INFRASTRUCTURE DATA AND ANALYSIS

GROUNDWATER AND AQUIFER RECHARGE

INTRODUCTION

The following is the Data and Analysis necessary to support the adopted Charlotte 2050 Plan goals, objectives and policies.

The purpose of the Groundwater and Aquifer Recharge section is to ensure the long term quality of water by identifying and protecting the areas of major recharge to subsurface aquifers. Subsurface aquifers provide water that is pumped from wells and treated before human consumption.

The groundwater underlying Charlotte County is contained within four aquifers of varying quality, but which may be susceptible to contamination because of the high groundwater table and direct infiltration from the land surface.

Water has historically been a readily available and cheap commodity in Florida. As the population continues to increase, however, that situation may change. Therefore, the protection of subsurface water sources is vital to the public interest. While there is a region of prime intermediate aquifer recharge in Charlotte County, located in an approximate 50 square mile area of the northeastern corner bordering DeSoto and Glades Counties, the remainder of the County has limited recharge characteristics. This area of prime aquifer recharge should be encouraged to remain relatively undeveloped in order to protect these capabilities.

RELATIONSHIP TO 2050 PLAN

Development creates an impact on the natural recharge of groundwater into the subsurface aquifer by increasing the amount of impervious surfaces and introduction of pollutants that would otherwise not occur in a natural setting.

The Aquifer Recharge Section of the Infrastructure element is closely related to several other elements of the Comprehensive Plan. Groundwater issues are related to the Future Land Use element because development creates impervious surfaces and the location, density and intensity is controlled by that element. Groundwater is related to the Natural Resources and Coastal Planning Elements because of concerns pertaining to saltwater intrusion of freshwater aquifers. Aquifer Recharge also ties to the Intergovernmental Coordination element as aquifers generally extend beyond political boundaries and many agencies are involved in groundwater management. Aquifer Recharge is also a major consideration with other sections of the Infrastructure element. The Stormwater Management section of the Infrastructure element is related because stormwater

management systems affect the recharge of aquifers. Stormwater management systems also channel stormwater away from developed sites for flood protection while decreasing infiltration and percolation in areas from which the stormwater was removed.

LEGISLATION

This section, as required by Rule 9J-5.011(1)(h) *Florida Administrative Code* (F.A.C.), contains existing regulations and programs that govern land use and development of groundwater recharge areas. The regulations will be identified for their strengths and deficiencies in maintaining the functions of groundwater recharge areas.

FEDERAL

- **The *Clean Drinking Water Act of 1972*** established criteria and goals concerning the release of pollution into the waters of the United States. The act focused largely on surface waters and provided the greatest protection for wetlands of any Federal legislation.
- **U.S. Public Law 92-500**, the *"Federal Water Pollution Control Act,"* commonly referred to as the "Clean Water Act," was amended in 1977 to address stormwater runoff into the waters of the United States.
- **The *"National Water Quality Inventory, 1986 Report to Congress,"*** provided a general assessment of water quality, based on biennial reports submitted by the states in Section 305(b) of the Clean Water Act. In the assessment, pollution from diffuse sources, such as runoff from agricultural and urban areas, is cited by the states as the leading cause of water quality impairment. Congress responded in 1987, by requiring that the EPA begin dealing with stormwater runoff pollution. The Water Quality Act of 1987 required that the EPA issue or deny permits for industrial and certain municipal stormwater discharges. Permitting responsibility has since been transferred to the states. In Florida, the Department of Environmental Protection (DEP) has the responsibility of issuing permits.
- In 1987, **the *Water Quality Act*** required the U.S. Environmental Protection Agency (EPA) to establish the National Pollutant Discharge Elimination System (NPDES) stormwater permitting program. NPDES establishes standards for the maximum amount of specific pollutants that can be discharged into the environment. The program requires local governments to comply with certain conditions to obtain permits for existing and future stormwater management systems, as well as for effluents from treatment facilities. Therefore, the focus of pollution control has shifted to regulating the amount of pollutants that can be discharged into receiving water bodies rather than cleaning up a water body after it becomes contaminated.

STATE

Florida Administrative Code:

- **Chapters 40D-8 and 40E-8, F.A.C.** establish guidelines (primarily in the floodplain) for development bordering lakes; conservation, water storage, and recharge capabilities of lakes within Water Management District boundaries, levels for operation of lake control structures, and a means for providing information on district consumptive use permitting (CUP) activities.
- **Chapter 62-40, (F.A.C.), "State Water Policy**," addresses many different aspects of water resource protection and management. The stormwater and surface water management components are critical to this topic of stormwater utilities and levels of service. The definition of "stormwater management system" covers aspects of the issues that are addressed in the County's level of service.

  "Stormwater management system" means a system that is designed and constructed or implemented to control stormwater, incorporating methods to collect, survey, store, absorb, inhibit, treat, use, or reuse stormwater to prevent or reduce flooding, over-drainage, environmental degradation, and water pollution or otherwise affect the quantity and quality of discharges from the system."
- **Chapter 62-781, (F.A.C.),** "Dry Cleaning Cleanup Rule," administered by DEP, requires new and existing dry-cleaning facilities to be equipped with secondary containment vessels installed beneath each machine or item of equipment in which dry-cleaning solvents are used. This rule protects groundwater quality by containing accidental spillage of dry-cleaning solvents.

Florida Statutes:

- **Chapter 373, Florida Statutes (F.S.)**, ***"Florida Water Resources Act (FWRA),"*** regulates the construction, alteration, maintenance, operation, and abandonment of dams, appurtenant works, impoundments, reservoirs, and works affecting waters of the State. The goal of the Act is to prevent harm to the water resources of the State. The Act provides for the permitting of various activities including management and storage of surface waters (Part IV) and consumptive uses of water (Part II). The Act creates Water Management Districts, which, together with the DEP, are the agencies responsible for implementing the regulatory components of the FWRA. The FWRA establishes minimum flow levels from surface water courses and minimum water levels for lakes and groundwater aquifers. The DEP is additionally directed to establish priorities for the development of a computerized groundwater database upon the following guidelines:
  - Regions deemed prone to groundwater contamination due to land use.
  - Regions that have an identifiable direct connection with any confined aquifer utilized as a drinking water aquifer.
  - Any region dependent on a single-source aquifer.

In addition, the DEP is to identify those areas of the State where saltwater intrusion is a threat to freshwater resources and report its findings to the water management districts, boards of County commissioners, and the concerned public.

- **Chapter 380, F.S., *"The Florida Environmental Land and Water Management Act of 1972,"*** ensures a water management system that will reverse the deterioration of water quality and provide optimum utilization of our limited water resources. The chapter also facilitates orderly and well-planned development and protects the health, welfare, safety, and quality of life of the residents of the State.
- **The *Water Quality Assurance Act of 1983*** required DEP to establish a groundwater quality monitoring network designed to detect or predict contamination of the State's groundwater resources (Chapter 403.063, F.S.). The goal of the monitoring program is to establish the background and baseline groundwater quality of major aquifer systems in the State. A background network consisting of 1,600 wells throughout the State was identified from DEP, US Geological Survey (USGS), and water management district wells.

State Programs

Charlotte County lies within two water management districts, the Southwest Florida Water Management District and the South Florida Water Management District. The Southwest Florida Water Management District's (SWFWMD) jurisdiction covers the majority of Charlotte County including all of the urbanized areas. The South Florida Water Management District's (SFWMD) area of jurisdiction is located in the eastern and southeastern portions of the County and includes relatively large and vacant tracts of land such as Babcock Ranch and the Telegraph-Cypress Swamp. While these lands are generally designated on the Future Land Use Map as Agricultural or Resource Conservation, the Babcock Ranch development itself is intended to develop into an urbanized area with all of the potential stormwater management issues associated with such development. In addition, the County's aquifer recharge area is almost completely contained within SFWMD's area, as shown in Future Land Use Map (FLUM) Series Map #6.

Concerns about saltwater intrusion and over-pumping of wells on a region-wide basis led SWFWMD to create the Southern Water Use Caution Area (SWUCA) in 1992. The SWUCA encompasses roughly the southern half of SWFWMD, approximately 7,000 square miles. Other water supply initiatives for Charlotte County include continuation of the Water Resource Assessment Project (WRAP) for the southern groundwater basin (SGWB).

SWFWMD's Ambient Groundwater Quality Monitoring Program (AGWQMP) has prepared a detailed description of the groundwater quality in the District. Information for Charlotte County can be found in the "Southern Region," Section 2 of the report, which provides information on the hydrology and hydrochemistry. Additionally, the report includes information on stratigraphy, structure, hydrostratigraphy, potentiometric surface, aquifer recharge, aquifer use, and groundwater quality.

In 1974, SWFWMD began the Quality of Water Improvement Program (QWIP) to restore hydrologic conditions altered by well drilling activity. QWIP was initiated in Charlotte County where the problems with free flowing and abandoned artesian wells were the most severe and complex.

The Florida Water Plan (1995) is an integrated, coordinated plan prepared jointly by DEP and the five WMDs. It is intended to guide DEP and the WMDs in implementing current statutory directives prescribed in the Water Resources Act (Chapter 373, *Florida Statutes*), the Florida Air and Water Pollution Control Act (Chapter 403, *Florida Statutes*), and the State Comprehensive Plan (Chapter 187, *Florida Statutes*). These statutes provide the basic authorities, directives, and policies for State-wide water management, pollution control, and environmental protection (DEP and WMDs, 1995).

REGIONAL

The only discrete areas of groundwater recharge that are readily regulated in terms of permitted land uses and development are wetland systems. Agencies currently involved in regulating uses in wetland areas are DEP, SFWMD, and SWFWMD. DEP regulates the dredging and filling of wetlands that are contiguous with waters of the State, excluding isolated wetland systems. Isolated wetland systems are regulated and protected by the Water Management Districts through a permitting process that includes established performance standards and criteria for consumptive water usage, stormwater management, well drilling, and management of surface waters. Destruction or alteration of such wetland systems is contingent upon demonstrating compliance with minimum standards, and providing satisfactory compensation for wetland loss. Compensation typically consists of the creation of new wetlands or restoration of previously impacted wetlands, thereby maintaining aquifer recharge surface area.

These Water Management District regulations are generally considered effective in protecting wetland systems and floodplains. However, these regulations have several deficiencies, including exemptions for wetlands less than one half acre in size, upland buffer requirements that are insufficient for the protection of potable water sources, and exemptions for mining proposals.

LOCAL

- The Land Development Regulations of Charlotte County address wellfield protection by requiring that any proposed commercial or industrial facility located within 1,500 feet of a well or a public water supply system must provide proposed contamination prevention methodologies to the local utility authority. The Board of County Commissioners (BCC)

holds public hearings to approve any agreement between the developer and utility, or to provide guidance and ultimate approval to the plan if the two parties cannot agree to terms.

- The Charlotte County Code Section 3-9, Zoning Regulations, is crucial to protecting the recharge capability of the aquifer system. The zoning regulations generally separate land uses into districts, and establish development standards for each district, depending on the allowable uses. These development standards address minimum lot sizes for development, minimum setbacks from property lines, road rights of way, and water bodies, maximum lot coverage by structures and other impervious surfaces, maximum heights of buildings, and maximum densities of dwelling units per acre. The zoning regulations include an Environmentally Sensitive (ES) zoning district, the purpose and intent of which is to preserve and protect certain land and water areas in unincorporated Charlotte County that have an overriding ecological, hydrological, or physiographic importance to the public at large. The ES district is intended to preserve and protect open spaces, park lands, wilderness areas, marshlands, watersheds and water recharge areas, scenic areas, beaches and native flora and fauna in those areas designated ES on the zoning map. This district allows limited public or private recreational or educational uses and their incidental accessory uses and structures. The development standards of this district require pervious surfaces so that water from rainfall events may infiltrate into the ground to recharge subsurface aquifers.
- Charlotte County is a member of the Peace River/Manasota Regional Water Supply Authority (PR/MRWSA) whose purpose is to ensure necessary development of water resources for public supply (within the territory of the Authority) while managing the resource to minimize negative environmental effects from improper or excessive withdrawals of water in concentrated areas.

EXISTING CONDITIONS

INVENTORY

Aquifers Underlying Charlotte County

The groundwater underlying Charlotte County is contained within four distinct but stratigraphically complex aquifers. The four aquifers include the *surficial aquifer*, two *intermediate aquifers*, and the deep *Floridan aquifer*. The intermediate and Floridan aquifers are artesian aquifers that each contains several water bearing strata. In general, the water in each aquifer is separated from other aquifers by confining beds of relatively impervious mineral or rock layers. Discontinuities or breaks in the confining beds allow some hydraulic exchange between overlying and underlying aquifers. The major hydrogeologic units and confining beds are shown in Table AQR-1.

The surficial aquifer (also referred to as the water table aquifer or unconfined aquifer) contains potable water and is located across the majority of eastern Charlotte County. It is composed of sand, marl, shell and limestone and has an average thickness of 35 feet. A clay confining layer

averaging about 40 feet thick separates the surficial aquifer from the underlying intermediate aquifer, making it difficult for rainfall to penetrate and recharge the intermediate aquifer. A 1978 water feasibility report for Charlotte County estimated that more than one billion gallons of relatively good quality water is stored in Charlotte County's surficial aquifer. The majority of this water is located in the eastern third of the County, at least 15 miles from the population centers of Port Charlotte and Punta Gorda. Hundreds of wells tap the surficial aquifer in Charlotte County (see FLUM Series Map #6), and may be responsible for the withdrawal of as much as 4 million gallons of water per day. Many of these wells are used to irrigate vegetable crops and water livestock.

Other wells are located in the Englewood, Charlotte Harbor, and Gasparilla Island wellfields and are used for public water supply. Water yields from wells tapping the surficial aquifer average 30 gallons per minute (Wolansky, 1983), but can range as high as 600-700 gallons per minute for wells tapping Caloosahatchee Marl in the eastern part of Charlotte County (see Table AQR-1).

The intermediate aquifers include the Tamiami-Upper Hawthorn aquifer, and the Lower Hawthorn-Upper Tampa aquifer (Wolansky, 1983). These aquifers consist of permeable sand, gravel, shell, limestone, and dolomite beds in the Tamiami Formation, the upper and lower portions of the Hawthorn Formation, and the Tampa Limestone.

The thickness of the intermediate aquifers and confining beds is approximately 550 feet in Charlotte County. The Tamiami-Upper Hawthorn aquifer is the most highly developed aquifer in western Charlotte County, and supplies most of the water for domestic irrigation. Wells that draw throughout the entire thickness of this aquifer are capable of producing 200 gallons per minute. The Lower Hawthorn-Upper Tampa aquifer is also used for irrigation, with wells yielding as much as 500 gallons per minute. Both of the intermediate aquifers contribute water to the Englewood and Rotonda West wellfields, but because the water is highly mineralized, it requires desalinization by reverse osmosis before water from these sources can be used for public supply.

Table AQR-1 Aquifers and Stratigraphic Units Underlying Charlotte County				
Aquifer (hydrogeologic unit)	**Yield (gal./min.)**	**Stratigraphic Unit**	**Thickness (ft.)**	**Remarks**
Surficial Aquifer (non-Artesian)	30 (10-750)	Surface & Terrance Sand Caloosahatchee Marl	0-20 0-50	Source of water for domestic and supply wells along the coast. Also used for lawn irrigation and watering stock. Wells tapping the shell beds in Caloosahatchee Marl yield as much as 600 gal./min. In Eastern Charlotte County.
Confining Bed	N/A	N/A	N/A	Green Clay
Tamiami-Upper Hawthorn Aquifer (Artesian)	75 (20-250)	Tamiami Formation	75-220	Domestic and irrigation wells tapping limestone beds in this aquifer yield as much as 200 gal./min. Used extensively for irrigation in the eastern part of the County and for public water supply on the Cape Haze Peninsula (Rotonda and Englewood wellfields).
Confining Bed	N/A	Hawthorn Formation	200-400	White Clay
Lower Hawthorn-Upper Tampa Aquifer (Artesian)	150 (20-250)	Tampa Limestone	150-300	Widely used for irrigation. Contributes water to wells for public supply at Rotonda and Englewood wellfields. Water is mineralized (saline) and is treated in reverse osmosis treatment plants.
Confining Bed	N/A	N/A	N/A	White to Grey Impermeable Limestone
Floridan Aquifer (Artesian)	2,000 (500-5,000)	Suwannee Limestone Ocala Limestone	200-300 200-300	Most productive aquifer, but not used as a source of water in Charlotte County because of its high mineral content.
Confining Bed	N/A	Avon Park Limestone Lake City Limestone	600-700	Impermeable limestone with intergranular Anhydride and Gypsum.

Source: Sutcliffe, 1975, and Wolansky, 1983

In Charlotte County, the Floridan aquifer consists of permeable layers in the Tampa Limestone, Suwannee Limestone, Ocala Limestone, and Avon Park Limestone formations. The Floridan aquifer is confined by impermeable limestone and clays of the Tampa Limestone on top and by impermeable limestone of the Lake City Limestone below, which forms the confining bed. The average thickness of the Floridan aquifer in Charlotte County is about 1,700 feet. The Floridan is the most productive of Charlotte County's aquifers, with wells capable of producing thousands of gallons of water per minute. This water is highly mineralized, however, and would require desalinization before being used for irrigation or potable water purposes.

Aquifers and Areas of Prime Recharge

Recharge is defined as the depth of water that enters an aquifer per unit area of aquifer. County-wide variations in recharge are dependent on a number of variables, including rates of surface water runoff, permeability of soils and the underlying confining beds, relative differences between potentiometric and water table levels, precipitation and evapotranspiration rates, and pumpage. Flowing artesian wells are also an artificial recharge variable.

The surficial aquifer is recharged by rainfall that has not been intercepted by evapotranspiration, runoff, foliage, or depression storage, upward leakage from the intermediate and Floridan aquifers, and groundwater flow from outside the County. The majority of recharge is by infiltration of rainfall. Upward leakage and groundwater flow from outside the County contributes minor amounts, and flowing artesian wells contribute appreciable amounts. It is estimated that recharge to the surficial aquifer in Charlotte County ranges from less than one inch per year to 16 inches per year depending on permeability and thickness of aquifer material and the topography.

In most of Charlotte County, the potentiometric surfaces of the confined aquifers are higher than the water levels in the surficial aquifer, and water generally leaks upward to the surficial aquifer. In an approximately 50 square mile area located in the northeastern corner of the County, the water level of the surficial aquifer is about 10 feet above the potentiometric surface of the intermediate aquifer; therefore, surficial aquifer water is recharging the intermediate aquifer. This area is designated as a natural recharge area and is shown on FLUM Series Map #6.

Potable groundwater withdrawal from the Floridan aquifer system is limited in Charlotte County because of high mineral content. Mineralization increases with depth towards the south and towards the coast where the surficial and intermediate aquifer systems are used. The intermediate aquifer is the principal potable groundwater source in Charlotte County. Understandably, surface water is the principal water supply in the County.

Several studies indicate groundwater recharge rates are low to the intermediate and Floridan aquifer systems in Charlotte County. The highest recharge rates to the Floridan in the County are less than two inches per year and occur in the northeastern upland areas. Generally, discharge occurs from the Floridan aquifer along the coast and in central Charlotte County. The highest recharge rates to the intermediate aquifer system in the County are estimated to be less

than two inches per year, but occur in a very limited area of northeastern Charlotte County. However, groundwater is actually discharged from the intermediate system in most of the County. Infiltration rates to the surficial system in the County vary depending on depth to the water table, soil type, soil moisture, topography, vadose zone material, evapotranspiration, and runoff characteristics. Infiltration rates to the surficial system range up to 20 inches per year. Groundwater recharge areas most suitable for protection in Charlotte County include the extreme northeastern area of the County.

Aquifer Recharge Areas: In an area of approximately 50 square miles, located in the northeastern corner of the County, the water level of the surficial aquifer is about 10 feet above the potentiometric surface of the intermediate aquifer; therefore, the surficial aquifer has the potential to recharge the intermediate aquifer. The western three-quarters of Charlotte County generally have zero recharge to the upper Floridan aquifer, while the eastern one-quarter has very low recharge of less than two inches per year.

Groundwater Quality: Groundwater quality is affected most severely by two measures, the mineral content of the groundwater, and contamination by surface pollutants and runoff.

Mineral Content of Groundwater: A groundwater's mineral content is one of the most basic measures of its chemical quality, and largely determines its suitability for domestic, agricultural or industrial use. The mineral content of groundwater is determined primarily by the composition and solubility of soil and rock that come into contact with the water and the length of time the water is in contact with these materials. Quartz sand, the major constituent of the surficial aquifer, is relatively insoluble. The sandy and clayey limestone and dolomite of the intermediate aquifers are more soluble than the quartz sand of the surficial aquifer, but less soluble than the limestone and dolomite of the Floridan aquifer (Hydrology of the Sarasota-Port Charlotte Area, Florida. Wolansky, 1983).

Because mineral content can be defined as the sum of all the dissolved inorganic ions and compounds, a measure of the mineral content of groundwater can be obtained by measuring the concentration of major inorganic constituent in the water, such as total dissolved solids (TDS), chloride, sulfate, and hardness (calcium and magnesium). Chapter 62-550 F.A.C. establishes standards for the quality of drinking water distributed by public water systems, but standards for private wells have not been developed on a State-wide basis at this time, and any standards that do exist are established by local governments. Charlotte County has not chosen to adopt private well water-quality standards at this time. Florida's secondary drinking water regulations include standards for TDS, chloride, and sulfate in public water supplies of 500, 250, and 250 milligrams per liter (mg/l), respectively, and are identical to the USEPA recommended levels for TDS, chloride, and sulfate in drinking water. A standard is not given for hardness, but water having a hardness concentration greater than 180 mg/l is considered very hard and can cause excessive soap consumption and scale build-up in water heaters.

The mineral content of Charlotte County's four aquifers is expressed as TDS, chloride, sulfate, and hardness. TDS and chloride are in excess of State public drinking water standards in the western half of the County. Sulfate concentrations in the surficial aquifer exceed 250 mg/l in the western third of the County and hardness is greater than 180 mg/l for the entire County. Sulfate exceeds State standards in the western half of the County.

All parameters are greater than would be allowed by public drinking water regulations, except for sulfate in the eastern half of the County. Except for the surficial aquifer in the eastern half of the County, water chemistry data indicate that, in general, the groundwater quality in Charlotte County is poor. The intermediate and Floridan aquifers have high mineral contents, especially in the western half of the County. Analysis by SWFWMD suggests that the County's low topography (near sea level) and relatively thick confining layers that separate the aquifers may retard the flushing of the salty aquifers by fresh rainwater.

Groundwater Contamination: The surficial aquifer contains the highest quality groundwater in the County, but it is also the most susceptible to contamination, making the management of groundwater contamination especially important in Charlotte County. Potential point sources of groundwater contamination include landfills, percolation ponds for sewage effluent disposal, industrial sites, and underground storage tanks. In Charlotte County, the majority of these sites are located in the western half of the County. Free flowing artesian wells also constitute a point source of contamination of groundwater. Non-point sources of contamination include septic systems, agricultural and residential use of fertilizers and pesticides, and salt-water intrusion along the coastal shoreline.

Analysis utilizing EPA methodology indicates that the surficial aquifer in Charlotte County is highly susceptible to groundwater contamination, primarily due to the shallow depth to the water table. Upland areas in northeastern Charlotte County are slightly less susceptible to contamination, because of the greater depths to the water table. In general, the intermediate and Floridan aquifers have a very low susceptibility to contamination due to thick overlying confining layers which impede contamination.

At the same time, Charlotte County has been identified as an area with major interaquifer contamination and wasteful artesian flow. The loss of potable and agricultural water due to the degrading effects of improperly-constructed or deteriorated artesian wells have been recognized by SWFWMD.

DEP requires point source dischargers to groundwater to perform water quality testing on samples collected from monitoring wells and submit groundwater quality data.

Chapter 403.063, F.S. requires groundwater quality monitoring. The DEP, in cooperation with other State and Federal agencies, SWFWMD, and Charlotte County government, has established a groundwater quality monitoring network designed to detect or predict contamination of the

groundwater resources of the County. The program uses the following criteria to determine the priority of sites to be monitored within the groundwater quality monitoring network:

- The degree of danger to the public health caused or potentially caused by contamination.
- The susceptibility of each site to contamination.

SWFWMD's Ambient Groundwater Quality Monitoring Program (AGWQMP) has prepared a detailed description of the groundwater quality within the District. Information for Charlotte County can be found in the "Southern Region," Section 2 of the report which provides information on the hydrology and hydrochemistry. Additionally, the report includes information on stratigraphy, structure, hydrostratigraphy, potentiometric surface, aquifer recharge, aquifer use, and groundwater quality. The collection of baseline data for this program began in 1985. Currently, 18 wells are located within Charlotte County including five in the surficial aquifer, ten in the intermediate aquifer, and three in the Floridan aquifer. These wells are sampled every three years on a phased schedule.

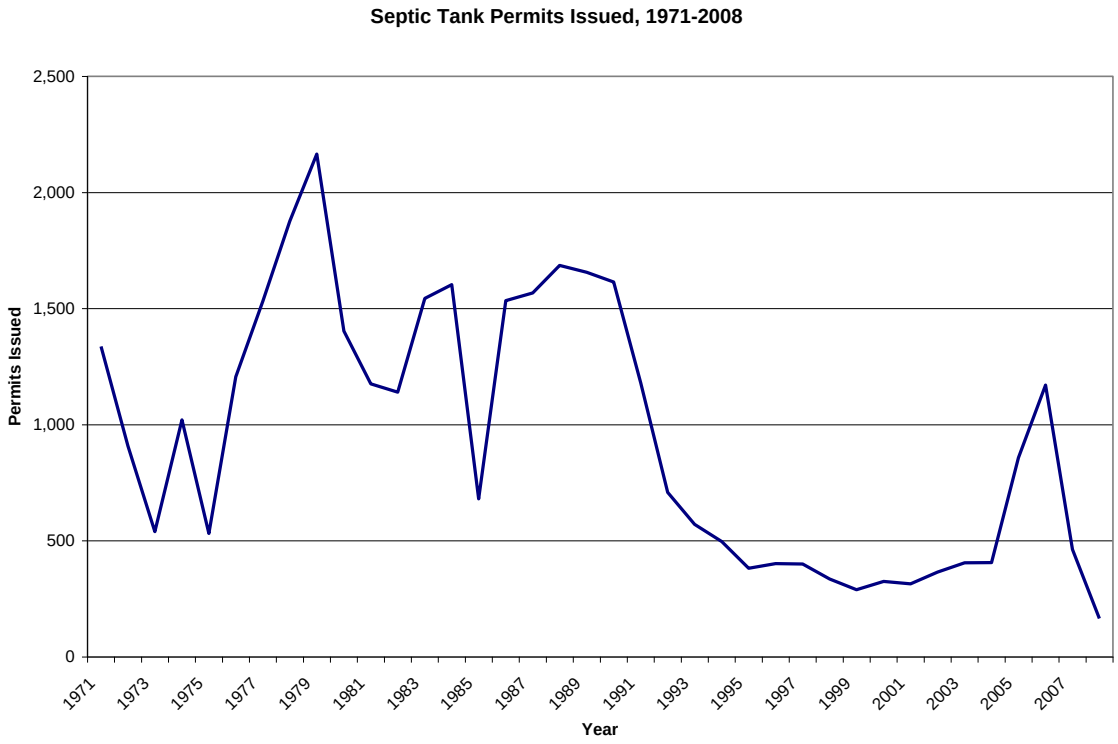
In 1974, SWFWMD began the Quality of Water Improvement Program (QWIP) to restore hydrologic conditions altered by well drilling activity. QWIP was initiated in Charlotte County where the problems with free flowing and abandoned artesian wells were the most severe and complex. QWIP continues to inventory and plug artesian wells in order to restore the aquifer system. As of 1996, QWIP has inspected 399 wells and plugged 210 wells in Charlotte County responsible for hydrologic connection between one or more artesian zones, or wasteful artesian flow. There are 142 wells needing to be addressed or already known to be in non-compliance. In 1994, SWFWMD began a funding assistance initiative designed to serve as an added incentive for property owners to come into compliance with well plugging requirements as stated in Chapter 373.206, F.S.. Wells located on agricultural land qualify for assistance through the Agricultural Stabilization and Conservation Service (ASCS). The ASCS offered 75 percent of the cost to plug a well, not to exceed $3,500 per year, per property owner. The District would fund the remaining 25 percent (not to exceed $5,000 per well).

In central and western Charlotte County, wells drilled into the intermediate and Floridan aquifers are artesian wells, since hydrostatic pressure of these confined aquifers is great enough to push water to the ground surface. As mentioned earlier, the Floridan aquifer has a greater mineral content than the intermediate aquifers, which, in turn, is more mineralized than the surficial aquifer. When a well is drilled into any artesian aquifer and the well is not encased, or is improperly constructed, or deteriorates, or free flows at the land surface, the poorer quality water of the deeper aquifers can leak or be injected into the less mineralized water of overlying aquifers. Thus, water quality in the overlying aquifers becomes degraded because that water is hydrologically connected to a deeper aquifer of lower water quality. Hydrologic connections between aquifers do occur naturally, as evident from artesian springs such as Warm Mineral Springs in Sarasota County. However, most of the major free flowing artesian wells in Charlotte County are the result of drilling.

Artesian wells that free flow at the surface accelerate aquifer contamination in two ways. In the first, uncontrolled discharge from the hydrostatic pressure of the artesian aquifer, accelerating the intrusion of even more highly mineralized water from the sea or deeper aquifers, and in the second, highly mineralized water discharged at the land surface results in artificial recharge of the surficial aquifer with poor water quality. Reestablishing the separation between aquifers by plugging sections of wells that allow hydrologic connection is crucial in eliminating inter-aquifer contamination.

Septic systems are recognized as both a major alternative to centralized sewage treatment plants and as potential polluters of groundwater, especially when not functioning properly. With non-ideal conditions, septic systems can contaminate the surficial aquifer with nitrate, total dissolved solids, bacteria, and viruses. Since most of the naturally occurring soils in Charlotte County are classified by the National Resources Conservation Service (formerly the U.S. Soils Conservation Service) as severe for septic tank use (US SCS, 1984), the suitability of using septic tanks to treat domestic sewage in some of the more densely populated areas of Charlotte County is questionable. The Charlotte County Environmental Health Unit of the Florida Department of Health has issued approximately 36,000 permits for septic tanks in Charlotte County since 1971, and estimates that there may be more than 45,000 septic tanks in use. Chart AQR-1 shows the number of permits issued annually from 1971 to 2008. While the trend has generally been towards a decrease in the number of permits issued annually, a spike occurred from 2004 to 2006, during the height of the housing boom of those years. Research by the Mote Marine Laboratory has documented a statistically defensible relationship between the decline of water quality and the increase in the total number of both in-ground septic systems and dwelling units.

Chart AQR-1 Septic Tank Permits Issued by Department of Health



Source: Charlotte County Health Department, Environmental Health Unit, 2009

Charlotte County's extensive coastal and estuarine shoreline provides for an equally extensive interface between the brackish surface water of the bays, harbor, and tidal creeks and the fresh water of the surficial aquifer. When natural conditions prevail, the surficial aquifer discharges fresh water into these estuaries, but with extreme drought conditions saltwater may intrude into the surficial aquifer along the coast. Pumping and draining the surficial aquifer in coastal areas creates an artificial drought-like condition through the withdrawal of the water, causing saltwater intrusion, or the lateral movement of saltwater within the permeable zones of the surficial aquifer. The construction of saltwater canals and drainage ditches has introduced saltwater farther inland, and so many of the manmade canals in Port Charlotte are now equipped with physical barriers to limit the inland extent of brackish tidal waters.

FUTURE CONDITIONS

WATER ISSUES

Water has historically been a cheap and readily available commodity in Florida, but in many areas that situation is changing. Population increases, combined with a prolonged drought, have placed

greater strain on the resource. The issues of water conservation and irrigation efficiency are essential considerations when planning to meet the expanding demands on the resource.

Charlotte County has limited potable surface and groundwater resources. Table AQR-2 shows a comparison of permitted capacities and withdrawals. For those potable water service providers that require a Water Use Permit (WUP) from the appropriate Water Management District, the WUP generally permits greater withdrawals than DEP permits to be treated for distribution. Approximately 13.551 million gallons per day (MGD) of the 38.582 MGD of permitted municipal water supply in the County is derived from groundwater sources and the remaining 25.031 MGD is derived from surface waters. About 2.700 MGD of groundwater is imported from the Englewood Wellfield in Sarasota County. Approximately 15.031 MGD of surface water is imported from the Peace River in DeSoto County and the City of Punta Gorda is permitted to withdraw about 10.000 MGD from the Shell Creek Reservoir in Charlotte County to serve users both within the incorporated boundaries of the City of Punta Gorda and in the unincorporated area of the County within the City's certificated area.

Table AQR-2 Water Use Permits

Provider	Department of Environmental Protection Permitted Amount (MGD)	Water Use Permit Permitted Amount (MGD)	Source
Bocilla Island Utilities	0.120	0.143	Groundwater
Charlotte County Utilities – Burnt Store	2.400	3.172	Groundwater
Charlotte County Utilities – Mid/West County	15.031	40.042	Surface water
Charlotte Harbor Water Association	0.750	0.712	Groundwater
City of Punta Gorda	10.000	8.088	Surface water
Englewood Water District(1)	2.700	2.412	Groundwater
Gasparilla Island Water Association	1.846	1.538	Groundwater
Town & Country Utilities	5.000	7.880	Groundwater
Alligator Park MHP	0.060	0.055	Groundwater

Source: Florida Department of Environmental Protection, Southwest Florida Water Management District, South Florida Water Management District, 2009

(1) The Englewood Water District has a permitted treatment capacity of 6.000 MGD and a WUP for 5,360 MGD. Approximately 45% of the EWD service population lies within the boundaries of Charlotte County, and the capacities of EWD have been adjusted accordingly.

Seven of the nine certificated potable water utilities in the County are required to obtain WUPs for their water sources. These amount to 64.042 MGD, although the 40.042 MGD WUP shown for Charlotte County Utilities in the Mid- and West County region includes the 32.700 MGD WUP assigned to the Peace River/Manasota Regional Water Supply Authority. Groundwater withdrawals account for 23.254 MGD of the permitted withdrawals, with the remaining 40.788 MGD involving withdrawals from surface water bodies.

As part of the County's Water Supply Facilities Work Plan, projected future increases in potable water demand in the County will be met through a combination of conservation, additional withdrawals from groundwater requiring local desalination and treatment, and additional surface water withdrawals requiring conventional treatment. The Peace River/Manasota Regional Water Supply Authority (PRMRWSA) facilities on the Peace River are projected to provide the major portion of the County's potable water supply through the sale to, and resale or distribution by Charlotte County Utilities (CCU). Public supply users of the intermediate aquifer include the Gasparilla Island Water Association, Charlotte Harbor Water Association, and Englewood Water District, all of which treat the water by reverse osmosis. CCU is also pursuing a Water Use Permit that would allow it to withdraw 12.500 million gallons per day from wells on the Babcock Ranch Preserve, within SFWMD's jurisdiction, and transport it to the South and Mid-County regions, within SWFWMD's jurisdiction, for distribution.

Although Charlotte County is not now experiencing an overdraft problem, there are areas of significant groundwater withdrawals. These areas include the Charlotte Harbor and Gasparilla Island wellfields. These areas should be closely monitored to protect aquifers from saltwater encroachment, increased mineralization, and impacts to the terrestrial environment.

The Peace River Reservoir is the only off-stream reservoir in the SWFWMD area. Unlike other utilities, the daily river water pumpage is not a reflection of daily water consumed by the public. Built in 1980, the PRMRWSA's Peace River facility holds 625 million gallons, and supplies water to Charlotte County, the City of North Port, and DeSoto County. While all of the available water produced for public supply comes from the Peace River, the PRMRWSA has an intricate system for insuring adequate supply throughout the year. The surface reservoir system is used for storing untreated water pumped from the river. The facility also uses an aquifer storage recovery (ASR) system for storing treated water pumped from the river. The current permit restrictions on the PRMRWSA facility state that they may not withdraw water from the Peace River if the river gauging station at Arcadia has declined below pre-established, monthly levels. Also, withdrawals may not exceed 10 percent of the preceding day's flow level as calculated at the Peace River Arcadia gauge station. To the greatest extent possible, the PRMRWSA fills its reservoir and ASR facilities to full capacity to insure water is available during times they are not permitted to withdraw from the Peace River. The combined daily average withdrawal (withdrawal from the river, its aquifer storage recovery system, and off-stream reservoir) for the PRMRWSA facility is 8.620 mgd, with a maximum daily withdrawal of 22.0 mgd from the river. The maximum daily combined withdrawal from their off-stream reservoir and ASR system is 17.2 mgd.

PROJECTIONS

Projections of permanent population levels indicate that Charlotte County's population will increase to approximately 236,422 by the year 2030 and 323,244 by the year 2050. Consequently, groundwater withdrawal rates are expected to increase to meet these growth

demands. Northeastern Charlotte County appears to be the most suitable for future groundwater supply development to meet these demands. Continued growth along with poor water quality, support increased conservation, water reuse, and demineralization as a basic water treatment process as well as the development of a supplemental water source in Charlotte County.