Chapter 1 Introduction

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FL652.0100 Purpose and objective

The Florida supplement to the National Engineering Handbook, Part 652, Irrigation Guide was prepared by the Natural Resources Conservation Service (NRCS) for use in Florida to provide technical information and procedures for successfully planning and designing of irrigation systems and to use in developing irrigation water management plans. The recommendations in this guide are for the most common types of irrigation systems used in Florida.

Irrigation systems should be adapted for site conditions (soil, slope, crop grown, climate, water quantity and quality, air quality, etc.) and capable of efficiently applying water to meet the intended purpose(s).

The objective of this guide is to assist NRCS employees, Technical Service Providers, Mobile Irrigation Labs, consultants, and others in providing sound technical assistance for the maintenance of soil productivity, conservation of water resources, conservation of energy, maintenance or improvement of the standard of living, and maintenance or improvement of the environment. Basic data used will help ensure that the planned irrigation system will be capable of supplying the amount of water needed by plants for optimum or planned production and quality during the growing season. Procedures for optimizing use of limited water supplies are also included.

Planning for an irrigation system should take into account physical conditions of the site, producer resources, cropping pattern, market availability, water quantity and quality, Federal and State rules and regulations, and effects on the environment. Economics should provide the basis for sound conservation irrigation decisions but may not be the ultimate consideration, as many other factors may influence final decisions.

FL652.0101 Rainfall in Florida

Rainfall in Florida is quite varied both in annual amount and in seasonal distribution. Annual averages at individual climatological stations range from about 40 to 65 inches. Many localities have received more than 80 inches in a calendar year, and a few stations have measured more than 100 inches in wet years. In contrast, almost all localities have received less than 40 inches in a calendar year in dry years. Figure FL1-1 shows the average annual precipitation in Florida.

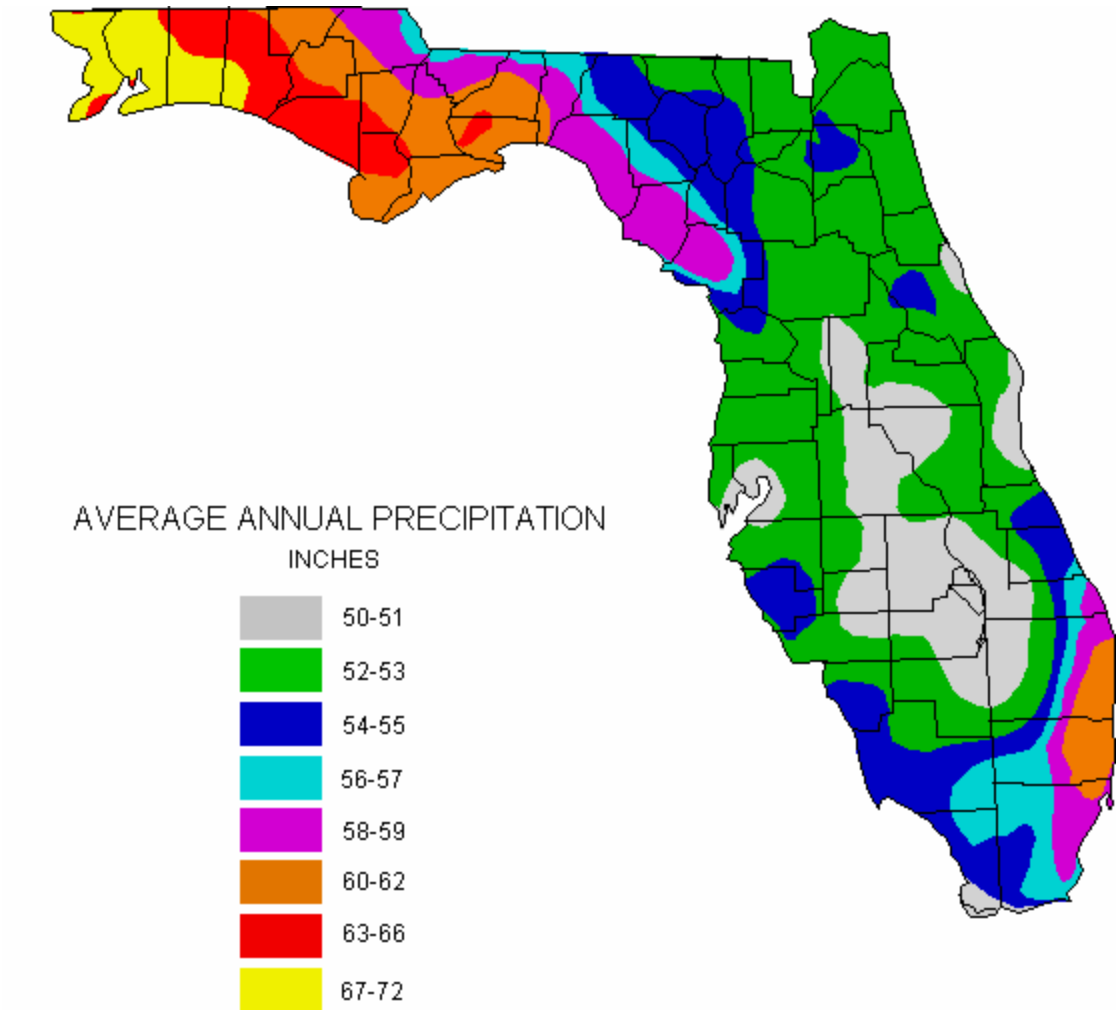
On an annual basis, most of Florida's rainfall is seasonal. For the peninsula, a distinct wet season occurs between the months of June and September, during which an average of 60% of the total rainfall occurs, and a pronounced dry season in the winter, especially during the months of December through May. In the panhandle and areas of north peninsular Florida, two wet seasons occurs - one in the summer corresponding to that of the peninsula, and another in the winter months of December, January and February. Between these wet seasons, much drier weather prevails.

Figure FL4-1 of Chapter 4 in this guide shows the seasonal rainfall distribution in Florida by climatic zones.

Florida is not immune from drought even though annual rainfall amounts are relatively large. Prolonged periods of deficient rainfall occasionally occur even during the time of the expected rainy season. Several such dry periods in the course of one or two years can lead to significantly lowered water tables and lake levels. This can lead to serious water shortages for those who depend upon lakes and shallow wells for their water supply.

Due to uneven rainfall distribution and because a large part of the state's agricultural produce is planted, grown, and marketed during fall, winter, and spring (normally the driest part of the year), growers of high valued crops find it almost mandatory to provide supplemental irrigation for successful crop production.

Figure FL1-1 Average Annual Precipitation in Florida, Inches (1971-2000)



FL652.0102 Irrigation in Florida

As of 2000, 1.87 million acres were irrigated in Florida for agricultural uses. This does not include urban and recreational irrigation. Total irrigated acreage increased by 17% between 1970 and 2000.

Growth in irrigation can be attributed to the limited moisture holding capacity of some Florida soils, increased scientific knowledge of crop water requirements, uneven rainfall distribution and demand for greater crop intensification. These factors make irrigation more appealing and economical than ever before to farmers who have a high investment in crop production. Besides preventing crop-water stress, irrigation systems are also used to protect the crop against heat and cold and to apply fertilizers and pesticides.

Irrigation systems currently used in Florida can be broadly classified as sprinkler, subsurface, and microirrigation. These systems are discussed in detail in Chapter 6 of this guide. Microirrigation has become the system of choice in the Florida citrus industry due to the ability to

manage, economics, and water savings. The different types of irrigation systems and crops irrigated in Florida are shown in Table FL1-1 (all values shown are in million gallons per day, MGD).

Table FL1-1. Crops Irrigated and Irrigation Systems in Florida[1]

Crop and Acreage			**Irrigation System Type**		
Crop Type	Total Acres	Irrigated Acres	Microirrigation	Sprinkler	Subsurface
Vegetable Crops	239,674	209,925	21,025	69,951	118,949
Fruit Crops	863,757	843,703	658,267	77,690	107,746
Field Crops	882,313	533,683	1,031	80,648	452,004
Ornamentals and Grasses	2,632,607	278,840	21,835	96,646	160,359
Totals	**4,618,351**	**1,866,151**	**702,158**	**324,935**	**839,058**

[1] Richard Marella, *Water, Withdrawals, Use, Discharge and Trends in Florida, 2000* (U.S. Geological Survey Investigations Report 2004-5151).

FL652.0103 Florida's water supply

In 2000, the total amount of water withdrawn in Florida was estimated at 20,148 MGD. Approximately 3,923 MGD of water was used in agricultural irrigation. Table FL1-2 illustrates the total water withdrawals in Florida in 2000 by category (All values are in MGD).

Major sources of surface water for irrigation purposes include Lake Okeechobee and associated canals, the Everglades Agricultural Area (Glades, Hendry, Martin, Palm Beach, and St. Lucie Counties), and the canals associated with the headwaters of the Upper St. Johns River (Brevard, Indian River, Okeechobee, and St.Lucie Counties).

Florida obtains its groundwater from five major aquifers: the Floridan aquifer, the Biscayne aquifer, the sand-and-gravel aquifer, the shallow aquifer and an aquifer with highly mineralized water. Figure FL1-2 shows the approximate extent of these aquifers. In some areas water quality has been degraded by the intrusion of salt water. In other areas trapped, highly mineralized water provides poor quality water.

Groundwater withdrawals in Florida total approximately 7.2 billion gallons per day, with approximately 45% being used by agriculture and irrigation.

The Floridan aquifer, which underlies all of the state, is the principal source of water in central, northern, and most of northwestern Florida. In the southern portion of the state the Floridan aquifer is too highly mineralized to be useable.

The Biscayne aquifer is the chief source of water supply for industries, municipalities, and irrigation in southeastern Florida. This aquifer, one of the most productive aquifers in the world, underlies about 3,500 square miles of Broward,

Dade, and Palm Beach Counties. The usefulness of the Biscayne aquifer is sharply restricted in areas adjacent to the coast because of the presence of saline water in the aquifer.

The sand-and-gravel aquifer is the principal source of water supply in the extreme northwestern part of Florida. The aquifer extends beneath all of Escambia and Santa Rosa Counties and part of western Okaloosa County.

A shallow aquifer is present over much of the state, but in most areas it is not an important source of water because a better supply is available from other aquifers. However, in rural areas where water requirements are small, this aquifer is tapped by small-diameter wells. The shallow aquifer is a major source of water in Martin, Palm Beach, Hendry, Lee, Collier, Indian River, St. Lucie, Glades, and Charlotte Counties.

A highly mineralized aquifer underlies the extreme southwestern portion of the state. The water is not considered usable. The area covers about half of Monroe and Collier counties and portions of Hendry, Palm Beach, Broward, and Dade Counties.

Due to Florida's geographical position as a peninsula between two bodies of salt water, the concern of salt water intrusion into the fresh ground water supply is ever present. Salt water intrusion has resulted in irrigation water supplies with high chloride content in some areas. Improperly constructed irrigation wells or over-pumping an area can cause salt water intrusion.

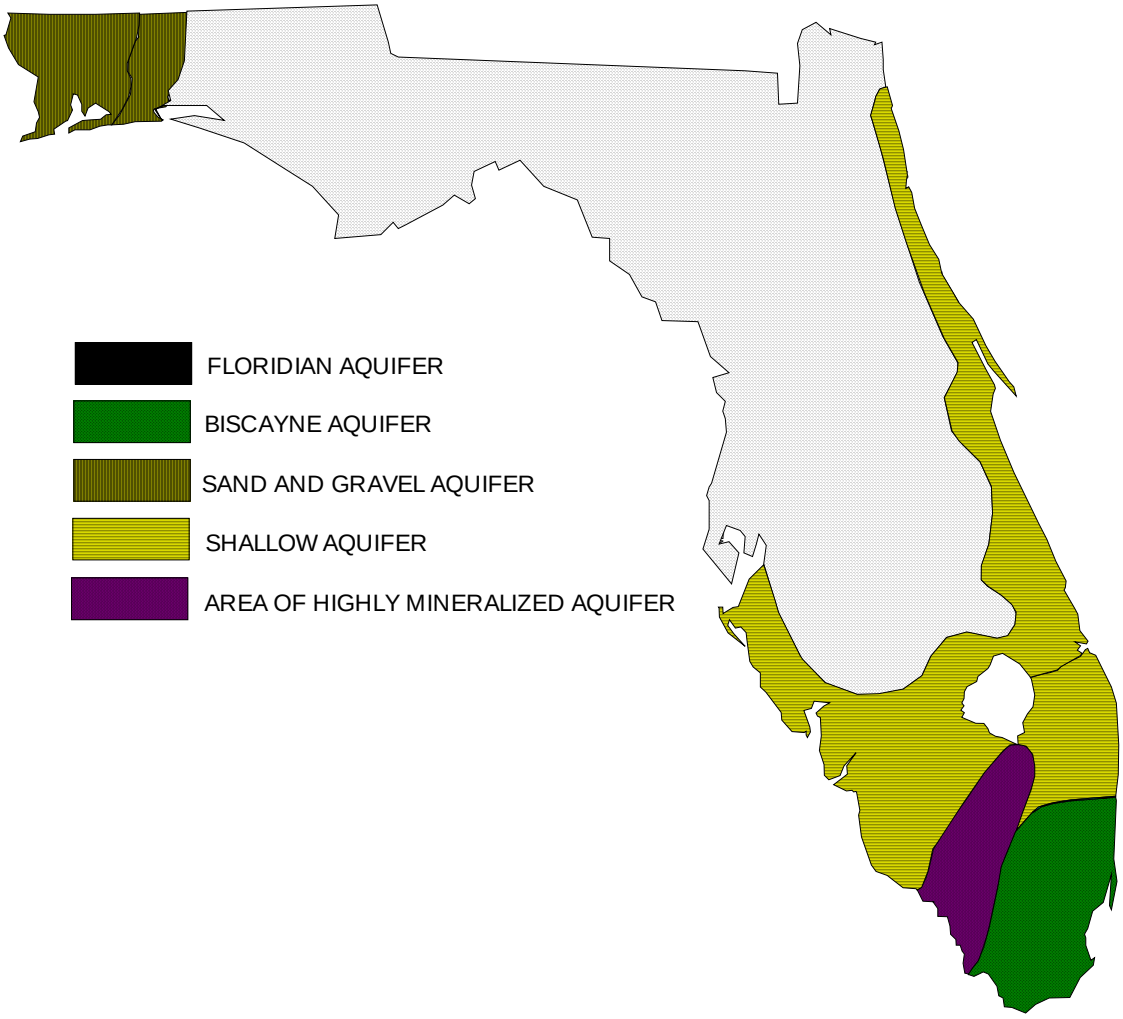
Salt-water contamination occurs in areas where high chloride content water is used to irrigate crops. Subsequent flushing by precipitation during the rainy season can dilute or remove most of the contaminates so that a progressive increase in chloride content may not occur. However, the residual salts remaining after complete flushing may curtail crop production in some areas.

Table FL1-2. Total Water Withdrawals in Florida by Category[2]

Florida 2000	**Freshwater**			**Saline Water**		
	Ground	**Surface**	**Total**	**Ground**	**Surface**	**Total**
Agricultural Self-supplied	1,990	1,933	3,923	0	0	0
Public Supply	2,199	238	2,437	0	0	0
Domestic Self-supplied	199	0	199	0	0	0
Commercial-industrial Self-supplied	431	132	563	0	1	1
Recreational Irrigation	231	181	412	0	0	0
Power Generation	29	629	658	4	11,951	11,955
Totals	**5,079**	**3,113**	**8,192**	**4**	**11,952**	**11,956**

[2] Richard Marella, *Water, Withdrawals, Use, Discharge and Trends in Florida, 2000* (U.S. Geological Survey Investigations Report 2004-5151).

Figure FL1-2 Principal Aquifers in Florida.



FL652.0104 Water rights and allocation

The Florida Water Resources Act of 1972 (Chapter 373, Florida Statutes) modified common law doctrines dealing with water use by creating water management districts with board statutory powers for water management in Florida. This Act created a two-tiered (state and local) system of regulation directed at all waters of the state. The Act has had a significant impact on decisions concerning water resource allocation in Florida.

The Act designates the Department of Environmental Protection (DEP) as the agency responsible for its administration at the state level. At the local level, it is the responsibility of five water management districts. Each water management district has a governing board composed of nine members. An important feature of water management districts is their independence and diversity in viewpoints regarding water management. This diversity reflects the different types and complexities of water management problems with which they must deal in their geographical regions. Water management district boundaries fall approximately along watershed boundaries rather than political boundaries. Figure FL1-3 shows the boundaries of the five water management districts.

The governing boards are empowered by statute to adopt rules and regulations affecting water use within the district and are given authority to enforce such rules and regulations in any court of competent jurisdiction. A most significant aspect of the water management districts' regulatory power is their consumptive use permitting authority.

The governing board or the DEP may require such permits for consumptive use of water and may impose such reasonable conditions as are necessary to assure that such is consistent with the overall objectives of the district or department and is not harmful to the water resources of the area.

The legislature in 1976 expressly provided that the water management districts' statutory authority over consumptive use permitting was exclusive and that any conflicting laws, rules, or regulations were superseded. Consumptive use permits are regulated under Chapter 40-2 Florida Administrative Code. To obtain a consumptive use permit, the applicant must establish that the purposed use: (1) is a reasonable beneficial use, (2) will not interfere with any presently existing legal use of water, and (3) is consistent with the public interest. Should the water supply be inadequate for both of two competing uses, the governing board or DEP can approve or modify the application which best serves the public interest.

This is an extensive power, subject to statutory standards, to decide who can use the available water and to what extent. Additional permitting authority is conferred on the water management districts in the areas of artificial recharge projects, projects related to the management and storage of surface waters (dams), the use of district works or land, the construction, repair and abandonment of water wells, and registration of well drillers.

The above covers in general the topic of water rights and allocation. Concerned individuals should refer to Chapter 373, Florida Statutes and confer with appropriate water management district personnel.

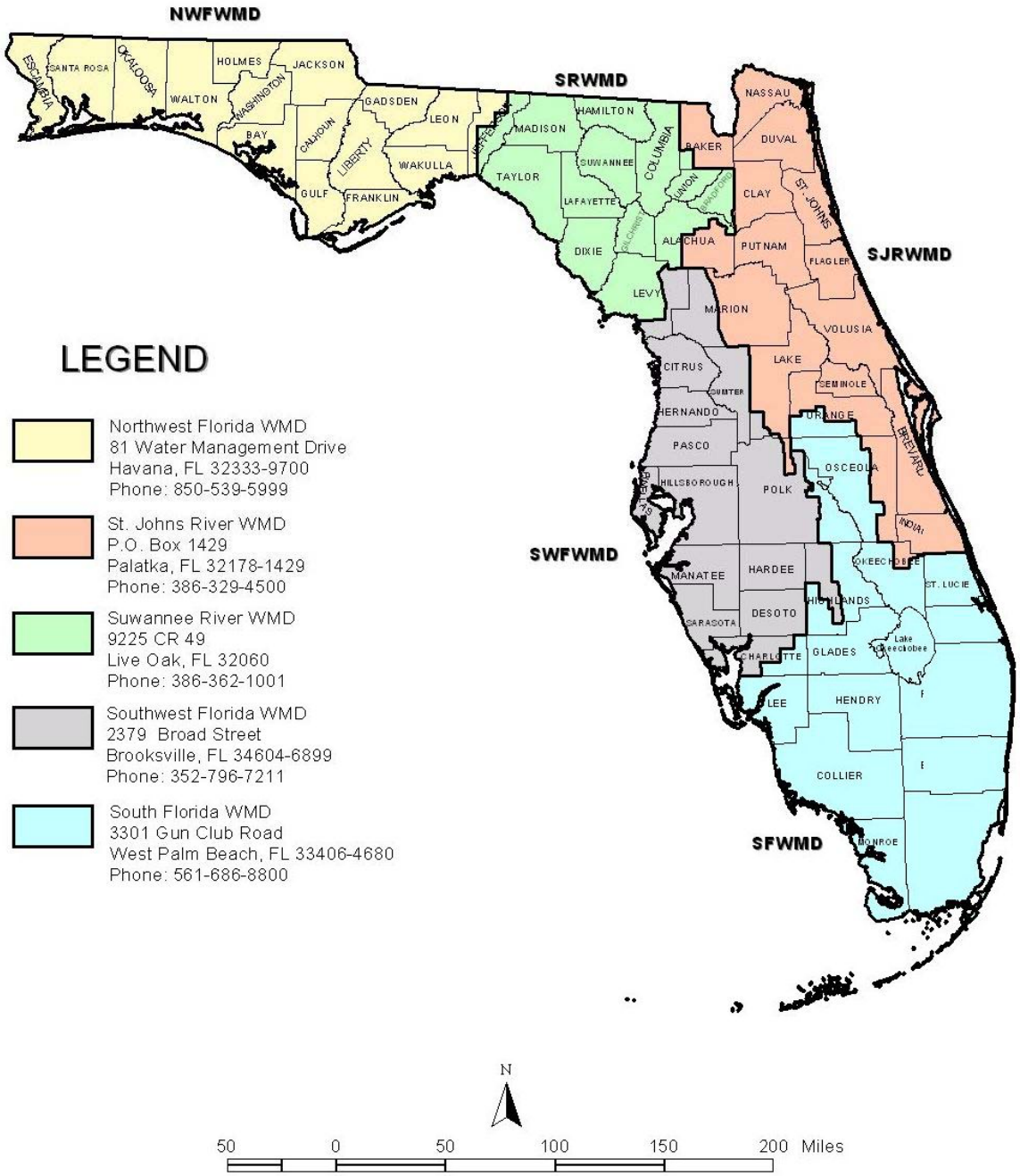



Figure FL1-3 Water Management Districts of Florida