Background Information on the
Peace River Basin

Southwest Florida
Water Management District

Resource Conservation &
Development Department
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Background

Physiography

The Peace River drainage basin occupies large parts of Polk, Hardee, DeSoto, and Charlotte Counties and minor parts of several adjacent counties (Figure 1). The basin contains major portions of three physiographic provinces: the Gulf Coastal Lowlands, the DeSoto Plain, and the Polk Upland. All, or part, of four sand hill ridge provinces are contained within the northern end of the basin. The basin begins in central Polk County, the Polk Uplands, as an internally drained lake region and transitions to a poorly drained upland. Within the DeSoto Plain of central Hardee and northern DeSoto Counties, the basin becomes a gently sloping plain with well-developed surface drainage features. Downstream of central DeSoto County, the basin enters the Gulf Coastal Lowlands province where elevations are less than 30 feet and the river develops a broad flood plain.

Climate and Rainfall

The climate of the area is generally subtropical with an annual average temperature of about 73 degrees. Annual rainfall in or near the Peace River drainage basin averages 50 to 56 inches. Some 60 percent of the rainfall occurs from June through September (Figure 2).

Annual rainfall has decreased about 5 inches/year between 1940s-60s and the last 30 years (Basso and Schultz, 2003). Based on the monthly distribution, about 80 percent of this change was due to a decline in wet season rainfall during the months of June through October. The largest monthly declines have taken place in June, July, September, and October. This decline in wet season rainfall is consistent with Enfield and others (2001) who found a statistically significant change in wet season rainfall pre-1970 versus post-1970 for the National Weather Service (NWS) Region 4, which includes the Peace River basin.

Land Use

The principal land use within the basin as of 1999 (Figure 3) is agricultural accounting for nearly 50 percent when rangeland is included. Urban or built-up land accounts for about 10 percent of the land use, almost twice the amount reported in 1972. Phosphate mining accounts for about 10 percent of the use, almost three times the amount of 1972. Mining and most urban use is concentrated in the upper third of the basin. Phosphate mining has generally moved from north to the south in the basin. The depth to the phosphate ore increases and the quality decreases from the north to the south in the basin. Undeveloped lands consisting of forest, water, and wetlands make up the remaining 30 percent of the land use.

In many parts of the basin there has been considerable alteration to drainage systems in order to facilitate agricultural and residential/urban development. The principal purpose of these alterations has been to increase usable land area and reduce flooding. This has certainly altered the timing of the hydrologic processes. Phosphate mining alters not only drainage patterns but the structure of the landscape as well. Current regulations require reclaiming the land after mining. However, reclaimed land, especially older lands, may have altered drainage properties.

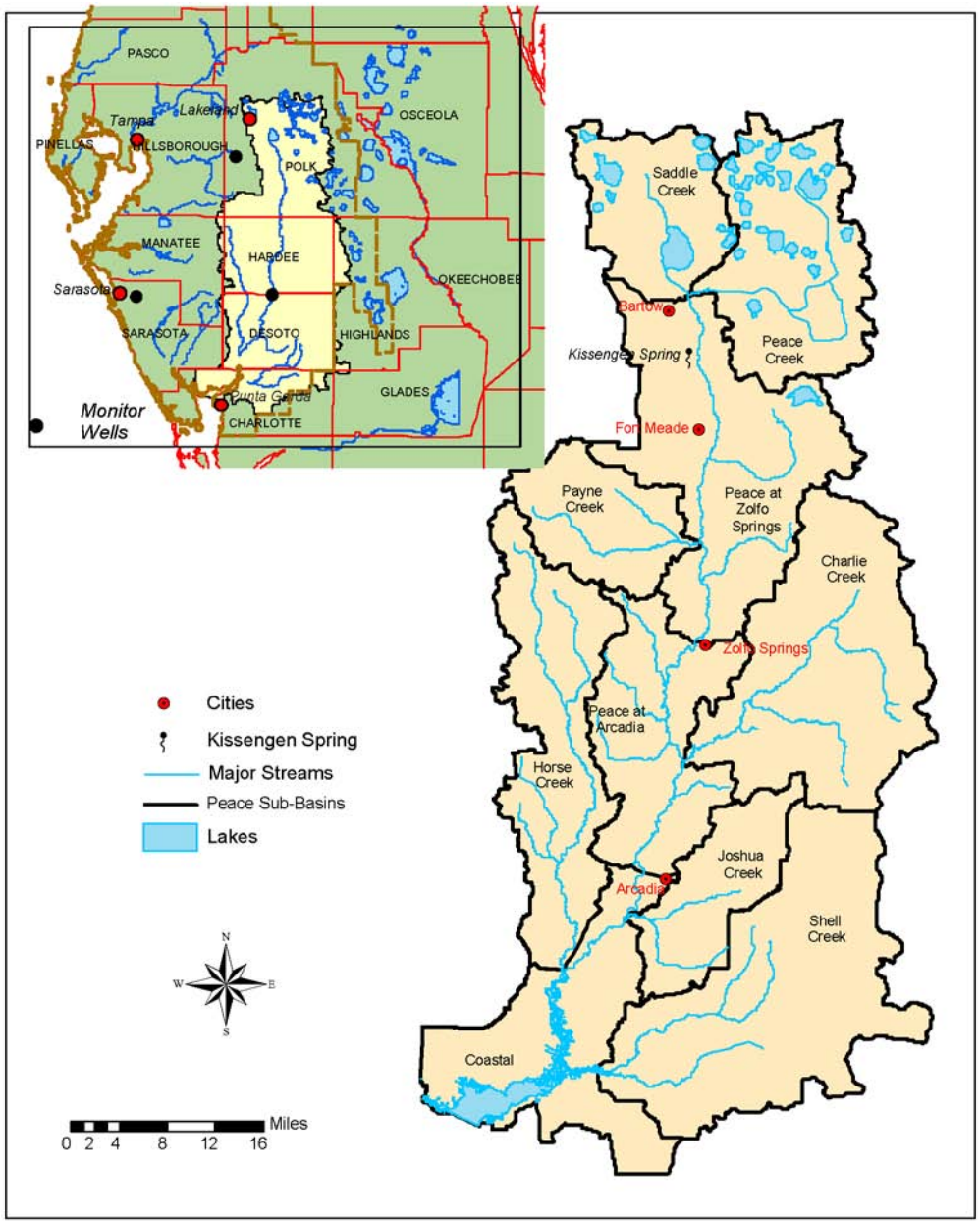

Figure 1. Map of Peace River Basin and principal sub basins.

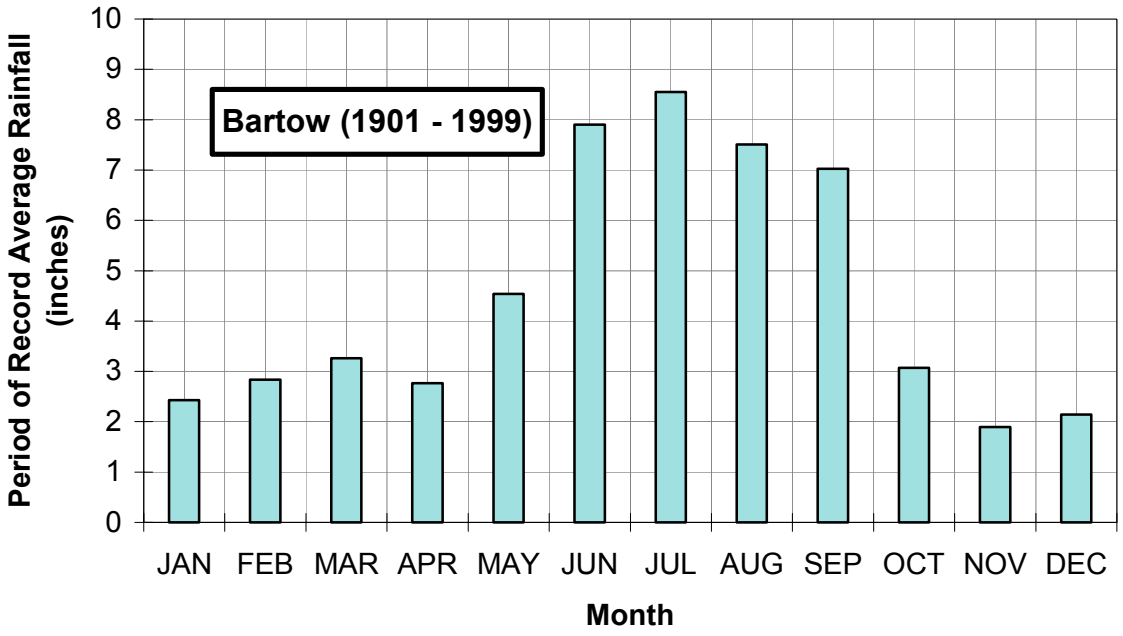

Figure 2. Average monthly rainfall at Bartow (1901 – 1999).

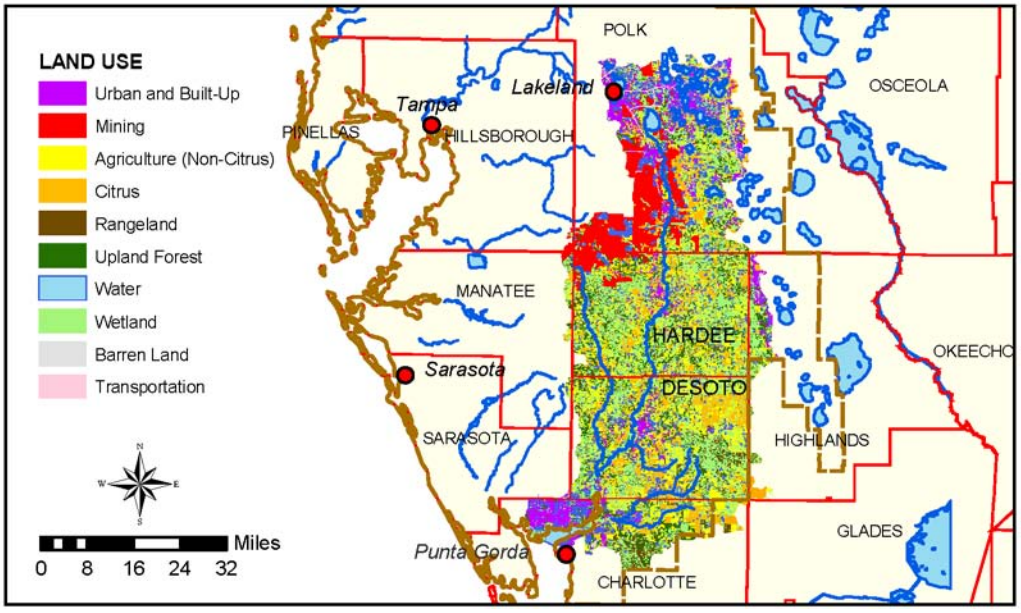

Figure 3. Land use in the Peace River Basin – 1999.

Hydrogeology

The area is underlain by three aquifer systems. The uppermost system is the unconfined surficial aquifer system (SAS). It consists of unconsolidated quartz sand, silt, and clayey sand. The depth of the SAS varies from a few feet to over a hundred in the sand hill ridges. Underlying the SAS is the confined intermediate aquifer system (IAS) consisting of thin, inter-bedded limestones, sands, and phosphatic clays of generally low permeability. The IAS is relatively thin in the upper reaches of the Peace River basin and thickens to the south. Underlying the IAS, the confined Floridan aquifer system (FAS) consists of limestone and dolostone formations. The FAS is extremely permeable along some horizons. This is the principal water supply source of the basin. The FAS within the basin is a part of a much larger ground water basin, the Southern West-Central Florida Ground-Water Basin (SWCFGWB). The FAS is usually divided into upper and lower permeable units separated by a middle-confining unit. About 85 to 90 percent of all ground water is derived from the Upper Floridan aquifer (UFA). Currently, no water supply is derived from the Lower Floridan aquifer (LFA) since it is generally brine-saturated and low in permeability over much of the basin.

Upstream of Fort Meade, in the vicinity of the Peace River, the terrain and geology is dominated by karst features. During recent periods of low flows, the river has been observed disappearing into crevices of the streambed. Large sinks and solution features occur in the nearby flood plain. Kissengen Spring near Bartow was a significant local attraction in the early 1900s until it ceased flowing in 1950. Peak flows were recorded at over 30 cubic feet per second. Previous studies have attributed the decline of spring flow to increasing ground water withdrawals.

Water Use

Water use for the Peace River Basin is approximated from the water use estimates for Polk, Hardee, and DeSoto Counties. A considerable portion of the Polk County agricultural use is for citrus along the Lake Wales Ridge in the eastern portion of the county. Most of this area is outside the Peace River drainage basin.

Historically, ground water has provided the largest portion of the water supply. In 2000, combined ground water and surface water withdrawals were estimated by SWFWMD at 560 million gallons per day (mgd) for the three counties. Only 25 mgd was withdrawn from surface-water sources. Water use for Polk County has generally declined from around 400 mgd since the peak period of the mid-1970s to about 300 mgd today. This is due to increased water-conservation efforts by phosphate mining and agriculture (Figure 4).

The major withdrawal of surface water occurs in southern DeSoto County, where a regional utility withdraws water from the Peace River to provide public supply for DeSoto, Charlotte, and Sarasota Counties. In 2000, the amount was about 10 mgd. The remaining surface water withdrawals are small, occur in Polk County, and are used by many different permittees for various uses.

Stream and Spring Flows

Hammett (1990) determined a statistically significant decline in annual mean discharge for the Peace River at Bartow, Zolfo Springs, and the Arcadia gaging stations from the

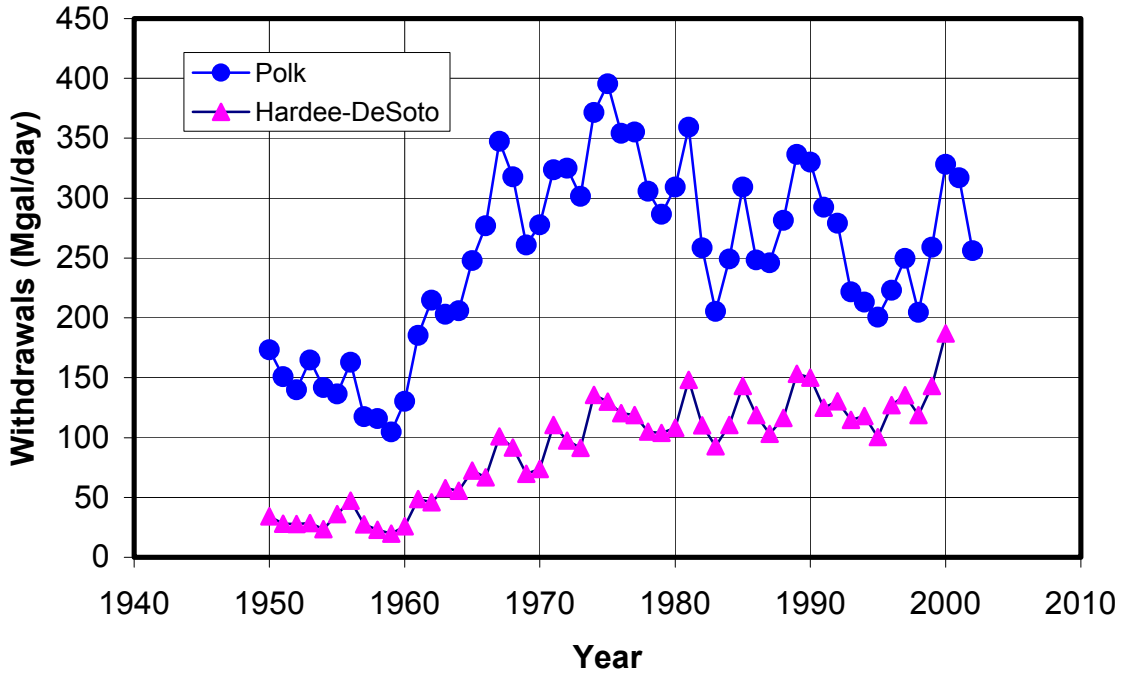

Figure 4. Estimated water use 1950 – 2000 for Polk and Hardee and DeSoto Counties.

1930s to 1984. Lewelling and others (1998) updated this work by including the subsequent 10-year period and found the same declining trend from the 1930s to 1994. A five-year moving average of annual stream flow measured at the Bartow, Ft. Meade, Zolfo Springs, and Arcadia gaging stations illustrates this decline (Figure 5).

Historically, areas within the upper Peace basin exhibited artesian flow from the underlying confined aquifers. Between Bartow and Homeland, there are numerous sinks within the riverbed and in the adjacent flood plain which have periodically resulted in the loss of perennial flow during the dry season in the upper part of the river. Kissengen Spring and other minor springs previously discharged to the river. Flow from Kissengen Spring declined steadily from the early 1930s, when flow was measured at greater than 30 cfs, until 1950 when continuous discharge ceased (Figure 6). Cessation of flow from the springs is generally attributed to the decline in the hydraulic potential of the confined aquifers caused by the development of the ground-water resource. The hydraulic potentials of the confined aquifers, previously observed above the riverbed, are generally tens of feet below the riverbed since the early-1960s. This has affected the baseflow to the upper portion of the river.

Other changes in baseflow have been affected by operations for mining, agriculture, and drainage alterations. Phosphate mining and domestic waste discharges to the river have gradually declined since the mid-1980s (SWFWMD, 2002). Agricultural runoff has

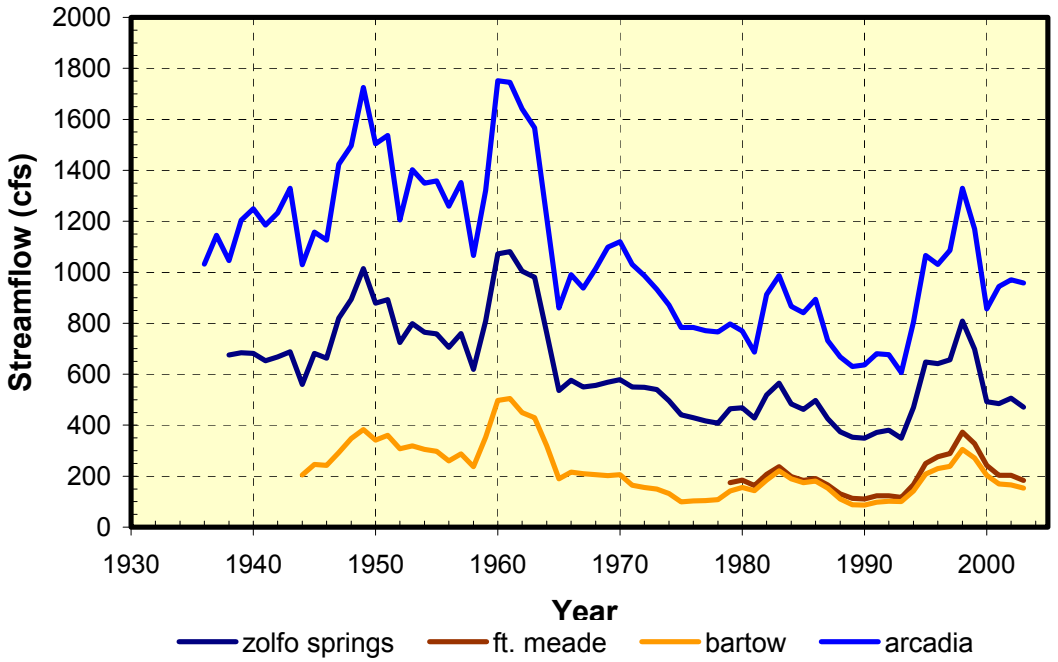

Figure 5. 5-year moving average of annual streamflow at the Peace River stations.

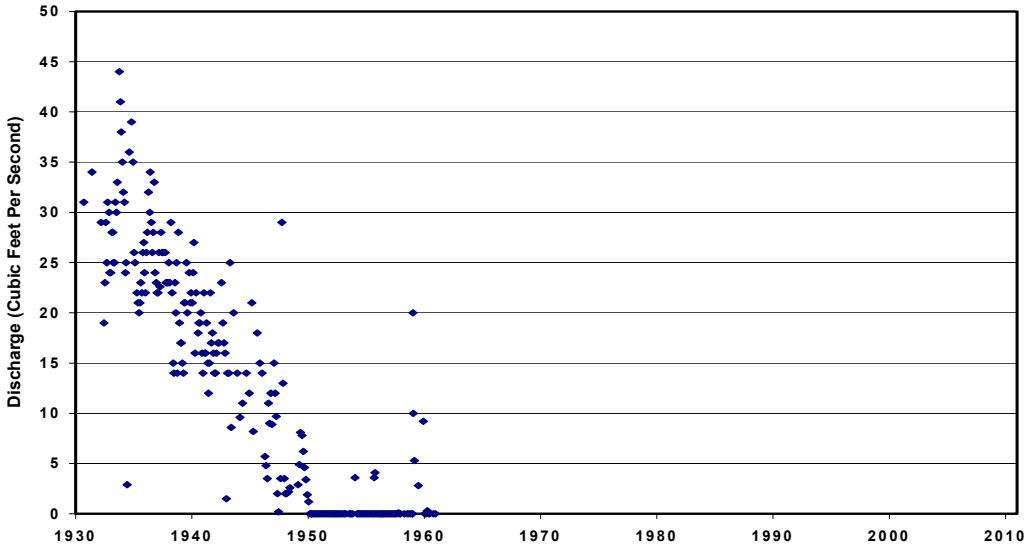

Figure 6. Flow at Kissengen Spring.

contributed to increased baseflow in the Joshua, Prairie, and Shell Creek tributaries. In addition, median and high flows have been affected by multi-decadal changes in rainfall. Wet season rainfall (June through October) was greater prior to 1970 than since that time (Figure 7).

Aquifer Levels

Ground-water levels in SWCFGWB wells, which are open to the UFA, have generally declined since the 1930s. This is the earliest period for which ground-water level data exists and the decline is evident from the hydrograph of Sarasota Well 9 water levels (Figure 8). The well is located in Sarasota County about 20 miles west of the Peace River drainage basin. The basin-wide decline is also apparent on a difference map of the predevelopment potentiometric surface versus the 1991 through 2000 average potentiometric surface.

Ground-water levels in Polk County reached their lowest levels in the mid-1970s when ground-water withdrawals peaked (Figure 9). Levels have increased somewhat since that time due principally to water conservation efforts by the phosphate mining industry and agriculture. Demand for ground water in Hardee and DeSoto counties was much less than in Polk County in the early and middle Twentieth Century. Recent water use data from the past decade indicate increasing ground-water withdrawals due primarily to agriculture. Ground-water levels for these two counties, as represented by the Marshall well water levels, are shown in Figure 10.

Ground-water levels in the UFA beneath the Peace River drainage basin are also affected by ground-water withdrawals in other parts of the SWCFGWB: particularly the Lake Wales Ridge area to the east and the areas of Manatee, southern Hillsborough, and northern Sarasota Counties to the west.

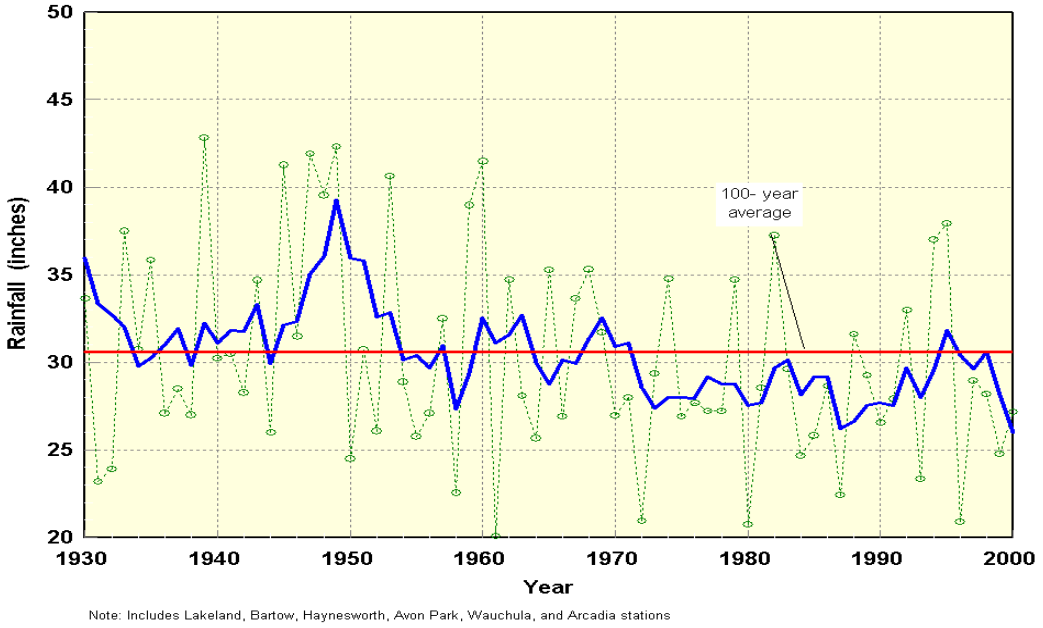

Figure 7. Annual and 5-year running mean of wet season rainfall averaged from six stations within or adjacent to the Peace River Basin (1930 – 2000).

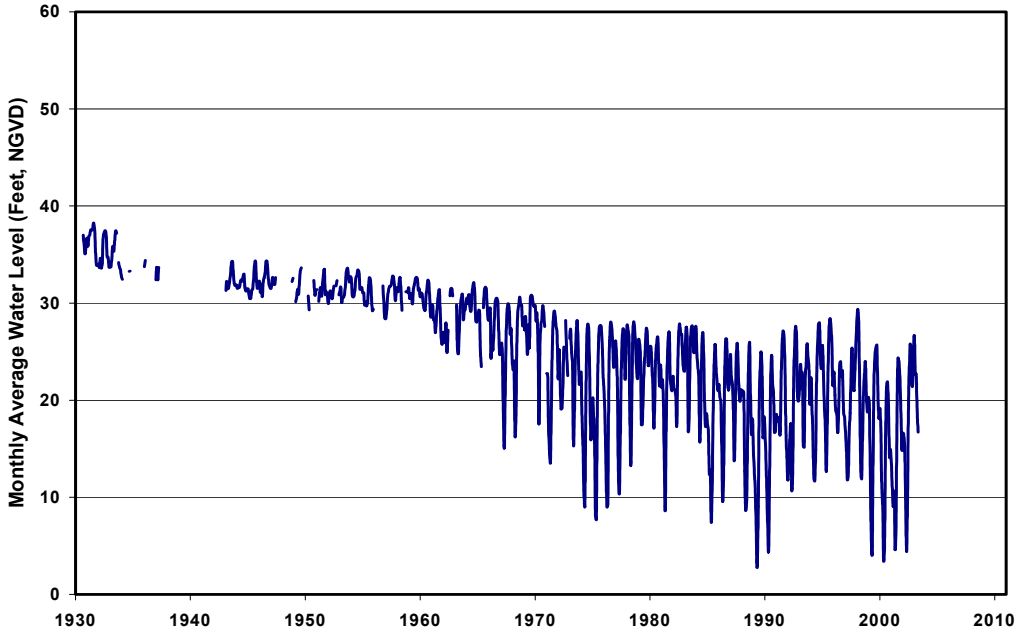

Figure 8. Ground-water levels at the Sarasota 9 well in Sarasota County.

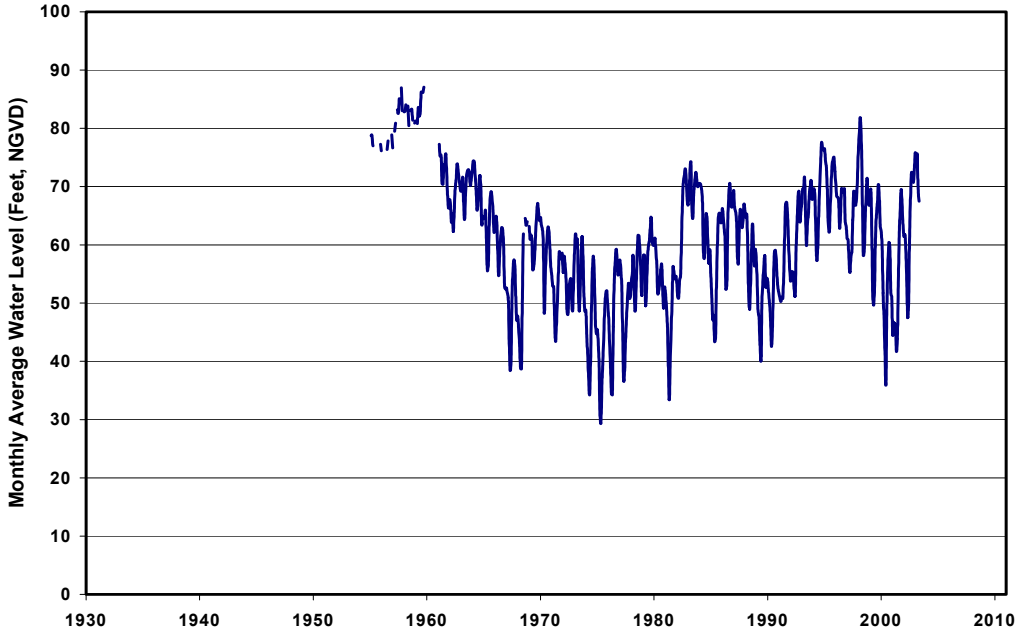

Figure 9. Ground-water levels at the ROMP 60 well in Polk County.

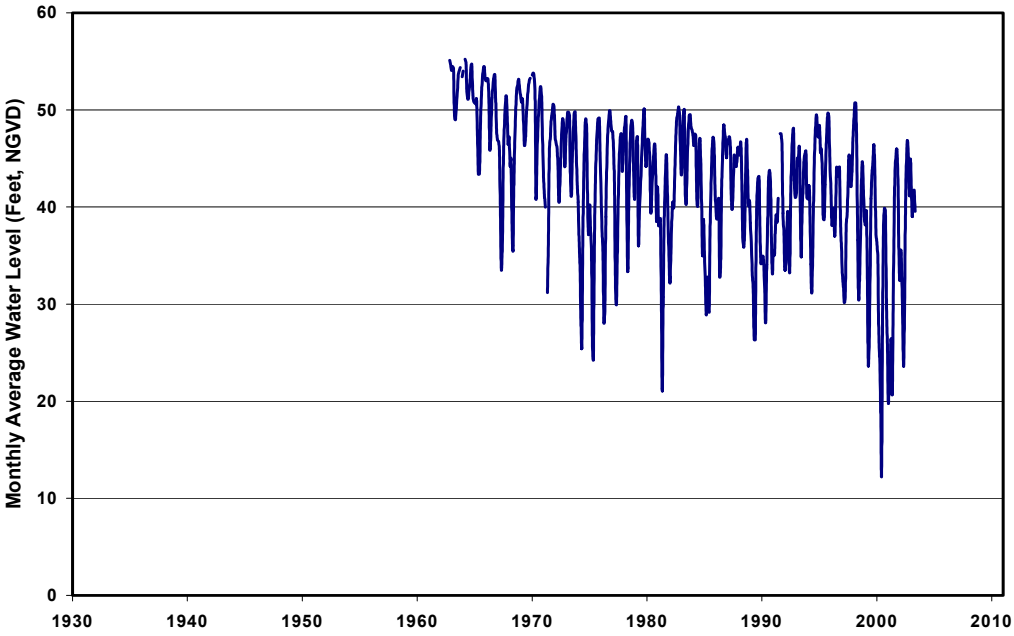

Figure 10. Ground-water levels at the Marshall Deep well in DeSoto County.