MEMORANDUM

TO: Suwannee River Water Management District Governing Board

FROM: Tom Mirti, Director, Division of Water Resources

THRU: Noah Valenstein, Executive Director

DATE: July 8, 2016

RE: June 2016 Hydrologic Conditions Report for the SRWMD

RAINFALL

- District-wide rainfall in June averaged 5.95" across the District, versus the long-term June average monthly rainfall for the District of 6.39". Highest rainfall amounts fell in the southern portion of the District; both Alachua and Levy counties received more than 8" of rain, although a greater proportion of that rain fell outside the District boundary. The north central portion of the District received the least amount of rainfall, and Hamiltion County in particular received only half the normal rainfall for the month. (Table 1 and Figure 1). Small areas of Alachua, Dixie and Levy counties saw rainfall totals over 11", generally associated with the passage of Tropical Storm Colin early in June (Figure 2). Georgia rainfall was roughly normal for the time of year, with only the upper Aucilla River receiving consistent above-average rainfall totals, also associated with the tropical storm (Figure 3).
- The highest gaged monthly rainfall total of 9.19" was recorded at the Wacissa Tower rainfall station in Jefferson County, and the highest daily total of 6.33" (on June 6, the peak of Tropical Storm Colin) was also recorded there. The lowest gaged monthly total was 1.24" at the Jasper rainfall station in central Hamilton County.
- The rainfall average across the District for the 12-month period ending June 30 was 52.0", compared to the long-term average of 54.7". The cumulative 12-month District-wide rainfall deficit continued to improve for the third month in a row to 2.6". Annual rainfall deficits improved again in the Santa Fe Basin again, but the Suwannee River Basin, and the Upper Suwannee in particular, dropped to 90 percent of normal. The Waccasassa River Basin continues to show a large annual rainfall surplus (Figure 4).
- Average District rainfall for the 3 months ending June 31 totaled 12.5", about an inch below the long-term average of 13.4". The Santa Fe and Waccasassa river basins both saw increases that brought their respective rainfall deficits to near parity during June. The Suwannee River basin deficit increased to -2.4"(Figure 5).

SURFACEWATER

- **Rivers:** All District river level stations except for the Steinhatchee River began June in the normal range of flows (between the 25th and the 75th percentiles). The passage of Tropical Storm Colin brought river levels up temporarily during the month but, despite that event, most stations ended the month lower than they had begun. The Steinhatchee River near Tennille began and ended the month in low category (below the 25th percentile) and was joined there by the Suwannee River at Ellaville and at White Springs. Gaging stations in the upper Alapaha and Withlacoochee rivers in Georgia dropped into the low and very low (below the 10th percentile) categories. 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**: Lakes toward the center of the District tended to decrease in level during June, while those at the western and eastern boundaries increased. This pattern was primarily due to the rainfall pattern resulting from Tropical Storm Colin. Four lakes remained below average levels as the month ended. Alligator Lake in Lake City remains below the

gage bottom, and Waters Lake in Gilchrist County declined about 9" during the month. Sneads Smokehouse Lake in Jefferson County rose by just over 1' as a result of tropical storm rainfall. Figure 8 shows lake levels relative to their respective long-term minimum, average and maximum levels.

- **Springs**: The flows of 20 springs or spring groups were measured by the USGS, District staff, and District contractors during June. Spring flows generally decreased during the month as a result of declining levels in the Floridan aquifer, particularly along the Suwannee River springs. Historical flow data for three river rise springs are provided in graphical format on Figure 9.

GROUNDWATER

Groundwater levels in Upper Floridan Aquifer monitor wells continued to decline overall, although less steeply than during May, ended the month at the 47th percentile as an average across the District, a drop of 6 percentile points. Only 12 of the roughly 100 longterm wells across the District showed an increase in level, primarily in and near southern Levy County. Levels in the Steinhatchee River Basin continued to drop and in northwestern Dixie County one well has dropped into the extremely low category (below the 10th percentile) 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 with a description of aquifer characteristics.

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 2 showed ongoing near-normal conditions in north Florida and southern Georgia; the remainder of Florida is experiencing similar conditions.
- The National Weather Service Climate Prediction Center (CPC) is projecting near normal rainfall for North Florida through mid-July, and subsequently is projecting above-normal chances for rainfall in North Florida over the following two months. On June 9, the CPC announced that the ongoing El Niño event had concluded; the current El Niño index is at the zero level (i.e., neutral status).
- The U.S. Drought Monitor report of July 5 showed no drought conditions present anywhere in Florida or southern Georgia.

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	June 2016	June Average	Month % of Normal	Last 12 Months	Annual % of Normal
Alachua	8.24	6.57	125%	56.12	110%
Baker	4.48	6.29	71%	43.85	88%
Bradford	6.61	6.11	108%	53.09	105%
Columbia	4.71	6.25	75%	46.36	90%
Dixie	7.69	6.42	120%	63.14	107%
Gilchrist	5.73	6.43	89%	52.95	92%
Hamilton	3.18	6.13	52%	44.93	86%
Jefferson	7.39	6.09	121%	52.60	87%
Lafayette	5.46	6.25	87%	48.68	86%
Levy	8.58	6.87	125%	62.36	105%
Madison	5.75	6.08	94%	51.26	91%
Suwannee	4.35	6.20	70%	47.04	89%
Taylor	5.76	6.93	83%	54.76	92%
Union	5.33	6.78	79%	50.88	94%

June 2016 Average:	5.95
June Average (1932-2015):	6.39
Historical 12-month Average (1932-2015):	54.66
Past 12-Month Total:	52.00
12-Month Rainfall Surplus/Deficit:	-2.66

Figure 1: Comparison of District-wide Monthly Rainfall

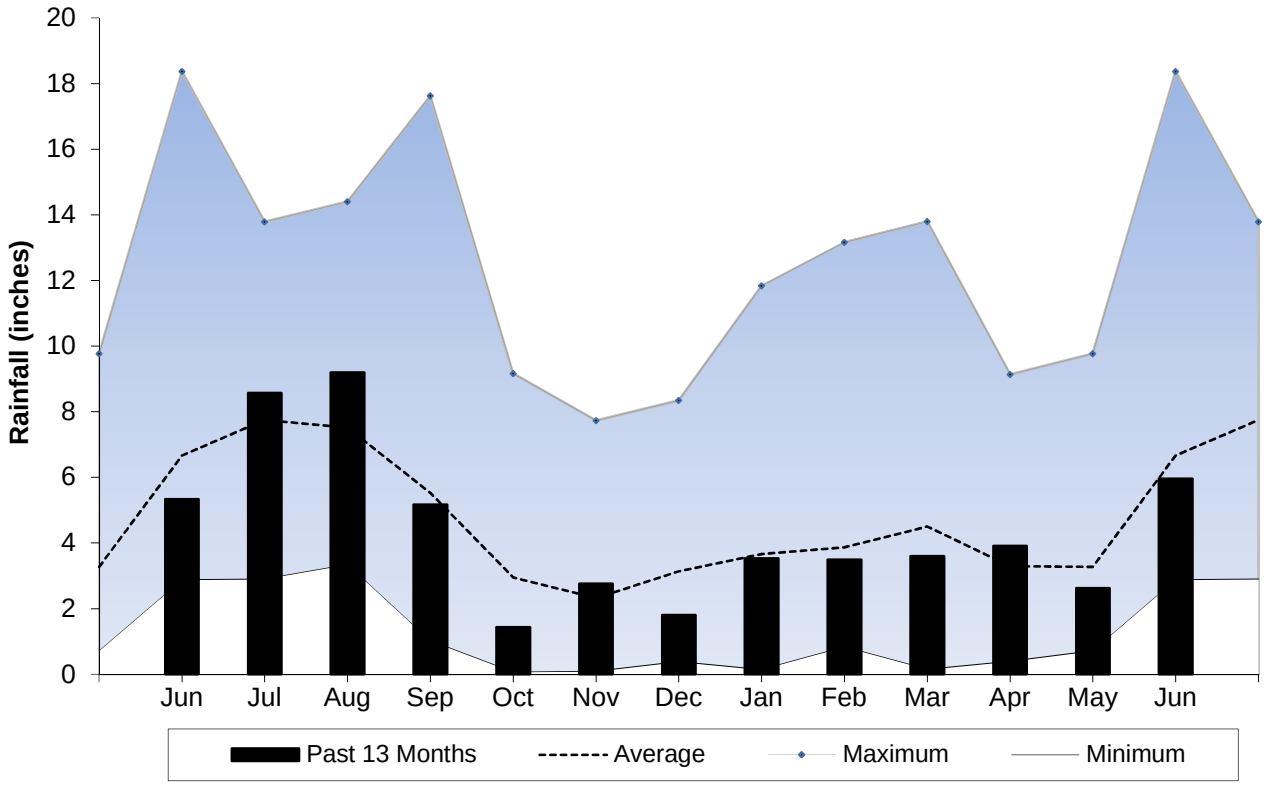


Figure 2: June 2016 Gage-Adjusted Radar Rainfall Estimate

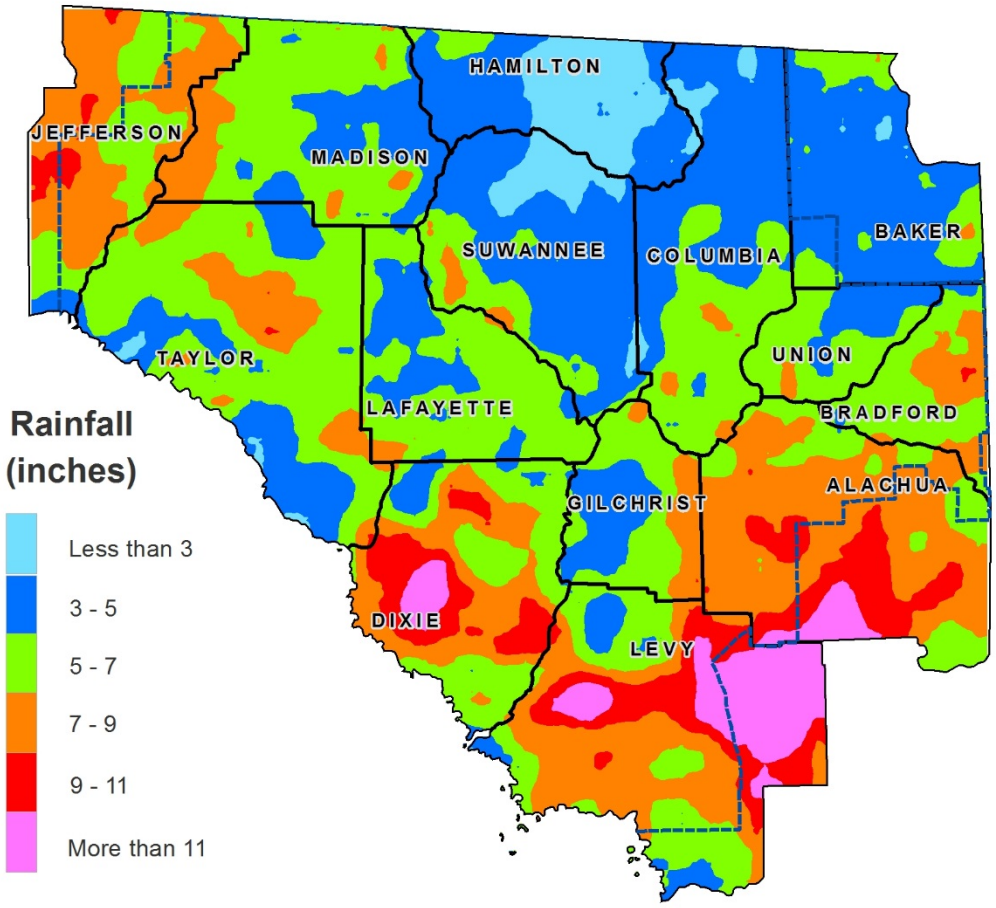


Figure 3: June 2016 Percent of Normal Rainfall

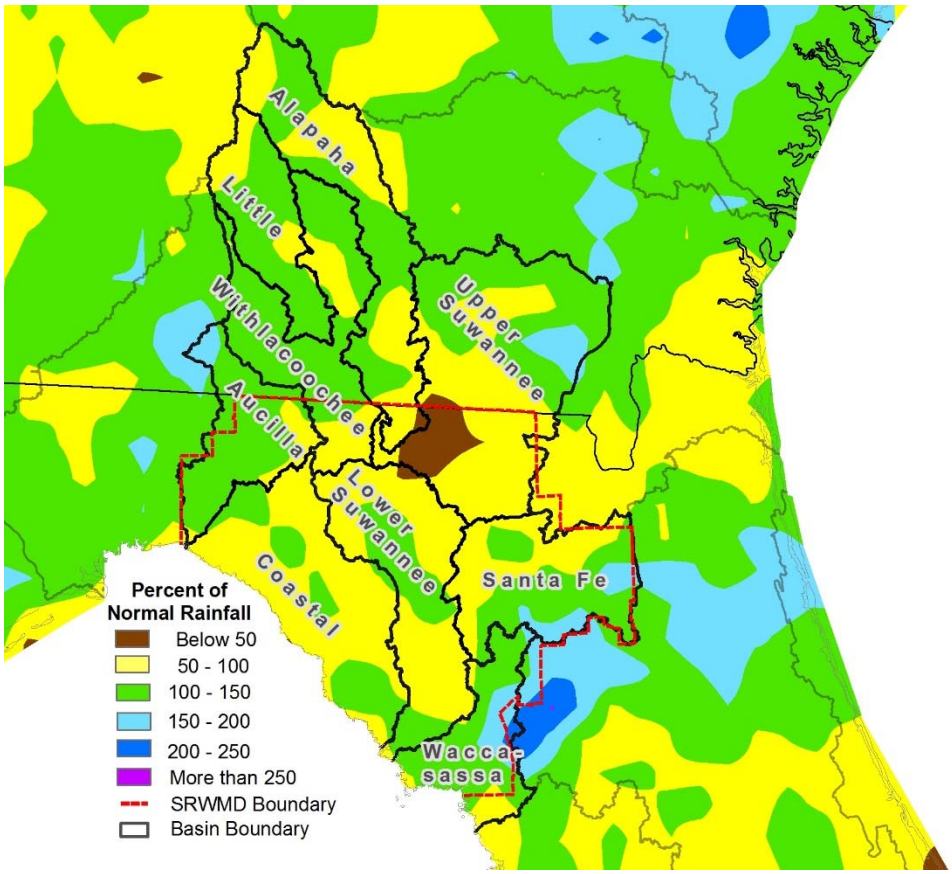


Figure 4: 12-Month Rainfall Surplus/Deficit by River Basin
Through June 30, 2016

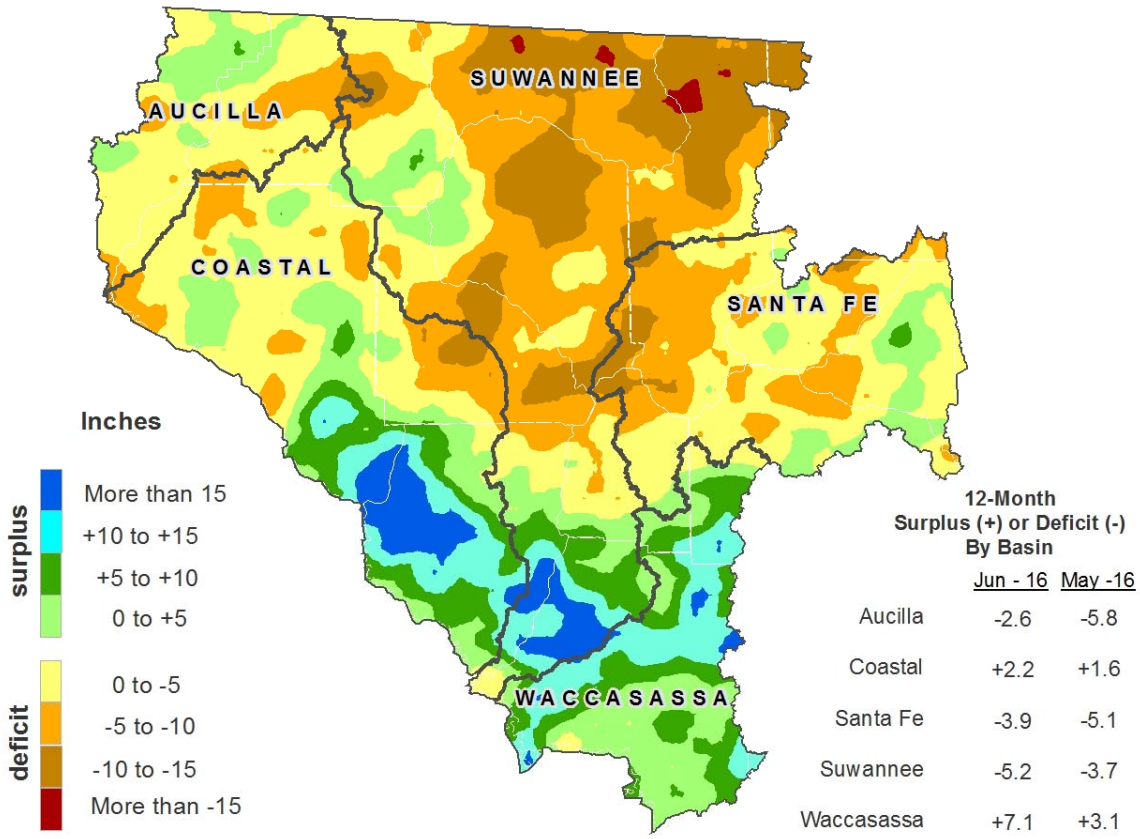


Figure 5: 3-Month Rainfall Surplus/Deficit by River Basin
Through June 30, 2016

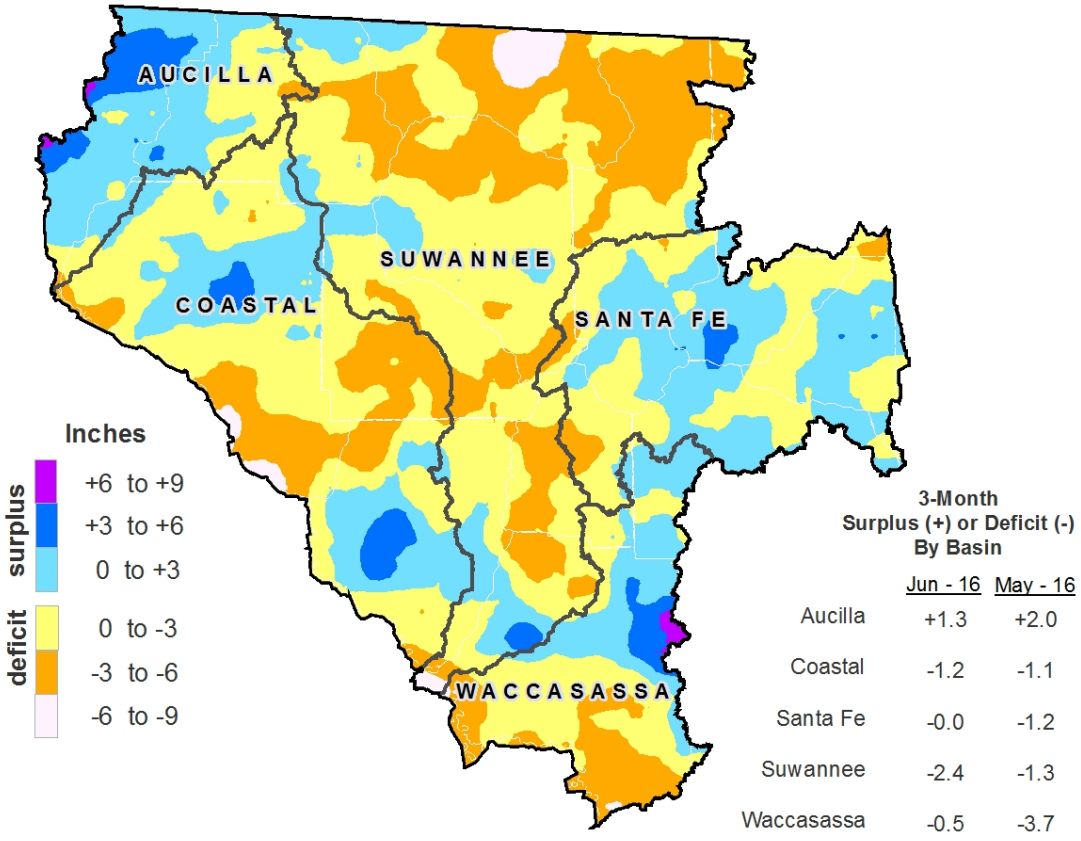


Figure 6: Daily River Flow Statistics
July 1, 2015 through June 30, 2016

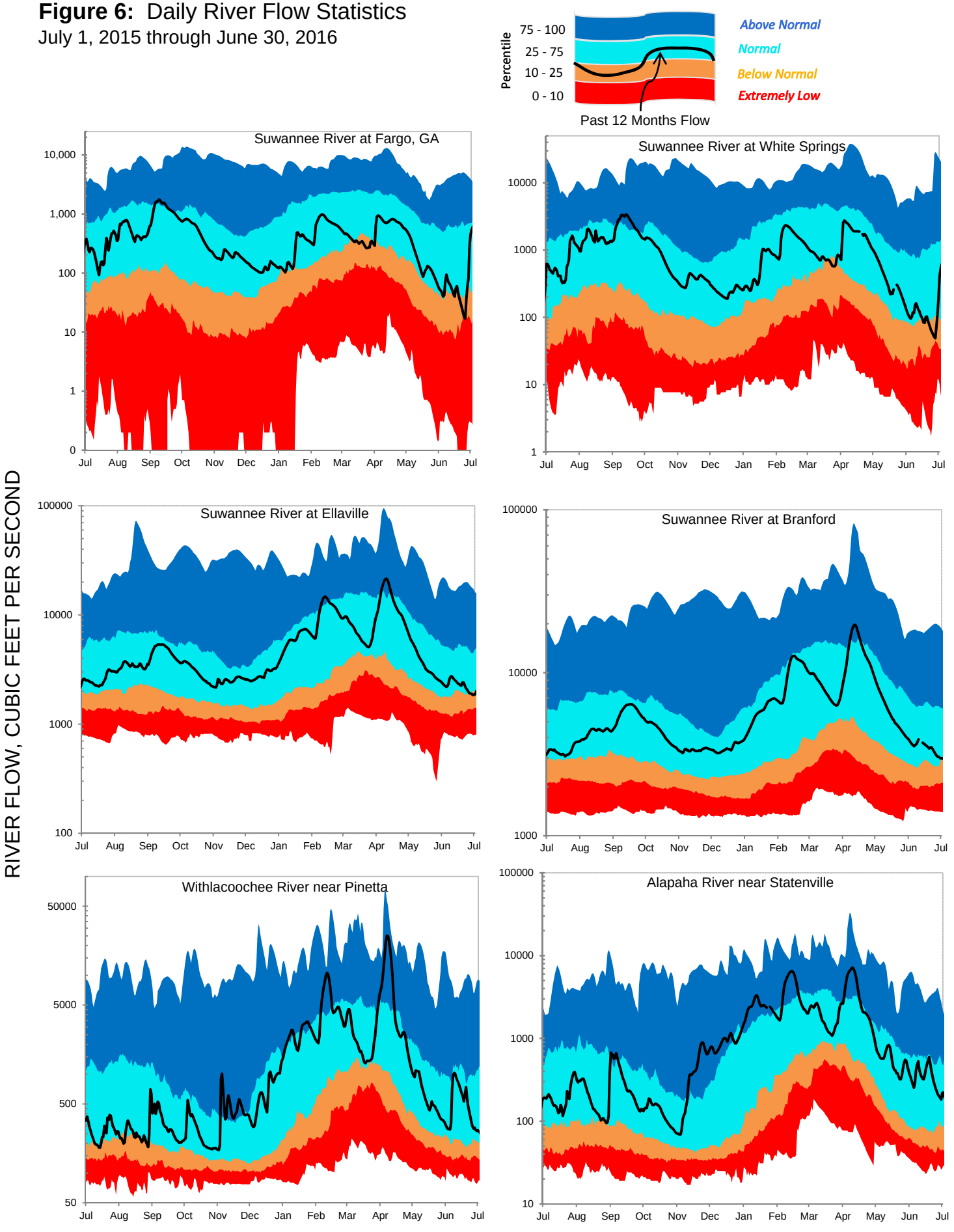
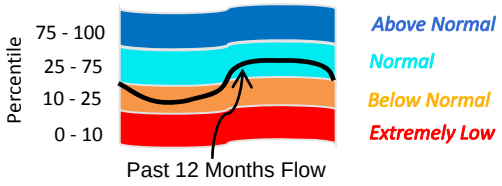
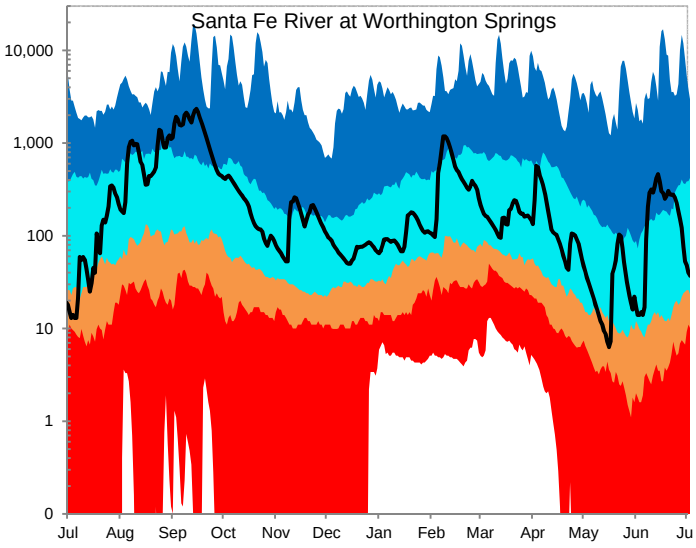
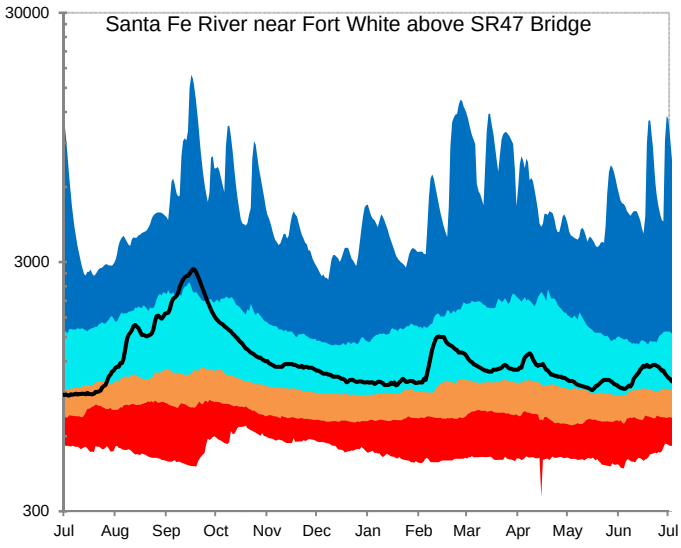


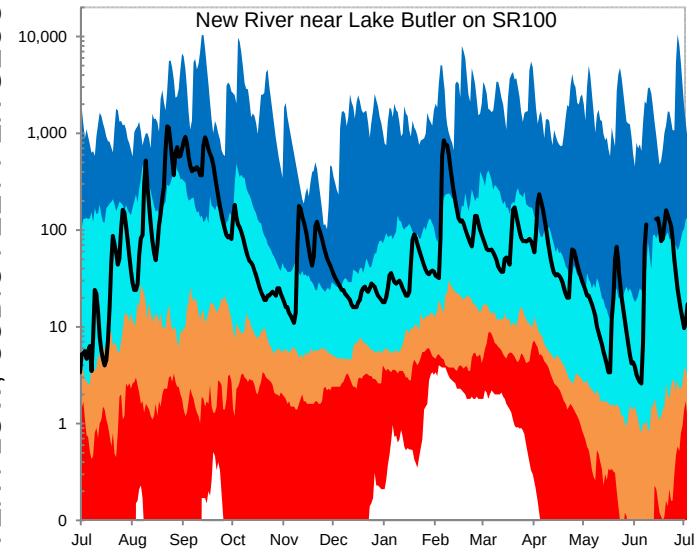
Figure 6, cont: Daily River Flow Statistics
July 1, 2015 through June 30, 2016

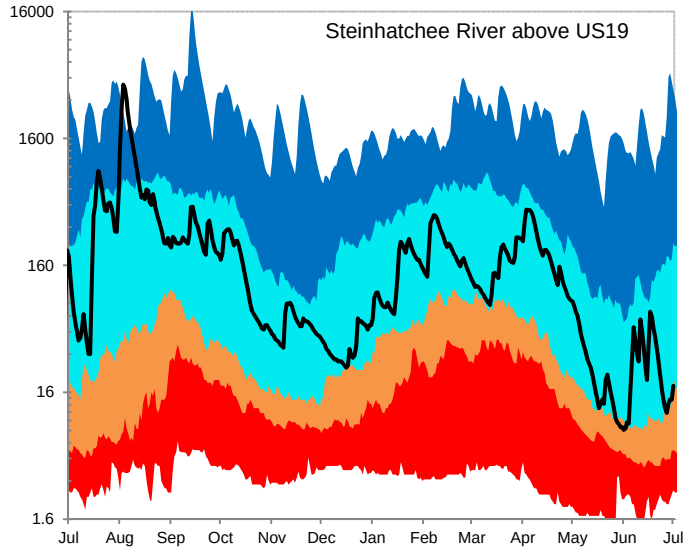


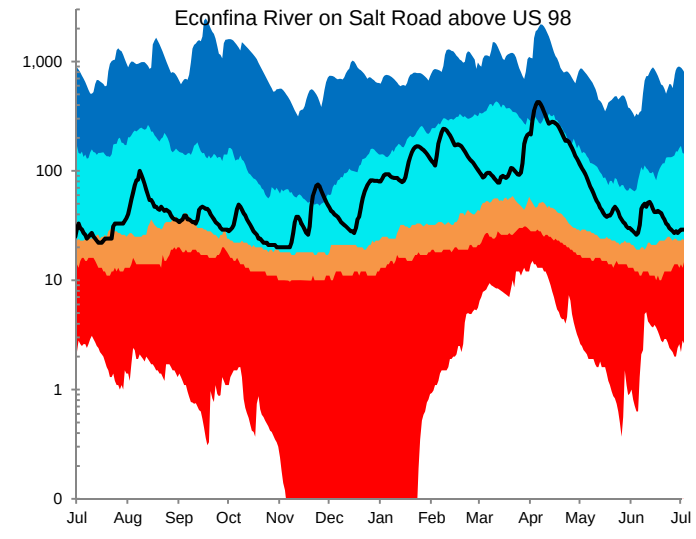
RIVER FLOW, CUBIC FEET PER SECOND

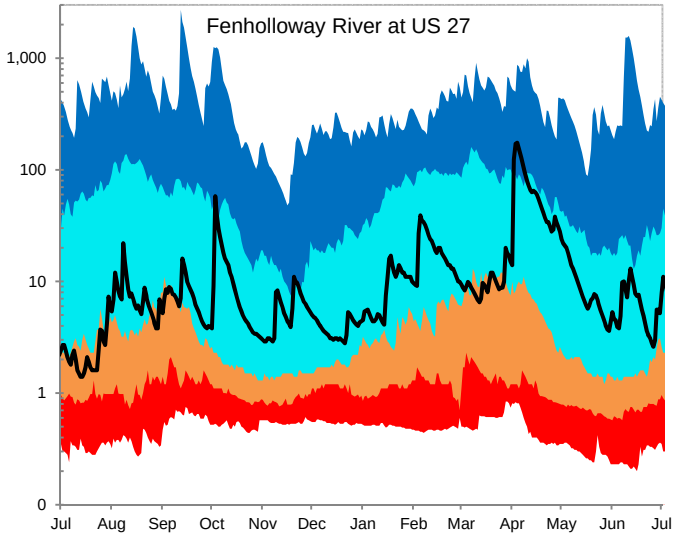












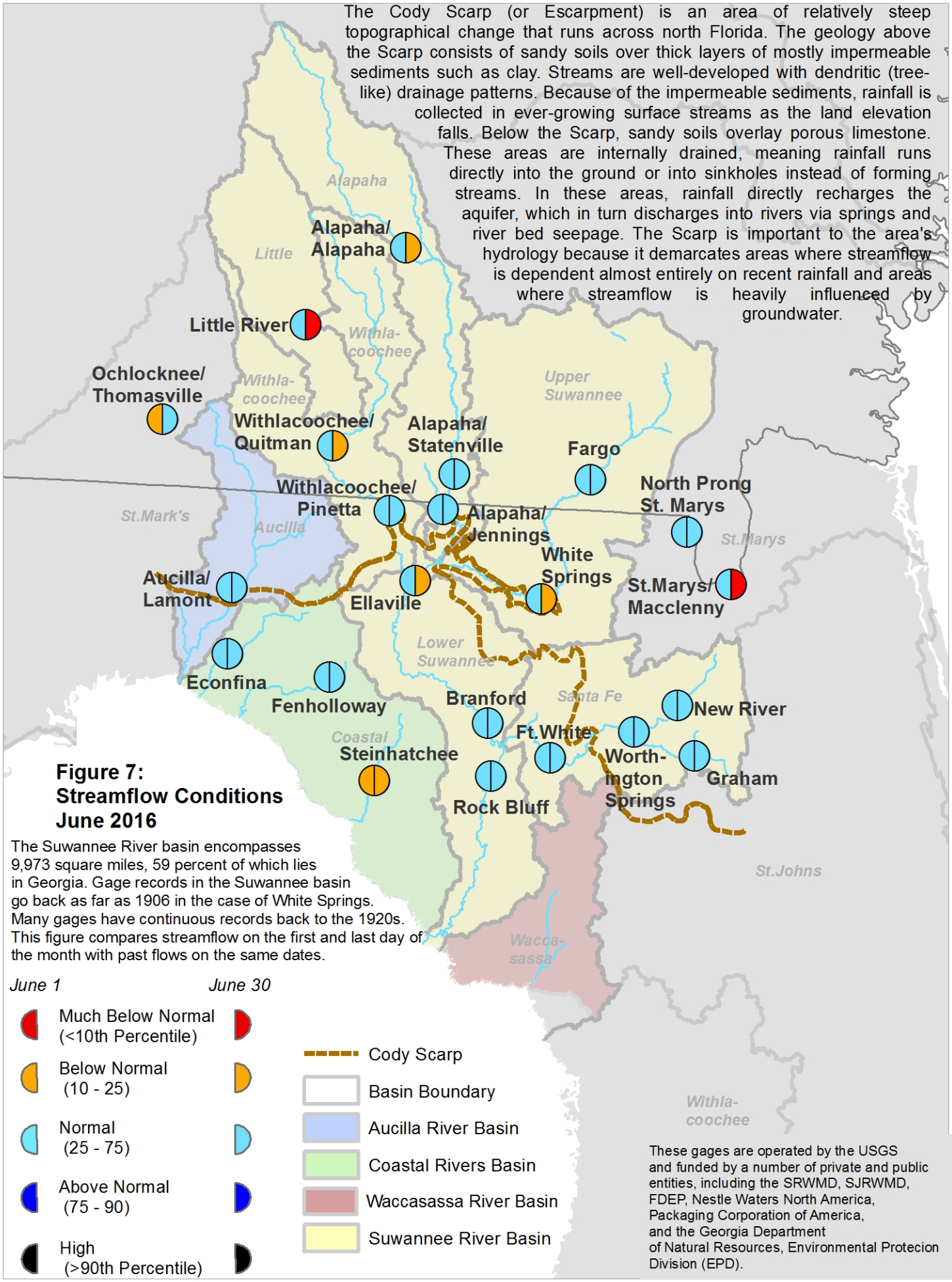
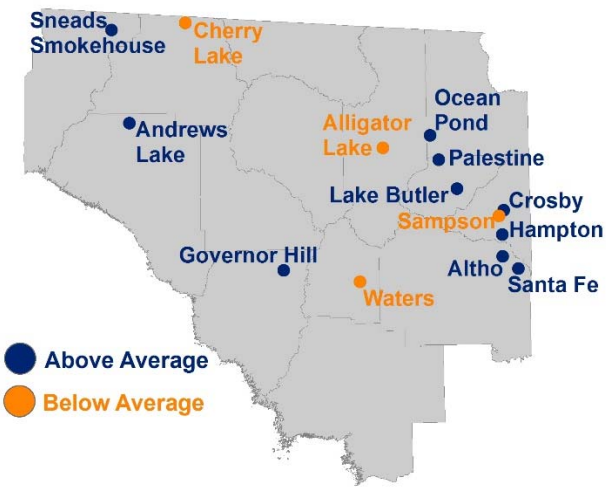

The Cody Scarp (or Escarpment) is an area of relatively steep topographical change that runs across north Florida. The geology above the Scarp consists of sandy soils over thick layers of mostly impermeable sediments such as clay. Streams are well-developed with dendritic (tree-like) drainage patterns. 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
June 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.
June 1
June 30
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: June 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 monitors 14 lakes with much of the data originally provided by volunteer observers. Monitoring records begin in the 1970s, except for Lakes Butler, Sampson, and Santa Fe, which started in 1957.

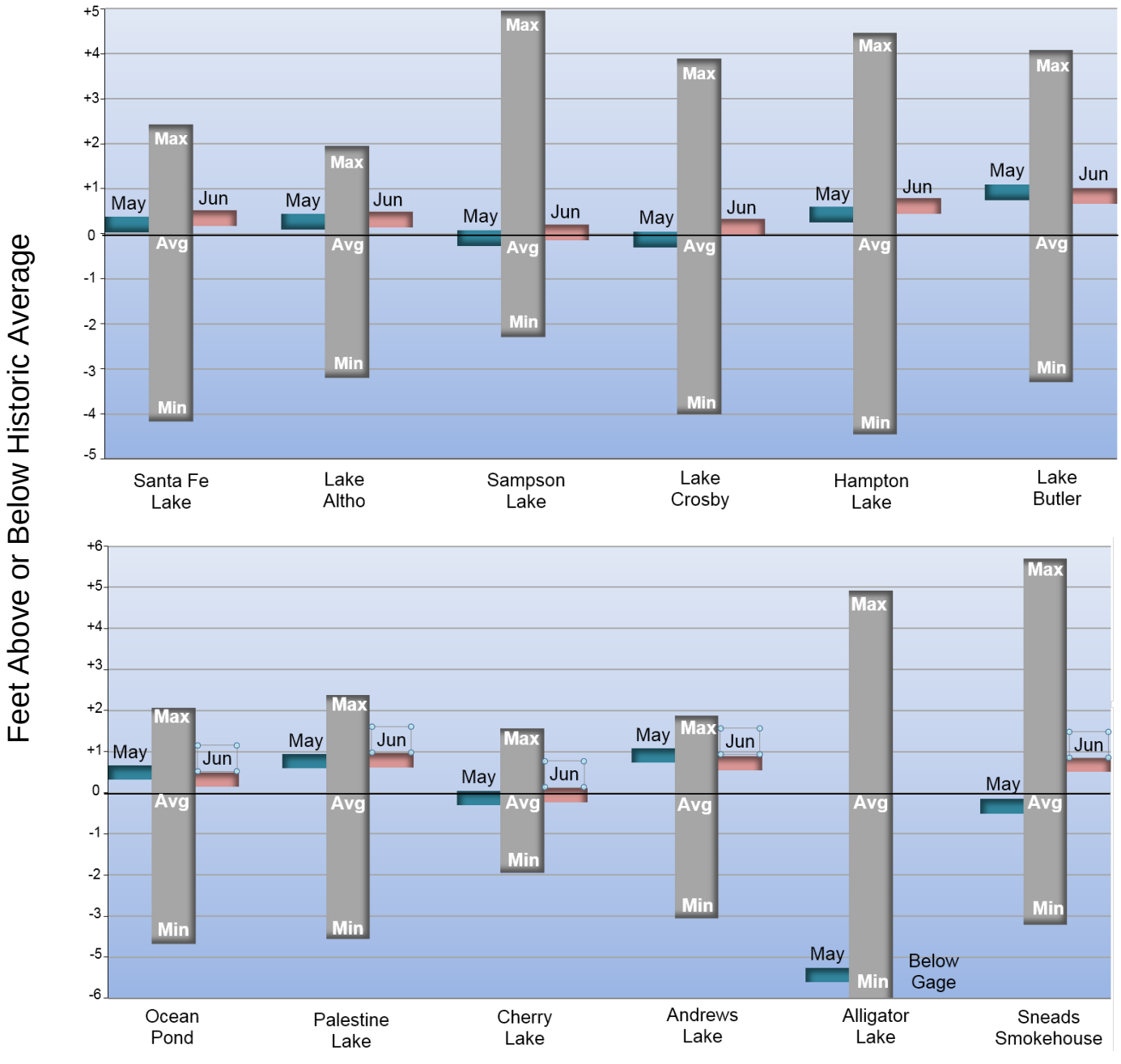
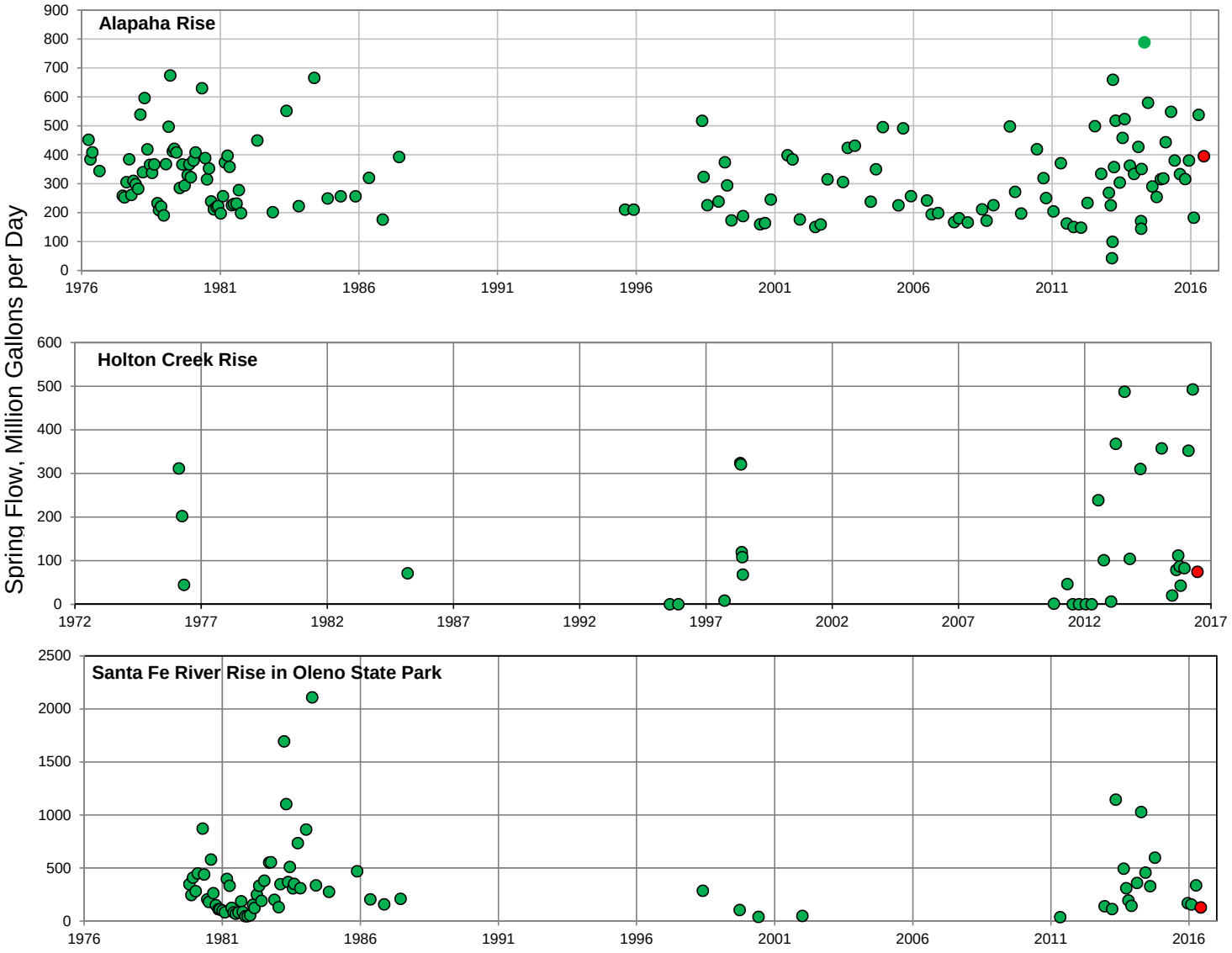


Figure 9: Monthly Springflow Measurements

The SRWMD monitors water quality at 44 springs. Flow is usually measured at the time of the sampling. The springs below were measured in June 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.

During the month of June, the Florida Geological Survey in coordination with SRWMD conducted a dye trace of Dead River Sink on the Alapaha River; dye was visually detected within 6-8 days resurfacing at Alapaha Rise on the Suwannee River and at Holton Creek Rise, which also leads to the Suwannee River. The dye covered distances of just over 10 miles during this period. This test tangibly confirmed the direct connection of the recharge occuring in the area near Jennings Bluff in northern Hamilton County with springs on the Suwannee River, and represents an essential understanding of major conduit flow patterns in the Upper Suwannee River Basin. Historical flow measurements from Alapaha Rise, Holton Creek Rise, and the other major river rise in the District at Oleno State Park 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.



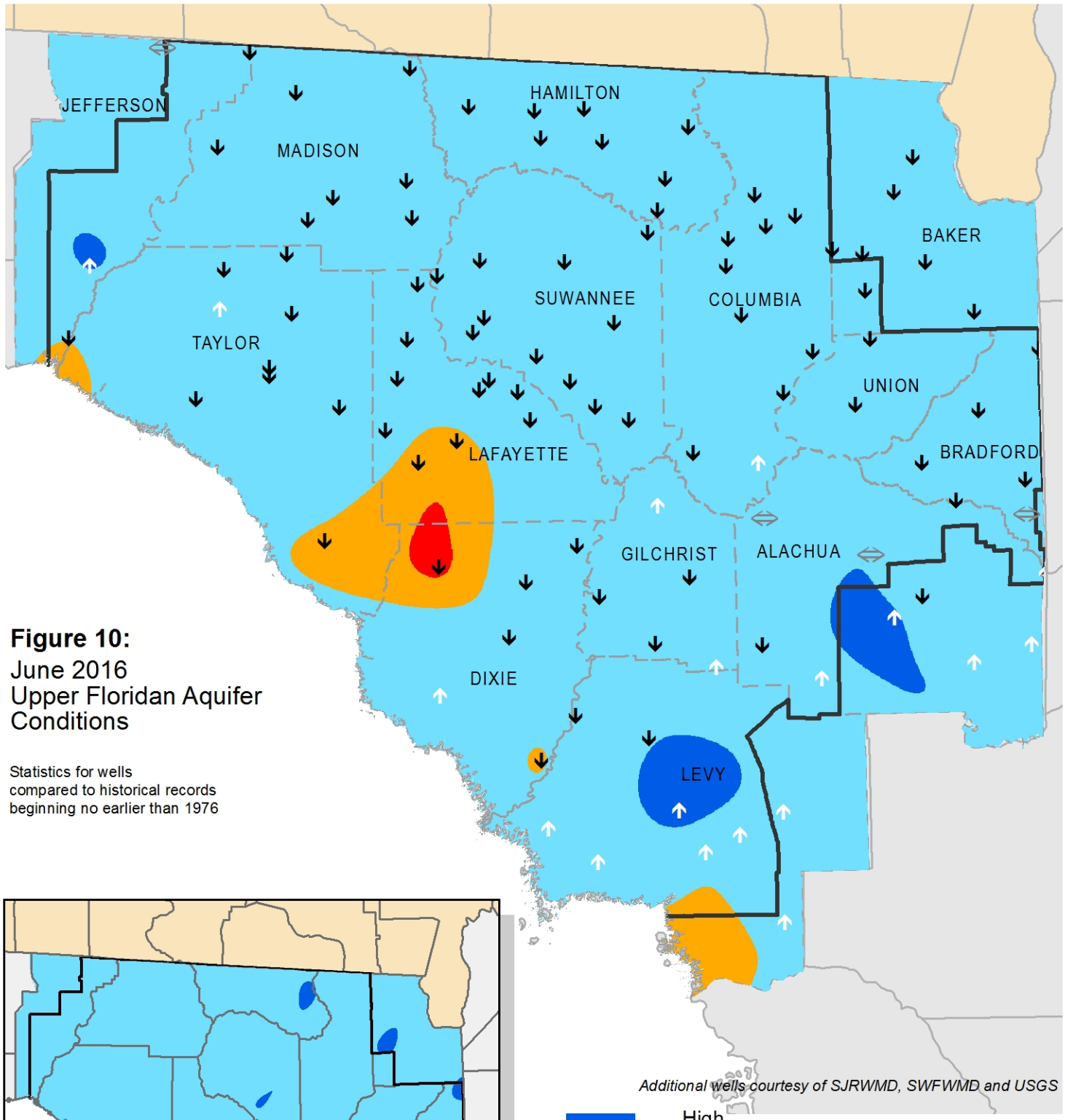
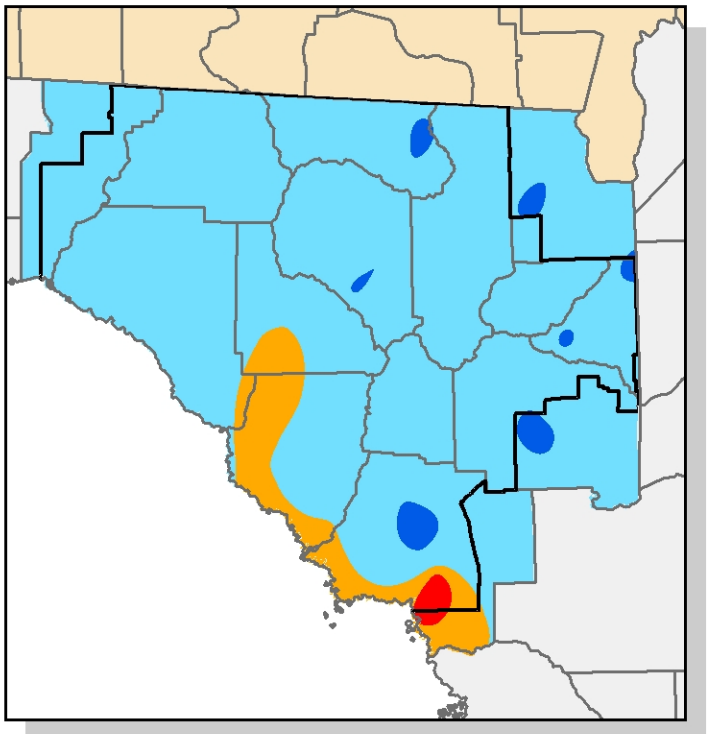


Figure 10:
June 2016
Upper Floridan Aquifer
Conditions

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



Inset: May 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)

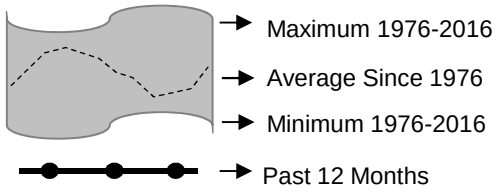
Extremely Low
(Less than 10th Percentile)

Increase/decrease in level since last month

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

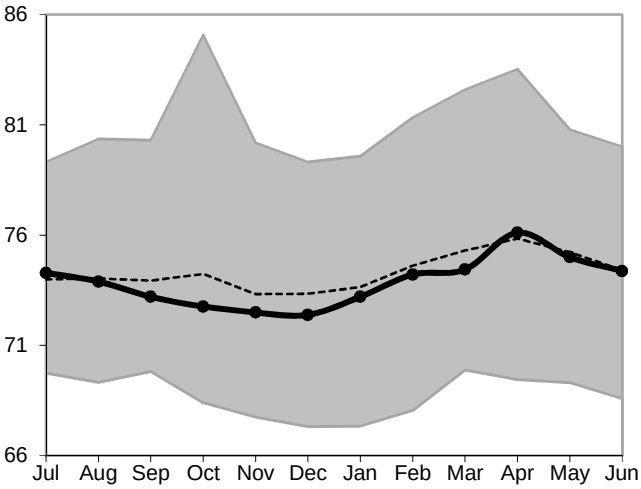
District Boundary

Figure 11: Monthly Groundwater Level Statistics
Levels July 1, 2015 through June 30, 2016
Period of Record Beginning 1976

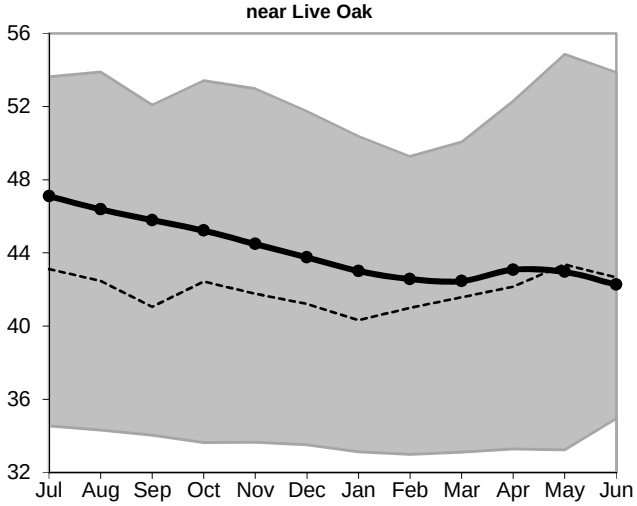


Upper Floridan Aquifer Elevation above NGVD 1929, Feet

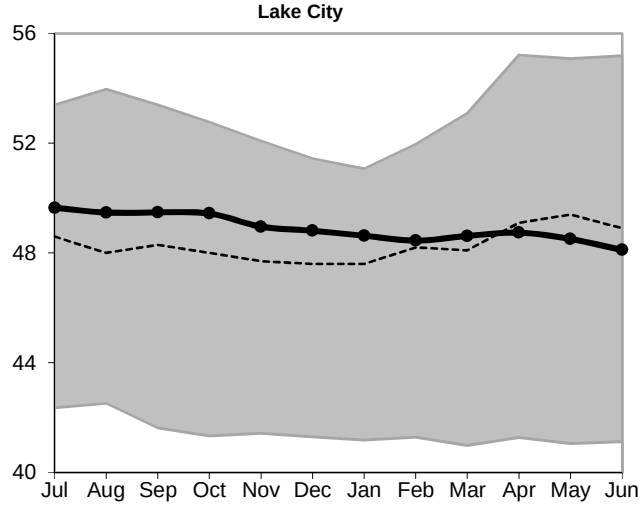
Madison County N010719001
near Greenville



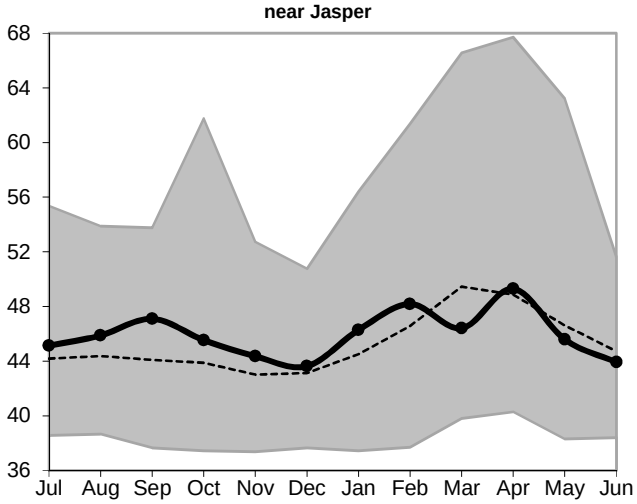
Suwannee County S021335001
near Live Oak



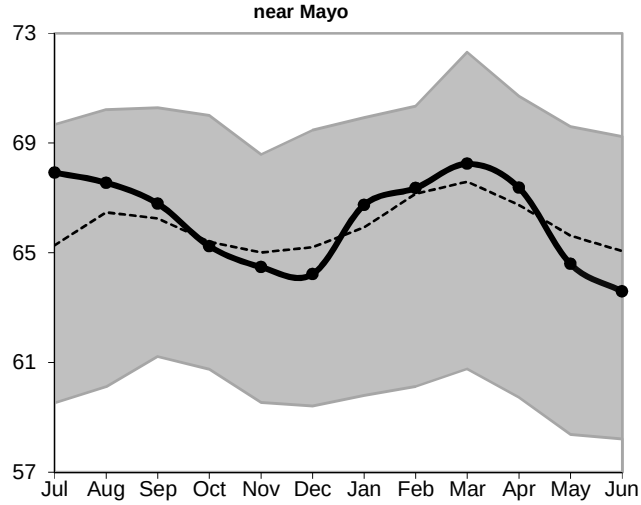
Columbia County S041705001
Lake City



Hamilton County N011422007
near Jasper



Lafayette County S061114001
near Mayo



Taylor County S050701001
near Perry

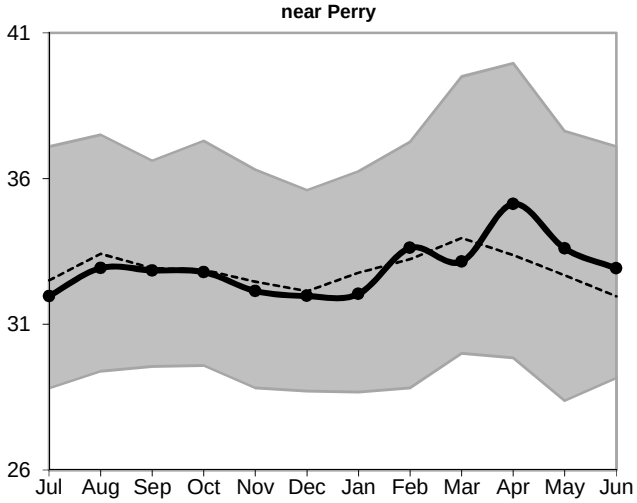
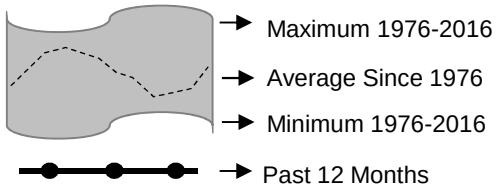
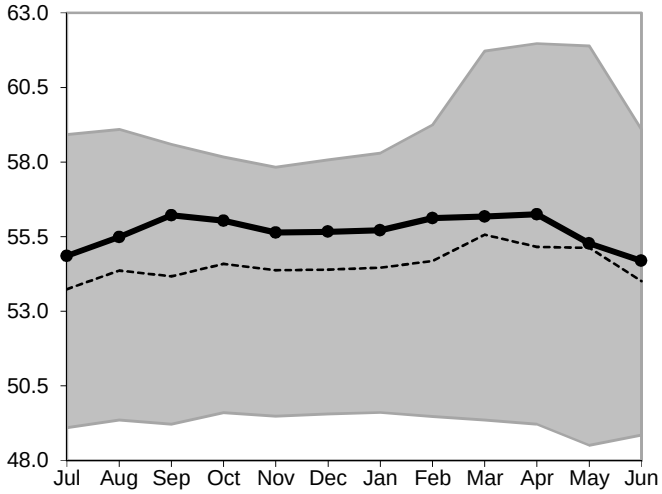


Figure 11, cont.: Groundwater Level Statistics
Levels July 1, 2015 through June 30, 2016
Period of Record Beginning 1976

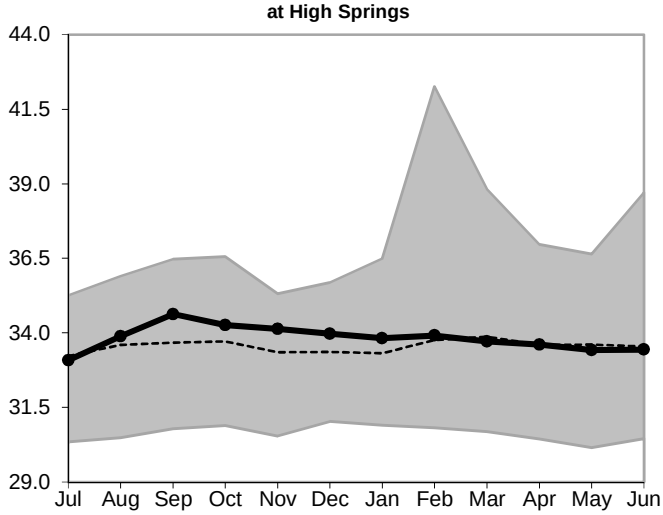


Upper Floridan Aquifer Elevation above NGVD 1929, Feet

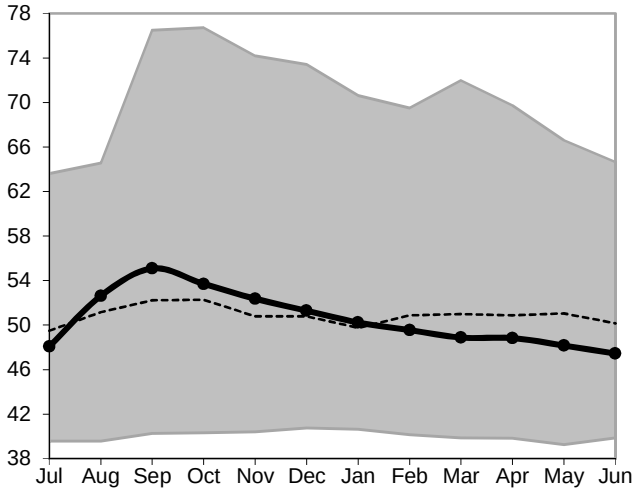
Union County S051933001 near Lake Butler



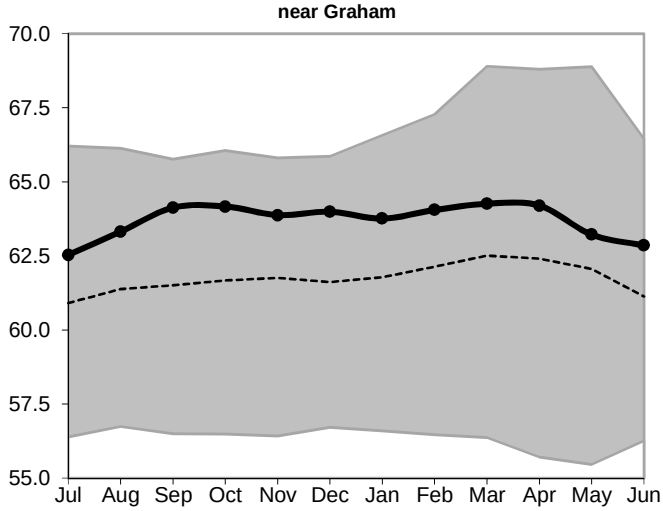
Alachua County S081703001 at High Springs



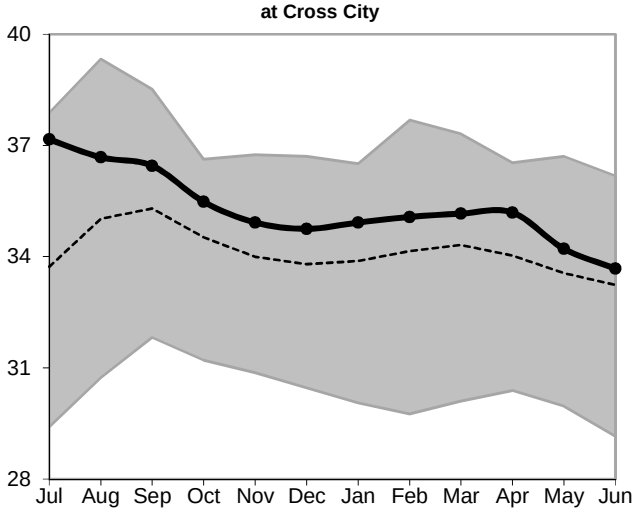
Gilchrist County S091607001 near Trenton



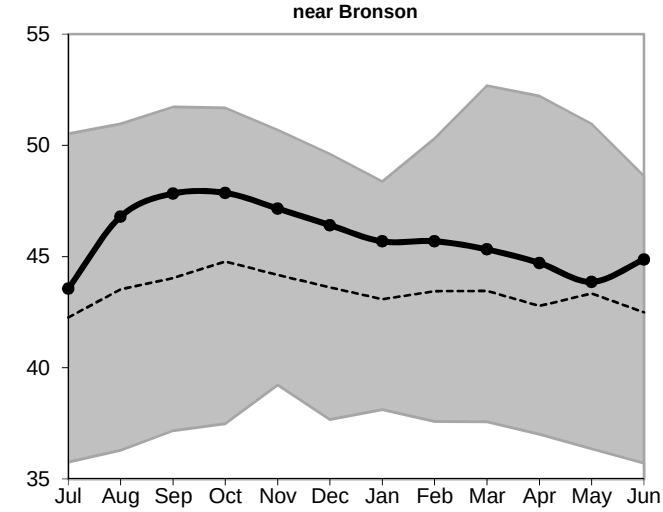
Bradford County S072132001 near Graham



Dixie County S101210001 at Cross City



Levy County S131736001 near Bronson



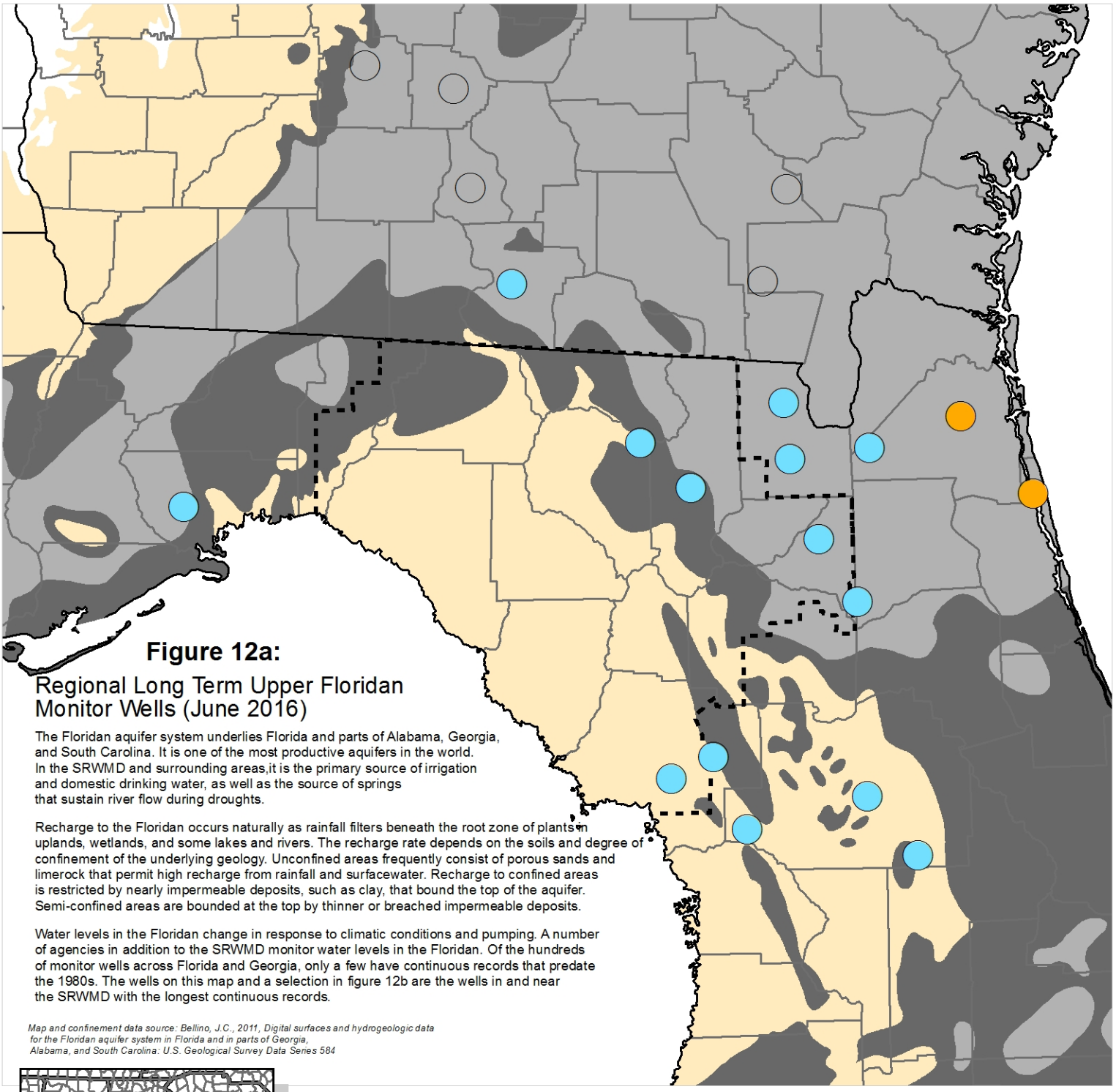


Figure 12a:

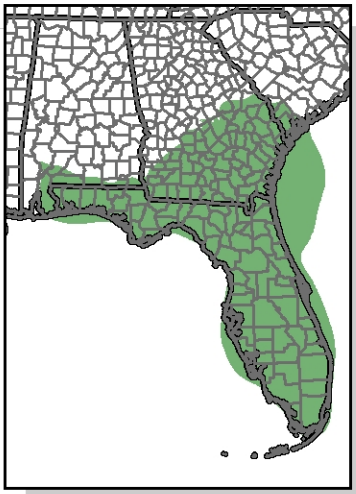
Regional Long Term Upper Floridan Monitor Wells (June 2016)

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

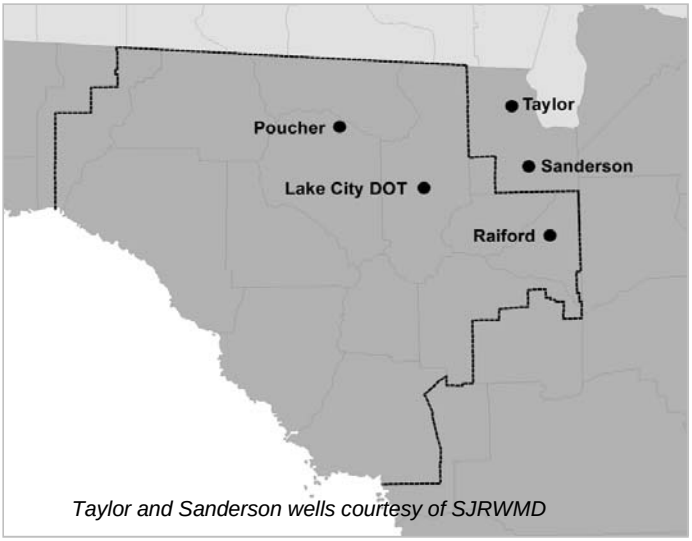
- Confined: Upper confining unit is generally greater than 100 feet thick and unbreached. Recharge is low.
- Semi-confined: Upper confining unit is generally less than 100 feet thick, breached, or both. Recharge is moderate.
- Unconfined: Upper confining unit is absent or very thin. Recharge is high.

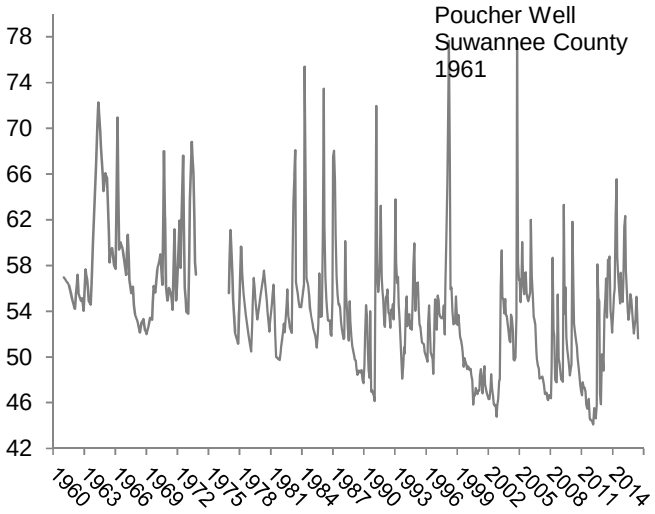
Percentile of Most Recent Water Level Relative to Entire Record

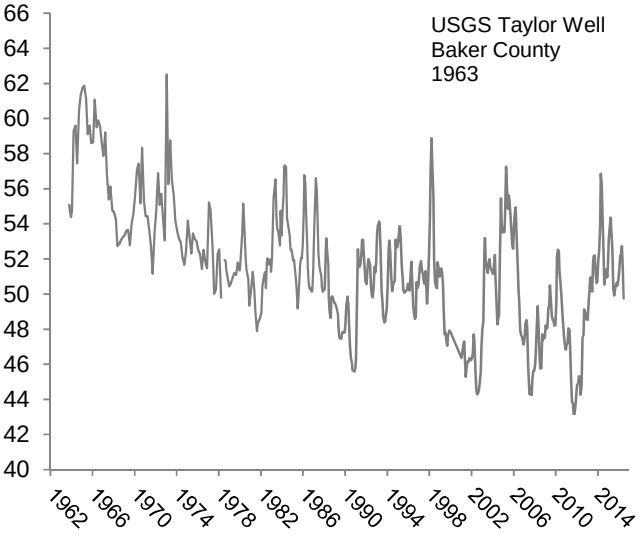
- High (Greater than 75th Percentile)
- Normal (25th to 75th Percentile)
- Low (10th to 25th Percentile)
- Extremely Low (Less than 10th Percentile)
- Not Available
- SRWMD Boundary

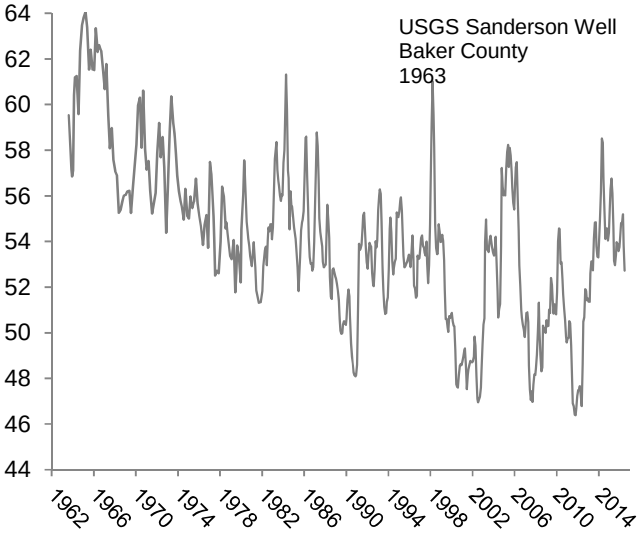
Figure 12b: Regional Long Term Upper Floridan Levels

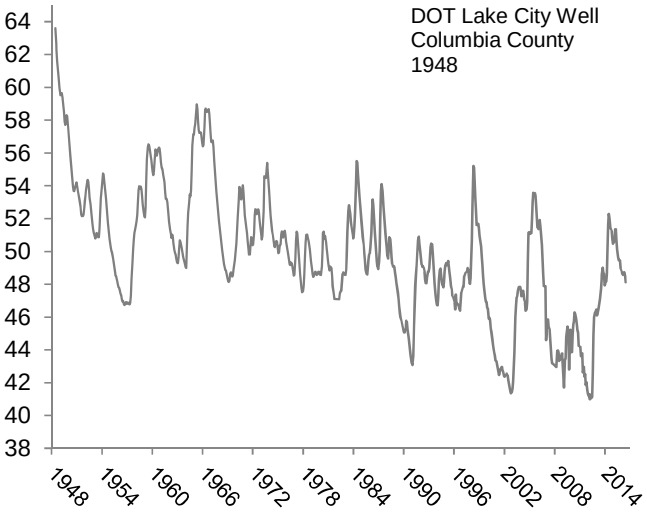
Data through June 2016

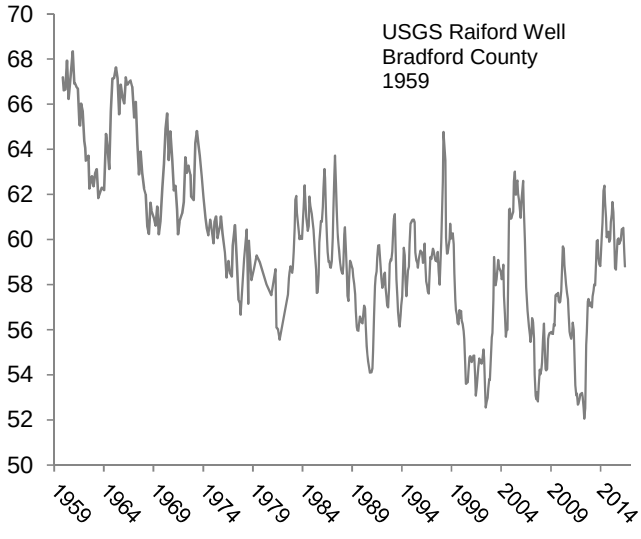












Upper Floridan Aquifer Elevation above NGVD 1929, Feet