MEMORANDUM

TO: Suwannee River Water Management District Governing Board

FROM: Tom Mirti, Director, Division of Water Resources

THRU: Noah Valenstein, Executive Director

DATE: August 5, 2016

RE: July 2016 Hydrologic Conditions Report for the SRWMD

RAINFALL

- District-wide rainfall in July averaged 4.45" across the District, about 60% of normal, versus the long-term July average monthly rainfall for the District of 7.64". While no county received average rainfall amounts, Gilchrist County received the greatest amount, about 80 percent of normal. Jefferson County received the least amount of rainfall, less than half of the normal rainfall for the month. (Table 1 and Figure 1). Highest rainfall amounts fell in the Lower Suwannee and Steinhatchee River basins, with many areas receiving in excess of 7" (Figure 2). Georgia rainfall was well below normal, particularly in the upper reaches of the Alapaha and Withlacoochee Basins. Only the Valdosta area received above normal amounts of rain (Figure 3).
- The highest gaged monthly rainfall total of 8.71" was recorded at the Newberry rainfall station in southwest Alachua County, while the highest daily total of 2.99" on July 22 was recorded at Ocean Pond in Baker County. The lowest gaged monthly total was 2.14" at the Live Oak rainfall station in Suwannee County.
- The rainfall average across the District for the 12-month period ending July 31 was 47.9", compared to the long-term average of 54.7". The cumulative 12-month District-wide rainfall deficit declined sharply to -6.8", due both to the deficit monthly rainfall and the removal from the annual 'window' of the high July 2015 rainfall. Annual rainfall deficits declined in all basins; the Suwannee and Santa Fe River basins are both over 8" below normal for the past year. The Waccasassa River Basin has maintained a tiny surplus (Figure 4).
- Average District rainfall for the 3 months ending July 31 totaled 13.0", below the long-term average total of 17.8". The Aucilla and Suwannee River Basins both declined to a 6" deficit during July. All major river basins are in a deficit; the Waccasassa River Basin's deficit is only -1.1" (Figure 5).

SURFACEWATER

- **Rivers:** Most District river level stations began July in the normal range of flows (between the 25th and the 75th percentiles). The lack of rainfall during July resulted in virtually all these stations dropping into the low category (below the 25th percentile) and at Worthington Springs into the very low category (below the 10th percentile. Only the Santa Fe River near Graham maintained normal status by the end of the month. Two gaging stations in the upper Alapaha and Withlacoochee rivers in Georgia joined the Little River near Adel in the very low category. Flow statistics for major river stations are presented graphically in Figure 6, and river level conditions relative to historic conditions are provided in Figure 7.
- **Lakes**: District lakes on average dropped about 2" during the month. Most remained at above average levels, although 5 lakes were below average levels as the month ended. Andrews Lake in Taylor County declined 6" during the month. Two lakes increased in level; Lake Sampson in Bradford County rose about 2" and Governor Hill Lake in Dixie County rose a fraction of an inch. Figure 8 shows lake levels relative to their respective long-term minimum, average and maximum levels.

- **Springs**: The flows of 21 springs or spring groups were measured by the USGS, District staff, and District contractors during July. Spring flows continued to decrease during the month as a result the average 9" drop in the Floridan aquifer level across the District. Historical flow data for four springs in the Santa Fe River Basin are provided in graphical format on Figure 9.

GROUNDWATER

The groundwater level decline in the Upper Floridan Aquifer continued during July, ending the month at the 39th percentile as an average across the District, a drop of 8 percentile points. Only 10 of the roughly 100 long-term wells across the District showed an increase in level, promoting a modest rebound in the Steinhatchee River Basin and otherwise scattered through the coastal counties. Most areas of the District remain in the normal category (between the 25th and the 75th percentiles) as shown in Figure 10. Floridan aquifer levels for a representative sample of long-term wells are provided in Figure 11 along with summary statistics, and regional long-term well status is provided in Figure 12 along with a description of Floridan aquifer characteristics; two Floridan wells in southern Georgia appear to have set record low levels during the month.

HYDROLOGICAL/METEOROLOGICAL INFORMATION

- The Palmer Drought Severity Index (PDSI), a climatological tool produced by the National Climatic Data Center, assesses the severity and frequency of abnormally dry or wet weather using rainfall, temperature, and soil moisture data. PDSI values for the week ending July 30 showed ongoing near-normal conditions in north Florida,but encroaching moderate drought conditions in southern Georgia and central Florida.
- The National Weather Service Climate Prediction Center (CPC) is projecting near normal rainfall for North Florida over the upcoming three months. On July 9, the CPC announced that the ongoing El Niño event had concluded; the current El Niño index is at neutral status and continuing to drop.
- The U.S. Drought Monitor report of for the week ending on August 2 displayed abnormally dry conditions in a band from Madison County eastward to Jacksonville. The remainder of the District showed no drought condition, although abnormally dry conditions are now present all along Florida's Atlantic coast.

CONSERVATION

Water conservation is necessary to sustain healthy flows in springs and rivers. All users are urged to eliminate unnecessary uses. Landscape irrigation is limited to twice per week during Daylight Savings Time (between March 13 and November 6, 2016) based on a water conservation rule that applies to residential landscaping, public or commercial recreation areas, and businesses that aren't regulated by a District-issued permit. Information about SRWMD's year-round water conservation measures is available at www.mysuwanneeriver.com.

This report is compiled in compliance with Chapter 40B-21.211, Florida Administrative Code, using rainfall (gage-adjusted radar-derived estimate), groundwater (117 wells), surfacewater (35 stations), and general information such as drought indices and forecasts. Data are provisional and are updated as revised data become available. Data are available at www.mysuwanneeriver.com or by request.

Table 1: Estimated Rainfall Totals (inches)

County	July 2016	July Average	Month % of Normal	Last 12 Months	Annual % of Normal
Alachua	3.66	7.01	52%	51.07	100%
Baker	4.00	7.06	57%	40.99	82%
Bradford	3.93	6.92	57%	48.03	95%
Columbia	3.81	7.01	54%	42.38	82%
Dixie	5.86	9.14	64%	54.66	93%
Gilchrist	6.66	8.03	83%	49.62	87%
Hamilton	4.48	6.79	66%	42.70	82%
Jefferson	2.87	7.23	40%	51.30	85%
Lafayette	4.69	8.21	57%	45.02	80%
Levy	5.43	8.98	60%	53.93	90%
Madison	4.02	7.29	55%	49.90	89%
Suwannee	4.41	7.17	61%	44.39	84%
Taylor	4.49	8.62	52%	49.84	84%
Union	4.07	7.49	54%	46.63	86%

July 2016 Average:	4.45
July Average (1932-2015):	7.64
Historical 12-month Average (1932-2015):	54.66
Past 12-Month Total:	47.88
12-Month Rainfall Surplus/Deficit:	-6.78

Figure 1: Comparison of District-wide Monthly Rainfall

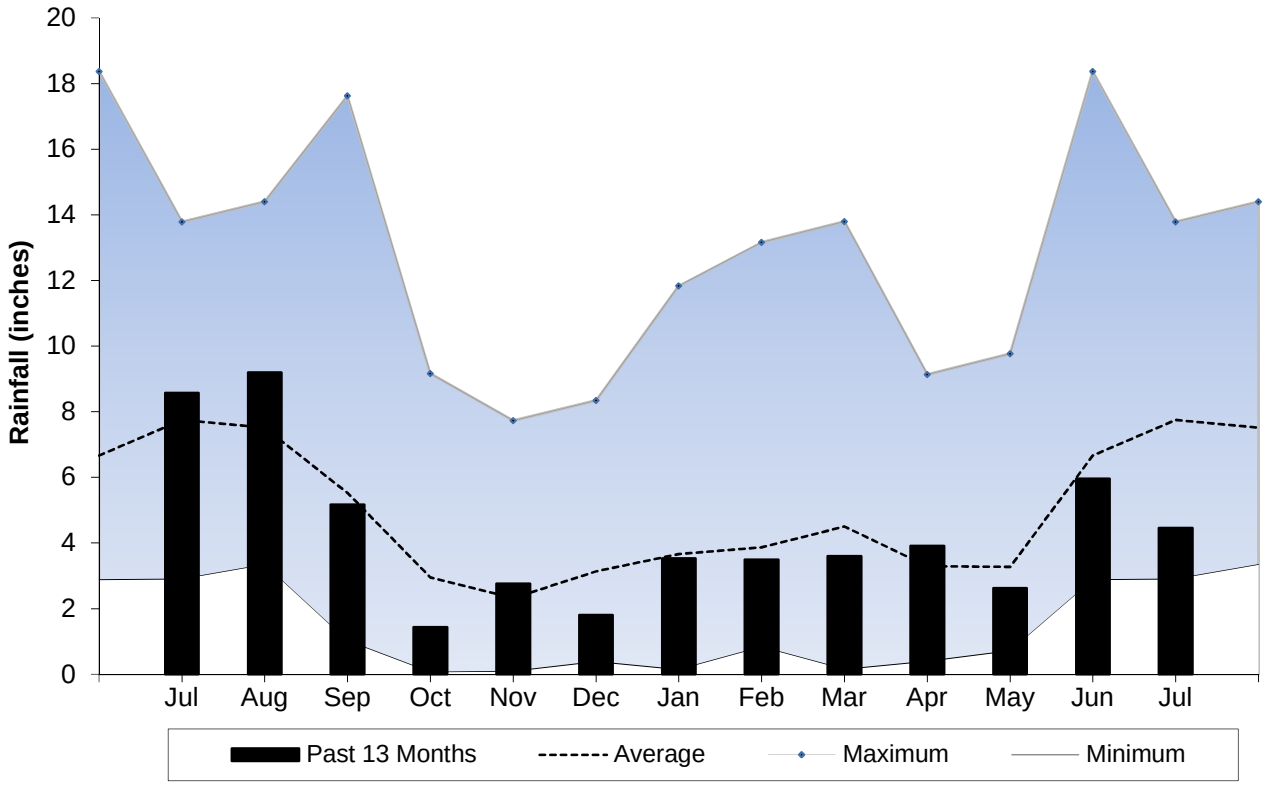


Figure 2: July 2016 Gage-adjusted Radar Rainfall Estimate

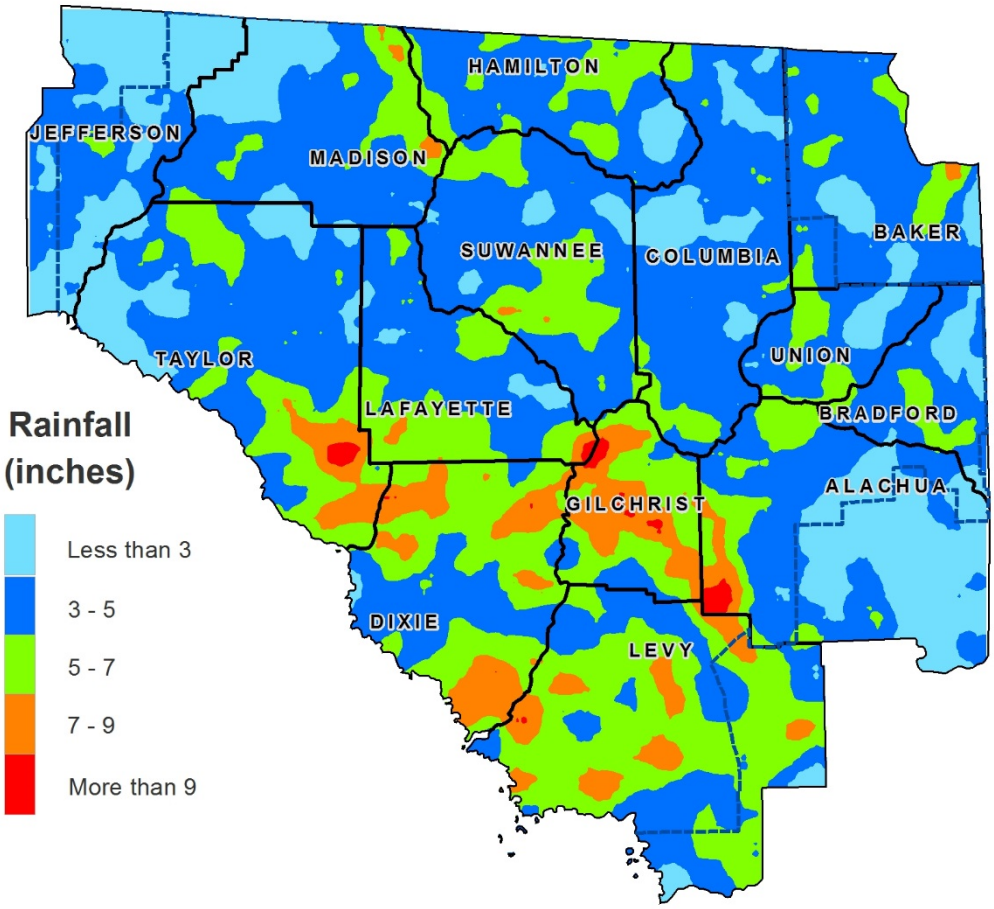


Figure 3: July 2016 Percent of Normal Rainfall

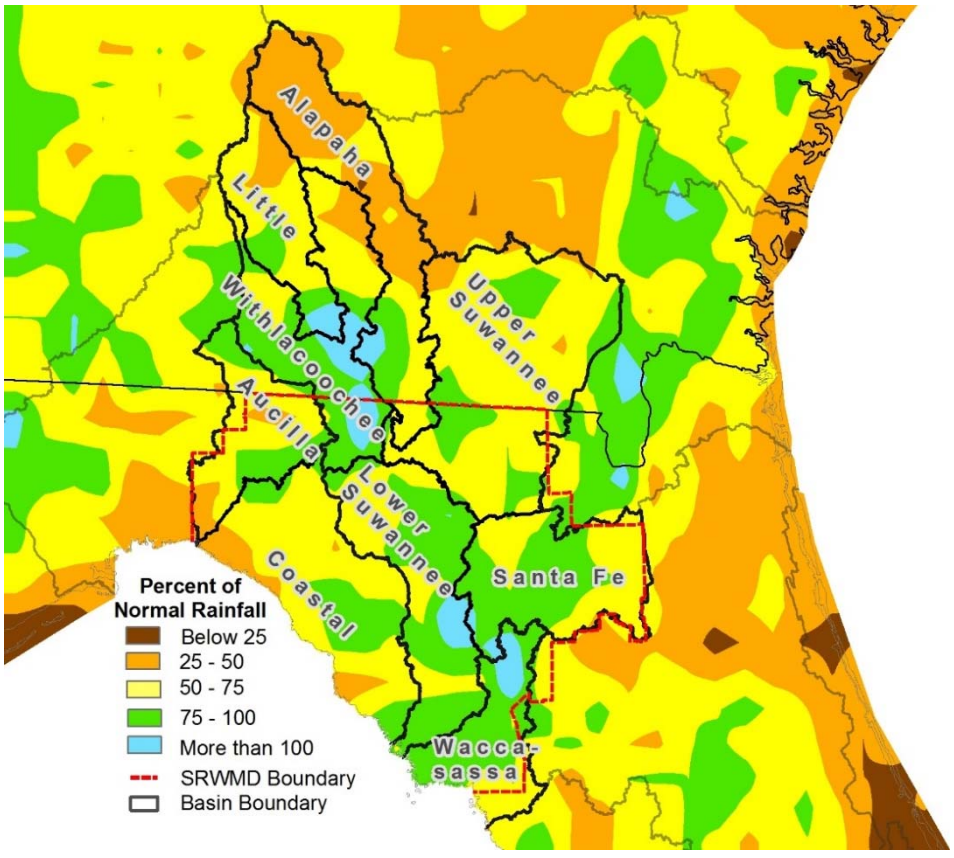


Figure 4: 12-Month Rainfall Surplus/Deficit by River Basin through July 31, 2016

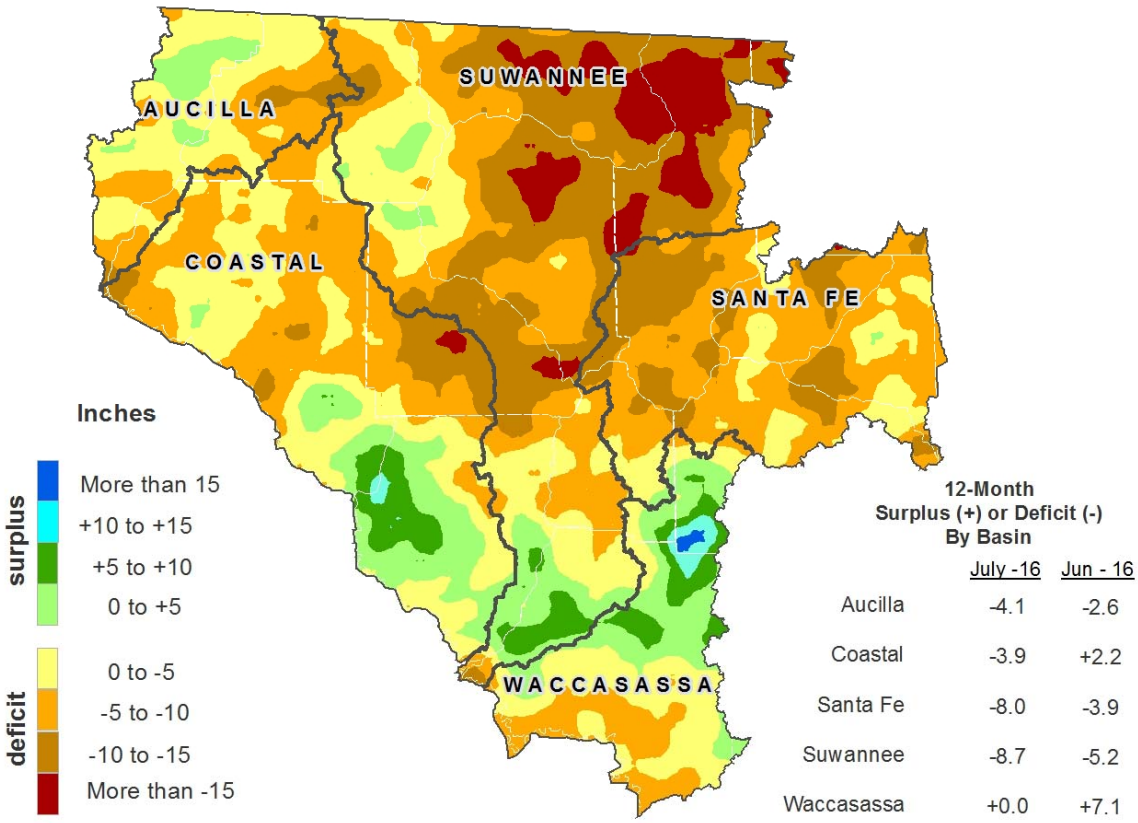


Figure 5: 3-Month Rainfall Surplus/Deficit by River Basin through July 31, 2016

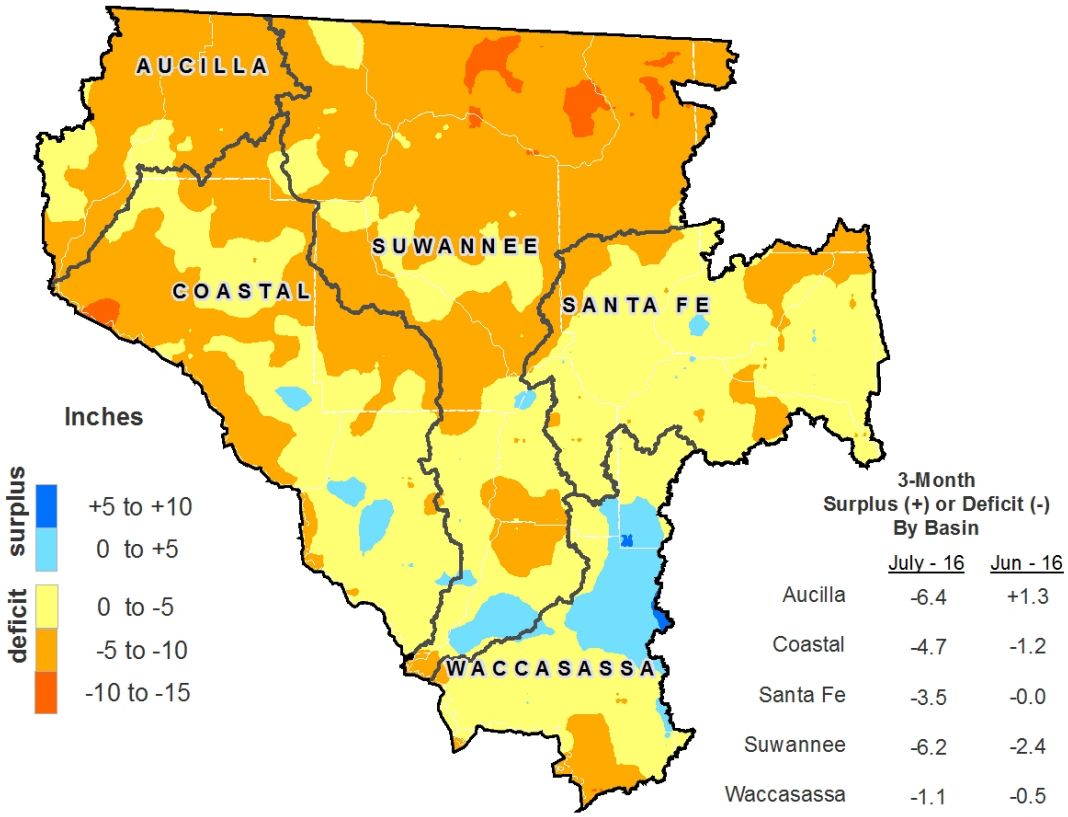
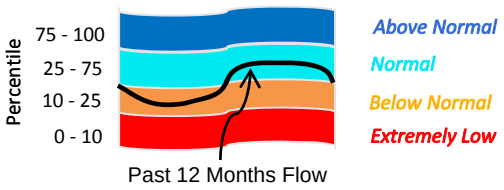
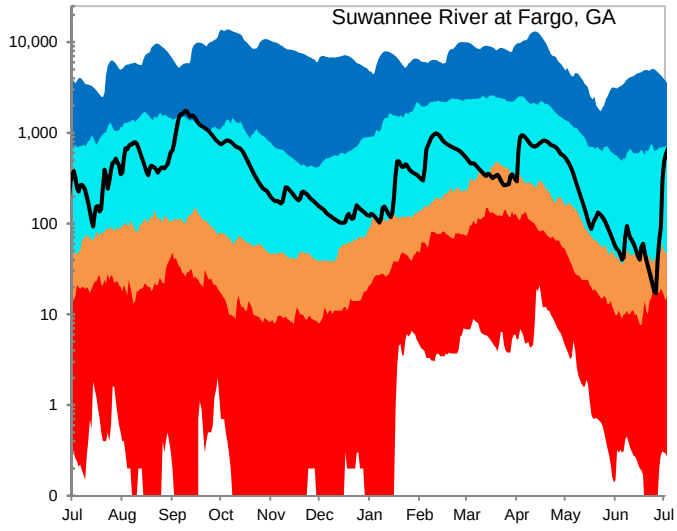
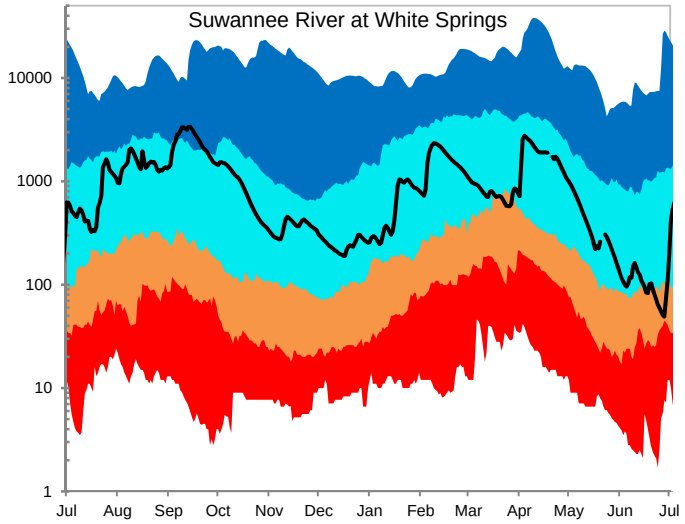


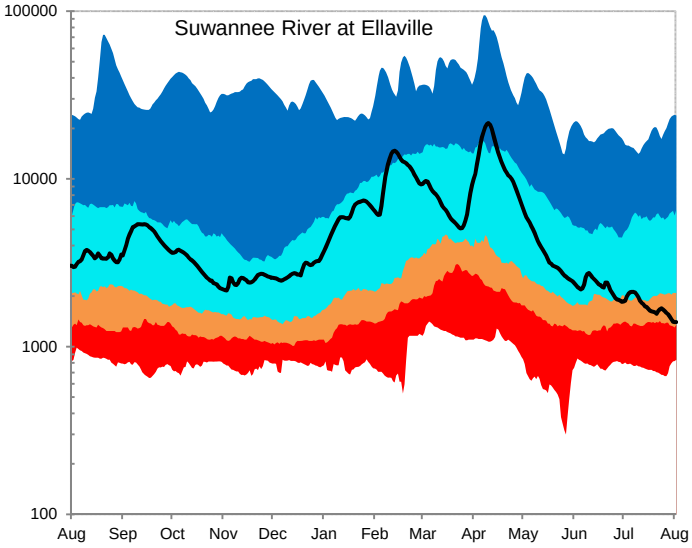
Figure 6: Daily River Flow Statistics
August 1, 2015 through July 31, 2016

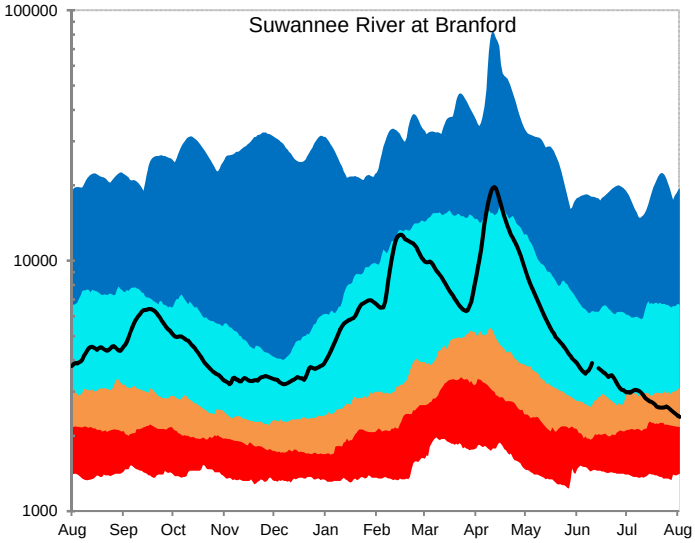


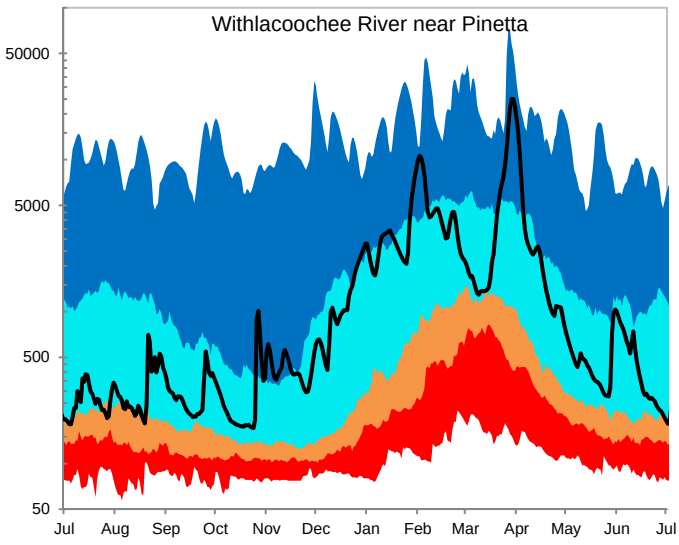
RIVER FLOW, CUBIC FEET PER SECOND











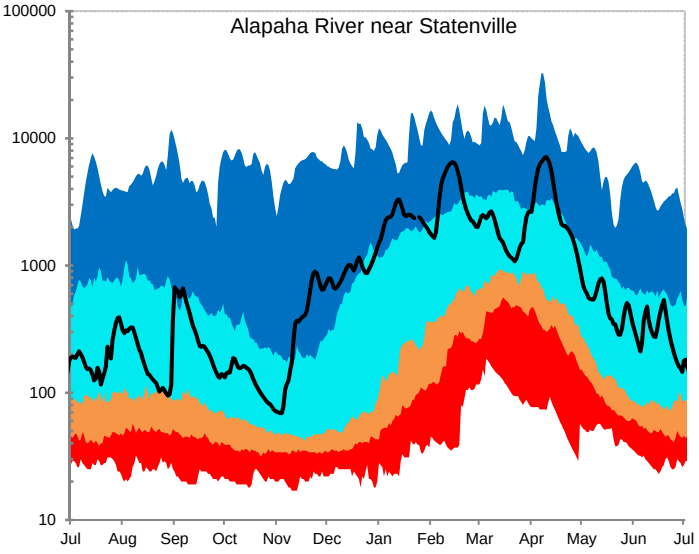
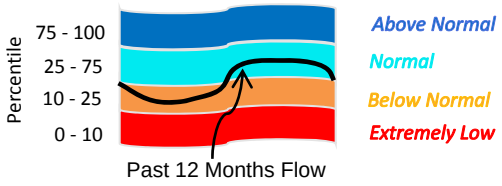
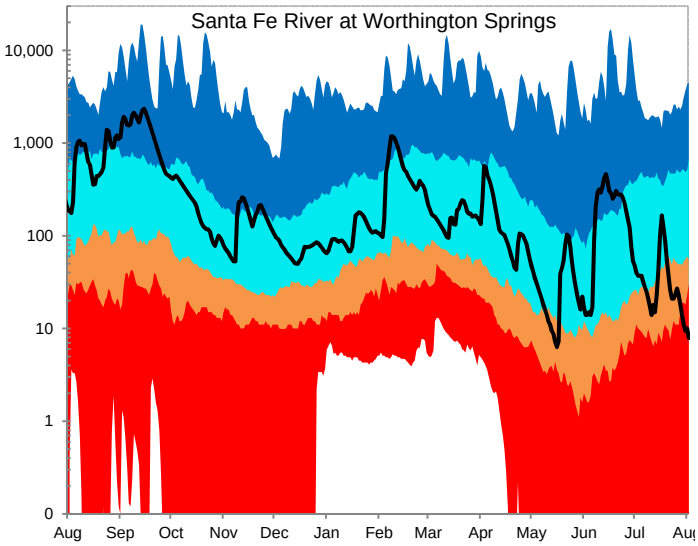
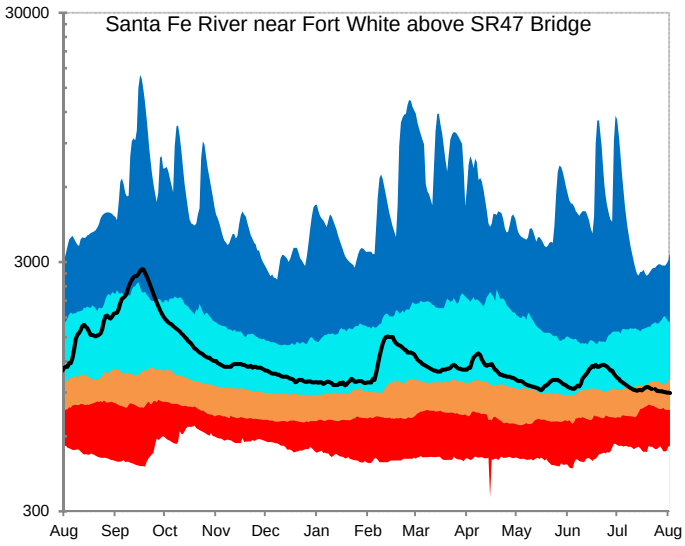


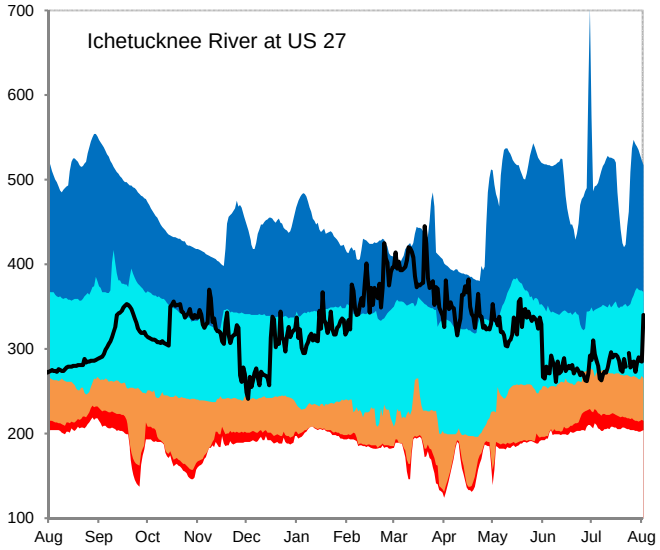
Figure 6, cont: Daily River Flow Statistics
August 1, 2015 through July 31, 2016

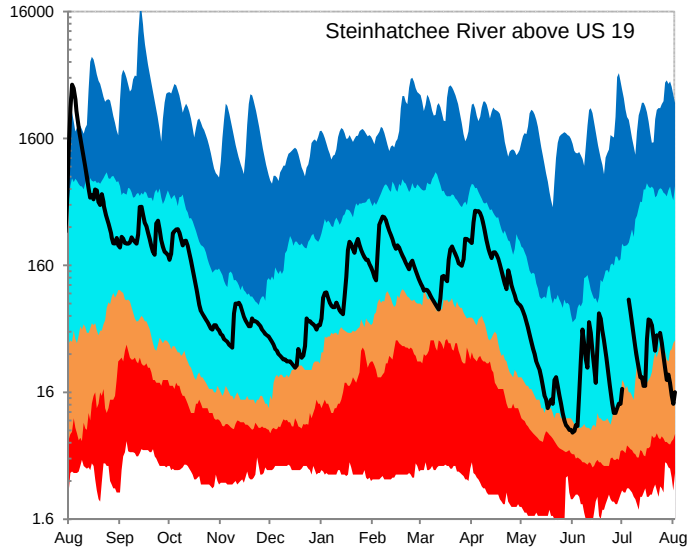


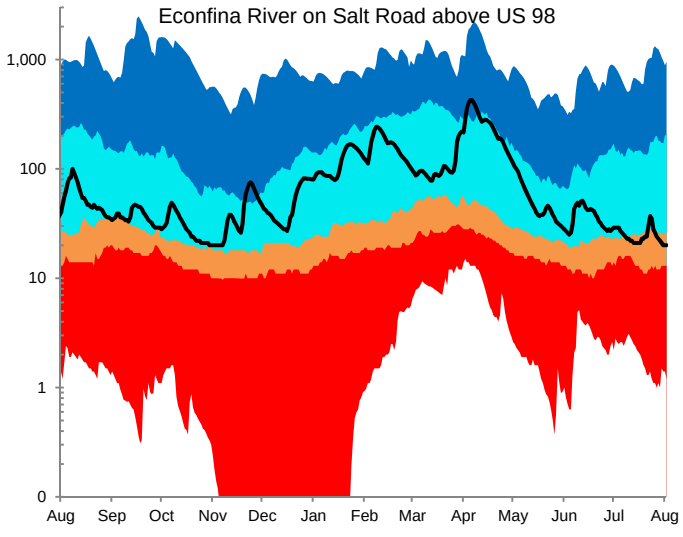
RIVER FLOW, CUBIC FEET PER SECOND

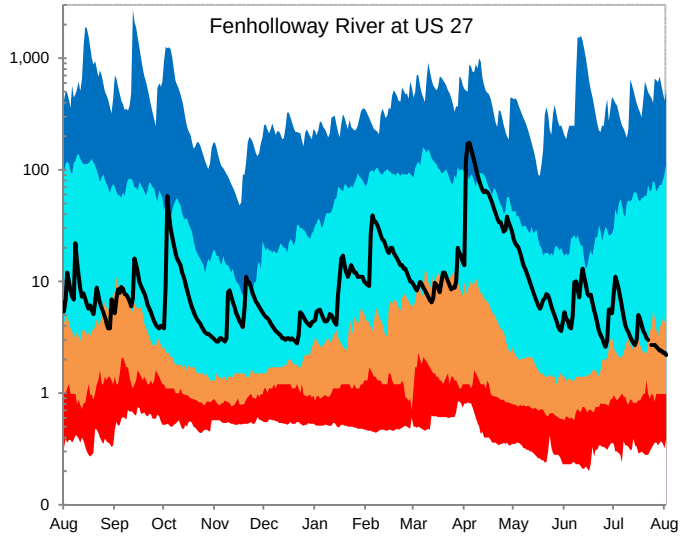












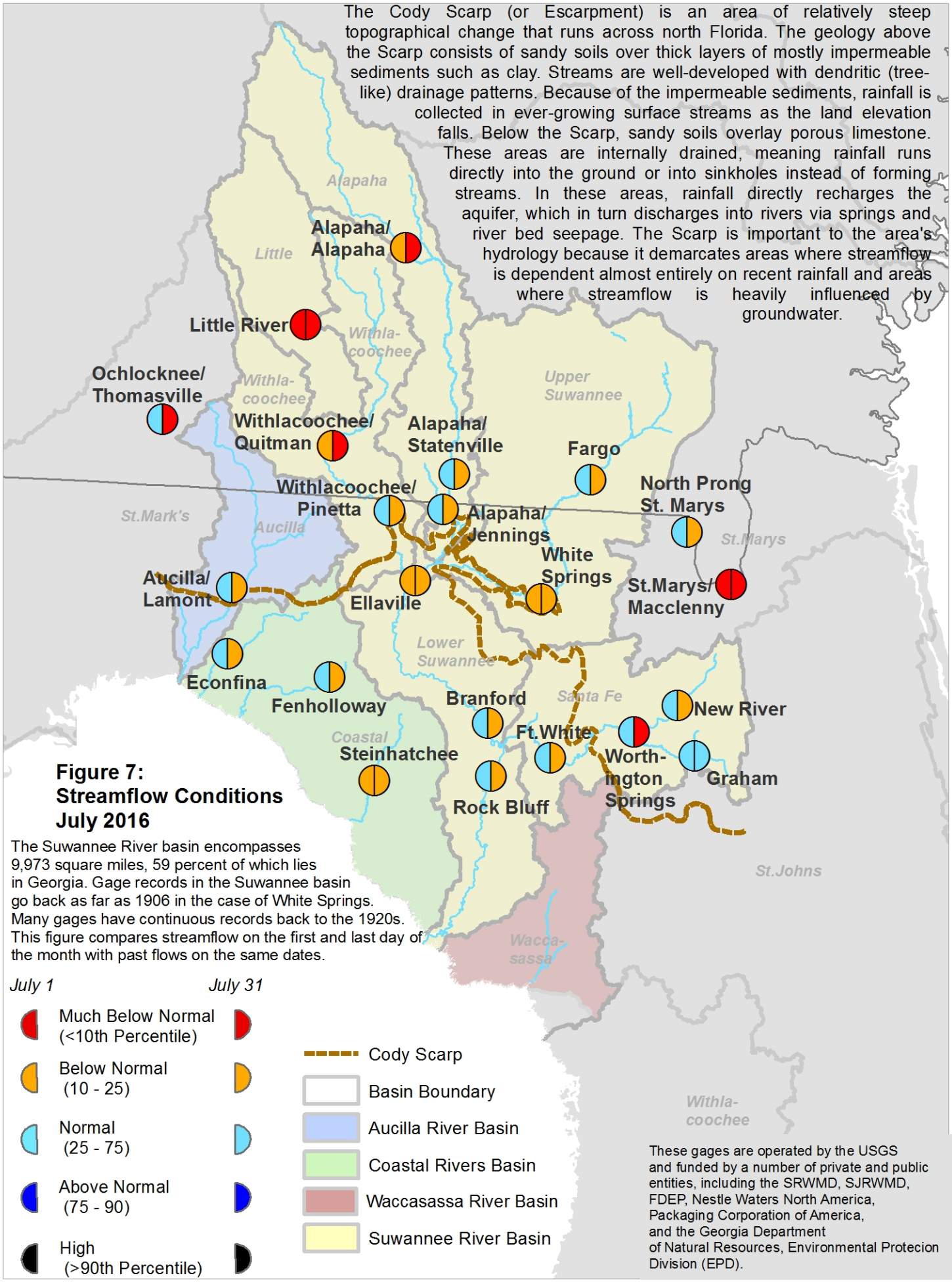
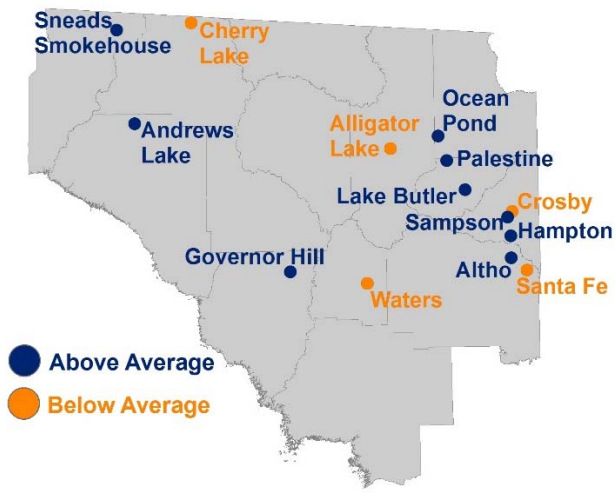

The Cody Scarp (or Escarpment) is an area of relatively steep topographical change that runs across north Florida. The geology above the Scarp consists of sandy soils over thick layers of mostly impermeable sediments such as clay. Streams are well-developed with dendritic (tree-like) drainage patterns. Because of the impermeable sediments, rainfall is collected in ever-growing surface streams as the land elevation falls. Below the Scarp, sandy soils overlay porous limestone. These areas are internally drained, meaning rainfall runs directly into the ground or into sinkholes instead of forming streams. In these areas, rainfall directly recharges the aquifer, which in turn discharges into rivers via springs and river bed seepage. The Scarp is important to the area's hydrology because it demarcates areas where streamflow is dependent almost entirely on recent rainfall and areas where streamflow is heavily influenced by groundwater.
Alapaha
Alapaha/ Alapaha
Little
Little River
Withla-coochee
Ochlocknee/ Thomasville
Withla-coochee
Upper Suwannee
Withlacoochee/ Quitman
Alapaha/ Statenville
Fargo
Withlacoochee/ Pinetta
North Prong St. Marys
St.Mark's
Aucilla
Alapaha/ Jennings
St.Marys
White Springs
Aucilla/ Lamont
Ellaville
St.Marys/ Macclenny
Lower Suwannee
Econfina
Fenholloway
Branford
Santa Fe
New River
Ft.White
Coastal
Steinhatchee
Worth-ington Springs
Graham
Rock Bluff
St.Johns
Wacca-sassa
Withla-coochee
Figure 7:
Streamflow Conditions
July 2016
The Suwannee River basin encompasses 9,973 square miles, 59 percent of which lies in Georgia. Gage records in the Suwannee basin go back as far as 1906 in the case of White Springs. Many gages have continuous records back to the 1920s. This figure compares streamflow on the first and last day of the month with past flows on the same dates.
July 1
July 31
Much Below Normal (<10th Percentile)
Below Normal (10 - 25)
Normal (25 - 75)
Above Normal (75 - 90)
High (>90th Percentile)
Cody Scarp
Basin Boundary
Aucilla River Basin
Coastal Rivers Basin
Waccasassa River Basin
Suwannee River Basin
These gages are operated by the USGS and funded by a number of private and public entities, including the SRWMD, SJRWMD, FDEP, Nestle Waters North America, Packaging Corporation of America, and the Georgia Department of Natural Resources, Environmental Protecion Division (EPD).

Figure 8: July 2016 Lake Levels



SRWMD lakes react differently to climatic changes depending on their location in the landscape. Some lakes, in particular ones in the eastern part of the District, are embedded in a surficial or intermediate aquifer over relatively impermeable clay deposits. These lakes rise and fall according to local rainfall and surface runoff. They retain water during severe droughts since most losses occur from evaporation. Other lakes, such as Governor Hill and Waters Lake, have porous or "leaky" bottoms that interact with the Floridan aquifer. These lakes depend on groundwater levels to stay high. If aquifer levels are low, these lakes go dry even if rainfall is normal.

The District currently monitors 14 lakes; much of the data was originally provided by volunteer observers. Monitoring records begin in the 1970s, except for Lakes Butler, Sampson, and Santa Fe, which started in 1957.

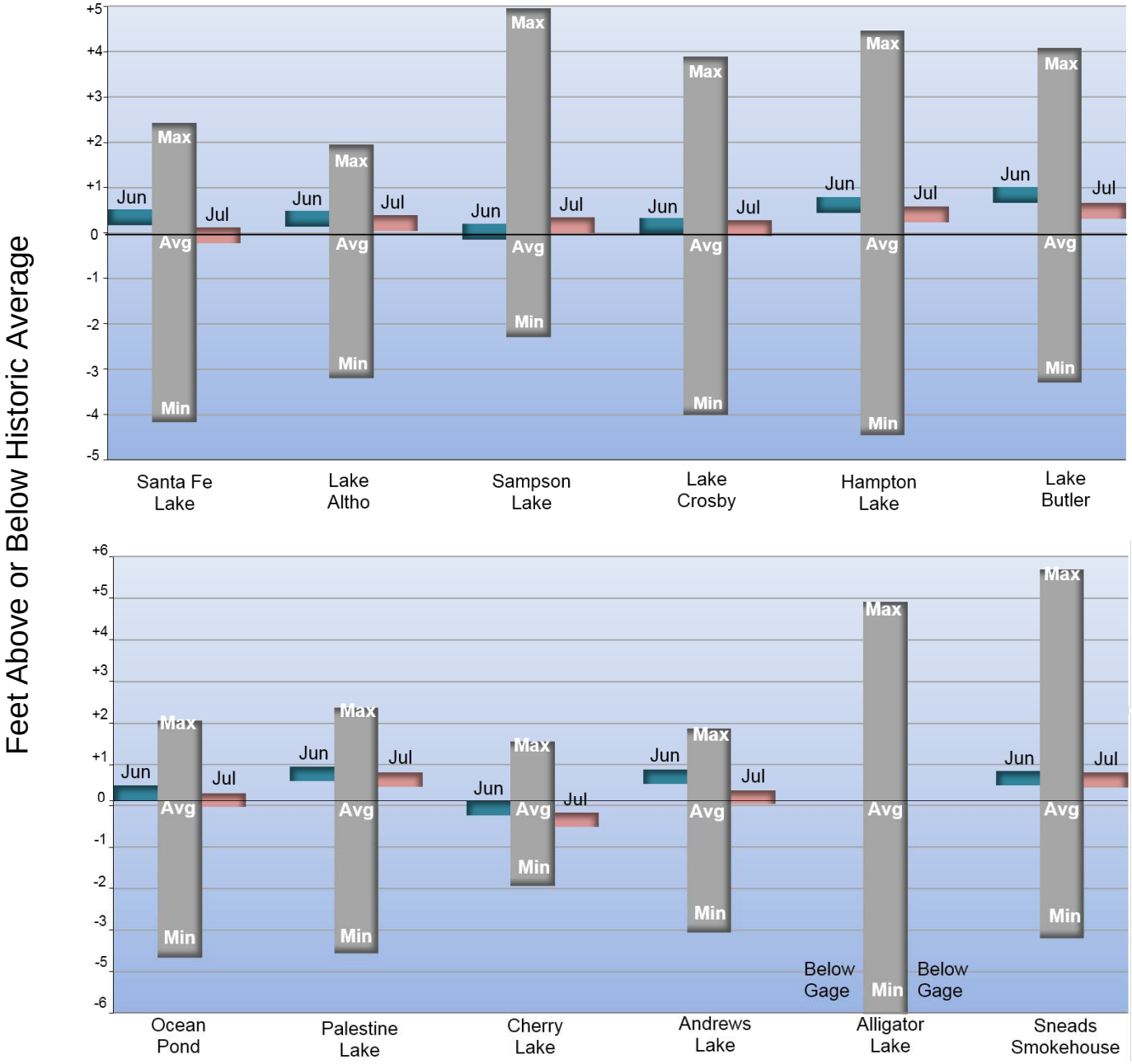
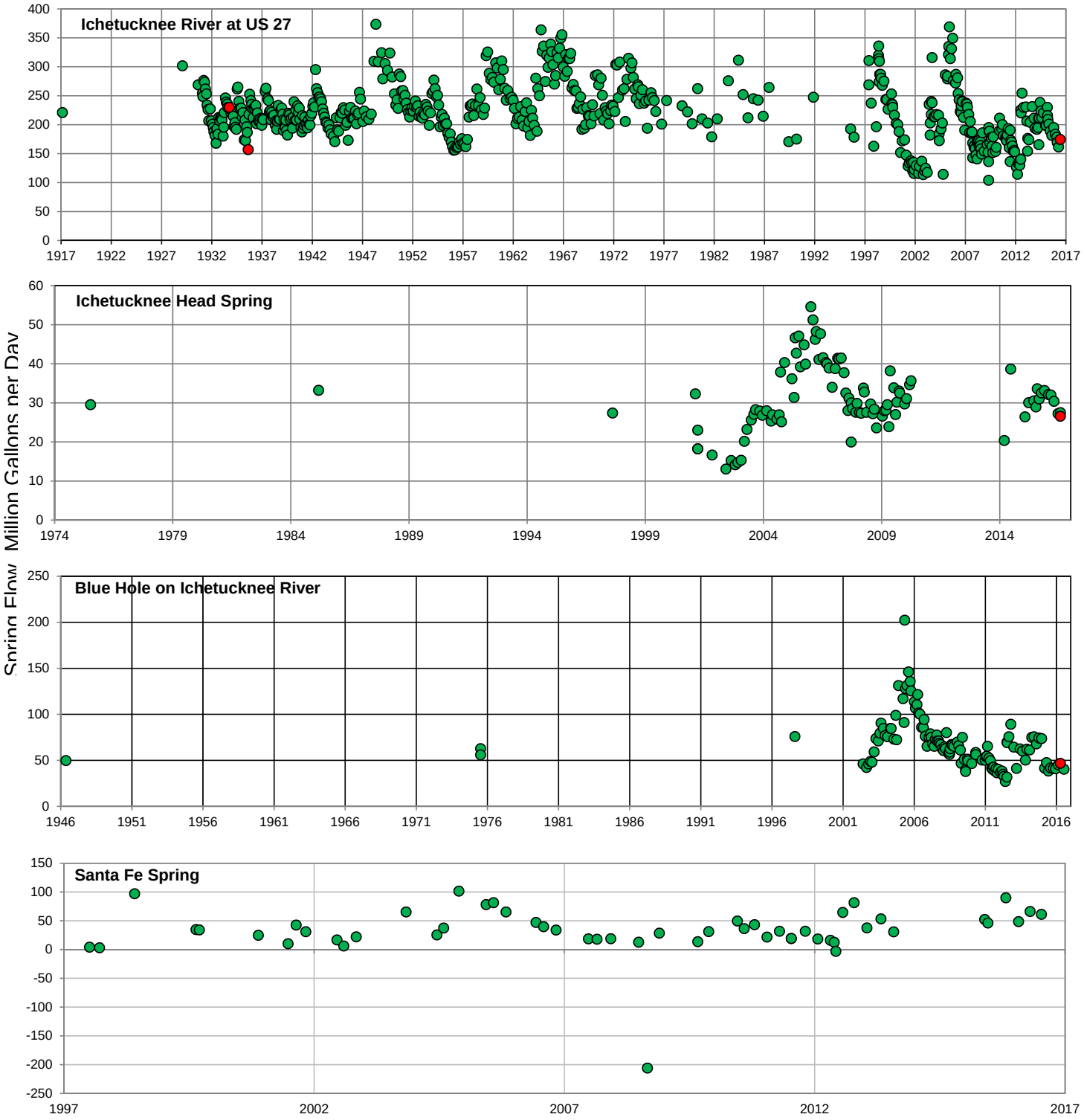


Figure 9: Monthly Springflow Measurements

The SRWMD monitors water quality at 44 springs. Flow is usually measured at the time of the sampling. The springs below were measured in July 2016 by SRWMD staff or by the USGS with the last measurement marked in red. Flow is given in MGD (million gallons per day--a million gallons would fill a football field about 3' deep). With the exception of the Ichetucknee River, Santa Fe Rise and the Alapaha Rise, springs in the SRWMD were measured infrequently prior to the late 1990s. Springs with long records were rarely measured more than once per decade; 'reverse' flow measurements have only been made during the past 10 years. Historical flow measurements from springs in the Santa Fe River Basin, including ongoing measurements in the Ichetucknee River system, are provided below.

A spring's flow can be greatly affected by the level of the river it runs into. Rising river levels can act like a dam and slow spring flow causing what is known as a backwater effect. A river can flood a spring completely, known colloquially as a "brown-out". If the river levels are high enough, river water can flow back into the spring vent and thence into the aquifer, resulting in a negative flow rate. Because of the interaction between a spring and its receiving water body, some low flow measurements recorded are the result of river flooding and not necessarily drought conditions.



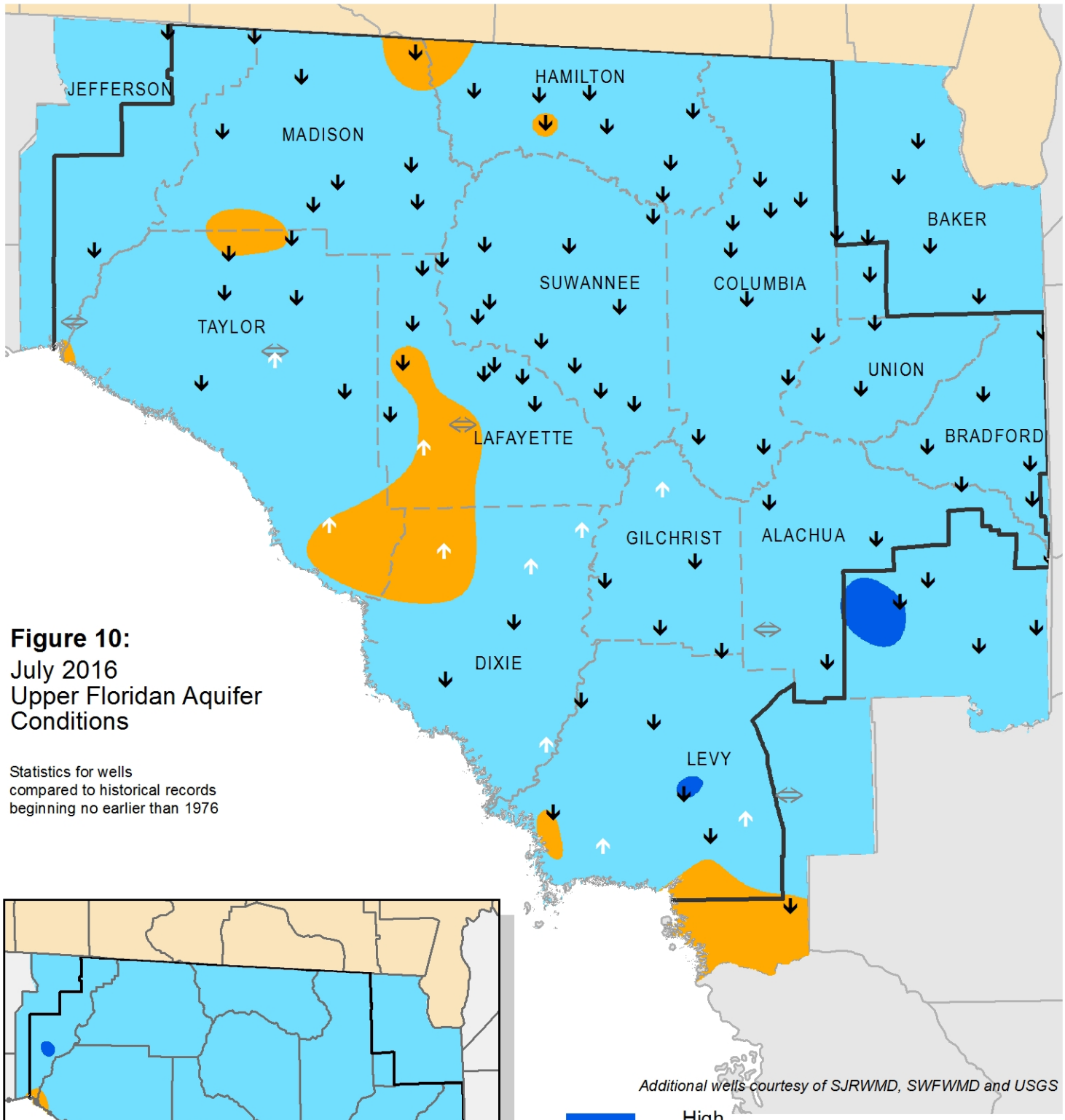
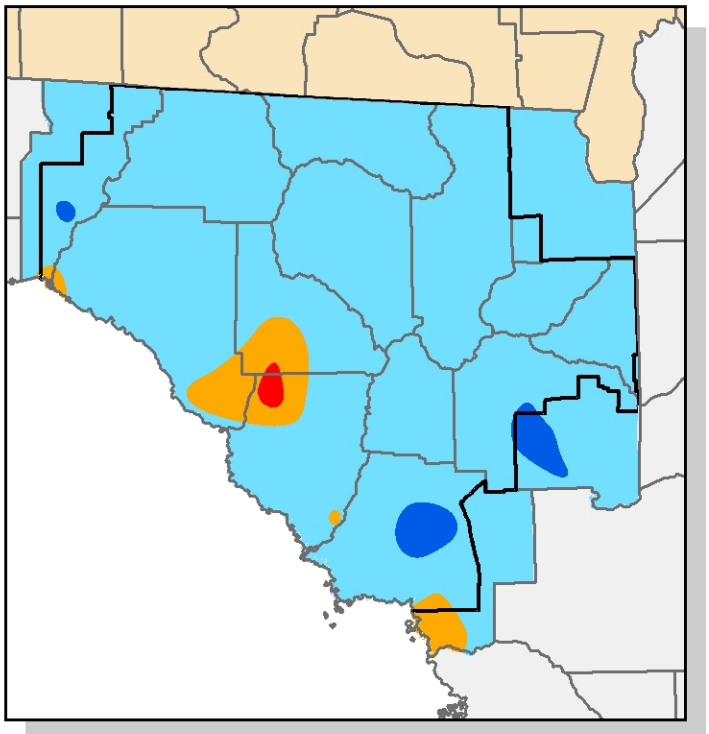


Figure 10:
July 2016
Upper Floridan Aquifer
Conditions

Statistics for wells
compared to historical records
beginning no earlier than 1976



Inset: June Groundwater Levels

Additional wells courtesy of SJRWMD, SWFWMD and USGS

High
(Greater than 75th Percentile)

Normal
(25th to 75th Percentile)

Low
(10th to 25th Percentile)

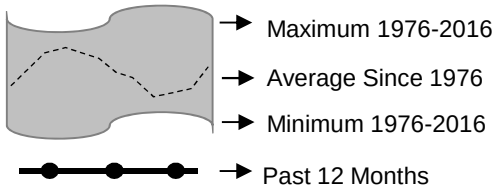
Extremely Low
(Less than 10th Percentile)

Increase/decrease in level since last month

Increase/decrease since last month
less than one percent of historic range

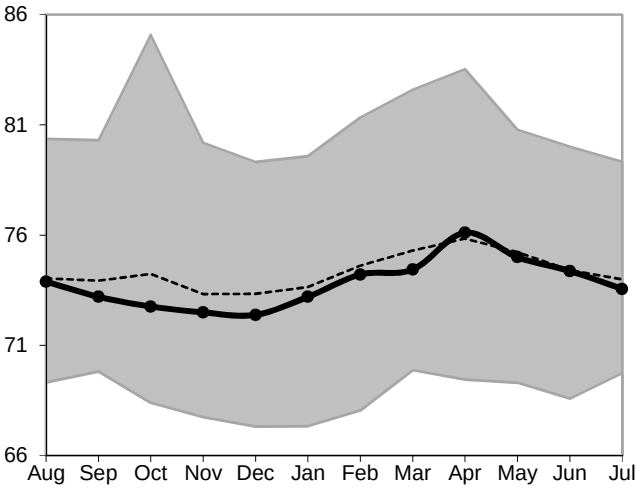
District Boundary

Figure 11: Monthly Groundwater Level Statistics
Levels August 1, 2015 through July 31, 2016
Period of Record Beginning 1976

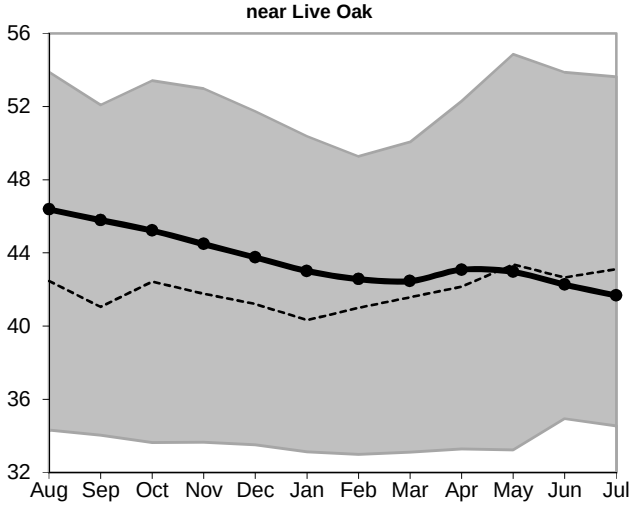


Upper Floridan Aquifer Elevation above NGVD 1929, Feet

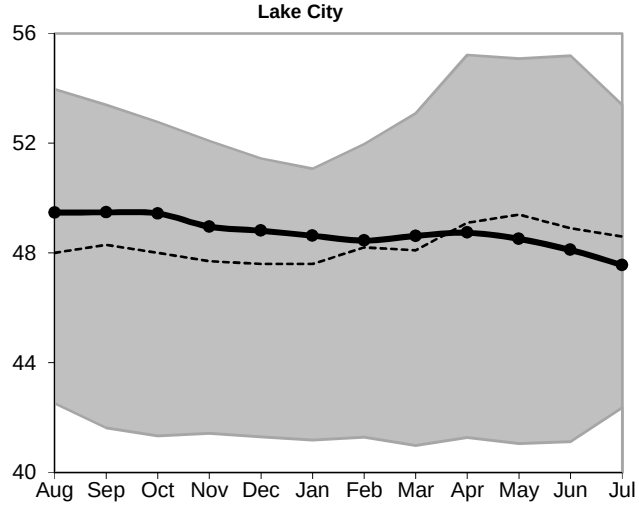
Madison County N010719001
near Greenville



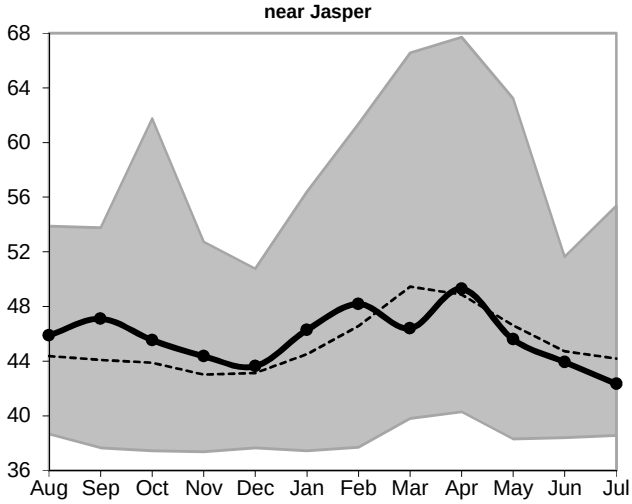
Suwannee County S021335001
near Live Oak



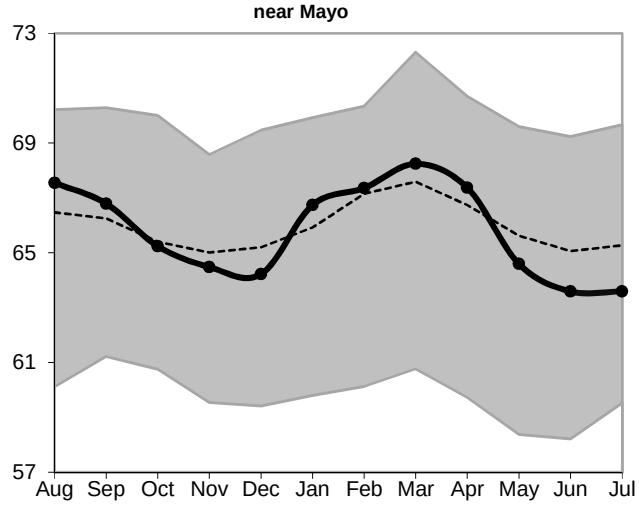
Columbia County S041705001
Lake City



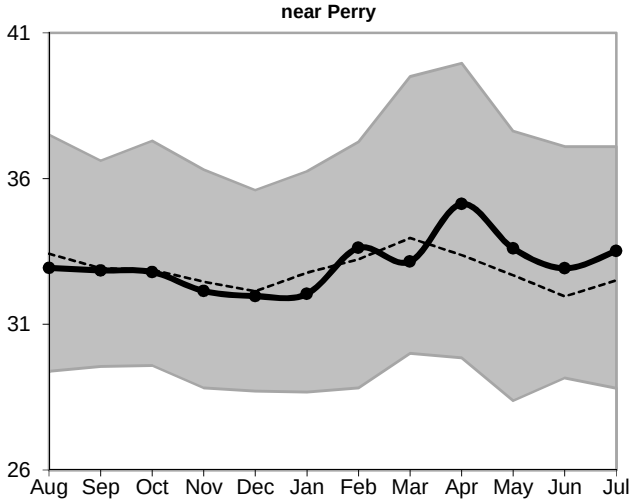
Hamilton County N011422007
near Jasper



Lafayette County S061114001
near Mayo



Taylor County S050701001
near Perry



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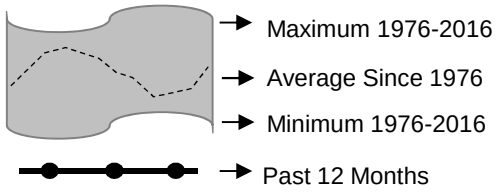
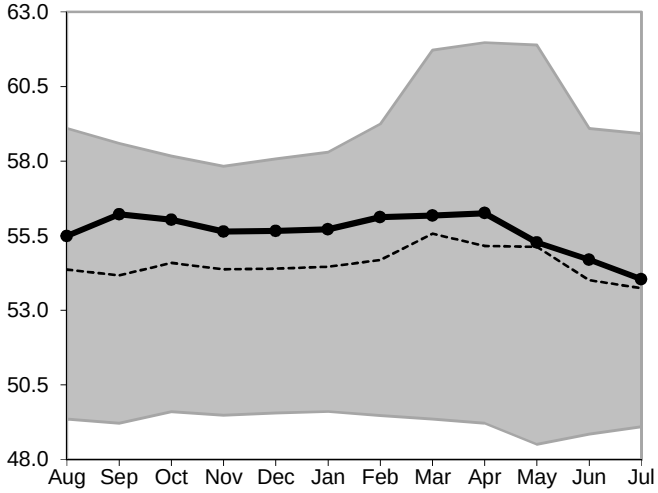
Period of Record Beginning 1976

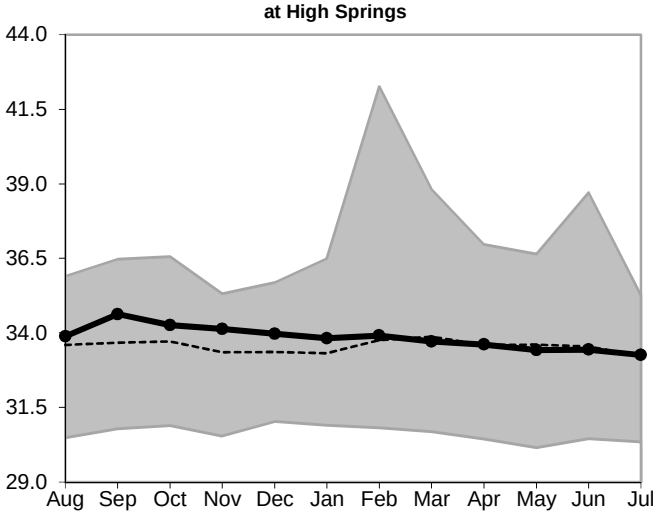


Upper Floridan Aquifer Elevation above NGVD 1929, Feet

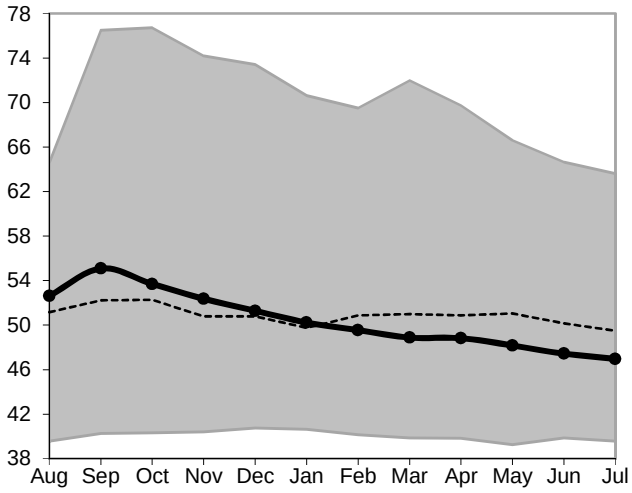
Union County S051933001
near Lake Butler



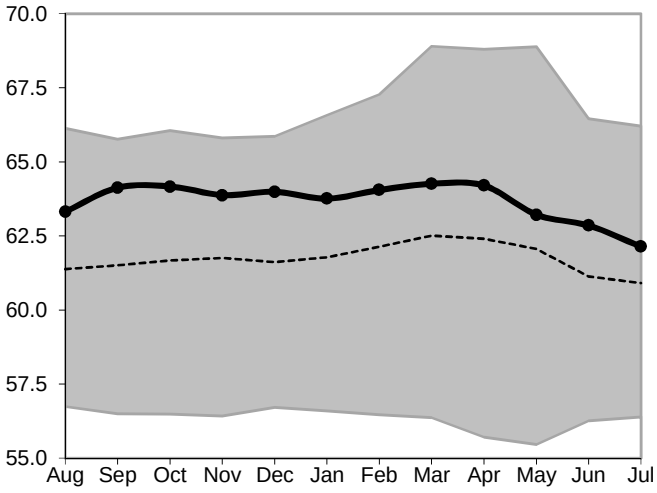
Alachua County S081703001
at High Springs



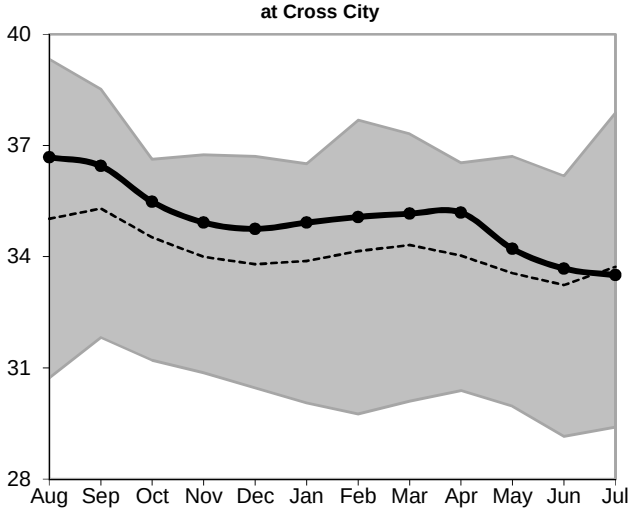
Gilchrist County S091607001
near Trenton



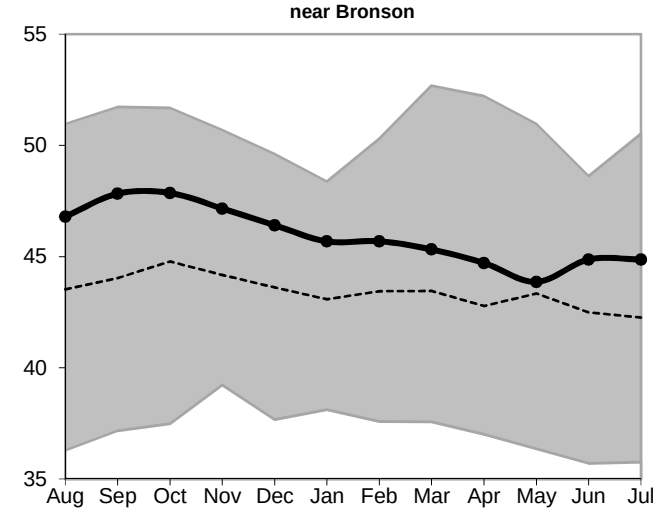
Bradford County S072132001
near Graham



Dixie County S101210001
at Cross City



Levy County S131736001
near Bronson



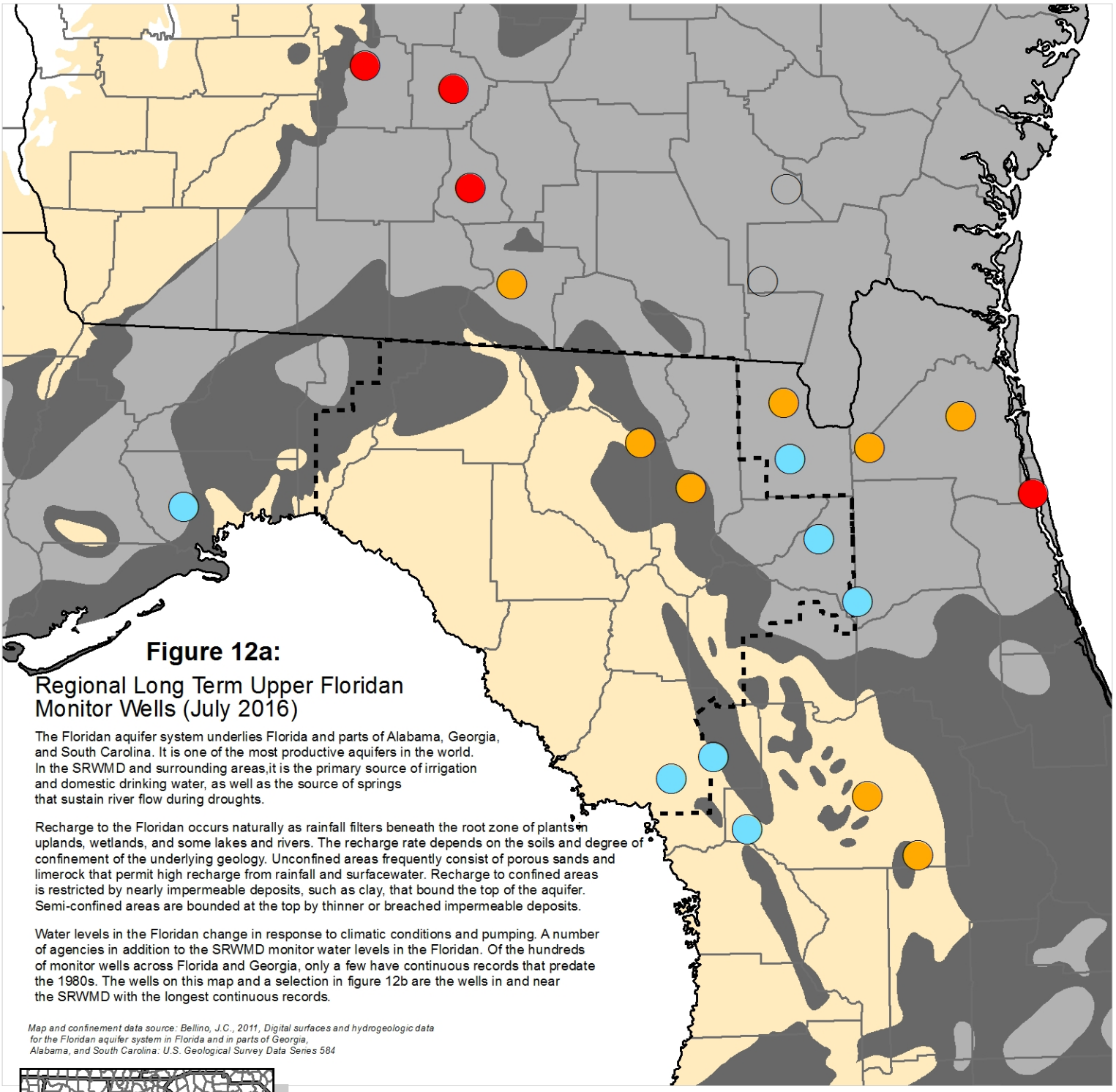


Figure 12a:

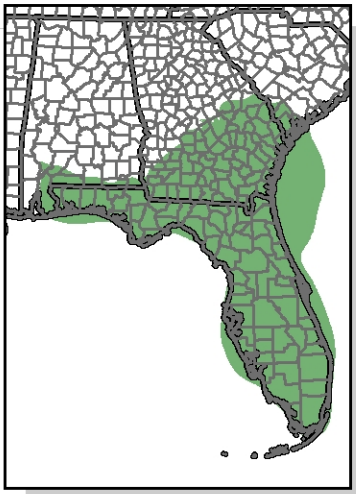
Regional Long Term Upper Floridan Monitor Wells (July 2016)

The Floridan aquifer system underlies Florida and parts of Alabama, Georgia, and South Carolina. It is one of the most productive aquifers in the world. In the SRWMD and surrounding areas,it is the primary source of irrigation and domestic drinking water, as well as the source of springs that sustain river flow during droughts.

Recharge to the Floridan occurs naturally as rainfall filters beneath the root zone of plants in uplands, wetlands, and some lakes and rivers. The recharge rate depends on the soils and degree of confinement of the underlying geology. Unconfined areas frequently consist of porous sands and limerock that permit high recharge from rainfall and surfacewater. Recharge to confined areas is restricted by nearly impermeable deposits, such as clay, that bound the top of the aquifer. Semi-confined areas are bounded at the top by thinner or breached impermeable deposits.

Water levels in the Floridan change in response to climatic conditions and pumping. A number of agencies in addition to the SRWMD monitor water levels in the Floridan. Of the hundreds of monitor wells across Florida and Georgia, only a few have continuous records that predate the 1980s. The wells on this map and a selection in figure 12b are the wells in and near the SRWMD with the longest continuous records.

Map and confinement data source: Bellino, J.C., 2011, Digital surfaces and hydrogeologic data for the Floridan aquifer system in Florida and in parts of Georgia, Alabama, and South Carolina: U.S. Geological Survey Data Series 584



Inset: Extent of Floridan Aquifer

Occurence of Confined and Unconfined Conditions in the Upper Floridan Aquifer

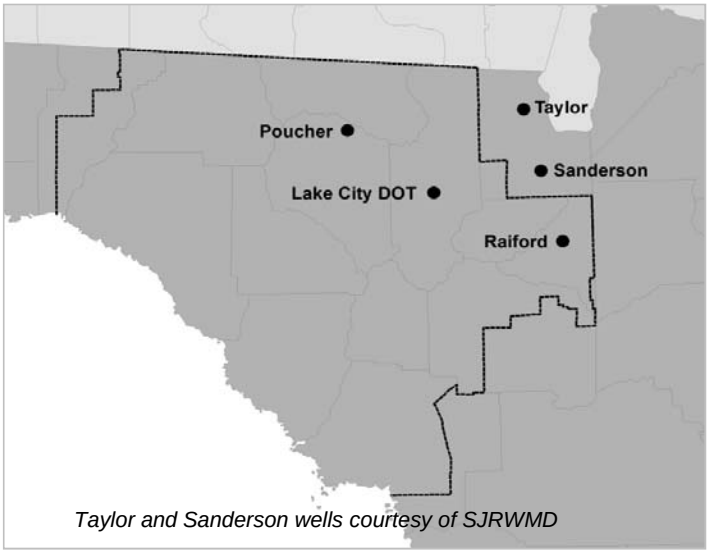
- Confined: Upper confining unit is generally greater than 100 feet thick and unbreached. Recharge is low.
- Semi-confined: Upper confining unit is generally less than 100 feet thick, breached, or both. Recharge is moderate.
- Unconfined: Upper confining unit is absent or very thin. Recharge is high.

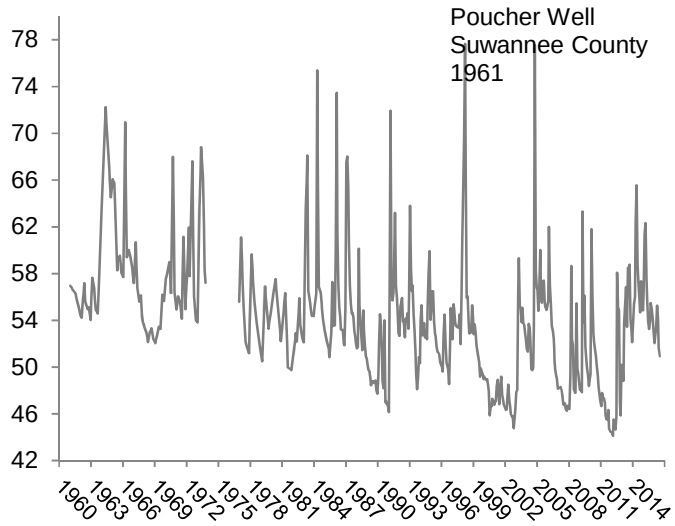
Percentile of Most Recent Water Level Relative to Entire Record

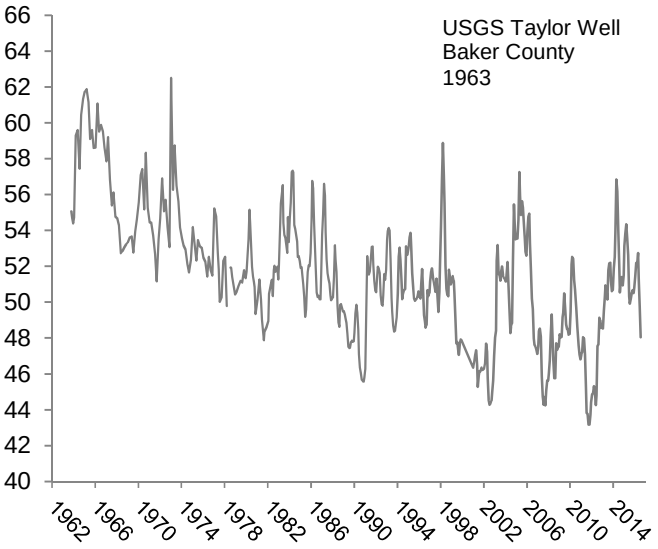
- High (Greater than 75th Percentile)
- Normal (25th to 75th Percentile)
- Low (10th to 25th Percentile)
- Extremely Low (Less than 10th Percentile)
- Not Available
- SRWMD Boundary

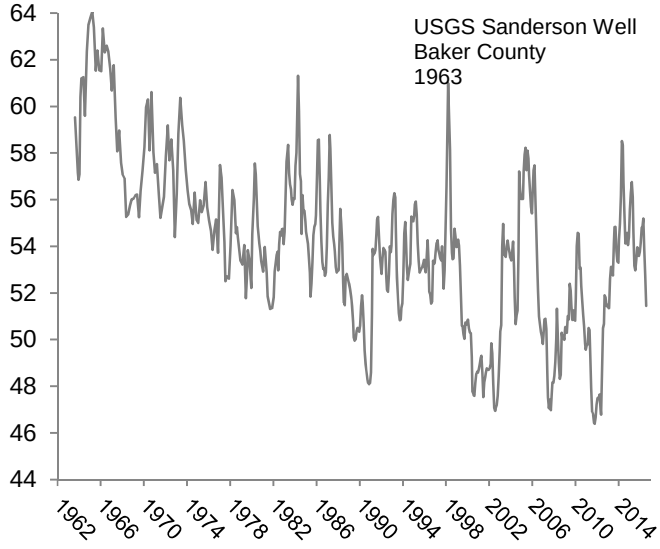
Figure 12b: Regional Long Term Upper Floridan Levels

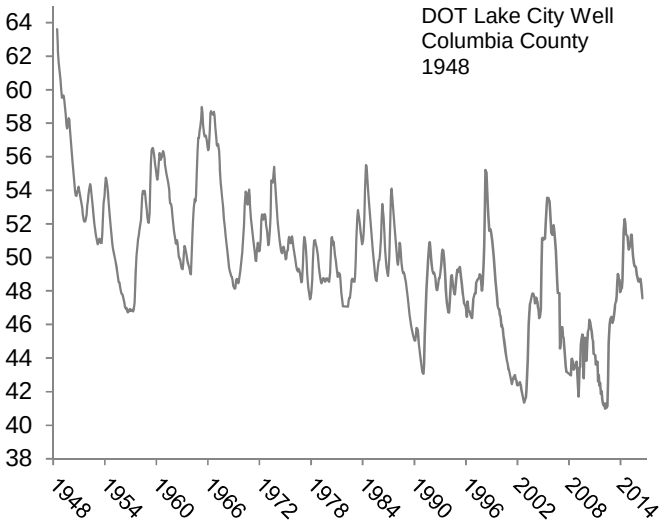
Data through July 2016

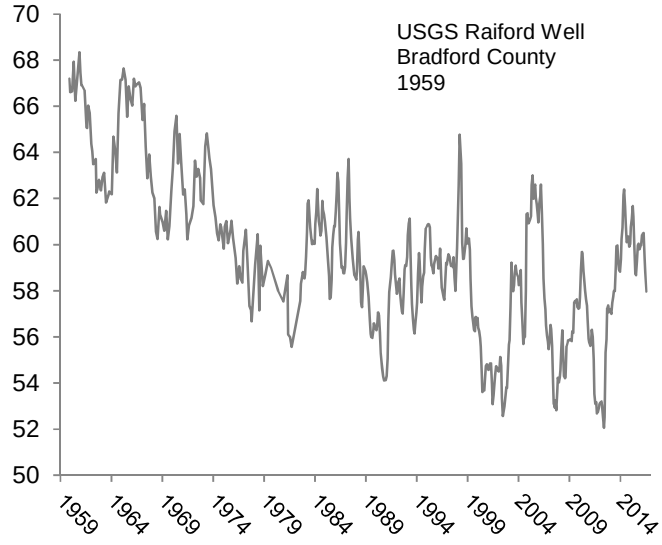












Upper Floridan Aquifer Elevation above NGVD 1929, Feet