GROUNDWATER USE AND EFFECTS ON WATER LEVELS

Groundwater has long been a valuable source of plentiful, good-quality drinking water in Florida. About 93 percent of the state's population (14 million residents) relied on groundwater for their drinking water supply in 1995. Most of those people rely on the Upper Floridan aquifer, the Biscayne aquifer, and the surficial aquifer system for their water supplies. The sand and gravel aquifer and intermediate aquifer system are used much less, and only locally in northwestern and southwestern coastal parts of the state. The abundant supply of groundwater is vital to the state's important tourism and agricultural industries in addition to residential usage.

Because of differences in the distribution of population and agriculture, water use varies greatly around the state. The largest amounts of groundwater used were in southeastern and central areas: Dade, Polk, Broward, Orange, and Palm Beach counties. Dade and Broward withdrawals are from the Biscayne aquifer, Polk and Orange from the Upper Floridan aquifer, and Palm Beach from the Biscayne and other surficial aquifers. Most of the water used in these counties is for agriculture and public supply, although Polk County withdrawals also include large amounts of water for phosphate mining.

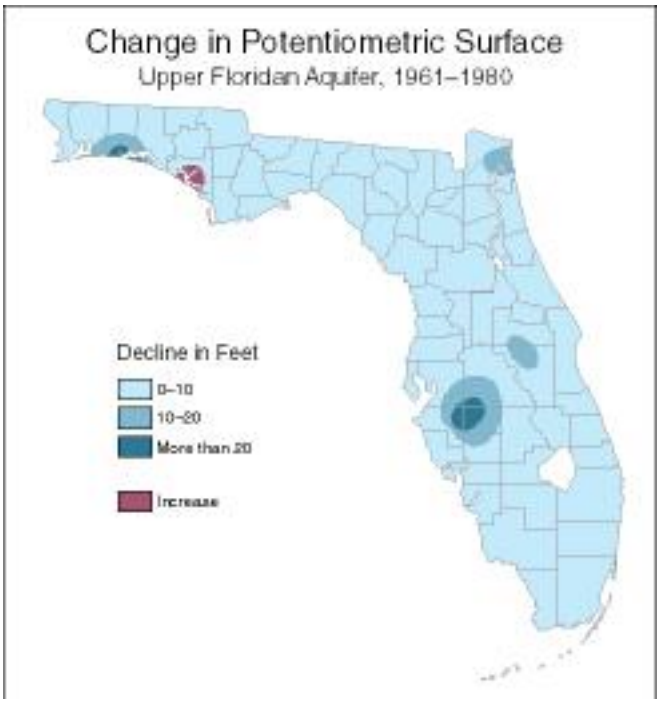
To assess the impact of groundwater withdrawals and pumping on the water supply in an aquifer, periodic measurements are made of water levels in wells. These water levels are measured at various intervals, but measurements are made at least once every five years in a large group of wells in the Upper Floridan aquifer to assess current water levels and to monitor changes over time. In some wells, water levels are measured over long time periods, and graphs can be prepared showing long-term changes in water levels. Groundwater levels decline when wells are pumped and rise when pumping is reduced. Water levels also respond to recharge from rainfall, droughts, and seasonal changes in water demands for drainage, irrigation, public supply, and industry. Irrigation is the largest user of groundwater in Florida and usage varies seasonally and annually in relation to the amount of rainfall. In areas with increased groundwater pumping, water levels have declined over time. When pumping ceases or is reduced substantially, water levels can recover to former levels.

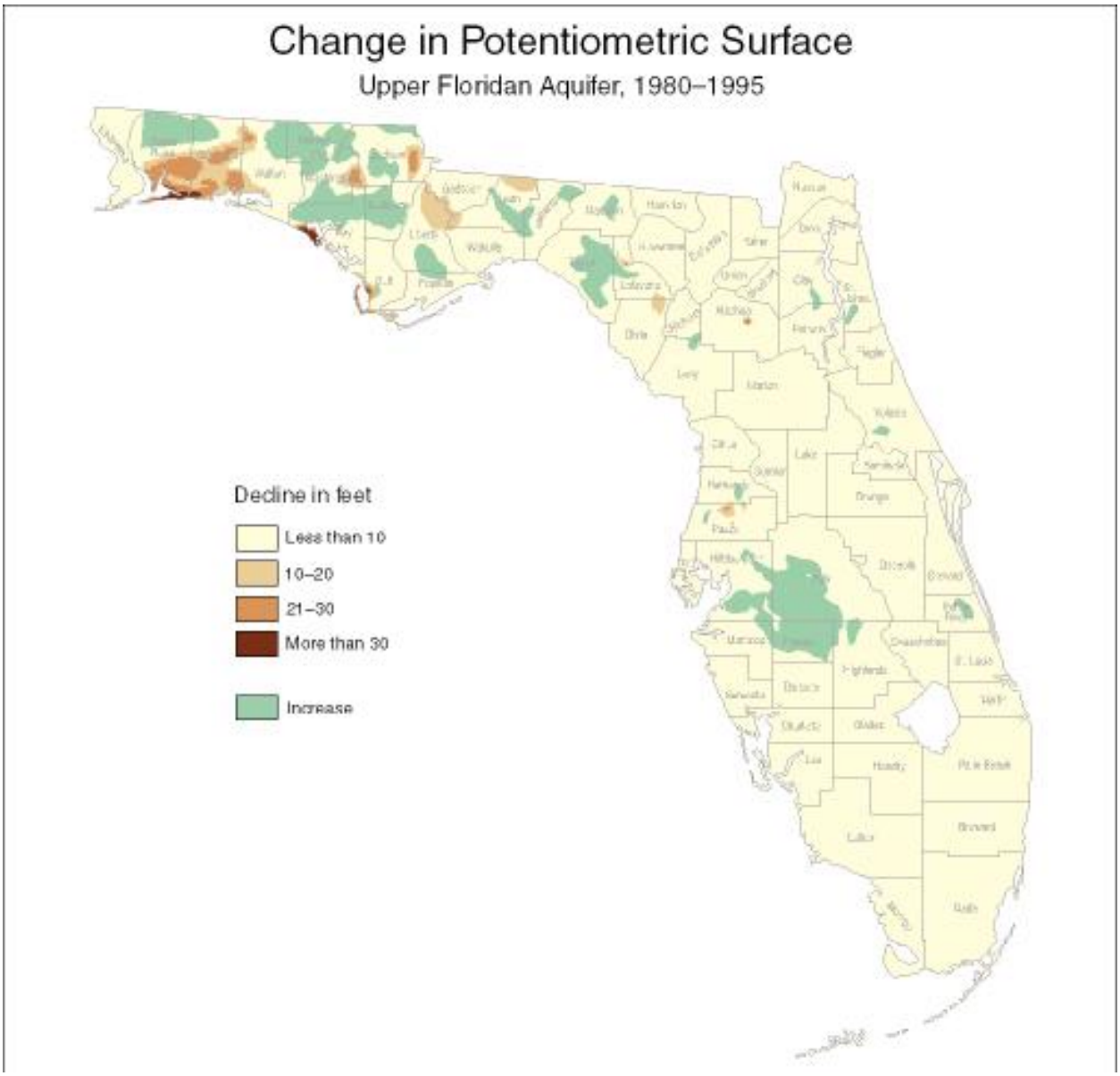
Groundwater levels can fluctuate in response to groundwater management activities, such as control of the discharge in canals in southeastern Florida. The water levels in the Biscayne aquifer in Dade County near Homestead show seasonal changes of as much as eight feet in the early years before water-management control was fully effective, whereas in recent years seasonal changes have been about 4 feet. In general, construction and control of drainage canals have lowered the high seasonal groundwater levels and raised the low seasonal groundwater levels near the coast. Also, despite experiencing large withdrawals in a concentrated area, the Biscayne aquifer in Dade County has not exhibited noticeable declines in water levels. Management of water withdrawals and the extremely high permeability and high recharge rate for the Biscayne aquifer are probably responsible for the lack of decline in water levels.

Saltwater encroachment into groundwater supplies caused by large groundwater withdrawals is a concern in Florida, and of most concern in coastal areas. Saltwater encroachment into freshwater aquifers has several possible mechanisms, including the presence of pockets of relict seawater in the aquifers; lateral movement of saltwater in coastal areas; upconing of saltwater from deeper zones below the pumping zone; upward leakage of saltwater from deeper zones through uncased or improperly constructed wells; upward leakage of saltwater from deeper zones through breached confining units or through joints, faults, or collapse features; and through abandoned or improperly plugged exploratory holes drilled for testing for the presence of

petroleum and other minerals and aggregates. These mechanisms are exacerbated by the pumping of large amounts of groundwater. Studies have been done to determine the extent of saltwater encroachment in northeastern, southeastern, southwestern, and west central parts of Florida. Construction of canals and control structures has helped control saltwater encroachment in southeastern Florida. Other parts of the state have not been as strongly impacted by saltwater encroachment.

Despite concerns about groundwater quality and quantity, declining water levels in some areas, and saltwater encroachment, the Upper Floridan aquifer has large areas that contain large quantities of high quality water for public supplies. This includes areas where the aquifer is thick, transmissivities are high, recharge amounts are large, and water quality is unaffected by saltwater encroachment. Because many of these areas include places where the aquifer is unconfined and karst features such as sinkholes and springs occur, these areas can be extremely vulnerable to contamination from surface sources. Potential sources of contamination include waste disposal impoundments, underground storage tanks, drainage wells, septic tanks, landfills, hazardous waste sites, and agricultural chemicals.





Study Questions

1. What aquifers are used by 93% of Florida's population?
2. How do State scientist monitor the supply of groundwater?
3. What is a real danger that can occur by pumping large amounts of groundwater from areas near a coast?
4. What are five sources of contaminants that can pollute an aquifer?
5. What are the characteristics that make an aquifer susceptible to groundwater pollution?