MEMORANDUM

TO: Suwannee River Water Management District Governing Board

FROM: Tom Mirti, Director, Division of Water Resources

THRU: Noah Valenstein, Executive Director

DATE: December 12, 2016

RE: November 2016 Hydrologic Conditions Report for the SRWMD

RAINFALL

- District-wide rainfall in November averaged 0.15" across the District, about one-third of the long-term average November rainfall of 2.65". Most areas of the District received less than 0.2" of rain during the month, and only Jefferson and Madison counties received more than 10% of normal monthly rainfall (Table 1 and Figure 1). The last time the District experienced less November rainfall than this year was in 1936. Most of the November rain occurred late on the evening of November 30. The District received virtually no rain since the passage of Hurricane Matthew in early October (Figure 2). As in October, the entire Suwannee River Basin including Georgia received well below normal rainfall during the month, as indicated in Figure 3.
- The highest gaged monthly rainfall total of 0.46" was recorded at the Wacissa forestry tower in Jefferson County, all of which fell on November 30. The lowest gaged monthly total was 0.00" at the Live Oak rainfall station in Suwannee County.
- The rainfall average by county across the District for the 12-month period ending November 30 was 43.5", compared to the long-term average of 54.7", resulting in a cumulative 12-month District-wide rainfall deficit of -11.1". Most coastal areas of the District maintained a surplus due to heavier rains earlier in the year, but annual deficits increased elsewhere, particularly in the Upper Santa Fe and Suwannee River basins, with an annual deficit in excess of 20 inches appeared (Figure 4).
- Average District rainfall for the 3 months ending November 30 totaled 9.4", about 1.5" below the long-term average total of 10.8". Past surpluses in coastal areas of the District have declined, although most such areas still show at least a 3" surplus for the period. Deficit areas in the north and east of the District, primarily the Upper Santa Fe and Suwannee River basin persisted (Figure 5).

SURFACEWATER

- **Rivers:** The prolonged dry period that persisted through the end of November brought declines to District river level stations and most ended the month at below normal (below the 25th percentile) or much below normal status (below the 10th percentile). The lower Santa Fe, Steinhatchee, and Aucilla basins transitioned from normal to below normal status over the course of the month; four of six long-term monitoring stations in the Georgia portion of the Suwannee River Basin were in the much below normal 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**: All 14 monitored District lakes declined by at least 2" during the month of November, with an average decline of 4.5". Waters Lake in Gilchrist County and Alligator Lake in Columbia County—both sinkhole lakes---declined almost a foot during the month, while Sneads Smokehouse Lake and Cherry Lake in the northwest of the District declined the least, each dropping about 0.1'. Two more lakes dropped to below average levels, for a total of 10. Figure 8 shows lake levels relative to their respective long-term minimum, average and maximum levels.

- **Springs**: The flows of 11 springs or spring groups were measured by the USGS, District staff, and District contractors during November. Monitored District springs generally maintained flows during the month, although White Sulphur Springs in the Upper Suwannee River basin has not been flowing. Historical flow data for four of the District's monitored springs monitored by the USGS are provided in graphical format on Figure 9.

GROUNDWATER

Floridan Aquifer levels declined in November, ending the month at the 35th percentile on average across the District, a decrease of 11 percentile points from October. All but one of the District's long-term wells showed a month-to-month decrease in aquifer level; the average decline was 0.7'. About one-third of the District is now in the low aquifer level category (below the 25th percentile) and small areas of extremely low levels (below the 10th percentile) developed in the north and west of the District. Low conditions were also present along the Steinhatchee River corridor and in coastal Dixie County. The remainder of the District was in the normal category (between the 25th and the 75th percentiles), as shown in Figure 10; high aquifer level areas that had been present had mostly disappeared by month end. 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 shown in Figure 12 with a description of Floridan 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 December 3 showed ongoing near-normal conditions in most areas of the District, but Jefferson County and all tributary basins of the Suwannee River in Georgia displayed moderate drought conditions. Areas further north in Georgia continue to experience extreme drought.
- The National Weather Service Climate Prediction Center issued a projection of below normal rainfall for North Florida through March 2017. The El Niño Southern Oscillation (ENSO) Index has shown weak La Niña conditions for the past 3 months, which tend to depress frontal rainfall totals across the southern United States and in north Florida for the fall and winter. Conditions thereafter are expected to shift to ENSO neutral.
- The U.S. Drought Monitor report of for the week ending December 6 showed abnormally dry conditions present throughout the District, with a small area of northern Hamilton County displaying moderate drought conditions. The Florida Panhandle is showing moderate to severe drought conditions progressively towards the west.

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 once per week during Eastern Standard Time (between November 6, 2016 and March 12, 2017) 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	November 2016	November Average	Month % of Normal	Last 12 Months	Annual % of Normal
Alachua	0.10	2.35	4%	42.61	84%
Baker	0.05	2.22	2%	38.06	76%
Bradford	0.11	2.32	5%	41.72	82%
Columbia	0.03	2.44	1%	40.63	79%
Dixie	0.15	2.50	6%	51.26	87%
Gilchrist	0.18	2.72	7%	42.73	75%
Hamilton	0.15	2.72	6%	41.58	80%
Jefferson	0.36	3.44	11%	53.86	89%
Lafayette	0.12	2.78	4%	51.98	92%
Levy	0.16	2.55	6%	50.95	85%
Madison	0.33	3.12	11%	47.77	85%
Suwannee	0.04	2.53	2%	46.75	88%
Taylor	0.18	2.85	6%	54.25	91%
Union	0.10	2.55	4%	41.98	78%

November 2016 Average:	0.15
November Average (1932-2015):	2.65
Historical 12-month Average (1932-2015):	54.66
Past 12-Month Total:	43.53
12-Month Rainfall Surplus/Deficit:	-11.13

Figure 1: Comparison of District-wide Monthly Rainfall

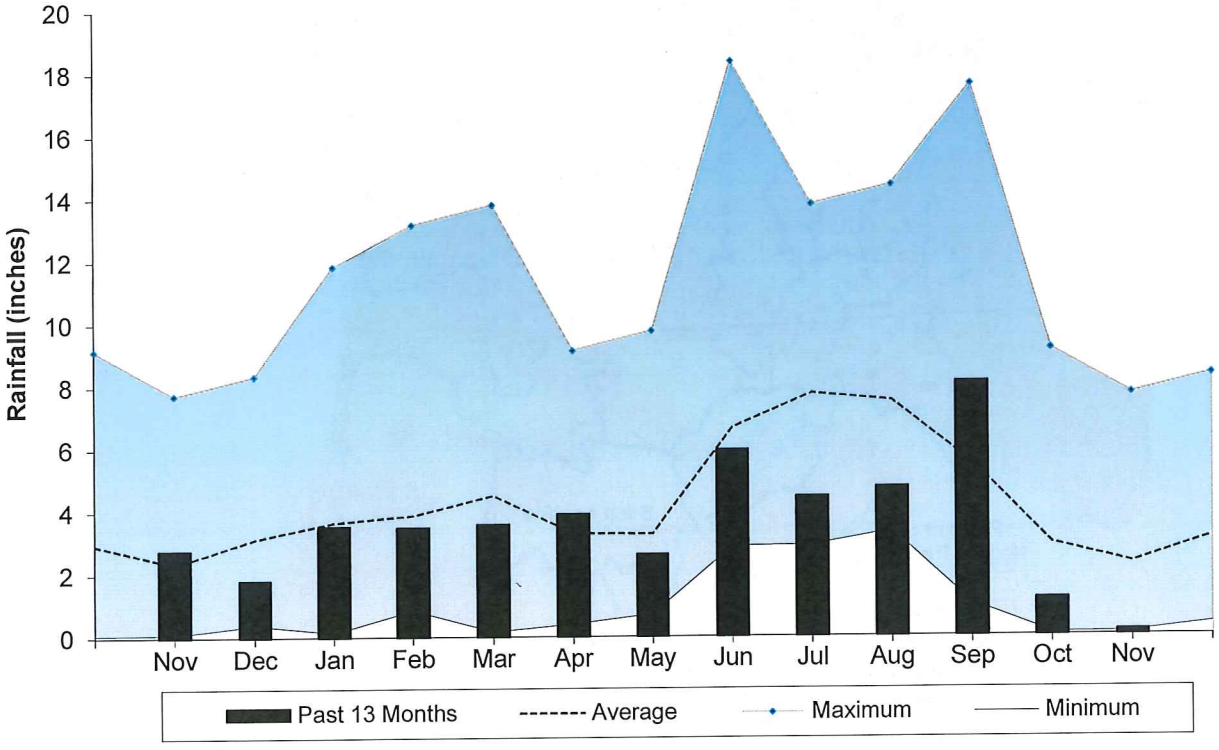


Figure 2: November 2016 SRWMD Gage-adjusted Radar Rainfall Estimate

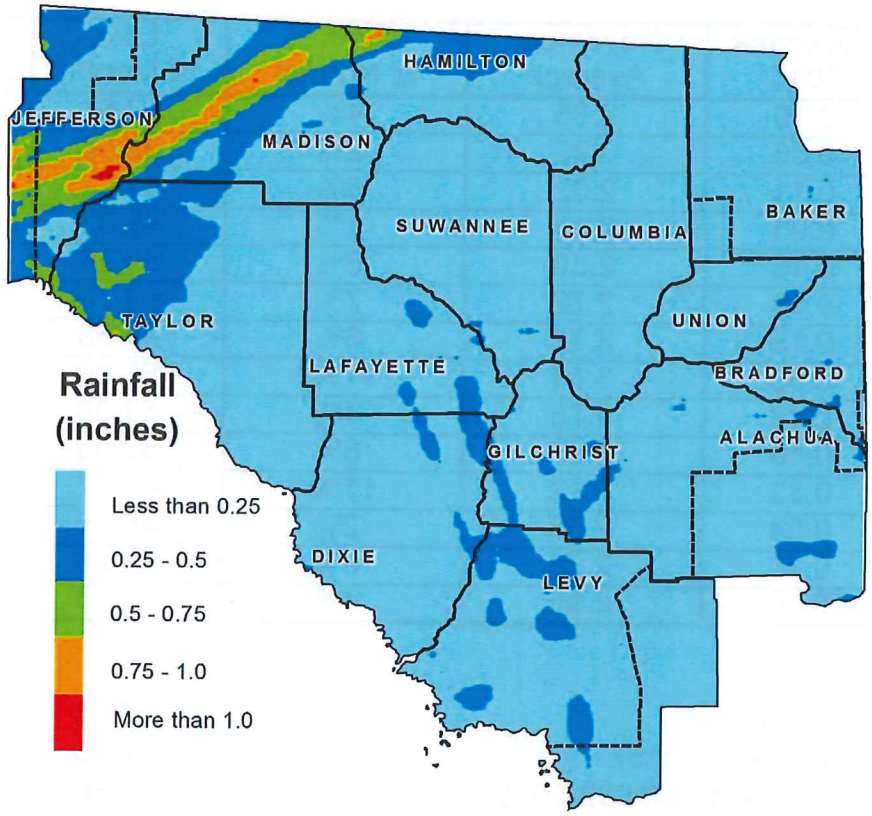


Figure 3: November 2016 Percent of Normal Rainfall – Suwannee River Basin

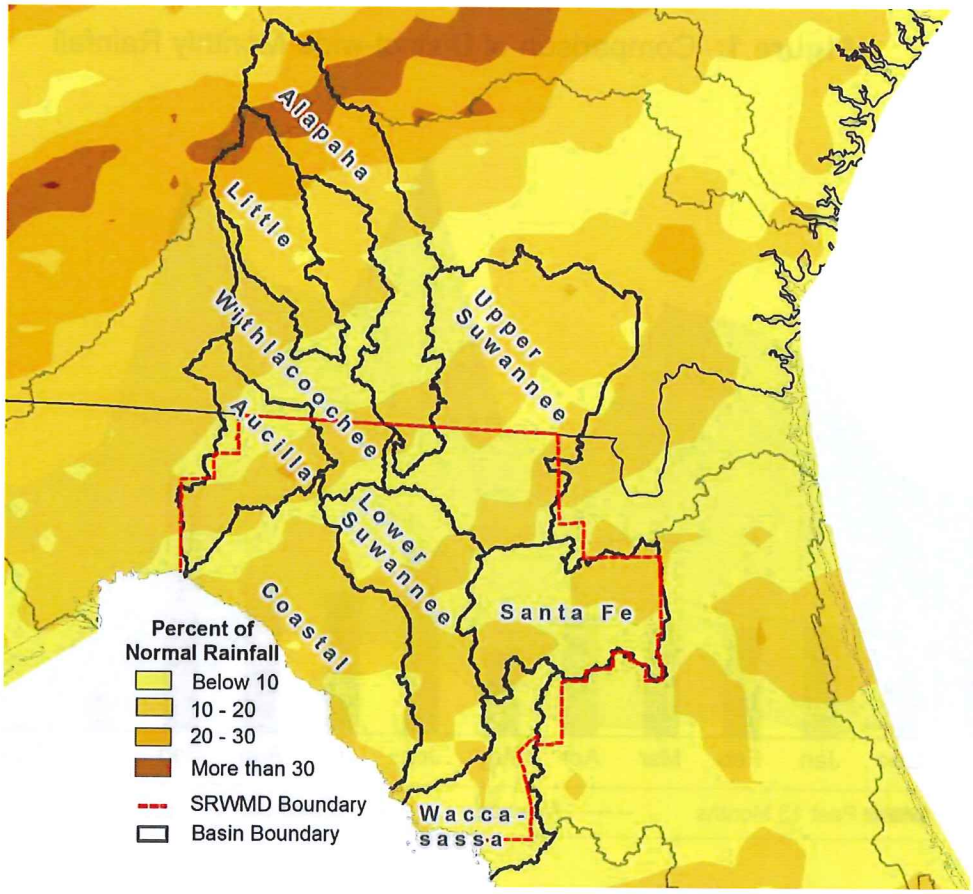


Figure 4: 12-Month Rainfall Surplus/Deficit by River Basin through November 30, 2016

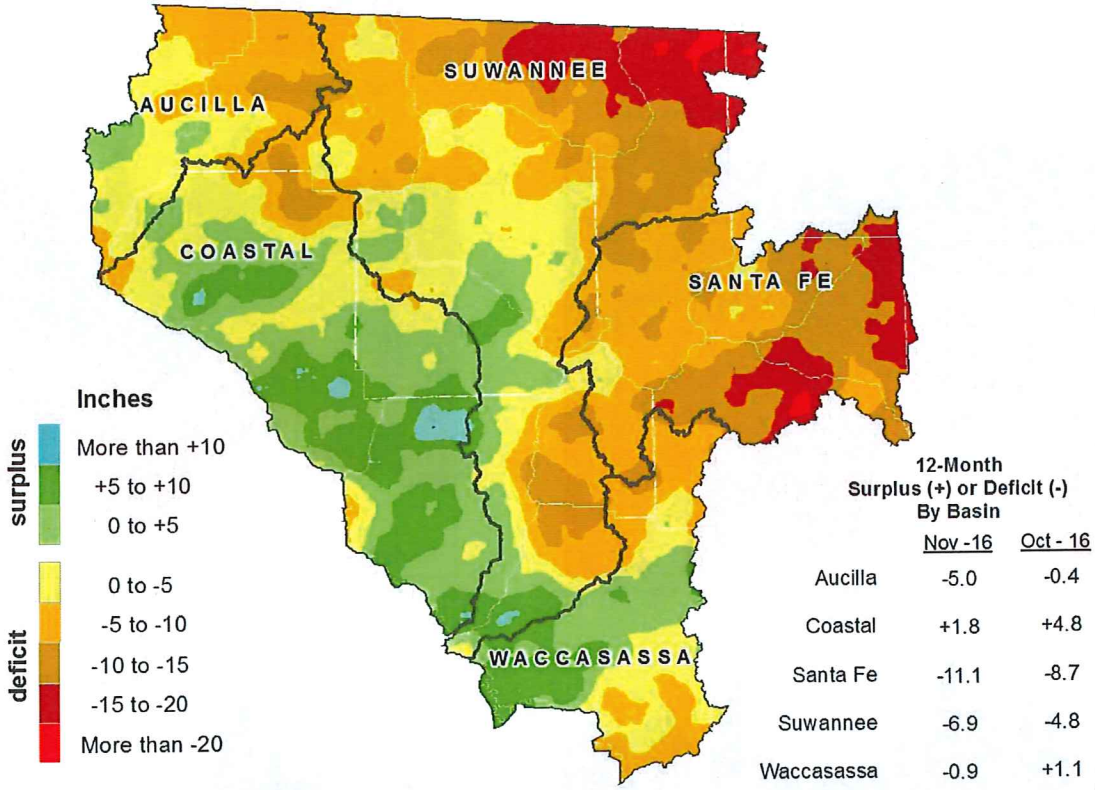


Figure 5: 3-Month Rainfall Surplus/Deficit by River Basin through November 30, 2016

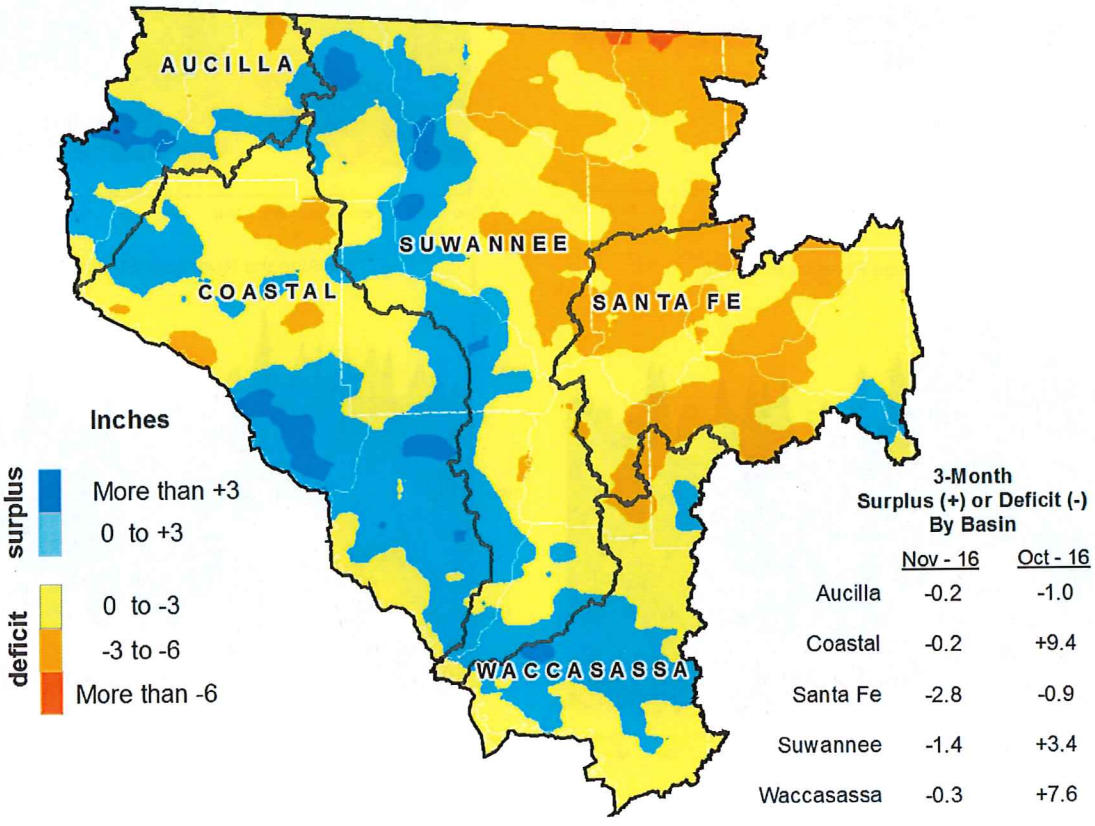


Figure 6: Daily River Flow Statistics
December 1, 2015 through November 30, 2016

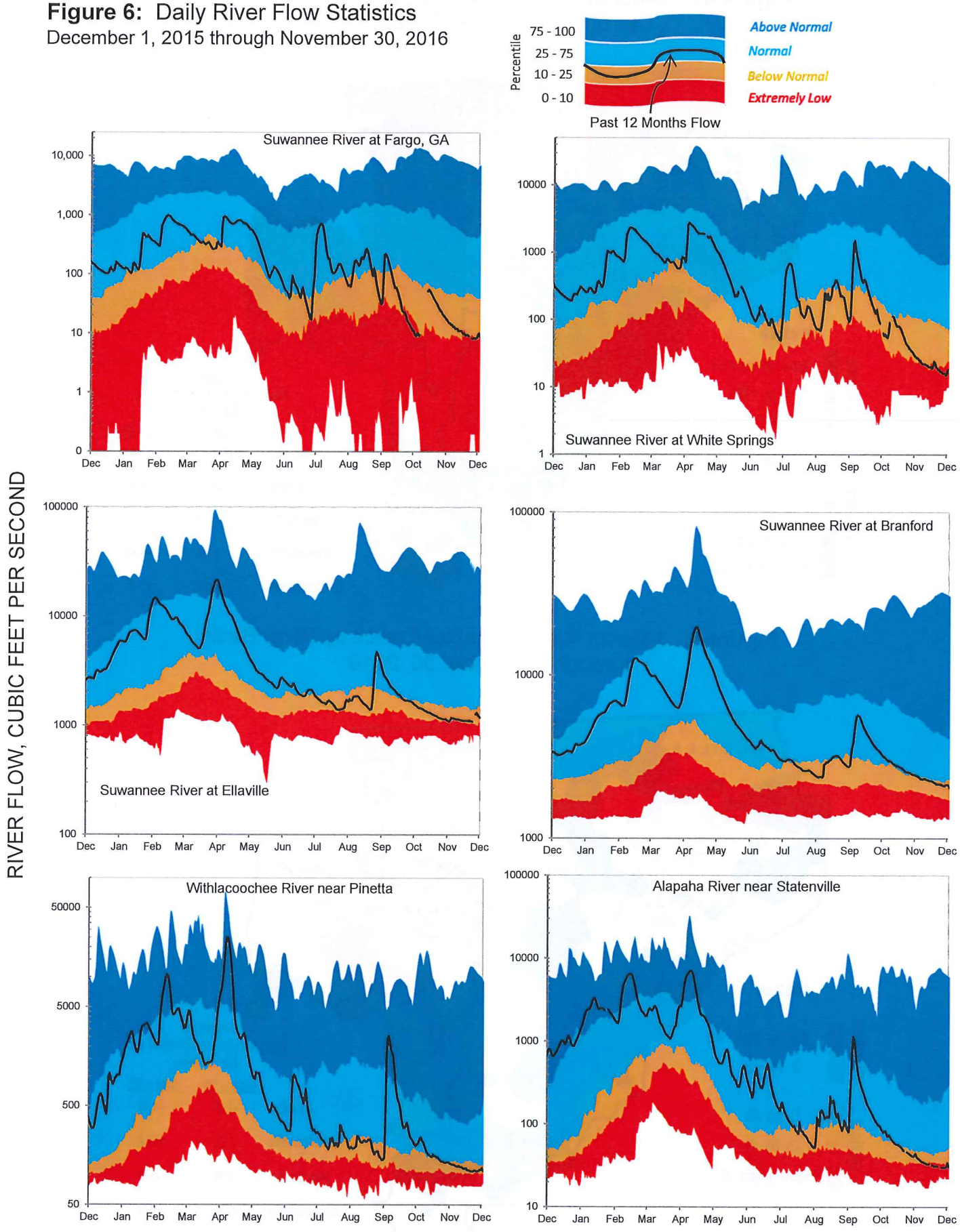
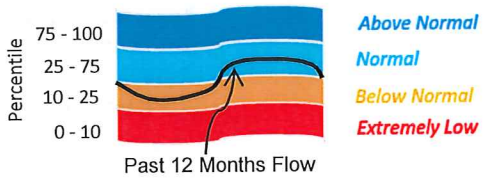
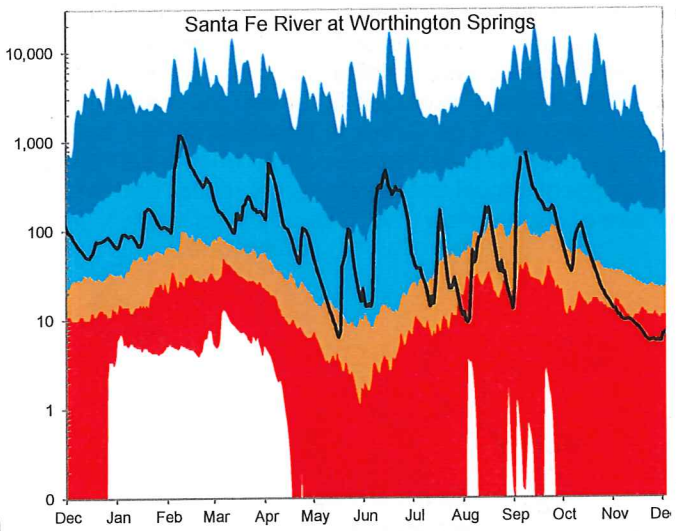
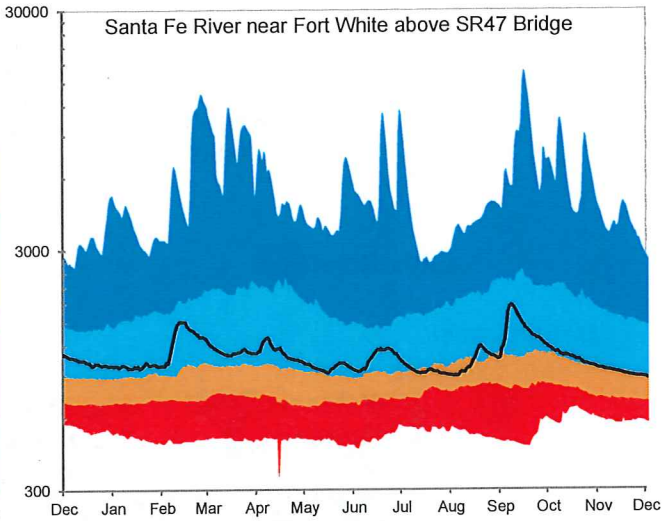


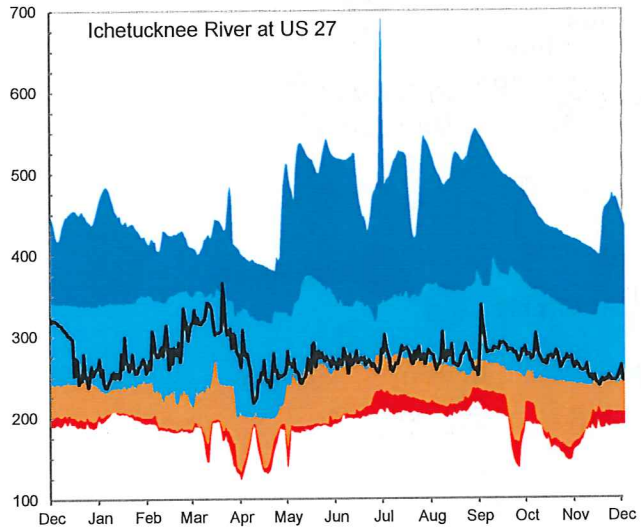
Figure 6, cont: Daily River Flow Statistics
December 1, 2015 through November 30, 2016

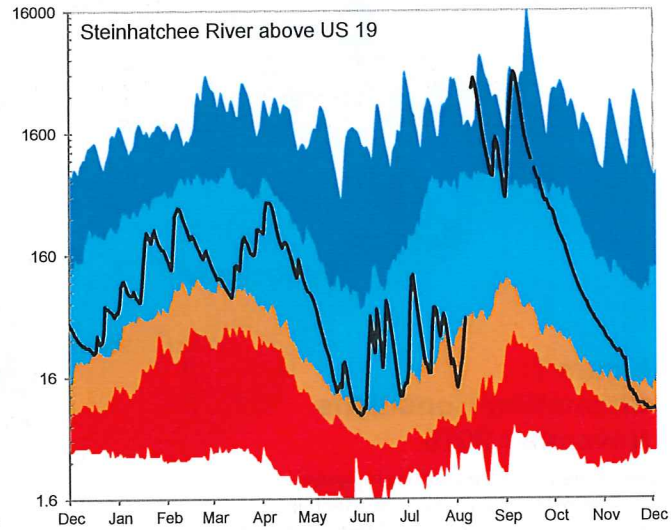


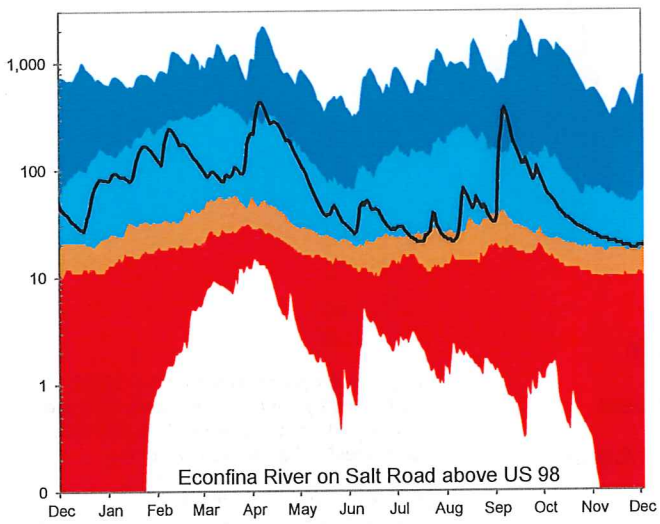
RIVER FLOW, CUBIC FEET PER SECOND

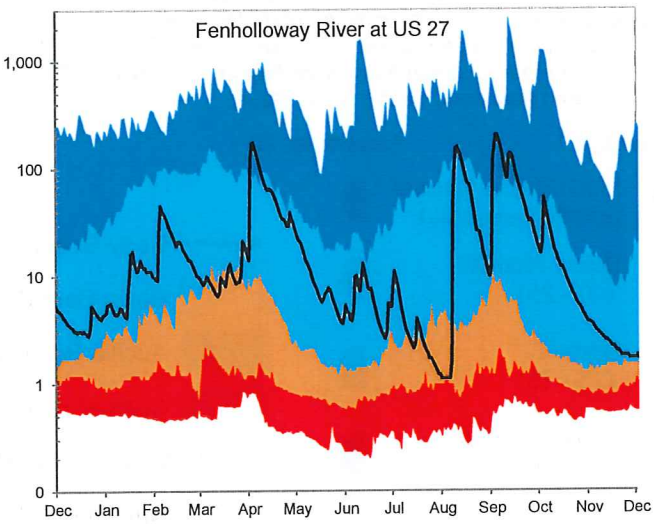












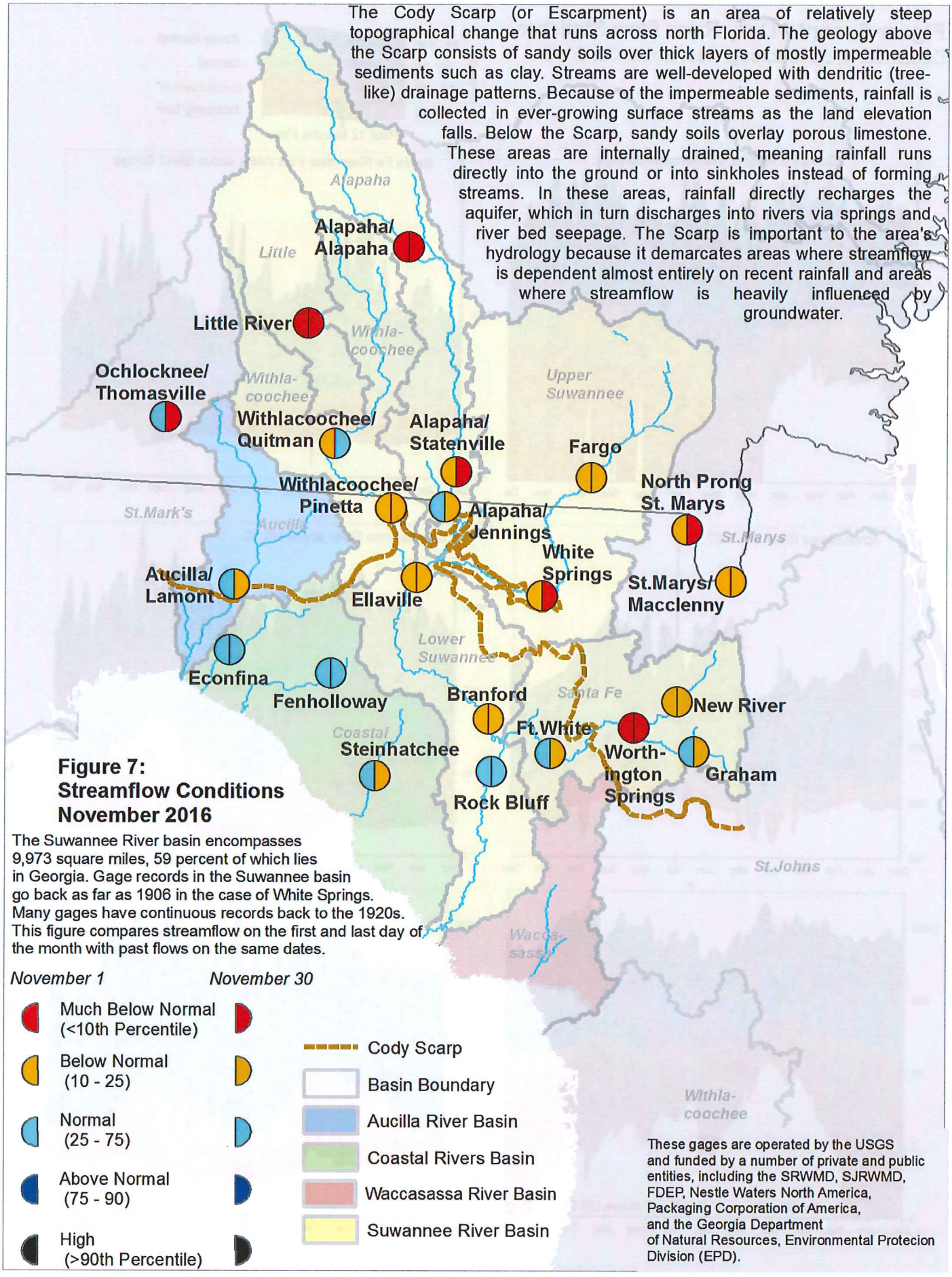
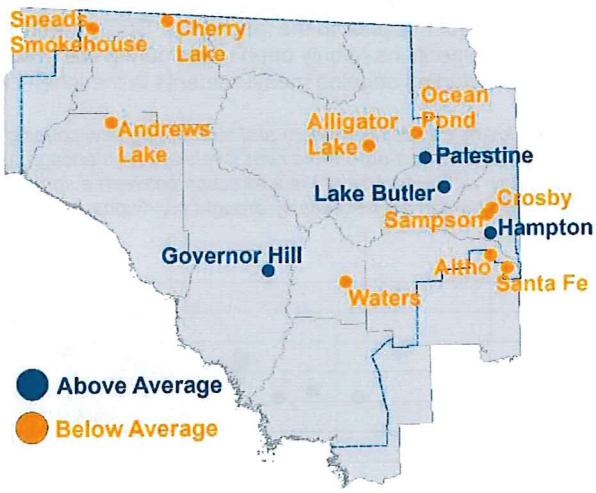
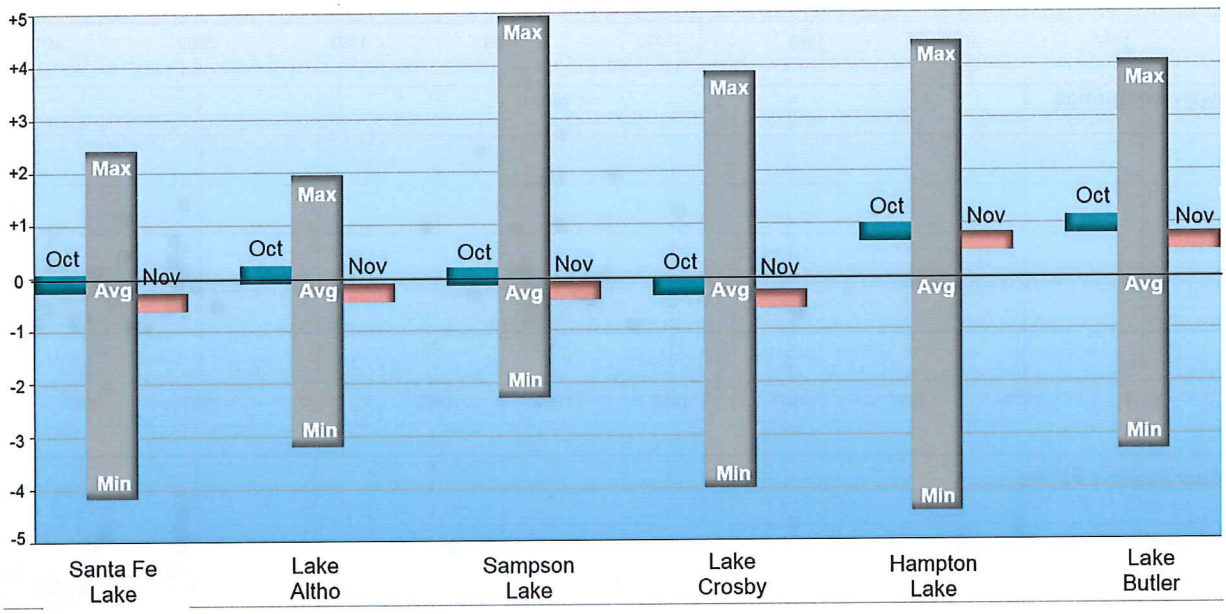

The Cody Scarp (or Escarpment) is an area of relatively steep topographical change that runs across north Florida. The geology above the Scarp consists of sandy soils over thick layers of mostly impermeable sediments such as clay. Streams are well-developed with dendritic (tree-like) drainage patterns. 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
Coastal
Steinhatchee
Ft.White
Worth-ington Springs
Graham
Rock Bluff
St.Johns
Wacca-sassa
Withla-coochee
Figure 7: Streamflow Conditions November 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.
November 1
November 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: November 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.



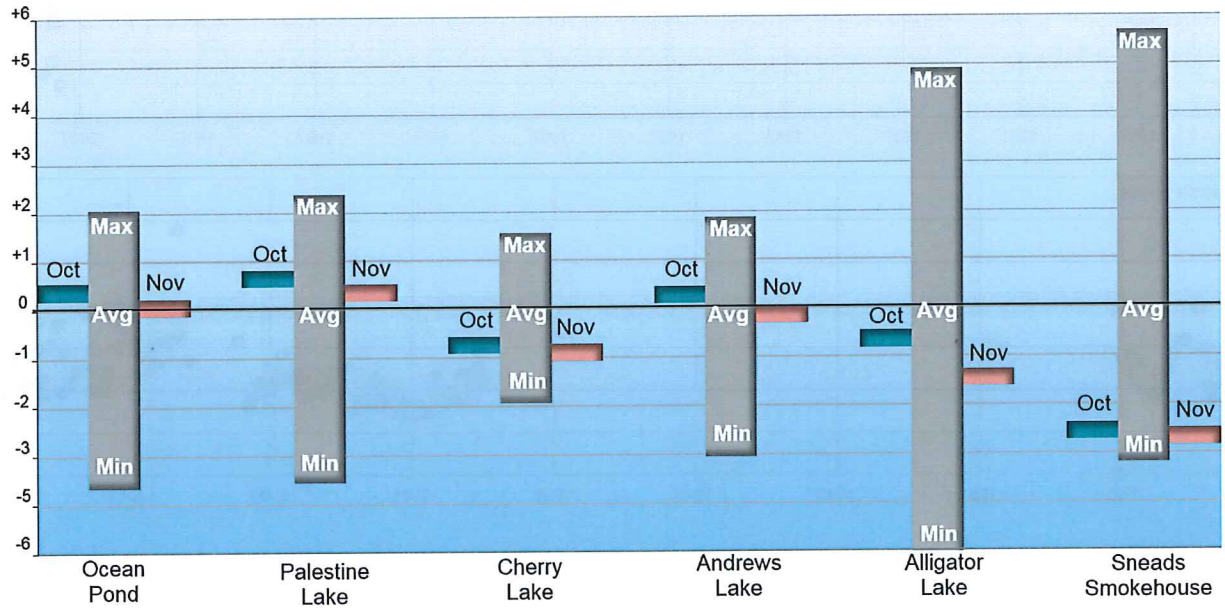
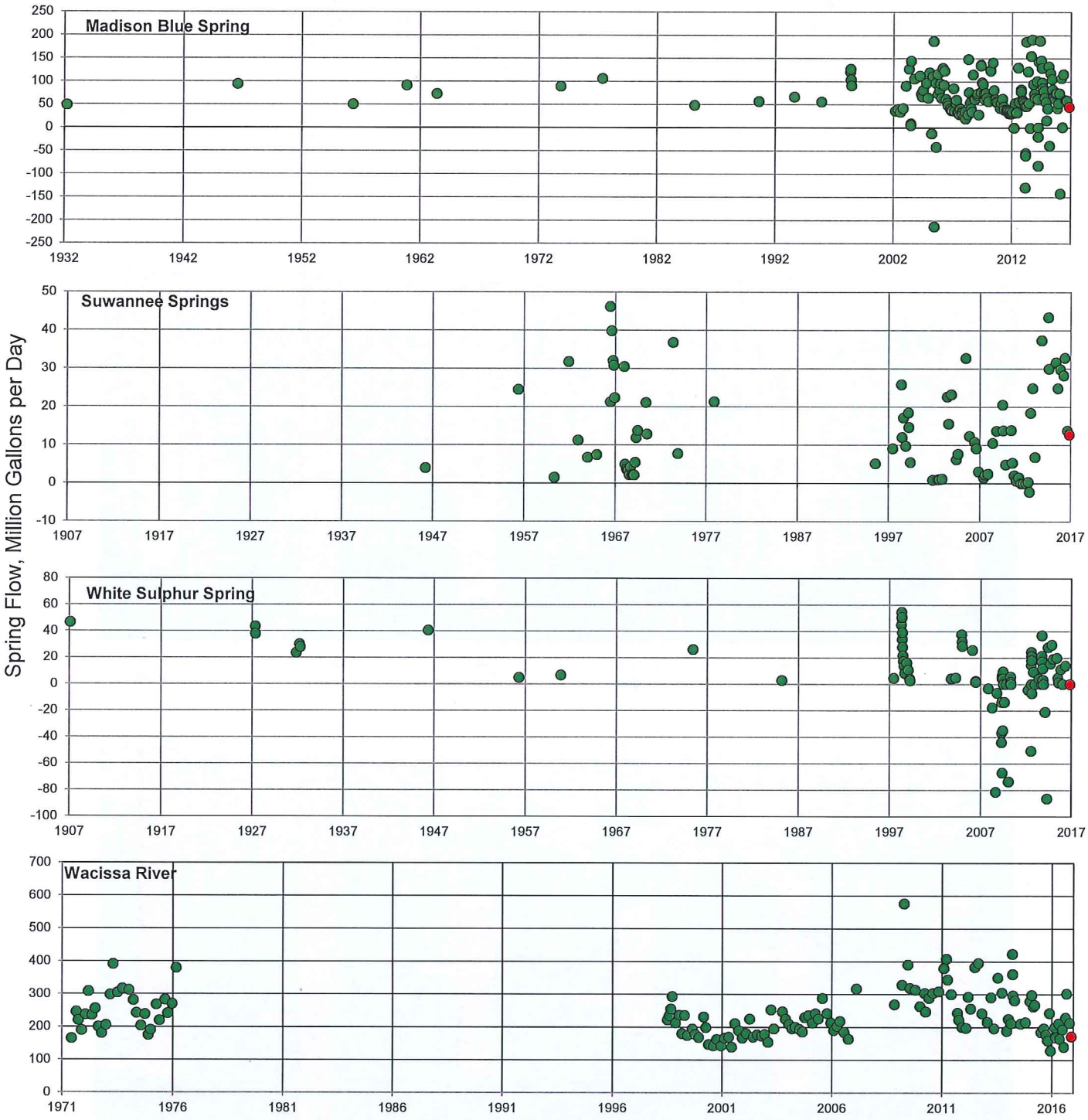


Figure 9: Monthly Springflow Measurements

The SRWMD monitors water quality at 44 springs. Flow is usually measured at the time of the sampling. The springs below were measured in November 2016 by SRWMD staff or by the USGS with the last measurement marked in red. Flow data is provided below 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.



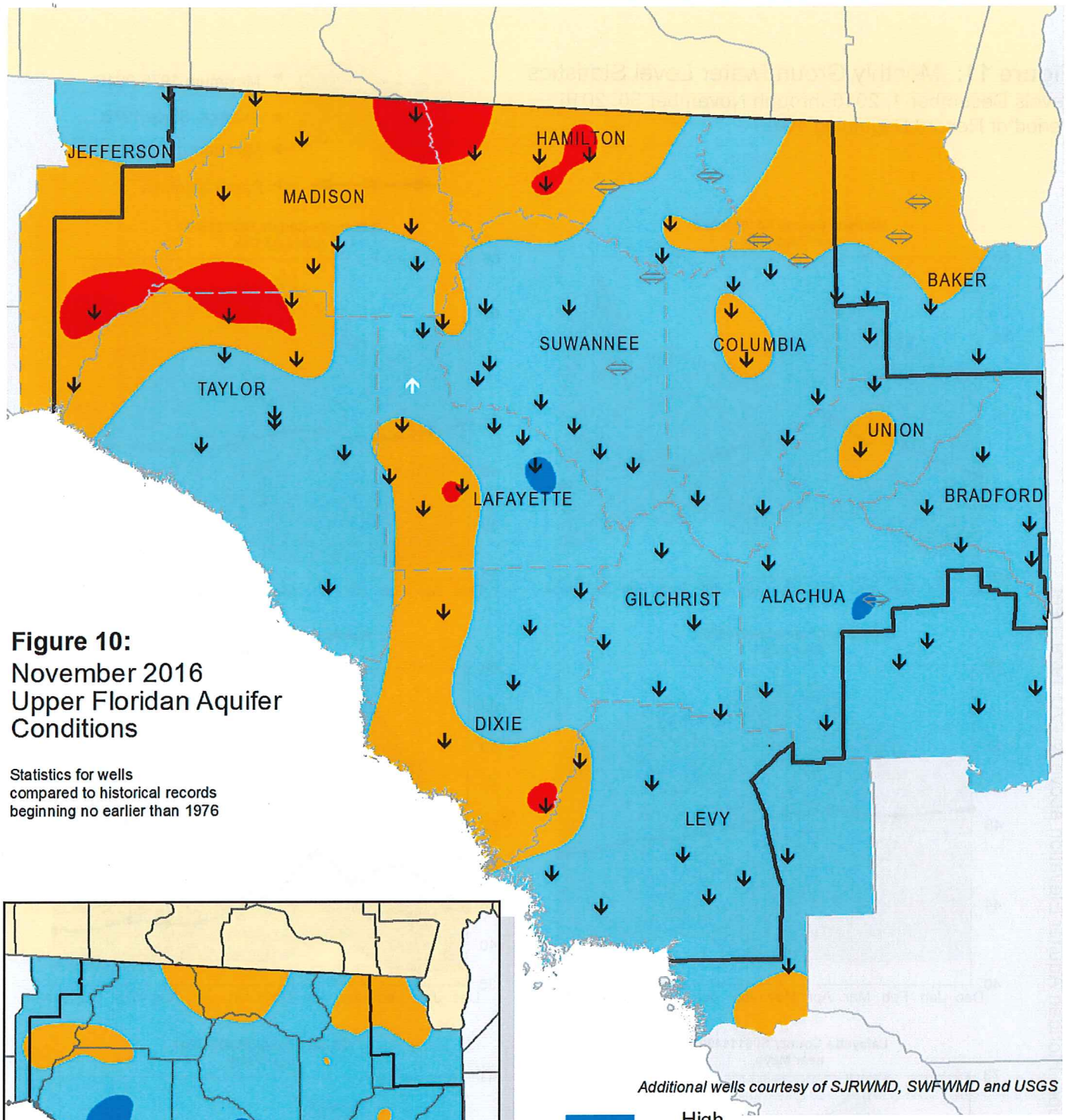
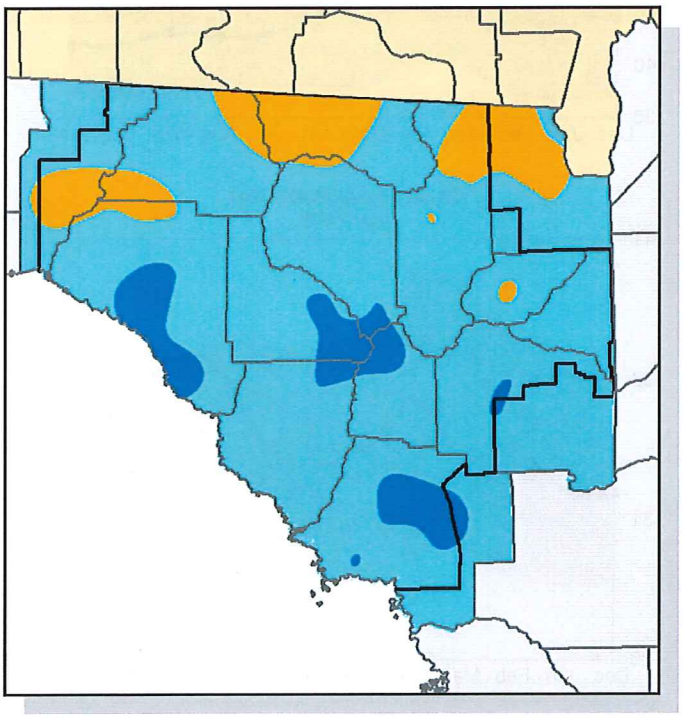


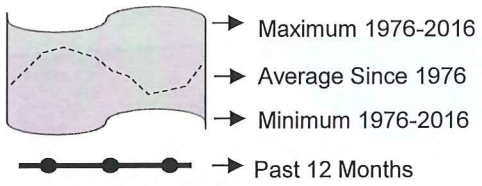
Figure 10:
November 2016
Upper Floridan Aquifer
Conditions

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



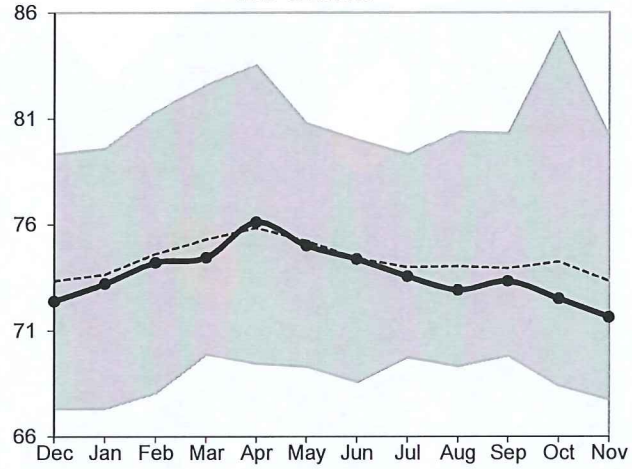
Inset: October Groundwater Levels

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

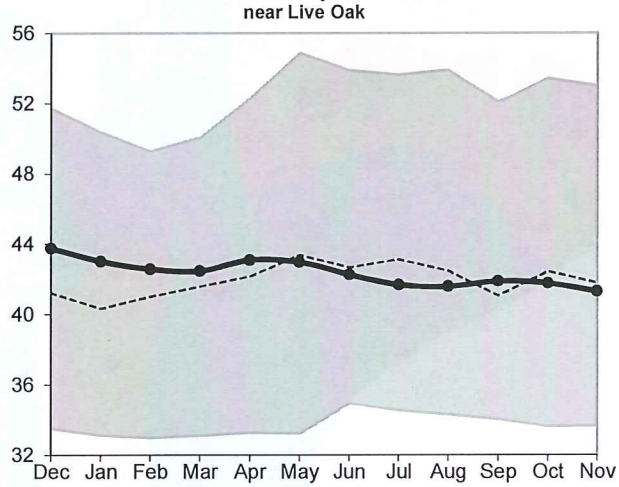


Upper Floridan Aquifer Elevation above NGVD 1929, Feet

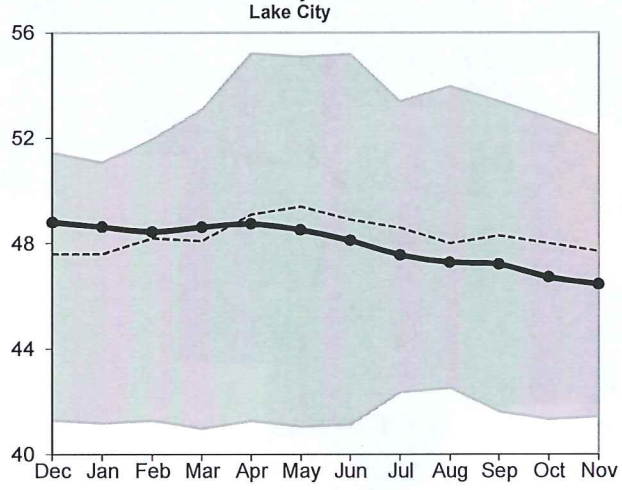
Madison County N010719001
near Greenville



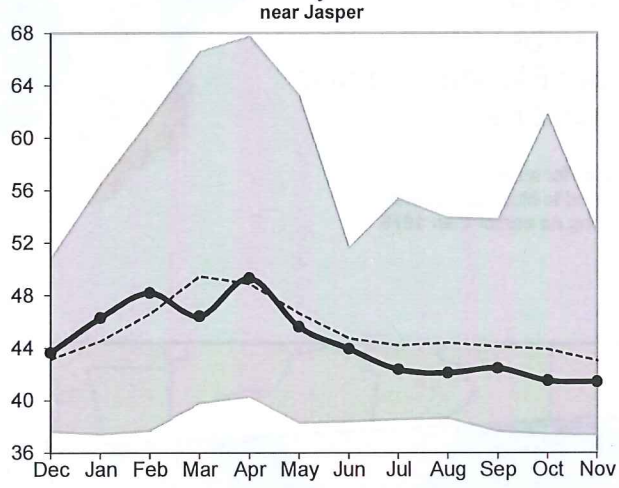
Suwannee County S021335001
near Live Oak



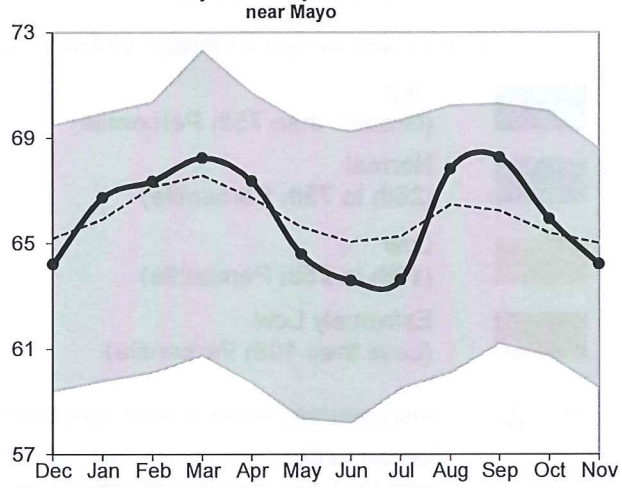
Columbia County S041705001
Lake City



Hamilton County N011422007
near Jasper



Lafayette County S061114001
near Mayo



Taylor County S050701001
near Perry

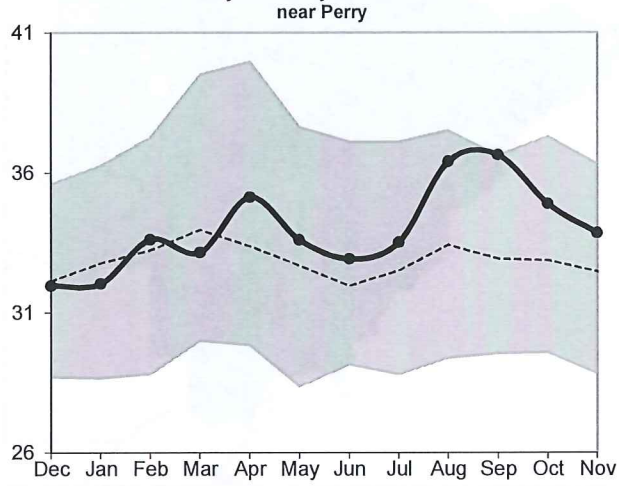
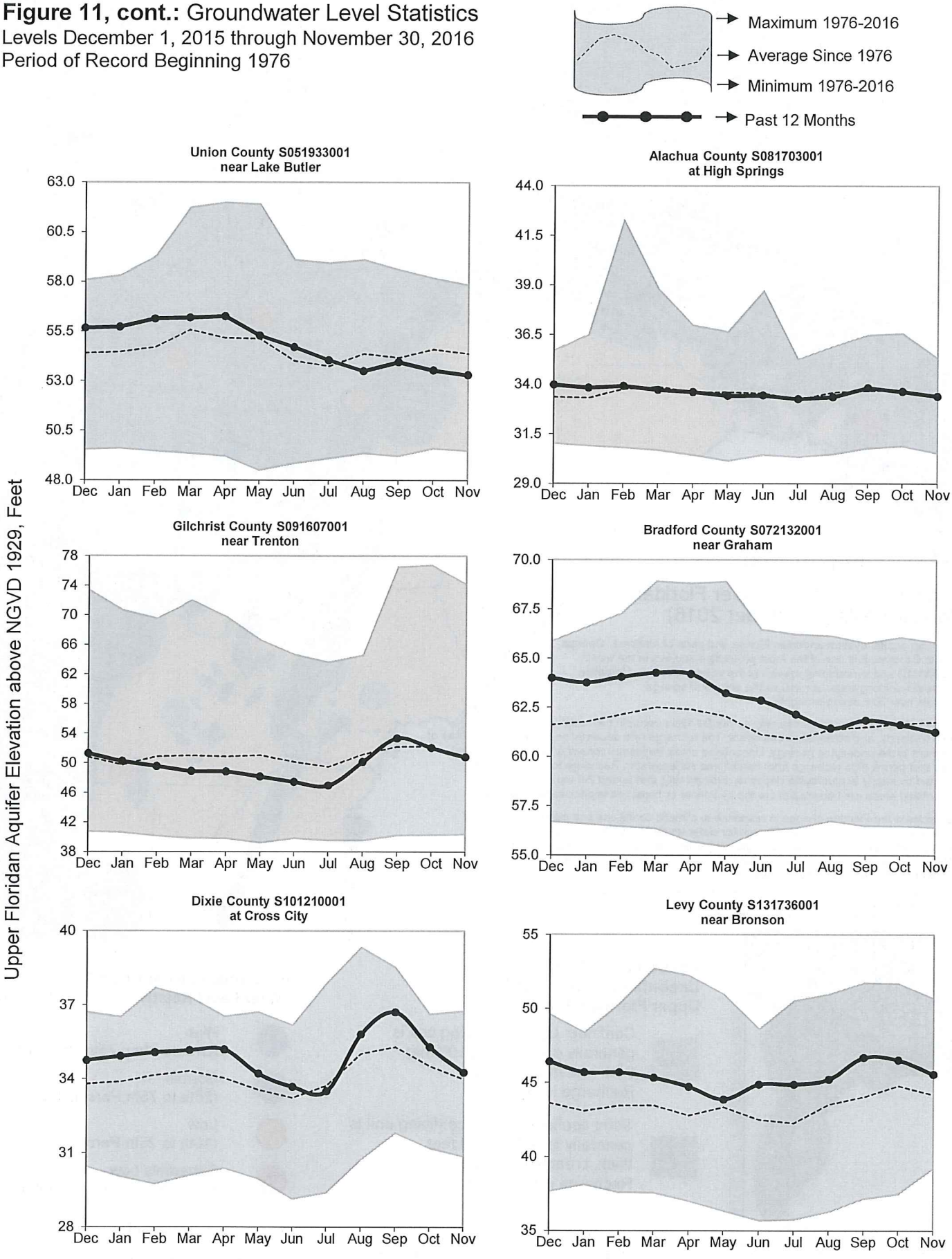


Figure 11, cont.: Groundwater Level Statistics
Levels December 1, 2015 through November 30, 2016
Period of Record Beginning 1976



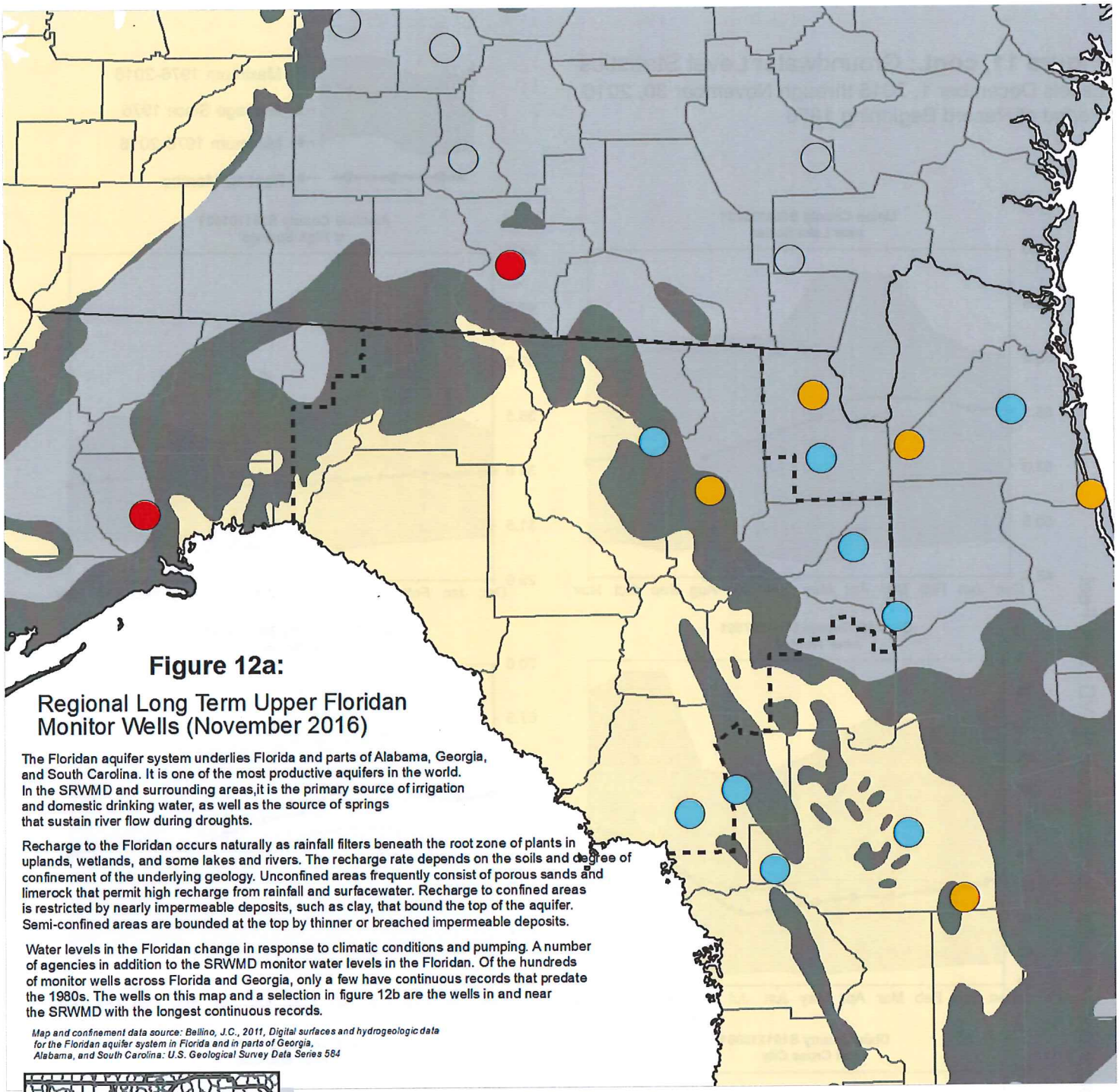


Figure 12a:

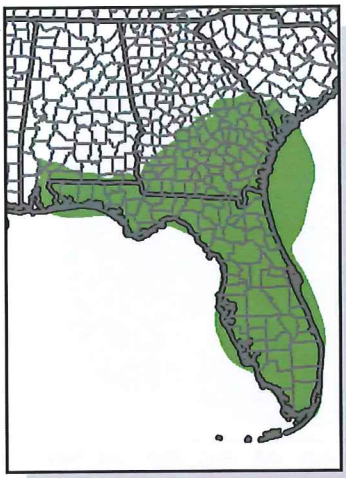
Regional Long Term Upper Floridan Monitor Wells (November 2016)

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

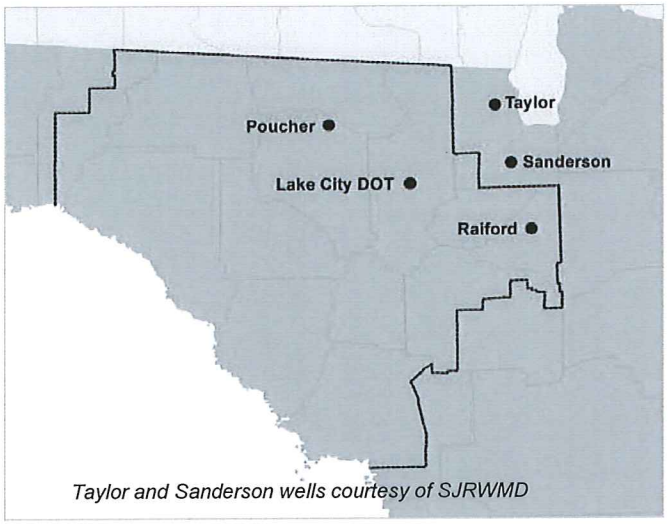
- Confined: Upper confining unit is generally greater than 100 feet thick and unbreached. Recharge is low.
- Semi-confined: Upper confining unit is generally less than 100 feet thick, breached, or both. Recharge is moderate.
- Unconfined: Upper confining unit is absent or very thin. Recharge is high.

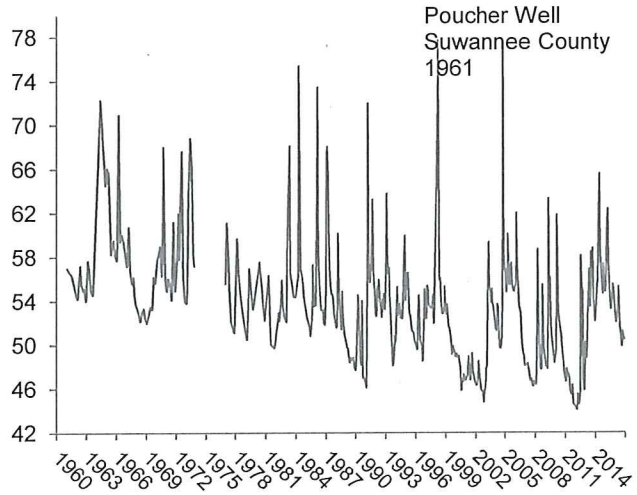
Percentile of Most Recent Water Level Relative to Entire Record

- 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 November 2016





Upper Floridan Aquifer Elevation above NGVD 1929, Feet