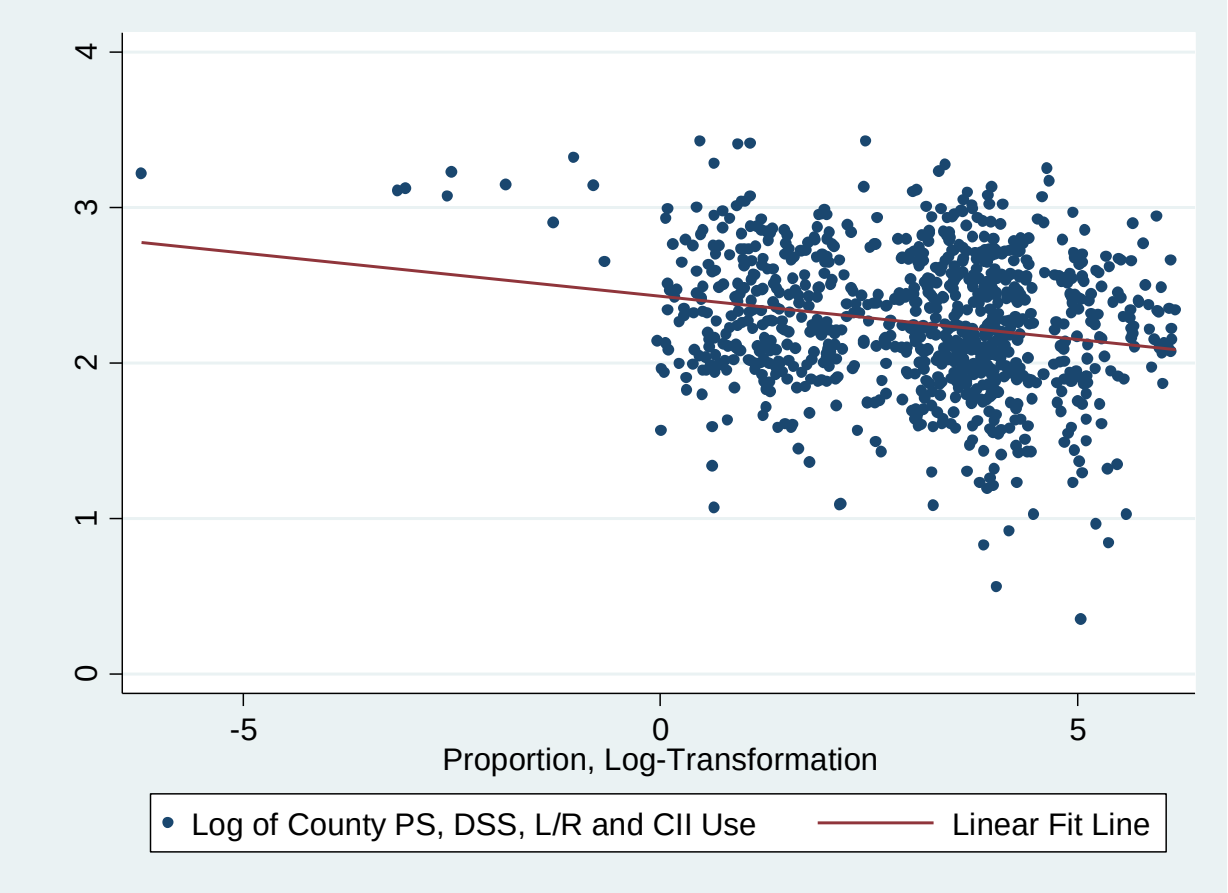
[120] NOAA. County Time Series. Available online at: https://www.ncdc.noaa.gov/cag/county/time-series . (Accessed September 2022.)

Figure A.7.8 Total Precipitation from March Through May (inches)



[See figure on following page]

Figure A.7.9 Scatter Plot for Total County PS, DSS, L/R, and CII Water Use (mgd) and the County Precipitation from March Through May (inches), Log-Transformations



County population, precipitation, time trend, and employment proportions in accommodation and food services, as well as in mining, manufacturing, and utilities, can explain water use variation among most of the counties over time.

EDR's Pilot PS, DSS, L/R and CII Water Use Model Development

Regression analysis was used to estimate coefficients for the following seven models associated with seven clusters of water use. To find the optimal number of clusters, EDR follows a commonly used method, the Elbow curve, which shows the percentage variance explained as a function of the number of clusters. Figure 7.10 shows the Elbow curve for varying values of the number of clusters. The curve suggests that a considerable amount of variance in the data can be explained with four clusters. However, EDR opts to choose seven clusters to explain most of the variance in the data. The FE technique was also used (as opposed to the OLS technique used in the 2022 Edition) to control for unobservable or unmeasurable factors such as cultural, economic, and demographic factors or differences in water use patterns (see Figure 7.11) across the counties due to regulations and climate conditions.

For all seven models, coefficients were estimated using the *regress* procedure in STATA 13.1.[121] The procedure executed a linear (county) fixed effects regression analysis. Option "*vce(cluster county_FIPS)*" was added to account for correlation in observations from the same county when estimating the standard error.[122] The models adequately represent the variability of the dependent variable – county water use (R-squared = 0.74 or higher).

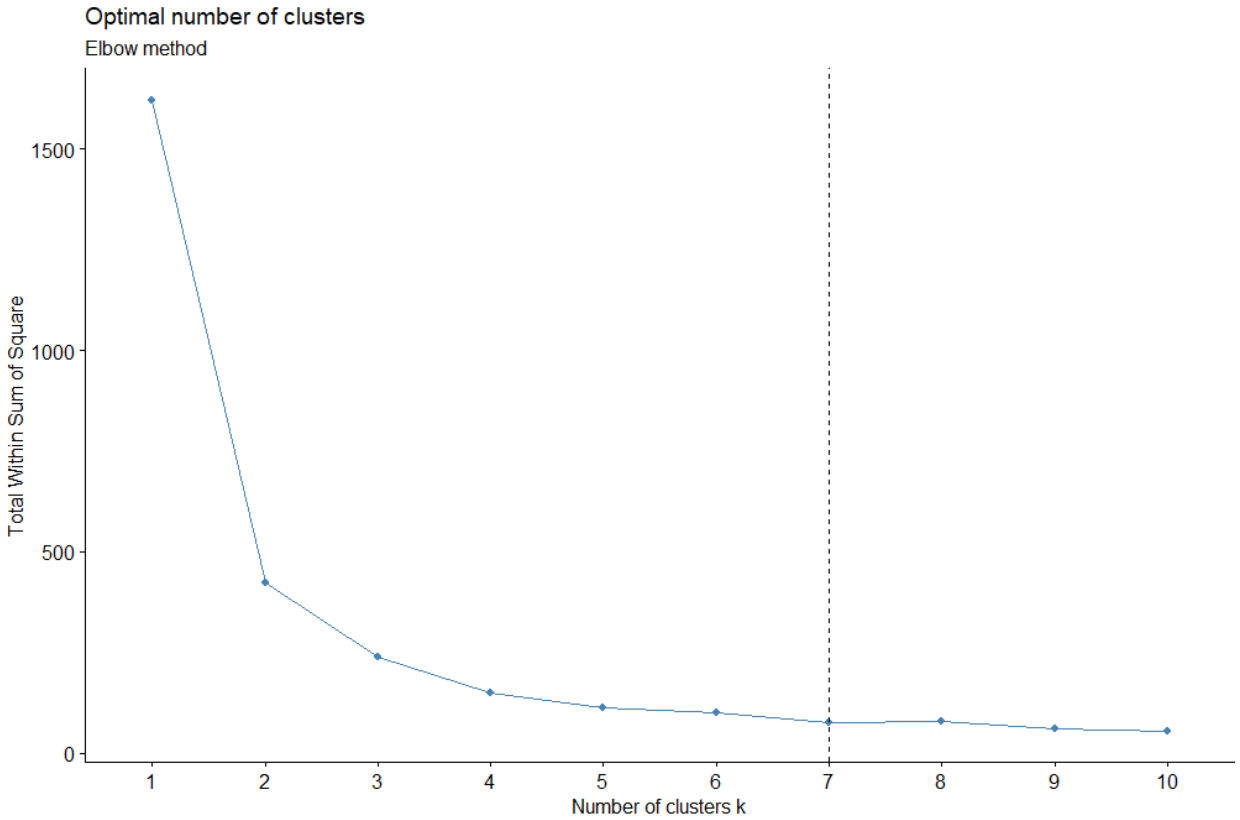
County water use forecasts generated by the seven models were combined to estimate water use for specific water supply planning regions.

[See figure on following page]

[121] StataCorp. 2013. Stata Statistical Software: Release 13. College Station, TX: StataCorp LP.

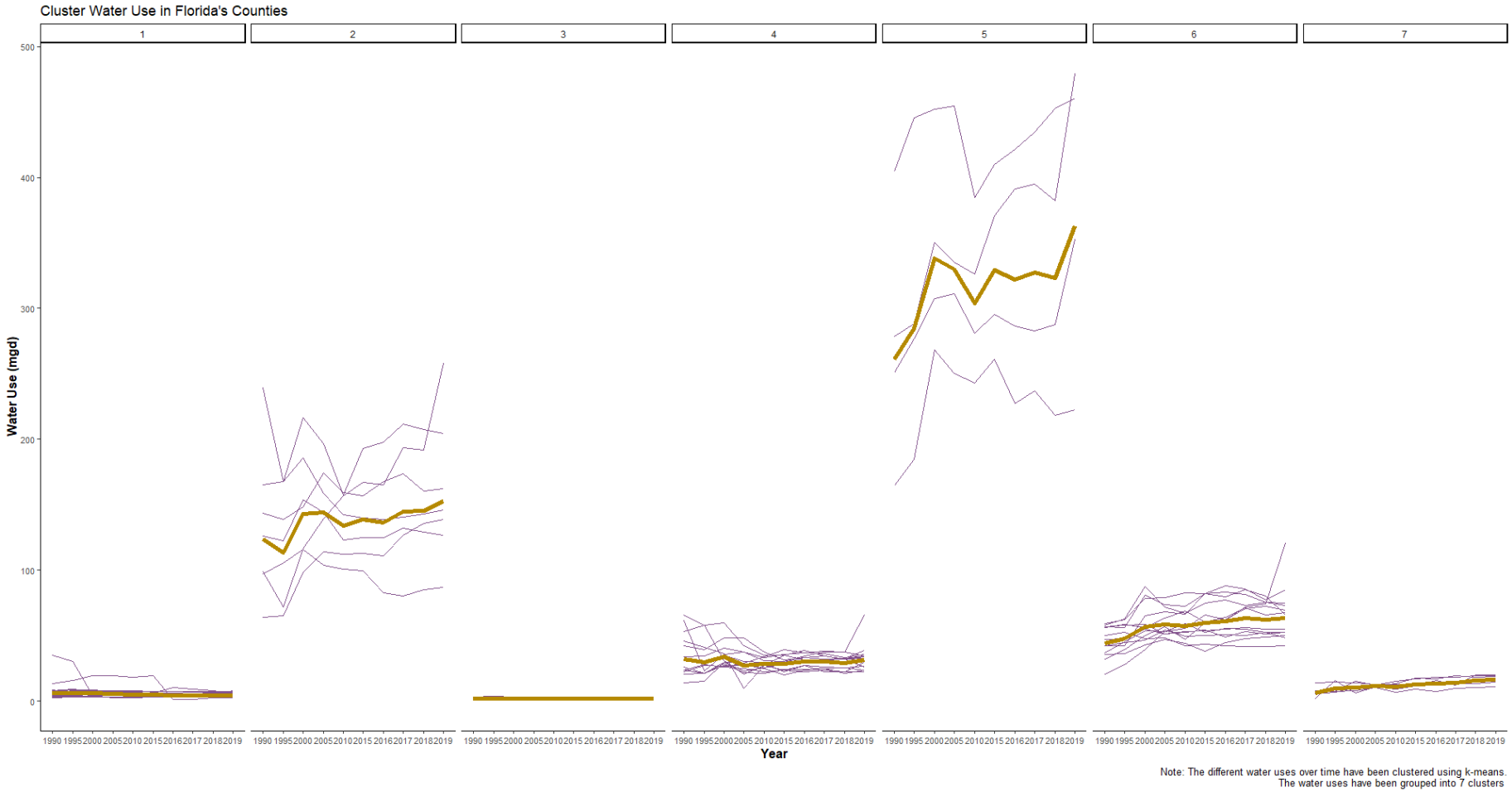
[122] This option relaxes the usual OLS linear regression analysis requirement specifying that all the observations should be independent. See more in STATA. Undated. vce options — Variance estimators. Available online at: https://www.stata.com/manuals13/xtvce_options.pdf (Accessed October 2022.)

Figure 7.10 Optimal Number of Clusters



Note: The optimal number of clusters has been identified using the Elbow method using Cluster and Factoextra packages in R programming software. The optimal number of clusters is associated with the point after which the distortion/inertia (total within the sum of the squares) starts decreasing linearly.

Figure 7.11. Clustering Water Use



Note: The different water uses in 67 Florida counties have been clustered into 7 clusters using k-means using R programming software. The gold lines are the mean water use of clusters while the purple lines represent individual county water use over time.

Table A.7.2 PSS, DSS, L/R, and CII Water Use Projections and Forecasts

	2020	2025	2030	2035	2040
EDR Forecast					
NW – II	85.39	74.08	77.76	80.56	82.29
NW – Other	225.51	183.59	184.66	185.16	184.28
SR – West	44.64	37.58	37.04	36.45	35.65
NFRWSP	399.80	415.58	424.69	431.41	433.27
SJR – CSEC	274.31	266.69	270.58	272.33	270.71
SW – N (excluding CFWI)	134.59	123.31	126.42	128.31	129.01
SW – TB	414.94	401.37	408.10	412.46	412.14
SW – H (excluding CFWI)	15.13	16.73	16.57	16.48	16.23
SW – S	143.93	161.72	168.54	173.88	176.96
CFWI	624.11	627.28	654.86	677.25	694.74
SF – LKB	8.67	8.95	8.89	8.88	8.74
SF – UEC	71.45	85.31	86.15	86.82	86.70
SF – LEC	1,112.84	1,150.55	1,174.98	1,201.09	1,232.77
SF – LWC	297.43	337.80	348.04	355.44	358.25
Statewide	**3,852.75**	**3,890.54**	**3,987.28**	**4,066.51**	**4,121.74**
Water Management Districts' Projections					
NW – II	73.87	79.01	83.5	87.42	90.91
NW – Other	206.22	215.45	221.37	226.12	230.61
SR – West*	57.23	58.61	60.04	61.28	62.75*
NFRWSP*	416.09	439.37	460.48	480.01	503.70*
SJR – CSEC	252.21	263.9	272.98	282.53	292.34
SW – N (excluding CFWI)	121.11	130.56	138.71	146.37	153.09
SW – TB	366.88	388.24	394.25	409.74	423.31
SW – H (excluding CFWI)	19.99	20.46	29.91	29.76	26.97
SW – S	135.75	143.82	154.08	160.04	165.04
CFWI	567.05	620.54	665.86	701.03	732.83
SF – LKB	8.59	8.82	9.02	9.2	9.35
SF – UEC	101.81	109.78	116.21	122.36	128.18
SF – LEC	1,120.99	1,180.65	1,233.02	1,279.84	1,328.52
SF – LWC	394.98	428.51	460.23	489.04	516.45
Statewide	**3,842.77**	**4,087.72**	**4,299.66**	**4,484.74**	**4,664.05**
Difference between WMDs' and EDR projections**					
NW – II	-11.52	4.93	5.74	6.86	8.62
NW – Other	-19.29	31.86	36.71	40.96	46.33
SR – West	12.59	21.03	23.00	24.83	27.10
NFRWSP	16.29	23.79	35.79	48.60	70.43
SJR – CSEC	-22.10	-2.79	2.40	10.20	21.63
SW – N (excluding CFWI)	-13.48	7.25	12.29	18.06	24.08
SW – TB	-48.06	-13.13	-13.85	-2.72	11.17
SW – H (excluding CFWI)	4.86	3.73	13.34	13.28	10.74
SW – S	-8.18	-17.90	-14.46	-13.84	-11.92
CFWI	-57.06	-6.74	11.00	23.78	38.09
SF – LKB	-0.08	-0.13	0.13	0.32	0.61
SF – UEC	30.36	24.47	30.06	35.54	41.48
SF – LEC	8.15	30.10	58.04	78.75	95.75
SF – LWC	97.55	90.71	112.19	133.60	158.20
Statewide	**-9.98**	**197.18**	**312.38**	**418.23**	**542.31**

* This value was projected by EDR using a trend from the WMDs' 2015-2035 estimates and projections.

** Font colors are used to indicate positive and negative differences between the WMDs' and the EDR's projections. Positive numbers indicate WMD's projections are higher than EDR's projections

PG Water Use: Data and Model Estimation

For Power Generation water use, historical data from the USGS and WMDs showed that for most of the counties, PG water use was zero. It was assumed that the withdrawal would remain at zero in the future. For several counties, no specific patterns in historical water use were identified, and therefore, future water use is assumed to be equal to average historical use (see Table A.7.3). For the following three counties, regression analysis was applied to forecast PG water use: Hardee, Osceola, and Pasco. The figures below illustrate the model specifications and the forecasts produced for each county. Regression models include such variables as county population, employment in manufacturing, mining, and utility industries; and time trend.

[See figure on following page]

Table A.7.3 Assumptions about PG Water Use

County FIPS	County Name	Estimated Water Use Value (mgd)	Notes
12001	Alachua	2.34	Average water use in 2000, 2005, 2010, and 2015 (freshwater withdrawals for closed loop systems, USGS)
12003	Baker	0	Average water use in 2000, 2005, 2010, and 2015 (freshwater withdrawals for closed loop systems, USGS)
12005	Bay	4.6	Average; WMD data for 2016-2018
12007	Bradford	0	Average water use in 2000, 2005, 2010, and 2015 (freshwater withdrawals for closed loop systems, USGS)
12009	Brevard	0	Average water use in 2000, 2005, 2010, and 2015 (freshwater withdrawals for closed loop systems, USGS)
12011	Broward	0	Average; WMD data for 2014-2018
12013	Calhoun	0	Average water use in 2000, 2005, 2010, and 2015 (freshwater withdrawals for closed loop systems, USGS)
12015	Charlotte	0	Average; WMD data for 2014-2018
12017	Citrus	2.674	Use average PG water use in 2016-2018
12019	Clay	0	Average water use in 2000, 2005, 2010, and 2015 (freshwater withdrawals for closed loop systems, USGS)
12021	Collier	0	Average; WMD data for 2014-2018
12023	Columbia	0	Average; WMD data for 2016-2018
12027	DeSoto	0.07	Use average PG water use in 2016-2018
12029	Dixie	0	Average; WMD data for 2016-2018
12031	Duval	5.19	Average water use in 2000, 2005, 2010, and 2015 (freshwater withdrawals for closed loop systems, USGS)
12033	Escambia	9.71	Average; WMD data for 2016-2018
12035	Flagler	0	Average; WMD data for 2016-2018
12037	Franklin	0	Average; WMD data for 2016-2018
12039	Gadsden	0	Average; WMD data for 2016-2018
12041	Gilchrist	0	Average; WMD data for 2016-2018
12043	Glades	0	Average; WMD data for 2014-2018
12045	Gulf	0	Average water use in 2000, 2005, 2010, and 2015 (freshwater withdrawals for closed loop systems, USGS)
12047	Hamilton	0	Average; WMD data for 2016-2018
12049	Hardee	Varies	Based on regression analysis, see description below
12051	Hendry	0	Average; WMD data for 2014-2018
12053	Hernando	4.54	Use average PG water use in 2016-2018
12055	Highlands	0	Average; WMD data for 2014-2018
12057	Hillsborough	0	Average; WMD data for 2002-2018
12059	Holmes	0	Average water use in 2000, 2005, 2010, and 2015 (freshwater withdrawals for closed loop systems, USGS)
12061	Indian River	0	Average water use in 2000, 2005, 2010, and 2015 (freshwater withdrawals for closed loop systems, USGS)
12063	Jackson	1.41	Average; WMD data for 2016-2018
12065	Jefferson	0	Average; WMD data for 2016-2018
12067	Lafayette	0	Average; WMD data for 2016-2018
12069	Lake	0.24	Average water use in 2000, 2005, 2010, and 2015 (freshwater withdrawals for closed loop systems, USGS)
12071	Lee	0.36	Average; WMD data for 2014-2018
12073	Leon	2.5	Average; WMD data for 2016-2018
12075	Levy	0	Average; WMD data for 2016-2018
12077	Liberty	0.48	Average; WMD data for 2016-2018
12079	Madison	0	Average; WMD data for 2016-2018
12081	Manatee	4.58	Average; WMD data for 2006-2018
12083	Marion	0	Average water use in 2000, 2005, 2010, and 2015 (freshwater withdrawals for closed loop systems, USGS)
12085	Martin	7.5	Average; WMD data for 2014-2018
12086	Miami-Dade	7.92	Average; WMD data for 2014-2018
12087	Monroe	0	Average; WMD data for 2014-2018
12089	Nassau	0	Average water use in 2000, 2005, 2010, and 2015 (freshwater withdrawals for closed loop systems, USGS)
12091	Okaloosa	0	Average water use in 2000, 2005, 2010, and 2015 (freshwater withdrawals for closed loop systems, USGS)
12093	Okeechobee	0	Average water use in 2000, 2005, 2010, and 2015 (freshwater withdrawals for closed loop systems, USGS)
12095	Orange	0.59	Average water use in 2000, 2005, 2010, and 2015 (freshwater withdrawals for closed loop systems, USGS)
12097	Osceola	Varies	Based on regression analysis, see description below
12099	Palm Beach	1.18	Average; WMD data for 2014-2018
12101	Pasco	Varies	Based on regression analysis, see description below
12103	Pinellas	0	Average; WMD data for 1991-2018
12105	Polk	6.16	Average; WMD data for 2014-2018
12107	Putnam	17.79	Average water use in 2000, 2005, 2010, and 2015 (freshwater withdrawals for closed loop systems, USGS)
12109	St Johns	0	Average water use in 2000, 2005, 2010, and 2015 (freshwater withdrawals for closed loop systems, USGS)
12111	St Lucie	1.35	Average; WMD data for 2014-2018
12113	Santa Rosa	0.14	Average water use in 2000, 2005, 2010, and 2015 (freshwater withdrawals for closed loop systems, USGS)
12115	Sarasota	0	Average; WMD data for 2002-2018
12117	Seminole	0	Average water use in 2000, 2005, 2010, and 2015 (freshwater withdrawals for closed loop systems, USGS)
12119	Sumter	0	Average; WMD data for 1991-2018
12121	Suwannee	0.04	Average; WMD data for 2016-2018
12123	Taylor	0	Average; WMD data for 2016-2018
12125	Union	0	Average; WMD data for 2016-2018
12127	Volusia	3.99	Average water use in 2000, 2005, 2010, and 2015 (freshwater withdrawals for closed loop systems, USGS)
12129	Wakulla	0.29	Average; WMD data for 2016-2018
12131	Walton	0	Average water use in 2000, 2005, 2010, and 2015 (freshwater withdrawals for closed loop systems, USGS)
12133	Washington	0	Average water use in 2000, 2005, 2010, and 2015 (freshwater withdrawals for closed loop systems, USGS)

Table A.7.4 PG: WMDs' Water Use Projections and EDR Forecasts

	2020	2025	2030	2035	2040
EDR Forecast					
NW – II	0.14	0.14	0.14	0.14	0.14
NW – Other	18.99	18.99	18.99	18.99	18.99
SR – West	0.00	0.00	0.00	0.00	0.00
NFRWSP	25.36	25.36	25.36	25.36	25.36
SJR – CSEC	4.15	4.15	4.15	4.15	4.15
SW – N (excluding CFWI)	7.22	7.22	7.22	7.22	7.22
SW – TB	0.27	0.22	0.19	0.16	0.15
SW – H (excluding CFWI)	0.00	0.02	0.02	0.02	0.02
SW – S	4.65	4.65	4.65	4.65	4.65
CFWI	7.06	7.16	7.26	7.36	7.45
SF – LKB	0.00	0.00	0.00	0.00	0.00
SF – UEC	8.85	8.85	8.85	8.85	8.85
SF – LEC	9.10	9.10	9.10	9.10	9.10
SF – LWC	0.36	0.36	0.36	0.36	0.36
Statewide	***86.16***	***86.21***	***86.28***	***86.36***	***86.44***
Water Management Districts' Projections					
NW – II	0	0	0	0	0
NW – Other	25.16	26.33	27.73	27.73	27.76
SR – West	0	0	0	0	0
NFRWSP	29.56	30.38	32.08	33.88	33.88
SJR – CSEC	12.14	12.26	12.42	12.59	12.62
SW – N (excluding CFWI)	1.8	1.85	1.96	2.08	2.21
SW – TB	0.34	0.35	0.36	0.37	0.38
SW – H (excluding CFWI)	0	0	0	0	0
SW – S	3.69	3.92	4.17	4.4	4.64
CFWI	11	11.06	11.13	11.19	11.27
SF – LKB	0	0	0	0	0
SF – UEC	17.47	17.47	17.47	17.47	17.47
SF – LEC	39.75	39.75	52.75	52.75	52.75
SF – LWC	0.4	0.4	0.4	15.4	15.4
Statewide	***141.31***	***143.77***	***160.47***	***177.86***	***178.38***
Difference between WMDs' and EDR projections*					
NW – II	-0.14	-0.14	-0.14	-0.14	-0.14
NW – Other	6.17	7.34	8.74	8.74	8.77
SR – West	0.00	0.00	0.00	0.00	0.00
NFRWSP	4.20	5.02	6.72	8.52	8.52
SJR – CSEC	7.99	8.11	8.27	8.44	8.47
SW – N (excluding CFWI)	-5.42	-5.37	-5.26	-5.14	-5.01
SW – TB	0.07	0.13	0.17	0.21	0.23
SW – H (excluding CFWI)	0.00	-0.02	-0.02	-0.02	-0.02
SW – S	-0.96	-0.73	-0.48	-0.25	-0.01
CFWI	3.94	3.90	3.87	3.83	3.82
SF – LKB	0.00	0.00	0.00	0.00	0.00
SF – UEC	8.62	8.62	8.62	8.62	8.62
SF – LEC	30.65	30.65	43.65	43.65	43.65
SF – LWC	0.04	0.04	0.04	15.04	15.04
Statewide	**55.15**	**57.56**	**74.19**	**91.50**	**91.94**

* Font colors are used to indicate positive and negative differences between the WMDs' and the EDR's projections. Positive numbers indicate WMD's projections are higher than EDR's projections

Total Water Use Projections and Forecasts

Table A.7.5 Total Water Use Projections and Forecasts

	2020	2025	2030	2035	2040
EDR Forecast					
NW – II	88.45	77.57	81.81	85.17	87.46
NW – Other	291.46	250.88	252.94	254.47	254.88
SR – West	105.97	102.27	105.70	109.87	113.50
NFRWSP	581.62	601.33	614.40	625.98	632.67
SJR – CSEC	371.52	377.24	372.10	362.95	350.32
SW – N (excluding CFWI)	168.45	158.66	163.48	168.08	171.28
SW – TB	465.75	450.35	456.04	459.02	457.16
SW – H (excluding CFWI)	116.31	118.05	118.11	116.80	114.56
SW – S	314.46	334.92	344.86	352.04	356.96
CFWI	761.73	765.79	793.86	814.69	830.41
SF – LKB	120.08	122.27	124.60	127.62	130.87
SF – UEC	203.68	212.35	208.56	204.66	199.09
SF – LEC	1,776.07	1,793.06	1,816.52	1,842.07	1,872.13
SF – LWC	625.31	669.40	679.46	691.13	699.40
Statewide	**5,988.23**	**6,018.03**	**6,125.08**	**6,217.21**	**6,283.71**
Water Management Districts' Projections					
NW – II	76.88	82.25	87.03	91.19	94.88
NW – Other	273.72	287.12	296.92	304.58	311.9
SR – West	106.53	110.92	116.69	122.35	127.54
NFRWSP	585.06	612.7	641.36	667.47	696.57
SJR – CSEC	383.47	395.62	406.11	416.72	427.87
SW – N (excluding CFWI)	142.49	153.55	163.54	173.09	181.73
SW – TB	413.34	432.77	436.96	450.56	461.85
SW – H (excluding CFWI)	91.52	89.45	96.17	94.96	89.15
SW – S	245.02	254.22	265.77	272.99	279.33
CFWI	735.24	789.49	836.65	873.94	907.59
SF – LKB	249.9	251.83	253.68	253.83	257.49
SF – UEC	289.26	289.7	287.84	286.07	283.96
SF – LEC	1,813.99	1,863.91	1,923.28	1,963.65	2,006.54
SF – LWC	1,030.31	1,073.57	1,113.64	1,170.36	1,210.68
Statewide	***6,436.73***	***6,687.10***	***6,925.64***	***7,141.76***	***7,337.08***
Difference between WMDs' and EDR projections*					
NW – II	-11.57	4.68	5.22	6.02	7.42
NW – Other	-17.74	36.24	43.98	50.11	57.02
SR – West	0.56	8.65	10.99	12.48	14.04
NFRWSP	3.44	11.37	26.96	41.49	63.90
SJR – CSEC	14.58	34.48	41.35	51.10	64.53
SW – N (excluding CFWI)	-25.96	-5.11	0.06	5.01	10.45
SW – TB	-52.41	-17.58	-19.08	-8.46	4.69
SW – H (excluding CFWI)	-24.79	-28.60	-21.94	-21.84	-25.41
SW – S	-69.44	-80.70	-79.09	-79.05	-77.63
CFWI	-26.49	23.70	42.79	59.25	77.18
SF – LKB	129.82	129.56	129.08	126.21	126.62
SF – UEC	85.58	77.35	79.28	81.41	84.87
SF – LEC	37.92	70.85	106.76	121.58	134.41
SF – LWC	405.00	404.17	434.18	479.23	511.28
Statewide	**448.50**	**669.07**	**800.56**	**924.55**	**1,053.37**

* Font colors are used to indicate positive and negative differences between the WMDs' and the EDR's projections. Positive numbers indicate WMD's projections are higher than EDR's projections

A.8 Population and Water Use for the Counties Divided Between Water Supply Planning Regions

A special procedure was applied to the counties split among two or more supply planning regions. First, the county population distribution was assessed using census block information. The proportion of the population in each supply planning region was estimated. EDR further assumed that the population distribution would remain unchanged in the planning horizon. For example, suppose in 2021, 90% of a county's population resided in water supply planning region A, and 10% resided in Region B. It is assumed that the population distribution among the regions will remain at 90% and 10% for the planning horizon, regardless of population growth. The specific percentage assumed for each region and each county is presented in Table A.8.1.

[See table on following page]

Table A.8.1 Percent of County Population in Various Water Supply Planning Regions

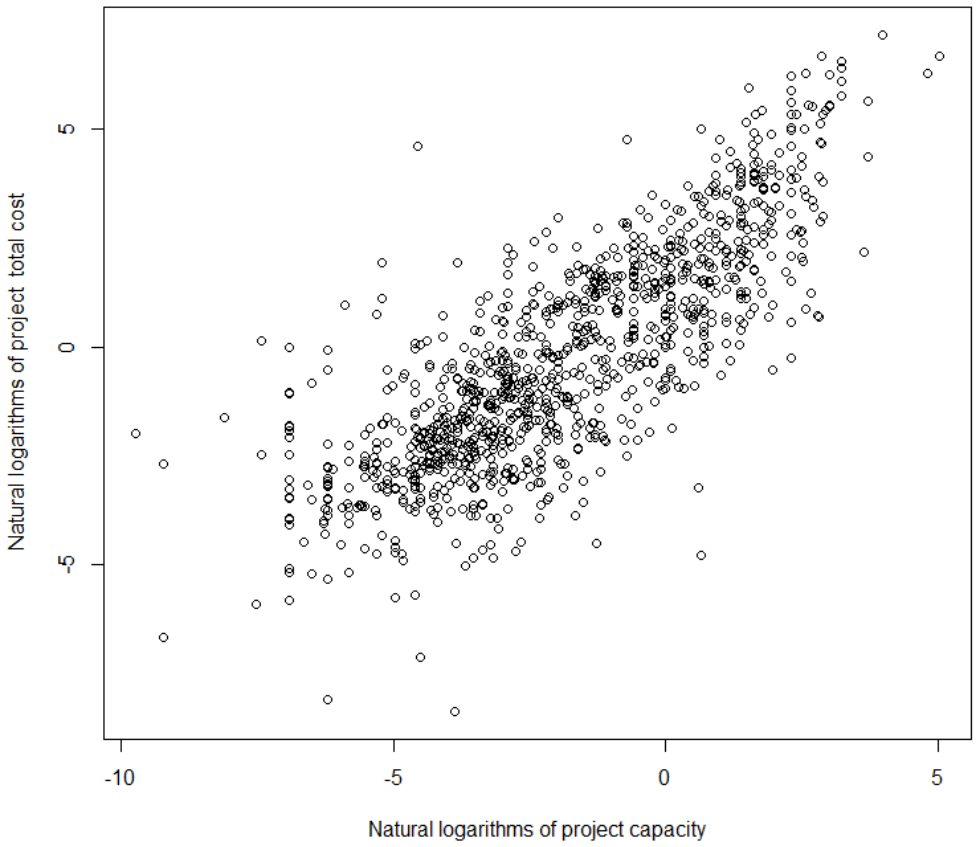
	NWF REG I	NWF REG II	NWF REG III	NWF REG IV	NWF REG V	NWF REG VI	NWF REG VII	SR EX-NFRWSP	SJR CSEC	SW – H*	SW – N*	SW – S	SW – TB	SF LEC	SF LKB	SF LWC	SF UEC	CFWI	NFRWSP
Alachua	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**
Baker	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**
Bay	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bradford	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**
Brevard	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Broward	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%
Calhoun	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Charlotte	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**99.15%**	0.00%	0.00%	0.00%	**0.85%**	0.00%	0.00%	0.00%
Citrus	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Clay	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**
Collier	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**0.01%**	0.00%	**99.99%**	0.00%	0.00%	0.00%
Columbia	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**
DeSoto	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Dixie	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Duval	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**
Escambia	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Flagler	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**
Franklin	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Gadsden	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Gilchrist	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**
Glades	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**32.08%**	**67.92%**	0.00%	0.00%	0.00%
Gulf	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Hamilton	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**
Hardee	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Hendry	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**10.44%**	0.00%	**89.56%**	0.00%	0.00%	0.00%
Hernando	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Highlands	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**91.31%**	0.00%	0.00%	0.00%	0.00%	**8.69%**	0.00%	0.00%	0.00%	0.00%
Hillsborough	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Holmes	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Indian River	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Jackson	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Jefferson	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**67.64%**	**32.36%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Lafayette	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Lake	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**64.88%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**35.12%**	0.00%
Lee	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%
Leon	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Levy	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**42.96%**	0.00%	0.00%	**57.04%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Liberty	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Madison	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Manatee	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Marion	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**68.59%**	0.00%	**31.41%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Martin	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%
Miami-Dade	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%
Monroe	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**99.99%**	0.00%	**0.01%**	0.00%	0.00%	0.00%
Nassau	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**
Okaloosa	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Okeechobee	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**2.59%**	0.00%	0.00%	0.00%	0.00%	0.00%	**91.95%**	0.00%	**5.46%**	0.00%	0.00%
Orange	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%
Osceola	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%
Palm Beach	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%
Pasco	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Pinellas	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Polk	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%
Putnam	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**
Santa Rosa	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sarasota	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Seminole	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%
St. Johns	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**
St. Lucie	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%
Sumter	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Suwannee	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**
Taylor	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Union	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**
Volusia	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Wakulla	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Walton	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Washington	0.00%	0.00%	0.00%	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

*excluding CFWI

A.9 Regression Analysis of Project Expenditures

Regression analysis was used to explore the relationship between project expenditures and project types, capacities, regions of implementation, and project status. To develop a regression model, 1,089 projects from the project appendix were selected. These were projects identified as "Additional water supply" and "Water for natural systems" projects.[123] The natural logarithm of "project total ($)" was strongly correlated with the natural logarithm of the project capacity. As shown in the scatter plot in Figure A.9.1, the relationship between these two variables is linear. Since log-transformation is applied to both variables, the results can be interpreted as each one percent change in project capacity leading to a one percent change in the "project total ($)."

Figure A.9.1 Scatter Plot, Natural Logarithms of "Project total ($)" and Project Capacity (mgd)



The DEP project appendix provides information about project capacity, type, status, and region of implementation. The regression model includes all these characteristics. However, EDR revised slightly how it modeled the effects of project capacity, type, status, and region of implementation on the expenditures for this year's analysis. The model now explains approximately 75% of the variability in the dependent variable (as opposed to 74% in the report's 2022 Edition). EDR will continue testing alternative model specifications to improve the predictive model capacity for this report's 2024 Edition.

[123] Note project type "Reclaimed Water (for groundwater recharge or natural system restoration)" was excluded.

Table A.9.1 Regression Analysis Results (dependent variable is the natural logarithm of "project total", in million $2022)

Variable description	Estimate	Std. Error	t value	Pr(>|t|)
Intercept	0.800	0.319	2.508	0.012
Natural Logarithms of project capacity	0.589	0.023	26.133	< 2e-16
Project Type				
Brackish Groundwater	0.539	0.338	1.595	0.111
Desalination	1.908	0.72	2.649	0.008
Groundwater Recharge	-0.989	0.401	-2.469	0.014
Other	-1.043	0.318	-3.279	0.001
Reclaimed Water (for potable offset)	0.479	0.312	1.534	0.125
Storm Water	-0.65	0.434	-1.497	0.135
Surface Water	0.705	0.364	1.936	0.053
Surface Water Storage	0.41	0.514	0.798	0.425
Aquifer Storage and Recovery	Baseline, captured in the intercept			
Project Status				
Construction/Underway	0.396	0.13	3.056	0.002
Design	0.211	0.182	1.158	0.247
On Hold	-0.036	0.765	-0.047	0.963
RWSP or RPS Option Only	0.963	0.127	7.574	< 2e-16
Complete	Baseline, captured in the intercept			
Project Region				
NFRWSP	0.382	0.14	2.737	0.006
NW-II	0.909	0.498	1.825	0.068
NW-Other	0.701	0.351	1.996	0.046
SF-LEC	-0.073	0.139	-0.525	0.600
SF-LKB	-0.585	0.503	-1.164	0.245
SF-LWC	0.277	0.185	1.497	0.135
SF-UEC	-0.160	0.232	-0.689	0.491
SJR-CSEC	0.358	0.151	2.369	0.018
SR-West	1.431	0.587	2.438	0.015
SW-H	0.465	0.545	0.854	0.393
SW-N	0.177	0.222	0.798	0.425
SW-S	0.528	0.172	3.079	0.002
SW-TB	0.381	0.15	2.539	0.011
CFWI	Baseline, captured in the intercept			

Table A.9.1 presents the regression results showing that expenditures increase with the project capacity. Note that since natural logarithm transformations are used for both expenditure and capacity, the model coefficient reflects a one percent change in the expenditure for a one percent change in capacity. As expected, the model shows that expenditures increase with the project's

capacity. The model results also show that the "RWSP or RPS Option Only" projects are more expensive than those completed in the past and those currently in construction, in design, or on hold (other things being equal). Groundwater recharge and stormwater projects are identified as statistically less expensive (aquifer storage and recovery category being the reference category). Finally, the SF – LEC, SF – LKB, and SF – LWC regions tend to be less costly (when compared with projects in the CFWI).

This regression model is used to estimate the expenditures for various project types, capacities, and regions. Estimated project expenditures for median project capacity are presented in Table A.9.2. Note that if the model results for "RWSP or RPS Option Only" status are used, the estimated project expenditure becomes significantly higher. The expenditure can be lowered for all project types and regions if larger projects are constructed.

Table A.9.2 Estimated Project Expenditures, Using Regression Model Coefficient for Median Project Capacity

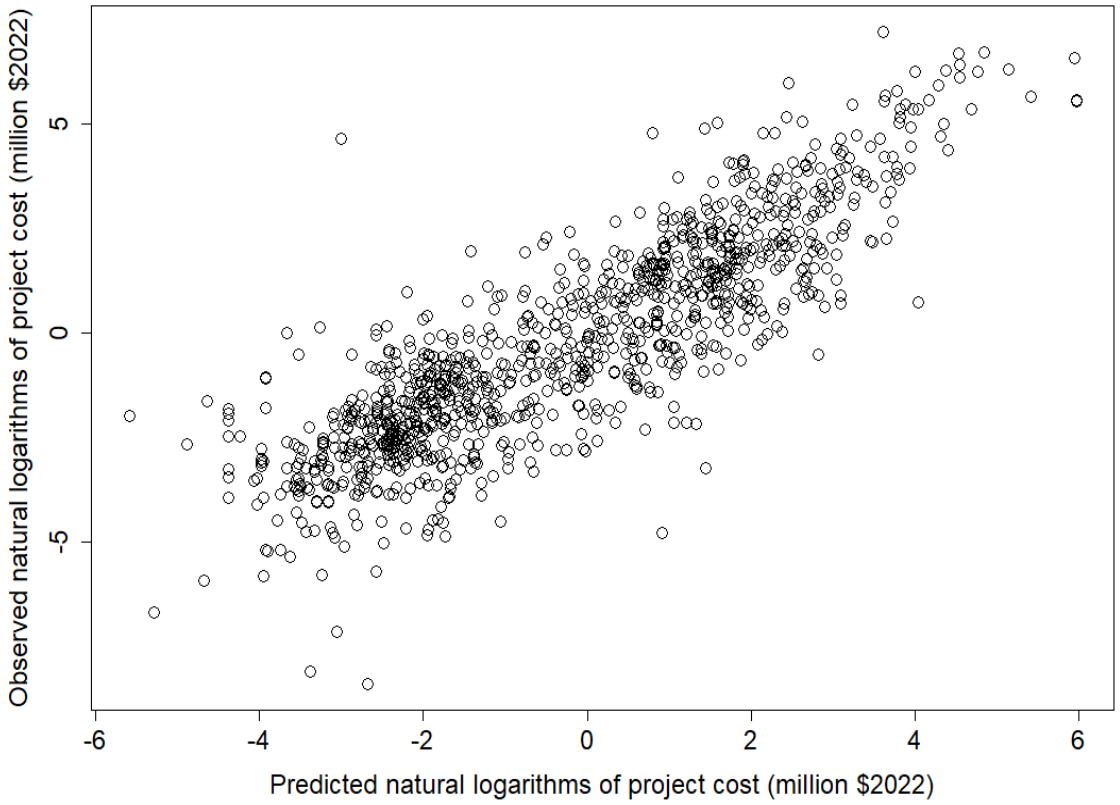
Project Type	Region	Median Project Capacity (mgd)	Total Expenditure (million $2022)	Expenditure Per mgd of the beneficial offset (million $2022)
Aquifer Storage and Recovery	SF – LEC	6.00	15.54	2.59
Brackish Groundwater	SF – LEC	3.00	15.60	5.20
Brackish Groundwater	CFWI	4.20	8.61	2.05
Brackish Groundwater	SW – S	1.50	8.22	5.48
Groundwater Recharge	NFRWSP	1.85	1.83	0.99
Reclaimed Water (for potable offset):	NW – II	0.33	4.64	14.06
Reclaimed Water (for potable offset):	SR– West	0.28	7.02	25.53
Reclaimed Water (for potable offset):	NFRWSP	0.28	2.46	8.95
Reclaimed Water (for potable offset):	SW – N*	0.29	2.05	7.17
Reclaimed Water (for potable offset):	CFWI	0.78	2.97	3.83
Reclaimed Water (for potable offset):	SF – LWC	4.35	11.34	2.61
Reclaimed Water (for potable offset):	SF – LEC	1.10	9.25	8.41
Reclaimed Water (for potable offset):	SW – S	0.20	2.35	11.85
Reclaimed Water (for potable offset):	SW – H	0.05	0.98	19.59
Surface water storage	SF – LEC	1.01	4.21	4.17
Surface water storage	SW – S	8.85	37.17	4.20

*excluding CFWI

Overall, groundwater recharge projects in the NFRWSP and brackish groundwater projects in the SF – LEC stand out as relatively inexpensive for the median project capacity.[124] In contrast, reclaimed water projects (especially in the NW – II, SR– West, NFRWSP, SW – N, SF – LEC, SW – S and SW – H) are expensive (per mgd of the beneficial offset). The beneficial offset is assumed to be 0.55 of the actual project capacity, increasing the per-unit expenditures for reclaimed water projects.

[124] Note that groundwater recharge projects' costs may be underestimated since the DEP project appendix does not account for the land purchase expenditures.

Figure A.9.2 Scatter Plot, Natural Logarithms of Predicted Project Total ($2021) and Observed Project Total ($2022)



This regression equation is used to estimate the expenditures for various project types, capacities, and regions. A comparison of estimated and observed project expenditures is presented in Figure A.9.2. Overall, the model seems to predict the project expenditures well. EDR will continue testing alternative model specifications to improve the predictive model capacity for this report's 2024 Edition.

A.10 Effect of Inflation on "Project Total $" Estimates

The effect of inflation on the cost and funding needs is an important element of the analysis, given that the earliest completion date of a project item listed in the project appendix is 1990s. To account for inflation and convert all "project total $" estimates to 2022 dollars, the construction cost index was used. [125]

Table A.10.1 Year and Inflation Multipliers for "Project Total ($)"

State FY Assumed by EDR for "Project Total ($)" Estimates	Inflation Index used to index "Project Total ($)" to State FY$2022
2022	1.00
2021	1.07
2020	1.13
2019	1.15
2018	1.17
2017	1.21
2016	1.25
2015	1.29
2014	1.32
2013	1.36
2012	1.39
2011	1.43
2010	1.47
2009	1.51
2008	1.56
2007	1.63
2006	1.67
2005	1.74
2004	1.82
2003	1.94
2002	1.98
2001	2.05
2000	2.09
1999	2.14
1998	2.19
1997	2.23
1996	2.31
1995	2.37
1994	2.40
1993	2.49
1992	2.60
1991	2.68
1990	2.74

[125] ENR. Construction Cost Index. Available online at: https://www.enr.com/economics/historical_indices/construction_cost_index_history (accessed October 2022)