1 Pinellas County's Natural Landscape

GEOLOGY AND TOPOGRAPHY

Pinellas County is a sub-peninsula located along the western edge of central Florida. The County lies on the southwestern flank of the Ocala platform, and is underlain by a series of limestone formations, all of which dip toward the south. Two formations reach the surface in Pinellas County, the Hawthorne and Tampa Limestone, while a third, the Suwannee, is beneath them throughout the County. These formations are the most important characteristics of the geology of the County.

The Suwannee Formation is the oldest geologic formation that has significance to the County. It is found at depths of 100 feet in the Tarpon Springs area and dips to over 250 feet under St. Petersburg. The formation consists of granular, porous limestone formed during ancient (Oligocene) times by carbonate secreting marine life.

Moving toward the surface, the Tampa Formation also underlies the entire County. The Tampa Formation nearly reaches the surface north of a line from Palm Harbor to Safety Harbor. It dips as it moves southward to a depth of over 100 feet in St. Petersburg with two intermediate high points, the Coachman High and the St. Petersburg Plateau area. Ancient reefs are believed to have originated at these high points. Spreading from these points is the now hard limestone of the Tampa Formation, intermixed with granules of sand and phosphate. In several areas in the north County, the formation is about 20 feet thick and widens to over 150 feet in the south. The water soluble hard limestone is honeycombed with many interconnected solution channels which store large quantities of water.

Just under the surface is the Hawthorne Formation, which is absent north of a line from Safety Harbor to Palm Harbor. Quite different from the Tampa and Suwannee, the Hawthorne Formation is dominated by layers of sandy clays. The top of the formation is gently rolling, but exhibits a prominent ridge which extends from central Pinellas County (east of Dunedin) south to the vicinity of Walsingham and east to the St. Petersburg area. Surface elevations of the formation ridge range from 50 feet mean sea level (msl) near Coachman to 11 feet below msl in St. Petersburg. This subsurface ridge in western Pinellas County forms the core for the Pinellas Ridge and to the south it forms the core for the more elevated St. Petersburg Plateau area. The Hawthorne Formation is only about 10 feet thick in the north County near Coachman but become over 100 feet thick in St. Petersburg.

Surface deposits are found atop the Hawthorne Formation and the Tampa Formation in the north County. Changes in the surface of the geologic formations occurred over time due to sea level changes, erosion and weathering. Whenever sea levels remained relatively stationary for long time periods, waves and currents formed level surfaces called "terraces" from these and additional sediment. Soils overlying the Tampa and Hawthorne Formation today comprise four marine terraces, consisting primarily of sand and shells with occasional deposits of clays and organics from decaying vegetation.

The process of land formation continues today. The barrier beach islands represent recent deposits of sand formed by the currents and the action of the Gulf of Mexico. These islands and the marine terraces are discussed in the Beaches and Dunes section of this report and in the *Coastal Management Element* of this Comprehensive Plan.

The most significant aspects of Pinellas County's geology, apart from its coastal beaches, are the water holding capacity of the limestone formations, the propensity of limestone to collapse and form sinkholes, and the creation of the Pinellas Ridge and St. Petersburg Plateau as discussed above.

Pinellas County has a geologically dynamic coastline

SOILS

OVERVIEW

Soils in Pinellas County are important for their interrelationship with drainage and development constraints. As described in the Geology section, the upper geological formations found in Pinellas County are the Tampa Formation in north County and the Hawthorne Formation in middle and south County. According to the U.S. Department of Agriculture, these formations are covered with sand ranging from several feet to more than 50 feet in thickness. Few soils found in the County are influenced by the underlying geological formations. Rather, unconsolidated marine sediments were deposited by Gulf currents over these formations in four terraces associated with different sea levels (see the Floodplains section of this Element). Each terrace is covered by a mantle of quartz sand. Where sands have supported plants during marine fluctuations, organic deposits are found. The topography and especially the depth to the water table, affected the formation of these organic soils. With the heavy rainfall, the most easily weathered minerals and more soluble particles are leached and consequently many soils are sandy, strongly acid, and have low natural fertility and low organic matter content. The clay layers are not thick but are often of low permeability and create a hardpan layer.

In 2002, the soils of Pinellas County were studied and mapped by the Natural Resources Conservation Service of the U.S. Department of Agriculture, updating the original survey conducted in 1972. The results of this survey were used to produce the 2006 *Soil Survey of Pinellas County, Florida*. In general, soil surveys provide an orderly classification of soils based on both field and laboratory investigations and thus, they provide valuable information for land use planning. The nature and properties of the soil at a given place determine its limitations for residential, industrial, transportation, recreational and other types of land use. The importance of any particular soil property may vary from one use to another.

SOIL ASSOCIATIONS

In conducting the soils survey, core samples of soil phases were taken and the sequence of natural layers, or horizons, were compared and grouped. Soils in a series consist of horizons similar in color, texture, structure, reaction, consistence, mineral and chemical compositions, and arrangement in the profile. Soil scientists dug many holes to study the soil profile, extending from the surface down into the unconsolidated material in which the soil is formed. For example, "Astatula fine sand, 0 to 5 percent slopes," is one of several phases within the Astatula series. There are a total of 25 different soil series in Pinellas County, consisting of 31 different soil phases.

After mapping each soil phase, a general soils map was prepared. Five "associations" were identified for the County in a general soils map, each consisting of two or more soils phases usually found in close proximity to each other and within the same hydrologic soil group, describing the drainage capabilities of each soil type. The general soils map, **Figure 1**, is used to identify and compare major soils characteristics for planning purposes. Land use categories can be based on such soil characteristics to determine what kinds of uses can be supported by the soils in certain locations. Those areas of **Figure 1** that do not have any assigned soil hydrologic group consist of Urban Land and Pits. The soils in these categories are considered

to be so significantly altered due to development and use as landfills, that they no longer display any of the characteristics common to the other soil types.

Group 'A' Soils
Soils in this association include those soil phases that have a high infiltration rate with low runoff potential. Soils in this group have a high rate of water transmission and are well to excessively drained. This group includes: Astatula soils and Urban Land (0 to 5 percent slopes), Astatula soils and Urban Land (5 to 12 percent slopes), Palm Beach Fine Sand (0 to 8 percent slopes), Paola and St. Lucie Soils and Urban Land (0 to 5 percent slopes), Paola and St. Lucie Soils and Urban Land (5 to 12 percent slopes), and Tavares Soils and Urban Land (0 to 5 percent slopes).

Group 'B' Soils
There are no soils in Pinellas County that are classified as Group 'B' soils.

Group 'C' Soils
Soils in this group have a slow infiltration rate and consist chiefly of soils that have a layer that impedes the downward movement of water and have a slow rate of water transmission. This group includes: Adamsville Soils and Urban Land (0 to 5 percent slopes), Dumps, Matlacha and St. Augustine Soils and Urban Land, Pomello Soils and Urban Land (0 to 5 percent slopes), and Seffner Soils and Urban Land.

Group 'D' Soils
These soils have a very slow infiltration rate with high runoff potential. These soils consist of slays that have a high shrink-swell potential, a high water table, and that are shallow or nearly impervious. This group includes: Anclote Fine Sand (depressional), Beaches, Felda Fine Sand (depressional), Kesson Fine Sand (very frequently flooded), and Wulfert Muck (very frequently flooded).

Group 'B/D' Soils
Soils assigned to this group have dual hydrologic group letters because the first group letter describes the drained areas of the soils, while the second group letter describes the undrained areas of the soil. This group includes: Basinger Fine Sand (depressional), Bassinger Soils and Urban Land, EauGallie Soils and Urban Land, Felda Soils and Urban Land, Immokalee Soils and Urban Land, Manatee Loamy and Fine Sand, Myakka Soils and Urban Land, Okeechobee Muck, Pineda Soils and Urban Land, Pinellas Soils and Urban Land, Placid Fine Sand (depressional), Samsula Muck, and Wabasso Soils and Urban Land.

FIGURE 1
SOIL ASSOCIATIONS BY HRYDOLIC ID IN PINELLAS COUNTY

SOIL PHASES AND LAND UTILIZATION

Although the soil association map is useful in the general delineation of areas with limiting characteristics, it is not specific enough to discuss areas of less than five to ten square miles. The limitations of the various soil phases have the potential to constrain the types of land uses which can occur on a piece of land. Some soil phases do not have the drainage properties that would make them conducive to urban development, while others can be too sandy to support recreational uses. In order to sustain certain types of development, extensive, and often expensive, steps have to be taken in order to make sure that the development on the property can be supported by the underlying soils. **Table 1** highlights each of the soil phases and their limitations for a number of selected non-farm uses.

As can be seen on **Figure 1**, those soils associations with the highest water tables (Group D) are commonly located in the coastal areas. These areas include the Weedon Island Gateway area, Joe's Creek Preserve, and other areas typically known to have large amounts of mangroves and high water tables. These areas are the least suitable for development in Pinellas County and are mostly set aside as wetland areas for wildlife habitat and environmental preservation. The soils located in the Group 'A' soil association, are typically well-drained and more suitable for development.

By understanding the limitations of the various soil phases in Pinellas County, steps can be taken to make sure that development does not proceed in areas where it may not be suitable, without proper precautions being taken first to protect the development from any adverse impacts that the soil may have on the site's buildings and infrastructure.

TABLE 1
SUMMARY OF LIMITATIONS BY SOIL PHASES FOR SELECTED NONFARM USES

SOIL TYPE	RECREATION	BUILDING SITE DEVELOPMENT	TRANSPORTATION	SANITARY FACILITIES*	WATER MANAGEMENT**	LAWNS AND LANDSCAPING
Adamsville soils and urban land, 0 to 5 percent slopes	Very limited; too sandy	Not limited	Not limited	Very limited; depth to saturation zone, filtering capacity	Very limited; seepage	Somewhat limited; droughty
Anclote fine sand, depressional	Very limited; depth to saturated zone, too sandy	Very limited; depth to saturation zone	Very limited; depth to saturation zone	Very limited; depth to saturation zone, filtering capacity	Very limited; seepage	Very limited; droughty, depth to saturation zone
Astatula Soils and urban land, 0 to 5 percent slopes	Very limited; too sandy	Not limited	Not limited	Very limited, filtering capacity	Very limited; seepage	Very limited; droughty
Astatula Soils and urban land, 5 to 12 percent slopes	Very limited; slope, too sandy	Somewhat limited; slope	Somewhat limited; slope	Very limited, slope, filtering capacity	Very limited; seepage	Very limited; slope, droughty
Basinger fine sand, depressional	Very limited; depth to saturated zone, too sandy	Very limited; depth to saturation zone	Very limited; depth to saturation zone	Very limited; depth to saturation zone, filtering capacity	Very limited; seepage	Very limited; depth to saturation zone,
Basinger soils and Urban land	Very limited; depth to saturated zone, too sandy	Very limited; depth to saturation zone	Very limited; depth to saturation zone	Very limited; depth to saturation zone, filtering capacity	Very limited; seepage	Very limited; depth to saturation zone,
Beaches	Not Rated	Not Rated	Not Rated	Not Rated	Not Rated	Not Rated
Dumps	Not Rated	Not Rated	Not Rated	Not Rated	Not Rated	Not Rated
EauGallie soils and urban land	Very limited; depth to saturated zone, too sandy	Very limited; depth to saturation zone	Very limited; depth to saturation zone	Very limited; restricted permeability, depth to saturated zone	Very limited; seepage	Very limited; depth to saturation zone,
Felda Fine sand, depressional	Very limited; depth to saturated zone, too sandy	Very limited; depth to saturation zone	Not Rated	Very limited; restricted permeability, depth to saturated zone, filtering capacity	Very limited; seepage	Very limited; droughty, depth to saturation zone
Felda Soils and Urban land	Very limited; depth to saturated zone, too sandy	Very limited; depth to saturation zone	Very limited; depth to saturation zone	Very limited; restricted permeability, depth to saturated zone, filtering capacity	Very limited; seepage	Very limited; droughty, depth to saturation zone
Immokalee soils and urban land	Very limited; depth to saturated zone, too sandy	Very limited; depth to saturation zone	Very limited; depth to saturation zone	Very limited; restricted permeability, depth to saturated zone, filtering capacity	Very limited; seepage	Very limited; droughty, depth to saturation zone
Kesson fine sand, very frequently flooded	Very limited; flooding, salinity, too sandy, depth to saturation zone	Very limited; flooding, depth to saturation zone	Very limited; depth to saturation zone	Very limited; restricted permeability, depth to saturated zone, filtering capacity	Very limited; seepage	Very limited; flooding, salinity, droughty, depth to saturation zone

TABLE 1
SUMMARY OF LIMITATIONS BY SOIL PHASES FOR SELECTED NONFARM USES

SOIL TYPE	RECREATION	BUILDING SITE DEVELOPMENT	TRANSPORTATION	SANITARY FACILITIES*	WATER MANAGEMENT**	LAWNS AND LANDSCAPING
Manatee loamy fine sand	Very limited; depth to saturated zone, too sandy	Very limited; depth to saturation zone	Very limited; flooding, depth to saturation zone	Very limited; restricted permeability, depth to saturation zone	Somewhat limited; seepage	Very limited; depth to saturation zone,
Matlacha and St. Augustine soils and urban land	Very limited; depth to saturated zone, too sandy	Not limited	Not limited	Very limited; depth to saturation zone, filtering capacity	Very limited; seepage	Very limited; droughty, too sandy, depth to saturation zone
Myakka soils and urban land	Very limited; depth to saturated zone, too sandy	Very to somewhat limited; depth to saturation zone	Very limited; depth to saturation zone	Very limited; depth to saturation zone, filtering capacity	Very limited; seepage	Very limited; droughty, depth to saturation zone
Okeechobee muck	Very limited; content of organic matter, depth to saturation zone	Very limited; Subsidence, content of organic matter, depth to saturation zone	Very limited; subsidence, depth to saturation zone	Very limited; depth to saturation zone, filtering capacity, subsidence	Very limited; seepage	Very limited; Content of organic matter, depth to saturation zone
Palm Beach fine sand, 0 to 8 percent slopes	Very limited; too sandy	Not limited	Not limited	Very limited; filtering capacity	Very limited; seepage	Very limited; droughty
Paola and St. Lucie soils and urban land, 0 to 5 percent slopes	Very limited; too sandy	Not limited	Not limited	Very limited; filtering capacity	Very limited; seepage	Very limited; droughty
Paola and St. Lucie soils and urban land, 5 to 12 percent slopes	Very limited; too sandy	Somewhat limited; slope	Somewhat limited; slope	Very limited; slope, filtering capacity	Very limited; seepage	Very limited; slope, droughty
Pineda soils and urban land	Very limited; restricted permeability, depth to saturation zone, too sandy	Very limited; depth to saturation zone	Very limited; depth to saturation zone	Very limited; restricted permeability, depth to saturation zone, filtering capacity	Very limited; seepage	Very limited; droughty, depth to saturation zone
Pinellas soils and urban land	Very limited; depth to saturated zone, too sandy	Very limited; depth to saturation zone	Very limited; depth to saturation zone	Very limited; depth to saturated zone, filtering capacity, restricted permeability	Very limited; seepage	Very limited; droughty, depth to saturation zone
Pits	Not Rated	Not Rated	Not Rated	Not Rated	Not Rated	Not Rated
Placid fine sand, depressional	Very limited; depth to saturated zone, too sandy	Very limited; depth to saturation zone	Very limited; depth to saturation zone	Very limited; depth to saturated zone, filtering capacity	Very limited; seepage	Very limited; depth to saturation zone,
Pomello soils and urban land, 0 to 5 percent slopes	Very limited; too sandy	Not limited	Not limited	Very limited; depth to saturated zone, filtering capacity	Very limited; seepage	Very limited; droughty

TABLE 1
SUMMARY OF LIMITATIONS BY SOIL PHASES FOR SELECTED NONFARM USES

SOIL TYPE	RECREATION	BUILDING SITE DEVELOPMENT	TRANSPORTATION	SANITARY FACILITIES*	WATER MANAGEMENT**	LAWNS AND LANDSCAPING
Samsula muck	Very limited; content of organic matter, depth to saturation zone	Very limited; Subsidence, content of organic matter, depth to saturation zone	Very limited; subsidence, depth to saturation zone	Very limited; depth to saturated zone, filtering capacity, subsidence	Very limited; seepage	Very limited; Content of organic matter, depth to saturation zone
Seffner soils and urban land	Very limited; too sandy	Not limited	Not limited	Very limited; depth to saturated zone, filtering capacity	Very limited; seepage	Somwhat limited; droughty
Tavares soils and urban land, 0 to 5 percent slopes	Very limited; too sandy	Not limited	Not limited	Very limited; depth to saturated zone, filtering capacity	Very limited; seepage	Very limited; droughty
Urban Land	Not Rated	Not Rated	Not Rated	Not Rated	Not Rated	Not Rated
Wabasso soils and urban land	Very limited; restricted permeability, depth to saturation zone, too sandy	Very limited; depth to saturation zone	Very limited; depth to saturation zone	Very limited; depth to saturated zone, filtering capacity, restricted permeability	Very limited; seepage	Very limited; droughty, depth to saturation zone
Wulfert Muck	Very limited; flooding, salinity, depth to saturation zone	Very limited; Subsidence, flooding, content of organic matter, depth to saturation zone	Very limited; flooding, subsidence, depth to saturation zone	Very limited; depth to saturated zone, filtering capacity, subsidence, flooding	Very limited; seepage	Very limited; flooding, salinity, depth to saturation zone

Source: U.S. Department of Agriculture, Natural Resources Conservation Service, Soil Survey of Pinellas County, 2006.

*Septic Tanks

** Pond resevoir areas

URBANIZATION CONSTRAINTS

Drainage is important for construction and good soil permeability; if rapid and complete, it can be a great advantage for most types of construction. Highly permeable soils, however, may be subject to settling when structures or roads are placed on them. Mixtures of sand and silt are most subject to settling. Compaction, while not always the preferred method because of the impacts it can have on permeability and surface water runoff volumes, can be used to consolidate mixed sandy soils. Pressure is applied to the surface until soils reach an optimum volume. This method can improve the soil properties relative to the soil "bearing capacity," usually expressed in tons per square foot. Although buildings can be designed to distribute the loading over multiple or continuous footings, even with compaction, the soil eventually reaches a point where overloading can lead to structural failure unless pilings are used. Generally, dry, stiff clay and compacted dry sand can withstand an allowable bearing value of four tons per square foot, while wet sand and somewhat soft clay can withstand only two tons per square foot. In Pinellas County, this means that a two or three-story structure on a conventional foundation is about the highest allowable bearing on most soils without pilings. Typical commercial, multi-family, industrial or major transportation construction not only increases the surface (first 80 inches) loads, but increases the affected soil depth. Thus, the impact of unstable soils affecting a structure increases in depth as a structure increases in height or loading. Since the Natural Resources Conservation Service Soil Survey only tested soil core samples to 80 inches, non-single family problems must be identified on a site specific basis to a depth corresponding with the structure type. Generally, tests are run at a depth of 10-15 feet per story, 3-4 borings per footing. **Table 2** lists the various soil types, and explains the conditions of each in order to determine the constraints that may arise during site development. Lack of slope is actually a greater problem in the County. On-site urban drainage requires a sufficient gradient to allow soils to drain. Soils with insufficient natural slope to drain properly are identified in the *Soil Survey of Pinellas County*. They correspond with those soils subject to annual flooding shown in **Table 2**.

In addition to this, 11.9 percent of the County is classified as being highly susceptible to erosion from wind and sheet flow of water. Conditions which lead to erosion are worsened by tree and shrub removal and by removal of the topsoil associated with surface vegetation. Overgrazing by cattle is no longer a major problem since pasture lands have generally been converted to urban uses in the County. Construction and excavation practices, however, can remove the topsoil from land surfaces. If not immediately covered, rainfall and wind will erode the underlying sands, fouling drainage systems and raising dust. A better practice is to cover the original low vegetation with fill material, to plant quick growing vines or use mulch covers during construction, and to create temporary on-site catch basins to trap trash and sediment before they can reach drainage ways. Using fill instead of excavating is particularly recommended where aquifer recharge is necessary to supply potable water (See Groundwater Section of this Element). The organic layer at the soil surface acts like a purifying filter when left intact. Once covered by fill, the usefulness of the layer will be decreased, but the protective screen it provides will not be excavated and carted away. Another good practice involves setting shallow pilings or footings.

Erosion around foundations is also a potential problem encountered on sandy soils, especially with wet fine sand and silty soils, all of which are common in Pinellas County. According to the Standard Handbook for Civil Engineers, when wet, silt is not suitable as a foundation material and may become quicksand under wet conditions, flowing out form under a foundation. Roads

and streets are also subject to erosion problems of this nature. Mixing silts and fine sands with organics or again placing a structure on footings or shallow pilings which reach below the silts can alleviate some of these problems. Preventing topsoil excavation is a strategy which both prevents erosion and environmental damage.

Engineering methods have been devised to achieve an economic compatibility between soils and a proposed structure. Most newer residential construction in the County is single-family on slab with masonry walls. Soil moisture does not directly affect this use for most of the year, as it would wooden construction (wooden structures, however, are generally built up on cement foundations), unless flooding occurs.

An area of particular concern is the East Lake Tarpon area, in the Sector 2 Planning Area (see **Figures 2 & 3),** located in the northeastern portion of Pinellas County. Largely unincorporated, this is an area of generally low topography, poor drainage, and significant acreage of very limited soils and wetland vegetation. There are numerous constraints on urban development which Pinellas County is addressing in the following ways:

1. Maintaining low residential densities on the Future Land Use Plan;
2. Restricting intensive non-residential development;
3. Public purchase of substantial tracts of land; and
4. Designating major wetland systems as preservation on the Future Land Use Map.

Because of the concern posed by development, all building sites should be checked against the *Soil Survey of Pinellas County* for possible soil constraints. Additionally, soil tests should be required for all construction projects over four stories in height. In areas with limitations based on core samplings, developers should be required to design structures in accordance with the constraints or to reduce the structural loading.

TABLE 2
SOIL PROPERTIES AFFECTING URBANIZATION IN PINELLAS COUNTY

SOIL TYPE	ANNUAL FLOODING	DEPTH CLASS	DRAINAGE CLASS	PERMEABILITY	SHRINK-SWELL POTENTIAL	FLOODING	SURFACE WATER RUNOFF CLASS	CONTENT OF ORGANIC MATTER IN THE SURFACE LAYER	DOMINANT USE	SUBSIDENCE	BUILDING SITE DEVELOPMENT LIMITATION	HIGH ERODABILITY	PERCENT OF COUNTY
Adamsville soils and urban land, 0 to 5 percent slopes		Very Deep	Somewhat Poorly Drained	Rapid	Low	None	Very Low	Low	Urban Development		Not Limited	X	1.1
Anclote fine sand, depressional		Very Deep	Very Poorly Drained	Rapid	Low	None	Ponded	Moderate	Wildlife Habitat		Very Limited		0.2
Astatula Soils and urban land, 0 to 5 percent slopes		Very Deep	Excessively Drained	Rapid	Low	None	Very Low	Low	Urban Development		Not Limited	X	7.4
Astatula Soils and urban land, 5 to 12 percent slopes		Very Deep	Excessively Drained	Rapid	Low	None	Low	Low	Urban Development		Somewhat Limited	X	0.5
Basinger fine sand, depressional		Deep	Very Poorly Drained	Rapid	Low	None	Ponded	Low	Wildlife Habitat		Very Limited	X	0.5
Basinger soils and Urban land		Very Deep	Poorly Drained	Rapid	Low	None	Very Low	Low	Urban Development		Very Limited	X	0.5
Beaches	X					Very Frequent			Recreation		Not Rated	X	0.9
Dumps						None			Waste Disposal		Not Rated		0.3
EauGallie soils and urban land		Very Deep	Poorly Drained	Moderately rapid or rapid	Low	None	Very Low	Moderate	Urban Development		Very Limited		1.6
Felda Fine sand, depressional		Very Deep	Very Poorly Drained	Moderately rapid or rapid	Low	None	Ponded	Low	Wildlife Habitat		Very Limited	X	0.4
Felda Soils and Urban land		Very Deep	Poorly Drained	Moderately rapid or rapid	Low	None	Very Low	Low	Urban Development		Very Limited	X	0.8
Immokalee soils and urban land		Very Deep	Poorly Drained	Moderately rapid or rapid	Low	None	Very Low	Low	Urban Development		Very Limited	X	4.4

TABLE 2
SOIL PROPERTIES AFFECTING URBANIZATION IN PINELLAS COUNTY

SOIL TYPE	ANNUAL FLOODING	DEPTH CLASS	DRAINAGE CLASS	PERMEABILITY	SHRINK-SWELL POTENTIAL	FLOODING	SURFACE WATER RUNOFF CLASS	CONTENT OF ORGANIC MATTER IN THE SURFACE LAYER	DOMINANT USE	SUBSIDENCE	BUILDING SITE DEVELOPMENT LIMITATION	HIGH ERODABILITY	PERCENT OF COUNTY
Kesson fine sand, very frequently flooded	X	Very Deep	Very Poorly Drained	Moderately rapid or rapid	Low	Very Frequent	Negligible	Low	Wildlife Habitat		Very Limited	X	2.4
Manatee loamy fine sand		Very Deep	Very Poorly Drained	Moderate	Low	None	Slow	High	Wildlife Habitat		Very Limited		0.4
Matlacha and St. Augustine soils and urban land		Very Deep	Somewhat Poorly Drained	Moderately rapid or rapid	Low	Rare	Very Low	Low	Urban Development		Somewhat limited		9.8
Myakka soils and urban land		Very Deep	Poorly Drained	Moderately rapid or rapid	Low	None	Very Low	Low	Urban Development		Very Limited		22.7
Okeechobee muck		Very Deep	Very Poorly Drained	Rapid	Low	None	Ponded	Very High	Wildlife Habitat	X	Very Limited		0.2
Palm Beach fine sand, 0 to 8 percent slopes		Very Deep	Well drained to excessively drained	Very rapid	Low	None	Very Low	Very Low	Recreation		Not Limited		0.9
Paola and St. Lucie soils and urban land, 0 to 5 percent slopes		Very Deep	Excessively Drained	Very rapid	Low	None	Negligible	Very Low	Urban Development		Not Limited	X	0.5
Paola and St. Lucie soils and urban land, 5 to 12 percent slopes		Very Deep	Excessively Drained	Very rapid	Low	None	Very Little	Very Low	Urban Development		Somewhat limited	X	0.2
Pineda soils and urban land		Very Deep	Poorly Drained	Moderately Slow to Rapid	Low	None	Very Low	Low	Urban Development		Very Limited	X	2.1
Pinellas soils and urban land		Very Deep	Poorly Drained	Moderately rapid or rapid	Low	None	Very Low	Low	Urban Development		Very Limited	X	0.9
Pits											Not Rated		0.2
Placid fine sand, depressional		Very Deep	Very Poorly Drained	Rapid	Low	None	Ponded	Moderate	Wildlife Habitat		Very Limited	X	0.3

TABLE 2
SOIL PROPERTIES AFFECTING URBANIZATION IN PINELLAS COUNTY

SOIL TYPE	ANNUAL FLOODING	DEPTH CLASS	DRAINAGE CLASS	PERMEABILITY	SHRINK-SWELL POTENTIAL	FLOODING	SURFACE WATER RUNOFF CLASS	CONTENT OF ORGANIC MATTER IN THE SURFACE LAYER	DOMINANT USE	SUBSIDENCE	BUILDING SITE DEVELOPMENT LIMITATION	HIGH ERODABILITY	PERCENT OF COUNTY
Pomello soils and urban land, 0 to 5 percent slopes		Very Deep	Somewhat Poorly Drained or Moderately Well Drained	Moderately Rapid or Rapid	Low	None	Very Low	Low	Urban Development		Not Limited	X	2.3
Samsula muck		Very Deep	Very Poorly Drained	Rapid	Low	None	Ponded	Very High	Wildlife Habitat		Very Limited		0.6
Seffner soils and urban land		Very Deep	Somewhat Poorly Drained	Rapid	Low	None	Very Low	Moderate	Urban Development		Not Limited	X	0.3
Tavares soils and urban land, 0 to 5 percent slopes		Very Deep	Moderately Well Drained	Rapid	Low	None	Very Low	Low	Urban Development		Not Limited	X	6.3
Urban Land											Not Rated	X	2.2
Wabasso soils and urban land		Very Deep	Poorly Drained	Slow to Rapid	Low	None	Very Low	Low	Urban Development		Very Limited	X	3.4
Wulfert Muck	X	Very Deep	Very Poorly Drained	Rapid	Low	Very Frequent	Negligible	Very High	Wildlife Habitat	X	Very Limited		0.5

Source: U.S. Department of Agriculture, Natural Resources Conservation Service, Soil Survey of Pinellas County, 2006.

FIGURE 2
14 Planning Sectors (North)

FIGURE 3
Planning Sectors (South)

POTENTIAL FOR CONSERVATION, USE OR PROTECTION

Although diminishing in total land use acreage, agricultural areas can still be valuable as open space areas in the County. The ridge and Lake Tarpon area of the County support most of the currently viable agricultural activity, although the ridge soils are also highly suited to development and are being converted to urban uses rapidly. As of 2007, less than one percent (%) of the total land area in Pinellas County supports agricultural uses. The value of agricultural lands in terms of livelihood, aesthetics, cultivated land and open space conservation has diminished significantly, and conservation of natural lands has received more focus in recent years.

Erosion of soils can significantly alter the landscape and impact the function of drainageways, etc. Therefore, erosion control regulations should be used to control sedimentation, assure the continual efficient operation of the drainage system and protect streams and bays from substantial alteration of their natural functions. It is strongly recommended that on all projects and development sites where excavation and vegetation removal is necessary, quick growing vines, mulch or performance equivalent covers should be utilized. Temporary on-site catch basins (not permanent lakes or wetlands) should be constructed to trap trash and sediment before they can reach drainage ways. Wherever possible, development should be phased, including street construction, to maintain a good vegetative cover on those parts of a development which are not being immediately developed.

Undeveloped areas with severe soils should be developed in a way that would cover no more than 40 percent of the site with impervious surfaces. Disturbance should be confined to areas not characterized by soils with bearing capacity problems. Consequently, removal of topsoil and low vegetation should be avoided by covering topsoil with fill for roads and parking and raising structures on pilings or slightly buried footings. And finally, water table lowering should be discouraged. Where it is necessary for public safety, a lowering of not more than one foot should be allowed.

Commercially Valuable Minerals

There are no commercially valuable minerals in Pinellas County, and no active mining activities.

SINKHOLES

OVERVIEW

Wherever limestone geology or other soluble rocks exist, evidence of sinkhole formation can be found. They are a natural erosion process of limestone terraces. A sinkhole is a depression in the land surface formed either by solution of near-surface limestone or similar rocks, or by collapse of the roofs of underground channels and caverns. Ancient seas existed in many places in the world thousands of years ago. The marine life in those shallow seas left behind structures similar to the coral reefs which live today in the Florida Keys. Time and pressure compacted these reefs into limestone and dolomite formations. In Pinellas County, the Tampa Formation has been described by geologists as the most prone to development of sinkholes.

Florida's warm, wet climate can quicken the process that forms sinkholes. This process, known as "carbonation" involves the dissolving of the calcium carbonate which makes up the limestone. Through constant movements caused by earth processes, the limestone cracks and breaks and develops fractures and weak layers. Carbonic acid, which is found in weak concentrations in rainfall, and in stronger concentrations in the soil humus layer, seeps into crevices in the limestone and chemically changes the calcium carbonate to calcium bicarbonate, a highly soluble salt. Eventually, passageways are formed and the salts are washed away into streams. This process of chemical erosion of limestone has been going on in the Tampa Formation for thousands of years. Many solution channels are large and as changes take place at the surface or in the water, weaker limestone cavities may collapse.

The ground surface above a collapsed sink may be a depression or, where the water table is high, a pond or lake. Two types of sinkholes, cover-subsidence and cover-collapse, are known to occur on ground surfaces. Cover-subsidence sinkholes tend to occur in areas where the sand layer is as deep as 50 to 100 feet. As limestone is dissolved, the resulting voids are filled by granules of overlaying sand. The process reduces the size of cavities in the limestone and results in less surface subsidence at the time of collapse. Examples of these sinkholes can be found in the Patricia Estates area of Dunedin, and are typically only a few feet in diameter and depth. Cover-collapse sinkholes are caused by layers of clay rather than sand. The clay provides a cohesive material for soil that forms bridges of existing cavities in the limestone. Collapse of such a bridge can cause abrupt and relatively deep sinkholes.

Aerial photographs and topographic maps show that in Pinellas County, sinkholes are found primarily in the northern one-third of the County, inland of the Tarpon Springs area. The remainder of observed sinkholes appear to be distributed evenly about the County, but are much less common. Geologists believe this pattern of occurrence is caused by the Tampa Limestone dipping to the south and becoming more deeply buried by the Hawthorne Formation found south of Curlew Road. The continuous clay layers comprising the Hawthorne Formation prevent the fast percolation of rain water to dissolve the Tampa Limestone. By the time the water seeps through the clay, it is neutralized. In addition, the thick clay formation (100 feet) acts as an additional support over any ancient solution channels in the underlying limestone.

By contrast, clays in the north County are only present in the soils where they fill irregularities in the top of the Tampa Formation. The layers are discontinuous, and allow the fast percolation of the rain water directly to the limestone. Besides increasing the honeycombed character of the limestone, the lack of a consistent clay layer does not lend the support as is the case with the Hawthorne Formation in the south County.

Areas of greatest sinkhole potential are believed to be where the soils lack a clay layer and have a much higher rate of permeability. Associations with these characteristics are the Astatula - St. Lucie Association and the Astatula - Adamsville Association. Further, the geologic parameters used for delineating areas shown in this figure include the location of those areas where the Hawthorne Formation is absent or less than 20 feet thick or where the distance between the ground surface and the Tampa Formation is less than 60 feet.

HUMAN INFLUENCE ON SINKHOLE FORMATION

Activities that promote the formation of sinkholes may occur naturally or be induced by people. The most conducive natural condition for sinkholes to form is when rainy weather causes the water levels to increase dramatically following a drought. In Pinellas County, the notably dry month of April experiences the majority of sinkhole collapses. During the dry season, the clay layer consolidates into a dry, weakly cemented roof over the limestone. When rains soak this layer, the roof over the cavity becomes very heavy, it weakens and may collapse. Reports of road collapses and sunken homes usually come at the very end of the dry season due to this process.

Sinkholes can appear suddenly and cause significant damage to infrastructure.

Sinkholes may be induced in several ways. The most common is the proliferation of sinkholes which can occur when a new well extending into the aquifer begins to pump water. This process is the opposite of the case described above. Water under high pressure in the aquifer is believed to act as an additional support to the roof of an open limestone chamber. When this water level is lowered sinks may form in the area surrounding a new well.

Sinkholes can also result from test drilling when the hard clay layer or the limestone roof of a cavity is broken by the drill, causing its collapse. Test borings of this type may be required for construction of heavy structures such as high rise buildings and bridges. In some cases when sinkholes have been found, the solution has been to fill the hole with gravel or concrete. In others, relocation is the only solution.

Spontaneous sinkhole development has also been known to be induced by vibrations from drilling, heavy traffic, passing cars on a highway, planes landing on runways, or the construction of new, heavy buildings. The combination of urban construction and limestone depths of less than 200 feet have been found to be significant factors involved with many modern sinkholes. While there is no reliable method to prevent or predict the formation of sinkholes, structures can be designed to mitigate the damage from potential sinkhole formation.

BENEFITS OF SINKHOLE FORMATION

Sinkhole lakes and ponds perform several positive environmental functions which deserve land use planning consideration. Aside from aesthetics, the two prime functions are direct aquifer recharge in areas with high relief, and the maintenance of water table levels during dry seasons to protect surrounding areas from fire. Management of sink lakes and ponds which offer direct connection to the aquifer is important to the protection of aquifer water quality. Careful planning is needed to avoid the serious consequences of contaminating these lakes. Urban runoff, leaking sewage lines and storage tank seepage are a few of the possible sources of pollution.

Another valuable function of sinkhole ponds is the creation of cypress ponds. Over thousands of years cypress stands and ponds evolved in low areas formed by sinks and other depressions. In the north County, many cypress wetlands are still found. Most are surrounded by pine flatwoods which are underlain by soils with hardened clay layers. During the dry season, water levels are maintained to a greater extent in the cypress pond due to the unique growth cycle of those trees. Water seeping from the cypress pond into the water table under the pines helps prevent the drying of the understorage. This storage of water in dry seasons is found in other swamps and forested wetlands. Where swamps have been drained, fires may sweep through destroying hundreds of acres every winter. Aspects of management measures for wetlands are discussed further in the Soils Section of this report. Clearly, complete preservation of these sinkhole ponds is the best strategy for maintaining their important function, particularly in light of the many values they offer.

ANALYSIS OF SINKHOLE HAZARDS

In 1991, the Pinellas County Board of County Commissioners contracted with the Florida Sinkhole Research Institute to conduct a geologic summary, for planning purposes, of sinkhole hazards in Pinellas County. A second study, conducted by the University of South Florida, was completed in early 1996. The goal of this study was to provide Pinellas County with information and a map that depicts the potential foundation-failure risk from sinkhole collapse, from shrink-swell action within clayey soils, or subsidence associated with former wetlands. The study described the location of known sinkholes, wetlands, and shrink-swell soils, and used this information in the construction of a risk model.

The 1991 Florida Sinkhole Research Institute study led to the development of geophysical techniques for site investigation and site design standards suitable for Pinellas County's particular geological and land use context. Given the relatively low probability of sinkhole collapses in the County as a whole (1:5,555 for a 2,000 sq. ft. suburban home in northern

Pinellas County), a determination must be made on a site-by-site basis as to whether there is a significant hazard for the specific intended use of property on that site. If this hazard is determined to be significant, and if there are appropriate remedies available to minimize or avoid sinkhole damage, then it may be warranted to conduct a detailed, site specific investigation. Geological/geotechnical investigations in the planning phase of a site investigation should be conducted by a professional geologist or engineer with specific knowledge of the processes involved in sinkhole collapses.

Certain precautionary measures can be taken before construction activity begins on a certain site. Water supply wells should be properly evaluated and installed, and boreholes that extend into or through the Hawthorne Group should be properly grout-sealed upon completion. Load-bearing capabilities of soils in sinkhole-prone area can also be improved prior to development. This can be accomplished by several methods including chemical grouting, dynamic deep compaction or densification, etc. These solutions can also be adopted if a sinkhole develops and the building superstructure is still intact.

When a decision is made to commence construction, precautionary measures can be taken to reduce structural damage from sinkholes. Rigid frame foundations are capable of providing support to structures in sinkhole-prone areas. Slab on grade is recommended where the superstructure loads are distributed by the slab over its entire ground area. The use of spread footing for foundations is not advisable.

Since the majority of development in sinkhole-prone areas of Pinellas County consists of single family housing, the cost of design of rigid slab foundations for building support cannot be justified strictly on economic principles. The Florida Sinkhole Research Institute study conducted an economic analysis of the costs and benefits of taking precautionary measures against sinkhole related ground subsidence. The cost-benefit analysis found that the cost of repair or maintenance to be incurred as a result of sinkholes is a more economical and justifiable alternative to the costs incurred by rigid slab foundations.

The University of South Florida study was completed in early 1996 and involved the mapping of geologic and hydrologic features related to subsidence-induced foundation failures in Pinellas County. This study attempted to create a statistically-significant subsidence prediction model in an effort to reduce damage to public and private property in a more cost-effective manner.

One of the goals of the study was to create a predictive model for the occurrence of foundation failures in Pinellas County. Based on geotechnical reports of foundation failure investigations, it was hypothesized that foundation failures should be associated with areas of former wetlands, areas of shrinking and swelling clays (the Fellowship soil series), and reported occurrences of sinkholes. However, only areas of Fellowship soils were found to show significant, positive, statistical correlation with reported occurrences of foundation failures.

No statistical correlation was found to occur between former wetlands and foundation failures, or between the reported occurrence of sinkholes and foundation failures. It was hypothesized in the study that this lack of correlation might be due to the fact that foundation failures from

these causes would also need to take into account subsurface conditions. Since detailed subsurface investigation was beyond the scope of the study, it was recommended that a comparison of the subsurface geology of areas with widely differing rates of foundation failures might reveal the principal subsurface features and processes that contribute to foundation failures in Pinellas County. The study also recommended that future research on the problem should concentrate on the northern part of the County, from Largo to Tarpon Springs, where foundation failures have been more common.

Two types of soils pose a potential risk for foundation failure. The first type of soil, Fellowship Sandy Loam, contains montmorillonitic clay. This type of clay has a shrink/swell capacity. The clay swells when wet and shrinks when dry. This shrink/swell capacity has been known to cause foundation failure in Pinellas County. The second type of soil that can cause foundation failure is a Histosol. The Histosol has a thick, organic surface horizon. These soils typically form in wetlands and are often used to indicate the presence of seasonal or permanent surface water in a given location. The reason the Histosols are a threat for foundation failure is that they tend to shrink when drained. The organic matter in the soil can then oxidize and cause a reduced soil volume, or the de-watering of the Histosol can cause a loss in soil volume.

Histosols are located in disparate locations throughout Pinellas County. They exist as small features in depressions and are most commonly found in a north-trending line in the northern half of the County. Isolated Histosols are found irregularly throughout the southern half of the County. Many Histosols have been destroyed or buried as development has occurred in Pinellas County. Since these soils are now classified as Urban Land by the Soil Conservation Service, it is impossible to determine the location of buried Histosols that may pose a potential risk for foundation failure without detailed subsurface investigation.

Fellowship soils are located in a distinct zone in the northern portion of the County, especially in Safety Harbor. As with Histosols, some Fellowship soils might have been buried or destroyed during construction of the built environment in Pinellas County. These buried soils also pose a potential threat for foundation failure.

It can be concluded from the analysis that there is no conclusive means of predicting where or when a sinkhole collapse may occur. This makes it difficult, if not impossible, to provide a map of sinkhole susceptibility for example. Individual site analysis remains the best way to determine sinkhole rise, and is still not exact.

VEGETATIVE COMMUNITIES

LOCAL BIODIVERSITY

The natural environment in Pinellas County offers benefits on both a local and regional scale. Wildlife habitat biodiversity is perhaps the largest benefit of the natural environment. From the seagrass beds along the shores of the Gulf of Mexico to the pinelands of Brooker Creek Preserve, a variety of wildlife are able to thrive because of the natural environment. Wading birds, loggerhead turtles, coyotes, white-tailed deer, river otters, manatees, and other species are among those that can be found within the borders or waters of Pinellas County.

While much of Pinellas County has been developed, Pinellas County still has several excellent examples of natural vegetative communities under public ownership and management. For example, Brooker Creek Preserve is home to a variety of upland forest communities, Weedon Island Preserve has extensive mangrove and wetland communities, and Shell Key Preserve is the location of a significant amount of coastal scrub vegetation and submerged aquatic vegetation. Each of these County properties has distinct vegetative characteristics that exemplify the diversity of natural vegetation present in Pinellas County. The County owns and/or manages over 15,000 acres of environmental land for both public and natural benefit. The three major environmental land units are summarized below.

Overall, the biodiversity, and preserving the lands that contribute to biodiversity, is very important for the environmental quality of both Pinellas County and the region. The incremental loss of native vegetative communities can have a detrimental effect on a number of different plant and animal species that are dependent on Pinellas County's natural areas, whether for migratory habitat or for yearlong habitat. Protecting the natural environment supports the survival of the County's diverse plant and animal species, and also provides the citizens of Pinellas County with opportunities to appreciate the natural environment.

Brooker Creek Preserve, an over 8,000 acre wildlife area in northeastern Pinellas County, provides value as both a local and regional ecosystem, as it borders both Hillsborough and Pasco counties, and connects to existing preservation areas in those counties. Brooker Creek Preserve contains a variety of vegetative communities, according to the Florida Land Use, Cover and Forms Classification (FLUCCS), including Rangeland, Upland Forests and Wetlands. These communities allow over 600 species of plants, 21 species of amphibians, 39 species of reptiles, 183 species of birds and 20 mammals to be found within Brooker Creek Preserve. This range of vegetative and wildlife diversity contributes to the overall biodiversity of Pinellas County and the region, which allows for the survival of a number of different plant and animal species that may otherwise not thrive because of the adverse impacts that development can have on the natural environment.

Weedon Island Preserve, including the Gateway Tract, is an approximately 3,164 acre preserve that extends along the west side of Tampa Bay in Pinellas County. It is the second largest environmental land unit in Pinellas County and the largest on Tampa Bay. Mangrove-dominated islands and shoreline define the eastern edge of the Preserve. The variety of

FLUCCS vegetative communities that can be found within Weedon Island Preserve include Freshwater Marshes, Wetlands, and Upland Forests. Collectively, the Weedon Island Preserve is a dominant feature along the western bank of Tampa Bay. The Gateway Tract, the northernmost property, encompasses approximately five miles of shoreline, and is bisected by the Howard Frankland Bridge. The Gandy Bridge defines the southern boundary of the Gateway Tract and the northern boundary of Weedon Island Preserve. The islands, adjacent shoreline, and uplands that comprise the Preserve are also dotted with an impressive array of cultural features and artifacts, which illustrate the land's significant role in Florida's anthropological history.

Shell Key Preserve is another natural area managed by Pinellas County that contributes to local and regional biodiversity. 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 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. The Preserve also hosts a range of vegetative diversity. Shell Key Preserve contains five distinct plant communities, as described by the Florida Natural Areas Inventory (FNAI) in the 1990 publication of the *Guide to the Natural Communities in Florida*. The communities include Marine Tidal Marsh, Marine Tidal Swamp, Beach Dune, Marine Unconsolidated Substrate, Marine Grass Beds, and Developed (while no development is permitted within the Preserve, there are some previously- developed areas located at its eastern and northern boundaries). The Preserve is also the site of FWC's Coastal Strand vegetative classification. 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.

BACKGROUND INFORMATION

Statistics prepared by the Pinellas County Planning Department in 2007 show that 19 percent of the total land in Pinellas County is undeveloped, and characterized as conservation or preservation (21,480 acres). Only 7,600 acres of the total land area of the County is vacant and developable. Natural vegetative communities are shown on **Figure 4.** An additional nine percent of the total land area in Pinellas County is designated as Recreation and Open Space, as shown on **Figure 5,** in addition to all conservation and preservation areas. While not necessarily considered vacant or developable, these recreation and open space areas, including golf courses, community centers, and ball fields, can still offer opportunities for maintaining or enhancing vegetative diversity and wildlife habitat.

The percentage and distribution of undeveloped land underscores the importance of protecting the County's remaining natural resources. After all, it was the unique subtropical climate and

natural environmental features that brought many people, and ultimately growth, to Pinellas County. But this growth has historically brought about a decline in the County's natural environment, including its natural vegetative communities and wildlife. Therefore, the conservation and preservation of vegetative communities and wildlife species today is an important concern of County residents. **Figures 6, 7, 8, 9 & 10** display the historical development patterns of Pinellas County from before the 1930's through 2005. **Figure 11** shows the present development with Preservation areas, to show how much of the County is actually remaining for development. As is clear from these Figures, development has taken over much of the natural environment in Pinellas County as of this date. It is therefore, of great importance to strive to maintain the remaining natural vegetative communities in the County.

Weedon Island Preserve is the second-largest environmental land unit in Pinellas County.

FIGURE 4a
Vegetation Map – North Pinellas

FIGURE 4b
Vegetation Map – Central Pinellas

FIGURE 4c
Vegetation Map – South Pinellas

FIGURE 5
REC/OPEN SPACE AND PRESERVATION CATEGORY MAP

FIGURE 6
PINELLAS COUNTY LAND DEVELOPMENT UP TO 1930

FIGURE 7
PINELLAS COUNTY LAND DEVELOPMENT TO 1950

FIGURE 8
PINELLAS COUNTY LAND DEVELOPMENT TO 1970

FIGURE 9
PINELLAS COUNTY LAND DEVELOPMENT TO 1990

FIGURE 10
PINELLAS COUNTY LAND DEVELOPMENT TO 2005

FIGURE 11
PINELLAS COUNTY LAND DEVELOPMENT TO 2005 WITH PRESERVATION AREAS

VEGETATIVE COMMUNITIES INVENTORY

An overview of the local vegetative communities and their importance to Pinellas County is presented below. This inventory is based upon the most recent research done by the Southwest Florida Water Management District (SWFWMD) as of 2007, using the Florida Land Use, Cover and Forms Classification System (FLUCCS), produced by the Florida Department of Transportation Surveying and Mapping Office, Geographic Mapping Section. The last classification, Florida Coastal Strand, is based upon information from the Florida Wildlife Commission (FWC), and incorporated to stress the importance of this vegetative community within Pinellas County (which may not be clear using FLUCCS categories only). **Table 3** displays the total number of acres of each vegetative community in Pinellas County.

Rangeland

Description – Rangeland in Pinellas County is comprised predominantly of shrub and brushland with a few acres of herbaceous land. As of 2004, approximately 1,190 acres of land in Pinellas County were classified as rangeland. In such areas, the natural vegetation is predominately shrubs and grasses. The land is typically not irrigated, cultivated or fertilized and brush control is the general extent of management. This category includes some aspects of the Coastal Scrub community, discussed later as its own community to note its importance in Pinellas County.

Associated Soils - Nearly level to strongly sloping, deep, moderately well to excessively drained. Representative soils in Pinellas County include the Coastal Beaches and Palm Beach series.

Associated Vegetation - In Pinellas County, rangeland consists mainly of palmettos, wax myrtle, and other shrubs and brush.

Value to Society –The rangeland community has historically been among the most desirable areas to develop because of its well drained soils and lack of a dense tree canopy. As a result, this community has been exploited to a high degree for development. In the process, much of this community in the County has been destroyed.

Value to Individuals - Highly desirable for development because of land characteristics.

Urbanization - This community has been heavily urbanized in Pinellas County throughout the years and very little remains.

Threats - Development is among the greatest threats to this community. Many of the barrier islands in Pinellas County consisted of this vegetative community prior to their development. The tendency of this community to be located along the waterfront has led to the destruction of the community because of the demand for high density residential and tourist development. There are small amounts of rangeland remaining in Pinellas County, mainly on Fort DeSoto, Shell Key, Sand Key, Caladesi Island and Honeymoon

Island. These areas are protected from future development through preservation and conservation land uses.

Upland Forests

In FLUCCS, upland forest areas are areas that support a tree canopy closure of ten percent or more. This vegetative community includes both the drysites (xeric) and moderately moist (mesic) forest communities. Wetland forests are categorized separately. In Pinellas County, there are a number of different upland forest habitats. These habitats are hardwood conifer mixed, longleaf pine-xeric oak, pine flatwoods, tree plantations, upland coniferous forests, and upland hardwood forests. **Table 3** outlines the 2004 acreages of each of these habitats in detail and their locations can be found on **Figure 4**. Below is a sampling of the details surrounding the various habitats found within the upland forests vegetative community.

Description - Pine flatwoods is the most extensive forest community occurring in Pinellas County; in 2004 approximately 3,807 acres remained throughout the County, compared to 9,600 acres in 1983, according to SWFWMD. This vegetative community is second only to mangrove swamps, in its prevalence in Pinellas County. This community occurs on nearly level land, and during the rainy season water may be on or near the soil surface.

The longleaf pine-xeric oak habitat is generally situated on elevated, sandy soils and is a fairly open forest community influenced by fire, heat, and drought. Fire is crucial since it prevents competing hardwoods from regenerating.

The upland hardwood habitat occurs on rolling terrain with nearly level to strong slopes. Readily identified by the occurrence of thick stands of shade-tolerant hardwoods and few pines, the community is characterized by moderately moist conditions without excessive water or drought conditions.

Associated Soils – A variety of soil types are present in the upland forest vegetative community. In the pine flatwoods habitat, nearly level, deep, acidic, poorly to somewhat poorly drained soils, some of which typically develop an organic hardpan confining layer are present. These soils include EauGallie soils and Urban Land; Pinellas soils and Urban Land; Immokalee soils and Urban Land; and Wabasso soils and Urban Land.

Nearly level to strongly sloping, deep, acidic, moderately well to excessively drained soils are common in the longleaf pine-xeric oak habitats. Soils underlying this habitat in Pinellas County include the Astatula and Tavares series.

Soils in the hardwood forests are nearly level to strongly sloping, deep, somewhat poorly to well-drained. Soils underlying this habitat in Pinellas County are the Adamsville and Seffner series.

Associated Vegetation - In Pinellas County, there is a wide variety of vegetation in the upland forest community. The pine flatwoods habitat is usually dominated by an open canopy of

slash pine (**Pinus elliottii**) with an under story vegetation composed chiefly of saw palmetto (**Serenoa repens**), staggerbush (**Lyonia** spp.), wax myrtle (**Myrica cerifera**), gallberry (**Ilex glabra**), and wire grass (**Aristida stricta).** The pine flatwoods habitat is perpetuated and rejuvenated by fire, which controls hardwoods and promotes the natural regeneration of pine. When fires do not occur, this community will succeed to a hardwood community.

When in a climax stage, the upland hardwood habitat is dominated with hardwoods with only a few pines included. Commonly encountered species in Pinellas County are live oak (**Quercus virginiana**), bluejack oak (**Quercus cinerea**), turkey oak (**Quercus laevis**), persimmon (**Diospyros virginiana**), and cabbage palm (**Sabal palmetto**) in the more xeric or dryer locations; and sweetbay (**Magnolia virginiana**), wild olive (**Osmanthus americanus**), pignut hickory (**Carya glabra**), sweetgum (**Liquidambar styraciflua**), and American horn beam (**Carpinus caroliniana**) in the damper, cooler locations.

Examples of other species in the upland forest community include: longleaf pine (**Pinus palustris**), slash pine (**Pinus elliottii**), sand pine (**Pinus clausa**), wax myrtle (**Myrica cerifera**), laurel oak (**Quercus laurifolia)**, live oak (**Quercus virginiana**), and many others are examples of species found within this category.

Value to Society – This community functions as valuable wildlife habitat, and provides shade and erosion control. The community is found throughout Pinellas County, as seen on **Figure 4**.

Habitat - The Upland Forest community provides a home for many species of wildlife including Quail, Rabbit, Raccoons, and Opossums along with a wide variety of songbirds. The County's undeveloped upland forests and County-owned well fields in the northeastern portion of Pinellas County are also known to support white-tailed deer and wild turkey. Threatened or endangered species known to exist within this upland community in Pinellas County include the Gopher Tortoise, the Eastern Indigo Snake, and the Gopher Frog. The Southern Bald Eagle and the Osprey may also occasionally nest in the tall trees of this community.

Urbanization - This community has been heavily urbanized in Pinellas County since the problem of a seasonal high watertable can be overcome with proper development techniques. As a result, while many wetland areas are either being purchased for public ownership or protected in other ways, the upland forests are being depleted by development pressure in Pinellas County.

Agriculture - Although little agricultural land use occurs in Pinellas County, remnants of this once extensive activity still occur in portions of the County - primarily in the northeast sector. Pine flatwoods located in these areas have the potential for producing significant amounts of high quality forage and have a moderate potential productivity for commercial wood production.

Erosion - Water erosion can be a problem on the steeper slopes. Dense upland forests however, can have extensive root systems which can help to stabilize the slopes and provide for erosion control.

Aesthetics - The cooler, moister and shadier conditions provided by the attractive hardwood vegetation creates an environment prized by people and often sought for residential development.

Watersheds - Upland hardwood habitats are valuable for watershed protection.

Threats – The upland hardwoods community is often depleted for development. Because wetland and mangrove areas are being protected as conservation areas, development is being focused on other areas, namely the upland forest areas.

Water

In the FLUCCS report, the Water category includes the following habitats: streams and waterways, lakes, reservoirs, bays and estuaries, major springs, slough waters, and major bodies of water, that are at least 1/8 of a mile wide or, if extended, cover at least 40 acres.

Description **-** The waters of Pinellas County include the lakes of Pinellas County and the surrounding water bodies, including lakes Seminole and Tarpon, the Gulf of Mexico, Boca Ciega Bay and Tampa Bay.

Associated Soils – The soils included in this vegetative community in Pinellas County range from sand to mud, including Samsula muck, Okeechobee much, and Manatee loamy fine sand.

Associated Vegetation –Vegetation is not taken into consideration here; any submerged vegetation would be classified under either Wetlands or Seagrasses.

Value to Society – This community serves a vital role in the quality of life in Pinellas County, with both residents and tourists dependent upon these resources.

Habitat – This community is home a diverse variety of fish species, which also serve to benefit a number of shoreline birds.

Urbanization – The urbanization of Pinellas County has been so great, due in part, to the Water community. Residents and tourists are both drawn to Pinellas County to recreate on the waters of the County, serving both a quality of life and an economic benefit for the County.

Aesthetics - An attractive view of beaches and the Gulf of Mexico create a prized location for residential, recreational, and tourist-related development.

Threats – Major threats to the waters of Pinellas County come from development pressures. Point-source and non-point-source discharges from developed urban areas, discussed in greater detail in the Surface Water Management Element, are the greatest threat to water quality in Pinellas County. Pollution from atmospheric deposition is also a contributing factor to water pollution problems in the area.

Wetlands

Wetlands are all those waters, fresh and saline, or areas which are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation specifically adapted to life in saturated conditions.

Description – Wetlands in Pinellas County consist of a number of different ecological habitats, including bay swamps, cypress, emergent aquatic vegetation, freshwater marshes, mangrove swamps, salt flats, saltwater marshes, stream and lake swamps, vegetated non-forested wetlands, wet prairies, wetland coniferous forests, wetland forested mixed, and wetland hardwood forests. These communities typically have poorly drained soils, which are sometimes organic, depending upon the specific habitat. There are a total of 15,553 acres of wetland habitat in Pinellas County, the largest of which are mangroves swamps, consisting of approximately 5,000 acres.

Associated Soils - Soils vary somewhat depending on the habitat in the wetlands. All wetland soils are generally poorly drained. Soils underlying wetlands in Pinellas County include Wulfert muck and Kesson Fine Sand.

Associated Vegetation - In general, throughout Florida this community supports a luxurious growth of vegetation with a diversity of species, depending upon the habitat. Wetland hardwood habitats are dominated by the laurel, live, and wateroaks, magnolia, and cabbage palm. Another dominant tree is the sweetgum. Although red maple, various bay trees, and cypress may also occur, they are not dominant in this community. In Pinellas County, commonly encountered tree species are laurel oak (**Quercus laurifolia**), water oak (**Quercus nigra**), sweetbay (**Magnolia grandiflora**), red maple (**Acer rubrum**), American elm (**Ulmus americana**), and ash (**Fraxinus caroliniana**).

In the cypress habitat in Pinellas County, two types of cypress exist - bald cypress (**Taxodium distichum**), which predominates along rivers and lakes; and pond cypress (**Taxodium distichum var. ascendens**), which predominates in the wet depressions forming cypress domes. Other tree species associated with the cypress swamps are blackgum (**Nyssa sylvatica**), sweetbay (**Magnolia virginiana**), red maple (**Acer rubrum**), loblolly bay (**Gordonia lasianthus**), and red bay (**Persea borbonia**). In the County, approximately 43 percent of this community is predominantly comprised of cypress trees. The remaining acreage, however, consists of a mixture of cypress and other hardwood species.

In freshwater marshes, the dominant vegetation includes cattails (**Typha spp.**) saw grass (**Cladium jamaicense**), and sedges. Other vegetation associated with this community include pickerelweed (**Pontederia cordata**), duck potato (**Sagittaria falcata**), wax myrtle (**Myrica cerifera**), maidencane (**Panicum hemitomon**), primrose willow (**Ludwigia peruviana**). St. Johns wort (**Hypericum spp.**), and occasionally pines and palmettos along the edges of the marsh.

Freshwater marshes and ponds are maintained by fire and by water fluctuations. The elimination of fire and the permanent lowering of the water table will cause this community to convert into a woody community. Permanent inundation will tend to cause this community to become dominated by cattails and primrose willow.

In mangrove swamps in the Tampa Bay area, the most frequent species found in the community are three mangroves: red (**Rhizophora mangle**), black (**Avicennia germinans**), and white (**Laguncularia racemosa**). Also occasionally found in the mangrove community is the buttonwood (**Conocarpus erectus**). Mangrove swamps may contain mixtures of all local mangrove species or be monospecific. In Tampa Bay, however, there is generally considerable intermixing of these species Caused in part by the low relief of shorelines in Tampa Bay, and also by a recent rise in sea level.

Value to Society - Vulnerable Resource Requiring Regulation to Avoid Social Costs.

Habitat - This community is rich in species diversity and represents one of the most productive and diverse wildlife habitats. While each individual habitat is distinct, the wetlands community as a whole provides a valuable asset to the County and the County's overall biodiversity. Below are some examples of the different habitats and their descriptions.

Wetland Hardwood Forests

This habitat provides good habitat for wild hogs, deer, turkey, gray squirrel, woodpeckers, owls, and furbearers. Since it is very moist most of the year, it is also good for reptiles and amphibians. If undisturbed, this community provides good cover and a travel corridor for wildlife, as is true of the upland hammock.

Endangered or threatened species associated with the Hardwood Hammock Community within Pinellas County include the Gopher Tortoise and the Indigo Snake. The Southern Bald Eagle and the Osprey are also known to use tall trees in this community for nesting. No species of endangered or threatened plants are known to exist within this community in Pinellas County.

Cypress

Cypress swamps are important as a wildlife refuge providing a wetland habitat during the dry season and roosting and breeding areas for many wildlife species found in adjacent upland habitats. This community enhances aquatic productivity in streams, rivers, lakes, and estuaries by releasing nutrients from its decomposing leaf litter.

Endangered or threatened species associated with the cypress swamp within Pinellas County are the Osprey, the Wood Stork, the Little Blue Heron, the American Alligator and the Southern Bald Eagle, both occasional nesting residents.

Freshwater Marsh

This habitat is excellent for many wetland wildlife species, including several endangered species. Many birds use this habitat year-round, or for wintering. In Pinellas County, as in all of Florida, the freshwater marsh habitat is endangered through destruction or degradation. Consequently, their protection should be an important goal of resource management. Threatened or endangered animals associated with Pinellas County freshwater marshes and ponds include the Silver Rice Rat, the Florida Sandhill Crane, the Wood Stork, the Little Blue Heron and the Snowy Egret. The Southern Bald Eagle and the Red Shoulder and Red Tail Hawks are also known to be occasional residents of this community. Ephemeral ponds are important habitats for amphibians.

Water Resources - One of the most important benefits of this vegetative community is the control of water quality and quantity. This regulation of the hydrologic regime is especially important in coastal areas.

Threats – Development pressures along the coastline, where a majority of wetland areas are located, pose the greatest threat to wetland communities. While the County and other government entities pursue the purchase and protection of wetland area and restrict development directly on them, impacts from surrounding development and filling practices serve to threaten the wetlands and the vital function they serve.

Protections - *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.

Barren Land

Description - According to the FLUCCS report, this community has very little or no vegetation and limited potential to support vegetation. Habitats included in this community include beaches other than swimming beaches and sand other than beaches. In Pinellas County, there are only 36 acres of land where this community exists, making it among the smallest in the County. These areas exhibit little human encroachments and include dune areas and beaches in protected bay and marsh locations.

Associated Soils – The soils in this vegetative community in Pinellas County consist mainly of sand.

Associated Vegetation –There is very little vegetation located within this community, except for some coarse grasses that may be in the dune areas.

Value to Society – This community, the dune areas in particular, serves a role in the protection of Pinellas County development from wave action.

Habitat – This community may host nesting turtles, but has little other native habitat.

Erosion –Development adjacent to barren land areas, can cause significant erosion of the barren land. When this occurs, those areas lose their designation within this category and are reclassified to accurately reflect the characteristics of the area.

Threats – The urbanization of Pinellas County has depleted much of this vegetative community, leaving only a few areas where barren land still exists.

Special Classification – Seagrass Meadows

Although seagrass meadows are usually not technically defined as wetlands, they are an important link in the overall health of the marine resources of the County. The clarity of the Gulf of Mexico and Tampa Bay waters is one of the limiting factors for seagrass meadows because they need high light intensity. Water clarity is directly related to the ability of wetlands and stormwater treatment areas to filter out sediments and nutrients from runoff. The sediments and nutrients, which lead to excess algae production, reduce clarity and the depth of sunlight penetration thus limiting the depth to which the seagrasses can grow. For more information on seagrasses and the location of these natural resources within the waters of Pinellas County, see the Seagrasses section of this Element.

Description -Seagrasses are submerged flowering aquatic plants with true root systems and stems that live in marine and estuarine waters. Although they are vascular plants, seagrasses grow in underwater beds that resemble terrestrial meadows or grasslands. Seagrasses require high light intensities, as well as quiet coastal waters and estuaries. Seagrass loss is due mostly to filling of submerged areas and to the reduction of water clarity. This fact places seagrass directly in the path of development and recreational use of coastal water.

The historic trend of seagrass acreage decline in Tampa Bay seems to have been reversed. Since 1998, surveys have recorded an additional 2,000 acres of seagrasses in Tampa Bay. While there has been an overall increase, some portions of Tampa Bay, specifically the western portion of Old Tampa Bay, have continued to see a decrease in the coverage of seagrasses. Additional studies are required to explain this decline. The majority of the 2,000 acre increase has been located within Boca Ciega Bay. The most recent aerial surveys assess changes from 2002-2004 and show a slower, but continued

recovery of 946 acres of seagrasses, or about 4%. Old Tampa Bay was the only segment to see decreases, with a documented loss of 636 acres, or 12% during this same two-year period.

Associated Soils - Sand to mud often with high organic content.

Associated Vegetation -Five of the seven known species of seagrasses native to Florida waters are found in the marine environment of Pinellas County. These include turtle grass (**Thalassia testudinum**), manatee grass (**Syringodium filiforme**), shoal grass (**Halodule wrightii**), widgeon grass (**Ruppia maritima**), and star grass (**Halophila engelmannii**). The dominant species are turtle and shoal grass.

Habitat - Seagrass plays a key role in the coastal marine community. Food and shelter are provided for many of Florida's invertebrate population by seagrasses, and many species depend on these meadows as a nursery for juveniles. These areas of mixed grasses and algae are known to contain many times the number of living organisms as unvegetated sandy areas. These same meadows are known to support eight different species of gamefish as juveniles.

Shoreline protection - Seagrasses bind shallow coastal sediments and decrease erosion by their physical interference with currents.

Importance to threatened and endangered species - Manatees are known to feed on seagrasses, particularly those growing in soft unconsolidated sediments. Seagrasses, at one time or another, provide food and shelter to virtually every living species of sea life in the Tampa Bay area. Large numbers of birds (particularly wading birds) are known to frequent seagrass beds and make use of them as foraging grounds for food. Predators of all types find seagrass beds an abundant food source.

Value to Individuals - Seagrasses play a vital role in the marine environment of Pinellas County. A great deal of the future of marine fishing, both commercial and recreational, depends on the existence of this coastal resource.

Threats – Water quality issues and boating practices pose the greatest threat to seagrasses in Pinellas County. Poor water quality inhibits the growth of vitality of seagrasses and scarring from boat propellers causes the destruction of seagrass beds.

Special Classification – South Florida Coastal Strand

Description –This is the only vegetative community that is included here that is not a part of the FLUCCS report. This Florida Wildlife Commission (FWC) classification was included here because it is not adequately addressed by the FLUCCS, and this community is of great importance to Pinellas County. There is some overlap between this classification and Barren Land and Rangeland, but the overlap does not account for all aspects of this community. This habitat includes those areas adjacent to the Gulf of Mexico and salt

water bays that are affected by salt spray and high winds. This habitat is generally narrow, occurring upon the coastal beaches and dunes along the Gulf. There are approximately 529 acres of this habitat remaining in Pinellas County, the majority of which can be found on Shell Key, Caladesi Island and Honeymoon Island.

Associated Soils -Nearly level to strongly sloping, deep, moderately well to excessively drained. Representative soils in Pinellas County include Beaches and Palm Beach fine sand.

Associated Vegetation -The vegetation of the South Florida coastal strand is characterized by low growing grasses, vines, and pioneering herbaceous plants. There are few trees or large shrubs, and when they do occur they are usually stunted due to the action of the wind. The beaches and foredunes are heavily influenced by wind, salt, and blowing sand and few plants are able to successfully establish themselves. Those that can include beach morning glory (**Ipomoea stolonifera**), railroad vine, and sea oats (**Uniola paniculata**). On the more protected back dunes, vegetation changes to saw palmetto (**Sereona repens**), wax myrtle (**Myrica cerifera**), dwarf scrubby oaks, sea grape (**Coccoloba uvifera**), and cocoplum (**Chrysobalanus icaco**).

Recreation - No vegetation community in Pinellas County is more desirable as a location for recreation. As a result, the beaches and dune systems have been exploited to a high degree for private residential and tourist-related commercial uses. In the process, much of the South Florida coastal strand community in the County has been destroyed. Remnants remain, primarily in state and County parks, but even here the recreation pressures have severely impacted much of what remains of this community.

Shoreline protection and stabilization - This community is located on the most dynamic landscape in the County. The vagaries of wind and waves (primarily the latter) can alter this landscape drastically, but such sculpturing is significantly restrained by the beach and dune systems and their associated vegetation. The dunes are especially important in the damping of storm-generated waves, and these fragile barriers are held together by the extensive root systems of their vegetation.

Aesthetics - The coastal strand community stretching along parallel to the Gulf shoreline creates a captivating landscape that has attracted intense development capitalizing on this beauty.

Habitat - The coastal strand community is highly endangered. This community serves as a habitat for a variety of shorebirds, reptiles, and mammals. Several species of endangered and threatened plants may occur in this community, and those known to be present in Pinellas County are the beach star and the beach creeper. The Pinellas County coastal strand community also provides habitat for many of the County's threatened or endangered species of birds: the American Oystercatcher, Least Tern, Piping Plover, and the Snowy Plover. This community also serves as a habitat for the Gopher Tortoise, which digs burrows that also provide shelter for several other dependant species: the Eastern Indigo snake, the Gopher Frog, and the Florida mouse. Undeveloped coastal

beaches preserved in Fort De Soto Park may provide nesting grounds for the Atlantic loggerhead and the Atlantic Green Turtle.

Value to Individuals - Maximum desirability for location

Aesthetics - An attractive view of beaches and the Gulf of Mexico create a prized location for residential, recreational, and tourist-related development.

Water and Beach Access - Located adjacent to the beaches and the Gulf waters, this community provides immediate access for recreation or commercial purposes.

Threats – The threats to this vegetative community are very similar to those posed to Coastal Strand communities. Located in a desirable location for both residential and tourist development, this community has been significantly impacted by development practices and replaced with buildings and roadways.

Some examples of Pinellas County's vegetative communities

TABLE 3
VEGETATIVE COMMUNITIES AND ASSOCIATED HABITATS WITHIN PINELLAS COUNTY

Vegetative Community Type and Associated Habitats	Acres	Percentage of County Acreage
Agriculture		
Tree Crops	166.718	0.093%
Rangeland		
Shrub and Brushland	1187.962	0.661%
Herbaceous	8.283	0.005%
Upland Forest		
Hardwood Conifer Mixed	3603.05	2.004%
Longleaf Pine-Xeric Oak	98.835	0.055%
Pine Flatwoods	3806.798	2.118%
Tree Plantations	263.203	0.146%
Upland Coniferous Forest	135.73	0.076%
Upland Hardwood Forests	213.12	0.119%
Water	6782.064	3.773%
Wetlands		
Bay Swamps	5.273	0.003%
Cypress	2419.026	1.346%
Emergent Aquatic Vegetation	186.081	0.104%
Freshwater Marshes	1389.116	0.773%
Mangrove Swamps	4995.082	2.779%
Salt Flats	20.286	0.011%
Saltwater Marshes	735.542	0.409%
Stream and Lake Swamps (bottomland)	3329.097	1.852%
Vegetated Non-Forested Wetlands	15.812	0.009%
Wet Prairies	362.62	0.202%
Wetland Coniferous Forests	598.529	0.333%
Wetland Forested Mixed	2840.308	1.580%
Wetland Hardwood Forests	45.051	0.025%
Barren		
Beaches Other Than Swimming Beaches	34.825	0.019%
Sand Other Than Beaches	1.299	0.001%
Developed/Disturbed/Other	146508.894	81.506%
Urban and Built-Up*		
Transportation, Communication and Utilities*		
Special Classifications		
Seagrass Beds	29530.165	N/A
South Florida Coastal Strand*	529	

Source: Florida Land Use, Cover and Forms Classification System (FLUCCS), Florida Department of Transportation, 2004.

*Denotes an actual FLUCCS category, but condensed here to highlight vegetative communities only.

**Florida Wildlife Commission category, not FLUCCS. Included here to highlight its importance to Pinellas County and because the category is not adequately covered by FLUCCS