

# *Planning and Managing for a Sustainable Future*

## **GROUNDWATER SYSTEMS AND AQUIFER RECHARGE**

Pinellas County obtains most of its potable water supply from groundwater sources via Tampa Bay Water (TBW), the regional water utility. Groundwater is located in geological formations known as aquifers, which are made up of porous rock, sand or gravel. These porous materials can store water and allow it to move within the aquifer. Several aquifers may be present below the surface at any one location. These aquifers are separated by confining layers that are impermeable or semi-permeable to water.

Rainfall is the source of groundwater. Under the force of gravity, rainfall percolates downward through porous surface soils to enter the aquifer strata. The permeability of different soils varies greatly; however, soils with a high degree of permeability will allow a better aquifer recharge by allowing more rain to percolate through the soil. Permeability is typically measured in inches per hour which expresses how rapidly water will travel downward through a soil type. Examples of typical values in Pinellas County include highly permeable sands and relatively impermeable clays. See the discussion on soils earlier in this Element for a detailed description of soils.

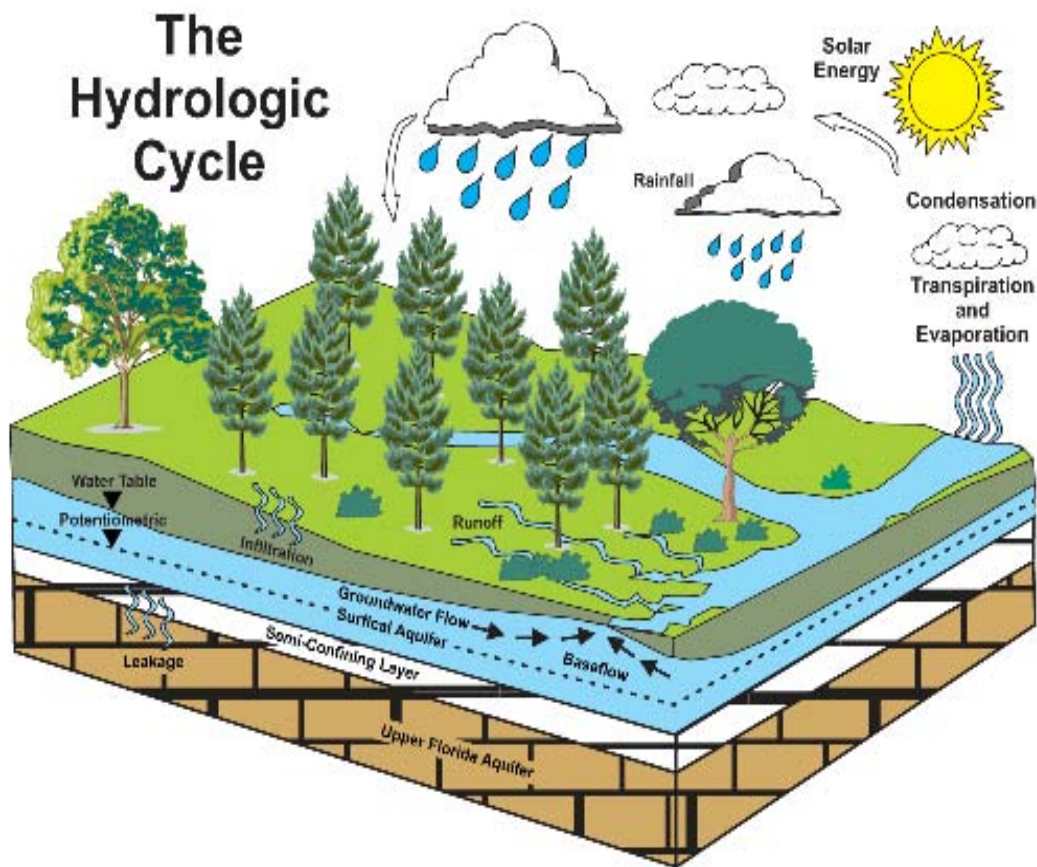
The groundwater system in Pinellas County is composed of three hydro-geologic layers. The top layer is the water table aquifer composed mostly of unconsolidated sands located at or near the ground surface. The lowest component is the Floridan Aquifer, which is found in the porous limestone underlying the County. Between these aquifers are the confining deposits composed of the finer grained sands and clays of the Hawthorn Group.

Aquifer recharge areas are subject to alteration by development. Covering a recharge area with impervious surfaces, such as roads, parking lots and buildings reduces the area available for rainfall percolation, altering the total rate and volume of recharge to the underlying aquifer. Increasing the rate at which stormwater is drained from recharge areas can also reduce recharge potential.

## **THE HYDROLOGIC CYCLE**

The hydrologic cycle is the process through which water moves from a surface water body to the atmosphere, to the land, and back to the water body. An understanding of the complexity and nature of aquifer recharge problems demands an examination of the hydrologic cycle. The source of much of the rain that falls on Pinellas County is air masses in the Gulf of Mexico colliding between sea breezes and easterly winds across the state. This occurs as air masses lying over the Gulf gain large quantities of moisture through evaporation. These air masses then move inward over the warm land surfaces. As the air rises, the moisture condenses, clouds develop and much of the water falls as precipitation. **Figure 12** below helps to demonstrate this process, known as the hydrologic cycle.

FIGURE 12



Rainfall, after reaching the County, is conveyed in two ways. First, the processes of evaporation and transpiration return a major part to the atmosphere. The water may return to the air as a result of evaporation from vegetation, streams, ponds, soils and the Gulf. It may also return to the air as a result of evaporation while falling, or through transpiration from vegetation. The remaining rainfall that does not run off directly to the Gulf or to streams and lakes percolates downward to the Surficial Aquifer. The Hydrologic Cycle continues as groundwater is eventually processed through the cycle and recharges the aquifer or evaporates, etc. This may occur as the groundwater passes to vegetation, to the soil from which it evaporates, to streams, or directly to the water body. Evaporation and drainage from the land are continuous processes, although they are variable in rate and amount. There is an endless sequence of additive and subtractive factors, which over a long period of time, must balance; that is, total inflow of rainfall must equal total outflow of water through evapotranspiration, runoff and aquifer recharge.

Pinellas County receives approximately 54 inches of rainfall in a year, with the heaviest rainfall occurring in the summertime. The average annual rainfall amounts can be unevenly distributed geographically, seasonally and annually. The mean annual rainfall, for the period of record, is 54.7 inches at St. Petersburg and 51.6 inches at Tarpon Springs. Rarely is annual rainfall less

than 35 inches or more than 70 inches. Rainfall shows a marked seasonal distribution in the Tampa Bay area with about 58 percent of the annual rainfall occurring from June to September. Most of the summer rainfall is associated with convective thunderstorms that are usually localized, of short duration, and which produce high intensity rainfalls. Tropical depressions and hurricanes may produce heavy rainfalls lasting several days during the summer and fall. Winter frontal systems may bring rain during the winter months.

Most rainfall is lost by evapotranspiration, and the chief factor affecting the evapotranspiration rate within the area is the depth to the water table. Because rainfall is variable in the region, the net recharge to the groundwater system is difficult to estimate at different times and at different locations. Localized recharge to the Floridan Aquifer directly through surface water bodies occurs in places where the confining layer is absent. Dredging the bottom of surface water bodies can therefore have an impact on the system.

Evapotranspiration in Pinellas County is estimated to be approximately 39 inches per year, with about 60 percent occurring from May to October. Average annual lake evaporation is estimated to be about 30 to 32 inches per year. A water budget for Pinellas County (see **Table 4**) was developed based on data collected in the County and on findings for adjacent counties. It is assumed that there is no change in the storage of groundwater in the surficial aquifer. The budget is based on the average annual rainfall of 53 inches, of which 25 inches returns from the land surface to the atmosphere as evapotranspiration and six inches flows directly out of the County as streamflow. The remaining 22 inches infiltrate to the surficial aquifer. Of the rainfall that reaches the surficial aquifer, six inches returns as groundwater discharge to streams, fourteen inches is evaporated or transpired from the water table, and only two inches percolate through to the underlying Floridan Aquifer. The U.S. Geological Survey, *Report 84-4289* indicates that recharge to the Florida Aquifer is probably more than two inches, because average runoff is probably less than 11 to 12 inches. In some cases, water from the Floridan Aquifer discharges as upward leakage (e.g., Wall Springs in Pinellas County).

**TABLE 4**  
**WATER BUDGET FOR PINELLAS COUNTY**

Evapotranspiration from land surface	25 inches
Direct runoff to streams	6 inches
Recharge to surficial aquifer	22 inches
Evapotranspiration from water table	14 inches
Contribution to base stream flow	6 inches
Vertical recharge to Florida Aquifer	2 inches*
<b>Average Annual Rainfall</b>	<b>53 inches</b>

Source: The Surficial Aquifer in Pinellas County, Florida. U.S. Geological Survey, Report 84-4289, page 13.

- Recharge rates in Pinellas County vary from two to 10 inches in the northern part of the County to zero to two inches in the southern portion of the County.

## GROUNDWATER AS A POTABLE WATER RESOURCE

In response to the concerns related to environmental impacts of groundwater pumping, and the need to ensure adequate potable water supply for the future growth and development of the region, the West Coast Regional Water Supply Authority was re-organized as a regional

water utility and became known as Tampa Bay Water, in 1998. This reorganization is the result of lengthy and historic negotiations between the six member governments (Hillsborough, Pasco, and Pinellas Counties, and the Cities of New Port Richey, St. Petersburg and Tampa). As part of the interlocal agreement adopted by the member governments, most of the potable water resources owned by the members were transferred to Tampa Bay Water with the exception of the City of Tampa, which maintained exclusive rights to surface water withdrawals from the Hillsborough River and Sulfur Springs (Tampa Bay Water may access these sources only when surplus flows are available), New Port Richey, which retained rights to several small urban wells, and Pasco County, which maintained rights to several small production wells. The 11 permitted regional wellfields were brought under a consolidated Southwest Florida Water Management District (SWFWMD) water use permit issued to Tampa Bay Water.

Since Oct. 1, 1998, Tampa Bay Water has been the sole and exclusive water provider to the six governments it serves. The main goals of the agency's creation were to reduce groundwater pumping from 11 long-producing wellfields, develop new water supply sources, end potable water litigation among various entities and obtain funding from the SWFWMD. Tampa Bay Water has successfully met those goals.

Tampa Bay Water is also charged with the responsibility of developing and implementing a Master Water Supply Plan to replace approximately 50% of the original permitted capacity of the regional wellfields and to meet the current and projected needs of the member governments. This Plan addresses the identification of and schedule for, implementing new sources of potable water and additional transmission mains for transfer of water between sources. The Interlocal Agreement effectively removed Pinellas County Utilities, and the other member governments, from water supply development activities, except for certain actions which may be undertaken if Tampa Bay Water fails to meet its obligations relating to production.

### ***Tampa Bay Water's Groundwater Supply Sources***

Tampa Bay Water obtains its potable water supply from a variety of sources. **Table 5** shows the various wellfields from which potable water is obtained by Tampa Bay Water:

**TABLE 5**  
**TAMPA BAY WATER CURRENT WATER SUPPLIES CHART (JAN. 2007)**

Wellfield Name	Year Placed in Service	Number of Wells	Location the Water Flows To	Well Location
Cosme-Odessa Wellfield	1930	23	Cosme Water Treatment Plant	Northwest Hillsborough County
Cross Bar Ranch Wellfield	1981	17	Cypress Creek Water Treatment Plant	Central Pasco County
Cypress Bridge Wellfield	1988 (2 wells); 1995-6 (8 wells)	10	Cypress Creek, Lake Bridge, and Morris Bridge Water Treatment Plants	Central Pasco/Hillsborough Counties
Cypress Creek Wellfield	1976	13	Cypress Creek Water Treatment Plant	Central Pasco County
Eldridge-Wilde Wellfield	1956	36	Keller Water Treatment Plant	Pinellas County/Hillsborough County border
Morris Bridge Wellfield	1978	20	Cypress Creek Water Treatment Plant via the Morris Bridge Booster Station or to Morris Bridge Water Treatment Plant	Northern Hillsborough County
Northwest Hillsborough Regional Wellfield	1985	7	Cosme Water Treatment Plant and Northwest Hillsborough Potable Water Facility	Northwest Hillsborough County
North Pasco Regional Wellfield	1992 (2 wells)	6	Moon Lake and Matum Water Treatment Plants	West Pasco County
Section 21 Wellfield	1963	8 (6 active)	Lake Park Water Treatment Plant	Northwest Hillsborough County
South-Central Hillsborough Regional Wellfield	1985	17	Lithia Water Treatment Plant	Northwest Hillsborough County
South Pasco Wellfield	1973	8	Cosme and Lake Park Water Treatment Plants	Pasco County/Hillsborough County Border
Starkey Wellfield	1976	14	Moon Lake and Matum Water Treatment Plants	West Pasco County

SOURCE: Tampa Bay Water's Special District Public Facilities Report for March 1, 2007 and TBW's web site at <http://www.tampabaywater.org/watersupply/currentsupplies.aspx#eldridgewilde> visited August 28, 2007.

Tampa Bay Water operates 12 wellfields. Pumping schedules are driven by the Optimized Regional Operations Plan (OROP). The OROP pumping schedules are designed to meet projected demand, maximize the surficial aquifer level, and comply with all regulatory restraints. Average Production Limits are generally no longer applicable with the OROP. Two exceptions are the South-Central Hillsborough Regional Wellfield and Brandon Urban, which are not under the OROP. Under a) the amended and restated interlocal agreement between Tampa Bay Water and its Member Governments, b) the Partnership Agreement between Tampa Bay Water, its Member Governments and the SWFWMD, and c) the Consolidated Water Use Permit for the 11 Northern Tampa Bay wellfields operated by Tampa Bay Water, submittal of an Optimized Regional Operations Plan (OROP) to the SWFWMD is required. Rotation of production of the 11 wellfields is governed by the OROP. Under the OROP, there are no average or maximum production limits.

Groundwater is capped at 90 mgd, therefore Pinellas County must work with Tampa Bay Water to concentrate on alternative sources for potable water. Tampa Bay Water supplements its groundwater supply with surface water and desalinated seawater. Water from Tampa Bay Water is delivered to members through a 66-mgd surface water treatment plant and the three sources that supply it, six groundwater treatment plants, 13 regional wellfields, intermittent service from a 25-mgd seawater desalination plant and almost 200 miles of pipeline.

Because Tampa Bay Water supplies wholesale potable water to Pinellas County via an interlocal agreement and master water supply contract, all potable water required by Pinellas County Utilities, except as otherwise provided by the agreement, is supplied by Tampa Bay Water. Tampa Bay Water has since taken over the ownership of all wells and permits previously held by Pinellas County and St. Petersburg as well as most of the facilities held by the other member governments.

In the event that a shortfall or production failure occurs, Pinellas County can respond with one or more of the following actions and alternatives: institute additional water conservation measures; halt or otherwise restrict the issuance of development orders and permits; develop new sources of potable water; purchase potable water from other suppliers; work with Tampa Bay Water, the SWFWMD and the affected local governments to develop a regional response to the situation; or use other actions as may be determined at the time of need.

### ***Groundwater Withdrawals***

The SWFWMD documents historical water use in an annual report entitled “Estimated Water Use in the Southwest Florida Water Management District.” Water use is analyzed according to six broad categories or types of use, including Public Supply, Domestic Self-Supply, Recreational/Aesthetic, Agricultural, Industrial/Commercial, and Mining/Dewatering. These categories generally correspond to the “predominate use” classifications used in the District’s water use permitting program. **Table 6** summarizes calendar year 2005 estimated water use for each use category for Pinellas County.

### ***Groundwater Recharge***

Since rain water percolating through the soil is the source for replenishing groundwater supplies, it is important that areas with high percolation rates be protected. These areas are known as recharge areas and have a direct influence on the quality and quantity of water within the aquifer. Measures should be taken to ensure that the natural conditions of the recharge area (i.e., soil type, vegetation, amounts of impervious surfaces, pollution sources) remain relatively unaffected by human activities. Any detrimental changes to recharge areas could interfere with their proper hydrological function.

According to the SWFWMD’s groundwater resource availability inventory for Pinellas County, it appears that recharge to the Florida Aquifer is along the uplands of the Pinellas ridge and Northeastern Pinellas County. The area east of Lake Tarpon is influenced to a certain extent by draw down from the Eldridge-Wilde wellfield. This recharge area is separated from the Clearwater/Dunedin recharge area by Lake Tarpon and the Lake Tarpon outfall canal. Lake Tarpon is probably part of a discharge area due to its connection with the Floridan Aquifer. The Lake Tarpon outfall canal is a relatively recent addition to the hydrologic system.

**TABLE 6**  
**SUMMARY OF TOTAL WATER WITHDRAWALS/USE (MGD)**  
**FOR PINELLAS COUNTY, 2005**

Type of Withdrawal/Use	MGD
Agricultural	0.243
Industrial/Commercial	0.037
Mining/Dewatering	0.00
Public Supply (Withdrawal)	23.059
Domestic Self-Supply	1.089
Recreation / Aesthetic	3.012
<b>Total Withdrawal</b>	<b>27.440</b>

Note: 2005 data are estimated number from the SWFWMD Regulatory Database, 2005, as reported in the SWFWMD's 2005 Estimated Water Use Report. As of October 2007, this is the latest-available report.

The Clearwater/Dunedin recharge area found west and south of Lake Tarpon exists primarily because of limestone formations overlain by relatively thin sinkhole perforated clay deposits and sands. The potentiometric surface is relatively high in this area and is found near the Coachman and Countryside areas of Clearwater. These highs represent a high water level in this area and have great potential for sustainable water withdrawals. Curlew Creek, with its deep stream bed, partially divides the north and south portion of the recharge area in the western portion of the County. Since much of the recharge in this area is derived from sinkholes, land use management practices must prevent contamination and alteration of these features, especially those in internally drained areas.

The upland St. Petersburg area has also been identified as a recharge area. Very few individuals use wells in this area as a source of potable water, and most use this groundwater for lawn irrigation. See **Figure 13** for a graphical depiction of aquifer recharge areas in Pinellas County.



## ***Groundwater Contamination***

One concern related to development within aquifer recharge areas is the potential for contamination of groundwater within the aquifer. Just as storm water runoff can carry pollutants into surface water, pollutants picked up by runoff which eventually enters an aquifer can degrade groundwater quality. Since water moves within an aquifer from higher pressure to lower pressure, down gradient portions of the aquifer have the potential to be polluted over time.

Pinellas County Utilities purchases 100 percent of its water from Tampa Bay Water. The Department of Environmental Protection has performed a Source Water Assessment on the TBW system. These assessments were conducted to provide information about any potential sources of contamination in the vicinity of their wells or surface water intakes. The assessment results for TBW are available on the FDEP Source Water Assessment and Protection Program (SWAPP) webpage at [www.dep.state.fl.us/swapp/](http://www.dep.state.fl.us/swapp/).

Contaminants that may be present in source water include:

- a) Microbial contaminants, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.
- b) Inorganic contaminants, such as salts and metals, which can be naturally occurring or result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming.
- c) Pesticides and herbicides, which may come from a variety of sources such as agriculture, urban stormwater runoff, and residential uses.
- d) Organic chemical contaminants, including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, and septic systems.
- e) Radioactive contaminants, which can be naturally occurring or the result of oil and gas production and mining activities.

Pinellas County Utilities provides a detailed listing of potential contaminants in its Consumer Confidence Report, available online at the following webpage address: [www.pinellascounty.org/utilities/documents/CCR2005.pdf](http://www.pinellascounty.org/utilities/documents/CCR2005.pdf).

## ***Potential Sources of Contamination***

Saltwater intrusion- Excessive pumping can result in saltwater intrusion by reducing the normal outward flow of groundwater, which allows saltwater to flow into the aquifer. Since chloride exists in brackish water and seawater, monitoring the movement of chloride is an important factor used to identify the potential for saltwater intrusion. Chloride levels in the Gulf of Mexico are approximately 19,000 milligrams per liter (mg/l), and approximately 12,700 mg/l in Old Tampa Bay. Tampa Bay Water's June 2007 Comprehensive Annual Ecological Monitoring and Environmental Assessment Report indicated the 250 mg/l isochlor, which is the recommended upper limit of chloride for drinking water supplies, existed generally to the east of Lake Tarpon within the Floridan aquifer.



**FIGURE 13**  
**AQUIFER RECHARGE AREAS IN PINELLAS COUNTY**

Abandoned Wells- If abandoned wells are not properly grouted or capped they can become a source of groundwater contamination by providing a direct link to the aquifer system. Groundwater contamination can occur when abandoned wells are used for illegal dumping sites, or when they receive polluted surface water runoff. Pinellas County Utilities has not identified any problems with abandoned wells in its wellfield area.

Landfills- The disposal of municipal and industrial waste on the land may be a major source of groundwater contamination, especially if landfills are not lined or if the water table is high. As precipitation percolates through refuse, organic and inorganic substances can leach contaminants into the groundwater system. No landfills are located in the vicinity of the Eldridge-Wilde Wellfield.

Accidental Spills - Accidental spills of hazardous materials are a very serious threat to groundwater quality. Spills from tanker car accidents, pipeline ruptures, underground storage tank leaks and improper storage and handling may all contaminate groundwater. Several clean up techniques, such as soil removal, trenching and skimming, biodegradation of petroleum, and in place detoxification have been successful for these types of contamination.

Sinkholes - When surface waters are sinkhole lakes there is a direct connection between the surface and the groundwater aquifer. Contamination of sinkhole lakes, from storm runoff and other sources can pass into the aquifer.

Other potential sources of groundwater contamination include stormwater runoff and on-site sewage disposal systems. However, with proper regulation, potential groundwater contamination can be minimized.

As stated in the Southwest Florida Water Management District (SWFWMD) publication "Groundwater Resource Availability Inventory," there are several methodologies to evaluate the susceptibility of groundwater contamination. One method is the mapping of areas susceptible to ground water contamination utilizing USEPAs recently developed DRASTIC methodology. The USEPAs (United States Environmental Protection Agency) objective in developing the DRASTIC methodology was to produce a product that would permit groundwater pollution potential of any hydro geologic setting, greater than 100 acres in size, to be systematically evaluated with existing information.

DRASTIC maps are constructed by individually mapping variations of the seven DRASTIC parameters (example: mapping areas in a County where depth from land surfaces to the water table is 0-5 feet, 5-15 feet,..., or greater than 100 feet). The variations in the seven mappable parameters are then assigned ratings. In the case of depth to water in an area, 0-5 feet are assigned a rating of 10, 5-15 feet a rating of 9, and a depth of water greater than 100 feet a rating of 1. In addition to ratings, each of the seven parameters is assigned a weight relative to their importance of restricting the potential for the groundwater system to become contaminated. The weights of the seven mappable parameters are as follows:

PARAMETER	WEIGHTING FACTOR
<u>D</u> epth to Water	5
net <u>R</u> echarge	4
<u>A</u> aquifer media	3
<u>S</u> oil media	2
<u>T</u> opography	1
<u>I</u> mpact of the vadose zone	5
Hydraulic <u>C</u> onductivity	3

Note: The reader should be very cautious with utilization of DRASTIC methodology. The methodology was developed to be applied universally. Due to the unique hydro geology of west-central Florida, the DRASTIC methodology can provide misleading results. Particularly, the competency of the clays overlying the intermediate and Upper Floridan aquifers is, in most cases, less than found in typical clay units, primarily due to breaching. However, if interpreted by a qualified professional, the DRASTIC maps can be an effective reconnaissance tool to assess contamination potential to the groundwater system.

Once the seven parameters are individually mapped and assigned ratings, the seven maps are superimposed, and composite DRASTIC areas are formed. These composite areas are assigned DRASTIC indices. These indices are the sum of the products of the ratings and weights of the seven parameters for the individual composite areas. Lastly, DRASTIC indices of the composite areas are grouped in categories for ease of map discernibility. These categories are listed below:

Category

200+  
180-199  
160-179  
140-159  
120-139  
100-119  
80- 99  
79 and below

The higher the DRASTIC index, the greater the groundwater pollution potential. DRASTIC methodology is designed to yield a relative numerical value which can readily be compared to a value obtained for another setting either in the same region or in a different region. A numerical value of 160, for example, has no intrinsic meaning. That number is of value only with respect to other numbers generated by the same DRASTIC index (Aller and others, 1985). For a thorough discussion of the construction and interpretation of DRASTIC maps, refer to USEPA/600/2-85/018, May 1985.

SWFWMD has prepared DRASTIC maps for the surficial and Floridan aquifers in Pinellas County. In general, the Floridan aquifer in Pinellas County has a moderate to low degree of susceptibility to ground water contamination. A general trend in DRASTIC pollution potential is

noticeable from north to south corresponding to the degree of aquifer confinement. In the northern portion of the County, the Floridan aquifer is essentially unconfined and DRASTIC indices are as high as 184. In the southern areas of Pinellas County, the Floridan aquifer is overlain by a confining unit. Under confined conditions, the DRASTIC methodology reduces the values of certain parameters such as the impact of the vadose zone, soil media, topography, and depth to water. These lowered DRASTIC numerical values account for the less potential contamination observed in the southern portion of the County. DRASTIC indices in this area of Pinellas County are as low as 53.

### ***Northern Tampa Bay Phase II (NTB II)***

The Southwest Florida Water Management District has developed the “Northern Tampa Bay Phase II” project. In 1996, the District published the final report of a multi-year study which assessed the regional water resources of the Northern Tampa Bay area. This study, known as the Northern Tampa Bay Water Resources Assessment Project (NTBWRAP), was an effort to better understand the current state of the water resources of the area, as well as to provide the foundation for future, more detailed, hydrogeologic and biologic studies.

Since that time, the District has entered into a Partnership Agreement with Tampa Bay Water and its member governments to reduce ground-water withdrawals in the area from 158 mgd to 90 mgd by 2007. Additionally, the District has established a Minimum Flows and Levels Rule (40D-8), which includes minimum levels for cypress wetlands, lakes, and aquifers.

As a follow-up to previous hydrologic and biologic analyses performed in the Northern Tampa Bay area, the Southwest Florida Water Management District has launched a new program known as Northern Tampa Bay Phase II program (NTB II).

The NTB II program includes a Scope of Work that will be updated annually. Public agencies and the general public are encouraged to read the document and provide any comment. The District’s goal is to produce a comprehensive plan that will provide the necessary scientific information to support regulatory and planning activities through 2010, and allow for optimizing the water supply in the region while providing protection and recovery of the natural systems.

### ***Water Conservation as a Means of Reducing Groundwater Withdrawals***

Because groundwater withdrawal is capped at 90 mgd, Pinellas County has developed a variety of tools for offsetting the use of groundwater. Pinellas County Utilities has developed an extensive reclaimed water program, for example. The use of reclaimed water for irrigation helps to significantly reduce the use of potable water. This indirectly helps to reduce the amount of groundwater withdrawals. For a detailed discussion about reclaimed water in Pinellas County, please refer to the *Potable Water, Wastewater and Reuse Element* of this Comprehensive Plan.

Pinellas County Utilities also has an extensive water conservation program and has developed and promoted numerous conservation programs and initiatives for customers. These programs have included educational outreach efforts as well as incentives and special events designed to highlight the importance of conservation and waste reduction. Education targeting potable water conservation, for example, has been a major initiative of Pinellas County Utilities. Irrigation restrictions, landscaping regulations, shallow well requirements, water

saving plumbing, a Commercial & Industrial Water Use Program, an Alternate Water Sources Rebate Program, Community “Water Wise” Awards, an Ultra Low Flow Toilet Program, Water Saving Kits, Free Indoor Plumbing Retrofit kits, Hotel/Motel Conservation Initiatives and Public Service and Information Newsletters are a few of the conservation programs and initiatives Pinellas County Utilities has utilized in conserving the region’s precious potable water resources. For more detailed information about water conservation programs in Pinellas County, please refer to the *Potable Water Supply and Reuse Element* of the Pinellas County Comprehensive Plan.

### ***Pinellas County Wellhead Protection Efforts***

Because Tampa Bay Water operates the wellfields from which potable water for Pinellas County is withdrawn, Pinellas County relies upon and coordinates with Tampa Bay Water to assess groundwater quality and the impacts of groundwater withdrawals. Nonetheless, it is Pinellas County’s policy that it will continue to enforce zones of protection for regional wellfields within Pinellas County boundaries, consistent with the adopted wellhead protection ordinance, as determined by a flow net analysis based on the Floridian Aquifer potentiometric surface.

The Pinellas County Board of County Commissioners has adopted a Wellhead Protection Ordinance. This ordinance was implemented to protect and safeguard the health, safety, and welfare of the residents and visitors of Pinellas County by providing criteria for regulating certain substances that may impair present and future public potable water supply wells and wellfields. It prohibits or restricts all non-residential activities that use, handle, produce, dispose, and/or store regulated substances within the Zone of Protection, except as provided under the General Exemption and Special Exemption provisions of the Ordinance. Residential activities and stormwater ponds are also regulated by this ordinance. Certain activities in non-compliance with this ordinance may be required to cease operation.

Pinellas County is committed to conserving its natural resources by developing policies designed to protect groundwater and natural systems by protecting groundwater, public supply wellheads and the watershed from substances that might cause degradation of the aquifer or system losses. Pinellas County will continue to control the use and storage of hazardous substances within its zone of protection for its wellfields through implementation of the wellhead protection provisions of the Pinellas County Code. Furthermore, Pinellas County will continue to utilize its emergency response program that includes provisions for responding to accidental pollution events and providing a list of toxic and hazardous substances subject to the restrictions of the program, and shall require that businesses within the wellhead protection zone include emergency response measures within their operating permits.

### ***The Wellhead Protection Zone***

Pinellas County’s Wellhead Protection Program creates a Zone of Protection around the Eldridge-Wilde wellfield. The wellfield is located in northeastern Pinellas County and northwest Hillsborough County, bordered on the north by Pasco County (see **Figure 14**). The Board of County Commissioners decided in the 1970s that since the area surrounding the wellfield was mostly undeveloped, the most direct way to offer protection to the groundwater resource was through the acquisition of land and the establishment of land use controls.

FIGURE 14  
WELLHEAD PROTECTION ZONE

The Zone of Protection was defined by hydro-geologic studies to identify and describe the aquifer that is present in the wellfield areas, and potential yields were estimated. The rate and directions of the groundwater flow were also established in order to understand the impact of contaminants introduced to the aquifer. The Zone was determined by obtaining historical water level data from the U.S. Geological Survey and PCU monitoring wells. Potentiometric surface contours were constructed based on average water levels, and a flow net was developed by drawing flow lines perpendicular to the potentiometric contours. The flow net identifies the Zone of Contribution to the wellfield. The Zone of Protection for the Pinellas County wellfield encompasses portions of Pinellas, Pasco, and Hillsborough.

Land use intensity and density in this zone were reduced. Pinellas County Utilities began to acquire vacant land in the vicinity of the wellfield and subsequently applied a Preservation, or Preservation-Resource Management land use designation, in order to allow for expansion and/or relocation of potable wells and to protect the recharge areas of the existing wellfield.

Additional protections offered by the Ordinance include requiring existing commercial users that use, handle, produce, store or dispose of regulated substances to obtain permits, with annual renewal and inspection requirements. Commercial or industrial septic tank disposal systems are also prohibited. Underground storage facilities, stormwater discharge, commercial stormwater runoff, and golf courses are also regulated. The ordinance also provides for interlocal agreements regarding the protection of potable water supply wells and wellfields, although to date, no official agreements have been reached.

### ***Pinellas County Pollution Prevention Program***

Pinellas County developed a pollution prevention program to minimize the amount of liquid, solid and gaseous pollutants throughout the County, which further enhance groundwater quality. In this voluntary program, County staff works with private industry to help them identify pollution prevention methods that can be incorporated into their normal business practices, including the use of new technologies, substitute products, conservation practices, efficiency enhancements and recycling. The overall goal of the program is for industry to reduce costs by utilizing practices that benefit the environment.

### ***Multi-Jurisdictional and Multi-Agency Cooperation***

Pinellas County has not formally adopted interlocal agreements regarding Wellhead Protection or groundwater protection, with adjacent counties; however, the County cooperates with adjacent municipalities and counties. Pinellas currently shares information with both Pasco and Hillsborough counties when proposed land use changes are within a one mile of the respective County lines. Pinellas County, along with the City of St. Petersburg, receives notices from both Pasco and Hillsborough counties regarding proposed development, changes in land use and rezoning, usually within one mile of the County boundary. Pinellas County also supports wellhead protection ordinances in Hillsborough and Pasco Counties to protect existing and future public potable water supplies.

Pinellas County participates in several cooperative efforts to promote enhancement and restoration of the County's groundwater resources. These opportunities for conservation include joint efforts with the SWFWMD, the Florida Department of Environmental Protection's Pollution Recovery Trust Fund, and the Pinellas Anclote Basin Board's Cooperative Funding Program.



# NATURAL SYSTEMS AND LIVING RESOURCES – AN ECOSYSTEMS APPROACH

## ECOSYSTEMS MANAGEMENT

The Natural Resources and Conservation Management Element provides a policy framework for ecosystem planning and management strategies affecting the County's natural resources. Pinellas County is a highly urbanized area and, as such, requires strategies for maintaining and restoring its remaining natural resources. The limited amount of undeveloped land and rapid pace of development in Pinellas County require that local governments take measures to conserve, protect and appropriately manage their natural systems. Environmental planning and management has been, and will continue to be, an important component of the County's growth management program.

Ecosystems management is a concept that requires activity coordination at all levels, including government planning, land management, environmental regulatory programs, volunteer programs, and the general public for the protection of Pinellas County's natural environment. Through the use of this kind of coordinated approach, several other activities have been identified as being essential to seagrass recovery in Pinellas County. The recovery of seagrasses will require (1) reductions in pollutants; (2) limiting physical damage; and (3) the education of boaters and fishermen about the importance of seagrasses and their role in preserving this essential habitat.



*Delicate Dune System in Pinellas County*

In the past, vegetation and wildlife were destroyed or degraded by development practices. It is not realistic to attempt restoration of all of the environmental features that the County once possessed. In light of these facts, an integrated systems approach to environmental planning and management has been implemented in order to effectively manage the complex interactions between human and natural systems in Pinellas County. The natural and human environments are interconnected systems that must be managed in a manner that is sustainable and adequate for both communities.

The preservation and restoration of natural systems will not only improve the environmental quality of the County, but also result in more cost effective performance of urban functions such as water purification, flood damage protection, stabilization of water course banks, aquifer recharge, and air quality maintenance. The County is currently involved in several initiatives designed to protect and enhance naturally functioning systems.

### ***Environmental Initiatives***

The programs discussed below represent a few of the environmental conservation initiatives underway within the County that are based on a systems approach to environmental

management. The development of watershed management plans, the Brooker Creek Preserve, the Seagrass Protection Initiatives, and the County's Parkland and Endangered Lands Acquisition Program are examples of the County's commitment to managing its resources in a comprehensive manner. They also serve as useful models for identifying and recommending future planning strategies for the preservation and restoration of the County's natural resources.

### Watershed Management Plans

One example of ecosystems management in Pinellas County is the development of Watershed Management Plans as an addition to the Surface Water Planning Program in Pinellas County. These plans were developed with more than just flooding and drainage issues in mind. Watershed management plans took a holistic approach to watershed planning, including the protection of natural systems and resources, and drainage concerns. As of 2007, Allen's Creek, Lake Tarpon, Lake Seminole, Cross Bayou, Roosevelt Creek, Brooker Creek and Starkey watersheds have been selected for the development of a watershed management plan, based on impaired water quality levels identified during monitoring. Allen's Creek, Lake Tarpon and Lake Seminole watershed management plans were completed first and are being used as prototypes for the development of the future watershed management plans for the County's remaining basins and waterbodies. Watershed management plans have also been developed for Alligator Creek and Stevenson's Creek. Completed in 1997, the Alligator Creek Plan was developed in a partnership between SWFWMD, Pinellas County, Clearwater and Safety Harbor. The Stevenson's Creek plan was completed by the City of Clearwater in 2001.

The development of these plans involved the coordination of a number of various agencies and stakeholders, including environmental groups, private citizens, and government agencies. More detailed information on watershed management plans can be found in the *Surface Water Management Element* of this Comprehensive Plan in the Watershed Planning section.

### Environmental Land Management Plans

These are another example of ecosystems management in Pinellas County. Currently, there are three environmental land units with Management Plans in the County. These management plans were designed to provide policy direction to stakeholders for the protection of the environmental lands of the County from the intended and unintended consequences caused by the utilization of the lands by residents and visitors to the County.

The **Brooker Creek Preserve** is comprised of approximately 8,800 acres of undeveloped land in the northeastern corner of Pinellas County. The Pinellas County Board of County Commissioners and the Southwest Florida Water Management District have set aside this land in order to preserve the quality of life for the citizens of Pinellas County. One of the missions of the Preserve is to create the opportunity for County residents to experience, understand, and enjoy native Florida. The preservation of this region will also help to protect groundwater supplies in the County's Eldridge-Wilde wellfield, surface water quality entering Lake Tarpon, and a wealth of native plants and animals. In addition, it will provide an exceptional opportunity for public environmental education programs and research.



**Brooker Creek**

The property currently includes approximately 7,200 acres owned or leased by Pinellas County, and almost 1,589 acres owned by the Southwest Florida Water Management District (SWFWMD). Located within unincorporated Pinellas County and the City of Oldsmar, the large tracts of land that form the Brooker Creek Preserve provide the natural ecosystem required to support a wide variety of trees, shrubs, grasses, fish, insects, reptiles, amphibians, birds and mammals. The Preserve will also provide aesthetic, recreational, aquifer recharge, and noise reduction benefits to residents of the surrounding area.

The Brooker Creek Preserve Management Plan, designed to provide a framework to guide the early development of the Preserve, was prepared by the University of South Florida for the Pinellas County Department of Environmental Management in 1993, and the Brooker Creek Watershed Management Plan is currently under development, due for completion in 2008. Several recommendations of the Management Plan have been implemented including an annual update of the Management Plan, ongoing environmental education about the Preserve, structural hydrological improvements, and the development of an Environmental Education Center. Pinellas County and the City of Oldsmar have designated the land within the Brooker Creek Preserve as Preservation and Preservation-Resource Management on their respective Future Land Use Map.

The Brooker Creek Preserve Management Plan has provided direction to the County's future efforts in environmental education, biological research, and public use. The Environmental Education Center provides innovative programs aimed at teaching the public about Florida's diverse natural systems. A companion research center will allow scientists from across Florida to study the Preserve's unique resources. This research will provide data to guide environmental management efforts throughout the County. The Brooker Creek Preserve Management Plan has resulted in a committed program of environmental education and human interaction with ecosystem components and processes. Recognition of Pinellas County's fragile ecosystems is the first step toward long term protection and wise management of our natural resources.



*Sandhill Cranes in the Brooker Creek Preserve*

The approximately 1,800 acre **Shell Key Preserve** protects sensitive marine habitats and includes one of the County's largest undeveloped barrier islands and numerous unnamed mangrove islands. The Preserve allows for both diverse wildlife habitat and provides recreational opportunities. The Preserve has been designated as one of the State's most important areas for shorebird nesting and wintering and is being restored for migratory songbird habitat. In 2007, the Pinellas County Board of County Commissioners adopted an update to the 2000 Shell Key Preserve Management Plan, providing direction for the future management and public use within the boundaries of the Preserve. According to the Plan, as of 2007, 117 species of birds have been observed and over 169,000 individual birds counted within the Preserve, including the Least Tern and the American Oystercatcher. Other wildlife has been observed in the Preserve as well, including the manatee, the bottlenose dolphin, the occasional sea turtle, butterflies, moths, marsh rabbits, raccoons, and three non-venomous snakes. The same features that attract a diverse wildlife and vegetative population, also attracts thousands of human visitor annually. The challenge for Pinellas County is to balance the demands for recreation in the Preserve, including camping, boating, swimming, shelling,



and fishing, with the high level of sensitivity to the management of natural resources in the Preserve. For example, 2,800 people and 350 boats were counted at the northeast tip of the Preserve by noon on Sunday during the Memorial Day Weekend in 2006. Such pressures from crowds seeking recreation have put a strain on the Preserve in terms of water quality and wildlife protection. The 2000 Management Plan proved to be a somewhat satisfactory tool for the protection of the Preserve, but increasing pressures from the surrounding community led to the need for increased protections. The updated management plan prohibits alcohol consumption, restricts camping and prohibits dogs from the Preserve boundaries.

The **Weedon Island Preserve** is the second largest preserve in Pinellas County at over 3,000 acres. In 2002, Pinellas County developed a Management Plan for this Preserve, with the goal of effectively coordinating the management of the site's ecological and cultural resources using methods that promote public education and encourage compatible recreational activities. This plan serves as the basic statement of policy and direction for the management of the Weedon Island Preserve and the Gateway Tract as a unit of Pinellas County's Environmental Lands Division. This plan provides the detail necessary to effectively manage the property to promote indigenous species use (with emphasis on listed species), to maintain a temporal and spatial ecological diversity through the application of management tools (e.g., prescribed burns, removal of exotic species), to protect the site's rich array of cultural resources, to continue to identify, and then encourage compatible recreational land uses, and to encourage the promotion of restoration, education, and research.



*Aerial View of Weedon Island Preserve*

### Seagrass Protection Initiatives

A third example of ecosystems management in Pinellas County is the several Seagrass Protection Initiatives that are currently underway in the County's marine waters. Seagrass Protection Areas have been established by County ordinance at Fort DeSoto Park, and by State statute at Caladesi Island, Honeymoon Island and Anclote Key State Parks. These partly submerged lands have traditionally been managed for public recreation and navigational purposes. The Seagrass Protection Initiatives add ecosystems protection to these traditional management objectives.

In 1992, the Pinellas County Board of County Commissioners, acting as the Pinellas County Water and Navigation Control Authority, took action to preserve and protect the fragile seagrass beds and marine resources associated with the submerged lands surrounding Fort DeSoto Park. The Fort DeSoto Park Wetlands and Aquatic Habitat Management Ordinance designates a portion of Fort DeSoto Park as an Aquatic Habitat Management Area. The designated area includes land from Indian Key in the north to Fort DeSoto Park in the south. This ordinance provided for the development of a Seagrass Recovery Program.

Management Areas controlling the use of internal combustion engines were established for seagrass protection. These measures were, and continue to be, consistent with the Pinellas County Comprehensive Plan, which provides for the protection of the County's marine resources, enhancement of its public recreation resources, and management of the County's natural resources.

In the spring of 1993, all Seagrass Caution Areas were marked with buoys, pilings and signs, informing boaters of restrictions regarding boating activities. Large interpretative signs have been erected at major area boat ramps to inform boaters of the location and requirements of individual seagrass protection zones. The area is divided into "Seagrass Caution Zones" and "Boat Restriction Zones". By early 1998, Pinellas County had completed updates and adopted significant revisions to the Comprehensive Plan to support such measures as enforcing no-wake zones and seagrass protection areas, and providing manatee caution signage. The Pinellas County Sheriff's Office and the Florida Marine Patrol are responsible for enforcing the requirements of the various zones. They are authorized to issue warnings and fines if necessary.

Pinellas County also provides aerial photographs and technical information to the State seagrass initiatives in the Honeymoon Island/Caladesi Island State Park area. The extent of seagrass coverage in all areas of Tampa Bay is currently being monitored by the Southwest Florida Water Management District's Surface Water Improvement and Management Program (SWFWMD-SWIM) every two years. Field examination is also being performed to ensure accuracy and provide additional information on the effects of bottom composition and water clarity on seagrass coverage. The Pinellas County Department of Environmental Management exchanges seagrass information with the SWFWMD on an ongoing basis.

An Environmental Protection Agency (EPA) grant was obtained through the Tampa Bay Estuary Program to help fund data collection and conversion for use in the County Geographic Information System (GIS). The results of this project so far, indicate that the Fort DeSoto Park Management Area has been very effective in reducing the rate of seagrass scarring. The County took the first detailed aerials in 1992 to gather baseline data prior to installing signs delineating the areas or enforcing the seagrass protection ordinance. Signs were installed in 1993 and aerials were taken on at least an annual basis thereafter. The aerials were then digitized and analyzed to determine the scar rate within each type of the protective areas (non-combustion and seagrass caution) and compared them to the unprotected areas. The County has tracked the prop scar rate over the years and had successfully slowed the increase in accumulated damage.

Hindering the project's success was the fact that many signs were lost after the first few years. What was once thought to be vandalism turned out to be a galvanic reaction of bird droppings, salt water and dissimilar metals corroding the sign attachment points. Eventually strong winds would pull the signs off the poles. Revised sign mounting methods resulted in minimal loss of new signs. Better signage, as well as more enforcement, education and experimental seagrass re-growth efforts have resulted in a significant reduction in seagrass scars in the Ft. DeSoto area.

These successes, and the fact that the Caution Areas have been about as effective as the Non-Combustion Areas in protecting the seagrass, resulted in modifications to the Zones. The Board of County Commissioners recently approved modifications within the Ft. DeSoto Habitat Management Area that change some zones from "Non-Combustion" to "Caution". More significantly, large areas that previously had no protection were designated as "Caution" areas. Discussions are also continuing to extend the seagrass re-growth experiments that have been successful in this area. These efforts should provide faster and more complete recovery of this valuable resource.

## ***Closing the Gaps in Florida's Wildlife Habitat Conservation System***

In 1994, the Office of Environmental Services, Florida Game and Fresh Water Fish Commission (now the Florida Fish and Wildlife Conservation Commission – FFWCC) published the report "Closing the Gaps in Florida's Wildlife Habitat Conservation System". This report describes habitat areas in Florida that should be conserved if key components of Florida's biological diversity are to be maintained. Lands recommended for additional environmental protection were mapped for the report and are referred to as Strategic Habitat Conservation Areas. A separate set of maps, referred to as Regional Biodiversity Hot Spots maps, were created to display the following information: areas where large numbers of 52 selected focal species co-occur; areas supporting rare plant and wildlife communities; county boundaries and conservation land boundaries; and coastal areas that support key components of biological diversity. A third map series identifies Priority Wetlands for Listed Species. These maps, included within the Future Land Use Element, can be used as supplemental information in making decisions guiding land acquisition, land conservation, land-use planning, and regulatory programs.

The report lists Northeast Pinellas County under Area 5 for the Tampa Bay Region. In this area, the focal species recorded as occurring include the Florida mouse, the fox squirrel, the southern bald eagle, the little blue heron (rookery), the limpkin, the sandhill crane, the eastern indigo snake, and the Tampa vervain. In the North Pinellas County Coastal Area, the



sandwich tern (rookery), least tern (nesting), tricolored heron (rookery), great egret (rookery), reddish egret (rookery), brown pelican (rookery), snowy egret (rookery), American oystercatcher, Wilson's plover, mangrove cuckoo, shorebird aggregation areas, gopher tortoise, hairy beach sunflower, and necklace pod are found. In the Southern Pinellas County Coastal Area, the sandwich tern (nesting), American oystercatcher, Wilson's plover, hairy beach sunflower, Tampa vervain, and the Sanibel lovegrass are found.

### ***An Endangered Gopher Tortoise***

Caladesi Island, Honeymoon Island, Anclote Key, and Three Rooker Bar are included in a Strategic Habitat Conservation Area proposed by the report for the Cuban snowy plover. Since this area is already under State ownership, the additional environmental measure recommended for this area would be to restrict recreational activities near nesting areas. According to the report, the Division of Recreation and Parks, of the Florida Department of Environmental Protection is considering limiting human access to snowy plover nesting areas on Caladesi Island, Honeymoon Island, Anclote Key, and Three Rooker Bar.

In reviewing the Strategic Habitat Conservation Areas Map, three other broad geographical areas are identified by the Florida Fish and Wildlife Conservation Commission. This includes the area known as East Lake, the Gateway Preservation area, and the area of the Weedon Island Preserve. Although not identified as such on the Strategic Habitat Conservation Areas Map, the majority of these areas are under local or state ownership and management. The Recreation and Open Space Map, **Figure 5** in Chapter 1 of this Element, shows these lands. This map depicts parks, recreation areas, preserves, wetlands, and other open space areas that are either under public/semi-public ownership or which are protected from development due to their future land use designation (e.g., Preservation, Preservation-Resource

Management, Recreation/Open Space). These protected areas can also be seen on the unincorporated Future Land Use Map.

The East Lake area contains the Brooker Creek Preserve, a natural area of over 8,000 acres, which has been purchased by the Pinellas County Board of County Commissioners and the Southwest Florida Water Management District in order to provide for natural resource protection and limited passive recreation and education. The 699 acre Gateway Preservation Area was jointly purchased by the Board of County Commissioners and the State of Florida through the Conservation and Recreation Lands (CARL) program. The 3,700 acre Weedon Island Preserve was purchased by the State of Florida and 115 upland acres have been leased to the Board of County Commissioners for a 50 year period to be managed for natural resource protection and passive recreation and education.

Currently, there are over 16,000 acres of Natural Reservations in Pinellas County, not including approximately 32,000 acres of submerged land. This equates to almost nine percent of Pinellas County. Also, when municipal and private recreation sites are considered, there are now over 41,000 acres, or more than 22 percent, of the County which is being utilized in some form of recreational or open space context. This does not include additional acreage which has been removed from potential development due to its designation as Preservation, Preservation-Resource Management, or Recreation/Open Space on the Future Land Use Map.

In addition to the fee-simple ownership acquisitions such as those discussed above that have been utilized to protect natural resources and wildlife habitat in Pinellas County, the Board of County Commissioners has utilized other sophisticated planning techniques in order to protect the areas that are identified on **Figure 5**, the Planning Department's Recreation and Open Space Map. The areas on the Recreation and Open Space Map and the Future Land Use Map correspond with similar areas on the Florida Game and Freshwater Fish Commission's Strategic Habitat Conservation Map and its Priority Wetlands for Listed Species Map. These techniques include the designation of these areas as Preservation, Preservation-Resource Management, or Recreation/Open Space on the Future Land Use Map. Also, the transfer of development rights of up to one unit per acre from lands designated as Preservation to the contiguous upland of a development is also allowed on a case-by-case basis. Since the time of Plan adoption, in all new developments a 15 to 50 foot buffer is required around wetlands and other waterbodies. These buffers must be recorded as conservation or drainage easements in the official records of the County. In developments greater than 10 acres in size, three percent of the upland area must be set aside and recorded as an official conservation easement. In addition to fee simple acquisition, the use of such techniques as transfer of development rights, conservation easements, wetlands buffers, and preservation/conservation type future land use designations has enabled the County to protect most if not all of the areas identified on the Strategic Habitat Conservation Map.



***The Pinellas Trail is Pinellas County's longest linear greenway system.***



## ***Using Greenways to Link Natural Systems***

The Florida Statutes (CH. 260, F.S.) defines a greenway as a linear open space established along either a natural corridor, such as a riverfront, stream valley, or ridgeline, or over land along a railroad right-of-way converted to recreational use, a canal, a scenic road, or other route; any natural or landscaped course for pedestrian or bicycle passage; an open space connector linking parks, nature reserves, cultural features, or historic sites with each other and with populated areas. The common characteristic of greenways is that they all go somewhere. Greenways follow natural land or water features, such as ridges or rivers, or human landscape features like abandoned railroad corridors or canals. They link natural reserves, parks, cultural and historic sites with each other and, in some cases, with populated areas. Greenways not only protect environmentally sensitive lands and wildlife, but also can provide people with access to outdoor recreation and enjoyment close to home.

Greenways are important because they provide connections between natural, historic, cultural, and recreational facilities. In addition, they are important as conservation and recreation areas in and of themselves. Three major functions of greenways include the following: protection and enhancement of natural, historic, and cultural resources; the provision of linear open space areas that are compatible for human use; and the provision of connections between conservation lands, parks, and other recreational facilities. Greenways that link parks provide valuable recreational opportunities. Greenways that link conservation areas help to prevent the fragmentation of valuable wildlife habitat.

Ecological, social and economic benefits are derived from greenways. Greenways help to maintain the health of native ecosystems and landscapes. They also provide for public recreation and outdoor education. Greenways such as the Pinellas Trail act as alternative transportation facilities and provide a focal point for community pride and identity. All of these benefits help to assure the economic prosperity, connectivity and overall well being of the community.



***Joe's Creek Preserve is an example of a linear greenway in Pinellas County.***

Individual greenways and greenway segments are also an important component of an overall Greenway system or network. Greenway systems act to link significant community “hubs” and smaller sites such as regional parks and preserves, ecological sites, and cultural and historic resources. The Greenway system makes up the “green infrastructure” of the community. Pinellas County has a number of officially designated Greenways, including the Pinellas Trail, Brooker Creek Preserve, Weedon Island Preserve, the Friendship Trail, and McKay Creek. For more information on greenways, see the Greenways section of the *Recreation, Open Space and Cultural Element* of this Comprehensive Plan.

## WETLANDS PROTECTION AND MANAGEMENT

### *Value of Wetlands*

The wetland resources of Pinellas County provide a number of benefits. Freshwater and tidal wetlands provide habitats for wildlife such as birds, mammals and reptiles, including some endangered species. Because of their important function as a source of organic matter which functions as the base of the detrital food chain, tidal wetlands provide habitat, breeding areas and nurseries for commercial and recreational marine fisheries. Freshwater wetlands attenuate the damaging effects of storm and flood waters during peak runoff by slowing and storing those waters, then releasing them gradually. Coastal shorelines and uplands are buffered from the severity of tidal surge during a storm by the adjacent coastal wetlands.

Wetlands also function as a natural filtration system, cleansing storm water runoff before it enters Tampa Bay, the Gulf of Mexico or other surface water bodies. Sedimentation of the down stream waters is reduced by slowing the water velocity, allowing sediments to drop out of the water column while in the wetland. Subsequently, pollutants that are attached to the sediments are buried in the wetland soil. Excess nutrients and other chemicals may be filtered out of the water and soil by the wetland vegetation, stored in their biomass (leaves, stems and roots) and buried in the organic soil when the plants die. The associated birdlife and open vistas of wetlands provide aesthetic beauty and visual relief from the urbanized landscape of Pinellas County.

The County has been, and continues to be, active in the protection, preservation, restoration, enhancement and creation of wetland habitats because of their important functions. In Tampa Bay, the salt barrens and oligohaline/mesohaline salt marshes have suffered substantially greater acreage loss than mangrove swamps. Acknowledging the value of certain wetland types such as oligohaline/tidal habitats in the life cycle of important marine species, the County, whenever possible, directs their wetland restoration and creation efforts toward these types. The St.Paul/Belleair oligohaline habitat restoration project in the Allen's Creek watershed, the Fort DeSoto water circulation improvement project, and the wetland rehabilitation project at St. Petersburg College are examples of such efforts.



***Aerial View of the Fort DeSoto  
Recirculation Project***

Pinellas County has a long history of cooperation with Federal and State agencies and has invested well over \$7 million to construct stormwater treatment facilities and habitat creation projects. Joe's Creek was one of the first collaborative sites. The Joe's Creek Nature Preserve is made up of several individual purchases of property over the past twenty years. Funding for these purchases has come from the endangered lands referendum approved by the voters in 1986 and from the Penny for Pinellas program, which has been extended through 2020. To date, over 390 acres have been assembled. This property has a wide variety of native plant communities representative of what Pinellas County was like prior to the urbanization we see today in most areas. The area is home to a variety of wildlife including representatives of just about every major species found in the County. This area is also an important area for migratory birds as both a feeding area and a resting area.

The habitats at Joe's Creek include both uplands and wetlands, specifically pine/oak forest (pine flatwoods with palmetto understory), mangrove forested mainland areas including mangrove islands, salt marsh and salt barren areas. The property has several areas which would be classified as "old fields" which are in a state of transition. There is also the remnants of an old borrow pit on site which is now a freshwater system. Several environmental restoration and enhancement projects have already been completed in conjunction with the State Department of Environmental Protection and the Southwest Florida Water Management District. These projects removed the exotic vegetation (mostly Brazilian Pepper) and re-graded the areas to preclude re-growth of this invasive species, and then planted the areas with native wetland plants.

Future plans for the area include individual projects to improve water quality within the creek, drainage improvements in the surrounding areas, and the development of a watershed management plan to address any water quality and drainage issues that may arise within the creek and the watershed as a whole, while updating the data available regarding the existing conditions of the watershed.

### ***Wetlands Protection and Management at the Federal and State Level***

Federal Protection: Historically, the value of wetlands as ecologically important areas was often overlooked or ignored when compared with economic uses (i.e., agriculture and development). As a result, wetland drainage and destruction has been extensive throughout the United States. As the scientific community began to quantify the values of wetlands in the early 1970s, federal policies and laws were created to protect wetlands.

One of those laws, The Federal Water Pollution Control Act of 1972 (Clean Water Act), has the goal of restoring the chemical, physical and biological integrity of the nation's waters. The main federal protection mechanism for wetlands is through the Clean Water Act, Section 404 which was last amended in 1977. Section 404 regulates the dredging and filling of materials in the waters of the United States. The definition of waters of the United States was expanded in 1975 to include wetlands. The U.S. Army Corps of Engineers is responsible for the permitting of dredge and fill permits under Section 404, with the Environmental Protection Agency holding veto authority on the Corps' permits. Compensatory mitigation is required for any permitted activity that results in the loss of a wetland. Guidelines have been established for the use of mitigation banks that satisfy the mitigation requirements of Section 404. Another important initiative, the national Wetlands Policy Forum in 1988, formulated an overall national objective of a no-net-loss of wetlands.

State Protection: The Florida Water Resources Act (FWRA), Chapter 373 of the Florida Statutes, governs the regulation of dams, appurtenant works, impoundments, reservoirs, and works affecting waters of the State. The goal of the FWRA is to prevent harm to the water resources of the State. One aspect of the FWRA is to provide for the protection and regulation of wetlands.

Regulation of wetlands falls under the jurisdiction of the Department of Environmental Protection (DEP) and the Water Management Districts (WMD). Under Florida Administrative Code (F.A.C.) 62-312, the DEP regulates dredging, filling, or construction within the waters of the State, and those bodies of water impacting them. The WMD are delegated authority for management of storm and surface waters in the FWRA, and regulate them under F.A.C. 40D-4, 40D-40 and 40D-400.

In order for any activity to take place in or on a wetland area of the State as delineated by the criteria set forth in F.A.C. 62-340, an Environmental Resource Permit (ERP) must be issued by either the DEP or the WMD. The ERP combines Wetland Resource permitting by the DEP and Management and Storage of Surface Waters permitting by the WMDs into a single process in order to streamline regulatory procedures.

The ERP program has the goal of no-net-loss of wetlands or other surface water functions due to a permitted activity. Any regulated destruction of a wetland area requires mitigation to offset the loss of the wetland functions. Due to the temporary loss of ecological value and uncertainty regarding the ability to recreate certain functions, protection of wetlands is preferred to alteration and mitigation. When mitigation is allowed, the ratio of the mitigation area to the impacted area varies depending on the type of mitigation proposed, and the type and condition of the impacted wetland. Creation and restoration are assigned the lowest range of ratios with restoration usually preferred due to the greater chance of functional success. Enhancement ratios are generally higher and preservation ratios are the highest depending on the prior status of the preservation area. F.A.C. 62-342 outlines the procedure for establishing mitigation banks and is intended to compliment existing mitigation criteria and requirements.

The 1996 Mangrove Trimming and Preservation Act, Chapter 403.9 Florida Statutes, has the intent to protect and preserve mangrove resources valuable to the environment and economy from unregulated removal, defoliation and destruction. The Act prohibits trimming of mangroves on uninhabited islands and requires a permit for trimming in certain cases. The Act encourages waterfront property owners to voluntarily maintain mangroves, encourage mangrove growth and plant mangroves along their shorelines. No mangroves may be cut lower than six feet under an exemption or general permit. Mangroves over 16 feet must be cut in stages limited to 25 percent of their height annually. The Act is administered locally by the Pinellas County Department of Environmental Management.

### ***Pinellas County Wetlands Protection and Management Program***

Pinellas County has developed a multi-tiered approach to wetland resource protection, utilizing such things as the Future Land Use Map (FLUM), transfer of development rights, the Land Development Code and the site plan review process.

History: With the rapid population growth that began soon after WWII, it became apparent over time that the resulting urbanization in Pinellas County was at times insensitive to the natural environment. Unquestionably, it is the County's natural features and subtropical climate that have been crucial factors in making Pinellas a desirable place to live. By the 1960s, it was becoming clear that people were modifying the County's natural systems resulting in significant environmental degradation in certain portions of the County. Although little could be done to restore many of the environmental features that had previously succumbed to development, the preservation of environmentally-sensitive lands, including wetlands, was enabled through the County's environmental and land use planning efforts which were expanded due to the County's Growth Management Program beginning in the 1970s.

The Local Government Comprehensive Planning Act of 1975 (Growth Management legislation) required all local governments within the State to adopt and implement comprehensive plans. Under the State's mandated comprehensive planning requirements, land use and

environmental planning issues were addressed through the development of the Pinellas County General Plan. The Conservation and Coastal Zone Management Element of the Plan was adopted by the Board of County Commissioners in 1979 and provided a detailed examination of seven ecological resource categories: geology, soils, surface hydrology, topography, climate and air quality, vegetation and wildlife, and historic, scenic, and cultural resources.

In addition, environmental and land use planning initiatives were undertaken to identify and protect wetlands and other environmentally-significant areas as a part of the comprehensive planning process in Pinellas County beginning in the late 1970s. This planning effort resulted in the delineation of the County's environmentally-sensitive properties such as wetlands and their subsequent protection through land use planning techniques afforded by the utilization of the Pinellas County General Plan's (today's Future Land Use Map and Comprehensive Plan) objectives and policies as implemented through the County's Land Development Regulations. As outlined below, this analysis included a review of the types, intensity, values, functions, sizes, conditions, and locations of wetlands and other environmentally-sensitive properties. Incompatible land uses were then directed away from wetlands through the County's comprehensive land use planning procedures.

This effort delineated the County's environmentally-sensitive properties, including wetlands, into two major classifications of environmental constraint: preservation and conservation. Preservation Areas were the most environmentally-sensitive areas; those considered to have no development potential without a severe loss of natural system functions and benefits. Conservation areas were those areas whose environmental-sensitivity varied according to the type of environmental feature(s) found on the property. While identifying those environmentally-sensitive areas that should be protected through a preservation or conservation designation, the County utilized a variety of resources, including aerial photographs and existing site plan reviews. This information was further supplemented by field surveys and aerial reconnaissance. The Pinellas County Planning Department worked closely with the Planning and Environmental Management staffs of local municipalities, the Pinellas County Department of Environmental Management and the Florida Department of Environmental Protection (formerly known as the Department of Environmental Regulation) in this effort.

Once the preservation and conservation areas were mapped, the information on the individual resources was integrated using a series of map overlays. Each overlay depicted a mapped parameter that was taken into consideration during the land use planning process in the early 1980s. By laying the resulting series of overlays on top of one another, areas where several significant environmental constraints existed could be identified.

This process resulted in a Conservation Plan Map which depicted the aforementioned preservation and conservation areas. Wetlands and other environmentally-sensitive areas were categorized as follows:

Preservation Areas - areas having major ecological, hydrological or physiographic significance including the following: Gulf beaches and dunes; the 25-year floodway and floodplain; saltwater wetlands; major freshwater wetland systems; and stream and natural drainage corridors; and

Conservation Areas - areas having certain natural use limitations requiring special precautions prior to their alteration or development including measures intended to prevent undue ecological damage. These areas included the following: the hurricane velocity zone; significant aquifer recharge areas; areas of the 100-year flood; and large areas where 50 percent of the area was preservation and the remaining area had some other form of environmental constraint.

The preservation areas were then designated as Preservation on the unincorporated Sector Plans for each of the 12 planning sectors in the County. Areas that were identified as conservation were then given very low density residential land use designations, or were designated as Recreation/Open Space on the Sector Plans. These Sector Plans were a major component of the Pinellas County Comprehensive Plan adopted in 1982. This information was compiled on the Future Land Use Map for the 1989 Comprehensive Plan.

One example of the detailed process that was undertaken to protect wetlands and other environmentally-sensitive lands is the Brooker Creek floodway in northeastern Pinellas County (Planning Sector 2, see **Figure 2**). Two years of data collection and modeling established the natural extent of the Brooker Creek floodway. Field surveys, cross sectional surveys, historic hydrological data, and computer modeling were utilized to establish the 25-year and 100-year flood zones for the Creek. Once identified, this information provided a basis for establishing the limits of the preservation area along the Creek course on the Sector Plan (Future Land Use Map). Analysis of the rest of Sector 2 resulted in the identification of the rest of the Sector's preservation areas and conservation type lands and resulted in Preservation, Recreation/Open Space, or low-density residential designations being assigned to the appropriate lands within the Sector. As a result of this process, residential densities were significantly lowered (i.e., from 7.5 units per acre to 0.5 unit per acre) in many areas of the Sector to accommodate the conservation nature of many of the parcels located there. In addition to Sector 2, the other wetlands and environmentally-sensitive properties throughout the County have been protected in a similar manner.

### ***Future Land Use Map***

As indicated above, one of the primary methods of protecting the major wetland systems of unincorporated Pinellas County was through the establishment of the Preservation category on the Future Land Use Map (FLUM). As outlined above, preservation areas were illustrated on the FLUM by a Preservation designation, while conservation areas are generally placed under a Recreation/Open Space or low-density residential designation. Development in the preservation areas is prohibited. The Preservation-Resource Management designation on the FLUM was also established in order to recognize and protect valuable well field and recharge areas and their associated natural habitats. Only resource-based recreational and conservation uses are allowed within this category. Conservation areas can be developed to an intensity limited by their existing environmental constraints.

As of July 2007, 6,404 acres were designated as Preservation on the Pinellas County Future Land Use Map. In addition, 4,432 acres were designated as Preservation-Resource Management on the FLUM for a total of 10,835 acres of the unincorporated area of the County being designated as Preservation.

The use of Transfer of Development Rights (TDRs) aids the County in its ability to direct incompatible land uses away from wetlands. TDRs are further used by the County to set aside, and restrict development in, areas designated as Preservation, Preservation-Resource Management and Recreation/Open Space. The transfer of development rights to the developable upland area of contiguous parcel(s), as outlined in the *Future Land Use and Future Land Use and Quality Communities Element* of this Comprehensive Plan, preserves wetlands while not infringing on property rights. However, there is no transfer of development allowed from submerged lands to upland areas.

The County continues to designate crucial environmentally-sensitive areas as Preservation on the Future Land Use Map as additional site specific information is gathered in the site plan process and through other mechanisms. Wetlands that were not initially identified by the process outlined above may be determined worthy of preservation through the detailed analysis done in the site plan process. Once these areas are identified as worthy of preservation, the FLUM is amended to designate them as preservation.

### ***Land Development Code/Site Plan Review Process***

The wetland areas of unincorporated Pinellas County are further protected by several County Land Development Regulations and the Site Plan Review Process. These Regulations include the Habitat Management and Landscaping Section, the Floodplain Management Section, the Flood Damage Prevention Section, the Water and Navigation Control Authority Section, the Marine Habitat Management Section, the Site Development and Platting Section, and the Comprehensive Zoning Code Section.

The Habitat Management and Landscaping Section 166-36 to-88 provides for an upland buffer around wetlands with the purpose of protecting them, their associated wildlife, and their water quality and quantity attributes from adjacent development impacts. On any development site plan in the unincorporated area of the County or participating municipality, a fifteen foot upland buffer is required to be shown adjacent to isolated wetlands, creeks, channels, canals, and other waterways. For all other wetlands, a fifty foot buffer is required. Upon approval of the County, the buffer width may be reduced by up to one-third in one section by providing additional width in another section of the same buffer. The square footage that results must be equivalent to or greater than that of the original buffer. The upland buffer is recorded as a conservation easement in the public records of the County. Buffers are usually shown as Preservation on the FLUM.

Section 166-82c states that wetlands are of special ecological value and no wetland vegetation shall be removed, trimmed, pruned, chemically treated, filled upon or altered without a permit or exemption. When a permit is issued, the applicant must provide compensation for all regulated wetland impacts. Compensation means measures provided to offset adverse impacts to wetlands. Compensation may include one of the following: mitigation; inclusion of upland areas, beyond any required buffer zones to maintain upland/wetland habitat diversity; establishment of vegetated littoral zones in on-site open water bodies; restoration of wetlands that have been previously impacted; compensation on off-site lands; or other reasonable measures, such as providing unlike wetland habitat. All compensation required shall provide for equivalent habitat value to the wetland system destroyed.



The Water and Navigation Control Authority Regulations Section 166-241 to -364 was created to protect, through sound management and the judicious issuance of permits, the natural resources of the County. This Section regulates all dredge and fill activity, the placement of seawalls, and the construction of commercial and private docking facilities including boardwalks, in the Waters of the County. In order to provide protection for habitats that have a high degree of ecological value, all proposed projects are reviewed for their impact on many natural resources including wetland areas. The Authority may consider proposals for mitigation in the review of permit applications. The replacement requirements for legally impacted wetlands are based on square footage. At a minimum, one acre (or portion thereof) is required to be created for each acre that is adversely impacted. Each acre must contain sufficient wetland replants to reestablish the wetland habitat with 85 percent coverage within three years. The Authority's jurisdiction is Countywide in most cases.

The Aquatic Preserves Section 58-376 to -396 includes the Countywide Aquatic Preserve and the Boca Ciega Bay Aquatic Preserve. These Sections have the intent of preserving the submerged lands of the County and Boca Ciega Bay, insofar as possible, in an essentially natural condition so that their ecological and aesthetic values may endure for the enjoyment of future generations. The Aquatic Preserves include the submerged bottom lands of Pinellas County and the water column upon such lands as well as all publicly owned islands within the boundaries of the Preserves. The Preserves are protected from further sale or transfer and dredging and filling except when it is in the dominant interest of the general public. The Pinellas County Water and Navigation Control Authority maintains its jurisdiction over these areas as conferred by law. Aquatic Preserves also confer special protection in State DEP permits under Chapter 403, Florida Statutes.

The Marine Habitat Management Section 58-471- to -483 provides for the preservation, recovery, and expansion of marine habitats by minimizing the damage from propeller scarring and by restricting internal combustion engines within the Ft. DeSoto and Weedon Island management areas. The Ft. DeSoto management area includes land from Indian Key in the north to Ft. DeSoto Park in the south. The Section also establishes slow down/minimum wake zones within the management areas, provides for posting and monitoring of the management areas, and creates a public education program. No internal combustion engines are allowed to be operated within combustion motor exclusion zones, as buoyed, posted or marked, except in specifically marked "navigation channels". Within these navigation channels, boats are required to slow down and produce only a minimum wake. In order to avoid damage to aquatic habitats, seagrass caution zones have also been established.

The public education program provides information to the boating public on the protection of aquatic habitats and the value of wetlands as natural resources. Large informational signs have been erected at the major boat ramps and informational brochures depicting the zones and the value of seagrass beds are distributed to the public at local boat ramps and bait shops. A monitoring program has recorded an increase in the seagrass beds in the protected areas. An added benefit has been the educational spillover effect that has greatly reduced scarring in the unprotected zones as well.

In addition to the extensive monitoring and protection program initiated in the Ft. DeSoto and Weedon Island Management areas, Pinellas County has provided aerial photography and piling location assistance for Honeymoon Island and Caladesi Island State Parks' seagrass protection initiatives.

The Floodplain Management Sections 158-1 to-14 and Flood Damage Prevention Sections 170-101 to -159 regulate the alteration of natural floodplains, stream channels, and natural protective barriers which are involved in the accommodation of floodwaters. The objectives of these Sections are to regulate filling, grading, dredging, and other development which may increase erosion or flood damage. An additional objective of the Floodplain Management Section is to ensure that floodplains are preserved, protected, and managed to maintain or enhance water quality, plant and animal diversity, and aquatic productivity. The Floodplain Management Section requires that any wetland portions of a site that lies within the 100 year floodplain that is to be developed or redeveloped must be dedicated as a conservation easement by the developer. These Sections incorporate the requirements of the Federal Flood Insurance Program.

#### Mangrove Trimming and Protection Act

Pinellas County has been managing mangrove resources in the unincorporated County since the 1970s. In 1995, the State enacted the Mangrove Trimming and Protection Act, which invalidated all local regulation of mangrove trimming but provided for delegation of the State Act to qualified local governments. As part of its overall management of coastal resources, Pinellas County took delegation of the mangrove trimming program in 1996 and now manages mangroves on a Countywide basis. Mangroves contribute to improved water quality, and provide coastal habitat for marine resources.



***Mangroves trees, such as the one pictured above, are protected from excessive trimming because of the environmental benefits which they provide.***

The Site Development and Platting Section 154-1 to-115 provides for drainage requirements, surface water management standards, and drainage and conservation easement requirements when sites are (re)developed. Any wetland portions of a site that lie within a 25-year floodplain and/or a 100-year floodway as designated by the Federal Emergency Management Agency must be dedicated as a public conservation and/or drainage easement.

The Comprehensive Zoning Code Section provides protection for wetlands and other natural resources through special zoning districts such as the Aquatic Lands district, the Preservation/Conservation District, the Wellhead Protection overlay District, and the Residential Planned Development category. The Aquatic Lands District protects coastal waterways and coastal wetlands where any significant alteration would result in damage to the aquatic ecosystem and its ecological value to the public. The Preservation/Conservation District regulates the use of properties having unique environmental, biological, or ecological features. The Residential Planned Development District allows a transfer of density from Preservation areas. The Wellhead Protection Overlay District protects the functional integrity of natural groundwater aquifer recharge areas and wellheads in a manner that preserves and enhances water quality.

Small, isolated wetlands are protected from private development by means of the Site Plan Review procedures performed by the Pinellas County Department of Building and Development Review Services (BDRS). BDRS is responsible for reviewing private development site plans and enforcing any applicable land development regulations before

construction proceeds. BDRS reviews any wetland delineation done by the developer, and enforces the Habitat Management and Landscaping Section requirements for wetland buffers.

### ***Wetlands Mitigation***

Pinellas County defines mitigation as replacement of a wetland, type for type, to restore those specific physical and functional characteristics which will be lost as a result of the proposed activity. Mitigation requirements have the goal of preserving the numerous benefits (see Value of Wetlands) provided by wetlands.

When a wetland is legally impacted through private land development, the compensation required typically involves mitigation. However, the Department of Building and Development Review Services (BDRS) has the flexibility to allow other types of compensation including: inclusion of upland areas, beyond any required buffer zones to maintain upland/wetland habitat diversity; establishment of vegetated littoral zones in on-site open water bodies; restoration of wetlands that have been previously impacted; compensation on off-site lands; or other reasonable measures, such as providing unlike wetland habitat. All compensation required shall provide for equivalent habitat value to the wetland system destroyed. When possible, BDRS will coordinate their review with the Southwest Florida Water Management District, the Department of Environmental Protection, or the U.S. Army Corps of Engineers, to coordinate any mitigation requirements. In some cases, the agencies will have different requirements and both requirements must be addressed by the developer.

The Pinellas County Department of Environmental Management enforces mitigation and enhancement requirements of the Water and Navigation Control Authority. Projects falling under this jurisdiction are permitted dock construction and development along coastal areas that require dredge or fill activities. Mitigation and enhancement requirements are defined on a square foot basis with a minimum one to one ratio to the impacted area. Enhancement of a local habitat may be considered as an option if such enhancement is reasonably expected to enhance the natural functions of the local ecosystem. These types of mitigation projects are uncommon because of the protection afforded coastal wetland areas by Federal, State and County regulations.

Pinellas County public works projects which impact wetlands fall under the mitigation requirements of the Environmental Resource Permits issued by the SWFWMD and the DEP (see State Protection).

### ***Mitigation Banking***

Mitigation banking has been defined as wetland restoration, creation, enhancement, and in exceptional circumstances, preservation undertaken expressly for the purpose of compensating for unavoidable wetland losses in advance of development actions, when such compensation cannot be achieved at the development site or would not be as environmentally beneficial. In effect, mitigation banking consolidates potentially small fragmented wetland mitigation sites into one large contiguous site. Units of restored, created, enhanced or preserved wetlands are expressed as credits which may subsequently be withdrawn to offset debits incurred at a project development site where an impact to wetlands has occurred.

Under F.A.C. 62-342.300, use of a mitigation bank is appropriate, desirable and a permissible mitigation option when the mitigation bank will offset the adverse impacts of the project; and onsite mitigation opportunities are not expected to have comparable long-term viability, due to such factors as unsuitable hydrologic conditions, or ecologically incompatible existing adjacent land uses, or future land uses identified in a local comprehensive plan adopted according to Chapter 163, F.S.; or use of the mitigation bank would provide greater improvement in ecological value than onsite mitigation. In some cases a combination of onsite mitigation and participation in a mitigation bank will be appropriate to offset adverse impacts of a project.

Mitigation banks may have several advantages over individual mitigation projects, including:

- Mitigation banking may be more advantageous to maintaining the overall quality of an aquatic ecosystem such as Tampa Bay, by consolidating smaller projects into a single large parcel that serves a function that the smaller projects could not duplicate;
- Mitigation banks are more advantageous to plant and animal species that need more acreage to establish themselves because of the increased diversity of habitat and buffering capacity of a larger tract;
- Mitigation banking can bring together financial, planning and scientific resources not practicable to smaller site specific projects. These resources can increase the chance of successfully duplicating the wetland functions that are lost due to development;
- Mitigation banks provide greater flexibility to applicants needing to comply with mitigation requirements, and permitting time can be reduced making the purchase of mitigation credits more cost effective for the applicant;
- Mitigation banks typically are functioning in advance of project impacts thereby reducing temporary loss of wetland functions, and eliminating uncertainty of mitigation project success;
- Mitigation banks provide a mechanism for the ongoing maintenance of a mitigation project to insure the site is ecologically viable in perpetuity; and
- Mitigation banking increases the efficiency of use of limited resources in agency review and monitoring of mitigation projects because of the centralized location of many projects at the mitigation bank.

In order to take advantage of the benefits of mitigation banking, Pinellas County has been allowed by the DEP and the SWFWMD to construct mitigation sites with more acreage than required for County projects. The excess acreage in the “bank” serves as a source of mitigation credits for future County development projects. These sites serve as a source of mitigation credits from which only the County can make “withdrawals.” The County has used this technique for accumulating mitigation credits since the late 1980s.

Pinellas County is reaching completion on its first mitigation bank designed for future County development projects. This 28-acre site was an abandoned pasture with little habitat value.

The County created a variety of habitats within the parcel consisting of hardwood hammocks, herbaceous wetlands and cypress stands adjacent to upland fingers and islands. Restoration projects were begun on the site as the need for mitigation was established. Construction work began in 1997, and the site was nearing completion as of 2007.

The County is currently doing restoration work within the Brooker Creek Preserve with funding from SWFWMD cooperative funding grants and funds from the Florida Department of Transportation (FDOT) mitigation program. The Preserve is a large tract of land that can support a myriad species of plants and animals. The Preserve needs restoration work to enhance degraded areas and to restore water flow to areas that have been drained or damaged by previous owners' land mismanagement. FDOT will be able to use the credits generated by the restoration of this site to mitigate area FDOT project impacts.



***Example of Pinellas County Environmental Restoration Work***



## FLOODPLAIN PROTECTION AND MANAGEMENT

### *Overview*

Pinellas County receives approximately 54 inches of rainfall in a year, with the heaviest rainfall occurring in the summertime. These rainfall characteristics, the County's topography, and the drainage characteristics of the area determine the floodplain areas within the County. Flooding and drainage can become critical factors constraining development, based on high water table, flooding from rainfall events and tidal surge.

The following discussion covers the history of floodplain management in Pinellas County, the natural functions of floodplains, the existence of floodplains in Pinellas County in relation to construction and human safety, and current federal, state, and local ordinances designed to ensure the health, safety, and welfare of persons living within a floodplain and to protect floodplains as natural conveyance systems, wildlife and vegetative habitat and groundwater recharge areas.



*Flooding in Pinellas County*

### *Floodplain Identification and the Beginnings of Floodplain Protection*

Unquestionably, it is the County's coastal features and subtropical climate that have been crucial factors in making Pinellas a desirable place to live. By the 1960s, with the pace of urbanization, it was becoming clear that development in certain areas of the County was taking place in unsuitable locations, resulting in environmental degradation and placing persons and property at risk of flood hazard. In an effort to ensure that future development was compatible with the natural environment, and that the protection of citizens and property was not compromised by development decisions, the County first started planning comprehensively for floodplain management in the 1970s.

The Local Government Comprehensive Planning Act of 1975 (Growth Management legislation) required all local governments within the State to adopt and implement comprehensive plans. Under the State's mandated comprehensive planning requirements, land use and environmental planning issues were addressed through the development of the Pinellas County General Plan. The Conservation and Coastal Zone Management Element of the Plan was adopted by the Board of County Commissioners in 1979 and provided a detailed examination of seven ecological resource categories: geology, soils, surface hydrology, topography, climate and air quality, vegetation and wildlife, and historic, scenic, and cultural resources.

Following the completion of this Plan, environmental and land use planning initiatives were undertaken to identify and protect wetlands, floodplains and other environmentally-significant areas. This resulted in the first significant delineation of the County's floodplains and environmentally-sensitive properties, and to the subsequent protection of the 25-year

floodplain through designation on the Future Land Use Map, and development of land development regulations.

This effort delineated the County's environmentally-sensitive properties, including floodplains, shown on **Figures 15 & 16**, into two major classifications of environmental constraint: preservation and conservation. The Preservation future land use category was used for the most environmentally sensitive areas, where any development would result in a loss of natural system function and environmental benefit, while conservation areas were identified as environmentally significant areas where development required certain constraints. The intact 25-year floodplain was included in the Preservation category. The County used a variety of resources, including aerial photographs, field surveys and existing site plans to identify floodplain areas, and include input from local municipalities and the Florida Department of Environmental Protection.

Once the Preservation and Conservation areas were mapped, the information was integrated using a series of map overlays. Each overlay depicted a mapped parameter that was taken into consideration during the land use planning process in the early 1980s. By laying the resulting series of overlays on top of one another, areas where several significant environmental constraints existed could be identified.

This process resulted in a Conservation Plan Map which depicted the aforementioned preservation and conservation areas. Wetlands, floodplains and other environmentally-sensitive areas were categorized as follows:

Preservation Areas - areas having major ecological, hydrological or physiographic significance including the following: Gulf beaches and dunes; the 25-year floodway and floodplain; saltwater wetlands; major freshwater wetland systems; and stream and natural drainage corridors; and

Conservation Areas - areas having certain natural use limitations requiring special precautions prior to their alteration or development including measures intended to prevent undue ecological damage. These areas included the following: the hurricane velocity zone; significant aquifer recharge areas; areas of the 100-year flood; and large areas where 50 percent of the area was preservation and the remaining area had some other form of environmental constraint.

The preservation areas were then designated as Preservation on the unincorporated Sector Plans (for each of the 12 original planning sectors in the County). Areas that were identified as conservation were then given very low density residential land use designations, or were designated as Recreation/Open Space on the Sector Plans. These Sector Plans were a major component of the Pinellas County Comprehensive Plan adopted in 1982, and later compiled on the Future Land Use Map for the 1989 Comprehensive Plan.



**FIGURE 15**  
**FLOODPLAIN MAP NORTH**

FIGURE 16  
FLOODPLAIN MAP SOUTH

An example of this systematic process can be found in the Brooker Creek floodway in northeastern Pinellas County (Planning Sector 2, see **Figure 2**). Two years of data collection and modeling established the natural extent of the Brooker Creek floodway. Field surveys, cross sectional surveys, historic hydrological data, and computer modeling were utilized to establish the 25-year and 100-year flood zones for the Creek. Once identified, this information provided a basis for establishing the limits of the Preservation area along the Creek course. Analysis of the rest of Sector 2 resulted in the identification of the rest of the Sector's preservation areas and conservation lands and resulted in Preservation, Recreation/Open Space, or low-density residential designations being assigned to the appropriate lands within the Sector. As a result of this process, residential densities were significantly lowered (i.e. from 7.5 units per acre to 0.5 units per acre) in many areas of the Sector to accommodate the conservation/environmental value of many of the parcels. In addition to Sector 2, the other wetlands, floodplains and environmentally-sensitive properties throughout the County have been protected in a similar manner.

### ***Natural Functions***

Flood control in Pinellas County has changed significantly over the years. In the past, a philosophy of "ditch and drain" brought development into many flood-prone areas, where it would not be permitted under current, more stringent environmental rules. Control structures were frequently built to block, divert, speed up, slow down, or otherwise change natural drainage patterns to protect developed areas from flooding. However, with the alteration of natural floodways, there was often an adverse impact on the wildlife which utilized flood-prone habitat. With a change in floodplain drainage patterns the habitat and natural systems were also altered. The typical result was that areas of previous periodic flooding were eliminated, while flood waters that remained were contained and diverted, their flow altered and increased to be more efficient in their drainage to retention ponds, detention ponds or open water bodies. In either case, natural floodplain topography and habitat were lost.



Today, water managers have become more familiar with the functions of natural floodways and recognize that trying to control natural flood-prone areas can often not only put citizens and property in increased danger during severe floods where man-made structures may fail, but also disrupt the natural functions of flood-prone lands. It has become apparent that the preservation and restoration of the natural resources of floodplains reduces the risk to human resources because many of the normal hydrologic and biologic functions of natural floodplains act to mitigate the intensity, extent, and damaging aspects of flooding. Pinellas County recognizes and considers the importance of floodplains to natural systems and living resources in the regulation of development, and incorporates this understanding into policy, land development regulation and floodplain protection.

Floodplains perform a number of vital functions, such as providing suitable habitat for increasingly rare wildlife. Floodplains also provide a critical biologic, geologic and hydrologic link between diverse habitat systems, transport vital nutrients, detritus and flood waters between habitats, and serve important hydrologic functions by cleansing rivers and

renourishing beaches. The development of floodplains in Pinellas County has hindered the ability of these areas to perform the natural functions they normally provide. Natural floodplains serve important functions including, but not limited to, the following:

- a. Floodplains provide natural storage and conveyance of flood waters;
- b. Floodplains promote infiltration and aquifer recharge, and are a basic source of flow to rivers, streams, and estuaries;
- c. Temporary storage of surface waters on flood-prone lands regulates flood elevations and the timing, velocity, and rate of flood discharges;
- d. Floodplains reduce the frequency and duration of low surface flows;
- e. Floodplains help to maintain water quality by reducing erosion, removing nutrients and other pollutants, and allowing sediment to settle;
- f. Floodplains export loose organic materials and other food sources to open water bodies, as well as being a vital habitat for fish, birds, wildlife, and native plant communities;
- g. Floodplains support a high rate of plant growth;
- h. Floodplains help maintain the integrity of ecosystems and biodiversity;
- i. Floodplains often provide habitats for numerous and diverse species, including many that are rare and endangered;
- j. Floodplains can provide areas for outdoor recreation;
- k. Floodplains provide open space and aesthetic pleasure; and
- l. Floodplains provide opportunities for environmental and other studies.

In a mutually supportive cycle, the living and nonliving parts of natural floodplains interact to form floodplain ecosystems. In recognizing the relationships between the hydrological, geological and biological features of these systems, we can begin to understand how changes to one feature can alter the entire system in significant ways. For example, development in floodplains can alter historic water courses. In turn, this effects the animals and plants which depend on periodic water flows, and can subsequently alter the entire floodplain ecosystem.

Natural floodplains can provide habitat for diverse ecological communities. Ecological communities are groups of plant and animal species that coexist in a certain area. The various plant species within an ecological community may share the need for a certain type or level of soil moisture that is available only in a particular portion of the floodplain. Cypress swamps, hardwood swamps and wetland hardwood hammocks are examples of such communities. The boundaries of these ecological communities can be identified by the landform, soil, and plant types that cover a portion of the floodplain. Although there are some general

characteristics that are common to the functions of ecosystems in stream and river corridors, each floodplain ecosystem has specific conditions that make it unique, and it is important to recognize these distinctive attributes when planning projects for a given area.

## ***Hydrology***

The periodic inundation of water in the natural floodplain is extremely important to the integrity of the ecosystem, and may be the primary reason for their biological richness. Flood waters carry nutrient-rich sediments and trigger chemical processes that cause beneficial changes in the soil, which contribute to a fertile environment for vegetation. The degree of soil saturation from flooding (and the resulting elevated groundwater levels) determines the types of vegetation that can grow throughout the floodplain and can create wetlands along stream and river channels.

Rainfall shows a marked seasonal distribution in the Tampa Bay area with about 58 percent of the annual rainfall occurring from June to September. The saturation of soils for at least part of the year is one reason why, in the absence of human-made alteration such as development, wetlands tend to form in floodplains along stream and river channels. These hydrological features, combined with the connections to upland and aquatic ecosystems, are what make riparian ecosystems so unique.

The primary determinant of the structure of a viable floodplain ecosystem is the hydroperiod, or the timing (frequency and duration) and intensity of flooding. The hydroperiod, which is governed by the climate, soils and geology of the area, determines the amount and movement of water in soils across the floodplain. Acting as obstructions to, and often redirecting flood waters, the hydroperiod can also be influenced by development. The degree of urbanization in Pinellas County, including early development in floodplains, has significantly altered the hydrology of these areas and therefore the structure of floodplain ecosystems.

## ***Soils and Nutrients***

The distinctive attributes of soils in riparian ecosystems are directly influenced by the hydroperiod, which determines the soil aeration (or oxygen level) as well as nutrients and content of organic material. In turn, the soil affects the structure and function of plant communities in these ecosystems. The aeration of soils is extremely important for rooted vegetation. When an area is flooded for long periods of time, low oxygen conditions can be created. Some plants have adaptations that help them survive in such conditions. Soils in riparian areas (especially wetlands) generally have a high level of nutrients because of the continual replenishment of nutrients during flooding. The periodic wetting of soil also releases nutrients from the leaf litter.

Approximately 22 percent of the County's soils have been altered beyond their natural conditions. Early agricultural interests in the County increased surface drainage in many areas in order to accommodate crops. A system of surface ditches connected to a stream or swamp was commonly used to dispose of excess rainwater. The water table was permanently lowered where these systems were used. Due to the Bay area's seasonal rainfall pattern, these systems created drought effects during much of the year. These hydrologic changes have drastically altered soil conditions and thus the natural communities and ecosystems in floodplains and other areas where these alterations have taken place. Approximately 11.5

percent of Pinellas County's land area was created by dredge and fill activities. This primarily took place in coastal areas and on keys. Typically, fill is 2 to 8 feet thick and consists of clay, sand, rocks and shell fragments. Most drainage in these areas occurs through the soil; since it is nearly level, there is little or no surface drainage. In addition, nearly all types of urban development that have taken place in Pinellas County have covered soils with impermeable material. Water in these areas can only be drained by sheet flow and the storage capacity of the soil beneath the ground can no longer be used to help reduce the impact of heavy rains. Further, in conventional concrete urban drainage systems, pollutants and nutrients collected in runoff flow directly into open waters of the bays and estuaries.

### ***Vegetation and Habitat***

The edge of two distinct natural communities (an ecotone) tends to be more biologically diverse than each individual community. This is indeed the case with floodplains, as nutrients, energy and water provide for high biological productivity. The soil conditions that result from varying amounts of moisture in soils leads to a greater diversity of plant species in riparian areas. Floodplains may be characterized by different zones of vegetation, with shallow aquatic vegetation shifting gradually to shrubs and trees toward the upland elevations. This variety in plant life translates into greater diversity of habitats for wildlife.

Relatively small changes in geology, topography and hydrology create diverse natural wildlife and vegetative habitats in Pinellas County. For example, transitions from hardwood swamp to wetland hardwood hammocks, and in turn, to hardwood forests in Pinellas County can be subtle. However, they create varied habitats which can support a greater diversity of vegetation and wildlife. Diverse vegetation can support a wide variety of wildlife and smaller organisms that feed on the plants. In addition, the trees and shrubs of upland areas offer protection and nesting and rooting areas for many species. Trees standing or fallen adjacent to the river's edge act to stabilize its banks, while fallen branches and root masses create aquatic microhabitats in the form of pools, breaks, and ripples. A stream itself can be a source of food and cover for wildlife, and the corridors themselves offer pathways along which birds, mammals, and fish can migrate. Wetlands are particularly valuable as nesting and feeding areas for fish and waterfowl.

### ***Vegetation and Water in the Floodplain***

While the type of vegetation inhabiting a riparian ecosystem is largely determined by its hydrological conditions, the vegetation itself plays an important role in maintaining these very conditions. The interaction of vegetation and water influences local microclimate conditions. Plants in river corridors provide natural floodwater storage capacity by retarding runoff and increasing the rate at which water infiltrates soils. This can result in the reduction of flood peaks downstream. Vegetation also allows the water to spread horizontally and more slowly, rather than running directly from upland areas into rivers or streams. In addition, the leaf litter and soils associated with floodplain vegetation act as sponges in absorbing some flood waters. Vegetation also passes water to the atmosphere through transpiration.

### ***Surface Water Quality***

Maintaining the ecological integrity of riparian areas can help protect and even enhance the quality of surface water. This is true because of the critical role that riparian vegetation plays in

these systems. First, trees and shrubs along stream beds can maintain the temperature of water by shading it. This is important as lower temperatures increase the capacity of the water to carry oxygen, which is critical for the support of aquatic life and decomposition of organic material.

Second, floodplain vegetation filters sediment and nutrients that move toward rivers and streams from upland areas. This function is critical because excessive nutrients in aquatic ecosystems can disturb the balance and growth of species, and reduce the availability of oxygen in the water. The results can include reduced diversity, unpleasant odors, and, ultimately, human health problems. The degree to which floodplain vegetation performs its filtration function is dependent on several factors, including the slope and width of the floodplain and the nature of the vegetation.

Excessive sediment in waterways can also blanket lake and river beds that are home to invertebrates such as insects and crustaceans. These creatures are an important link in the food chain, and destruction of their habitat can have far-reaching effects on populations that may be essential to recreational fishing areas. See **Figure 17** for a map of major drainage features in Pinellas County. For more information on Surface Water Quality, see the *Surface Water Management Element* of this Comprehensive Plan.

### ***Groundwater Supply and Quality***

Floodplains and wetlands can play an important role in contributing to sources of water supply for human consumption. The slowing and dispersal of runoff and floodwater by floodplain vegetation allows additional time for this water to infiltrate and recharge groundwater aquifers. Floodplain soils and vegetation can also help to purify the water as it filters down to the aquifer. In addition, water can also flow from higher groundwater systems into lower surface waters during periods of low flow, so that the frequency and duration of extremely low flows may be reduced. Many wetlands store water that is important for wildlife.



FIGURE 17  
MAJOR DRAINAGE FEATURES

## ***Health, Safety, and Welfare***

Uncontrolled development of flood-prone lands, inconsistent with their natural functions, and improper management of flood waters can have the following significant adverse impacts on the health, safety, and welfare of the community:

- a. The owners of homes and business structures located in frequently flooded areas and their customers, guests, employees, children, and future generations are subjected to unreasonable risk of personal injury and property damage;
- b. Expensive and dangerous search and rescue and disaster relief operations must be conducted when developed properties are flooded;
- c. Roads and utilities associated with development are subject to damage from flooding at great expense to taxpayers and rate payers;
- d. Flooding of developed properties leads to demands for governments to construct expensive and environmentally damaging projects to control flood waters;
- e. Loss of natural water storage capacity leads to reduction in available water supply;
- f. The level, velocity, frequency, and duration of flooding on other lands are often increased when flood waters are obstructed, diverted, displaced, or channeled;
- g. Water quality is degraded, freshwater inflows to estuaries are disrupted and habitats are lost; and
- h. Property values are lowered and economic activity is disrupted by damaging floods.

## ***Flood Programs***

In order to more adequately preserve the natural functions of flood-prone areas, yet allow development where possible without endangering the health, safety, and welfare of persons living in flood-prone areas, several programs have been instituted. These are explained below.

### **Federal Flood Programs**

The Federal Emergency Management Agency (FEMA) administers the National Flood Insurance Program (NFIP), which was established by Congress in 1968, and allows property owners to purchase federally-backed flood insurance within communities that participate in the NFIP. All municipalities in Pinellas County participate in the NFIP.

In return for this insurance protection, participating communities implement floodplain management measures to reduce flood risks to new development. The federal guidelines for participation in the NFIP require that the community enact and reasonably enforce the requirement that any new residential structure have the lowest floor, including basement, elevated to or above the 100-year flood elevation. The approved elevations range from five to nineteen feet above mean sea level (MSL) in Pinellas County. Non-residential structures have to meet anchoring, tie-down, and elevation requirements.

Some flood-prone areas of the County may also include a V, or velocity, zone along the immediate edge of most coastal areas. These areas are subject to flood surge in the shallows of the bays due to run-up from high waves (25-feet or more) breaking off shore in the shallows of the bays and Gulf. In the AV zone, no variances are permitted to the requirements of residential structure elevation and no fill is allowed as a method to raise structures. Subsequent amendments to the program included a rule that communities prohibit the human-made alteration of sand dunes and mangrove stands that would increase the potential for flood damage in the velocity zone. Since mangroves, beach vegetation, trees, and many other plants provide a rough and resilient surface which reduces the flow and velocity of floodwater considerably, the removal of this vegetation is greatly limited by this provision. Currently, each local government is responsible for developing and adopting its own floodplain ordinances.

Under the NFIP, FEMA is required to develop flood risk data for use in both insurance rating and floodplain management. Floodplain delineation is based on topography, depth to water table, history of flooding, flow obstructors (natural and human-made), and flow accelerators (e.g. vegetation versus parking lots and streets). FEMA develops this data through flood insurance studies (FISs). In FISs, both detailed and approximate analyses are employed. Generally, detailed analyses are used to generate flood risk data only for developed or developing areas within communities. For undeveloped areas where little or no development is expected to occur, FEMA uses approximate analyses to generate flood risk data.

Using the results of a flood insurance study, FEMA prepares a flood insurance rate map (FIRM) that depicts the special flood hazard areas (SFHAs) within the studied community. SFHAs are areas subject to inundation by a flood having a one percent or greater probability of being equaled or exceeded during any given year. This flood event, which is referred to as the 100-year flood (or base flood), is the national standard on which the floodplain management and insurance requirements of the NFIP are based. The results of studies that had determined the most conservative 100-year estimate for flood elevations were used to establish a Coastal Construction Control Line. The Purpose of the Coastal Construction Control Line is to protect lives and property.

Within the SFHAs identified by detailed analyses, the FIRM shows base flood elevations (BFEs) and flood insurance risk zones. In addition to special flood hazard areas, the rate map shows areas subject to inundation during the 100-year flood and may show areas designated as a regulatory floodway. The regulatory floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 100-year flood discharge can be conveyed without increasing the base flood elevations more than a specified amount. Within the special flood hazard areas identified by analysis, the flood insurance rate map shows only the flood insurance zone designations.

The results of the flood insurance studies (FIS) are also presented in a FIS report. This report is a technical document that provides information used mainly by community officials for floodplain management. The FIS report can be reviewed at community planning, zoning, or engineering offices.

FEMA publishes the flood insurance rate map (FIRM) and distributes it to a wide range of users. Private citizens, community officials, insurance agents and brokers, lending institutions, and federal agencies use the FIRM to determine the degree of flood hazard in specific areas of

the community so that actuarial premium rates can be assigned and full insurance coverage obtained for properties at risk.

The FIRM provides information that allows the map user to:

- Identify special flood hazard areas subject to flooding;
- Identify the location of a specific property;
- Estimate the base flood elevations at a specific site;
- Determine the flood insurance zone at a specific site; and
- Determine the locations of the regulatory floodway (where shown).

Insurance agents and brokers use the FIRM to determine the locations of properties and the corresponding insurance zones, which determine actuarial flood insurance premium rates. Lending institutions and federal agencies, when they make loans or provide grants for the acquisition or construction of buildings, use the FIRM to determine the locations of properties and whether flood insurance is required. Community officials use the FIRM to administer floodplain management regulations.

*NIP's Community Rating System* - In 1992, the County submitted an application to participate in the NIP's Community Rating System (CRS) program. The CRS program is designed to encourage and award communities that undertake public awareness and other floodplain activities beyond the minimum requirements of NIP. The County's present rating is a Class 8 which enables residents of the unincorporated county who have flood insurance and live in the Special Flood Hazard Area to receive a 10 percent discount on their flood insurance premiums. The County has initiated an extensive outreach program to inform residents of the NIP. Credit was granted to the County for its floodplain determination efforts, and its adoption of restrictive development regulations. In conjunction with participating in the CRS, the County adopted a Repetitive Loss Plan to encourage those properties that have more than one insurance claim (of greater than \$1,000) to take steps to protect their properties from future damage. Also, the Plan helps educate and increase awareness of the availability and importance of purchasing flood insurance.

#### State Flood Programs

The Southwest Florida Water Management District (SWFWMD), created by Chapter 61-691, Laws of Florida (1961), requires applicable state laws and countywide ordinances to be strictly followed by anyone building within a flood-prone area (**See Figures 15 & 16**). The SWFWMD enforces the Florida Water Resources Act of 1972, which provides for management of water and land-related resources. More specifically, the Act promotes the conservation, development and proper utilization of surface and groundwater, to provide water storage for beneficial purposes, to prevent damage from floods, soil erosion and excessive drainage, to preserve natural resources, fish and wildlife and to promote recreational development. Pinellas County works in cooperation with SWFWMD in these efforts. Primary regulatory authority resides with the State Department of Environmental Protection with direction to delegate the authority to the water management districts to the maximum extent practical. The SWFWMD is governed by Chapters 373 and 120, F.S., and Chapter 400, F.A.C.

Originally created as a flood control agency, the Southwest Florida Water Management District (SWFWMD) implements a flood management program that includes these four components:

- 1) Land Acquisition: Through the State's Save our Rivers and Preservation 2000 program, SWFWMD purchases lands to preserve natural flood storage and conveyance functions;
- 2) Technical Assistance: SWFWMD offers technical assistance in preparing surface water management master plans;
- 3) Regulation: SWFWMD Rules (Chapter 40D, FAC) require most new developments to manage surface waters so as not to increase peak flows from the site; and
- 4) Structures/Facilities: SWFWMD maintains a small network of flood management structures, such as the Lake Tarpon outfall canal and control structure and the Sawgrass control structure in Pinellas County.

#### County Floodplain Management Programs

Pinellas County enforces two specific Floodplain Management regulations in the unincorporated area. These are the Flood Damage Prevention provisions of the Pinellas County Land Development Code (Section 170-101) and the Floodplain Management provisions of the Code (Section 158). The intent of these regulations is to reduce flood hazard and preserve, protect and restore water quality, plant and animal diversity and aquatic productivity.

Section 158-2, et seq., of the Pinellas County Land Development Code, Floodplain Management Regulations, prohibits development, redevelopment or fill material within a designated 25-year floodway. Restrictions are imposed on development within the 25-year to 100-year floodplain. The purpose of the ordinance is as follows:

- 1) Restrict or prohibit development uses that are dangerous to health, safety, and property due to water or erosion caused by flood heights or velocities;
- 2) Require that uses in areas vulnerable of floods, including facilities that serve such uses, be protected against flood damage at the time of initial construction;
- 3) Control or prevent the alteration of natural floodplains, stream channels, wetlands, and other natural protective barriers, which are involved in the accommodation of flood waters.
- 4) Control filling, grading, dredging, and other development which may increase erosion or flood damage; and
- 5) Prevent or regulate the construction of flood barriers which will unnaturally redirect or divert flood waters or which may increase flood hazards to other lands.

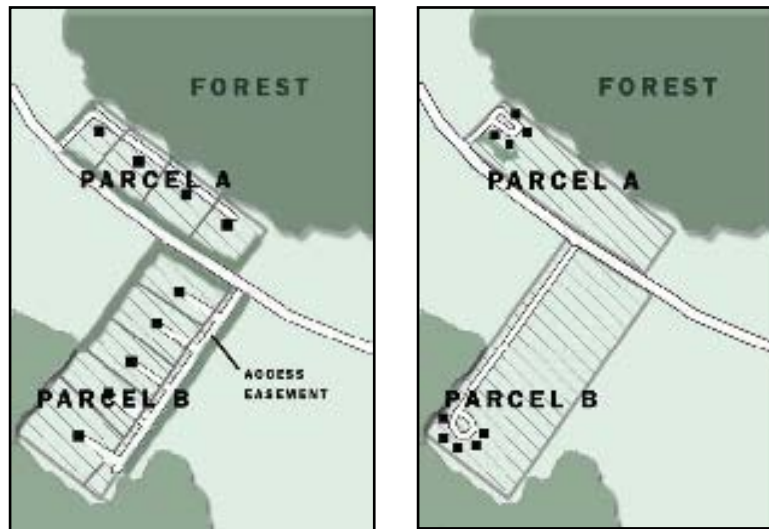
The objectives of this regulation are as follows:

- 1) Protect human life and health;
- 2) Minimize expenditures of public money for costly flood control projects;
- 3) Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;
- 4) Minimize damage to public facilities and utilities such as water and gas mains, electronic, telephone and sewer lines, streets and bridges located in floodplains;
- 5) Minimize prolonged business interruptions;
- 6) Help maintain a stable tax base by providing for the sound use and development of flood prone areas in such a manner as to minimize future flood blight areas; &
- 7) Ensure that potential home buyers are notified that property is in a flood area.

### ***Other Options for Floodplain Management***

Across the country, cluster or open space development is becoming more popular in order to protect the floodplain and other natural areas. Clustering of development and density transfers within individual sites are effective tools to protect sensitive environmental features such as wetlands and floodplains. Cluster development can be used to provide amenities such as passive open space or active recreation areas, avoid hazardous areas, and protect sensitive environmental features that provide protection against natural hazards. When using cluster development, the same gross density or overall development that would be permitted on the parcel is still allowed, but construction is limited to one portion of the site in order to protect the functional integrity of another portion of the same site. In a floodplain, this concept is applied so that development is clustered on the natural high ground of the site or on a small, contiguous, filled area with the remainder left as open space. Integrally related to the cluster development concept is the notion of density transfer in which developers can transfer density from one portion of the site to another as a means of encouraging cluster development. Transfer of density does not increase the number of dwelling units allowed on the site, but concentrates development on the least environmentally sensitive portions.

This technique can be used in both residential and commercial developments, transferring some of the density from one portion of a parcel to another, and is sometimes rewarded with a density bonus to encourage such development techniques. The left graphic below displays a conventional housing development, where each home site is built on a large parcel and takes up the entire development site. In the graphic on the right, the development potential is clustered together on smaller home sites, and open space is retained for both its ecological functions and its amenity to the potential buyers. Pinellas County currently allows for cluster development in its zoning code, provided minimum setbacks can be achieved.



*Traditional zoning that intrudes upon natural resources.*

*Cluster zoning is designed to protect vital natural resources.*

Planned Unit Developments (PUDs) are also utilized in Pinellas County to allow for flexibility in developments, including for the protection of the floodplain. In PUDs, a project is planned as a single entity via a site plan. The developer has significant flexibility in designing the project and can determine the size of the lots and utilize clustering, so that sensitive and open space areas can be easily retained without the need to build homes on larger sites in order to be in accordance with the existing zoning regulations. PUDs allow standards to be developed on a case-by-case basis with input from both the local government and the developer, allowing for the unique circumstances of the particular site to be taken into consideration, and for the best possible site design for all parties involved to be developed.

### ***Flood Damage Prevention Regulations***

Article III, Section 170-101 et seq., Flood Damage Prevention, of the Pinellas County Land Development Code outlines an array of requirements in an effort to eliminate or minimize the potential for flood damage. These include both general and specific standards of construction for a variety of structures as provisions for flood hazard reduction. The purpose of the regulation is the same as that for the Floodplain Management Regulations as stated above with the addition of the following: direct population concentrations out of the coastal high hazard areas.

The objectives of the Flood Damage Prevention Regulations are to be achieved by implementing a review system that:

1. Except as otherwise provided in the regulation, prohibits development within any designated 25-year floodway.
2. Requires the elevation or flood proofing of structures between the limits of the 25-year floodway and the 100-year floodplain at or above the base flood elevation.



3. Restricts development which would cause interference with the normal movement of flood waters.
4. Restricts development which would cause an increase in the rate or volume of surface water discharge or result in loss of natural flood storage.
5. Except as otherwise provided in the regulation, prohibits placement of fill within any designated 100-year floodplain without equivalent compensatory excavation within the floodplain to restore flood storage volume.
6. Floodplains shall be preserved, protected, restored and managed to maintain or enhance water quality, plant and animal diversity, and aquatic productivity.

### ***Habitat and Landscape Management Regulations***

Article II, Habitat Management and Landscaping, Section 166-83(e)(11) of the Pinellas County Land Development Code also contains regulations intended to prevent the detrimental effects of erosion on wetlands and floodplains. This provision is stated, as follows, as criteria by which a permit/application would be evaluated.

“*Soil stabilization*: Whether the removal of trees or other protected vegetation will result in uncontrollable erosion of soils into surface waters, or adjacent properties.”

### ***Water and Navigational Control Authority Regulations***

As discussed earlier, human-made alterations to drainage patterns can have an adverse effect on floodplains. In an effort to preserve natural drainage patterns Pinellas County encourages alternatives to, and often prohibits, the hardening or bulkheading of natural waterways. The Pinellas County Water and Navigational Control Authority Regulations, Section 166-359 (3,7-8) of the Land Development Code contain provisions for the deterrence of hardening or bulkheading as follows:

“Seawalls shall not be placed upon a shoreline which generally supports wetland vegetation....”, “Stabilization by the use of vegetation shall be required in lieu of shoreline hardening wherever possible.” and “It shall be the burden of the applicant to show that the vegetative option of shoreline stabilization is not viable.”

### ***Future Land Use Designations***

One of the primary methods utilized in Pinellas County to protect wetlands and environmentally sensitive areas, including floodplains, is through the establishment of the Preservation category on the Future Land Use Map (FLUM) in the *Future Land Use and Quality Communities Element* of the Pinellas County Comprehensive Plan. Development is prohibited in Preservation areas. Based on the 25-year and 100-year flood plains for Brooker Creek, the Brooker Creek floodway in Northeastern Pinellas County was protected in this manner. The 25-year floodplains along several other urban creeks in the unincorporated areas have also been designated as Preservation.

### ***Additional County Programs***

Other methods utilized by Pinellas County to protect the natural functions of floodplains and eliminate or reduce the potential for flood damage include land acquisition, transfers of development rights, regulations requiring upland buffers and a coastal construction code. The recent passage of a referendum to extend the Penny for Pinellas infrastructure sales tax will provide additional funds for the acquisition of environmentally sensitive lands, which may include lands within floodplains. Transfers of development rights are often utilized to direct incompatible land uses away from environmentally sensitive lands, wetlands and floodplains. In addition, Pinellas County regulations require that developers include an upland buffer adjacent to wetlands, which often also serves to buffer floodplains. The County also enforces a Coastal Construction Code, Chapter XXXIX, Section 3901, Building Code. This code applies to all barrier islands of Pinellas County and its municipalities. No urbanized barrier islands are located within the unincorporated areas of the County.

## PROTECTION OF UPLANDS

Intact upland areas serve a vital ecological function for Pinellas County, providing critical habitat for both plant and animal species that need to be preserved. Upland areas have been subject to destruction in efforts to meet wetland mitigation requirements in other parts of the County. When this is done, wildlife habitat is destroyed and species are displaced. The County will begin evaluating existing policies and practices to determine if there are alternatives to the destruction of upland areas for wetland mitigation purposes in order to preserve these habitat areas.

Upland areas also need protection because of the adverse impacts that their destruction can have on other ecosystems in the County. Excessive erosion from upland areas can have an adverse effect on adjacent aquatic habitats. In particular, suspended sediment can block sunlight, killing seagrass beds. Erosion from upland development activities, typically the destruction or removal of vegetation, can significantly increase sedimentation in an adjacent floodplain. This can result in an adverse impact on the ability of the natural system to function and on the flora and fauna that inhabit these areas. Pinellas County has incorporated provisions into its Land Development Code that minimize the impacts of erosion due to development activities. Chapter 154, Article II, Section 154-55, Floodplains, contains such provisions, including:

“All ground surfaces disturbed by construction, which are subject to soil erosion, shall be sodded per State Department of Transportation design standards. Other areas can be stabilized by grass and mulch or other practical methods.”



*Examples of Protected Upland Areas in Pinellas County*

## WATERSHED-BASED PLANNING

The County recognized very early, and began to address the concern in the original Master Drainage Plan (MDP) and its associated Storm Drainage Basin Studies, that stormwater control in isolation of the impact on the larger natural system is short-sighted. Even after the adoption of the MDP, the County realized that there was greater ability and opportunity to combine resource protection with traditional stormwater control requirements, and consequently the Basin Studies needed to be able to evolve. Today, the County's surface water management and watershed planning goals include the conservation, protection and restoration of County waters, the conservation and protection and restoration of wildlife habitat, and the protection of coastal areas in order to maintain or enhance water quality, biodiversity and estuarine productivity.



***Cross Bayou Canal Watershed***

Watershed management plans are developed to guide Pinellas County in protecting and managing environmental resources, achieving improvements in water quality, and providing flood protection when needed. Pinellas County realized that the Master Drainage Plan, even with the update from the Storm Drainage Basin Studies, was no longer accurate in describing the current conditions within the watersheds. Watershed management plans incorporate all aspects of environmental condition and are not limited to simply addressing drainage issues. The plans are developed using field surveys, flooding information, Digital Terrain Mapping technology, water quality and flow data, land use information and other available data to create a comprehensive plan for the management of a watershed. These plans include structural and nonstructural management strategies, goals dealing with flooding and environmental management, recreational and social opportunities, and educational components to inform citizens about the watershed, how they impact it and how they can help protect it. Watersheds are prioritized for the development of a watershed management plan during the Capital Improvements planning meetings. The prioritization is based on the greatest needs, including flooding problems, impaired water quality levels and other resource management issues that may arise. Information is gathered from the State on such items as requirements of the Total Maximum Daily Load program, from the County's Public Works' Highway and Engineering sections, and from the County's Department of Environmental Management (DEM) during the planning process to ensure that the most accurate data is being compiled for the development of a watershed management plan.

As of 2007, Allen's Creek, Lake Tarpon, Lake Seminole, Cross Bayou, Roosevelt Creek, Brooker Creek and Starkey watersheds have been selected for the development of a watershed management plan, based on impaired water quality levels identified during monitoring. Allen's Creek, Lake Tarpon and Lake Seminole watershed management plans were completed first and are being used as prototypes for the development of the future watershed management plans for the County's remaining basins and waterbodies. Watershed management plans have also been developed for Alligator Creek and Stevenson's Creek. The Alligator Creek Plan was developed in a partnership between SWFWMD, Pinellas County, Clearwater and Safety Harbor, and was completed in 1997. The Stevenson's Creek plan was

completed by the City of Clearwater in 2001. For more information on the surface water management program, see the *Surface Water Management Element* of this Comprehensive Plan.



***Lake Tarpon***



***Lake Seminole***



## LAND ACQUISITION

The largest tracts of natural vegetation continue to be those under public/semi-public ownership, or areas where federal, state, and local regulations prevent disturbance. This includes wetland areas and some adjacent uplands, especially if the area is utilized as a park or has been set aside as a preserve. Many of these environmentally sensitive properties, particularly in the rapidly developing northeastern corner of the County, would probably have been developed and lost forever as valuable natural assets to the County had they not been purchased by the Board of County Commissioners through its highly successful Parkland and Endangered Lands Acquisition Program. Current funding for this program comes from the Local Infrastructure Sales Tax, also known as the Penny for Pinellas. Since 1989, the County has purchased over 4,667 acres of parks and endangered lands worth over \$1.4 billion dollars. In March of 1997 and in March of 2007, voters approved, via referendum, 10-year extensions of the One Cent Infrastructure Sales Tax. The latest vote means that the County can now plan to purchase environmentally sensitive lands well into the future.



*Portions of Joe's Creek Preserve were acquired through the Penny for Pinellas Infrastructure Sales Tax for preservation purposes.*

These additional lands were identified by staff from the Real Estate Management Division of General Services, working closely with staff from the Department of Environmental Management, and were presented to the public as the lands proposed for acquisition should the Sales Tax extension receive voter approval. Now, with this voter approval, the County will be able to enhance its already significant endangered land and resource-based parkland holdings, and expedite the purchase of lands for habitat restoration projects. Overall, this program will significantly benefit the County's natural systems restoration, enhancement, protection and management program. It is notable that very few communities have expressed such a financial commitment to environmental lands acquisition as have the voters of Pinellas County. Through this commitment, they are also expressing their future land use vision for Pinellas County.

Pinellas County has shown an ongoing commitment to ecosystems management through its **Parkland and Endangered Lands Acquisition Program**. Following the principles of the "Red Flag Charrette" document published in 1972, the County has taken an integrated approach toward identifying and "red flagging" environmentally sensitive areas suitable for parkland or preservation uses. Ecosystems protection is being accomplished in Pinellas County through the purchase of preservation/open space areas based on an ecosystem's needs rather than on political jurisdiction. This ecosystem based approach will continue to focus on the establishment of larger (and thus more viable) preservation areas. Protecting the entire

ecosystem will improve the ecological diversity of the County and may help to reduce the need for protecting individual species under the Endangered Species Act in the future.

Through its acquisition of extensive natural areas, the County holds management and stewardship responsibilities over lands of local and regional importance to wildlife populations. By acquiring environmentally sensitive parcels and designating them as Preservation or Recreation/Open Space on the Future Land Use Map, the habitat integrity, diversity, quality and productivity of these lands will be maintained through the minimization of habitat disruptions and alterations.

Due to the multi-jurisdictional nature of ecosystems within Pinellas County, cooperation between the County and the incorporated cities and other governmental agencies has been a critical component of the Parkland and Endangered Lands Acquisition Program. Several joint acquisitions and management agreements have been executed in an effort to protect and preserve environmentally and archaeologically significant lands. Weedon Island was identified by the Red Flag Charrette as being an area of environmental and archaeological significance. The State of Florida has acquired over 3,000 acres of the Preserve, and Pinellas County acquired an additional 110 acres adjacent to the area. The County has recently agreed to a fifty year lease from the State to manage the property. Similar cooperation has been used to acquire and manage Cooper's Point with the City of Clearwater. Cooper's Point will be preserved in its natural state for all of the citizens and visitors of the County. Several County acquisitions have resulted in joint ventures with the Southwest Florida Water Management District (SWFWMD). The County has entered into agreements with the SWFWMD for the construction, operation and maintenance of Sawgrass Lake Park and the Brooker Creek Preserve. Approximately 390 acres of the Sawgrass Lake watershed have been preserved and serve as an excellent example of "wilderness" management in an urban setting. The land around Sawgrass Lake is used as a recreational and educational park, with an environmental education center operated jointly by Pinellas County, the SWFWMD, and the Pinellas County School Board.

Some of the more notable acquisitions of environmentally-sensitive lands have included joint acquisition with the Southwest Florida Water Management District for land in the Brooker Creek Preserve; 385 acres of the Mobbly Bay tidal swamp, on the east coast of the County near the city of Oldsmar; and over 305 acres of the Masters Bayou Tract in the area of Snug Harbor. Pinellas County began acquiring lands around Wall Springs in 1988 and continued until 2002, assembling a total of 195 acres for resource-based recreational opportunities. Eagle Lake Park will soon become the County's newest resource-based regional park, encompassing 156 acres of wooded parkland, open fields and freshwater ponds. It is also the site of an historic orange grove. Eagle Lake Park is scheduled to open by 2010. In addition to the acquisition of these properties, several drainage related projects, such as the Allen's Creek Watershed Management Plan, have resulted in the purchase and preservation of environmentally-sensitive lands for flood control and water quality enhancement purposes. See **Table 20** of the *Recreation, Open Space and Culture Element* of this Comprehensive Plan for a complete listing of lands acquired under Pinellas County's Endangered Lands Program since 1972.

Based upon recent statistics prepared by the Pinellas County Planning Department, in 2007 approximately 75 percent of the total land area in Pinellas County is developed; while only 5 percent of the County is vacant land suitable for future development. The remaining land is



allocated as Preservation, Conservation or Recreation/Open Space. This low percentage of vacant developable land continues to underscore the importance of protecting the County's remaining natural resources. Due to the Board of County Commissioner's highly successful parkland and endangered lands acquisition program, over 5,000 acres have been added to the County's Natural Reservations inventory since 1989. **Table 7** delineates the current list of Natural Reservations in Pinellas County. **Table 8** contains the flora and fauna found in Pinellas County that are listed as endangered, threatened, threatened due to similarity of appearance, **species of special concern**, possible candidates for federal listing, or listed under the Convention on International Trade in Endangered Species of Wild Fauna and Flora.

Over the past few years, the Board of County Commissioners has continued to promote responsible stewardship of the resources in the County. This has resulted in changes to local ordinances that affect natural systems and living resources. The Preservation land use category of the Future Land Use Element continues to be used as a primary implementation mechanism to recognize and identify environmentally-sensitive lands and features in the natural environment that should be kept essentially in their natural condition. Typical areas identified and designated for Preservation protection continue to include marine wetlands, major freshwater wetlands, tidal marshes, tidal swamps, shoreline vegetation, drainage/floodway corridors, areas within the 25-year floodplain, critical wildlife habitat, hardwood swamp, and cypress swamp. On the Pinellas County Future Land Use Map (unincorporated area of Pinellas County), there are 6,404 acres of land designated as Preservation and 4,432 acres designated as Preservation-Resource Management for a total of 10,836 (as of July 2007), which is approximately 17 percent of the entire unincorporated area. The Preservation-Resource Management category was added to the Comprehensive Plan in order to depict those areas of the County where passive recreational uses are compatible with the conservation and management of natural resources. For instance, much of the land within the Brooker Creek Preserve has been designated as Preservation-Resource Management.



*Boca Ciega Millennium County Park*

TABLE 7

EXISTING NATURAL RESERVATIONS IN PINELLAS COUNTY	
NATURAL RESERVATION	ACREAGE
<b>FEDERAL</b>	
Little Bird Key	1
Mule Key	3
Listen Key	4
Whale Key	5
Jackass Key	6
Indian Key	70
Tarpon Key	91
<b>Total</b>	<b>180</b>
<b>STATE</b>	
Anclote Key State Preserve*	5,301
Caladesi Island State Park*	2,470
Honeymoon Island State Recreation Area*	2,810
Pinellas County & Boca Ciega Aquatic Preserve*	22,000
<b>Total</b>	<b>32,581</b>
<b>PINELLAS COUNTY</b>	
Brooker Creek Preserve	9,069
<sup>1</sup> Pinellas County	7,284
Progress Energy	173
SWFWMD	1,612
Other Environmental Lands (listed in Recreation/Open Space Element)	2,577
Weedon Island Preserve	3,678
Pinellas County	115
State of Florida	3,230
Progress Energy	333
<b>Total</b>	<b>15,324</b>
<b>SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT (SWFWMD)</b>	
Alligator Creek	43
Clam Bayou	68
Jerry Lake	80
Joe's Creek	16
Lake Tarpon Outfall Canal	89
Lake Tarpon Sink Enclosure	6
Sawgrass Lake	390
<b>Total</b>	<b>692</b>
<b>OTHER</b>	
Mobbly Bayou (City of Oldsmar)	191
Cooper's Point (City of Clearwater)	1
<b>Total</b>	<b>192</b>
<b>TOTAL FOR ALL</b>	<b>49,754</b>
<b>*Includes submerged land.</b> <sup>1</sup> Includes 784 acres of the Wilde Trust Property acquired in 2008. Source: Pinellas County Parks Department, 2009.	

**TABLE 8**  
**FLORA AND FAUNA IN PINELLAS COUNTY THAT ARE LISTED AS ENDANGERED, THREATENED, THREATENED DUE TO SIMILARITY OF APPEARANCE, SPECIES OF SPECIAL CONCERN, POSSIBLE CANDIDATES FOR FEDERAL LISTING, OR LISTED UNDER THE CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES OF WILD FAUNA AND FLORA**

SPECIES	STATUS			
	FFWCC	FDA	USFWS	CITES
<b>PLANTS</b>				
Florida Golden Aster ( <i>Chrysopsis floridanus</i> )		E		
Wild Cotton ( <i>Gossypium hirsutum</i> )		E		
Pineethia pinetorum		E		
Golden Leather Fern ( <i>Acrostichum aureum</i> )		E		
Sand Dune Spurge ( <i>Chamaesyce cumulicola</i> )		C2		
Curtis Milkweed ( <i>Aselepias curtissii</i> )		E		
Beach Creeper ( <i>Ernodia littoralis</i> )		T		
Hairy Beach Sunflower ( <i>Helianthus debilis vestitus</i> )			C2	
Inkberry ( <i>Scaevola plumieri</i> )		T		
Sanibel Island Lovegrass ( <i>Eragrostis tracyi</i> )		T	C2	
Tampa Vervain ( <i>Verbena tamensis</i> )		E	C2	
Nuttall's Rayless Golden Rod ( <i>Bigelovia nuttallii</i> )		E		
Nodding Pinweed ( <i>Lechea divaricata</i> )		E	C2	
Pine Pinweed ( <i>Lechea divaricata</i> )		E	C2	
Catesby's Lilly ( <i>Lilium catesbaei</i> )		T		
Simpson Zephir Lilly ( <i>Zepheranthes simpsonii</i> )		E		
<b>REPTILES AND AMPHIBIANS</b>				
Atlantic Ridley Turtle ( <i>Lepidochelys kempi</i> )**	E			
Atlantic Loggerhead Turtle ( <i>Caretta caretta caretta</i> )**	T		T	I
Atlantic Green Turtle ( <i>Chelonia mydas mydas</i> )	E		E	I
Eastern Indigo Snake ( <i>Drymarchon Corais Couperi</i> )	T		T	
Short Tailed Snake ( <i>Stilosoma extenuatum</i> )	T		C2	
Florida Pine Snake ( <i>Pituophis melanoleucus mugitus</i> )	SSC		C2	
American Alligator ( <i>Alligator mississippiensis</i> )	SSC		T(s/a)	II
Gopher Frog ( <i>Rana capito aesopus</i> )	SSC		C2	
Gopher Tortoise ( <i>Gopherus polyphemus</i> )	T		C2	
<b>MAMMALS</b>				
West Indian Manatee	E		E	
Florida Mouse ( <i>Peromyscus floridanus</i> )	SSC		C2	
Round Tailed Muskrat ( <i>Neofiber alleni</i> )			C2	
Southeastern Big-Eared Bat ( <i>Plecotus Rafinesquii</i> )			C2	
Sherman's Fox Squirrel ( <i>Sciurus niger shermani</i> )	SSC		C2	
<b>BIRDS</b>				
Wood Stork ( <i>Mycteria americana</i> )	E		E	
Florida Sandhill Crane ( <i>Grus canadensis pratensis</i> )	T			II
Florida Scrub Jay ( <i>Apelocoma coerulescens coerulescens</i> )	T			II
Least Tern ( <i>Sterna antillarum</i> )	T			
Piping Plover ( <i>Charadrius melodus</i> )	T			
Southeastern Snowy Plover ( <i>Charadrius alexandrinus</i> )	T		C2	
Limpkin ( <i>Aramus guarauna</i> )	SSC			
American Oystercatcher ( <i>Haematopus palliatus</i> )	SSC			

**FLORA AND FAUNA IN PINELLAS COUNTY THAT ARE LISTED AS ENDANGERED, THREATENED, THREATENED DUE TO SIMILARITY OF APPEARANCE, SPECIES OF SPECIAL CONCERN, POSSIBLE CANDIDATES FOR FEDERAL LISTING, OR LISTED UNDER THE CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES OF WILD FAUNA AND FLORA**

SPECIES	STATUS			
	FFWCC	FDA	USFWS	CITES
Brown Pelican ( <i>Pelecanus occidentalis</i> )	SSC			
Little Blue Heron ( <i>Egretta caerulea</i> )	SSC			
Tricolor Heron ( <i>Egretta tricolor</i> )	SSC			
Roseate Spoonbill ( <i>Ajaia ajaja</i> )	SSC			
Reddish Egret ( <i>Egretta rufescens</i> )	SSC		C2	
Snowy Egret ( <i>Egretta thula</i> )	SSC			
White Ibis ( <i>Eudocimus albus</i> )	SSC			
Black Skimmer ( <i>Rynchops niger</i> )	SSC			
Mangrove Clapper Rail ( <i>Rallus longirostris insularum</i> )			C2	
Stoddard's Yellow Throated Warbler ( <i>Dendroica dominica stoddard</i> )			C2	
Burrowing Owl ( <i>Speotyto cunicularia</i> )	SSC			
Bachman's Sparrow ( <i>Aimophila Aestivalis</i> )			C2	
Peregrine Falcon ( <i>Falco peregrinus</i> )	E		T	I
Southeastern American Kestrel ( <i>Falco sparverius paulus</i> )	T		C2	II
Southern Bald Eagle ( <i>Haliaeetus leucocephalus leucocephalus</i> )	T			I

Source: Pinellas County Department of Environmental Management, 2007.

\*\*These turtles do not typically nest in Pinellas County but have been released here by the Clearwater Marine Center.

Accordingly, the abbreviations used herein are:

FFWCC-Florida Fish and Wildlife Conservation Commission

FDA-Florida Department of Agriculture and Consumer Services

USFWS-United States Fish and Wildlife Service

CITES-Convention on International Trade in Endangered Species of Wild Fauna and Flora

STATUS:

E=Endangered

T=Threatened

T(s/a)=Threatened/similarity of appearance

SSC=Species of Special Concern

C2\*=a candidate for federal listing with some evidence of vulnerability, but for which not enough information exists to justify listing

I=Appendix I Species (CITES)

II=Appendix II Species (CITES)

III=Appendix III Species (CITES)

\*both B1 and C2 candidate species are not federally protected under the Endangered Species Act, but the U.S. Fish and Wildlife Service "encourages their consideration on environmental planning."



### ***Environmental Lands and Resource-Based Parks***

Throughout the years, Pinellas County has developed a substantial system of environmental lands and resource-based parks that provide specialized resource-based recreational opportunities in conjunction and in harmony with their primary purposes of protection and conservation. Environmental lands and resource-based parks are also tremendous resources of open space, which is vitally important in a mature, highly developed county. These natural areas contribute to the biodiversity and biological sustainability of Pinellas County, while providing respite from urban life and instilling in future generations, a sense of appreciation for Florida's natural heritage. **Table 9** lists the environmental lands and resource-based parks in Pinellas County. The location of these lands can be found on **Figure 18**. For a more detailed discussion, see the Environmental Lands discussion in the *Recreation, Open Space and Culture Element* of this Comprehensive Plan.



***Fort DeSoto County Park***

**TABLE 9**  
**ENVIRONMENTAL LANDS AND RESOURCE-BASED PARKS**  
**IN PINELLAS COUNTY**

<b>Resource-Based Parks</b>	<b>Acreage</b>
A.L. Anderson Park	136
Boca Ciega Millennium Park	187
John Chesnut., Sr. Park	255
Fort DeSoto Park	1,136
Fred Howard Park	155
Lake Seminole Park	259
Philippe Park	122
Ridgecrest Park	23
Sand Key Park <sup>1</sup>	95
Sawgrass Lake Park <sup>2</sup>	390
John S. Taylor Park	157
Wall Springs Park	200
Walsingham Park	354
War Veterans' Memorial Park	122
<b>Resource-Based Parks Total</b>	<b>3,591</b>

<b>Environmental Lands</b>	<b>Acreage</b>
Allen's Creek	33
Alligator Lake	61
Anclote Islands	15
Brooker Creek Preserve <sup>1</sup>	8,285
Cow Branch South Bay	86
Joe's Creek	369
Lake Seminole By-Pass	97
Lake Tarpon Northeast	39
Long Branch	16
Mariner's Point	76
Mobbly Bayou Wilderness Preserve	396
Ozona	8
Shell Key Preserve <sup>2</sup>	2,181
Travatine Island	95
Weedon Island Preserve, including Gateway Tract <sup>2</sup>	3,678
<b>Environmental Lands Total</b>	<b>15,435</b>
<b>TOTAL OF BOTH RESOURCE-BASED PARKS AND ENVIRONMENTAL LANDS IN PINELLAS COUNTY</b>	<b>19,026</b>

Source: Pinellas County Planning Department and Department of Environmental Management, 2006.

<sup>1</sup> Includes 6,506 acres owned by Pinellas County, 1,1618 acres owned by SWFWMD, and 174 acres owned by Progress Energy and managed by Pinellas County

<sup>2</sup> Includes submerged lands

**FIGURE 18**  
**ENVIRONMENTAL LANDS MAP**



**FIGURE 19**  
**RESOURCE-BASED PARKS**

## NATIVE TREE CANOPY PRESERVATION AND PROTECTION OF NATIVE VEGETATION

Pinellas County was once a rural peninsula with a dense tree canopy, dominated by coniferous/pine forests punctuated with sabal palms, live oak trees and mangrove forests along the coastline. With the completion of the Orange Line Railroad in 1888 through the County from the north to the City of St. Petersburg, development pressures began to increase and most of Pinellas County was cut for timber prior to 1935. Following the exploitation for timber, much of the remaining land in the County was exploited for citrus, cattle and turpentine production. After all of the relic pines were used for turpentine production, more improved pastures were created for bovine production. Severe freezes in 1957 and again in 1962 decimated virtually the entire citrus crop in the County. Following the loss of this sector of the economy, residential development began at a rampant pace. In little more than 125 years, Pinellas County was transformed from an isolated, largely undisturbed wilderness into a major urban community. With this transformation, came the destruction of countless numbers of trees, and the existing wilderness gave way to miles of pavement and concrete.

Some areas of Pinellas County, however, have managed to maintain a significant portion of their native tree canopy, despite urban development. With increased pressures to redevelop existing properties at higher densities, the remaining native tree canopy in the County is even more at risk. The destruction of the tree canopy opens Pinellas County up to the possibility of the urban heat island effect, a loss of biodiversity, and even to the alteration of local weather patterns. Preservation and restoration of the tree canopy will provide many benefits to residents not only in Pinellas County, but in the region as a whole. Through the development of a program designed to maximize the retention of mature trees, and through the establishment of an inventory of mature trees in the County, Pinellas County may be able to develop strategies and update land development regulations to protect and enhance the remaining tree canopy, preserving the natural ecological functions of mature trees and incrementally improving the local and global climate.

### ***Environmental Benefits of Tree Canopy Preservation***



***The community of Ozona has an extensive native tree canopy***

Native trees provide a number of benefits to the local environment. The greatest benefit is arguably the transformation of carbon dioxide to oxygen, created through the process of photosynthesis. Carbon dioxide is increasingly present in Pinellas County and throughout the region. With increasing numbers of residents and tourists alike, there are more automobiles on the roads than ever before. These vehicles produce carbon dioxide as a side effect, polluting the air we breathe. Trees, and other plant life, absorb this carbon dioxide into their leaves, and release oxygen in return. Without the process of photosynthesis, the air could not be cleaned and a thick layer of smog would form over the area at times, potentially causing health

problems among residents. Mature trees are more beneficial than those that have been recently planted. According to the U.S. Department of Agriculture Forest Service, a healthy 30-inch tree removes 70 times more air pollution annually, than a 3-inch tree.

With the high degree of development in Pinellas County, there is also the threat of the urban 'heat island' effect. With a large amount of concrete, pavement and other building materials exposed to the sun without shade, the materials heat to a very high temperature, effectively raising the temperature around them. These materials have a much greater thermal capacity and heat conductivity than trees and other forms of vegetation, causing them to heat to a much greater degree and trap heat, keeping the area from cooling during the night. Trees offer shade, cooling buildings and pavement by keeping them from being exposed to direct sunlight. Preservation and restoration of the tree canopy can help Pinellas County from experiencing the full effects of the urban heat island, contributing to the moderation of temperatures in the entire County, and the region. With the increased attention on global warming, trees may also assist in the mitigating of global climate change. By absorbing carbon dioxide, a recognized greenhouse gas, and by countering the urban heat island effect associated with the increased urbanization of the entire globe, native trees can contribute to climate improvement.



***Tree Canopy along Belleair Road***

The native tree canopy in Pinellas County also provides food and shelter for a number of different plant and animal species that may not be able to survive otherwise. A variety of birds and mammals, such as scrub jays and squirrels, utilize trees for food, nesting and protection; and certain native vine species thrive at the base of large shade trees, using the tree trunks to support the vine as it grows.

Native trees and vegetation also serve a vital role in helping to control stormwater runoff. The extensive root systems common to trees and native vegetation absorb large quantities of water and can help slow the quantity of stormwater runoff reaching

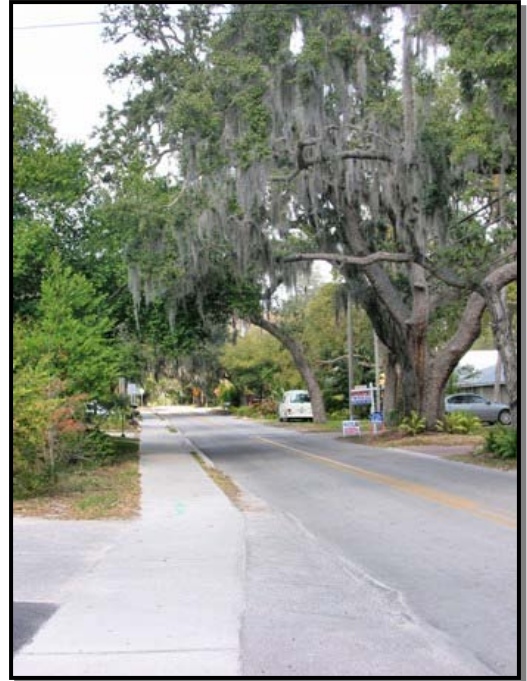
the surface waters of the County, thereby improving the quality of the surface waters. The U.S. Forest Service states that 100 mature trees intercept about 100,000 gallon of rainfall per year in their crowns. According to the *Urban Ecosystem Analysis* for the City of Jacksonville, conducted by American Forests®, that city lost 56 million cubic feet of stormwater retention capacity from 1992 through 2002, because of the decline in the tree canopy. The value of this stormwater detention capacity is valued at \$113 million. The remaining stormwater detention capacity of the tree canopy was valued at \$1.86 billion, based on what it would cost to construct stormwater retention ponds. This analysis shows that urban tree canopies offer a great benefit in the area of stormwater retention. This could be especially useful in Pinellas County, where the construction of a large number of detention ponds may not be viable, given the small amount of vacant land available for development. The root systems of trees also help to stabilize the ground, effectively reducing the likelihood of erosion on sloped areas.

### ***Other Benefits of Native Tree Canopies***

While aesthetics can be subject to personal opinion, there is little doubt about the value that native trees can add to homes, neighborhoods, and the County as a whole. Trees provide shade for people to socialize and recreate in. The monetary value that trees add to homes is debatable, but many find that the shade from trees helps to keep homes and business cool during the hot summer months, providing for lower electricity costs. According to the U.S. Department of Energy, homeowners can save \$100 to \$250 annually on cooling costs, just by

placing three shade trees around a house. Some people would pay more money for a property with trees because of the aesthetics, the cooling benefits and the wildlife that trees can attract. The U.S. Forest Service says that mature trees can add an average of ten percent to the value of a property. Trees also assist with the reduction of noise pollution. Their size alone absorbs noise and can shelter a home or a business from a highway or a busy arterial.

Trees can help to define a neighborhood. There are a few examples of communities known for their native tree canopies within the unincorporated areas of Pinellas County. The community of Lealman, in southern Pinellas County just outside of St. Petersburg, has an abundance of mature shade trees throughout the community, which are seen as a natural asset that should be protected and supplemented. The Lealman Revitalization Plan highlights these natural assets and expresses the desire of the community to preserve the existing tree canopy. The community of Ozona in northern Pinellas County is also known for having an excellent tree canopy. Residents in this community have expressed interest in creating a mature tree preservation program and in facilitating the replacement planting of native canopy trees along the community streets and common areas. Both of these communities see the tree canopy as being linked with their neighborhood identities and vital to preservation of these identities.



***Ozona's native tree canopy contributes to the community's quality of life and to the County's overall air quality.***

## **AIR QUALITY**

Acting under the auspices of the Clean Air Act, the United States Environmental Protection Agency (EPA), in consultation with the business, scientific, medical and academic communities, established national ambient air quality standards (NAAQS) for six criteria pollutants: particulate matter (fine and coarse), lead, nitrogen dioxides, carbon monoxide, sulfur dioxide and ozone. These standards were set at two levels, primary standards to protect public health and secondary standards to protect property, crops and quality of life. The standards are reviewed on a regular basis and revised, as needed, based on the latest medical and scientific evidence.

### **CRITERIA POLLUTANTS**

#### ***Particulate Matter***

Particulate matter (PM) consists of solid and liquefied particles that remain suspended in the air and includes materials such as chemicals, dust, soot, and pollen. Airborne particulates can be generated by activities such as fossil fuel combustion, heavy industry, diesel engines, land clearing, open burning, wind blown soils and traffic. PM is a complex pollutant, as it comes in a variety of sizes and chemical species, and is produced as both a primary and secondary pollutant. Particulate matter may impact the respiratory system or heart conditions directly and/or contribute to adverse health effects in combination with other pollutants.

#### ***Lead***

Lead is a common metal that can be present in food, air, water, dust, and many other materials. Lead effects the central nervous system and can cause neurological damage, especially in children. Ambient lead is a particulate, but is given special attention because of its potentially toxic effects. Before federal regulations prohibited its use, leaded gasoline was the major source of ambient lead. More common sources today are oil combustion, smelting, and manufacturing. Lead concentrations have dramatically decreased since tetraethyl lead was removed from gasoline.

#### ***Nitrogen Dioxides***

Nitrogen dioxides may irritate the eyes, nose, and throat, and can damage lung tissue and aggravate existing respiratory disease. Nitrogen dioxide is a principal contributor to acid rain and a key compound in the formation of ground level ozone, the Tampa Bay region's principal air quality concern. Nitrogen dioxide is produced from nitric oxide, a by-product of high temperature combustion. Gasoline engines and power plants are the primary sources.

#### ***Carbon Monoxide***

Carbon monoxide is a toxic gas produced by incomplete combustion of fuels and other organic material. Carbon monoxide can reduce a person's ability to think and see clearly, causes headaches and may lead to asphyxiation and death. More than 75 percent of ambient carbon monoxide is produced by automobiles. Carbon monoxide levels are worsened by traffic jams, poor automobile maintenance, and removing automobile pollution controls.

## ***Sulfur Dioxide***

Sulfur dioxide is a gas with a pungent odor that can destroy lung tissue and weaken the lung's cleaning and protective mechanisms. It is also one of the principal contributors to acid rain. Most ambient sulfur dioxide is produced by industrial sources that burn sulfur bearing fuels like coal or oil.

## ***Ozone***

Ground level ozone should not be confused with the ozone found in the upper atmosphere, or stratosphere. Stratospheric ozone is beneficial because it removes ultraviolet radiation that has been linked to skin cancer and global warming. Ground level ozone is the principal component of smog found in many urban centers. Ground level ozone has many adverse health effects including breathing difficulty, reduced endurance, disorientation, aggravation of respiratory disease and other harmful effects related to pulmonary stress. At ground level, ozone can damage vegetation and ecosystems, fabrics, rubber and many building materials. Ozone is not directly emitted into the air. It is produced by chemical reactions between volatile organic compounds and other pollutants, chiefly oxides of nitrogen and carbon monoxide, in the presence of sunlight.

## ***Air Toxics***

While there are thousands of chemicals used in manufacturing and commerce in the United States annually, the EPA has initially identified 187 chemicals of concern. The EPA is in the process of establishing and implementing a nationwide air toxics program. The program will be based on the risk of occurrence of cancer and other non-cancer illnesses in the general population. Through various County air toxics monitoring studies and EPA modeling assessments, the air toxics of concern in our region include: benzene, ethylene dibromide, butadiene, carbon tetrachloride, acetaldehyde, tetrachloroethane, naphthalene, acrolien, acrylonitrile, p-dichlorobenzene, arsenic, chromium, and ethylene dichloride. Air toxics are produced by a wide variety of industrial, commercial, and home use activities, as well as, mobile sources. They can be both primary and secondary pollutants.

## **THE TAMPA BAY AIR SHED**

For management and regulatory purposes, the EPA considers the Tampa Bay area to be an air shed including both Hillsborough and Pinellas Counties. In other words, if one County fails to achieve a NAAQS the entire air shed is considered to have a NAAQS violation. Due to a combination of weather/climatology (warm temperatures and stable high pressure) and particular emission sources, the Tampa Bay air shed's pollutant of concern has been Ozone. For many years the National Ambient Air Quality Standard (NAAQS) for ozone was a one hour standard set at 0.12 parts per million (ppm). The Tampa Bay air shed was initially classified by EPA as a nonattainment area for ozone. This meant that the measured ambient concentrations of ground level ozone had degraded to unhealthy levels. With advances in industrial and automotive pollution control technology and the implementation of federally required programs the Tampa Bay air shed continues to have improving air quality and the EPA reclassified the Tampa Bay air shed to attainment/maintenance status in February of 1996. In 2005 a new Ozone NAAQS was adopted and the one hour NAAQS was revoked. The



new standard is an eight hour standard (the highest 8 hour rolling average during any given day) and is set at 0.08 ppm (or 85 parts per billion/ppb). It has been shown that the longer exposure period is more protective of human health. The Tampa Bay air shed was classified as attainment for the new standard.

In March of 2007, the EPA was again petitioned by various environmental, health and policy groups to revise and lower the ozone standard further to 0.07 or 0.06 ppm. Actual response or action on these petitions is not expected until 2008.

In addition, the NAAQS for the Tampa Bay air shed's other criteria pollutant of concern, particulate matter, was recently reviewed and revised effective December 2006. The revisions are detailed in the following table.

PM Type/Standard	24 – Hour	Annual
Coarse Particulate Matter (PM10)	150 ug/m <sup>3</sup> (Old Standard Retained)	Revoked
Fine Particulate Matter (PM2.5)	35 ug/m <sup>3</sup> (Reduced From 65 ug/m3)	15 ug/m <sup>3</sup> (Old Standard Retained)

The Tampa Bay air shed was initially classified as attainment for all PM NAAQS. Final classification will occur three to four years after the new standard became effective. For our area, this will probably occur in 2010 using monitoring data from calendar years 2007 – 2009.

These new standards will have little practical impact on either the regulatory requirements or Pinellas County's operations, as personnel with the Department of Environmental Management Air Quality Division will continue to enforce and implement all required regulatory programs. One area that will be affected is Federal funding designated for transportation projects intended to relieve congestion and/or improve air quality.

## THE LOCAL AIR QUALITY PROGRAM

In order to achieve the air quality goals established in the Comprehensive Plan, Pinellas County maintains its accreditation as an approved local air quality program. The State of Florida and the EPA, annually review the work plan and work products of the air quality program. The Pinellas County Air Quality Division, Department of Environmental Management oversees the countywide Air Quality program, covering everything from monitoring, data analysis, planning for a wide range of issues, such as transportation projects and proposed regulatory programs, and conducting education/outreach. The Air Quality Division implements the compliance and enforcement requirements for local industries and businesses. Facility inspections and enforcement procedures have been established to fulfill federal, state and local regulatory programs which minimize human exposure to carcinogens and toxic substances.

Air pollution does not respect jurisdictional boundaries. Although air quality in Pinellas County is affected by activities outside its borders, the oversight, reporting and administration of the compliance and enforcement program have resulted in the improvement of air quality and compliance with established NAAQS.



The Air Quality Division operates and maintains sites for the State and Local Air Monitoring Stations (SLAMS) and National Air Monitoring Stations (NAMS) as part of the duties of a local air program. In addition, the County has a National Air Toxics Trends Site (NATTS). This site will be in operation through 2009. Its data will be used by the EPA in establishing the nationwide air toxics programs, and locally by the Division in formulating its programs, as well as establishing goals, objectives, and priorities. The ambient air monitoring data is checked for accuracy and completeness.

The countywide air quality forecasting program continues to be successful with an overall accuracy of 90 percent, and a 75 percent success rate of forecasting high pollution events. Under this program, the Pinellas County Air Quality Division staff issue both a current and next day air quality forecast by mid-morning Monday through Friday (the Friday forecast includes Sunday) and update the forecast as required by mid-afternoon. This information is critical for those individuals suffering from respiratory and heart conditions and whose physical activity should be curtailed on days with poor air quality. This forecast uses the existing air quality index color scheme and is an easy way to relate real time pollutant concentrations to the public. The forecasts are available on the County's website, the EPA's website, the Weather Channel, and by phone for those without internet or cable access.

The Division continues to implement an asbestos removal and demolition fee program. This allows the Division to recover the costs of compliance oversight resulting from activities performed by the regulated community.

The Division website is maintained and updated on an ongoing basis. The website is a key component of the Division's outreach and education program. It has detailed information relating to Division programs, an air quality complaint system, links to other environmental agencies, and provides access to historical and real time monitoring data.

Some of biggest challenges for the future are mobile source, monitoring network, and air toxic source issues. Mobile source emissions continue to decrease as a result of federal fuel and vehicle emission programs. Eventually, emissions are expected to rise as the number of vehicles and miles driven continues to increase and outweigh improvements from the federal programs. The challenge lies in developing alternative modes of transportation and moving drivers to these alternate modes. In addition, both on and off-road mobile diesel sources are significant contributors to air toxics emissions. The County has obtained funding through a federal grant and local pollution recovery trust fund to retrofit school buses with control devices that reduce air toxics emissions. The Division will continue to seek opportunities such as these to reduce mobile source emissions.

The EPA recently revised the national air quality monitoring network regulations. Future monitoring efforts will concentrate on pollutants that have higher risk, and on areas where those pollutants are present. Pinellas County Air Quality Division staff will play an important role in local network evaluation and perform the fieldwork required to reconfigure the network.

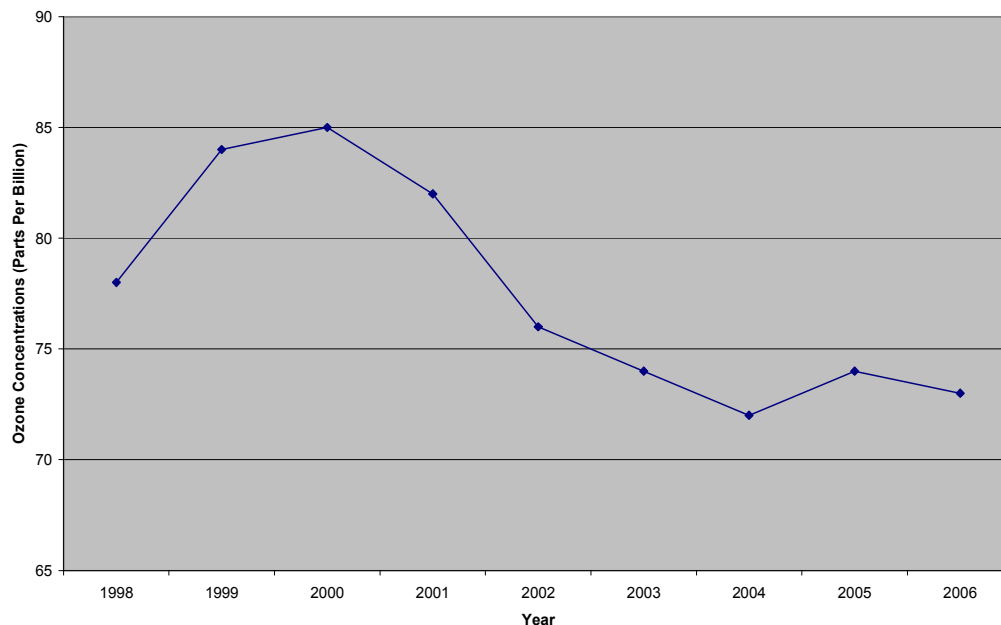
The EPA has begun promulgating air toxic regulations for approximately 70 area sources. Area sources are small sources, such as dry cleaners, that are prevalent throughout the County. Individually, they may emit small amounts of toxic chemicals, but when aggregated, they may become significant contributors to the total air toxics emissions budget. The regulations will be

promulgated in groups every six months over the next 2 - 3 years, and their impact on available resources is unknown at this time.

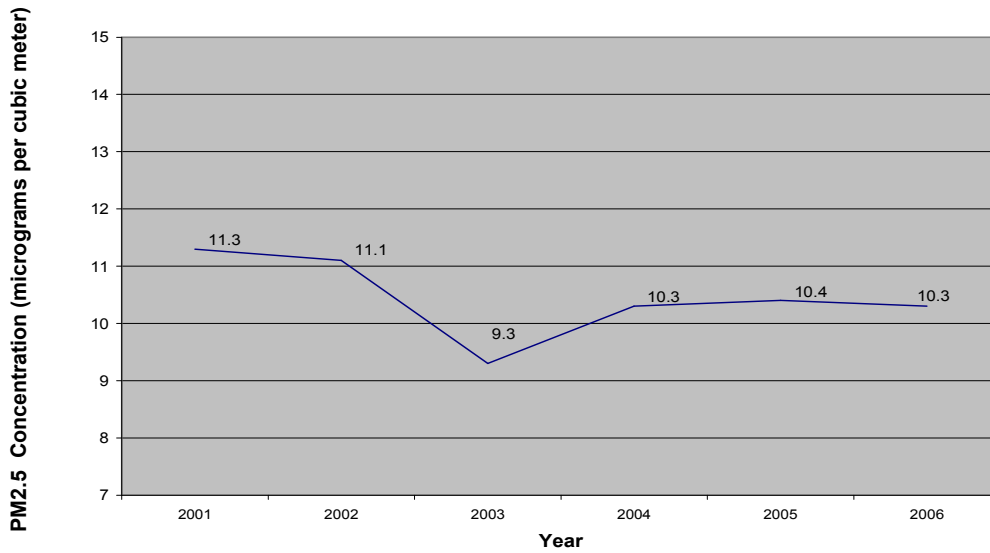
## ANALYSIS

A review of the air quality data shows a marked improvement over time. This is supported by the attainment designation for all the NAAQS. While monitored data for Ozone and PM do not directly represent other monitored data, they are good indicators of trends for the other criteria as well as toxic air pollutants. As best demonstrated by the following graphs, local air quality has continued to improve since 1998. The first graph indicates compliance with the ozone standard (three year rolling average of the 4<sup>th</sup> max compared to the standard of 85 parts per billion). After peaking in the year 2000, ozone concentrations have generally trended downward, finally stabilizing over the last few years. The second and third graphs represent trends in the PM Fine particle measurements (micrograms/cubic meter) for annual average and daily maximums since 2001, when data collection was initiated.

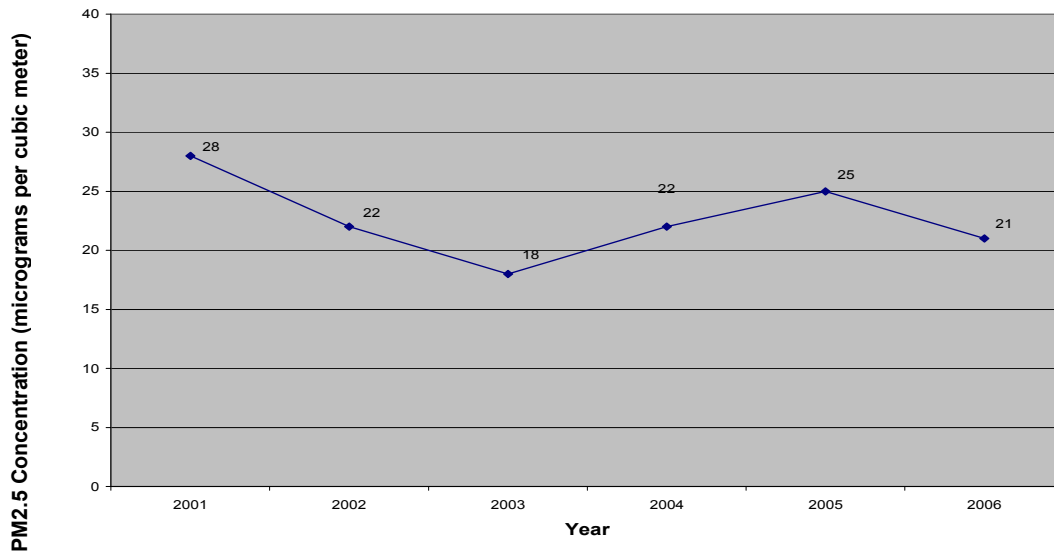
**FIGURE 20**  
**PINELLAS COUNTY OZONE DESIGN VALUES**  
**1996 - 2006**



**FIGURE 21  
FRM PM2.5 ANNUAL AVERAGE  
2000 -2006**



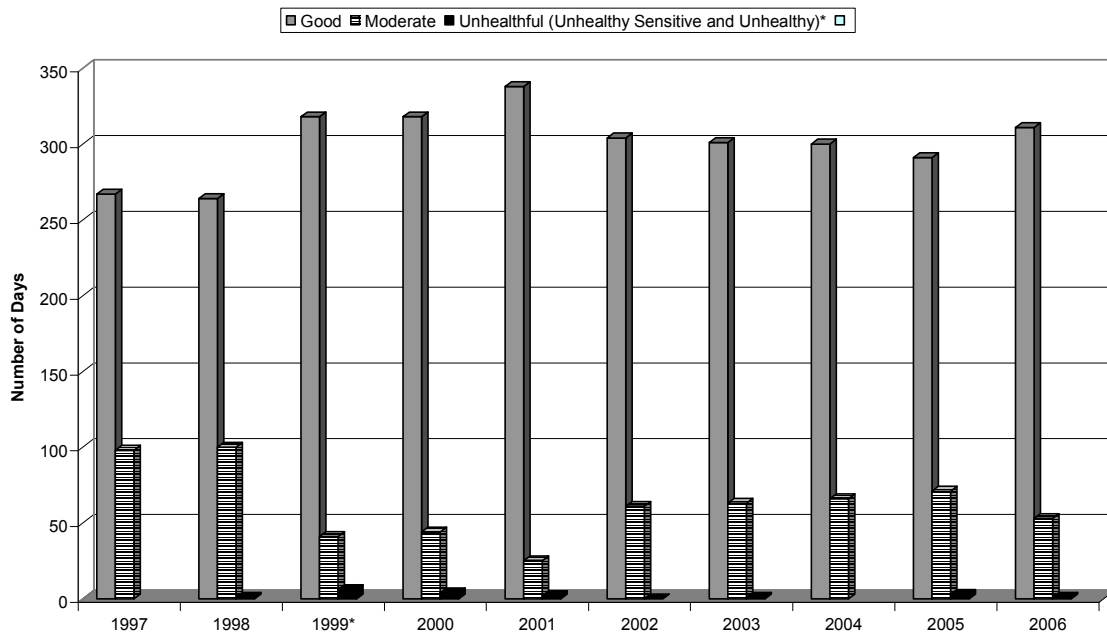
**FIGURE 22  
PM2.5 FRM 98<sup>TH</sup> PERCENTILE  
DAILY MAXIMUM**



Another indicator of air quality is the daily Air Quality Index (AQI). The AQI is a nation-wide standard method developed by the EPA for reporting daily air quality to the public in an easily understandable health-related manner. It tells you how clean your air is and what associated health concerns you should be aware of. The AQI describes ambient air quality concentration levels for sulfur dioxide (SO<sub>2</sub>), ozone (O<sub>3</sub>), carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>), and particulate matter (PM) in terms of a concentration index for the highest pollutant level in a given time period. The pollutant concentrations are measured and converted to numbers

based on a mathematical formula that transforms ambient pollutant concentrations onto a health-based scale. The higher the AQI value, the greater the level of air pollution and the greater the health danger. AQI values of 100 or less are generally thought of as satisfactory. When AQI values are above 100, air quality is considered to be unhealthy. Sensitive groups of people (children who are active outdoors, adults involved in moderate or strenuous outdoor activities, individuals with respiratory disease such as asthma, and individuals with heart disease) are impacted first, then as AQI values get higher everyone is impacted. For all pollutants except fine particulate matter, an AQI of greater than 100 would be equal to the National Ambient Air Quality Standard (NAAQS). For fine particulate matter, an AQI of greater than 150 would be equal to the National Ambient Air Quality Standard (NAAQS). The following figure shows the historical AQI trend from 1997 to present. Since 1997 the AQI has improved with more days in the good category and fewer days in both the moderate and unhealthy categories.

**FIGURE 23  
HISTORICAL AIR QUALITY INDEX**



\* In 1999, the unhealthy category was divided into 2 subgroups, unhealthy for sensitive groups and unhealthy.

The continued improvement in air quality can be attributed to the success of various programs enforced by the Division and required under Federal, State, and local regulations (e.g. Federal vehicle emission and fuel programs). Nevertheless, Pinellas County remains vigilant in their air quality program in an effort to maintain and improve air quality in the future. Continued measures to improve air quality may be hindered by future growth in both population and population density.

## ENERGY CONSERVATION

According to the Energy Information Administration, in 2005, Florida ranked third in the nation in total energy consumption, behind only Texas (#1) and California (#2). In spite of this, in 2004, Florida ranked #46 in total energy consumption per capita, due largely to low energy use by the industrial sector. *Florida's Energy Plan*, a report produced in January 2006 by the Florida Department of Environmental Protection, acknowledges that Florida's energy needs are expected to grow by approximately 58 percent (%) between 2002 and 2020. Despite the low per capita energy usage, these growth figures can be alarming. The need for energy in the State is compounded by the high population growth rate, the hot and humid summers, and the fact that very little energy is actually produced within the State itself. According to the *Energy Plan*, Florida produces less than 1% of its total energy requirements, and the geography of the State makes it very susceptible to supply interruptions. There are very few fossil fuel resources within the State that can be extracted and used for energy production, and those renewable resources that Florida may be able to rely upon (such as solar and wind) currently supply approximately 1% of the energy required to power the State. Transportation comprises more than one-third of the total energy usage in Florida. Without substantial refineries or even pipelines to ensure supply, the State is left dependent upon weather conditions and other factors to ensure that automobiles are not stranded without fuel.

In light of increasing oil and gas prices, and the increasing concern over environmental impacts that energy consumption can have on natural resources, it is time for the State, and for Pinellas County itself, to explore renewable and alternative energy sources that would be able to supply residents and businesses with electricity in spite of supply chain interruptions that may occur over time. Florida, Pinellas County and other regional entities have already begun to undertake a number of initiatives and programs that serve to promote energy conservation, in turn serving to protect the natural resources that have become a major contributor to both the quality of life in Pinellas County, and to the tourist-driven local economy.

## STATE INITIATIVES

### ***Demand-Side Management (DSM)***

According to the *Energy Plan*, DSM seeks to reduce customer peak demand and energy requirements. This program is designed to defer the need for new energy-producing units, by controlling the demand. This is done through a number of methods, such as implementing higher billing costs associated with certain times of the day to reduce peak demand. This has proven to increase customer awareness of energy usage and encourage conservation of energy resources when the supply levels are at their most critical. Since 1980, Florida's utility conservation programs have reduced statewide summer-time peak demand by 4,951 megawatts, and peak demand during the winter by 5,511 megawatts. It is anticipated, that by 2014, DSM programs will further reduce annual energy consumption by 6,883 giga-watt hours.

### ***Green Lodging Program***

In 2004, the State of Florida instituted the Green Lodging Program, encouraging hotels and motels to adopt energy efficient and sustainable practices to protect the State's natural

resources. As one of the largest commercial sectors in Florida, the lodging industry has a significant impact on the health and future of the natural resources of the State. According to VISIT Florida®, 83.6 million people visited Florida in 2005, with approximately 50% of them staying in hotels, motels, or bed and breakfasts. In return for reducing their energy use and environmental footprint, participating lodging facilities are able to save money on energy costs, utilize the Green Lodging Program logo on marketing materials, and receive free advertising through the Program's website and promotional materials.

### ***SunSmart Schools Program***

Florida's SunSmart Schools Program was designed to encourage the use of solar electricity generation in public schools across the State and to raise awareness about this free energy resource available to all residents. This program installed 29 solar electric systems in public schools through the State through a combination of State funding and private partnerships. These systems power classrooms, and sell excess energy back to the local power grid. Because of the placement of such systems in the schools, the solar systems are able to act as classrooms for the students to learn more about solar power and the benefits of renewable energy and energy conservation.

## **REGIONAL INITIATIVES**

### ***Water Conservation Hotel and Motel Program (CHAMP)***

CHAMP is a program developed by the Southwest Florida Water Management District (SWFWMD) that is similar in scope to the State's Green Lodging Program, but with more of a focus on water conservation. This program encourages hotels and motels to conserve water through more efficient laundry practices including towel and linen reuse, practicing more water-efficient landscaping methods, and even encouraging water conservation in restaurant dishwashing practices located within hotels and motels. Studies completed by Pinellas County Utilities and the City of Tampa Water Department showed that 71 hotels saved over 100 million gallons of water through participation in CHAMP, in only one year after the program's implementation.

### ***Water-Wise Awards***

The Community Water-Wise Awards Program was created by Tampa Bay Water, a major water supplier for the Tampa Bay region. The awards recognize those businesses and citizens who have shown a commitment to the conservation of water and protecting Florida's natural resources through the use of Florida-Friendly landscaping practices. Water-Wise landscaping includes efficient irrigation, the retention of stormwater runoff, and the proper placement of plants to minimize fertilizer and pesticide usage. Each year, Tampa Bay Water accepts applications from the community, whereby applicants self-evaluate their landscaping system. According to the results of the application process, Tampa Bay Water representatives will visit some of the properties to further evaluate the landscaping systems and make a final determination on awards.

## LOCAL INITIATIVES

### ***Waste-to-Energy Facility***

Pinellas County has an innovative energy conserving program of its own in the Waste-to-Energy facility. The Waste-to-Energy (WTE) facility has the capacity to burn 3,150 tons of garbage every day. The WTE facility processes about one million tons of garbage every year. The process can produce up to 75 megawatts (MW) per hour of electricity. The facility sells about 60 MW to Progress Energy for distribution within the community, and the remainder powers the plant itself. This electricity powers approximately 45,000 homes and businesses every day. The WTE facility uses state-of-the-art air pollution control technology, which continuously monitors WTE emissions, ensuring the plant's emissions fall within the United States Environmental Protection Agency's (EPA) standards.



***Aerial View of the Pinellas County Waste-to-Energy Facility***

Ash generated from the combustion of solid waste is transferred to the adjacent Residue Storage and Processing Building. There, the ash is size-separated using screens, and both ferrous (steel) and non-ferrous (aluminum) metals are recovered from the ash using mechanical equipment such as magnets and eddy currents. The recovered metals are sold to steel mills and smelters for recycling, and the remaining ash is used for landfill cover and interior site berms and roadways.

This facility allows Pinellas County to recycle energy and avoid the creation of significant landfill space. By creating energy from waste, Pinellas County is able to supply power to the local energy provider without the need to depend solely on fossil fuel resources to power homes and businesses. This facility is an excellent example of a local energy source that helps to protect the natural environment by keeping harmful pollutants out of natural areas, and instead burning them to create electricity for use by local residents and businesses.

## OTHER RENEWABLE ENERGY SOURCES

### ***Wind***

Wind power is one renewable energy source that has very little history in the State of Florida, and even less in Pinellas County. In *Florida's Energy Plan*, wind power is encouraged because of its potential to create a significant amount of local and renewable energy for the State. The Energy Plan notes that the costs associated with developing wind power have decreased significantly over the years because of the research and development advances surrounding the technology, and the turbines are becoming increasingly efficient. As Pinellas County is located on a peninsula along the Gulf of Mexico, the capturing of wind power along the coastlines may present an opportunity for the



***Windmills are one alternative to the use of fossil fuels***



development of this renewable energy source. Wind energy has a minimal impact on the environment, requiring only a footer to stabilize the turbine, and it does not generate any pollution. Because of this, wind can have a positive impact on global warming: generating electricity without causing additional pollution. The downside to wind power is the impact that the turbines can potentially have on migratory bird species. As Pinellas County is the winter home to a number of migratory birds, with rookeries on such locations as Shell Key, impacting their migration patterns or safety is a concern and this would have to be taken into consideration when evaluating potential sites for wind power generation.

### **Solar Power**

Pinellas County is fortunate to experience sunshine nearly every day of the year. As Florida is known as the Sunshine State, there is little doubt that the use of solar power could be very helpful in the development of renewable and local energy sources. According to the Tourist Development Council, Pinellas County averages 361 days of sunshine per year. The State of Florida has begun to take a proactive stance when it comes to energy conservation and efficiency. In 2006, the Florida Legislature passed the Renewable Energy Technologies and



*Florida has large potential to capture energy from the rays of the sun in order to power components in both residential and commercial structures.*

Energy Efficiency Act, providing \$2.5 million in rebate funding to businesses and residents installing solar panels for electricity, water heaters and pool heaters. These grants have assisted with the high cost of purchasing and installing solar panels, which has often been the reason for many citizens not applying the available technology. It could take years to recoup the cost of installing solar panels (photovoltaic cells) in a home, which often deters residents from doing more to utilize the resource. Despite the high cost, further development of solar technology in Pinellas County could have a very significant impact on the need to conserve energy and protect natural resources from pollution and exploitation in both Pinellas County and the State of Florida.

### **Biofuels and Other Fuel Sources**

According to Florida's Energy Plan, the State consumes 8.6 billion gallons of gasoline per year, and consumption is increasing by 300 million gallons annually. This is having a significant impact on the quality of the environment in Florida and in Pinellas County itself. The burning of gasoline contributes to air pollution, which is then transferred to the ground and the waterbodies during rain events. The State of Florida has become very interested in the creation and use of biofuels and other alternative fuel resources, such as ethanol. The State has been researching the potential of using citrus peels to develop an alternative fuel source, as the citrus industry in the State is the largest in the country. Alternative fuels burn much cleaner than standard gasoline, and many do not require the importation of foreign supplies for their production. While Pinellas County does not have significant agricultural resources from which to produce alternative fuel supplies, the County may be able to utilize biofuels and other alternative fuel sources to operate fleet vehicles. As the fleet of vehicles operated by the County is upgraded, the County may be able to obtain vehicles that either have the capability to use alternative fuels, or are hybrid, allowing the vehicles to consume less gasoline.

## PLANNING FOR CLIMATE CHANGE

The topic of climate change has come to the forefront in recent years. Regardless of the causes for the rising temperature of the atmosphere, whether by greenhouse gasses or natural cycles of the earth, there is consensus that the temperature is indeed rising and action needs to be taken to ensure the effects of climate change are not disastrous. Average global surface temperatures have risen during the past century and are expected to rise even more in the coming decades. The anticipated change in climate has several implications for natural resources within Pinellas County. Rising sea levels and the increasing strength and occurrences of hurricanes have the potential to devastate the County, and should be taken into consideration when planning for the future and making land use decisions.

### SEA LEVEL RISE

One direct result of increasing temperatures is the corresponding rise in sea levels, caused by the melting of polar ice caps and glaciers. Being largely surrounded by water, the potential consequences for Pinellas County could be profound, and any rise in sea level could have a significant impact. As can be seen in **Figure 4**, there is a substantial amount of land area that could be affected by sea level rise, particularly around Weedon Island, the Gateway area, Fort De Soto Park, Honeymoon Island and Caladesi Island. These natural vegetative communities could be completely wiped out with a significant rise in the level of the sea, destroying vital plant and animal habitat that would be very difficult, if not impossible, to re-create, particularly with the level of development that currently exists within Pinellas County. In addition to providing habitat, natural resources in Pinellas County help to protect developed lands from a variety of natural events, including wave action and flooding. Future planning in the County should take this into consideration. Significant thought should be given to where development is allowed, protecting low-lying areas from significant alteration, as it will be both expensive and time consuming to protect developed areas from sea level rise in the future. For more information on sea level rise, see the *Coastal Management Element* of this Comprehensive Plan.

### HURRICANES

In addition to sea level rise, increased hurricane activity is also an anticipated consequence of climate change. Hurricanes gain their strength from the warm waters of the Atlantic Ocean and the Gulf of Mexico. During the summer months, the warmer waters help to fuel the large storm systems known as hurricanes that impact the Florida peninsula. It is common for a greater number of hurricanes to occur during the late summer and fall months because the water temperatures are higher than other times of the year. Such storms are also often stronger than those occurring early in the hurricane season, which runs from June 1 to November 30. Hurricanes can bring a significant amount of rain and high storm surges to Florida. Pinellas



***Hurricanes are expected to increase in intensity as global temperatures continue on a warming trend. Pinellas County is particularly vulnerable being located on a peninsula.***

County is especially vulnerable to storm surge, with Tampa Bay bordering the County on its eastern side. Should a hurricane directly impact Pinellas County, the associated winds could push water up into the Bay, creating a large storm surge that could impact thousands of residents in low-lying areas. Natural coastal vegetation provides protection to inland areas from such storm surge, absorbing wave action and buffering development from rising waters. Unfortunately, Pinellas County has a large amount of development in low-lying areas that lack protection from such hurricane impacts. Restoration of natural vegetative communities along the waterfront could have a significant impact on protecting development from hurricanes. While hurricanes are not guaranteed to occur annually, and strong hurricanes are often few and far between, it is anticipated that the storms will increase in intensity and occur more often. Future planning in Pinellas County should focus on protecting natural resources in the coastal areas that serve to protect the lives and livelihoods of County residents.

## **ECOSYSTEM BALANCE**

Rising temperatures also have the ability to upset the delicate balance of the ecosystems within Pinellas County. Manatees thrive because of the existence of seagrass beds, which grow because of certain temperature and other conditional ranges. If the temperature rises too greatly, seagrass beds may not survive, thereby impacting manatee and fishery populations. In addition, wading birds that are dependent upon juvenile fish inhabiting the seagrass areas would be unable to find food as easily if the seagrasses were destroyed. This would in turn have an impact on the local economy, driven greatly by tourism that is focused on the natural environment, such as the beaches, birding, fishing and other types of recreation.

## **CLIMATE CHANGE PROGRAMS**

### ***National Organization of Counties Climate Change Program***

There are a number of programs that are open for Pinellas County's participation that would further encourage the recognition of, and planning for, climate change. In addition to the Florida Green Building Coalition's (FGBC) Green Local Government Standard, described in detail in the FGBC section of this Element, the Climate Change Program might also serve as a catalyst for Pinellas County to begin addressing climate change.



The National Organization of Counties (NACo) has established a Climate Change Program. This program began with a resolution issued by the NACo board of directors, calling on the United States Congress to address global warming. The Climate Change Program was designed to assist counties as they attempt to counter the effects of global warming in the midst of various state and federal laws and regulations. The program begins with counties making a pledge to reduce greenhouse gas emissions by a specific numerical target. This target is not a standard for each county, and every jurisdiction is able to set their own goals with their individual needs in mind. The program could help any county to set strategies and goals for itself in the quest to reduce its impact on climate change.

As is evident from the examples given above, climate change has the potential to have a very significant impact on Pinellas County and the natural resources found within and around its

borders. By making wise decisions today and planning for a future where the weather and conditions may be quite different than they are currently, Pinellas County may be able to transition into the future with as little impact on the lives of its residents as possible. Planning for the future would enable the County to take a proactive stance on climate change, instead of trying to remedy problems once they already exist.

### ***Cool Counties Initiative***

The Cool Counties Initiative was launched in July 2007 at the National Association of Counties Annual Conference. A group of twelve counties from across the country, representing 17 million people, came together to address the challenges that climate change poses for their communities. Among those counties involved were: Miami-Dade County, Florida; King County, Washington; Nassau County, New York; Cook County, Illinois; and San Mateo County, California. King County serves as the lead organizer of this effort, with assistance from the Sierra Club and other counties in the United States. By participating in this initiative, counties are committing themselves to work for a reduction in greenhouse gas emissions. According to the Cool Counties website, counties signing the Cool Counties Declaration are committing to take the following four actions: (1) assess internal policies to determine where greenhouse gas emissions could be reduced; (2) work with communities to reduce greenhouse gas emissions by 80 percent of current levels by 2050; (3) identify local vulnerabilities to climate change and create a plan to address them; and (4) work with other counties to persuade the federal government to enact legislation reducing greenhouse gas emissions by 80 percent of current levels by 2050.

As Pinellas County is highly vulnerable to the impact of climate change, the County has committed to adopting a Cool Counties resolution by early 2008. This action will demonstrate the County's leadership on climate change and the County will benefit from an exchange of knowledge and best practices with other counties throughout the country.

### ***Carbon-Neutral Resolution***

A number of jurisdictions around the country have adopted carbon-neutral resolutions, committing them to reduce their carbon emissions, and to mitigate for those emissions that they are unable to eliminate, so that the jurisdiction is not contributing to the greenhouse gases in the atmosphere. Mitigation can include taking action by one's self by doing such things as planting trees, or by purchasing carbon off-set credits, whereby an organization will use your payment to complete a mitigation project for you at a site of their choosing. These organizations often take in large sums of money from off-set requests and complete large-scale projects in an effort to mitigate for the carbon emissions of many people in various parts of the world.

### ***Bushnell Center for Urban Sustainability***

Pinellas County has its own Urban Sustainability Program through the Bushnell Center, in conjunction with the University of Florida's Cooperative Extension. The mission of the Bushnell Center is to catalyze urban sustainability by enabling the adoption of sustainable practices in the larger community, through education and outreach for organizations undergoing a sustainability transformation, and the creation of public-private and regional/statewide partnerships. The Bushnell Center has been spearheading the sustainability program in the

County, connecting the various County departments together in the common goal for a more sustainable Pinellas County.

Through a comprehensive sustainability approach, the Bushnell Center is able to transform existing County programs in a manner that ultimately provides more efficient and integrated service delivery. The Center is also contributing to enhanced quality of life for our community. Sustainability enables employees (key stakeholders) to move away from a narrow value-focus to a multi-faceted value proposition that treats the long-run consequences of decisions we make today as current day liabilities or opportunities, and looks for synergy between environmental, social and economic criteria. An example of this approach is the work of the Sustainable Built Environment and Development Committee which is made up of representatives of the County's Building and Development Review Services, Planning, Community Development, Cooperative Extension, Public Works, Utilities and Economic Development departments. As this team tries to figure out the best type of "green" building policies and programs for the County, it is able to realize synergies between affordable housing and energy efficient home design or job creation and mixed-use developments that might generate their own energy from waste.