Kissimmee Basin Water Supply Plan

Appendices

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prepared by

South Florida Water Management District

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Water Supply Planning and Development Department
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8) Water Resources

(a) Goal. --Florida shall assure the availability of an adequate supply of water for all competing uses deemed reasonable and beneficial and shall maintain the functions of natural systems and the overall present level of surface and ground water quality. Florida shall improve and restore the quality of waters not presently meeting water quality standards.

(b) Policies. --

1. Ensure the safety and quality of drinking water supplies and promote the development of reverse osmosis and desalinization technologies for developing water supplies.
2. Identify and protect the functions of water recharge area and provide incentives for their conservation.
3. Encourage the development of local and regional water supplies within water management districts instead of transporting surface water across district boundaries.
4. Protect and use natural water systems in lieu of structural alternatives and restore modified systems.
5. Ensure that new development is compatible with existing local and regional water supplies.
6. Establish minimum seasonal flows and levels for surface watercourses with primary consideration given to the protection of natural resources, especially marine, estuarine, and aquatic ecosystems.
7. Discourage the channelization, diversion, or damming of natural riverine systems.
8. Encourage the development of a strict floodplain management program by state and local governments designed to preserve hydrologically significant wetlands and other natural floodplain features.
9. Protect aquifers from depletion and contamination through appropriate regulatory programs and through incentives.
10. Protect surface and ground water quality and quantity in the state.
11. Promote water conservation as an integral part of water management programs as well as the use and reuse of water of the lowest acceptable quality for the purposes intended.
12. Eliminate the discharge of inadequately treated wastewater and stormwater runoff into the waters of the state.
13. Identify and develop alternative methods of wastewater treatment, disposal, and reuse of wastewater to reduce degradation of water resources.

14. Reserve from use that water necessary to support essential non-withdrawal demands, including navigation, recreation, and the protection of fish and wildlife.

History. --+ s.2, ch. 85-57; s. 1, ch. 87-354; s. 47, ch. 88-130; s. 4, ch. 89-279; s.85, ch. 90-201; s. 28, ch. 91-5; s. 103, ch. 91-282.

SELECTED PASSAGES FROM SECTIONS 373.016 - 373.62, F.S.

Part I State Water Resource Plan

373.016 Declaration of Policy

(1) The waters in the state are among its basic resources. Such waters have not heretofore been conserved or fully controlled so as to realize their full beneficial use.

(2) The department and the governing board shall take into account cumulative impacts on water resources and manage those resources in a manner to ensure their sustainability.

(3) It is further declared to be the policy of the Legislature:

(a) To provide for the management of water and related land resources;

(b) To promote the conservation, replenishment, recapture, enhancement, development, and proper utilization of surface and ground water;

(c) To develop and regulate dams, impoundments, reservoirs, and other works and to provide water storage for beneficial purposes;

(d) To promote the availability of sufficient water for all existing and future reasonable-beneficial uses and natural systems;

(e) To prevent damage from floods, soil erosion, and excessive drainage;

(f) To minimize degradation of water resources caused by the discharge of stormwater;

(g) To preserve natural resources, fish, and wildlife;

(h) To promote the public policy set forth in s. 403.021;

(i) To promote recreational development, protect public lands, and assist in maintaining the navigability of rivers and harbors; and

(j) Otherwise to promote the health, safety, and general welfare of the people of this state.

In implementing this chapter, the department and the governing board shall construe and apply the policies in this subsection as a whole, and no specific policy is to be construed or applied in isolation from the other policies in this subsection.

(4)(a) Because water constitutes a public resource benefiting the entire state, it is the policy of the Legislature that the waters in the state be managed on a state and regional basis. Consistent with this directive, the Legislature recognizes the need to allocate water throughout the state so as to meet all reasonable-beneficial uses. However, the Legislature acknowledges that such allocations have in the past adversely affected the water resources of certain areas in this state. To protect such water resources and to meet the current and future needs of those areas with abundant water, the Legislature directs the department and the water management districts to encourage the use of water from sources nearest the area of use or application whenever practicable. Such sources shall include all naturally occurring water sources and all alternative water sources, including but not limited to, desalination, conservation, reuse of nonpotable reclaimed water and stormwater, and aquifer storage and recovery. Reuse of potable reclaimed water and stormwater shall not be subject to the evaluation described in s. 373.223(3)(a)-(g). However, this directive to encourage the use of water, whenever practicable, from sources nearest the area of use or application shall not apply to the transport and direct and indirect use of water within the area encompassed by the Central and Southern Florida Flood Control Project, nor shall it apply anywhere in the state to the transport and use of water supplied exclusively for bottled water as defined in s. 500.03(1)(d), nor shall it apply to the transport and use of reclaimed water for electrical power production by an electric utility as defined in section 366.02(2).

(4)(b) In establishing the policy outlined in paragraph (a), the Legislature realizes that under certain circumstances the need to transport water from distant sources may be necessary for environmental, technical, or economic reasons.

(5) The Legislature recognizes that the water resource problems of the state vary from region to region, both in magnitude and complexity. It is therefore the intent of the Legislature to vest in the Department of Environmental Protection or its successor agency the power and responsibility to accomplish the conservation, protection, management, and control of the waters of the state and with sufficient flexibility and discretion to accomplish these ends through delegation of appropriate powers to the various water management districts. The department may exercise any power herein authorized to be exercised by a water management district; however, to the greatest extent practicable, such power should be delegated to the governing board of a water management district.

(6) It is further declared the policy of the Legislature that each water management district, to the extent consistent with effective management practices, shall approximate its fiscal and budget policies and procedures to those of the state.

History.--s. 2, part I, ch. 72-299; s. 36, ch. 79-65; s. 70, ch. 83-310; s. 5, ch. 89-279; s. 20, ch. 93-213; s. 250, ch. 94-356; s. 1, ch. 97-160.

373.019 Definitions.—

When appearing in this chapter or in any rule, regulation, or order adopted pursuant thereto, the following words shall, unless the context clearly indicates otherwise, mean:

(1) “Coastal waters” means waters of the Atlantic Ocean or the Gulf of Mexico within the jurisdiction of the state.

(2) “Department” means the Department of Environmental Protection or its successor agency or agencies.

(3) “District water management plan” means the regional water resource plan developed by a governing board under s. 373.036.

(4) “Domestic use” means the use of water for the individual personal household purposes of drinking, bathing, cooking, or sanitation. All other uses shall not be considered domestic.

(5) “Florida water plan” means the state-level water resource plan developed by the department under s. 373.036.

(6) “Governing board” means the governing board of a water management district.

(7) “Ground water” means water beneath the surface of the ground, whether or not flowing through known and definite channels.

(8) “Impoundment” means any lake, reservoir, pond, or other containment of surface water occupying a bed or depression in the earth's surface and having a discernible shoreline.

(9) “Independent scientific peer review” means the review of scientific data, theories, and methodologies by a panel of independent, recognized experts in the fields of hydrology, hydrogeology, limnology, and other scientific disciplines relevant to the matters being reviewed under s. 373.042.

(10) “Nonregulated use” means any use of water which is exempted from regulation by the provisions of this chapter.

(11) “Other watercourse” means any canal, ditch, or other artificial watercourse in which water usually flows in a defined bed or channel. It is not essential that the flowing be uniform or uninterrupted.

(12) “Person” means any and all persons, natural or artificial, including any individual, firm, association, organization, partnership, business trust, corporation, company, the United States of America, and the state and all political subdivisions, regions, districts, municipalities, and public agencies thereof. The enumeration herein is not intended to be exclusive or exhaustive.

(13) “Reasonable-beneficial use” means the use of water in such quantity as is necessary for economic and efficient utilization for a purpose and in a manner which is both reasonable and consistent with the public interest.

(14) “Regional water supply plan” means a detailed water supply plan developed by a governing board under s. 373.036[1].

(15) "Stream" means any river, creek, slough, or natural watercourse in which water usually flows in a defined bed or channel. It is not essential that the flowing be uniform or uninterrupted. The fact that some part of the bed or channel has been dredged or improved does not prevent the watercourse from being a stream.

(16) "Surface water" means water upon the surface of the earth, whether contained in bounds created naturally or artificially or diffused. Water from natural springs shall be classified as surface water when it exits from the spring onto the earth's surface.

(17) "Water" or "waters in the state" means any and all water on or beneath the surface of the ground or in the atmosphere, including natural or artificial watercourses, lakes, ponds, or diffused surface water and water percolating, standing, or flowing beneath the surface of the ground, as well as all coastal waters within the jurisdiction of the state.

(18) "Water management district" means any flood control, resource management, or water management district operating under the authority of this chapter.

(19) "Water resource development" means the formulation and implementation of regional water resource management strategies, including the collection and evaluation of surface water and ground water data; structural and nonstructural programs to protect and manage water resources; the development of regional water resource implementation programs; the construction, operation, and maintenance of major public works facilities to provide for flood control, surface and underground water storage, and ground water recharge augmentation; and related technical assistance to local governments and to government-owned and privately owned water utilities.

(20) "Water resource implementation rule" means the rule authorized by s. 373.036, which sets forth goals, objectives, and guidance for the development and review of programs, rules, and plans relating to water resources, based on statutory policies and directives. The waters of the state are among its most basic resources. Such waters should be managed to conserve and protect water resources and to realize the full beneficial use of these resources.

(21) "Water supply development" means the planning, design, construction, operation, and maintenance of public or private facilities for water collection, production, treatment, transmission, or distribution for sale, resale, or end use.

(22) For the sole purpose of serving as the basis for the unified statewide methodology adopted pursuant to s. 373.421(1), as amended, "wetlands" means those areas that are inundated or saturated by surface water or ground water at a frequency and a duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soils. Soils present in wetlands generally are classified as hydric or alluvial, or possess characteristics that are associated with reducing soil conditions. The prevalent vegetation in wetlands generally consists of facultative or obligate hydrophytic macrophytes that are typically adapted to areas having soil conditions described above. These species, due to morphological, physiological, or reproductive adaptations, have the ability to grow, reproduce, or persist in

aquatic environments or anaerobic soil conditions. Florida wetlands generally include swamps, marshes, bayheads, bogs, cypress domes and strands, sloughs, wet prairies, riverine swamps and marshes, hydric seepage slopes, tidal marshes, mangrove swamps and other similar areas. Florida wetlands generally do not include longleaf or slash pine flatwoods with an understory dominated by saw palmetto. Upon legislative ratification of the methodology adopted pursuant to s. 373.421(1), as amended, the limitation contained herein regarding the purpose of this definition shall cease to be effective.

(23) "Works of the district" means those projects and works, including, but not limited to, structures, impoundments, wells, streams, and other watercourses, together with the appurtenant facilities and accompanying lands, which have been officially adopted by the governing board of the district as works of the district.

History.--s. 3, part I, ch. 72-299; s. 37, ch. 79-65; s. 1, ch. 80-259; s. 5, ch. 82-101; s. 6, ch. 89-279; s. 21, ch. 93-213; s. 15, ch. 94-122; s. 251, ch. 94-356; s. 1, ch. 96-339; s. 1, ch. 96-370; s. 2, ch. 97-160.

[1]Note.--Former s. 373.194

373.033 Saltwater Barrier Line

(1) The department may, at the request of the board of county commissioners of any county, at the request of the governing board of any water management district, or any municipality or water district responsible for the protection of a public water supply, or, having determined by adoption of an appropriate resolution that saltwater intrusion has become a matter of emergency proportions, by its own initiative, establish generally along the seacoast, inland from the seashore and within the limits of the area within which the petitioning board has jurisdiction, a saltwater barrier line inland of which no canal shall be constructed or enlarged, and no natural stream shall be deepened or enlarged, which shall discharge into tidal waters without a dam, control structure or spillway at or seaward of the saltwater barrier line, which shall prevent the movement of salt water inland of the saltwater barrier line. Provided, however, that the department is authorized, in cases where saltwater intrusion is not a problem, to waive the requirement of a barrier structure by specific permit to construct a canal crossing the saltwater barrier line without a protective device and provided, further that the agency petitioning for the establishment of the saltwater barrier line shall concur in the waiver.

(2) Application by a board of county commissioners or by the governing board of a water management district, a municipality or a water district for the establishment of a saltwater barrier line shall be made by adoption of an appropriate resolution, agreeing to:

(a) Reimburse the department the cost of necessary investigation, including, but not limited to, subsurface exploration by drilling, to determine the proper location of the saltwater barrier line in that county or in all or part of the district over which the applying agency has jurisdiction.

(b) Require compliance with the provisions of this law by county or district forces under their control; by those individuals or corporations filing plats for record and by individuals, corporations or agencies seeking authority to discharge surface or subsurface drainage into tidal waters.

(3) The board of county commissioners of any county or the governing board of any water management district, municipality or water district desiring to establish a saltwater barrier line is authorized to reimburse the department for any expense entailed in making an investigation to determine the proper location of the saltwater barrier line, from any funds available to them for general administrative purposes.

(4) The department, any board of county commissioners, and the governing board of any water management district, municipality, or water district having competent jurisdiction over an area in which a saltwater barrier is established shall be charged with the enforcement of the provisions of this section, and authority for the maintenance of actions set forth in s. 373.129 shall apply to this section.

(5) The provisions of s. 373.191 shall apply specifically to the authority of the board of county commissioners, or to the governing board of a water management district, a municipality, or a water district having jurisdiction over an area in which a saltwater barrier line is established, to expend funds from whatever source may be available to them for the purpose of constructing saltwater barrier dams, dikes, and spillways within existing canals and streams in conformity with the purpose and intent of the board in establishing the saltwater barrier line.

History.--s. 2, ch. 63-210; ss. 25, 35, ch. 69-106; s. 25, ch. 73-190; s. 14, ch. 78-95; s. 40, ch. 79-65; s. 85, ch. 79-164.

373.036 Florida water plan; district water management plans.--

(1) FLORIDA WATER PLAN.--In cooperation with the water management districts, regional water supply authorities, and others, the department shall develop the Florida water plan. The Florida water plan shall include, but not be limited to:

(a) The programs and activities of the department related to water supply, water quality, flood protection and floodplain management, and natural systems.

(b) The water quality standards of the department.

(c) The district water management plans.

(d) Goals, objectives, and guidance for the development and review of programs, rules, and plans relating to water resources, based on statutory policies and directives. The state water policy rule, renamed the water resource implementation rule pursuant to s. 373.019(2), shall serve as this part of the plan. Amendments or additions to this part of the Florida water plan shall be adopted by the department as part of the water resource implementation rule. In accordance with s. 373.114, the department shall review rules of the water management districts for consistency with this rule. Amendments to the water resource implementation rule must be adopted by the secretary of the department and be submitted to the President of the Senate and the Speaker of the House of Representatives within 7 days after publication in the Florida Administrative Weekly. Amendments shall not become effective until the conclusion of the next regular session of the Legislature following their adoption.

(2) DISTRICT WATER MANAGEMENT PLANS.--

(a) Each governing board shall develop a district water management plan for water resources within its region, which plan addresses water supply, water quality, flood protection and floodplain management, and natural systems. The district water management plan shall be based on at least a 20-year planning period, shall be developed and revised in cooperation with other agencies, regional water supply authorities, units of government, and interested parties, and shall be updated at least once every 5 years. The governing board shall hold a public hearing at least 30 days in advance of completing the development or revision of the district water management plan.

(b) The district water management plan shall include, but not be limited to:

1. The scientific methodologies for establishing minimum flows and levels under s. 373.042, and all established minimum flows and levels.
2. Identification of one or more water supply planning regions that singly or together encompass the entire district.
3. Technical data and information prepared under ss. 373.0391 and 373.0395.
4. A districtwide water supply assessment, to be completed no later than July 1, 1998, which determines for each water supply planning region:
   a. Existing legal uses, reasonably anticipated future needs, and existing and reasonably anticipated sources of water and conservation efforts; and
   b. Whether existing and reasonably anticipated sources of water and conservation efforts are adequate to supply water for all existing legal uses and reasonably anticipated future needs and to sustain the water resources and related natural systems.
5. Any completed regional water supply plans.

(c) If necessary for implementation, the governing board shall adopt by rule or order relevant portions of the district water management plan, to the extent of its statutory authority.

(d) In the formulation of the district water management plan, the governing board shall give due consideration to:

1. The attainment of maximum reasonable-beneficial use of water resources.
2. The maximum economic development of the water resources consistent with other uses.

3. The management of water resources for such purposes as environmental protection, drainage, flood control, and water storage.
4. The quantity of water available for application to a reasonable-beneficial use.
5. The prevention of wasteful, uneconomical, impractical, or unreasonable uses of water resources.
6. Presently exercised domestic use and permit rights.
7. The preservation and enhancement of the water quality of the state.
8. The state water resources policy as expressed by this chapter.

(3) The department and governing board shall give careful consideration to the requirements of public recreation and to the protection and procreation of fish and wildlife. The department or governing board may prohibit or restrict other future uses on certain designated bodies of water which may be inconsistent with these objectives.

(4) The governing board may designate certain uses in connection with a particular source of supply which, because of the nature of the activity or the amount of water required, would constitute an undesirable use for which the governing board may deny a permit.

(5) The governing board may designate certain uses in connection with a particular source of supply which, because of the nature of the activity or the amount of water required, would result in an enhancement or improvement of the water resources of the area. Such uses shall be preferred over other uses in the event of competing applications under the permitting systems authorized by this chapter.

(6) The department, in cooperation with the Executive Office of the Governor, or its successor agency, may add to the Florida water plan any other information, directions, or objectives it deems necessary or desirable for the guidance of the governing boards or other agencies in the administration and enforcement of this chapter.

History.--s. 6, part I, ch. 72-299; ss. 2, 3, ch. 73-190; s. 122, ch. 79-190; s. 3, ch. 97-160; s. 7, ch. 98-88.

373.0361 Regional water supply planning.--

(1) By October 1, 1998, the governing board shall initiate water supply planning for each water supply planning region identified in the district water management plan under s. 373.036, where it determines that sources of water are not adequate for the planning period to supply water for all existing and projected reasonable-beneficial uses and to sustain the water resources and related natural systems. The planning must be conducted in an open public process, in coordination and cooperation with local governments, regional water supply authorities, government-owned and privately owned water utilities, self-suppliers, and other affected and interested parties. A determination by the governing board that initiation of a regional water supply plan for a specific planning region is not needed pursuant to this section shall be subject to s. 120.569. The governing

board shall reevaluate such a determination at least once every 5 years and shall initiate a regional water supply plan, if needed, pursuant to this subsection.

(2) Each regional water supply plan shall be based on at least a 20-year planning period and shall include, but not be limited to:

(a) A water supply development component that includes:

1. A quantification of the water supply needs for all existing and reasonably projected future uses within the planning horizon. The level-of-certainty planning goal associated with identifying the water supply needs of existing and future reasonable-beneficial uses shall be based upon meeting those needs for a 1-in-10-year drought event.
2. A list of water source options for water supply development, including traditional and alternative sources, from which local government, government-owned and privately owned utilities, self-suppliers, and others may choose, which will exceed the needs identified in subparagraph 1.
3. For each option listed in subparagraph 2., the estimated amount of water available for use and the estimated costs of and potential sources of funding for water supply development.
4. A list of water supply development projects that meet the criteria in s. 373.0831(4).

(b) A water resource development component that includes:

1. A listing of those water resource development projects that support water supply development.
2. For each water resource development project listed:
   a. An estimate of the amount of water to become available through the project.
   b. The timetable for implementing or constructing the project and the estimated costs for implementing, operating, and maintaining the project.
   c. Sources of funding and funding needs.
   d. Who will implement the project and how it will be implemented.

(c) The recovery and prevention strategy described in s. 373.0421(2).

(d) A funding strategy for water resource development projects, which shall be reasonable and sufficient to pay the cost of constructing or implementing all of the listed projects.

(e) Consideration of how the options addressed in paragraphs (a) and (b) serve the public interest or save costs overall by preventing the loss of natural resources or avoiding greater future expenditures for water resource development or water supply development. However, unless adopted by rule, these considerations do not constitute final agency action.

(f) The technical data and information applicable to the planning region which are contained in the district water management plan and are necessary to support the regional water supply plan.

(g) The minimum flows and levels established for water resources within the planning region.

(3) Regional water supply plans initiated or completed by July 1, 1997, shall be revised, if necessary, to include a water supply development component and a water resource development component as described in paragraphs (2)(a) and (b).

(4) Governing board approval of a regional water supply plan shall not be subject to the rulemaking requirements of chapter 120. However, any portion of an approved regional water supply plan which affects the substantial interests of a party shall be subject to s. 120.569.

(5) By November 15, 1997, and annually thereafter, the department shall submit to the Governor and the Legislature a report on the status of regional water supply planning in each district. The report shall include:

(a) A compilation of the estimated costs of and potential sources of funding for water resource development and water supply development projects, as identified in the water management district regional water supply plans.

(b) A description of each district's progress toward achieving its water resource development objectives, as directed by s. 373.0831(3), including the district's implementation of its 5-year water resource development work program.

(6) Nothing contained in the water supply development component of the district water management plan shall be construed to require local governments, government-owned or privately owned water utilities, self-suppliers, or other water suppliers to select a water supply development option identified in the component merely because it is identified in the plan. However, this subsection shall not be construed to limit the authority of the department or governing board under part II.

History.--s. 4, ch. 97-160.

373.0391 Technical Assistance to Local Governments

(1) The water management districts shall assist local governments in the development and future revision of local government comprehensive plan elements or public facilities report as required by s. 189.415, related to water resource issues.

(2) By July 1, 1991, each water management district shall prepare and provide information and data to assist local governments in the preparation and implementation of their local government comprehensive plans or public facilities report as required by s. 189.415, whichever is applicable. Such information and data shall include, but not be limited to:

(a) All information and data required in a public facilities report pursuant to s. 189.415.

(b) A description of regulations, programs, and schedules implemented by the district.

(c) Identification of regulations, programs, and schedules undertaken or proposed by the district to further the State Comprehensive Plan.

(d) A description of surface water basins, including regulatory jurisdictions, flood-prone areas, existing and projected water quality in water management district operated facilities, as well as surface water runoff characteristics and topography regarding flood plains, wetlands, and recharge areas.

(e) A description of ground water characteristics, including existing and planned wellfield sites, existing and anticipated cones of influence, highly productive ground water areas, aquifer recharge areas, deep well injection zones, contaminated areas, an assessment of regional water resource needs and sources for the next 20 years, and water quality.

(f) The identification of existing and potential water management district land acquisitions.

(g) Information reflecting the minimum flows for surface watercourses to avoid harm to water resources or the ecosystem and information reflecting the minimum water levels for aquifers to avoid harm to water resources or the ecosystem.

History.--s. 55, ch. 89-169; s. 8, ch. 89-279.

373.0395 Ground water basin resource availability inventory.—

Each water management district shall develop a ground water basin resource availability inventory covering those areas deemed appropriate by the governing board. This inventory shall include, but not be limited to, the following:

(1) A hydrogeologic study to define the ground water basin and its associated recharge areas.

(2) Site specific areas in the basin deemed prone to contamination or overdraft resulting from current or projected development.

(3) Prime ground water recharge areas.

(4) Criteria to establish minimum seasonal surface and ground water levels.

(5) Areas suitable for future water resource development within the ground water basin.

(6) Existing sources of wastewater discharge suitable for reuse as well as the feasibility of integrating coastal wellfields.

(7) Potential quantities of water available for consumptive uses.

Upon completion, a copy of the ground water basin availability inventory shall be submitted to each affected municipality, county, and regional planning agency. This inventory shall be reviewed by the affected municipalities, counties, and regional planning agencies for consistency with the local government comprehensive plan and shall be considered in future revisions of such plan. It is the intent of the Legislature that future growth and development planning reflect the limitations of the available ground water or other available water supplies.

History.--s. 6, ch. 82-101.

373.0397 Floridan and Biscayne aquifers; designation of prime ground water recharge areas.—

Upon preparation of an inventory of prime ground water recharge areas for the Floridan or Biscayne aquifers as a part of the requirements of s. 373.0395(3), but prior to adoption by the governing board, the water management district shall publish a legal notice of public hearing on the designated areas for the Floridan and Biscayne aquifers, with a map delineating the boundaries of the areas, in newspapers defined in chapter 50 as having general circulation within the area to be affected. The notice shall be at least one-fourth page and shall read as follows:

NOTICE OF PRIME RECHARGE
AREA DESIGNATION

The (name of taxing authority) proposes to designate specific land areas as areas of prime recharge to the (name of aquifer) Aquifer.

All concerned citizens are invited to attend a public hearing on the proposed designation to be held on (date and time) at (meeting place).

A map of the affected areas follows.

The governing board of the water management district shall adopt a designation of prime ground water recharge areas to the Floridan and Biscayne aquifers by rule within 120 days after the public hearing, subject to the provisions of chapter 120.

History.--s. 2, ch. 85-42.

373.042 Minimum Flows and Levels

(1) Within each section, or the water management district as a whole, the department or the governing board shall establish the following:

   (a) Minimum flow for all surface watercourses in the area. The minimum flow for a given watercourse shall be the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area.

   (b) Minimum water level. The minimum water level shall be the level of ground water in an aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources of the area.

The minimum flow and minimum water level shall be calculated by the department and the governing board using the best information available. When appropriate, minimum flows and levels may be calculated to reflect seasonal variations. The department and the governing board shall also consider, and at their discretion may provide for, the protection of nonconsumptive uses in the establishment of minimum flows and levels.

(4)

(a) Upon written request to the department or governing board by a substantially affected person, or by decision of the department or governing board, prior to the establishment of a minimum flow or level and prior to the filing of any petition for administrative hearing related to the minimum flow or level, all scientific or technical data, methodologies, and models, including all scientific and technical assumptions employed in each model, used to establish a minimum flow or level shall be subject to independent scientific peer review. Independent scientific peer review means review by a panel of independent, recognized experts in the fields of hydrology, hydrogeology, limnology, biology, and other scientific disciplines, to the extent relevant to the establishment of the minimum flow or level.

(b) If independent scientific peer review is requested, it shall be initiated at an appropriate point agreed upon by the department or governing board and the person or persons requesting the peer review. If no agreement is reached, the department or governing board shall determine the appropriate point at which to initiate peer review. The members of the peer review panel shall be selected within 60 days of the point of initiation by agreement of the department or governing board and the person or persons requesting the peer review. If the panel is not selected within the 60-day period, the time limitation may be waived upon the agreement of all parties. If no waiver occurs, the department or governing board may proceed to select the peer review panel. The cost of the peer review shall be borne equally by the district and each party requesting the peer review, to the extent economically feasible. The panel shall submit a final report to the governing board within 120 days after its selection unless the deadline is waived by agreement of all parties. Initiation of peer review pursuant to this paragraph shall toll any applicable deadline under chapter 120 or other law or district rule regarding permitting, rulemaking, or administrative hearings, until 60 days following submittal of the final report. Any such deadlines shall also be tolled for 60 days following withdrawal of the request or following agreement of the parties that peer review will no longer be pursued. The department or the governing board shall give significant weight to the final report of the peer review panel when establishing the minimum flow or level.

(c) If the final data, methodologies, and models, including all scientific and technical assumptions employed in each model upon which a minimum flow or level is based, have undergone peer review pursuant to this subsection, by request or by decision of the department or governing board, no further peer review shall be required with respect to that minimum flow or level.

(d) No minimum flow or level adopted by rule or formally noticed for adoption on or before May 2, 1997, shall be subject to the peer review provided for in this subsection.

(5) If a petition for administrative hearing is filed under chapter 120 challenging the establishment of a minimum flow or level, the report of an independent scientific peer review conducted under subsection (4) is admissible as evidence in the final hearing, and the administrative law judge must render the order within 120 days after the filing of the petition. The time limit for rendering the order shall not be extended except by agreement of all the parties. To the extent that the parties agree to the findings of the peer review, they may stipulate that those findings be incorporated as findings of fact in the final order.

History.--s. 6, part I, ch. 72-299; s. 2, ch. 73-190; s. 2, ch. 96-339; s. 5, ch. 97-160.

373.0421 Establishment and implementation of minimum flows and levels.--

(1) ESTABLISHMENT.--

(a) Considerations.--When establishing minimum flows and levels pursuant to s. 373.042, the department or governing board shall consider changes and structural alterations to watersheds, surface waters, and aquifers and the effects such changes or alterations have had, and the constraints such changes or alterations have placed, on the hydrology of an affected watershed, surface water, or aquifer, provided that nothing in this paragraph shall allow significant harm as provided by s. 373.042(1) caused by withdrawals.

(b) Exclusions.--

1. The Legislature recognizes that certain water bodies no longer serve their historical hydrologic functions. The Legislature also recognizes that recovery of these water bodies to historical hydrologic conditions may not be economically or technically feasible, and that such recovery effort could cause adverse environmental or hydrologic impacts. Accordingly, the department or governing board may determine that setting a minimum flow or level for such a water body based on its historical condition is not appropriate.
2. The department or the governing board is not required to establish minimum flows or levels pursuant to s. 373.042 for surface water bodies less than 25 acres in area, unless the water body or bodies, individually or cumulatively, have significant economic, environmental, or hydrologic value.
3. The department or the governing board shall not set minimum flows or levels pursuant to s. 373.042 for surface water bodies constructed prior to the requirement for a permit, or pursuant to an exemption, a permit, or a reclamation plan which regulates the size, depth, or function of the surface water body under the provisions of this chapter, chapter 378, or chapter 403, unless the constructed surface water body is of significant

hydrologic value or is an essential element of the water resources of the area.

The exclusions of this paragraph shall not apply to the Everglades Protection Area, as defined in s. 373.4592(2)(h).

(2) If the existing flow or level in a water body is below, or is projected to fall within 20 years below, the applicable minimum flow or level established pursuant to s. 373.042, the department or governing board, as part of the regional water supply plan described in s. 373.036[1], shall expeditiously implement a recovery or prevention strategy, which includes the development of additional water supplies and other actions, consistent with the authority granted by this chapter, to:

(a) Achieve recovery to the established minimum flow or level as soon as practicable; or

(b) Prevent the existing flow or level from falling below the established minimum flow or level.

The recovery or prevention strategy shall include phasing or a timetable which will allow for the provision of sufficient water supplies for all existing and projected reasonable-beneficial uses, including development of additional water supplies and implementation of conservation and other efficiency measures concurrent with, to the extent practical, and to offset, reductions in permitted withdrawals, consistent with the provisions of this chapter.

(3) The provisions of this section are supplemental to any other specific requirements or authority provided by law. Minimum flows and levels shall be reevaluated periodically and revised as needed.

History.--s. 6, ch. 97-160.

[1]Note.--Former s. 378.16.

373.0831 Water resource development; water supply development.--

(1) The Legislature finds that:

(a) The proper role of the water management districts in water supply is primarily planning and water resource development, but this does not preclude them from providing assistance with water supply development.

(b) The proper role of local government, regional water supply authorities, and government-owned and privately owned water utilities in water supply is primarily water supply development, but this does not preclude them from providing assistance with water resource development.

(c) Water resource development and water supply development must receive priority attention, where needed, to increase the availability of sufficient water for all existing and future reasonable-beneficial uses and natural systems.

(2) It is the intent of the Legislature that:

(a) Sufficient water be available for all existing and future reasonable-beneficial uses and the natural systems, and that the adverse effects of competition for water supplies be avoided.

(b) Water management districts take the lead in identifying and implementing water resource development projects, and be responsible for securing necessary funding for regionally significant water resource development projects.

(c) Local governments, regional water supply authorities, and government-owned and privately owned water utilities take the lead in securing funds for and implementing water supply development projects. Generally, direct beneficiaries of water supply development projects should pay the costs of the projects from which they benefit, and water supply development projects should continue to be paid for through local funding sources.

(d) Water supply development be conducted in coordination with water management district regional water supply planning and water resource development.

(3) The water management districts shall fund and implement water resource development as defined in s. 373.019. Each governing board shall include in its annual budget the amount needed for the fiscal year to implement water resource development projects, as prioritized in its regional water supply plans.

(4)

(a) Water supply development projects which are consistent with the relevant regional water supply plans and which meet one or more of the following criteria shall receive priority consideration for state or water management district funding assistance:

1. The project supports establishment of a dependable, sustainable supply of water which is not otherwise financially feasible;
2. The project provides substantial environmental benefits by preventing or limiting adverse water resource impacts, but requires funding assistance to be economically competitive with other options; or
3. The project significantly implements reuse, storage, recharge, or conservation of water in a manner that contributes to the sustainability of regional water sources.

(b) Water supply development projects which meet the criteria in paragraph (a) and also bring about replacement of existing sources in order to help implement a minimum flow or level shall be given first consideration for state or water management district funding assistance.

History.--s. 11, ch. 97-160.

373.086 Providing for District Works

(1) In order to carry out the works for the district, and for effectuating the purposes of this chapter, the governing board is authorized to clean out, straighten,

enlarge, or change the course of any waterway, natural or artificial, within or without the district; to provide such canals, levees, dikes, dams, sluiceways, reservoirs, holding basins, floodways, pumping stations, bridges, highways, and other works and facilities which the board may deem necessary; to establish, maintain, and regulate water levels in all canals, lakes, rivers, channels, reservoirs, streams, or other bodies of water owned or maintained by the district; to cross any highway or railway with works of the district and to hold, control, and acquire by donation, lease, or purchase, or to condemn any land, public or private, needed for rights-of-way or other purposes, and may remove any building or other obstruction necessary for the construction, maintenance, and operation of the works; and to hold and have full control over the works and rights-of-way of the district.

(2) The works of the district shall be those adopted by the governing board of the district. The district may require or take over for operation and maintenance such works of other districts as the governing board may deem advisable under agreement with such districts.

(3)

(a) Notwithstanding the provisions of chapter 120, the temporary construction, operation, or maintenance of water supply backpumping facilities to be used for storage of surplus water shall not require a permit under this chapter, chapter 253, or chapter 403 from the Department of Environmental Protection if the governing board issues an order declaring a water emergency which order is approved by the Secretary of Environmental Protection. Such approval may be given by telephone and confirmed by appropriate order at a later date. The temporary construction, operation, or maintenance of the facilities shall cease when the governing board or the secretary issues an order declaring that the emergency no longer exists. If the district intends to operate any such facilities permanently under nonemergency conditions, it shall apply for the appropriate required permits from the Department of Environmental Protection within 30 days of rescinding the emergency order.

(b) Notwithstanding the provisions of chapter 120, emergency orders issued pursuant to this subsection shall be valid for a period of 90 days and may be renewed for a single 90-day period.

History.--s. 16, ch. 25209, 1949; s. 2, ch. 29790, 1955; s. 1, ch. 61-147; s. 3, ch. 61-497; s. 2, ch. 63-224; s. 1, ch. 67-206; s. 1, part VI, ch. 72-299; s. 25, ch. 73-190; s. 1, ch. 82-46; s. 4, ch. 82-101; s. 25, ch. 88-242; ss. 1, 2, ch. 89-279; ss. 11, 12, ch. 90-217; s. 255, ch. 94-356.

373.087 District works using aquifer for storage and supply.—

The governing board may establish works of the district for the purpose of introducing water into, or drawing water from, the underlying aquifer for storage or supply. However, only water of a compatible quality shall be introduced directly into such aquifer.

History.--s. 1, ch. 72-318; s. 1, ch. 82-46; s. 25, ch. 88-242; ss. 1, 2, ch. 89-279; ss. 11, 12, ch. 90-217.

373.106 Permit Required for Construction Involving Underground Formation

1) No construction may be begun on a project involving artificial recharge or the intentional introduction of water into any underground formation except as permitted in chapter 377, without the written permission of the governing board of any water management district within which the construction will take place. Such application shall contain the detailed plans and specifications for the construction of the project.

2) Each water management district has the exclusive authority to process and issue permits under this section and permits and licenses delegated under s. 403.812, except permits required by the department pursuant to 42 U.S.C. s. 300h until delegated by the department to the districts.

(3) A water management district may do any act necessary to replenish the ground water of the district. The district may, among other things, for the purposes of replenishing the ground water supplies within the district:
   - (a) Buy water;
   - (b) Exchange water;
   - (c) Distribute water to persons in exchange for ceasing or reducing ground water extractions;
   - (d) Spread, sink, and inject water into the underground;
   - (e) Store, transport, recapture, reclaim, purify, treat, or otherwise manage and control water for the beneficial use of persons or property within the district; and
   - (f) Build the necessary works to achieve ground water replenishment.

History.--s. 18, part I, ch. 72-299; s. 14, ch. 78-95; s. 71, ch. 83-310; s. 2, ch. 84-338; s. 1, ch. 84-341.

373.171 Rules and Regulations

(1) In order to obtain the most beneficial use of the water resources of the state and to protect the public health, safety, and welfare and the interests of the water users affected, governing boards, by action not inconsistent with the other provisions of this law and without impairing property rights, may:

(a) Establish rules, regulations, or orders affecting the use of water, as conditions warrant, and forbidding the construction of new diversion facilities or wells, the initiation of new water uses, or the modification of any existing uses, diversion facilities, or storage facilities within the affected area.

(b) Regulate the use of water within the affected area by apportioning, limiting, or rotating uses of water or by preventing those uses which the governing board finds have ceased to be reasonable or beneficial.

(c) Make other rules, regulations, and orders necessary for the preservation of the interests of the public and of affected water users.

(2) In promulgating rules and regulations and issuing orders under this law, the governing board shall act with a view to full protection of the existing rights to water in this state insofar as is consistent with the purpose of this law.

(3) No rule, regulation or order shall require any modification of existing use or disposition of water in the district unless it is shown that the use or disposition proposed to be modified is detrimental to other water users or to the water resources of the state.

(4) All rules and regulations adopted by the governing board shall be filed with the Department of State as provided in chapter 120. An information copy will be filed with the Department of Environmental Protection.

History.--s. 11, ch. 57-380; s. 8, ch. 63-336; ss. 10, 25, 35, ch. 69-106; s. 8, ch. 76-243; s. 1, ch. 77-117; s. 14, ch. 78-95; s. 256, ch. 94-356.

373.175 Declaration of Water Shortage; Emergency Orders[1]

(1) The governing board of the district may by order declare that a water shortage exists within all or part of the district when insufficient ground or surface water is available to meet the needs of the users or when conditions are such as to require temporary reduction in total use within the area to protect water resources from serious harm.

(2) The governing board may impose such restrictions on one or more users of the water resource as may be necessary to protect the water resources of the area from serious harm.

(3) When a water shortage is declared, the governing board shall cause notice thereof to be published in a prominent place within a newspaper of general circulation throughout the area. Publication of such notice shall serve as notice to all users in the area of the condition of water shortage.

(4) If an emergency condition exists due to a water shortage within any area of the district and the executive director of the district, with the concurrence of the governing board, finds that the exercise of powers under this section is not sufficient to protect the public health, safety, or welfare, the health of animals, fish, or aquatic life, a public water supply, or recreational, commercial, industrial, agricultural, or other reasonable uses, the executive director may, pursuant to the provisions of chapter 120, issue emergency orders reciting the

existence of such an emergency and requiring that such action, including, but not limited to, apportioning, rotating, limiting, or prohibiting the use of the water resources of the district, be taken as the executive director, with the concurrence of the governing board, deems necessary to meet the emergency.

History.--s. 1, ch. 72-730; s. 25, ch. 73-190; s. 1, ch. 73-295; s. 14, ch. 78-95; s. 35, ch. 83-218; s. 597, ch. 95-148.

[1]Note.--Former s. 378.152.

373.185 Local Xeriscape ordinances.--

1) As used in this section, the term:

(a) "Local government" means any county or municipality of the state.

(b) "Xeriscape" means a landscaping method that maximizes the conservation of water by the use of site-appropriate plants and an efficient watering system. The principles of Xeriscape include planning and design, appropriate choice of plants, soil analysis which may include the use of solid waste compost, efficient irrigation, practical use of turf, appropriate use of mulches, and proper maintenance.

(2) Each water management district shall design and implement an incentive program to encourage all local governments within its district to adopt new ordinances or amend existing ordinances to require Xeriscape landscaping for development permitted after the effective date of the new ordinance or amendment. Each district shall adopt rules governing the implementation of its incentive program and governing the review and approval of local government Xeriscape ordinances or amendments which are intended to qualify a local government for the incentive program. Each district shall assist the local governments within its jurisdiction by providing a model Xeriscape code and other technical assistance. A local government Xeriscape ordinance or amendment, in order to qualify the local government for a district's incentive program, must include, at a minimum:

(a) Landscape design, installation, and maintenance standards that result in water conservation. Such standards shall address the use of plant groupings, soil analysis including the promotion of the use of solid waste compost, efficient irrigation systems, and other water-conserving practices.

(b) Identification of prohibited invasive exotic plant species.

(c) Identification of controlled plant species, accompanied by the conditions under which such plants may be used.

(d) A provision specifying the maximum percentage of turf and the maximum percentage of impervious surfaces allowed in a xeriscaped area and addressing the practical selection and installation of turf.

(e) Specific standards for land clearing and requirements for the preservation of existing native vegetation.

(f) A monitoring program for ordinance implementation and compliance.

The districts also shall work with local governments to promote, through educational programs and publications, the use of Xeriscape practices, including the use of solid waste compost, in existing residential and commercial development. This section may not be construed to limit the authority of the districts to require Xeriscape ordinances or practices as a condition of any consumptive use permit.

History.--s. 3, ch. 91-41; s. 3, ch. 91-68.

373.191 County water conservation projects.—

The several counties of the state may cooperate with the division[1] by engaging in county water development and conservation projects and may use county funds and equipment for this purpose and to do all other things necessary in connection with the development and conservation of the county's water resources consistent with the provisions of this law and the rules and regulations adopted pursuant thereto.

History.--s. 13, ch. 57-380; ss. 25, 35, ch. 69-106.

[1]Note.--Former s. 373.081(1), which defined the word "division" as the Division of Interior Resources of the Department of Natural Resources, was repealed by s. 1, pt. VI, ch. 72-299.

373.196 Legislative findings.--

(1) It is the finding of the Legislature that cooperative efforts between municipalities, counties, water management districts, and the Department of Environmental Protection are mandatory in order to meet the water needs of rapidly urbanizing areas in a manner which will supply adequate and dependable supplies of water where needed without resulting in adverse effects upon the areas from whence such water is withdrawn. Such efforts should utilize all practical means of obtaining water, including, but not limited to, withdrawals of surface water and ground water, recycling of waste water, and desalinization, and will necessitate not only cooperation but also well-coordinated activities. The purpose of this act is to provide additional statutory authority for such cooperative and coordinated efforts.

(2) Municipalities and counties are encouraged to create regional water supply authorities as authorized herein. It is further the intent that municipalities, counties, and regional water supply authorities are to have the primary responsibility for water supply, and water management districts and their basin boards are to engage only in those functions that are incidental to the exercise of their flood control and water management powers or that are related to water resource development pursuant to s. 373.0831.

(3) Nothing herein shall be construed to preclude the various municipalities and counties from continuing to operate existing water production and transmission facilities or to enter into cooperative agreements with other municipalities and counties for the purpose of meeting their respective needs for dependable and

adequate supplies of water, provided the obtaining of water through such operations shall not be done in a manner which results in adverse effects upon the areas from whence such water is withdrawn.

History.--s. 1, ch. 74-114; s. 43, ch. 79-65; s. 257, ch. 94-356; s. ch. 98-88.

373.1961 Water production.--

(1) In the performance of, and in conjunction with, its other powers and duties, the governing board of a water management district existing pursuant to this chapter:

(a) Shall engage in planning to assist counties, municipalities, private utilities, or regional water supply authorities in meeting water supply needs in such manner as will give priority to encouraging conservation and reducing adverse environmental effects of improper or excessive withdrawals of water from concentrated areas. As used in this section, regional water supply authorities are regional water authorities created under s. 373.1962 or other laws of this state.

(b) Shall assist counties, municipalities, private utilities, or water supply authorities in meeting water supply needs in such manner as will give priority to encouraging conservation and reducing adverse environmental effects of improper or excessive withdrawals of water from concentrated areas.

(c) May establish, design, construct, operate, and maintain water production and transmission facilities for the purpose of supplying water to counties, municipalities, private utilities, or regional water supply authorities. The permit required by part II of this chapter for a water management district engaged in water production and transmission shall be granted, denied, or granted with conditions by the department.

(d) Shall not engage in local distribution.

(e) Shall not deprive, directly or indirectly, any county wherein water is withdrawn of the prior right to the reasonable and beneficial use of water which is required to supply adequately the reasonable and beneficial needs of the county or any of the inhabitants or property owners therein.

(f) May provide water and financial assistance to regional water supply authorities, but may not provide water to counties and municipalities which are located within the area of such authority without the specific approval of the authority or, in the event of the authority's disapproval, the approval of the Governor and Cabinet sitting as the Land and Water Adjudicatory Commission. The district may supply water at rates and upon terms mutually agreed to by the parties or, if they do not agree, as set by the governing board and specifically approved by the Governor and Cabinet sitting as the Land and Water Adjudicatory Commission.

(g) May acquire title to such interest as is necessary in real property, by purchase, gift, devise, lease, eminent domain, or otherwise, for water production and transmission consistent with this section. However, the district shall not use any of the eminent domain powers herein granted to acquire water and water rights already devoted to reasonable and beneficial use or any water production or transmission facilities owned by any county, municipality, or regional water supply authority. The district may exercise eminent domain powers outside of its district boundaries for the acquisition of pumpage facilities, storage areas, transmission facilities, and the normal appurtenances thereto, provided that at least 45 days prior to the exercise of eminent domain, the district notifies the district where the property is located after public notice and the district where the property is located does not object within 45 days after notification of such exercise of eminent domain authority.

(h) In addition to the power to issue revenue bonds pursuant to s. 373.584, may issue revenue bonds for the purposes of paying the costs and expenses incurred in carrying out the purposes of this chapter or refunding obligations of the district issued pursuant to this section. Such revenue bonds shall be secured by, and be payable from, revenues derived from the operation, lease, or use of its water production and transmission facilities and other water-related facilities and from the sale of water or services relating thereto. Such revenue bonds may not be secured by, or be payable from, moneys derived by the district from the Water Management Lands Trust Fund or from ad valorem taxes received by the district. All provisions of s. 373.584 relating to the issuance of revenue bonds which are not inconsistent with this section shall apply to the issuance of revenue bonds pursuant to this section. The district may also issue bond anticipation notes in accordance with the provisions of s. 373.584.

(i) May join with one or more other water management districts, counties, municipalities, private utilities, or regional water supply authorities for the purpose of carrying out any of its powers, and may contract with such other entities to finance acquisitions, construction, operation, and maintenance. The contract may provide for contributions to be made by each party thereto, for the division and apportionment of the expenses of acquisitions, construction, operation, and maintenance, and for the division and apportionment of the benefits, services, and products therefrom. The contracts may contain other covenants and agreements necessary and appropriate to accomplish their purposes.

(2) The Legislature finds that, due to a combination of factors, vastly increased demands have been placed on natural supplies of fresh water, and that, absent increased development of alternative water supplies, such demands may increase in the future. The Legislature also finds that potential exists in the state for the production of significant quantities of alternative water supplies, including reclaimed water, and that water production includes the development of alternative water supplies, including reclaimed water, for appropriate uses. It is the intent of the Legislature that utilities develop reclaimed water systems, where reclaimed water is the most appropriate alternative water supply option, to deliver reclaimed water to as many users as possible through the most cost-effective means, and to construct reclaimed water system infrastructure to their owned or operated properties and facilities where they have reclamation

capability. It is also the intent of the Legislature that the water management districts which levy ad valorem taxes for water management purposes should share a percentage of those tax revenues with water providers and users, including local governments, water, wastewater, and reuse utilities, municipal, industrial, and agricultural water users, and other public and private water users, to be used to supplement other funding sources in the development of alternative water supplies. The Legislature finds that public moneys or services provided to private entities for such uses constitute public purposes which are in the public interest. In order to further the development and use of alternative water supply systems, including reclaimed water systems, the Legislature provides the following:

(a) The governing boards of the water management districts where water resource caution areas have been designated shall include in their annual budgets an amount for the development of alternative water supply systems, including reclaimed water systems, pursuant to the requirements of this subsection. Beginning in 1996, such amounts shall be made available to water providers and users no later than December 31 of each year, through grants, matching grants, revolving loans, or the use of district lands or facilities pursuant to the requirements of this subsection and guidelines established by the districts.

(b) It is the intent of the Legislature that for each reclaimed water utility, or any other utility, which receives funds pursuant to this subsection, the appropriate rate-setting authorities should develop rate structures for all water, wastewater, and reclaimed water and other alternative water supply utilities in the service area of the funded utility, which accomplish the following:

   1. Provide meaningful progress toward the development and implementation of alternative water supply systems, including reclaimed water systems;
   2. Promote the conservation of fresh water withdrawn from natural systems;
   3. Provide for an appropriate distribution of costs for all water, wastewater, and alternative water supply utilities, including reclaimed water utilities, among all of the users of those utilities; and
   4. Prohibit rate discrimination within classes of utility users.

(c) In order to be eligible for funding pursuant to this subsection, a project must be consistent with a local government comprehensive plan and the governing body of the local government must require all appropriate new facilities within the project's service area to connect to and use the project's alternative water supplies. The appropriate local government must provide written notification to the appropriate district that the proposed project is consistent with the local government comprehensive plan.

(d) Any and all revenues disbursed pursuant to this subsection shall be applied only for the payment of capital or infrastructure costs for the construction of alternative water supply systems that provide alternative water supplies for uses within one or more water resource caution areas.

(e) By January 1 of each year, the governing boards shall make available written guidelines for the disbursal of revenues pursuant to this subsection. Such guidelines shall include at minimum:

1. An application process and a deadline for filing applications annually.
2. A process for determining project eligibility pursuant to the requirements of paragraphs (c) and (d).
3. A process and criteria for funding projects pursuant to this subsection that cross district boundaries or that serve more than one district.

(f) The governing board of each water management district shall establish an alternative water supplies grants advisory committee to recommend to the governing board projects for funding pursuant to this subsection. The advisory committee members shall include, but not be limited to, one or more representatives of county, municipal, and investor-owned private utilities, and may include, but not be limited to, representatives of agricultural interests and environmental interests. Each committee member shall represent his or her interest group as a whole and shall not represent any specific entity. The committee shall apply the guidelines and project eligibility criteria established by the governing board in reviewing proposed projects. After one or more hearings to solicit public input on eligible projects, the committee shall rank the eligible projects and shall submit them to the governing board for final funding approval. The advisory committee may submit to the governing board more projects than the available grant money would fund.

(g) All revenues made available annually pursuant to this subsection must be disbursed annually by the governing board if it approves projects sufficient to expend the available revenues.

(h) For purposes of this subsection, alternative water supplies are supplies of water that have been reclaimed after one or more public supply, municipal, industrial, commercial, or agricultural uses, or are supplies of stormwater, or brackish or salt water, that have been treated in accordance with applicable rules and standards sufficient to supply the intended use.

(i) This subsection shall not be subject to the rulemaking requirements of chapter 120.

(j) By January 30 of each year, each water management district shall submit an annual report to the Governor, the President of the Senate, and the Speaker of the House of Representatives which accounts for the disbursal of all budgeted amounts pursuant to this subsection. Such report shall describe all projects funded and shall account separately for moneys provided through grants, matching grants, revolving loans, and the use of district lands or facilities.

History.--s. 2, ch. 74-114; s. 14, ch. 76-243; s. 7, ch. 82-101; s. 2, ch. 87-347; s. 7, ch. 95-323.

373.1962 Regional water supply authorities.--

(1) By agreement between local governmental units created or existing pursuant to the provisions of Art. VIII of the State Constitution, pursuant to the Florida Interlocal Cooperation Act of 1969, s. 163.01, and upon the approval of the Secretary of Environmental Protection to ensure that such agreement will be in the public interest and complies with the intent and purposes of this act, regional water supply authorities may be created for the purpose of developing, recovering, storing, and supplying water for county or municipal purposes in such a manner as will give priority to reducing adverse environmental effects of excessive or improper withdrawals of water from concentrated areas. In approving said agreement the Secretary of Environmental Protection shall consider, but not be limited to, the following:

(a) Whether the geographic territory of the proposed authority is of sufficient size and character to reduce the environmental effects of improper or excessive withdrawals of water from concentrated areas.

(b) The maximization of economic development of the water resources within the territory of the proposed authority.

(c) The availability of a dependable and adequate water supply.

(d) The ability of any proposed authority to design, construct, operate, and maintain water supply facilities in the locations, and at the times necessary, to ensure that an adequate water supply will be available to all citizens within the authority.

(e) The effect or impact of any proposed authority on any municipality, county, or existing authority or authorities.

(f) The existing needs of the water users within the area of the authority.

(2) In addition to other powers and duties agreed upon, and notwithstanding the provisions of s. 163.01, such authority may:

(a) Upon approval of the electors residing in each county or municipality within the territory to be included in any authority, levy ad valorem taxes, not to exceed 0.5 mill, pursuant to s. 9(b), Art. VII of the State Constitution. No tax authorized by this paragraph shall be levied in any county or municipality without an affirmative vote of the electors residing in such county or municipality.

(b) Acquire water and water rights; develop, store, and transport water; provide, sell and deliver water for county or municipal uses and purposes; provide for the furnishing of such water and water service upon terms and conditions and at rates which will apportion to parties and nonparties an equitable share of the capital cost and operating expense of the authority's work to the purchaser.

(c) Collect, treat, and recover wastewater.

(d) Not engage in local distribution.

(e) Exercise the power of eminent domain in the manner provided by law for the condemnation of private property for public use to acquire title to such interest in real property as is necessary to the exercise of the powers herein granted, except water and water rights already devoted to reasonable and beneficial use or any water production or transmission facilities owned by any county or municipality.

(f) Issue revenue bonds in the manner prescribed by the Revenue Bond Act of 1953, as amended, part I, chapter 159, to be payable solely from funds derived from the sale of water by the authority to any county or municipality. Such bonds may be additionally secured by the full faith and credit of any county or municipality, as provided by s. 159.16 or by a pledge of excise taxes, as provided by s. 159.19. For the purpose of issuing revenue bonds, an authority shall be considered a "unit" as defined in s. 159.02(2) and as that term is used in the Revenue Bond Act of 1953, as amended. Such bonds may be issued to finance the cost of acquiring properties and facilities for the production and transmission of water by the authority to any county or municipality, which cost shall include the acquisition of real property and easements therein for such purposes. Such bonds may be in the form of refunding bonds to take up any outstanding bonds of the authority or of any county or municipality where such outstanding bonds are secured by properties and facilities for production and transmission of water, which properties and facilities are being acquired by the authority. Refunding bonds may be issued to take up and refund all outstanding bonds of said authority that are subject to call and termination, and all bonds of said authority that are not subject to call or redemption, when the surrender of said bonds can be procured from the holder thereof at prices satisfactory to the authority. Such refunding bonds may be issued at any time when, in the judgment of the authority, it will be to the best interest of the authority financially or economically by securing a lower rate of interest on said bonds or by extending the time of maturity of said bonds or, for any other reason, in the judgment of the authority, advantageous to said authority.

(g) Sue and be sued in its own name.

(h) Borrow money and incur indebtedness and issue bonds or other evidence of such indebtedness.

(i) Join with one or more other public corporations for the purpose of carrying out any of its powers and for that purpose to contract with such other public corporation or corporations for the purpose of financing such acquisitions, construction, and operations. Such contracts may provide for contributions to be made by each party thereto, for the division and apportionment of the expenses of such acquisitions and operations, and for the division and apportionment of the benefits, services, and products therefrom. Such contract may contain such other and further covenants and agreements as may be necessary and convenient to accomplish the purposes hereof.

(3) A regional water supply authority is authorized to develop, construct, operate, maintain, or contract for alternative sources of potable water, including desalinated water, and pipelines to interconnect authority sources and facilities, either by itself or jointly with a water management district; however, such

alternative potable water sources, facilities, and pipelines may also be privately developed, constructed, owned, operated, and maintained, in which event an authority and a water management district are authorized to pledge and contribute their funds to reduce the wholesale cost of water from such alternative sources of potable water supplied by an authority to its member governments.

(4) When it is found to be in the public interest, for the public convenience and welfare, for a public benefit, and necessary for carrying out the purpose of any regional water supply authority, any state agency, county, water control district existing pursuant to chapter 298, water management district existing pursuant to this chapter, municipality, governmental agency, or public corporation in this state holding title to any interest in land is hereby authorized, in its discretion, to convey the title to or dedicate land, title to which is in such entity, including tax-reverted land, or to grant use-rights therein, to any regional water supply authority created pursuant to this section. Land granted or conveyed to such authority shall be for the public purposes of such authority and may be made subject to the condition that in the event said land is not so used, or if used and subsequently its use for said purpose is abandoned, the interest granted shall cease as to such authority and shall automatically revert to the granting entity.

(5) Each county or municipality which is a party to an agreement pursuant to subsection (1) shall have a preferential right to purchase water from the regional water supply authority for use by such county or municipality.

(6) In carrying out the provisions of this section, any county wherein water is withdrawn by the authority shall not be deprived, directly or indirectly, of the prior right to the reasonable and beneficial use of water which is required adequately to supply the reasonable and beneficial needs of the county or any of the inhabitants or property owners therein.

(7) Upon a resolution adopted by the governing body of any county or municipality, the authority may, subject to a majority vote of its voting members, include such county or municipality in its regional water supply authority upon such terms and conditions as may be prescribed.

(8) The authority shall design, construct, operate, and maintain facilities in the locations and at the times necessary to ensure that an adequate water supply will be available to all citizens within the authority.

(9) Where a water supply authority exists pursuant to s. 373.1962 or s. 373.1963 under a voluntary interlocal agreement that is consistent with requirements in s. 373.1963(1)(b) and receives or maintains consumptive use permits under this voluntary agreement consistent with the water supply plan, if any, adopted by the governing board, such authority shall be exempt from consideration by the governing board or department of the factors specified in s. 373.223(3)(a)-(g) and the submissions required by s. 373.229(3). Such exemptions shall apply only

to water sources within the jurisdictional areas of such voluntary water supply interlocal agreements.

History.--s. 7, ch. 74-114; s. 1, ch. 77-174; s. 35, ch. 79-5; s. 1, ch. 86-22; s. 258, ch. 94-356; s. 29, ch. 97-160; s. 3, ch. 98-88.

Part II Permitting Consumptive Uses Water

373.207 Abandoned Artesian Well--

(1) Each water management district shall develop a work plan which identifies the location of all known abandoned artesian wells within its jurisdictional boundaries and defines the actions which the district must take in order to ensure that each such well is plugged on or before January 1, 1992. The work plan shall include the following:

(a) An initial inventory which accounts for all known abandoned artesian wells in the district.

(b) The location and owner of each known abandoned well.

(c) The methodology proposed by the district to accomplish the plugging of all known abandoned wells within the district on or before January 1, 1992.

(d) Data relating to costs to be incurred for the plugging of all wells, including the per-well cost and personnel costs.

(e) A schedule of priority for the plugging of wells, which schedule is established to mitigate damage to the ground water resource due to water quality degradation.

(2) Each water management district shall submit an annual update of its work plan to the Secretary of Environmental Protection by January 1 of each year, until all wells identified by the plan are plugged.

History.--s. 8, ch. 83-310; s. 263, ch. 94-356.

373.217 Superseded Laws and Regulations

(1) It is the intent of the Legislature to provide a means whereby reasonable programs for the issuance of permits authorizing the consumptive use of particular quantities of water may be authorized by the Department of Environmental Protection, subject to judicial review and also subject to review by the Governor and Cabinet, sitting as the Land and Water Adjudicatory Commission as provided in s. 373.114.

(2) It is the further intent of the Legislature that Part II of the Florida Water Resources Act of 1972, as amended, as set forth in ss. 373.203-373.249, shall provide the exclusive authority for requiring permits for the consumptive use of water and for authorizing transportation thereof pursuant to s. 373.223(2).

(3) If any provision of Part II of the Florida Water Resources Act of 1972, as amended, as set forth in ss. 373.203-373.249, is in conflict with any other

provision, limitation, or restriction which is now in effect under any law or ordinance of this state or any political subdivision or municipality, or any rule or regulation promulgated thereunder, Part II shall govern and control, and such other law or ordinance or rule or regulation promulgated thereunder shall be deemed superseded for the purpose of regulating the consumptive use of water. However, this section shall not be construed to supersede the provisions of the Florida Electrical Power Plant Siting Act.

(4) Other than as provided in subsection (3) of this section, Part II of the Florida Water Resources Act of 1972, as amended, preempts the regulation of the consumptive use of water as defined in this act.

History.--s. 9, ch. 76-243; s. 1, ch. 77-174; s. 265, ch. 94-356.

373.219 Permits required.--

(1) The governing board or the department may require such permits for consumptive use of water and may impose such reasonable conditions as are necessary to assure that such use is consistent with the overall objectives of the district or department and is not harmful to the water resources of the area. However, no permit shall be required for domestic consumption of water by individual users.

(2) In the event that any person shall file a complaint with the governing board or the department that any other person is making a diversion, withdrawal, impoundment, or consumptive use of water not expressly exempted under the provisions of this chapter and without a permit to do so, the governing board or the department shall cause an investigation to be made, and if the facts stated in the complaint are verified the governing board or the department shall order the discontinuance of the use.

History.--s. 2, part II, ch. 72-299; s. 9, ch. 73-190.

373.223 Conditions for a permit.--

(1) To obtain a permit pursuant to the provisions of this chapter, the applicant must establish that the proposed use of water:

(a) Is a reasonable-beneficial use as defined in s. 373.019[1];

(b) Will not interfere with any presently existing legal use of water; and

(c) Is consistent with the public interest.

(2) The governing board or the department may authorize the holder of a use permit to transport and use ground or surface water beyond overlying land, across county boundaries, or outside the watershed from which it is taken if the governing board or department determines that such transport and use is consistent with the public interest, and no local government shall adopt or enforce any law, ordinance, rule, regulation, or order to the contrary.

(3) Except for the transport and use of water supplied by the Central and Southern Florida Flood Control Project, and anywhere in the state when the transport and use of water is supplied exclusively for bottled water as defined in s. 500.03(1)(d), any water use permit applications pending as of April 1, 1998, with the Northwest Florida Water Management District and self-suppliers of water for which the proposed water source and area of use or application are located on contiguous private properties, when evaluating whether a potential transport and use of ground or surface water across county boundaries is consistent with the public interest, pursuant to subsection (1)(c), the governing board or department shall consider:

(a) The proximity of the proposed water source to the area of use or application.

(b) All impoundments, streams, groundwater sources, or watercources that are geographically closer to the area of use or application than the proposed source, and that are technically and economically feasible for the proposed transport and use.

(c) All economically and technically feasible alternatives to the proposed source, including, but not limited to, desalination, conservation, reuse of nonpotable reclaimed water and stormwater, and aquifer storage and recovery.

(d) The potential environmental impacts that may result from the transport and use of water from the proposed source, and the potential environmental impacts that may result from the use of other water sources identified in paragraphs (b) and (c).

(e) Whether existing and reasonably anticipated sources of water and conservation efforts are adequate to supply water for existing legal uses and reasonably anticipated future needs of the water supply planning region in which the proposed water source is located.

(f) Consultations with local governments affected by the proposed transport and use.

(g) The value of the existing capital investment in water-related infrastructure made by the applicant.

Where districtwide water supply assessments and regional water supply plans have been prepared pursuant to ss. 373.036 and 373.0361, the governing board or the department shall use the applicable plans and assessments as the basis for its consideration of the applicable factors in s. 373.223(3).

(4) The governing board or the department, by regulation, may reserve from use by permit applicants, water in such locations and quantities, and for such seasons of the year, as in its judgment may be required for the protection of fish and wildlife or the public health and safety. Such reservations shall be subject to periodic review and revision in the light of changed conditions. However, all presently

existing legal uses of water shall be protected so long as such use is not contrary to the public interest.

History.--s. 3, part II, ch. 72-299; s. 10, ch. 73-190; s. 10, ch. 76-243; s. 35, ch. 85-81; s. 4, ch. 98-88.

373.224 Existing Permits

Any permits or permit agreements for consumptive use of water executed or issued by an existing flood control, water management, or water regulatory district pursuant to this chapter or chapter 378 prior to December 31, 1976, shall remain in full force and effect in accordance with their terms until otherwise modified or revoked as authorized herein.

History.--s. 11, ch. 73-190; s. 3, ch. 75-125.

373.226 Existing uses.--

(1) All existing uses of water, unless otherwise exempted from regulation by the provisions of this chapter, may be continued after adoption of this permit system only with a permit issued as provided herein.

(2) The governing board or the department shall issue an initial permit for the continuation of all uses in existence before the effective date of implementation of this part if the existing use is a reasonable-beneficial use as defined in s. 373.019 and is allowable under the common law of this state.

(3) Application for permit under the provisions of subsection (2) must be made within a period of 2 years from the effective date of implementation of these regulations in an area. Failure to apply within this period shall create a conclusive presumption of abandonment of the use, and the user, if he or she desires to revive the use, must apply for a permit under the provisions of s. 373.229.

History.--s. 4, part II, ch. 72-299; s. 12, ch. 73-190; s. 598, ch. 95-148; s. 9, ch. 98-88.

[1]Note.--Substituted by the editors for a reference to s. 373.019(5) to conform to the redesignation of subunits by s. 37, ch. 79-65, and the further redesignation of subunits by s. 2, ch. 97-160.

373.2295 Interdistrict Transfers of Ground water

(1) As used in this section, “interdistrict transfer and use” means a consumptive water use which involves the withdrawal of ground water from a point within one water management district for use outside the boundaries of that district.

(2) To obtain a permit for an interdistrict transfer and use of ground water, an applicant must file an application in accordance with s. 373.229 with the water management district having jurisdiction over the area from which the applicant proposes to withdraw ground water and submit a copy of the application to the

water management district having jurisdiction over the area where the water is to be used.

(3) The governing board of the water management district where the ground water is proposed to be withdrawn shall review the application in accordance with this part, the rules of the district which relate to consumptive water use permitting, and other applicable provisions of this chapter.

(4) In determining if an application is consistent with the public interest as required by s. 373.223, the projected populations, as contained in the future land use elements of the comprehensive plans adopted pursuant to chapter 163 by the local governments within which the withdrawal areas and the proposed use areas are located, will be considered together with other evidence presented on future needs of those areas. If the proposed interdistrict transfer of ground water meets the requirements of this chapter, and if the needs of the area where the use will occur and the specific area from which the ground water will be withdrawn can be satisfied, the permit for the interdistrict transfer and use shall be issued.

(5) In addition to other requirements contained in this part, the water management district where the ground water is proposed to be withdrawn shall:

(a) Furnish copies of any application, information, correspondence, or other related material to the water management district having jurisdiction over the area where the water is to be used; and

(b) Request comments on the application and the future water needs of the proposed use area from the water management district having jurisdiction over the area where the water is to be used. If comments are received, they must be attached to the preliminary notice of intended agency action and may not create a point of entry for review whether issued by the governing board or district staff.

(6) Upon completion of review of the application, the water management district where the ground water is proposed to be withdrawn shall prepare a notice of preliminary intended agency action which shall include an evaluation of the application and a recommendation of approval, denial, or approval with conditions. The notice shall be furnished to the district where the water is to be used, the applicant, the Department of Environmental Protection, the local governments having jurisdiction over the area from which the ground water is to be withdrawn and where the water is to be used, and any person requesting a copy of the notice.

(a) Any interested person may, within the time specified in the notice, notify in writing the district from where the ground water is to be withdrawn of such person’s position and comments or objections, if any, to the preliminary intended action.

(b) The filing of the notice of intended agency action shall toll the time periods contained in s. 120.60 for the granting or denial of a permit for an interdistrict transfer and use of ground water.

(c) The preliminary intended agency action and any comments or objections of interested persons made pursuant to paragraph (a) shall be considered by the governing board of the water management district where the ground water is proposed to be withdrawn. Following such consideration, the governing board shall issue a notice of intended agency action.

(d) Any substantially affected person who submitted a notification pursuant to paragraph (a) may request review by the department within 14 days after the filing of the notice of intended agency action. If no request for review is filed, the notice of intended agency action shall become the final order of the governing board.

(7) Notwithstanding the provisions of chapter 120, the department shall, within 30 days after its receipt of a request for review of the water management district's action, approve, deny, or modify the water management district's action on the proposed interdistrict transfer and use of ground water. The department shall issue a notice of its intended action. Any substantially affected person who requested review pursuant to paragraph (6)(a) may request an administrative hearing pursuant to chapter 120 within 14 days after notice of the department's intended action. The parties to such proceeding shall include, at a minimum, the affected water management districts and the applicant. The proceedings initiated by a petition under ss. 120.569 and 120.57, following the department's issuance of a notice of intended agency action, is the exclusive proceeding authorized for the review of agency action on the interdistrict transfer and use of ground water. This procedure is to give effect to the legislative intent that this section provide a single, efficient, simplified, coordinated permitting process for the interdistrict transfer and use of ground water.

(8) The department shall issue a final order which is subject to review pursuant to s. 120.68 or s. 373.114.

(9) In administering this part, the department or the water management districts may enter into interagency agreements. However, such agreements are not subject to the provisions of s. 373.046 and chapter 120.

(10) The state hereby preempts any regulation of the interdistrict transfer and use of ground water. If any provision of this section is in conflict with any other provision or restriction under any law, administrative rule, or ordinance, this section shall govern and such law, rule, or ordinance shall be deemed superseded for the purposes of this section. A water management district or the department may not adopt special rules which prohibit or restrict interdistrict transfer and use of ground water in a manner inconsistent with this section.

(11) Any applicant who has submitted an application for interdistrict transfer and use of ground water which is pending on July 11, 1987, may have the application considered pursuant to this section. New permits are not required for interdistrict transfers existing on July 11, 1987, for the duration of the permits issued for such uses.

(12) If, after the final order of the department or final agency action under this section, the proposed use of the site designated in the application for ground water production, treatment, or transmission facilities does not conform with the existing zoning ordinances, a rezoning application may be submitted. If local

authorities deny the application for rezoning, the applicant may appeal this decision to the Land and Water Adjudicatory Commission, which shall authorize a variance or nonconforming use to the existing comprehensive plan and zoning ordinances, unless the commission determines after notice and hearing that such variance or nonconforming use is contrary to the public interest.

(13) The permit required under this section and other sections of this chapter and chapter 403 are the sole permits required for interdistrict transfer and use of ground water, and such permits are in lieu of any license, permit, or similar document required by any state agency or political subdivision pursuant to chapter 163, chapter 380, or chapter 381, and the Florida Transportation Code.

(14) When a consumptive use permit under this section is granted for water use beyond the boundaries of a local government from which or through which the ground water is withdrawn or transferred and a local government denies a permit required under chapter 125 or chapter 153 for a facility or any infrastructure which produces, treats, transmits, or distributes such ground water, the person or unit of government applying for the permit under chapter 125 or chapter 153 may appeal the denial to the Land and Water Adjudicatory Commission. The commission shall review the local government action for consistency with this chapter and the interdistrict ground water transfer permit and may reverse, modify, or approve the local government's action.

History.--s. 1, ch. 87-347; s. 266, ch. 94-356; s. 99, ch. 96-410.

373.233 Competing applications.--

(1) If two or more applications which otherwise comply with the provisions of this part are pending for a quantity of water that is inadequate for both or all, or which for any other reason are in conflict, the governing board or the department shall have the right to approve or modify the application which best serves the public interest.

(2) In the event that two or more competing applications qualify equally under the provisions of subsection (1), the governing board or the department shall give preference to a renewal application over an initial application.

History.--s. 6, part II, ch. 72-299.

373.236 Duration of permits; compliance reports.--

(1) Permits shall be granted for a period of 20 years, if requested for that period of time, if there is sufficient data to provide reasonable assurance that the conditions for permit issuance will be met for the duration of the permit; otherwise, permits may be issued for shorter durations which reflect the period for which such reasonable assurances can be provided. The governing board or the department may base the duration of permits on a reasonable system of classification according to source of supply or type of use, or both.

(2) The governing board or the department may authorize a permit of duration of up to 50 years in the case of a municipality or other governmental body or of a public works or public service corporation where such a period is required to provide for the retirement of bonds for the construction of waterworks and waste disposal facilities.

(3) Where necessary to maintain reasonable assurance that the conditions for issuance of a 20-year permit can continue to be met, the governing board or department, in addition to any conditions required pursuant to s. 373.219, may require a compliance report by the permittee every 5 years during the term of a permit. This report shall contain sufficient data to maintain reasonable assurance that the initial conditions for permit issuance are met. Following review of this report, the governing board or the department may modify the permit to ensure that the use meets the conditions for issuance. Permit modifications pursuant to this subsection shall not be subject to competing applications, provided there is no increase in the permitted allocation or permit duration, and no change in source, except for changes in source requested by the district. This subsection shall not be construed to limit the existing authority of the department or the governing board to modify or revoke a consumptive use permit.

History.--s. 7, part II, ch. 72-299; s. 13, ch. 97-160.

373.239 Modification and renewal of permit terms.--

(1) A permittee may seek modification of any terms of an unexpired permit.

(2) If the proposed modification involves water use of 100,000 gallons or more per day, the application shall be treated under the provisions of s. 373.229 in the same manner as the initial permit application. Otherwise, the governing board or the department may at its discretion approve the proposed modification without a hearing, provided the permittee establishes that:

(a) A change in conditions has resulted in the water allowed under the permit becoming inadequate for the permittee's need, or

(b) The proposed modification would result in a more efficient utilization of water than is possible under the existing permit.

(3) All permit renewal applications shall be treated under this part in the same manner as the initial permit application.

History.--s. 8, part II, ch. 72-299; s. 14, ch. 73-190.

373.243 Revocation of permits.—

The governing board or the department may revoke a permit as follows:

(1) For any material false statement in an application to continue, initiate, or modify a use, or for any material false statement in any report or statement of fact required of the user pursuant to the provisions of this chapter, the governing

board or the department may revoke the user's permit, in whole or in part, permanently.

(2) For willful violation of the conditions of the permit, the governing board or the department may permanently or temporarily revoke the permit, in whole or in part.

(3) For violation of any provision of this chapter, the governing board or the department may revoke the permit, in whole or in part, for a period not to exceed 1 year.

(4) For nonuse of the water supply allowed by the permit for a period of 2 years or more, the governing board or the department may revoke the permit permanently and in whole unless the user can prove that his or her nonuse was due to extreme hardship caused by factors beyond the user's control.

(5) The governing board or the department may revoke a permit, permanently and in whole, with the written consent of the permittee.

History.--s. 9, part II, ch. 72-299; s. 14, ch. 78-95; s. 600, ch. 95-148.

373.246 Declaration of Water Shortage or Emergency

(1) The governing board or the department by regulation shall formulate a plan for implementation during periods of water shortage. Copies of the water shortage plan shall be submitted to the Speaker of the House of Representatives and the President of the Senate no later than October 31, 1983. As a part of this plan the governing board or the department shall adopt a reasonable system of water-use classification according to source of water supply; method of extraction, withdrawal, or diversion; or use of water or a combination thereof. The plan may include provisions for variances and alternative measures to prevent undue hardship and ensure equitable distribution of water resources.

(2) The governing board or the department by order may declare that a water shortage exists for a source or sources within all or part of the district when insufficient water is or will be available to meet the present and anticipated requirements of the users or when conditions are such as to require temporary reduction in total use within the area to protect water resources from serious harm. Such orders will be final agency action.

(3) In accordance with the plan adopted under subsection (1), the governing board or the department may impose such restrictions on one or more classes of water uses as may be necessary to protect the water resources of the area from serious harm and to restore them to their previous condition.

(4) A declaration of water shortage and any measures adopted pursuant thereto may be rescinded by the governing board or the department.

(5) When a water shortage is declared, the governing board or the department shall cause notice thereof to be published in a prominent place within a newspaper of general circulation throughout the area. Publication of such notice will serve as notice to all users in the area of the condition of water shortage.

(6) The governing board or the department shall notify each permittee in the district by regular mail of any change in the condition of his or her permit or any suspension of his or her permit or of any other restriction on the permittee's use of water for the duration of the water shortage.

(7) If an emergency condition exists due to a water shortage within any area of the district, and if the department, or the executive director of the district with the concurrence of the governing board, finds that the exercise of powers under subsection (1) is not sufficient to protect the public health, safety, or welfare; the health of animals, fish, or aquatic life; a public water supply; or recreational, commercial, industrial, agricultural, or other reasonable uses, it or he or she may, pursuant to the provisions of s. 373.119, issue emergency orders reciting the existence of such an emergency and requiring that such action, including, but not limited to, apportioning, rotating, limiting, or prohibiting the use of the water resources of the district, be taken as the department or the executive director deems necessary to meet the emergency.

(8) An affected party to whom an emergency order is directed under subsection (7) shall comply immediately, but may challenge such an order in the manner set forth in s. 373.119.

History.--s. 10, part II, ch. 72-299; s. 14, ch. 78-95; s. 11, ch. 82-101; s. 10, ch. 84-341; s. 601, ch. 95-148.

373.250 Reuse of reclaimed water.--

(1) The encouragement and promotion of water conservation and reuse of reclaimed water, as defined by the department, are state objectives and considered to be in the public interest. The Legislature finds that the use of reclaimed water provided by domestic wastewater treatment plants permitted and operated under a reuse program approved by the department is environmentally acceptable and not a threat to public health and safety.

(2)

(a) For purposes of this section, “uncommitted” means the average amount of reclaimed water produced during the three lowest-flow months minus the amount of reclaimed water that a reclaimed water provider is contractually obligated to provide to a customer or user.

(b) Reclaimed water may be presumed available to a consumptive use permit applicant when a utility exists which provides reclaimed water, which has uncommitted reclaimed water capacity, and which has distribution facilities, which are initially provided by the utility at its cost, to the site of the affected applicant's proposed use.

(3) The water management district shall, in consultation with the department, adopt rules to implement this section. Such rules shall include, but not be limited to:

(a) Provisions to permit use of water from other sources in emergency situations or if reclaimed water becomes unavailable, for the duration of the emergency or the unavailability of reclaimed water. These provisions shall also specify the method for establishing the quantity of water to be set aside for use in emergencies or when reclaimed water becomes unavailable. The amount set aside is subject to periodic review and revision. The methodology shall take into account the risk that reclaimed water may not be available in the future, the risk that other sources may be fully allocated to other uses in the future, the nature of the uses served with reclaimed water, the extent to which the applicant intends to rely upon reclaimed water and the extent of economic harm which may result if other sources are not available to replace the reclaimed water. It is the intent of this paragraph to ensure that users of reclaimed water have the same access to ground or surface water and will otherwise be treated in the same manner as other users of the same class not relying on reclaimed water.

(b) A water management district shall not adopt any rule which gives preference to users within any class of use established under s. 373.246 who do not use reclaimed water over users within the same class who use reclaimed water.

(4) Nothing in this section shall impair a water management district's authority to plan for and regulate consumptive uses of water under this chapter.

(5) This section applies to new consumptive use permits and renewals of existing consumptive use permits.

(6) Each water management district shall submit to the Legislature, by June 1 of each year, an annual report which describes the district's progress in promoting the reuse of reclaimed water. The report shall include, but not be limited to:

(a) The number of permits issued during the year which required reuse of reclaimed water and, by categories, the percentages of reuse required.

(b) The number of permits issued during the year which did not require the reuse of reclaimed water and, of those permits, the number which reasonably could have required reuse.

(c) In the second and subsequent annual reports, a statistical comparison of reuse required through consumptive use permitting between the current and preceding years.

(d) A comparison of the volume of reclaimed water available in the district to the volume of reclaimed water required to be reused through consumptive use permits.

(e) A comparison of the volume of reuse of reclaimed water required in water resource caution areas through consumptive use permitting to the volume required in other areas in the district through consumptive use permitting.

(f) An explanation of the factors the district considered when determining how much, if any, reuse of reclaimed water to require through consumptive use permitting.

(g) A description of the district's efforts to work in cooperation with local government and private domestic wastewater treatment facilities to increase the reuse of reclaimed water. The districts, in consultation with the department, shall devise a uniform format for the report required by this subsection and for presenting the information provided in the report.

History.--s. 2, ch. 94-243; s. 35, ch. 97-160; s. 18, ch. 97-164.

Part V Finance and Taxation

373.536 District budget and hearing thereon.--

(1) The fiscal year of districts created under the provisions of this chapter shall extend from October 1 of one year through September 30 of the following year. The budget officer of the district shall, on or before July 15 of each year, submit for consideration by the governing board of the district a tentative budget for the district covering its proposed operation and requirements for the ensuing fiscal year. Unless alternative notice requirements are otherwise provided by law, notice of all budget hearings conducted by the governing board or district staff must be published in a newspaper of general circulation in each county in which the district lies not less than 5 days nor more than 15 days before the hearing. Budget workshops conducted for the public and not governed by s. 200.065 must be advertised in a newspaper of general circulation in the community or area in which the workshop will occur not less than 5 days nor more than 15 days before the workshop. The tentative budget shall be adopted in accordance with the provisions of s. 200.065; however, if the mailing of the notice of proposed property taxes is delayed beyond September 3 in any county in which the district lies, the district shall advertise its intention to adopt a tentative budget and millage rate, pursuant to s. 200.065(3)(g), in a newspaper of general paid circulation in that county. The budget shall set forth, classified by object and purpose, and by fund if so designated, the proposed expenditures of the district for bonds or other debt, for construction, for acquisition of land, for operation and maintenance of the district works, for the conduct of the affairs of the district generally, and for other purposes, to which may be added an amount to be held as a reserve. District administrative and operating expenses must be identified in the budget and allocated among district programs.

(2) The budget shall also show the estimated amount which will appear at the beginning of the fiscal year as obligated upon commitments made but uncompleted. There shall be shown the estimated unobligated or net balance which will be on hand at the beginning of the fiscal year, and the estimated amount to be raised by district taxes and from other sources for meeting the requirements of the district.

(3) As provided in s. 200.065(2)(d), the board shall publish one or more notices of its intention to finally adopt a budget for the district for the ensuing fiscal year. The notice shall appear adjacent to an advertisement which shall set forth the tentative budget in full. The notice and advertisement shall be published in one or more newspapers having a combined general circulation in the counties having land in the district. Districts may include explanatory phrases and

examples in budget advertisements published under s. 200.065 to clarify or illustrate the effect that the district budget may have on ad valorem taxes.

(4) The hearing to finally adopt a budget and millage rate shall be by and before the governing board of the district as provided in s. 200.065 and may be continued from day to day until terminated by the board. The final budget for the district will thereupon be the operating and fiscal guide for the district for the ensuing year; however, transfers of funds may be made within the budget by action of the governing board at a public meeting of the governing board. Should the district receive unanticipated funds after the adoption of the final budget, the final budget may be amended by including such funds, so long as notice of intention to amend is published one time in one or more newspapers qualified to accept legal advertisements having a combined general circulation in the counties in the district. The notice shall set forth the proposed amendment and shall be published at least 10 days prior to the public meeting of the board at which the proposed amendment is to be considered. However, in the event of a disaster or of an emergency arising to prevent or avert the same, the governing board shall not be limited by the budget but shall have authority to apply such funds as may be available therefor or as may be procured for such purpose.

(5)

(a) The Executive Office of the Governor is authorized to approve or disapprove, in whole or in part, the budget of each water management district and shall analyze each budget as to the adequacy of fiscal resources available to the district and the adequacy of district expenditures related to water supply, including water resource development projects identified in the district's regional water supply plans; water quality; flood protection and floodplain management; and natural systems. This analysis shall be based on the particular needs within each water management district in those four areas of responsibility.

(b) The Executive Office of the Governor and the water management districts shall develop a process to facilitate review and communication regarding water management district budgets, as necessary. Written disapproval of any provision in the tentative budget must be received by the district at least 5 business days prior to the final district budget adoption hearing conducted under s. 200.065(2)(d). If written disapproval of any portion of the budget is not received at least 5 business days prior to the final budget adoption hearing, the governing board may proceed with final adoption. Any provision rejected by the Governor shall not be included in a district's final budget.

(c)[1]Each water management district shall, by August 1 of each year, submit for review a tentative budget to the Governor, the President of the Senate, the Speaker of the House of Representatives, the chairs of all legislative committees and subcommittees with substantive or fiscal jurisdiction over water management districts, the secretary of the department, and the governing body of each county in which the district has jurisdiction or derives any funds for the operations of the district. The tentative budget must[2] include, but is not limited to, the following information for the preceding fiscal year and the current fiscal year, and the proposed amounts for the upcoming fiscal year, in a standard format prescribed by the Executive Office of the Governor which is generally consistent with the format prescribed by legislative budget instructions for state agencies and the format requirements of s. 216.031:

1. The millage rates and the percentage increase above the rolled-back rate, together with a summary of the reasons the increase is required, and the percentage increase in taxable value resulting from new construction;
2. The salary and benefits, expenses, operating capital outlay, number of authorized positions, and other personal services for the following program areas, including a separate section for lobbying, intergovernmental relations, and advertising:
   a. District management and administration;
   b. Implementation through outreach activities;
   c. Implementation through regulation;
   d. Implementation through acquisition, restoration, and public works;
   e. Implementation through operations and maintenance of lands and works;
   f. Water resources planning and monitoring; and
   g. A full description and accounting of expenditures for lobbying activities relating to local, regional, state, and federal governmental affairs, whether incurred by district staff or through contractual services and all expenditures for public relations, including all expenditures for public service announcements and advertising in any media.

In addition to the program areas reported by all water management districts, the South Florida Water Management District shall include in its budget document a separate section on all costs associated with the Everglades Construction Project.

3. The total amount in the district budget for each area of responsibility listed in paragraph (a) and for water resource development projects identified in the district's regional water supply plans.
4. A 5-year capital improvements plan.
5. A description of each new, expanded, reduced, or eliminated program.
6. A proposed 5-year water resource development work program, that describes the district's implementation strategy for the water resource development component of each approved regional water supply plan developed or revised pursuant to s. 373.0361. The work program shall address all the elements of the water resource development component in the district’s approved regional water supply plans. The office of the Governor, with the assistance of the department, shall review the proposed work program. The review shall include a written evaluation of its consistency with and furtherance of the district’s approved regional water supply plans, and adequacy of proposed expenditures. As part of

the review, the Executive Office of the Governor and the department shall afford to all interested parties the opportunity to provide written comments on each district's proposed work program. At least 7 days prior to the adoption of its final budget, the governing board shall state in writing to the Executive Office of the Governor which changes recommended in the evaluation it will incorporate into its work program, or specify the reasons for not incorporating the changes. The office of the Governor shall include the district's responses in the written evaluation and shall submit a copy of the evaluation to the Legislature; and

7. The funding sources, including, but not limited to, ad valorem taxes, Surface Water Improvement and Management Program funds, other state funds, federal funds, and user fees and permit fees for each program area.

(d) By September 5 of the year in which the budget is submitted, the House and Senate appropriations chairs may transmit to each district comments and objections to the proposed budgets. Each district governing board shall include a response to such comments and objections in the record of the governing board meeting where final adoption of the budget takes place, and the record of this meeting shall be transmitted to the Executive Office of the Governor, the department, and the chairs of the House and Senate appropriations committees.

(e) The Executive Office of the Governor shall annually, on or before December 15, file with the Legislature a report that summarizes the expenditures of the water management districts by program area and identifies the districts that are not in compliance with the reporting requirements of this section. State funds shall be withheld from a water management district that fails to comply with these reporting requirements.

History.--s. 28, ch. 25209, 1949; s. 3, ch. 29790, 1955; s. 4, ch. 61-497; s. 1, ch. 65-432; s. 1, ch. 67-74; s. 25, ch. 73-190; s. 18, ch. 74-234; s. 46, ch. 80-274; s. 230, ch. 81-259; s. 3, ch. 84-164; s. 2, ch. 86-190; s. 9, ch. 91-288; s. 24, ch. 93-213; s. 276, ch. 94-356; s. 1012, ch. 95-148; s. 5, ch. 96-339; s. 16, ch. 97-160.

[1]Note.--Section 16, ch. 97-160, purported to amend paragraph (c) of subsection (5), but did not set out in full the amended paragraph to include subparagraph 4. Absent affirmative evidence that the Legislature intended to repeal the omitted material, it is set out here pending clarification by the Legislature.

[2]Note.--The word "which" preceding the word "must" was deleted by the editors to improve clarity.

Note.--Former s. 378.28.

373.59 Water Management Lands Trust Fund.--

(1) There is established within the Department of Environmental Protection the Water Management Lands Trust Fund to be used as a nonlapsing fund for the purposes of this section. The moneys in this fund are hereby continually

appropriated for the purposes of land acquisition, management, maintenance, capital improvements, payments in lieu of taxes, and administration of the fund in accordance with the provisions of this section.

(2)

(a) By January 15 of each year, each district shall file with the Legislature and the Secretary of Environmental Protection a report of acquisition activity together with modifications or additions to its 5-year plan of acquisition. Included in the report shall be an identification of those lands which require a full fee simple interest to achieve water management goals and those lands which can be acquired using alternatives to fee simple acquisition techniques and still achieve such goals. In their evaluation of which lands would be appropriate for acquisition through alternatives to fee simple, district staff shall consider criteria including, but not limited to, acquisition costs, the net present value of future land management costs, the net present value of ad valorem revenue loss to the local government, and the potential for revenue generated from activities compatible with acquisition objectives. The report shall also include a description of land management activity. Expenditure of moneys from the Water Management Lands Trust Fund shall be limited to the costs for acquisition, management, maintenance, and capital improvements of lands included within the 5-year plan as filed by each district and to the department's costs of administration of the fund. The department's costs of administration shall be charged proportionally against each district's allocation using the formula provided in subsection (7)[1]. However, no acquisition of lands shall occur without a public hearing similar to those held pursuant to the provisions set forth in s. 120.54. In the annual update of its 5-year plan for acquisition, each district shall identify lands needed to protect or recharge ground water and shall establish a plan for their acquisition as necessary to protect potable water supplies. Lands which serve to protect or recharge ground water identified pursuant to this paragraph shall also serve to protect other valuable natural resources or provide space for natural resource based recreation.

(b) Moneys from the fund shall be used for continued acquisition, management, maintenance, and capital improvements of the following lands and lands set forth in the 5-year land acquisition plan of the district:

1. By South Florida Water Management District -- lands in the water conservation areas and areas adversely affected by raising water levels of Lake Okeechobee in accordance with present regulation schedules, and the Savannahs Wetland area in Martin County and St. Lucie County.
2. Each district shall remove the property of an unwilling seller from its plan of acquisition at the next scheduled update of the plan, if in receipt of a request to do so by the property owner.

(4)

(a). Moneys from the Water Management Lands Trust Fund shall be used for acquiring the fee or other interest in lands necessary for water management, water supply, and the conservation and protection of water resources, except that such moneys shall not be used for the acquisition of rights-of-way for canals or pipelines. Such moneys shall also be used for management, maintenance, and capital improvements. Interests in real property acquired by the districts under this section may be used for permittable water resource development and water supply development purposes under the following conditions: the minimum flows and levels of priority water bodies on such lands have been established; the project complies with all conditions for issuance of a permit under part II of this chapter; and the project is compatible with the purposes for which the land was acquired. Lands acquired with moneys from the fund shall be managed and maintained in an environmentally acceptable manner and, to the extent practicable, in such a way as to restore and protect their natural state and condition.

(b). The Secretary of Environmental Protection shall release moneys from the Water Management Lands Trust Fund to a district for preacquisition costs within 30 days after receipt of a resolution adopted by the district's governing board which identifies and justifies any such preacquisition costs necessary for the purchase of any lands listed in the district's 5-year plan. The district shall return to the department any funds not used for the purposes stated in the resolution, and the department shall deposit the unused funds into the Water Management Lands Trust Fund.

(c). The Secretary of Environmental Protection shall release acquisition moneys from the Water Management Lands Trust Fund to a district following receipt of a resolution adopted by the governing board identifying the lands being acquired and certifying that such acquisition is consistent with the plan of acquisition and other provisions of this act. The governing board shall also provide to the Secretary of Environmental Protection a copy of all certified appraisals used to determine the value of the land to be purchased. Each parcel to be acquired must have at least one appraisal. Two appraisals are required when the estimated value of the parcel exceeds $500,000. However, when both appraisals exceed $500,000 and differ significantly, a third appraisal may be obtained. If the purchase price is greater than the appraisal price, the governing board shall submit written justification for the increased price. The Secretary of Environmental Protection may withhold moneys for any purchase that is not consistent with the 5-year plan or the intent of this act or that is in excess of appraised value. The governing board may appeal any denial to the Land and Water Adjudicatory Commission pursuant to s. 373.114.

(d). The Secretary of Environmental Protection shall release to the districts moneys for management, maintenance, and capital improvements following receipt of a resolution and request adopted by the governing board which specifies the designated managing agency, specific management activities, public use, estimated annual operating costs, and other acceptable documentation to justify release of moneys.

(5) Water management land acquisition costs shall include payments to owners and costs and fees associated with such acquisition.

(6) If a district issues revenue bonds or notes under s. 373.584, the district may pledge its share of the moneys in the Water Management Lands Trust Fund as security for such bonds or notes. The Department of Environmental Protection shall pay moneys from the trust fund to a district or its designee sufficient to pay the debt service, as it becomes due, on the outstanding bonds and notes of the district; however, such payments shall not exceed the district's cumulative portion of the trust fund. However, any moneys remaining after payment of the amount due on the debt service shall be released to the district pursuant to subsection (3)[2].

(7) Any unused portion of a district's share of the fund shall accumulate in the trust fund to the credit of that district. Interest earned on such portion shall also accumulate to the credit of that district to be used for land acquisition, management, maintenance, and capital improvements as provided in this section. The total moneys over the life of the fund available to any district under this section shall not be reduced except by resolution of the district governing board stating that the need for the moneys no longer exists.

(8) Moneys from the Water Management Lands Trust Fund shall be allocated to the five water management districts in the following percentages:

(a) Thirty percent to the South Florida Water Management District.

(b) Twenty-five percent to the Southwest Florida Water Management District.

(c) Twenty-five percent to the St. Johns River Water Management District.

(d) Ten percent to the Suwannee River Water Management District.

(e) Ten percent to the Northwest Florida Water Management District.

(9) Each district may use its allocation under subsection (8) for management, maintenance, and capital improvements. Capital improvements shall include, but need not be limited to, perimeter fencing, signs, fire lanes, control of invasive exotic species, controlled burning, habitat inventory and restoration, law enforcement, access roads and trails, and minimal public accommodations, such as primitive campsites, garbage receptacles, and toilets.

(10) Moneys in the fund not needed to meet current obligations incurred under this section shall be transferred to the State Board of Administration, to the credit of the fund, to be invested in the manner provided by law. Interest received on such investments shall be credited to the fund.

(11) Lands acquired for the purposes enumerated in this section shall also be used for general public recreational purposes. General public recreational purposes shall include, but not be limited to, fishing, hunting, horseback riding, swimming, camping, hiking, canoeing, boating, diving, birding, sailing, jogging, and other related outdoor activities to the maximum extent possible considering the environmental sensitivity and suitability of those lands. These public lands shall be evaluated for their resource value for the purpose of establishing which parcels, in whole or in part, annually or seasonally, would be conducive to general public recreational purposes. Such findings shall be included in management plans which are developed for such public lands. These lands shall

be made available to the public for these purposes, unless the district governing board can demonstrate that such activities would be incompatible with the purposes for which these lands were acquired. For any fee simple acquisition of a parcel which is or will be leased back for agricultural purposes, or for any acquisition of a less-than-fee interest in land that is or will be used for agricultural purposes, the district governing board shall first consider having a soil and water conservation district created pursuant to chapter 582 manage and monitor such interest.

(12) A district may dispose of land acquired under this section, pursuant to s. 373.056 or s. 373.089. However, revenue derived from such disposal may not be used for any purpose except the purchase of other lands meeting the criteria specified in this section or payment of debt service on revenue bonds or notes issued under s. 373.584, as provided in this section.

(13) No moneys generated pursuant to this act may be applied or expended subsequent to July 1, 1985, to reimburse any district for prior expenditures for land acquisition from ad valorem taxes or other funds other than its share of the funds provided herein or to refund or refinance outstanding debt payable solely from ad valorem taxes or other funds other than its share of the funds provided herein.

(14)

(a) Beginning in fiscal year 1992-1993, not more than one-fourth of the land management funds provided for in subsections (1) and (9) in any year shall be reserved annually by a governing board, during the development of its annual operating budget, for payment in lieu of taxes to qualifying counties for actual ad valorem tax losses incurred as a result of lands purchased with funds allocated pursuant to s. 259.101(3)(b). In addition, the Northwest Florida Water Management District, the South Florida Water Management District, the Southwest Florida Water Management District, the St. Johns River Water Management District, and the Suwannee River Water Management District shall pay to qualifying counties payments in lieu of taxes for district lands acquired with funds allocated pursuant to subsection (8). Reserved funds that are not used for payment in lieu of taxes in any year shall revert to the fund to be used for management purposes or land acquisition in accordance with this section.

(b) Payment in lieu of taxes shall be available to counties for each year in which the levy of ad valorem tax is at least 8.25 mills or the amount of the tax loss from all completed Preservation 2000 acquisitions in the county exceeds 0.01 percent of the county’s total taxable value, and the population is 75,000 or less and to counties with a population of less than 100,000 which contain all or a portion of an area of critical state concern designated pursuant to chapter 380.

(c) If insufficient funds are available in any year to make full payments to all qualifying counties, such counties shall receive a pro rata share of the moneys available.

(d) The payment amount shall be based on the average amount of actual taxes paid on the property for the 3 years immediately preceding acquisition. For lands purchased prior to July 1, 1992, applications for payment in lieu of taxes shall be made to the districts by January 1, 1993. For lands purchased after July 1, 1992, applications for payment in lieu of taxes shall be made no later than January 31 of the year following acquisition. No payment in lieu of taxes shall be made for properties which were exempt from ad valorem taxation for the year immediately preceding acquisition. Payment in lieu of taxes shall be limited to a period of 10 consecutive years of annual payments.

(e) Payment in lieu of taxes shall be made within 30 days after: certification by the Department of Revenue that the amounts applied for are appropriate, certification by the Department of Environmental Protection that funds are available, and completion of any fund transfers to the district. The governing board may reduce the amount of a payment in lieu of taxes to any county by the amount of other payments, grants, or in-kind services provided to that county by the district during the year. The amount of any reduction in payments shall remain in the Water Management Lands Trust Fund for purposes provided by law.

(f) If a district governing board conveys to a local government title to any land owned by the board, any payments in lieu of taxes on the land made to the local government shall be discontinued as of the date of the conveyance.

(15) Each district is encouraged to use volunteers to provide land management and other services. Volunteers shall be covered by liability protection and workers' compensation in the same manner as district employees, unless waived in writing by such volunteers or unless such volunteers otherwise provide equivalent insurance.

(16) Each water management district is authorized and encouraged to enter into cooperative land management agreements with state agencies or local governments to provide for the coordinated and cost-effective management of lands to which the water management districts, the Board of Trustees of the Internal Improvement Trust Fund, or local governments hold title. Any such cooperative land management agreement must be consistent with any applicable laws governing land use, management duties, and responsibilities and procedures of each cooperating entity. Each cooperating entity is authorized to expend such funds as are made available to it for land management on any such lands included in a cooperative land management agreement.

History.—ss. 3, 5, ch. 81-33; s. 36, ch. 83-218; s. 5, ch. 85-347; s. 4, ch. 86-22; s. 8, ch. 86-294; s. 13, ch. 90-217; s. 11, ch. 91-288; s. 13, ch. 92-288; s. 277, ch. 94-356; s. 1, ch. 95-311; s. 6, ch. 95-349; s. 21, ch. 95-430; s. 17, ch. 96-389; s. 25, ch. 97-94; s. 17, ch. 97-160; s. 14, ch. 97-164.

[1]Note.—Redesignated as subsection (8) by s. 17, ch. 96-389.

[2]Note.—Redesignated as subsection (4) by s. 17, ch. 96-389.

Part VI Miscellaneous Provisions

373.619 Recognition of Water and Sewer-Saving Devices

The Legislature urges all public-owned or investor-owned water and sewerage systems to reduce connection fees and regular service charges for customers who utilize water or sewer-saving devices, including, but not limited to, individual graywater disposal systems.

History.--s. 2, ch. 82-10..--

373.62 Water conservation; automatic sprinkler systems.--

Any person who purchases and installs an automatic lawn sprinkler system after May 1, 1991, shall install a rain sensor device or switch which will override the irrigation cycle of the sprinkler system when adequate rainfall has occurred.

History.--s. 7, ch. 91-41; s. 7, ch. 91-68.

SELECTED PASSAGES FROM CHAPTER 62-40, F.A.C.

Part I General Water Policy Part I General Water

62-40.110 Declaration and Intent

(1) The waters of the state are among its basic resources. Such waters should be managed to conserve and protect natural resources and scenic beauty and to realize the full beneficial use of the resource. Recognizing the importance of water to the state, the Legislature passed the Water Resources Act, Chapter 373, Florida Statutes, and the Air and Water Pollution Control Act, Chapter 403, Florida Statutes. Additionally, numerous goals and policies within the State Comprehensive Plan, Chapter 187, Florida Statutes, address water resources and natural systems protection.

(2) This Chapter is intended to provide water policy goals, objectives, and guidance for the development and review of programs, rules, and plans relating to water resources, as expressed in Chapters 187, 373, and 403, Florida Statutes.

(3) These policies shall be construed as a whole and no individual policy shall be construed or applied in isolation from other policies. All constructions of this Chapter shall give meaning to all parts of the rule when possible.

(4) Notwithstanding the incorporation of other Department rules in Rule 62-40.120, F.A.C., this Chapter shall not constitute standards or criteria for decisions on individual permits.

(5) A goal of this Chapter is to coordinate the management of water and related land resources. Local governments shall consider state water policy in the development of their comprehensive plans as required by Chapter 163, Florida Statutes, and as required by Section 403.0891(3)(a), F.S. Special districts which manage water shall consider state water policy in the development of their plans and programs. The Legislature has also expressed its intent, in Section 373.0395, F.S., that future growth and development planning reflect the limitations of available ground water and other water supplies.

(6) It is an objective of the State to protect the functions of entire ecological systems, as developed and defined in the programs, rules, and plans of the Department and water management districts.

(7) Government services should be provided efficiently. Inefficiency resulting from duplication of permitting shall be eliminated where appropriate, including water quality and water quantity permitting functions.

(8) Public education, awareness, and participation shall be encouraged. The Department and Districts should assist educational institutions in the development of educational curricula and research programs which meet Florida's present and future water management needs.

(9) This Chapter does not repeal, amend or otherwise alter any rule now existing or later adopted by the Department or Districts. However, procedures are included

in this Chapter which provide for the review of Department and District plans, programs, and rules to assure consistency with the provisions of this Chapter. The procedure for modification of District rules as requested by the Department shall be as prescribed in Section 373.114, F.S. and applicable provisions of this Chapter.

(10) It is the intent of the Department, in cooperation with the Water Management Districts, to seek adequate sources of funding to supplement District ad valorem taxes to implement the provisions of this Chapter.

62-40.120 Department Rules

State water policy shall also include the following Department rules:

(1) Water Quality Standards, Chapter 62-3, F.A.C.

(2) Surface Water Quality Standards, Chapter 62-302, F.A.C.

(3) Surface Water Improvement and Management, Chapter 62-43, F.A.C.

(4) Ground Water Classes, Standards, and Exemptions, Chapter 62-520, F.A.C.

(5) Drinking Water Standards, Monitoring, and Reporting, Chapter 62-550, F.A.C.

Part II Definitions

62-40.210 Definitions

When used in this Chapter and in the review of rules of the Districts pursuant to Section 373.114(2), F.S., unless the context or content of such District rule requires a narrower, more specific meaning, the following words shall mean:

(1) “Aquifer” shall mean a geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield useful quantities of ground water to wells, springs or surface water.

(2) “Consumptive use” means any use of water which reduces the supply from which it is withdrawn or diverted.

(3) “Department” means the Department of Environmental Protection.

(4) “Detention” means the delay of stormwater runoff prior to its discharge.

(5) “District” means a Water Management District created pursuant to Chapter 373, Florida Statutes.

(6) “District Water Management Plan” means the long-range comprehensive water resource management plan prepared by a District.

(7) “Drainage basin” means a subdivision of a watershed.

(8) "Effluent", unless specifically stated otherwise, means water that is not reused after flowing out of any wastewater treatment facility or other works used for the purpose of treating, stabilizing, or holding wastes.

(9) "Floodplain" means land area subject to inundation by flood waters from a river, watercourse, lake, or coastal waters. Floodplains are delineated according to their estimated frequency of flooding.

(10) "Florida Water Plan" means the State Water Use Plan, together with the water quality standards and water classifications adopted by the Department.

(11) "Governing Board" means the governing board of a water management district.

(12) "Ground water" means water beneath the surface of the ground, whether or not flowing through known and definite channels.

(13) "Ground water availability" means the potential quantity of ground water which can be withdrawn without resulting in significant harm to the water resources or associated natural systems.

(14) "Ground water basin" means a ground water flow system that has defined boundaries and may include permeable materials that are capable of storing or furnishing a significant water supply. The basin includes both the surface area and the permeable materials beneath it.

(15) "High recharge areas" means areas contributing significant volumes of water which add to the storage and flow of an aquifer through vertical movement from the land surface. The term significant will vary geographically depending on the hydrologic characteristics of that aquifer.

(16) "Natural systems" for the purpose of this rule means an ecological system supporting aquatic and wetland-dependent natural resources, including fish and aquatic and wetland-dependent wildlife habitat.

(17) "Nutrient limitations" means those numeric values which establish a maximum or minimum allowable nutrient loading or concentration, as appropriate, for a specific nutrient. Nutrient limitations are established through an individual permit or other action within the regulatory authority of the Department or a District. These limitations serve to implement state water quality standards.

(18) "Pollutant load reduction goal" means estimated numeric reductions in pollutant loadings needed to preserve or restore designated uses of receiving bodies of water and maintain water quality consistent with applicable state water quality standards.

(19) "Prime recharge areas" means areas that are generally within high recharge areas and are significant to present and future ground water uses including protection and maintenance of natural systems and water supply.

(20) "Reasonable-beneficial use" means the use of water in such quantity as is necessary for economic and efficient utilization for a purpose and in a manner which is both reasonable and consistent with the public interest.

(21) "Reclaimed water" means water that has received at least secondary treatment and is reused after flowing out of a domestic wastewater treatment facility.

(22) "Retention" means the prevention of stormwater runoff from direct discharge.

(23) "Reuse" means the deliberate application of reclaimed water, in compliance with Department and District rules, for a beneficial purpose.

(a) For example, said uses may encompass:

1. Landscape irrigation (such as irrigation of golf courses, cemeteries, highway medians, parks, playgrounds, school yards, retail nurseries, and residential properties);
2. Agricultural irrigation (such as irrigation of food, fiber, fodder and seed crops, wholesale nurseries, sod farms, and pastures);
3. Aesthetic uses (such as decorative ponds and fountains);
4. Ground water recharge (such as slow rate, rapid-rate, and absorption field land application systems) but not including disposal methods described in Rule 62-40.210(23)(b), F.A.C.;
5. Industrial uses (such as cooling water, process water, and wash waters);
6. Environmental enhancement of surface waters resulting from discharge of reclaimed water having received at least advanced wastewater treatment or from discharge of reclaimed water for wetlands restoration;
7. Fire protection; or
8. Other useful purpose.

(b) Overland flow land application systems, rapid-rate land application systems providing continuous loading to a single percolation cell, other land application systems involving less than secondary treatment prior to application, septic tanks, and ground water disposal systems using Class I wells injecting effluent or wastes into Class G-IV waters shall be excluded from the definition of reuse.

(24) "Secretary" means the Secretary of the Department of Environmental Protection.

(25) "State water quality standards" means water quality standards adopted by the Environmental Regulations Commission pursuant to Chapter 403, Florida Statutes, including standards composed of designated most beneficial uses (classification of waters), the numerical and narrative criteria applied to the specific water use or classification, the Florida anti-degradation policy, and the moderating provisions contained in Rules 62-3, 62-4, 62-302, 62-520, and 62-550, F.A.C.

(26) "State Water Use Plan" means the plan formulated pursuant to Section 373.036, Florida Statutes, for the use and development of waters of the State.

(27) "Stormwater" means the water which results from a rainfall event.

(28) "Stormwater management program" means the institutional strategy for stormwater management, including urban, agricultural, and other stormwater.

(29) "Stormwater management system" means a system which is designed and constructed or implemented to control stormwater, incorporating methods to collect, convey, store, absorb, inhibit, treat, use, or reuse stormwater to prevent

or reduce flooding, over-drainage, environmental degradation and water pollution or otherwise affect the quantity and quality of discharges from the system.

(30) "Stormwater utility" means the entity through which funding for a stormwater management program is obtained by assessing the cost of the program to the beneficiaries based on their relative contribution to its need. It is operated as a typical utility which bills services regularly, similar to water and wastewater services.

(31) "Surface water" means water upon the surface of the earth, whether contained in bounds created naturally or artificially or diffused. Water from natural springs shall be classified as surface water when it exits from the spring onto the earth's surface.

(32) "Surface water availability" means the potential quantity of surface water that can be removed or retained without significant harm to the water resources or associated natural systems.

(33) "Water resource caution area" means a geographic area identified by a water management district as having existing water resource problems or an area in which water resource problems are projected to develop during the next twenty years. A critical water supply problem area, as described in Section 403.064, F.S., is an example of a water resource caution area.

(34) "Water" or "waters in the state" means any and all water on or beneath the surface of the ground or in the atmosphere, including natural or artificial watercourses, lakes, ponds, or diffused surface water and water percolating, standing, or flowing beneath the surface of the ground, as well as all coastal waters within the jurisdiction of the state.

(35) "Watershed" means the land area which contributes to the flow of water into a receiving body of water.

(36) "Watershed management goal" means an overall goal for the management of water resources within a watershed.

(37) "Wetlands" means those areas that are inundated or saturated by surface or ground water with a frequency sufficient to support, and under normal circumstances do or would support, a prevalence of vegetative or aquatic life that requires saturated or seasonably saturated soil conditions for growth and reproduction, such as swamps, marshes, bayheads, cypress ponds, sloughs, wet prairies, wet meadows, river overflows, mud flats and natural ponds. This definition does not alter the Department's jurisdiction over dredging and filling activities in wetlands as defined in Section 403.911(7), F.S.

Part III General Provisions

62-40.310 General Policies

The following statement of general water policy shall guide Department review of water management programs, rules, and plans. Water management programs, rules and plans, where economically and environmentally feasible, not contrary to the public interest, and consistent with Florida law, shall seek to:

(1) Water Supply

(a) Assure availability of an adequate and affordable supply of water for all reasonable-beneficial uses. Uses of water authorized by a permit shall be limited to reasonable-beneficial uses.

(b) Reserve from use that water necessary to support essential non-withdrawal demands, including navigation, recreation, and the protection of fish and wildlife.

(c) Champion and develop sound water conservation practices and public information programs.

(d) Advocate and direct the reuse of reclaimed water as an integral part of water and wastewater management programs, rules, and plans consistent with protection of the public health and surface and ground water quality.

(e) Encourage the use of water of the lowest acceptable quality for the purpose intended.

(f) Encourage the development of local and regional surface and ground water supplies within districts rather than transfer water across District boundaries.

(g) Encourage demand management and the development of alternative water supplies, including water conservation, reuse of reclaimed water, desalination, stormwater and industrial wastewater reuse, recharge, and aquifer storage and recovery.

(h) Protect aquifers from depletion through water conservation and preservation of the functions of high recharge areas.

(2) Water Quality Protection and Management

(a) Restore and protect the quality of ground and surface water by solving current problems and ensuring high quality treatment for stormwater and wastewater.

(b) Identify existing and future public water supply areas and protect them from contamination.

(3) Flood Protection and Floodplain Protection

(a) Encourage nonstructural solutions to water resource problems and give adequate consideration to nonstructural alternatives whenever structural works are proposed.

(b) Manage the construction and operation of facilities which dam, divert, or otherwise alter the flow of surface waters to minimize damage from flooding, soil erosion or excessive drainage.

(c) Encourage the management of floodplains and other flood hazard areas to prevent or reduce flood damage, consistent with establishment and maintenance of desirable hydrologic characteristics and associated natural systems.

(d) Encourage the development and implementation of a strict floodplain management program by state, regional, and local governments designed to preserve floodplain functions and associated natural systems.

(e) Avoid the expenditure of public funds that encourage or subsidize incompatible new development or significant expansion of existing development in high-hazard flood areas.

(f) Minimize flood-related emergencies, human disasters, loss of property, and other associated impacts.

(4) Natural Systems Protection and Management

(a) Establish minimum flows and levels to protect water resources and the environmental values associated with marine, estuarine, freshwater, and wetlands ecology.

(b) Mitigate adverse impacts resulting from prior alteration of natural hydrologic patterns and fluctuations in surface and ground water levels.

(c) Utilize, preserve, restore, and enhance natural water management systems and discourage the channelization or other alteration of natural rivers, streams and lakes.

(5) Management Policies

(a) Protect the water storage and water quality enhancement functions of wetlands, floodplains, and aquifer recharge areas through acquisition, enforcement of laws, and the application of land and water management practices which provide for compatible uses.

(b) Emphasize the prevention of pollution and other water resource problems.

(c) Develop interstate agreements and undertake cooperative programs with Alabama and Georgia to provide for coordinated management of surface and ground waters.

Part IV Resource Protection and Management

62-40.410 Water Supply Protection and Management

The following shall apply to those areas where the use of water is regulated pursuant to Part II of Chapter 373, Florida Statutes:

(1) No permit shall be granted to authorize the use of water unless the applicant establishes that the proposed use is a reasonable-beneficial use, will not interfere

with presently existing legal uses of water and is consistent with the public interest.

(2) In determining whether a water use is a reasonable-beneficial use, the following factors will be considered:

(a) The quantity of water requested for the use;

(b) The demonstrated need for the use;

(c) The suitability of the use to the source of water;

(d) The purpose and value of the use;

(e) The extent and amount of harm caused;

(f) The practicality of mitigating any harm by adjusting the quantity or method of use;

(g) Whether the impact of the withdrawal extends to land not owned or legally controlled by the user;

(h) The method and efficiency of use;

(i) Water conservation measures taken or available to be taken;

(j) The feasibility of alternative sources such as reclaimed water, stormwater, brackish water and salt water;

(k) The present and projected demand for the source of water;

(l) The long term yield available from the source of water;

(m) The extent of water quality degradation caused;

(n) Whether the proposed use would cause or contribute to flood damage;

(o) Whether the proposed use would significantly induce saltwater intrusion;

(p) The amount of water which can be withdrawn without causing harm to the resource;

(q) Whether the proposed use would adversely affect public health; and

(r) Whether the proposed use would significantly affect natural systems.

(3) Water may be reserved from permit use in such locations and quantities, and for such seasons of the year, as is required for the protection of fish and wildlife or the public health or safety. Such reservations shall be subject to periodic review and revision in light of changed conditions. However, all presently existing legal users of water shall be protected so long as such use is not contrary to the public interest.

(4) Water use shall not be allowed to exceed ground water availability or surface water availability. If either is exceeded, the Districts shall expeditiously implement a remedial program. The remedial program shall consider options such as designation of a water resource caution area, declaration of a water shortage, development of water resource projects, regulation of consumptive water users, or other options consistent with this chapter and Chapter 373, F.S.

(5) In implementing consumptive use permitting programs, the Department and the Districts shall recognize the rights of property owners, as limited by law, to make consumptive uses of water from their land, and the rights of other users, as

limited by law, to make consumptive uses of water, for reasonable-beneficial uses in a manner consistent with the public interest that will not interfere with any presently existing legal use of water.

(6) Permits authorizing consumptive uses of water which cause unanticipated significant adverse impacts on off-site land uses existing at the time of permit application, or on legal uses of water existing at the time of permit application, should be considered for modification, to curtail or abate the adverse impacts, unless the impacts can be mitigated by the permittee.

(7) The Districts shall determine whether Section 373.233, F.S., entitled “Competing Applications”, and implementing rules, are applicable to pending applications.

(8) Any reallocation of an existing permitted quantity of water shall be reviewed by the District and shall be subject to full compliance with the applicable permitting criteria of the District.

62-40.412 Water Conservation

The overall water conservation goal of the state shall be to prevent and reduce wasteful, uneconomical, impractical, or unreasonable use of water resources. Conservation of water shall be required unless not economically or environmentally feasible. The Districts shall accomplish this goal by:

(1) Assisting local and regional governments and other parties in formulating plans and programs to conserve water to meet their long-term needs, including incentives such as longer term or more flexible permits, economic incentives, and greater certainty of supply during water shortages;

(2) Establishing efficiency standards for urban, industrial, and agricultural demand management which may include the following:

(a) Restrictions against inefficient irrigation practices;

(b) If a District imposes year-round restrictions, which may include variances or exemptions, on particular irrigation activities or irrigation sources, using a uniform time period of 10:00 a.m. to 4:00 p.m.;

(c) Minimizing unaccounted for water losses;

(d) Promoting water conserving rate structures;

(e) Water conserving plumbing fixtures, xeriscape, and rain sensors.

(3) Maintaining public information and education programs for long- and short-term water conservation goals;

(4) Executing provisions to implement the above criteria and to consistently apply water shortage restrictions between those Districts whose boundaries contain political jurisdictions located in more than one District.

62-40.416 Water Reuse

(1) As required by Section 373.0391(2)(e), F.S., the Districts shall designate areas that have water supply problems which have become critical or are anticipated to

become critical within the next 20 years. The Districts shall identify such water resource caution areas during preparation of a District Plan pursuant to Rule 62-40.520, F.A.C., and shall adopt and amend these designations by rule.

(2) In implementing consumptive use permitting programs, a reasonable amount of reuse of reclaimed water shall be required within designated water resource caution areas, unless objective evidence demonstrates that such reuse is not economically, environmentally, or technically feasible.

(3) The Districts shall periodically update their designations of water resource caution areas by rule. Such updates shall occur within one year after updates of the District Plan prepared pursuant to Rule 62-40.520, F.A.C. After completion of the District Plan or updates pursuant to Rule 62-40.520, F.A.C., the Districts may limit areas where reuse shall be required to areas where reuse is specified as a remedial or preventive action pursuant to Rule 62-40.520, F.A.C. Any such limitation of areas where reuse shall be required shall be designated by rule.

(4) In implementing consumptive use permitting programs, a reasonable amount of reuse of reclaimed water from domestic wastewater treatment facilities may be required outside of areas designated pursuant to Rule 62-40.416(1), F.A.C., as subject to water supply problems, provided:

(a) Reclaimed water is readily available;

(b) Objective evidence demonstrates that such reuse is economically, environmentally, and technically feasible; and

(c) The District has adopted rules for reuse in these areas.

(5) The Department encourages local governments to implement programs for reuse of reclaimed water. The Districts are encouraged to establish incentives for local governments and other interested parties to implement programs for reuse of reclaimed water. These rules shall not be deemed to preempt any such local reuse programs.

62-40.422 Interdistrict Transfer

The following shall apply to the transfers of surface and ground water where such transfers are regulated pursuant to Part II of Chapter 373, Florida Statutes:

(1) The transfer or use of surface water across District boundaries shall require approval of each involved District. The transfer or use of ground water across District boundaries shall require approval of the District where the withdrawal of ground water occurs.

(2) In deciding whether the transfer and use of surface water across District boundaries is consistent with the public interest pursuant to Section 373.223, Florida Statutes, the Districts should consider the extent to which:

(a) Comprehensive water conservation and reuse programs are implemented and enforced in the area of need;

(b) The major costs, benefits, and environmental impacts have been adequately determined including the impact on both the supplying and receiving areas;

(c) The transfer is an environmentally and economically acceptable method to supply water for the given purpose;

(d) The present and projected water needs of the supplying area are reasonably determined and can be satisfied even if the transfer takes place;

(e) The transfer plan incorporates a regional approach to water supply and distribution including, where appropriate, plans for eventual interconnection of water supply sources; and

(f) The transfer is otherwise consistent with the public interest based upon evidence presented.

(3) The interdistrict transfer and use of ground water must meet the requirements of Section 373.2295, Florida Statutes.

62-40.430 Water Quality

(1) Water quality standards shall be enforced pursuant to Chapter 403, Florida Statutes, to protect waters of the State from point and non-point sources of pollution.

(2) State water quality standards adopted by Department rule shall be a part of the Florida Water Plan.

62-40.432 Surface Water Protection and Management

(1) Surface Water Protection and Management Goals.

The following goals are established to provide guidance for Department, District and local government storm water management programs:

(a) It shall be a goal of surface water management programs to protect, preserve and restore the quality, quantity and environmental values of water resources. A goal of surface water management programs includes effective storm water management for existing and new systems which shall seek to protect, maintain and restore the functions of natural systems and the beneficial uses of waters.

(b) The primary goals of the state’s storm water management program are to maintain, to the maximum extent practicable, during and after construction and development, the pre-development storm water characteristics of a site; to reduce stream channel erosion, pollution, siltation, sedimentation and flooding; to reduce storm water pollutant loadings discharged to waters to preserve or restore beneficial uses; to reduce the loss of fresh water resources by encouraging the reuse of storm water; to enhance ground water recharge by promoting infiltration of storm water in areas with appropriate soils and geology; to maintain the appropriate salinity regimes in estuaries needed to support the natural flora and fauna; and to address storm water management on a watershed basis to provide cost effective water quality and water quantity solutions to specific watershed problems.

(c) Inadequate management of storm water throughout a watershed increases storm water flows and velocities, contributes to erosion and sedimentation, overtaxes the carrying capacity of streams and other conveyances, disrupts the functions of natural systems, undermines floodplain management and flood control efforts in downstream communities, reduces ground water recharge, threatens public health and safety, and is the primary source of pollutant loading entering Florida's rivers, lakes and estuaries, thus causing degradation of water quality and a loss of beneficial uses. Accordingly, it is a goal to eliminate the discharge of inadequately managed storm water into waters and to minimize other adverse impacts on natural systems, property and public health, safety and welfare caused by improperly managed storm water.

(d) It shall be a goal of storm water management programs to reduce unacceptable pollutant loadings from older storm water management systems, constructed before the adoption of Chapter 62-25, F.A.C., (February 1, 1982), by developing watershed management and storm water master plans or District-wide or basin specific rules.

(e) The concept of developing comprehensive watershed management plans in designated watersheds is intended not only to prevent existing environmental, water quantity, and water quality problems from becoming worse but also to reduce existing flooding problems, to improve existing water quality, and to preserve or restore the values of natural systems.

(2) Watershed management goals shall be developed by the District for all watersheds within the boundaries of each District and shall be consistent with the Surface Water Improvement and Management (SWIM) program and the EPA National Pollution Discharge Elimination System (NPDES) program. Watershed management goals shall be included in the District Water Management Plans.

(3) Storm Water Management Program Implementation.

As required by Section 403.0891, F.S., the Department, Districts and local governments shall cooperatively implement on a watershed basis a comprehensive storm water management program designed to minimize the adverse effects of storm water on land and water resources. All such programs shall be mutually compatible with the State Comprehensive Plan (Chapter 187, Florida Statutes), the Local Government Comprehensive Planning and Land Development Regulation Act (Chapter 163, Florida Statutes), the Surface Water Improvement and Management Act (Sections 373.451-.4595, F.S.), Chapters 373 and 403, F.S., and this chapter. Programs shall be implemented in a manner that will improve and restore the quality of waters that do not meet state water quality standards and maintain the water quality of those waters which meet or exceed state water quality standards.

(a) The Department shall be the lead agency responsible for coordinating the statewide storm water management program by establishing goals, objectives and guidance for the development and implementation of storm water management programs by the Districts and local governments. The Department shall implement the state storm water management program in Districts which do not have the economic and technical resources to implement a comprehensive storm water and surface water management program.

(b) The Districts which have implemented a comprehensive storm water and surface water management program shall be the chief administrators of the state storm water management program. The Department or the Districts, where appropriate, shall set regional storm water management goals and policies on a watershed basis, including watershed storm water pollutant load reductions necessary to preserve or restore beneficial uses of receiving waters. For water bodies which fully attain their designated use and meet the applicable state water quality standards, the pollutant load reduction goal shall be zero. Such goals and policies shall be implemented through District SWIM plans, through preparation of watershed management plans in other designated priority watersheds and through appropriate regulations.

(c) Local governments shall establish storm water management programs which are in accordance with the state and District storm water quality and quantity goals. Local governments may establish a storm water utility or other dedicated source of funding to implement a local storm water management program which shall include the development and implementation of a storm water master plan and provisions, such as an operating permit system, to ensure that storm water systems are properly operated and maintained.

(d) Any water control district created pursuant to Chapter 298, F.S., or special act, and other special districts as defined in Section 189.403(1), F.S., which have water management powers shall:

1. Be consistent with the applicable local comprehensive plan adopted under Part II, Chapter 163, F.S., and state and district storm water quality and quantity goals, for the construction and expansion of water control and related facilities.
2. Operate existing water control and related facilities consistent with applicable state and district storm water quality and quantity goals. Any modification or alteration of existing water control and related facilities shall be consistent with the applicable local government comprehensive plan and state and district storm water quality and quantity goals.

(4) Surface Water Management.

The following shall apply to the regulation of surface water pursuant to Part IV, Chapter 373, Florida Statutes.

(a) The construction and operation of facilities which manage or store surface waters, or other facilities which drain, divert, impound, discharge into, or otherwise impact waters in the state, and the improvements served by such facilities, shall not be harmful to water resources or inconsistent with the objectives of the Department or District.

(b) In determining the harm to water resources and consistency with the objectives of the Department or District, consideration should be given to:

1. The impact of the facilities on:
   a. water quality;
   b. fish and wildlife;
   c. wetlands, floodplains, estuaries, and other environmentally sensitive lands;
   d. reasonable-beneficial uses of water;
   e. recreation;
   f. navigation;
   g. saltwater or pollution intrusion, including any barrier line established pursuant to Section 373.033, F.S.;
   h. minimum flows and levels established pursuant to Section 373.042, F.S.; and
   i. other factors relating to the public health, safety, and welfare;
2. Whether the facilities meet applicable design or performance standards;
3. Whether adequate provisions exist for the continued satisfactory operation and maintenance of the facilities; and
4. The ability of the facilities and related improvements to avoid increased damage to off-site property, water resources, natural systems or the public caused by:
   a. floodplain development, encroachment or other alteration;
   b. retardance, acceleration or diversion of flowing water;
   c. reduction of natural water storage areas;
   d. facility failure; or
   e. other actions adversely affecting off-site water flows or levels.

(5) Minimum Storm Water Treatment Performance Standards.

(a) When a storm water management system complies with rules establishing the design and performance criteria for storm water management systems, there shall be a rebuttable presumption that such systems will comply with state water quality standards. The Department and the Districts, pursuant to Section 373.418, F.S., shall adopt rules that specify design and performance criteria for new storm water management systems which:

1. Shall be designed to achieve at least 80 percent reduction of the average annual load of pollutants that would cause or contribute to violations of state water quality standards.
2. Shall be designed to achieve at least 95 percent reduction of the average annual load of pollutants that would cause or contribute to violations of state water quality standards in Outstanding Florida Waters.
3. The minimum treatment levels specified in subparagraphs 1 and 2 above may be replaced by basin specific design and performance criteria adopted by a District in order to achieve the pollutant load reduction goals established in paragraph (c).

(b) Erosion and sediment control plans detailing appropriate methods to retain sediment on-site shall be required for land disturbing activities.

(c) The pollutant loading from older storm water management systems shall be reduced as necessary to restore or maintain the beneficial uses of waters. The Districts shall establish pollutant load reduction goals and adopt them as part of a SWIM plan, other watershed management plan, or District-wide or basin specific rules.

(d) Watershed specific storm water pollutant load reduction goals shall be developed for older storm water management systems on a priority basis as follows:

1. The Districts shall include in adopted SWIM Plans numeric estimates of the level of pollutant load reduction goals anticipated to result from planned corrective actions included in the plan.
    a. For SWIM water bodies with plans originally adopted before January 1, 1992, these estimates shall be established before December 31, 1994.
    b. For SWIM water bodies with plans originally adopted after January 1, 1992, these estimates shall be established within three years of the plan's original adoption date.
2. Each District shall develop water body specific pollutant load reduction goals for non-SWIM water bodies on a priority basis according to a schedule provided in the District Water Management Plan. The list of water bodies and the schedule shall be developed by each District, giving priority consideration to water bodies that receive discharges from storm water management systems that are required to obtain a NPDES municipal storm water discharge permit.
3. The Districts shall consider economic, environmental, and technical factors in implementing programs to achieve pollutant load reduction goals. These goals shall be considered in local comprehensive plans submitted or updated in accordance with Section 403.0891(3)(a), F.S.

62-40.450 Flood Protection

Flood protection shall be implemented within the context of other interrelated water management responsibilities. Florida will continue to be dependent on some structural water control facilities constructed in the past, and new structural facilities may sometimes be unavoidable in addressing existing and future flooding or other water-related problems. The Department and the Districts shall promote nonstructural flood protection strategies.

(1) Flood Protection Responsibilities

(a) Local governments have the primary responsibility for regulating land use, enforcing construction criteria for flood prone areas, establishing local storm water management levels of service, constructing and maintaining local flood control facilities, and otherwise preventing flood damages to new and existing development.

(b) District flood protection responsibilities relate primarily to serving regional water conveyance and storage needs. Districts have the authority to plan, construct, and operate water control facilities, as well as regulate discharges into works of the District or facilities controlled by the District.

(c) Rules adopted under Part IV of Chapter 373, F.S., shall require that appropriate precautions be taken to protect public health and safety in the event of failure of any water control structures, such as pumps and levees.

(d) Department and District programs shall discourage siting of incompatible public facilities in floodplains and flood prone areas wherever possible. Where no feasible alternative exists to siting an incompatible public facility in a floodplain or flood prone Area, the facility shall be designed to minimize flood damage risks and adverse impacts on natural flood detention and conveyance capabilities.

(e) Each District shall clearly define in its District Water Management Plan, in basin specific plans, or rules, the District's responsibilities related to flood emergencies, including its mechanisms for coordinating with emergency response agencies.

(2) District Facilities

(a) District water control facilities shall be operated and maintained in accordance with established plans or schedules.

(b) Districts shall assess the design characteristics and operational practices of existing District water control facilities to ascertain opportunities for minimizing adverse impacts on water resources and associated natural systems. Where feasible, facility design modifications or operational changes shall be implemented to enhance natural systems or fulfill other water management responsibilities.

62-40.458 Floodplain Protection

(1) The Department and the Districts shall provide leadership to protect and enhance the beneficial values of floodplains. This shall include active coordination with local governments, special districts, and related programs of federal agencies, the Department of Community Affairs, and the Department of Health and Rehabilitative Services. Nothing in this section is intended to diminish the Department's and District's responsibilities regarding flood protection.

(a) The Department and the Districts shall pursue development of adequate floodplain protection information, including:

1. District determination of flood levels for priority floodplains. At a minimum, this shall include the 100-year flood level, with other flood levels to be determined where needed for watershed-specific management purposes. Districts are encouraged to determine the 10-year flood level for the purpose of assisting the Department of Health and Rehabilitative Services to regulate septic tanks in floodplains pursuant to Section 10D-6.0471, F.A.C.

2. Identification of floodplains with valuable natural systems for potential acquisition.
3. Identification of floodplain areas having potential for restoration of natural flow regimes.

(b) The Department and the Districts shall develop jointly a comprehensive system of coordinated planning, management, and acquisition to protect and, where feasible, enhance floodplain functions and associated natural systems in floodplains. This system shall include implementation of policies and programs to:

1. Acquire and maintain valuable natural systems in floodplains.
2. Protect the natural water storage and water conveyance capabilities of floodplains.
3. Where feasible, enhance or restore natural flow regimes of rivers and watercourses that have been altered for water control purposes.

(c) District regulatory programs shall minimize incompatible activities in floodplains. For regulated floodplains, each District, at a minimum, shall ensure that such activities:

1. Will not result in significant adverse effects on surface and ground water levels and surface water flows.
2. Will not result in significant adverse impacts to existing surface water storage and conveyance capabilities of the floodplain.
3. Will not result in significant adverse impacts to the operation of District facilities.
4. Will assure that any surface water management facilities associated with the proposed activity will be capable of being effectively operated and maintained.
5. Will not cause violations of water quality standards in receiving waters.
6. Will not otherwise be harmful to water resources.

(2) Each District shall provide to local governments and water control districts available information regarding floodplain delineation and floodplain functions and associated natural systems, and assist in developing effective measures to manage floodplains consistently with this Chapter.

62-40.470 Natural Systems Protection and Management

Programs, plans, and rules to accomplish natural systems protection and management shall include rules to address adverse cumulative impacts, the establishment of minimum flows and levels (Rule 62-40.473, F.A.C.) and may include protection measures for surface water resources (Rule 62-40.475, F.A.C.).

62-40.473 Minimum Flows and Levels

(1) In establishing minimum flows and levels pursuant to Section 373.042, consideration shall be given to the protection of water resources, natural seasonal fluctuations in water flows or levels, and environmental values associated with coastal, estuarine, aquatic, and wetlands ecology, including:

(a) Recreation in and on the water;

(b) Fish and wildlife habitats and the passage of fish;

(c) Estuarine resources;

(d) Transfer of detrital material;

(e) Maintenance of freshwater storage and supply;

(f) Aesthetic and scenic attributes;

(g) Filtration and absorption of nutrients and other pollutants;

(h) Sediment loads;

(i) Water quality; and

(j) Navigation.

(2) Established minimum flows and levels shall be protected where relevant to:

(a) The construction and operation of water resource projects;

(b) The issuance of permits pursuant to Part II, Part IV, and Section 373.086, Florida Statutes; and

(c) The declaration of a water shortage pursuant to Section 373.175 or Section 373.246, Florida Statutes.

(3) Each water management district shall advise the Secretary by January 1, 1995 of the date by which each District shall establish minimum flows and levels for surface water bodies within the District. Priority shall be given to establishment of minimum flows and levels on waters which are located within:

(a) an Outstanding Florida Water;

(b) an Aquatic Preserve;

(c) an Area of Critical State Concern; or

(d) an area subject to Chapter 380 Resource Management Plans adopted by rule by the Administration Commission, when the plans for an area include waters that are particularly identified as needing additional protection, which provisions are not inconsistent with applicable rules adopted for the management of such areas by the Department and the Governor and Cabinet.

62-40.475 Protection Measures for Surface Water Resources

(1) As part of SWIM Plans or basin-specific management plans, programs, or rules, the Districts are encouraged to implement protection measures as appropriate to enhance or preserve surface water resources. Protection measures shall be based on scientific evaluations of particular surface waters and the need for enhancement or preservation of these surface water resources.

(2) In determining if basin-specific rules should be adopted to establish protection areas, due consideration shall be given to surface waters with the following special designations:

(a) an Outstanding Florida Water,

(b) an Aquatic Preserve,

(c) an Area of Critical State Concern, or

(d) an area subject to Chapter 380 Resource Management Plans adopted by rule by the Administration Commission, when the plans for an area include waters that are particularly identified as needing additional protection, which provisions are not inconsistent with applicable rules adopted for the management of such areas by the Department and the Governor and Cabinet.

62-40.510 Florida Water Plan

(1) The Department shall formulate an integrated, coordinated Florida Water Plan for the management of Florida's water resources. The scope of the plan shall include the State Water Use Plan and all other water-related activities of the Department and the Districts. It shall give due consideration to the factors in Section 373.036(2), F.S.

(2) The Florida Water Plan shall be developed in coordination with District Water Management Plans and include, at a minimum:

(a) Department overview, including a discussion of the interrelationships of Department and District programs;

(b) Water management goals and responsibilities, including the following areas of responsibilities:

1. water supply protection and management,
2. flood protection and management,
3. water quality protection and management, and
4. natural systems protection and management;

(c) Statewide water management implementation strategies for each area of responsibility;

(d) Intergovernmental coordination, including the Department's processes for general supervision of the water management districts;

(e) Procedures for plan development, including public participation;

(f) Methods for assessing program effectiveness and the Department's progress toward implementation of the Plan;

(g) Linkages to Department rulemaking, budgeting, program development, and legislative proposals;

(h) Strategies to identify the amount and sources of supplemental funding to implement the programs identified in Chapter 373, District Water Management Plans, this Chapter, and any delegated programs;

(i) Chapter 62-40, F.A.C., State Water Policy;

(j) Appropriate sections of the District Water Management Plans;

(k) State water quality standards.

(3) The Florida Water Plan shall be developed expeditiously and may be phased. It shall be completed by November 1, 1995.

(4) At a minimum, the Florida Water Plan shall be updated every five years after the initial plan development. Annual status reports on the Plan shall also be prepared by the Department.

Part V Water Program Development

62-40.520 District Water Management Plans

(1) As required by Section 373.036(4), F.S., a long range comprehensive water management plan shall be prepared by each District which is consistent with the provisions of this Chapter and Section 373.036, Florida Statutes. District Water Management Plans are comprehensive guides to the Districts in carrying out all their water resource management responsibilities, including water supply, flood protection, water quality management, and protection of natural systems. The plans shall provide general directions and strategies for District activities, programs, and rules. They will be implemented by a schedule of specific actions of the District, which may include program development, water resource projects, land acquisition, funding, technical assistance, facility operations, and rule development.

(2) The District Plan shall include an assessment of water needs and sources for the next 20 years. The District Plan shall identify specific geographical areas that have water resource problems which have become critical or are anticipated to become critical within the next 20 years to be called water resource caution areas. Identification of water resource caution areas needed for imposition of reuse requirements pursuant to Rule 62-40.416, F.A.C., may be accomplished before publication of the complete District Plan.

(3) Based on economic, environmental, and technical analyses, a course of remedial or preventive action shall be specified for each current and anticipated future problem.

(4) Remedial or preventive measures may include, but are not limited to, water resource projects; water resources restoration projects pursuant to Section 403.0615, Florida Statutes; purchase of lands; conservation of water; reuse of reclaimed water; enforcement of Department or District rules; and actions taken by local government pursuant to a local government comprehensive plan, local ordinance, or zoning regulation.

(5) District Plans shall also provide for identifying areas where collection of data, water resource investigations, water resource projects, or the implementation of regulatory programs are necessary to prevent water resource problems from becoming critical.

(6) District plans shall address, at a minimum, the following subjects:

(a) District overview;

(b) Water management goals;

(c) Water management responsibilities, including:

1. Water supply protection and management, to include needs and sources, source protection, and a schedule for recharge mapping and recharge area designation.

2. Flood protection and floodplain management. This shall include the District's strategies and priorities for managing facilities and floodplains, and a schedule for District mapping of floodplains.
3. Water quality protection and management for both surface water and ground water. This shall include the District's strategies, priorities, and schedules to develop pollutant load reduction goals; and
4. Natural systems protection and management. This shall include a schedule for establishing minimum flows and levels for a priority selection of surface waters and ground waters in the District, considering ground water availability and surface water availability, and a schedule for establishing protection areas for surface waters in the District, where appropriate.

(d) For each water management responsibility, the following shall be included:

1. Resource assessments, including identification of regionally significant water resource issues and problems, and determinations of the need for ground water basin resource availability inventories in various portions of the District;
2. Evaluation of options;
3. Water management policies for identified issues and problems;
4. Implementation strategies for each issue and problem, including tasks, schedules, responsible entities, and measurable benchmarks.

(e) Integrated plan, describing how the water problems of each county in the District are identified and addressed;

(f) Intergovernmental coordination, including measures to implement the plan through coordination with the plans and programs of local, regional, state and federal agencies and governments; and

(g) Procedures for plan development, including definitions and public participation.

(7) District Plans shall be developed expeditiously and may be phased. All District Plans shall be accepted by the Governing Board no later than November 1, 1994. A District Water Management Plan is intended to be a planning document and is not self-executing.

(8) At a minimum, District Plans shall be updated and progress assessed every five years after the initial plan development. Each District shall include in the Plan a procedure for evaluation of the District's progress towards implementing the Plan. Such procedure shall occur at least annually and a copy of the evaluation shall be provided to the Department each year by November 15 for review and comment.

(9) Plan development shall include adequate opportunity for participation by the public and governments. The Districts shall initiate public workshops at least four months before Plan acceptance by the Governing Board. At the workshops, a preliminary list of schedules to be included in the Plan shall be presented.

62-40.530 Department Review of District Water Management Plans

(1) After acceptance by the District Governing Board, District Water Management Plans shall be submitted to the Department.

(2) Within sixty days after receipt of a Plan for review, the Department shall review each Plan for consistency with this Chapter and recommend any changes to the Governing Board.

(3) After consideration of the comments and recommendations of the Department, the Governing Board shall, within sixty days, either incorporate the recommended changes into the Plan or state in the Plan, with specificity, the reasons for not incorporating the changes.

(4) Plan amendments shall follow the same process as for initial Plan acceptance.

62-40.540 Water Data-

(1) All local governments, water management districts, and state agencies are directed by Section 373.026(2), F.S., to cooperate with the Department in making available to the Department such scientific or factual data as they may possess. The Department shall prescribe the format and ensure the quality control for all water quality data collected or submitted.

(2) The Department is the state's lead water quality monitoring agency and central repository for surface water and ground water information. The Department shall coordinate Department, District, state agency, and local government water quality monitoring activities to improve data and reduce costs.

(3) The U.S. Environmental Protection Agency water quality data base (STORET) shall be the central repository of the state's water quality data. All appropriate water quality data collected by the Department, Districts, local governments, and state agencies shall be placed in the STORET system within one year of collection.

(4) The Department's biennial state water quality assessment (the "305(b) Report") shall be the state's general guide to water quality assessment and should be used as the basis for assessments unless more recent, more accurate, or more detailed information is available.

(5) Appropriate monitoring of water quality and water withdrawal shall be required of permittees.

(6) The Districts shall implement a strategy for measuring, estimating, and reporting withdrawal and use of water by permitted and exempted users. Thresholds for measurement requirements and reporting applicable to permittees shall be established and adopted by rule.

(7) The Department and the Districts shall coordinate in the development and implementation of a standardized computerized statewide data base and methodology to track activities authorized by environmental resource permits in wetlands and waters of the state. The data base will be designed to provide for the rapid exchange of information between the Department and the Districts. The

Department will serve as the central repository for environmental resource permit data and shall specify the data base organization and electronic format in which the data are to be provided by the Districts.

Part VI Water Program Administration and Evaluation

62-40.610 Review and Application

(1) This Chapter shall be reviewed periodically, but in no case less frequently than once every four years. Revisions, if any, shall be adopted by rule.

(2) Within 12 months after adoption or revision of this Chapter, the Districts shall have revised their rules and reviewed their programs to be consistent with the provisions contained herein.

(3) District rules adopted after this Chapter takes effect shall be reviewed by the Department for consistency with this Chapter.

(4) At the request of the Department, each District shall initiate rulemaking pursuant to Chapter 120, Florida Statutes, to consider changes the Department determines to be necessary to assure consistency with this Chapter. The Department shall be made a party to the proceeding.

(5) District water policies may be adopted which are consistent with this Chapter, but which take into account differing regional water resource characteristics and needs.

(6) A District shall initiate rulemaking or program review to consider implementation of programs pursuant to Sections 373.033, 373.042, 373.106, Part III, or Part IV of Chapter 373, Florida Statutes, where the Department or District determines that present or projected conditions of water shortages, saltwater intrusion, flooding, drainage, or other water resource problems, prevent or threaten to prevent the achievement of reasonable-beneficial uses, the protection of fish and wildlife, or the attainment of other water policy directives.

(7) The Department and Districts shall assist other governmental entities in the development of plans, ordinances, or other programs to promote consistency with this Chapter and District water management plans.

SELECTED PASSAGES FROM FLORIDA FOREVER PROGRAM LEGISLATION

The Florida Forever Program is a comprehensive legislative effort that includes statutory amendments that provide guidelines for funding the purchase of environmentally significant lands and water resource development projects. The full legislation is approximately 150 pages long and is found throughout Florida Statutes, including chapters 201, 373, 259, and 215. Due to the comprehensive nature of the Florida Forever Program, the reader is advised to refer to the specific statute of interest cited in the text below.

SUMMARY

- Florida Forever Fund (10 year funding program) replaces the P2000 Fund. Florida Forever funds can be used for land acquisition and capital projects to implement the District's Florida Forever Work plan. Funding commences in FY2001, most likely spring after legislative session. Such funds can be specifically used for ecosystem management, water resource development, SWIM implementation, and open space and recreation. Funding for water resource development does not include construction of treatment, transmission, or distribution facilities. Land uses authorized also include water supply development, stormwater management, linear facilities, and sustainable agriculture and forestry.
- Separate authority provided for water resource development and water supply projects funded other than with Florida Forever funds. This authority somewhat broader.
- Water Management Land Trust Fund receives limited doc. stamps tax revenues for District land management and pre-acquisition expenses. WMLTF can't be used for land acquisition costs other than pre-acquisition costs. Capital improvements to be funded by WMLTF is defined.
- Land Acquisition Trust Fund receives doc stamps to pay Florida Forever bond debt service.
- Florida Forever Fund receives bond sale proceeds. At least 50% of the funds must be used for land acquisition. Capital improvements are to be identified prior to acquisition of the parcel or the approval of a project.
- New 5 Year Work Plan to be developed that is very comprehensive in nature and integrates all major water management district projects, including SWIM Plans, SOR land acquisition, stormwater management projects, water resource projects, water body restoration projects, and other acquisitions

and activities to meet Florida Forever Act goals. Deadline for development of the plan not clear but not earlier than FY 2001. Hopefully glitch bill will specify that plan is due June/July 2001.

- Multiple Use Management- all lands acquired under the Florida Forever Act are to be managed for multiple uses where compatible with resource values and management objectives. Multiple use includes general recreational use, water resource development projects, and sustainable forestry development.

1. SOR PROGRAM

SOR program continues until funds allocated to water management districts have been expended or committed. SOR Plan update will be filed with Legislature and DEP by Jan 15 of each year until that time. (See 373.59(2))

Water Management Lands Trust Fund (WMLTF) (See s. 201.15, F.S.) - WMLTF continues in existence. 4.2% of doc stamps distributed to water management districts. **WMLTF can't be used for land acquisition other than pre-acquisition costs**. Acquisition and Restoration Council to decide by 2005 whether to repeal this restriction on land acquisition costs.

Section 373.59 also amended to broaden the purposes for use of the WMLTF to include debt service on bonds issued prior to July 1, 1999 (District may pledge WMLTF as security for revenue bonds or notes issued under 373.584 prior to July 1, 1999), pre-acquisition costs associated with land purchases. It also defines "**capital improvements**" which had already been an authorized purpose, as including but not limited to: perimeter fencing, signs, fire lanes, control of exotic species, controlled burning, habitat inventory and restoration, law enforcement, access roads and trails, and minimal public accommodations, such as primitive campsites, garbage receptacles, and toilets. A district with fund balances in the WMLTF as of March 1, 1999 may use those funds for land acquisitions under 373.139 or for purposes specified in 373.59 (7).

Payment in Lieu of Taxes (373.59(10) – Beginning July 1, 1999, not more than one-fourth of WMLTF in any year may be reserved annually by a governing board during the development of its operating budget for payments in lieu of taxes for all actual tax losses resulting from FF program. Payment in-lieu of tax is available 1) to all counties with a population of 150,000 or less in which amount of tax loss from all completed P-2000 and FF acquisitions in the county exceeds .01 percent of county's total taxable value, 2) all local governments located in eligible counties and whose lands are bought and taken off the tax rolls. Local govt defined in 373.59(10)(b)(2). If insufficient funds are available in any year to make full payments, counties and local govt's receive pro rata share. Payment amount on the average amount of actual taxes paid on the property for the 3 years preceding the acquisition. Once eligibility is established, that governmental entity shall receive 10 consecutive annual payments for each tax loss. Applications by governmental entity payment in lieu shall be made no later than Jan 31 of the year following acquisition. Payments made after Department of Revenue certifies that amounts are reasonably appropriate.

2. FLORIDA FOREVER ACT ("FFA") FUNDING (See s. 259.105, F.S.)

A. <u>Findings and Declaration</u>. Legislature made ten findings. Crux of which is that the P2000 program was successful, but rapidly growing population is impacting water resources, wildlife habitat, outdoor recreation area space, wetlands, forests, beaches. Potential development of remaining natural areas needs response. Groundwater, surface water and springs are being impacted and to ensure sufficient quantities of water are available to meet needs of natural systems and population, water resource development projects on public lands, where compatible with the resource values of and management objectives for the lands is appropriate. Many unique ecosystems, such as Florida Everglades, facing ecological collapse due to population. Land must be acquired to facilitate ecosystem restoration. Florida Forever program will be developed and implemented with measurable state goals and objectives. Performance measures, standards, outcomes , and goals need to be established at the outset. The legislative intent is to change the focus and direction of state's major land acquisition programs, including use of land protection agreements and similar tools with private landowners where appropriate, better coordination among public agencies and other entities in their land acquisition programs, long term financial commitment to managing acquired lands, competitive selection process, and bond proceeds will be used to implement the goals and objectives recommended by Florida Forever Advisory Council(FFAC)

B. <u>District Share</u>. SFWMD gets 35% of water management districts allocation ($36.75 million minus bond admin costs and fees) for **lands and capital projects** to implement the priority lists developed under its FFA 5year workplan in 373.199. **At least 50% of the funds must be used for land acquisition** over the life of the program. See 259.105(3)(a))

Capital improvement project defined in s. 259.03(3) as activities relating to acquisition, restoration, public access, and recreational uses of such lands, waters, necessary to accomplish objectives of this chapter. Activities include but not limited to: initial invasive plant removal, enlargement or extension of facility signs, firelanes, access roads, and trails, or any other activities that serve to restore, conserve, protect, or provide public access, recreational opportunities or necessary services for land or water areas. **Such activities shall be identified prior to acquisition of the parcel or the approval of a project.** Continued expenditures necessary for a capital improvement project approved under this subsection not eligible for funding.

C. <u>DEP Share</u>. DEP gets 35% of the yearly allocation (approx. $105million) for state agencies and other entities for lands and projects under the FFA with priority for acquisitions which achieve combination of conservation goals, including protecting Fl resources and natural groundwater recharge. **Capital projects not to exceed 10% of such funds.** See 259.105(3)(b) Acquisition and Restoration Council to accept applications from state agencies, local governments, nonprofit and for profit organizations, private land trust, and individuals for this funding. The Acquisition and Restoration Council (ARC) evaluates the proposals. (See259.105(3)(b), (7)(a))

D. **<u>WATER RESOURCE DEVELOPMENT PROJECTS</u>** (s. 259.105(6), F.S.) Water Resource or Water Supply Development project is allowed if following conditions met:

1. minimum flows and levels established for those waters, if any, which may reasonably be expected to experience significant harm to water resources as a result of the project
2. project complies with all applicable permits
3. project is consistent with the regional water supply plan, if any, of the water management district and with relevant recovery or prevention strategies if required pursuant to 373.0421(2)(this pertains to water bodies expected within 20 years to fall below the minimum flow or level established under 373.042.)

Water Resource Development defined in 259.03(6) as a project eligible for funding under 259.105 that increases the amount of water available to meet needs of natural system and enhance or restore aquifer recharge, facilitate capture and storage of excess flows in surface waters, or promotes reuse. These projects include land acquisition, land and water body restoration, ASR facilities, surface water reservoirs, and other capital improvements**. TERM DOES NOT INCLUDE** construction of treatment, transmission, or distribution facilities. **(Note see section 8 below for separate authority for such projects where no FFA funds used.)**

3. FLORIDA FOREVER WATER MANAGEMENT DISTRICT WORKPLAN (s. 373.199, F.S.)

Overall quality of Florida water resources continue to degrade, surface water natural systems continue to be altered or not restored to fully functioning level, sufficient quantities of water for current and future reasonable beneficial use and for natural systems remain in doubt.

5 Year Workplan is required to identify projects that meet criteria in subsections (3), (4), and (5) below.

<u>3 (a) integrate plans and projects</u> - including SWIM Plans, SOR land acquisition lists, stormwater management projects, proposed water resource projects, proposed water body restoration projects, and other properties and activities that assist in meeting goals of FFA.

<u>(b) cooperate - with ecosystem mgt teams,</u> citizen advisory groups, DEP, and other entities

<u>(4) Workplan list</u> – shall include following information, where applicable.

(a) water body description, historical and current uses, hydrology, conditions requiring restoration or protection; restoration efforts to date

(b) other governments with jurisdiction over water body and drainage basin within approved SWIM Plan area, including local, regional, state, and federal units

(c) land uses within the project area drainage basin, tributaries, point and non-point sources pollution, and permitted discharge activities

(d) strategies and potential strategies for restoring or protecting water body to Class III or better surface water quality, including improved stormwater management

(e) studies of water body, stormwater project, or water resource development project

(f) measures to manage and maintain i) the water body once restored and to prevent future degradation, ii) the stormwater management system , or iii) water resource development

(g) schedule for i) restoration and protection water body, ii) implementation of stormwater management project, iii) or development of the water resource development project.

(h) Funding estimate for the restoration, protection, or improvement project or development of new water resources, where applicable, and source of the funding

(i) Numeric performance measures for each project. Including baseline, performance standard project will achieve, performance measurement itself which reflects incremental improvements toward achieving the performance standard. Measures need to reflect the **goals** in s. 259.105(4). These **goals** pertain to 1) Water Management District projects in their Workplan list (35% of FF funds) and 2) state and other entities projects approved by the Acquisition and Restoration Council (see 259.105(4)

259.105(4) <u>Goals</u> (each goal has method of measurement, see legislation):

(a) increase protection or increase populations for listed plant species

(b) increase protection or increase populations for listed animal

species
- (c) restoration of land areas by reducing non-native species or regeneration of natural communities
- (d) increase public landholdings
- (e) completion of project begun under previous land acquisition programs
- (f) increase in amount of forest land for sustainable resources
- (g) increase public recreational opportunities
- (h) reduction amount of pollutants flowing into surface waters
- (i) improvement of water recharge rates on public lands
- (j) restoration of water areas
- (k) protection of natural flood plain functions, prevention or reduction in flood damage
- (l) restoration of degraded water bodies
- (m) restoration of wetlands
- (n) preservation of strategic wetlands
- (o) preservation or reduction of contaminants in aquifers and springs

(j) Permitting and regulatory issues related to the project

(k) Identification of the proposed public access for projects with land acquisition components

(l) Identification of lands requiring full fee simple interest to achieve water management goals, lands that can be acquired with alternatives to fee considering acquisition cots, net present value of future land management costs, net present value of local govt. loss of ad valorem revenue, potential for revenue generated by activities compatible with acquisition objectives

(m) Lands needed to protect or recharge groundwater and plan for their acquisition as necessary to protect potable water supplies.

(5) List to indicate relative significance of each project. The schedule of activities, and sums of money earmarked should reflect those rankings as much as possible over the 5 year planning horizon

Pollution Responsibility (259.105(12) – Funds are not to be used to abrogate financial responsibility of point and nonpoint sources that have contributed to the degradation of water or land areas. **Increased priority** is to be given by water management districts to those projects that have secured a cost-sharing agreement allocating responsibility for cleanup of point and nonpoint sources.

Florida Forever Advisory Council to establish specific goals for those identified in s. 259.105(4) above.

No timeframe given for submittal of the original workplan. Since FFA funding is not available until FY 2001, presumably the Workplan would not be due earlier than then. Note that FFAC is to prepare a report by November 2000 to among other things establish specific goals identified in 259.105(4). It would make sense for the report to be completed for guidance to the acquiring agencies in preparing their workplans.

4. WORKPLAN UPDATES (s. 373.199(7) –

By January of each year District must file with DEP and Legislature a report of acquisitions completed during the year together with modifications or additions to its 5Year Workplan. The report must include a description of the land management activity for each property or project area owned by the District. A list of any lands surplused and the amount of compensation received.

105(3) (this includes water management district allocations), and other aspects of the FFA.

5. PUBLIC HEARING (s. 373.139(3)(a) –

No acquisition of lands shall occur without a public hearing similar to those held pursuant to 120.54.

6. DEP RELEASE OF FUNDS –

Pre- Acquisition Costs – DEP must release funds within 30 days after receipt of GB resolution which identifies and justifies the pre-acquisition costs for 5 year plan lands. (See s. 373.139 (3)(c)

Land Acquisition Costs – DEP must release funds after receipt of GB resolution certifying the acquisition is consistent with 5 year work plan. Each parcel must have at least one appraisal. Acquisitions over 500k require 2 appraisals. Third appraisal may be obtained when first two differ significantly. Purchase price in excess of appraised value requires justification. (s. 373.139 (3)(d)

7. MULTIPLE USE MANAGEMENT (259.105(5) –

All lands acquired under FFA are to be managed for **multiple-use purposes**, where compatible with the resource values and management objectives for the land. **“Multiple-use”** is defined to include i) **outdoor recreational activities** including those under 253.034 (couldn’t find any reference to recreation activities) and 259.032(9)(b) , which include fishing, hunting, camping bicycling, hiking, nature study, swimming, boating, canoeing, horseback riding, diving, model hobbyist activities, birding, sailing, jogging, and other related outdoor activities compatible with the purposes for which the land was acquired, ii) **water resource development projects**, and iii**) sustainable forestry management**.

Lands may be designated for single use as defined in s. 253.034(2)(b) by the decision of the acquiring entity. Single use is defined in .034(2)(b) as management for one particular purpose to exclusion of all other purposes except compatible secondary purposes which will not interfere or detract with primary management purposes. Single use includes agricultural use, institutional use, use for parks, preserves, wildlife management, archaeological or historic sites, or wilderness areas where maintenance of essentially natural conditions is important. All submerged lands shall be considered single use lands and managed primarily for maintenance of essentially natural conditions, the propagation of fish and wildlife, and public recreation including hunting and fishing where deemed appropriate.

Reporting on Land Management (s. 259.032(10)(g) – By July 1 of each year, each Water Management District reports to DEP on land management matters.

8. DISTRICT LAND MANAGEMENT (s373.1391) –

Lands to be managed to ensure balance between public access, general public recreational purposes, and restoration and protection of their natural state. Lands owned, managed and controlled by a district may be used for multiple purposes, including but not limited to agriculture, silvaculture, and water supply, as well as boating and other recreational uses.

Whenever practicable, such lands shall be open to the general public for recreational uses. General public recreation purposes shall include but not be limited to fishing, hunting, horseback riding, swimming, camping, hiking, canoeing, boating, diving, birding, sailing, jogging, and other related outdoor activities to maximum extent possible considering the environmental sensitivity and suitability of those lands. Management plans developed for such lands shall evaluate the lands resource value to establish which parcels, in whole or in part, annually or seasonally, are conducive to general public recreational purposes. The lands shall be made available to the public for these purposes unless the Governing Board can demonstrate that such activities would be incompatible with the purposes for which the lands were acquired. Disputes re land management plans not resolvable by water management districts shall be forwarded to DEP who shall submit it to the FFAC.

Any acquisition of fee or lesser interest that will be leased back/used for agricultural purposes, Governing Board will first consider having a soil and water conservation district created under Ch. 582 manage and monitor the interest.

Water Resource Development/Water Supply Projects (s. 373.1391((2). Lands acquired with funds other than those appropriated under the Florida Forever Act may be used for permittable water resource development and water supply development purposes provided that 1) minimum flows and levels of priority water bodies on such land established, 2) project complies with all applicable permits under Part II of this Chapter, and 3) project is compatible with the purposes for which the land was acquired. (Note this authority seems somewhat broader than authority for such projects using FFA funding. (See section 2.C above)

Additional land uses authorized (s, 373.1391(5) - The following land uses of lands acquired under the FFA program and other state-funded land purchase programs are authorized upon a finding by the governing board: **water resource development, water supply development, stormwater management, linear facilities, and sustainable agriculture and forestry**, provided they meet all the following criteria: 1) not inconsistent with the management plan for such lands, 2) compatible with the natural ecosystem and resource value of such lands, 3) use is appropriately located on the lands and due consideration to use of other available lands, 4) using entity reasonably compensates the titleholder for such use based on an appropriate measure of value, and 5) the use is consistent with the public interest. Decision of Governing Board presumed correct. Moneys received from the use of state lands shall be returned to the lead managing agency in accordance with s. 373. 59

9. UNWILLING SELLERS (s. 373.199(6) –

District must remove the property of an unwilling seller at the next scheduled update of the plan when requested by the property owner.

10. ALTERNATIVES TO FEE ACQUISITION (s. 259.04(11) –

Beginning in FY99, districts shall implement initiatives to use alternatives to fee simple acquisition. Less than fee simple acquisition that provide public access may be given preference. Legislature recognizes that public access is not always appropriate for less than fee acquisitions an no proposed less than fee simple acquisition shall be rejected simply because public access would be limited. `

11. CONVEYANCE OF LAND INTERESTS (s. 259.105(17)(a) –

Water Management Districts may authorize granting lease, easement, or license for use of lands acquired for uses determined to be compatible with the resource values and management objectives for such lands. Presumed any existing lease, easement, or license for incidental public or private use is compatible. However, no such grant of land interest is permissible if it adversely affects the exclusion of interest from gross income of any revenue bond issued to fund the acquisition under IRS regulations.

12. SURPLUSING LANDS (s. 373.089(5) –

Lands acquired for conservation purposes – 2/3 vote to dispose of based on a determination no longer needed for conservation purposes. All other lands may be disposed of by majority vote.

After July 1, 1999, Governing Board needs to determine if land acquired for conservation purposes. All lands acquired prior to July 1 are designated as acquired for conservation purposes.

13. DISTRICT RULEMAKING (S.373.1391(6) –

Districts authorized to adopt rules that specify

1) allowable activities on District owned lands, 2) amount of fees, licenses, or other charges for land users, 3) application and reimbursement process for payments in lieu of taxes, 4) use of volunteers for management activities, 5) process for entering into or severing cooperative land management agreements. Rules only become effective after submitted to Senate President and House Speaker not later than 30 days prior to next regular session for Legislature review and approval.

14. FLORIDA FOREVER BONDS (s. 215.618) –

Authorizes issuance of up to $3 billion dollars in Florida Forever bonds for **acquisition and improvement** of land, water areas and related property interests for **purposes of restoration, conservation, recreation, water resource development, or historical preservation**, and for **capital improvements** to lands and water areas that accomplish environmental restoration, enhance public access and recreational enjoyment, promote long-term management goals, and facilitate water resource development subject to provisions of Florida Forever Act and s. 11(e), Art. VII of State Constitution. Fl. Forever bonds equally and ratably secured by Land Acquisition Trust Fund pursuant to s.201.15(1)(a) and payable from taxes distributable to the Land Acquisition Trust fund. Proceeds from the sale of bonds deposited into Florida Forever Trust Fund for distribution by DEP under 259.105. Land Acquisition Trust Fund is continued and recreated pursuant to s. 11(e) , Art. VII, State Constitution. LATF continues for so long as Preservation 2000 bonds or Florida Forever bonds are outstanding and secured.

15. DISTRIBUTION OF DOCUMENTARY STAMP TAXES COLLECTED (s. 201.15) –

Amount to be transferred into Land Acquisition Trust Fund can’t exceed $300 million in FY 2000 to pay debt service, fund debt service reserve funds, etc. for P-2000 bonds, and $300 million in FY 2001 for Florida Forever bonds.

16. FLORIDA FOREVER ADVISORY COUNCIL (s.259.0345) –

Seven member council appointed by the Governor. FACC tasked with preparing a report to be submitted to DEP, TIITF and Legislature **by November 1, 2000**. Report is to establish specific goals identified in 259.105(4) (which applies to Water Management Districts pursuant to 373.199(4)(i), provide recommendations for development and identification of performance measures on progress made toward the goals, provide recommendations on the process by which projects are submitted and approved by Acquisition and Restoration Council. FFAC also to provide a report prior to the regular legislative sessions in years 2002, 04, 06, and 08. Report shall provide recommendations for adjusting the goals in 259.105(4), adjusting percentage distributions in 259.

17. ACQUISITION AND RESTORATION COUNCIL (s. 259.035) –

Created effective March 1, 2000. Nine voting members, four appointed by Governor, remaining five comprised of Secretary of DEP, Director, Division of Forestry, ACS Department, Executive Director, Fish and Wildlife Conservation Commission, Director, Historical Resources, Dept. of Start, and Secretary, DCA, or designees. Council provides assistance to TIITF in reviewing recommendations and plans for state-owned lands required under s. 253.034, consider optimization of multiple use and conservation strategies to accomplish the provisions funded in 259.101.(3)(a)(Florida P-2000 Act)

EXCERPT FROM THE RESTUDY PLAN REPORT REGARDING ASSURANCES TO WATER USERS

The Governing Board directs staff to develop the implementation of the Kissimmee Basin Plan in accordance with the following "assurances":

C&SF Project Comprehensive Review Study, Volume 1, Section 10.2.9 (April 1999)
10.2.9. Assurances To Water Users

The concept of “assurances” is key to the successful implementation of the Comprehensive Plan. Assurances can be defined in part as protecting, during the implementation phases of the Comprehensive Plan, the current level(s) of service for water supply and flood protection that exist within the current applicable Florida permitting statutes. Assurances also involve protection of the natural system.

The current C&SF Project has generally provided most urban and agricultural water users with a level of water supply and flood protection adequate to satisfy their needs. Florida law requires that all reasonable beneficial water uses and natural system demands be met. However, the C&SF Project, or regional system, is just one source of water for south Florida to be used in concert with other traditional and alternative water supplies.

The Governor’s Commission for a Sustainable South Florida developed a consensus-based set of recommendations concerning assurances to existing users, including the natural system (GCFSSF, 1999). The following text is taken from the Commission’s Restudy Plan Report, which was adopted on January 20, 1999:

> “Assurances are needed for existing legal users during the period of plan implementation. It is an important principle that has helped gain consensus for the Restudy that human users will not suffer from the environmental restoration provided by the Restudy. At the same time, assurances are needed that, once restored, South Florida’s natural environment will not again be negatively impacted by water management activities. Getting ‘from here to there’ is a challenge. The implementation plan will be the key to assuring predictability and fairness in the process.
>
> <u>Protecting Current Levels of Service (Water Supply and Flood Protection) during the Transition from the Old to the New C&SF Project.</u>
>
> The goal of a sustainable South Florida is to have a healthy Everglades ecosystem that can coexist with a vibrant economy and quality communities. The current C&SF Project has generally provided most urban and agricultural water users with a level of water supply and flood protection adequate to satisfy their needs. In fact, if properly managed, enough water exists within the South Florida system to meet restoration and future water supply needs for the region. However, past water management activities in South Florida, geared predominantly toward satisfying urban and agricultural demands, have often ignored the many needs of the natural system (GCSSF, 1995; transmittal letter to Governor Chiles, p. 2). Specifically, water managers of the C&SF Project historically discharged vast amounts of water to tide to satisfy their mandate to

provide flood protection for South Florida residents, oftentimes adversely impacting the region's estuarine communities.

The Commission recommended that in the Restudy, the SFWMD and the Corps should ensure that the redesign of the system allows for a resilient and healthy natural system (GCSSF, 1995; p. 51) and ensure an adequate water supply and flood protection for urban, natural, and agricultural needs (GCSSF, 1996a; p.14). In response to the need to restore South Florida's ecosystem, and in light of the expected future increase of urban and agricultural water demands, the Restudy aims to capture a large percentage of water wasted to tide or lost through evapotranspiration for use by both the built and natural systems. In order to maximize water storage, the Restudy intends to use a variety of technologies located throughout the South Florida region so that no one single area bears a disproportionate share of the storage burden. This direction reinforces the Commission's recommendation that water storage must be achieved in all areas of the South Florida system using every practical option (GCSSF, 1996a; p. 25).

However, concerns have been expressed that a water user would be forced to rely on a new water storage technology before that technology is capable of fully providing a water supply source or that existing supplies would otherwise be transferred or limited, and that the user would thereby experience a loss of their current legal water supply level of service. Any widespread use of a new technology certainly has potential limitations; however, the Restudy should address technical uncertainties prior to project authorization and resolve them before implementation in the new C&SF Project. With the addition of increased water storage capabilities, water managers will likely shift many current water users to different water sources.

Additionally, stakeholders are concerned that a preservation of the current level of service for legal uses would not encompass all the urban uses, some of which are not incorporated in the term 'legal' and covered by permit. Specifically, an adequate water supply is needed to address urban environmental preservation efforts as well as water level maintenance to reduce the impact of salt water intrusion.

The Commission believes that in connection with the Restudy, the SFWMD should not transfer existing legal water users from their present sources of supply of water to alternative sources until the new sources can reliably supply the existing legal uses. The SFWMD should implement full use of the capabilities of the new sources, as they become available, while continuing to provide legal water users as needed from current sources. It is the Commission's intent that existing legal water users be protected from the potential loss of existing levels of service resulting from the implementation of the Restudy, to the extent permitted by law.

The Commission also recognizes that the SFWMD cannot transfer the Seminole Tribe of Florida from its current sources of water supply without first obtaining the Tribe's consent. This condition exists pursuant to the Seminole Tribe's Water Rights Compact, authorized by Federal (P.L. 100-228) and State Law (Section 285.165, F.S.).

However, the issues surrounding the development of specific assurances to water users are exceedingly complex and will require substantial additional effort to resolve.

RECOMMENDATION

- The SFWMD and the Corps should work with all stakeholders to develop appropriate water user assurances to be incorporated as part of the Restudy authorizations. These water user assurances should be based on the following principles:

A. Physical or operational modifications to the C&SF Project by the federal government or the SFWMD will not interfere with existing legal uses and will not adversely impact existing levels of service for flood management or water use, consistent with State and federal law.

B. Environmental and other water supply initiatives contained in the Restudy shall be implemented through appropriate State (Chapter 373 F.S.) processes.

C. In its role as local sponsor for the Restudy, the SFWMD will comply with its responsibilities under State water law (Chapter 373 F.S.).

D. Existing Chapter 373 F.S. authority for the SFWMD to manage and protect the water resources shall be preserved.

Water Supply for Natural Systems

Concerns have been raised about long term protection of the Everglades ecosystem. According to WRDA 1996, the C&SF Project is to be rebuilt 'for the purpose of restoring, preserving, and protecting the South Florida ecosystem' and 'to provide for all the water-related needs of the region, including flood control, the enhancement of water supplies, and other objectives served by the C&SF Project.'

Environmental benefits achieved by the Restudy must not be lost to future water demands. When project implementation is complete, there must be ways to protect the natural environment so that the gains of the Restudy are not lost and the natural systems, on which South Florida depends, remain sustainable.

A proactive approach which includes early identification of future environmental water supplies and ways to protect those supplies under Chapter 373 F.S. will minimize future conflict. Reservations for protection of fish and wildlife or public health and safety can be adopted early in the process and conditioned on completion and testing of components to assure that replacement sources for existing users are on line and dependable. The SFWMD should use all available tools, consistent with Florida Statutes, to plan for a fair and predictable transition and long term protection of water resources for the natural and human systems.

Apart from the more general goals of the Restudy, there are specific expectations on the part of the joint sponsors - the State and the federal government. The more discussion that goes into an early agreement on expected outcomes, the less conflict there will be throughout the project construction and operation.

RECOMMENDATIONS

- The SFWMD should use the tools in Chapter 373 F.S. to protect water supplies necessary for a sustainable Everglades ecosystem. This should include early planning and adoption of reservations. These reservations for the natural system should be conditioned on providing a replacement water source for existing legal users which are consistent with the public interest. Such replacement sources should be determined to be on line and dependable before users are required to transfer.

- The SFWMD should expeditiously develop a 'recovery plan' that identifies timely alternative water supply sources for existing legal water users. The recovery plan should consist of water supply sources that can reliably supply existing uses and whose development will not result in a loss of current levels of service, to the extent permitted by law. To assure that long term goals are met, the State and federal governments should agree on specific benefits to water users, including the natural system, that will be maintained during the recovery.
- In the short term, the Restudy should minimize adverse effects of implementation on critical and/or imperiled habitats and populations of State and federally listed threatened and/or endangered species. In the long term, the Restudy should contribute to the recovery of threatened species and their habitats.

Protecting Urban Natural Systems and Water Levels

Water supply for the urban environment is connected to water supply for the Everglades and other natural areas targeted for restoration and preservation under the Restudy.

It is essential that the Restudy projects proposed to restore and preserve the environment of the Everglades do not reduce the availability of water to such an extent in urban areas that the maintenance of water levels and the preservation of natural areas becomes physically or economically infeasible.

The successful restoration of Everglades functions is dependent not only upon the establishment of correct hydropatterns within the remaining Everglades, but also upon the preservation and expansion of wetlands, including those within urban natural areas that once formed the eastern Everglades. Some of the westernmost of these areas have been incorporated in the Restudy as components of the WPAs. However, the on-going preservation efforts of local governments have acquired hundreds of millions of dollars worth of additional natural areas for protection both inside and outside of the WPA footprint.

Water supplies for these urban wetlands are not covered by existing permits or reservations and are therefore, not adequately protected. Efforts are underway at both the SFWMD and the local level to preserve these vital areas and assure their continuing function as natural areas and in ecosystem restoration.

Detailed design for the Restudy, in particular the detailed modeling associated with the WPA Feasibility Study, will make possible plans to protect these urban wetlands from damage and to assure maximum integration with Restudy components.

RECOMMENDATIONS

- The SFWMD and the Corps should acknowledge the important role of urban natural areas as an integral part in the restoration of a functional Everglades system. As a part of the implementation plan, the SFWMD and the Corps should develop an assurance methodology in conjunction with the detailed design and modeling processes, such as the WPA Feasibility Study, to provide the availability of a water supply adequate for urban natural systems and water level maintenance during both implementation and long term operations.

- Expand and accelerate implementation of the WPAs. Accelerate the acquisition of all lands within the WPA footprint to restore hydrologic functions in the Everglades ecosystem, and ensure hydrologic connectivity within the WPA footprint. The WPA Feasibility Study process should be given a high priority. The WPA concept should be expanded into other SFWMD planning areas such as the Upper East Coast.
- The Restudy should assure that the ecological functions of the Pennsuco wetlands are preserved and enhanced."

There is a substantial body of law that relates to the operation of Federal flood control projects, both at the state and Federal level. Much of the Governor's Commission language is directed to the South Florida Water Management District and matters of state law. To the extent that the Governor's Commission's guidance applies to the Corps' actions, the Corps will give it the highest consideration as Restudy planning proceeds and as plan components are constructed and brought on-line consistent with state and Federal law. The recommended Comprehensive Plan does not address or recommend the creation or restriction of new legal entitlements to water supplies or flood control benefits.

AGREEMENT BETWEEN
THE SOUTH FLORIDA WATER MANAGEMENT DISTRICT
AND THE SEMINOLE TRIBE OF FLORIDA
AND WATER SUPPLY PLAN FOR THE BRIGHTON RESERVATION
IMPLEMENTING SECTION VI.B. OF THE WATER RIGHTS
COMPACT AND SUBPARAGRAPH 3.3.3.2.A.3 OF THE CRITERIA MANUAL
(AGREEMENT NO. C-4121)

WHEREAS, the South Florida Water Management District (District) has entered into a Water Rights Compact (Compact) with the State of Florida and the Seminole Tribe of Florida (Tribe); and

WHEREAS, pursuant to Part VI., Section B of the Compact and subparagraph 3.3.3.2.A.3 of the Criteria Manual for the Compact, there is specific authority for the District to take actions to ensure that the Tribe receives the fifteen percent (15%) entitlement set forth in the Compact for the Brighton Reservation; and

WHEREAS, the District makes water supply releases from Lake Istokpoga to maintain the canals at or near optimum until such time as the level of Lake Istokpoga reaches the water supply minimum level as outlined in the regulation schedule for Lake Istokpoga, hereby attached and incorporated as Exhibit "A"; and

WHEREAS, historically, water shortages have' been declared for Lake Istokpoga and the Indian Prairie Basin when Lake Istokpoga reaches the water supply level as outlined in the regulation schedule and the canals reach the minimum levels established in Rule 40E-22.072, Florida Administrative Code, hereby attached and incorporated as Exhibit "B"; and

WHEREAS, the District issued a preliminary report in December, 1988, which concluded that, at times, the lower reaches of the Indian Prairie Basin canals traversing the Seminole Brighton Reservation did not get a fair share of the discharge from Lake Istokpoga and/or run-off generated and that, for various reasons the fifteen percent (15%) minimum entitlement was not always available to the Reservation; and

WHEREAS, the preliminary report also determined that implementation plans would be developed employing specific strategies to assure maximum reliability in delivering the Tribe's fifteen percent (15%) share to the Reservation; and

WHEREAS, the District installed pumps on the C-41 and C-40 canals at S-71 and S-72 respectively, to provide additional water supply from Lake Okeechobee.

NOW, THEREFORE, the District and the Tribe hereby agree, in order to provide the Tribe with its entitled share of surface water for the Brighton Reservation, to implement the provisions of section VI.B. of the Compact and subparagraph 3.3.3.2.A.3 of the Criteria Manual by the following method:

1. <u>No Declared Water Shortage</u>

The District agrees to maintain the water in the C-41 and C-40 canals south of S-70 and S-75 at optimum levels provided that neither Lake Istokpoga nor Lake Okeechobee are in declared water shortages. Optimum levels shall be 19.2 feet mean sea level (msl) in the segment of the C-41 canal between S-70 and S-71 and 20.2 feet msl in the segment of the C-40 canal between S-75 and S-72.

2. <u>Declared Water Shortage in Lake Istokpoga</u>

If Lake Istokpoga is in a declared water shortage and Lake Okeechobee is not in a declared shortage, the District agrees to maintain the water in the C-41 and C-40 canals south of S-70 and S-75 at optimum levels unless and until a shortage is declared for Lake Okeechobee. In order to accomplish this, when Lake Istokpoga is at or below the water supply level of the regulation schedule, the District agrees to operate the pumps at S-71 and S-72 on the C-41 and C-40 canals.

3. <u>Declared Water Shortage in Lake Okeechobee</u>

If Lake Okeechobee is in a declared water shortage, ‘the District agrees to maintain the water in the C-41 and C-40 canals south of S-70 and S-75 at optimum levels through releases from Lake Istokpoga unless and until a shortage is declared for Lake Istokpoga or until Lake Istokpoga reaches the water supply level of the regulation schedule.

a. When sufficient water is not available in Lake Istokpoga to maintain water levels in these canals at optimum levels, the District agrees to operate the pumps at S-71 and S-72 on the C-41 and C-40 canals when Lake Okeechobee is at or above elevation 10 (ten) feet National Geodetic Vertical Datum (NGVD), or utilize available storage in District canals, to supply the minimum water amounts to which the Tribe is entitled under the Compact, as set forth in Table 7 of the December 1988 Technical Report entitled “A Technical Report on Water Availability Estimates for Brighton Reservation.” Table 7 of this report is hereby attached and incorporated as Exhibit “C.”

b. The District shall use its best efforts to operate the pumps at S-71 and S-72 on the C-41 and C-40 canals when the level of Lake Okeechobee falls below 10 (ten) feet NGVD as long as mechanically possible without damaging the pumps, in order to provide the minimum amounts of water identified in Table 7 of the December 1988 Technical Report The District cannot guarantee that the pumps will operate if the level of Lake Okeechobee falls below 10 (ten) feet NGVD.

c. If in any given month the Tribe requests the District to withhold deliveries, in whole or in part, the District will not be responsible for delivery of the quantity of water withheld in a later month.

4. Reserved Lake Okeechobee Water

A sufficient volume of water from Lake Okeechobee, (See column 4 of Table 7 of the December 1988 Technical Report) shall be reserved and set aside in order to satisfy the District's obligations under section VI.B. of the Compact, as specified above in Sections 2 and 3 of this Agreement and Plan. This volume of water shall not be available for other users of water.

5. Education and Training

The District will provide Tribal representatives with appropriate training and education and necessary available data concerning the regulation schedules of both Lake Istokpoga and Lake Okeechobee.

6. Other Provisions

a. This Agreement and Plan may be modified with the consent of the parties, and shall be reviewed as operational data becomes available concerning the mechanical operations for the pumps when the elevation of Lake Okeechobee falls below 10 (ten) feet NGVD.

b. This Agreement and Plan is in full satisfaction of the District's obligations under subsections VI.B.l, 2 and 3 of the Compact and subsection 3.3.3.2 of the Manual.

c. The Tribe warrants that approval of this Agreement and Plan by the Seminole Tribal Council will bind the Tribe to its terms and will provide the District with an opinion of counsel to that effect or, at the option of the Tribe, to obtain any approval by federal authorities that may be necessary.

d. The District warrants that approval of this Agreement and Plan by the District's Governing Board will bind the District to its terms.

e. This Agreement shall commence on the date of execution and continue in full force and effect until such time as it is terminated by the parties by mutual written consent.

f This Agreement shall be subject to the procedures established pursuant to Section VII F and VIII of the Water Rights Compact with respect to disputes and court actions.

g. If it is subsequently determined by a federal court of competent jurisdiction that either of the approvals specified in subsections (c) and (d) of this section were not effective, then this Agreement and Plan shall be null and void.

Dated this 30th day of November, 1992.

SOUTH FLORIDA WATER MANAGEMENT DISTRICT,
BY ITS GOVERNING BOARD

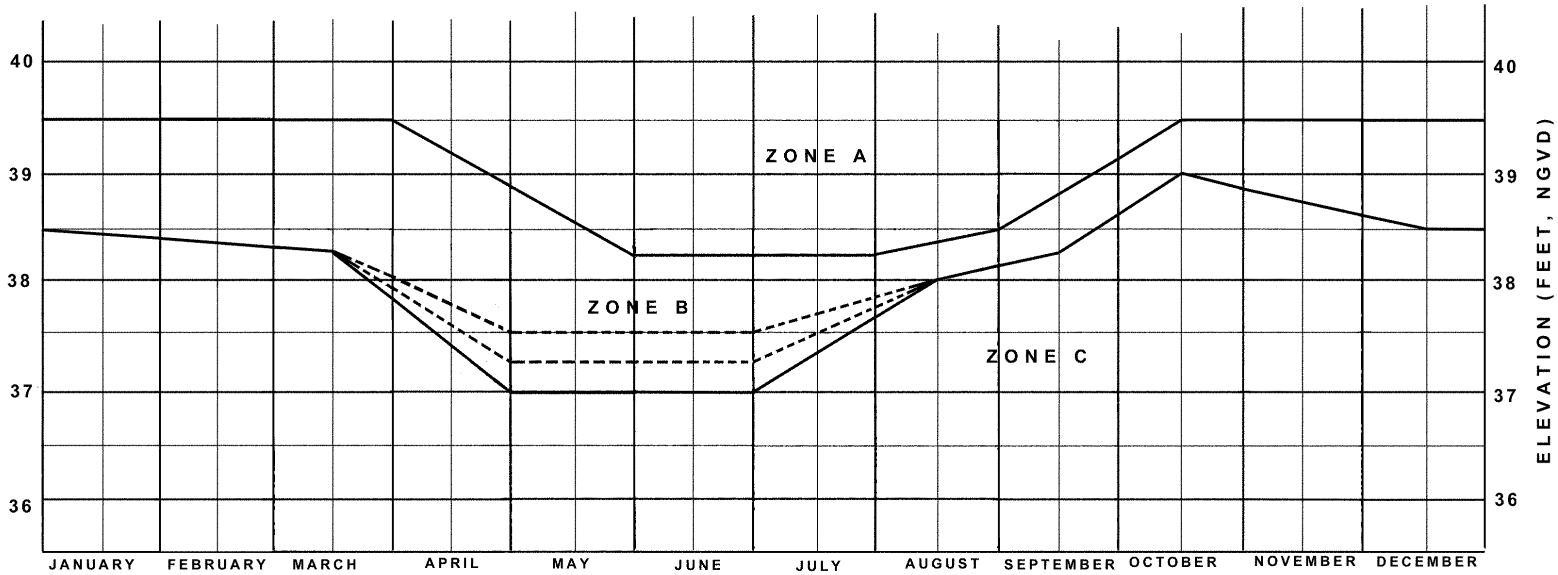
Legal Form Approved

By Thomas K. Wolfe

By: Allan Milledge
Chairman

SEMINOLE TRIBE OF FLORIDA

By:
Title: Chairman



ZONE	RELEASES
A	REGULATORY RELEASES MADE THROUGH ALL OUTLETS: S-68 FIRM CAPACITY 3,000 CFS S-68 SECONDARY CAPACITY UP TO 5,900 CFS ISTOKPOGA CANAL CAPACITY UP TO 800 CFS
*B	WATER SUPPLY RELEASE MADE IF NEEDED
*C	NO RELEASES MADE

	SPECIAL CONDITIONS
	UPPER WATER SUPPLY LINE WILL BE USED FOR ZONE B AND C ONCE THE PROPOSED PUMPS ADJACENT TO S-71 AND S-72 ARE IN OPERATION BY LOCAL INTERESTS
	MIDDLE WATER SUPPLY LINE WILL BE USED ONCE THE PROPOSED PUMP ADJACENT TO S-71 IS IN OPERATION
	IT MIGHT BE NECESSARY TO DRAW THE LAKE DOWN TO 37.5 FT M.S.L. IF THIS LEVEL HAS NOT BEEN REACHED FOR AN AN EXTENDED PERIOD OF TIME

CENTRAL AND SOUTHERN FLORIDA
KISSIMMEE RIVER BASIN

REGULATION SCHEDULE

LAKE ISTOKPOGA

U.S. ARMY ENGINEER DISTRICT JACKSONVILLE
CORPS OF ENGINEERS, JACKSONVILLE FLA

Exhibit A

40E-22.072 Minimum Levels.

The following minimum levels shall be maintained.

(1) Lake Istokpoga

(a) The minimum levels for Lake Istokpoga are shown in Figure 22-2.

(b) The District may. after public notice, allow the minimum levels in Figure 22-2 to be temporarily lowered for environmental or water quality reasons.

(2) Primary Canals (feet above mean sea level)

	CANAL	**LEVEL**
(a)	Canal 39-A above Structure 75	22.5
(b)	Canal 40 above Structure 72	17.7
(c)	Canal 41 above Structure 71	17.0
(d)	Canal 41 above Structure 70	22.5
(e)	Canal 41-A above Structure 84	21.7
(f)	Canal 41-A above Structures 82 and 83	29.0
(g)	Borrow Canal of Interceptor Levee 59	17.7
(h)	Borrow Canal of Interceptor Levee 60	17.7
(i)	Borrow Canal of Interceptor Levee 6	17.0

Specific Authority *373.044,373.113 FS.*
Law Implemented *373.042,373.086,373.103(4) F.S.*
History — New *9-3-81.*
Formerly *16K-30.03, 16K-30.05, 40E-21.072.*

Exhibit B

Table 7

Water Availability Estimates
(acre-feet)

Month	(1) Water Available in Lake Istokpoga	(2) Runoff Generated in the Basin	(3) Water Available to the basin (1)+ (2)	(4) Presumptive Water Availability for the Reservation 15% of(3)
January	10,148	2,002	12,150	1,823
February	10,856	2,498	13,354	2,003
March	22,369	3,583	25,952	3,893
April	17,801	1,755	19,556	2,933
May	15,4.47	5,352	20,799	3,120
June	17,180	21,090	38,270	5,741
July	19,859	19,950	39,809	5,971
August	22,909	16,950	39,859	5,979
September	19,475	17,250	36,725	5,509
October	15,717	8,760	24,477	3,672
November	10,4.82	1,927	12,490	1,861
December	7,109	1,983	9,092	1,364

Exhibit C

3.3.3.2 Special Provisions Applicable to Specified Reservation and Tribal Trust Lands.

A. Brighton Reservation --

1. The District shall determine, to the degree possible, whether the Tribe is getting its share of surface water, as specified in the Compact from the District canals and from District borrow canals calculated by the District on a monthly basis, and shall take the necessary steps to provide solutions to the water supply problems.

   The District shall:

   i. Examine operational criteria for District structures in the Indian Prairie Basin to balance the available surface water in the northern and southern areas of the system;

   ii. To the extent feasible, seek to eliminate structural bypasses in the Indian Prairie Basin and uses of Indian Prairie Basin water by those outside the basin by substituting an alternate source for such uses; and

   iii. Cooperate with the Tribe to identify functional problems within the Tribe's internal water supply system.

MEMORANDUM OF UNDERSTANDING
BETWEEN
ST. JOHNS RIVER WATER MANAGEMENT DISTRICT
AND
SOUTH FLORIDA WATER MANAGEMENT DISTRICT
AND,
SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

The *St. Johns River Water Management District* ("St. Johns"), the *South Florida Water Management District* ('"South Florida"), and the *Southwest Florida Water Management District* ("Southwest Florida"), enter into this *Memorandum of Understanding* to accomplish the goals and purposes stated below.

Whereas St. Johns, South Florida, and Southwest Florida are legislatively created regional agencies of the state with abutting geographic boundaries:

Whereas St. Johns, South Florida, and Southwest Florida each have existing programs to assess hydrologic conditions, to plan for future water supply needs, to regulate consumptive uses of water, and to declare water shortages within their boundaries;

Whereas St. Johns, South Florida, and Southwest Florida desire to cooperate in the areas of water resource investigation, water supply planning, water use regulation, and water shortage management where such cooperation is prudent and efficient;

Whereas St. Johns, South Florida, and Southwest Florida find that cooperation in the areas of water resource investigation, planning, water use regulation and water shortage management is prudent and efficient in situations arising outside the context of Section 373.2295, Florida Statutes, (F.S.) *Interdistrict transfers of groundwater,*

Now therefore, St. Johns, South Florida, and Southwest Florida (collectively referred to hereinafter as the Districts), agree as follows:

This Memorandum of Understanding addresses interdistrict coordination in five subject areas, including:

Part I - Water Resource Investigations,
Part II - Water Supply Planning,
Part III - Water Use Regulation,
Part IV - Water Shortage Management, and
Part V - General Provisions.

For each subject area, a geographic area within which coordination will be applicable is described and coordination procedures are outlined.

I. Water Resource Investigations

Geographic Area: The area to be' considered for water resource investigation coordination is the entirety of each of the Districts.

Coordination between districts will involve: (A) collection and management of hydrologic data and (B) data modeling.

A. Data Collection and Management - each of the districts has ongoing hydrologic data collection and management programs. These programs collect data on rainfall, evapotranspiration, surface water levels and flows, ground water levels, aquifer characteristics, water quality and water use, among other parameters. By improving consistency and exploring areas for improved efficiency and effectiveness, coordination between the districts can be beneficial to each district, as well as third parties which utilize district hydrologic data.

In order to increase efficiency and avoid unnecessary duplication of efforts, the Districts agree to cooperate as follows:

1. Coordination will be accomplished by a team of personnel from the Districts. The team shall cooperate closely with the Interdistrict Data Collection Focus Group and shall include technical staff from each district familiar with hydrologic data collection, databases, and GIS development, including at least one Data Collection Focus Group member from each district.

2. Hydrologic data contained within existing and/or future databases will be organized and sufficiently documented so that data can be easily shared by personnel of the Districts. Specific examples are listed below:

- Hydrologic, geologic, and water use permit information will be stored in databases that are available for access by appropriate district personnel.

- Geographic Information System (GIS) coverages will be shared.

Development and extension of hydrologic databases and networks will be coordinated by personnel of the Districts', with the goal being the development of a comprehensive water resources observation network.

3. Each of the districts has a number of hydrologic investigations and modeling efforts which extend beyond the boundaries of that particular district in order to encompass the entire water resource unit (e.g., an entire aquifer system) and/or to address factors which may have impacts upon the resource under investigation (e.g., water withdrawals outside of, but

influencing, a ground or surface water resource). The Districts agree to share all available existing hydrologic data, including but not limited to permitted withdrawal locations, amounts, water use types, and other related information in a form compatible with model requirements, as well as to coordinate in the collection of additional hydrologic data determined to be necessary for specific modeling purposes. for such hydrologic investigations which cross district boundaries.

4. The Districts will coordinate in the acquisition of data collection equipment and services in an effort to ensure compatibility and achieve monetary savings.

B. Hydrologic Modeling - A number of modeling efforts initiated by a particular district may transcend that district's boundaries and encompass a part of an adjacent district. It is necessary in such cases for the Districts to coordinate their respective hydrologic modeling efforts. Coordination will be aimed at assuring consistency in model development, data sets and results where model boundaries coincide or overlap.

In order to accomplish this coordination, the Districts agree to cooperate as follows:

I. Coordination will be accomplished by a team of personnel from the Districts comprised of staff members who are knowledgeable of the modeling efforts at their respective districts. The team shall meet at a minimum twice per year to review progress on specific modeling efforts and to seek input from other district team members. This coordination is in addition to coordination that may be ongoing between respective district staff involved in specific modeling efforts.

2. Coordination will include model conceptualization, selection of data points and parameters, review of calibration runs, and review of preliminary and final results, as appropriate. The Districts agree to subject each applicable modeling effort to peer review by appropriate staff from each distfict prior to finalization, with the common goal of a uniform interpretation. This coordination may include methodologies used to produce rainfall intensity/frequency/duration maps. Where differences result in discrepancies between model results in the vicinity of the Districts' common boundaries, the Districts shall seek to achieve consistency.

II. Water Supply Planning

Pursuant to Section 373.036(2), F.S., the Districts must, as a part of their District Water Management Plans, identify one or more water supply planning regions that singly or together encompass the entire district and prepare a Districtwide Water Supply Assessment. As part of the planning effort, the Districts are initiating water supply planning for their entire district or based upon the results of the assessments. limiting the planning area to areas where " *sources of water are not adequate for the planning period to supply water for all existing and projected reasonable-beneficial uses and to sustain the water resources and related natural systems"* subsection (373.0361(l), F,S.)

The purpose of this section is to seek consistency and coordination, as appropriate, among' the Districts in these respective water supply planning initiatives. This consistency is particularly important within those local governments encompassed by more than one district as well as in other common boundary areas.

Geographic Area: The areas within which water supply planning coordination will be considered include all appropriate water supply planning regions or portions thereof within the Districts.

A. Coordination will be accomplished by a team of personnel from the Districts comprised of staff members who are knowledgeable of the water supply planning efforts at their respective district. The team shall meet at a minimum twice per year to review progress on water supply planning efforts and to seek input from other district team members.

B. In order to achieve consistency in water supply planning, the Districts agree to the following:

1. The Districts will make water use projections for their respective areas following the recommendations of the interdistrict Water Planning Coordination Group (created by DEP pursuant to Executive Order 96-297). Water Demand Projections Subcommittee, as reflected in its Final Report, dated April, 1998, as may be amended from time to time by consensus of the Districts. For all local governments divided by the Districts' boundaries, the appropriate districts will agree upon consistent population and water use estimates and projections.

2. The Districts will work together to jointly identify factors for consideration by each district when determining that regional water supply planning must be coordinated within an area and to develop consistent methods to be used to delineate the extent of the area for which planning will be coordinated.

3. When the Districts have determined that regional water supply planning must be coordinated within an area, the Districts agree to coordinate in the identification of water supply options for that area. The Districts will develop a strategy for performance of investigations of traditional and alternative water supply options and shall also cooperate in the development of joint implementation strategies for the identified water supply options.

4. When one of the Districts timely receives a complete application for funding of an alternative water supply project under subsection 373.1961(2). F.S. the district receiving the application shall consider as one factor, under its subsection 373.1961(2), F.S. program guidelines, another district's approval of *funding for* the same or a related alternative water supply project under its subsection 373.1961(2), F.S. program. This provision shall not obligate either district to provide funding for a water supply project located outside its boundaries.

C. In order to achieve consistency in 'water supply planning-related technical assistance to local governments, tile Districts agree to do the following:

1. The Districts will coordinate with each other in their review of *comprehensive plan* amendments which involve any water supply issues which could impact another district, as follows:

a. The district receiving notification of a proposed comprehensive plan amendment involving any water supply issues which could impact another district, will notify the other district of receipt of the notice of the proposed change, and if requested, forward a copy of the pertinent information to the other district(s) upon receipt of the proposed amendment.

b. The Districts will coordinate in the preparation of comments to the Florida Department of Community Affairs (DCA) on comprehensive plan amendments of interest to each district. The district in which the change is proposed shall forward preliminary comments to the other district(s) in as timely a manner as possible prior to the date comments are due to the DCA. The district(s) receiving those preliminary comments shall respond with any recommended revisions or additional concerns in as timely a manner as possible.

c. In cases where a proposed amendment to a policy or land use designation directly involves lands which are divided by district boundaries, the appropriate districts will coordinate in developing their comments to the DCA, with each district forwarding their own comments to DCA. The coordination should consist of discussions between the districts and draft comments forwarded to each other in as timely a manner as possible prior to the deadline to send comments to DCA.

2. The Districts will coordinate in the provision of technical assistance to the local governments which are divided by water management district boundaries through the preparation and future updating of the Integrated Plan portions of each district's District Water Management Plan for each such county. Pursuant to this Memorandum of Understanding, the Districts agree to the division of responsibilities for the preparation and updating of these Integrated Plans as shown in Exhibit 1. In addition, the Districts agree to discuss major water resource projects and data with each other prior to delivery of that information to the affected local governments.

III. Water Use Regulation

Geographic Area: The area to be considered for water use regulation coordination purposes generally includes a five mile distance on either side of joint district boundaries (see Exhibit 2). In addition, for purposes of coordination between the SJRWMD and SFWMD, the area shall also include those parts of Osceola and Orange counties that lie within the boundaries of the respective districts.

A. Coordination will be accomplished by a team of personnel from the, Districts comprised Of staff members who are knowledgeable of the water use regulation efforts at their respective districts. The team shall meet at a minimum twice per year to review progress on water supply planning efforts and to seek input from other district team members.

B. In order to achieve a comprehensive review of proposed withdrawals of water within one water management district which may have impacts within one or more of the other districts, and in an effort to better protect the water resources of the state, within the geographic area defined above and delineated on Exhibit 2 as "water use regulation coordination area", the staff of the Districts will do the following for all proposed uses of groundwater from the Floridan aquifer. equal to or greater than 1,000,000 gallons per day:

1. Whenever possible, the Districts shall notify each other prior to pre-application meetings and when requested, shall arrange a joint pre-application meeting between the affected district(s) and the applicant.

2. A copy of the Notice of Receipt of Application shall be provided to the commenting district(s), preferably no later than 7 days following actual receipt of the application. A copy of the application and supporting technical information together with the name and phone number of the reviewing hydrologist shall be included with the Notice.

3. Comments on the application should be provided to the reviewing district no later than 21 days following receipt of the application by the commenting district(s). The comments shall indicate whether a copy of subsequently submitted compliance information required under the permit is desired.

4. A copy of any correspondence between the reviewing district and the applicant should be provided to the commenting district(s) contemporaneously with either mailing or receipt. If any additional comments are necessitated by receipt of such correspondence, the commenting district(s) shall communicate these in as timely a manner as possible.

5. If comments are received from another district, these comments should be incorporated in any subsequent requests for additional information or in the staff report issued by the reviewing district. as appropriate and consistent with the reviewing district's rules.

6. A copy of the Notice of Intended or Proposed Agency Action, whichever is appropriate to the reviewing district, should be provided to the commenting district(s) contemporaneously with its provision to the applicant.

The Districts each agree to forward to the others' designated regulation contact person copies of staff reports or abstracts and actual permits (if substantially different from the staff recommendation) for all appropriate applications requesting uses of water equal to or greater than 100.000 gallons per day on an average annual basis. These documents should be provided contemporaneously with their provision to applicants.

The Districts each agree to forward monthly to the others' designated regulation contact person a co y of the Regulatory agenda, as revised at the Governing Board meeting. The agendas should be provided no later than 30 days after the Governing Board meeting date.

IV. Water Shortage Management

Geographic Area: The area to be included for water shortage management coordination is depicted in Exhibit 3.

In order to enhance the effectiveness of current and future water shortage declarations and to 0enhance interdistrict efficiency by avoiding unnecessary duplication of related efforts, the Districts agree to cooperate as follows:

A. Coordination will be accomplished by a team of personnel from the Districts who are familiar with each district's respective water shortage programs. This staff team will meet on a regular and as-needed basis.

B. Each district will provide the following information to the two other districts: a detailed description of the factors currently monitored to determine whether to declare a water shortage (i.e., specific hydrologic conditions, water demand, and other data), a schedule which indicates the frequency at which each of these factors is collected and analyzed, and a description of the committee or other staff arrangement which currently conducts the monitoring and analysis efforts

C . The Districts will identify and implement appropriate means of coordinating these monitoring and analysis efforts. At a minimum, a mechanism for notifying one another of- current monitoring and analysis results shall be established. When applicable, databases included or analogous to those described in the "Water Resource Investigations" and "Water Supply Planning" sections of this Memorandum of Understanding will be utilized.

D. The Districts will establish a mechanism for notifying one another of recommended and adopted water shortage orders (declarations, modifications and rescissions). At a minimum, this mechanism should fulfill the following coordination needs:

1. Any recommendation for a Governing Board issued water shortage order or emergency order, notification shall, whenever practicable, occur prior to the applicable Governing Board meeting; and

2. Any adopted Governing Board order or emergency order, timely transmittal of the signed order and samples of related permittee and/or public communication mate rials as soon as available.

E. The Districts will respond to each notification or transmittal (described in Paragraph number 4 above), by providing any comments in as timely a manner is possible.

V. General Provisions

In order to ensure the orderly administration of this MOU, the staff of the Districts will do the following:

A. The Districts' executive directors will each designate in writing one position for each of the four areas of coordination, including Water Resource Investigations, Water Supply Planning, Water Use Regulation and Water Shortage Management, to oversee the administration of this MOU. These staff shall also serve as the principal contact persons for the districts under this MOU.

B. The Districts shall meet in April and October of each year to assess compliance with this MOU and its effectiveness in achieving the above-stated purposes and goals. Any concems with the language of the MOU or problems with implementation may also be addressed at these meetings.

C. The responsibility for the meeting arrangements shall be rotated annually amongst the Districts, beginning with St. Johns.

D. This MOU may be amended in writing by mutual agreement of the Districts. Any district may terminate its participation in this MOU by providing 60 days written notice to the other.

E. Nothing herein should be construed to conflict with any requirement of Chapter 373, F.S., or water management district rules.

AGREED TO this 28th day of October, 1998.

ST. JOHNS RIVER WATER MANAGEMENT DISTRICT GOVERNING BOARD

BY: [signature]
JAMES DANIEL ROACH
CHAIRMAN

BY: [signature]
OTIS MASON
SECRETARY

SOUTH FLORIDA WATER MANAGEMENT DISTRICT GOVERNING BOARD

BY: Frank Williamson Jr
FRANK WILLIAMSON, JR.
CHAIRMAN

BY: Sam E Poole III
SAMUEL E. POOLE, III
SECRETARY

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT GOVERNING BOARD

BY: Jim Allen
JIM ALLEN
CHAIRMAN

BY: Sally Thompson
SALLY THOMPSON
SECRETARY

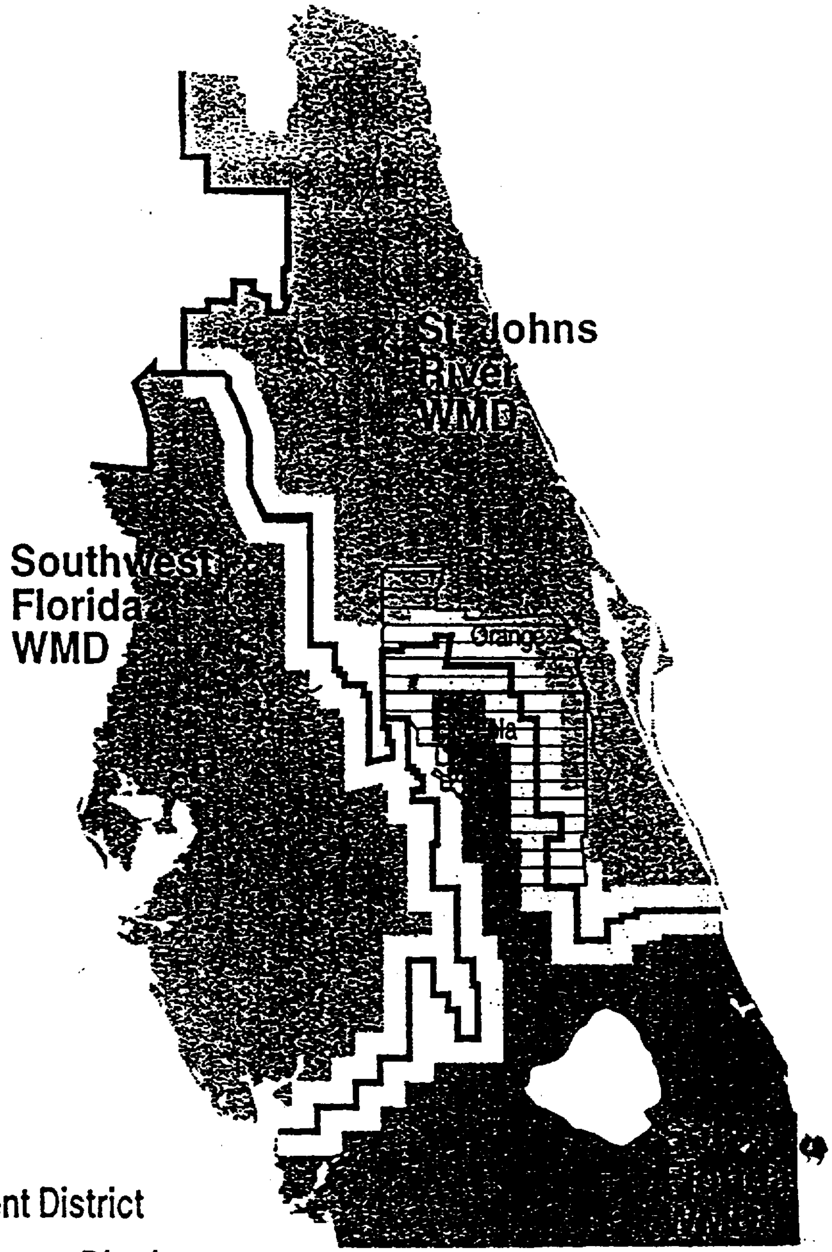
MEMORANDUM OF UNDERSTANDING

EXHIBIT I

RESPONSIBILITIES FOR THE PREPARATION OF
DISTRICT WATER MANAGEMENT PLAN
INTEGRATED PLANS

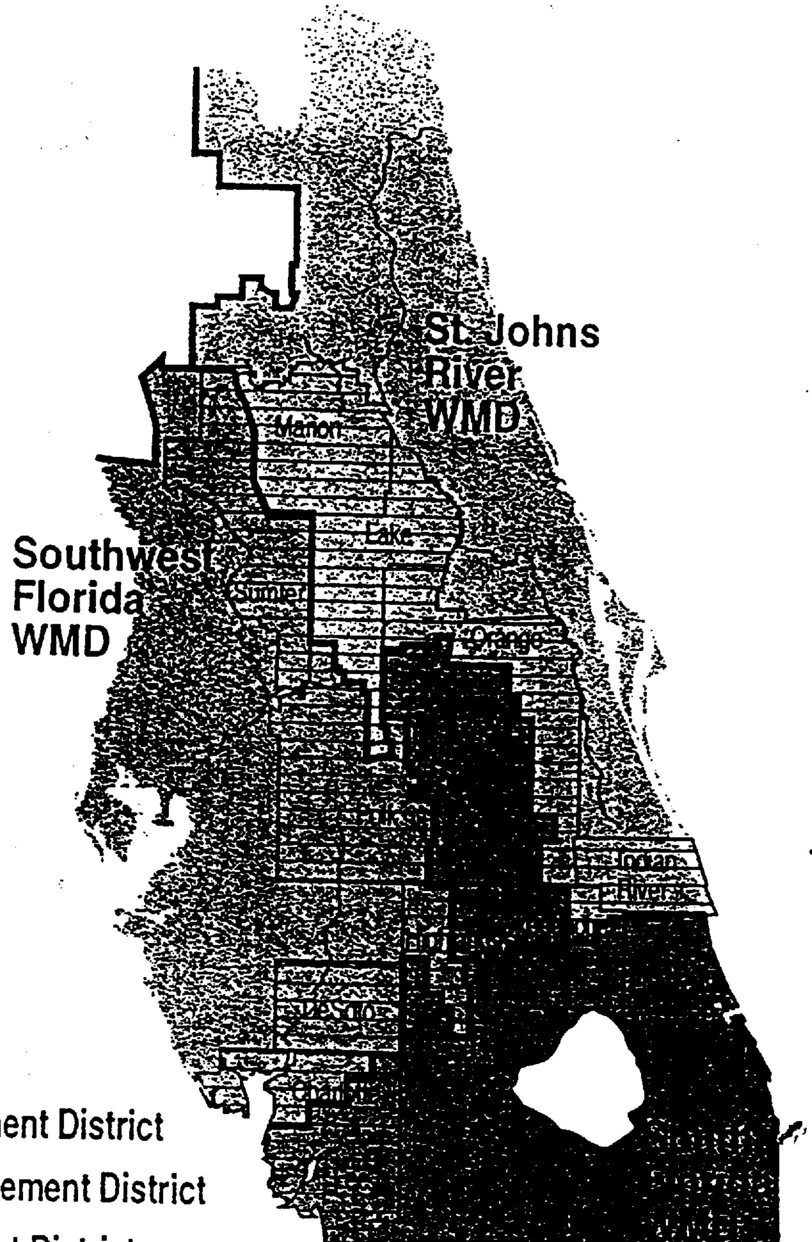
COUNTY	LEAD AND SUPPORT DISTRICTS		
	SJRWMD	**SFWMD**	**SWFWMD**
Charlotte		Support	Lead
Highlands		Support	Lead
Lake	Lead		Support
Marion	Lead		Support
Okeechobee	Support	Lead	
Orange	Lead	Support	
Osceola	Support	Lead	
Polk	Support	Support	Lead

Exhibit 2
Water Use Regulation Coordination Area



- Five Mile Zone
- St. Johns River Water Management District
- Southwest Florida Water Management District
- South Florida Water Management District
- Water
- Joint District Boundaries
- SJRWMD/SFWMD "Orange/Osceola" Coordination Area

Exhibit 3
Water Shortage Coordination Area



St. Johns River Water Management District

Southwest Florida Water Management District

South Florida Water Management District

Water

Joint District Boundaries

Counties for Water Shortage Coordination

Appendix B
RAINFALL ANALYSIS

A primary goal of the Kissimmee Basin (KB) Water Supply Plan is to identify areas of expected water supply shortage and the frequency with which those shortages may occur. Rainfall is responsible for nearly all surface water inflows and outflows in the KB Planning Area and is the single most important source of recharge to the Surficial Aquifer System (SAS). Rainfall is also the single most important variable controlling the occurrence of water shortages in the KB Planning Area.

RAINFALL DISTRIBUTION

Since rainfall varies from county to county within the KB Planning Area, eleven rainfall stations distributed throughout the KB Planning Area were used to determine mean rainfall data (**Figure B-1**). These stations were chosen because they have relatively long and reliable records. A summary of the data is presented in **Table B-1**. The table also lists the period of record for each station, as well as the DBKEYs used to retrieve the data from the District's DBHYDRO database.

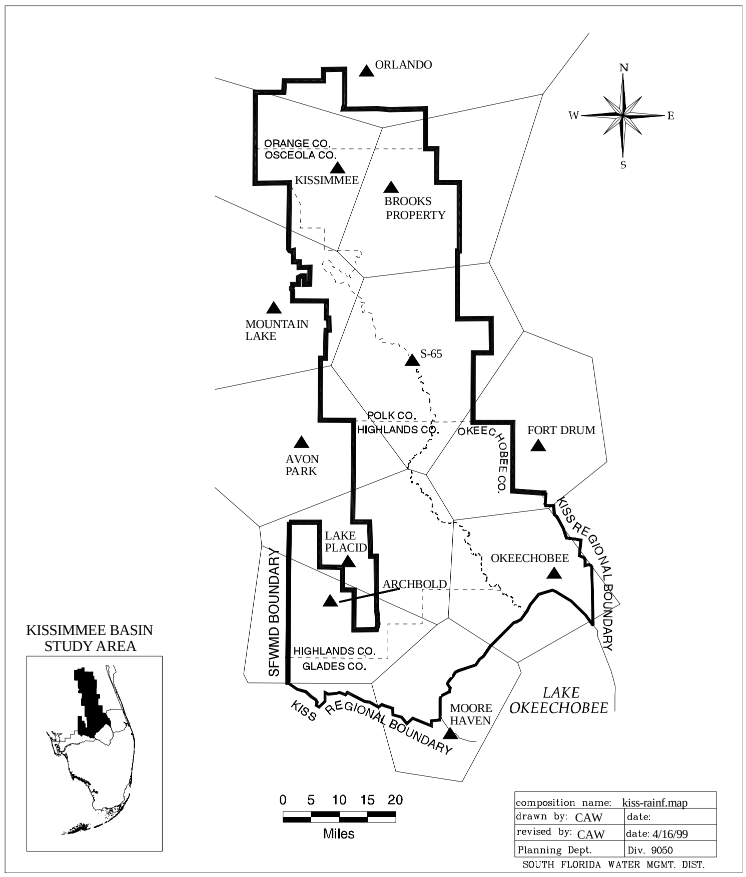


Figure B-1. Rainfall Stations in the Kissimmee Basin Planning Area.

The mean annual rainfall for the KB Planning Area is 50.14 inches. The mean monthly distribution of rainfall at the eleven stations is presented in **Figure B-2**. The wet period begins on June 1 and ends on October 31, with the heaviest rainfall usually occurring in June or September. The dry period begins on November 1 and ends on May 31. December is usually the month with the lowest rainfall.

Monthly and annual rainfall recorded at each station for the entire period of record are presented in **Tables B-2** through **B-12**. The annual and monthly means for each station are also presented in these tables.

Table B-1. Mean Rainfall Data for Rainfall Stations in the Kissimmee Planning Area.

County	Rainfall Station	Average Annual Rainfall (inches)	Years and Period of Record	Maximum Monthly Rainfall		Minimum Monthly Rainfall		% Rain Falling in Wet Season	Primary DBKEY[a]
				inches	month	inches	month		
Glades	Moore Haven	48.72	56 1940-1995	7.69	Jun	1.60	Dec	65.8	06124
Highlands	Archbold	49.16	53 1929-1995	7.81	Jun	1.56	Dec	65.7	06205
	Avon Park	52.25	82 1902-1995	8.27	Jun	1.71	Nov	66.2	06136
	Lake Placid	49.73	50 1933-1995	8.05	Jun	1.47	Dec	65.8	06137
Okeechobee	Fort Drum	50.96	40 1956-1995	7.61	Jun	1.72	Dec	63.8	06141
	Okeechobee	48.53	67 1922-1995	7.35	Jun	1.56	Dec	64.2	06196, 06152, 06070, 06020
Orange	Orlando	51.97	89 1900-1995	7.80	Jul	1.89	Nov	62.9	06185
Osceola	Kissimmee	49.63	81 1901-1995	7.46	Jul	1.95	Nov	62.7	06146, 06147
	Brooks Property	48.91	30 1963-1995	7.49	Jul	1.99	Apr	62.5	05813
	S-65	50.79	31 1965-1995	7.90	Jun	1.78	Dec	63.2	05940
Polk	Mountain Lake	50.95	61 1935-1995	7.82	Jul	1.96	Nov	62.5	06134
Overall average		50.14		7.75		1.75		64.1	

a. For those interested in accessing DBHYDRO. Missing data were replaced with data from nearby stations, when available. Some years were excluded when values were missing and no nearby stations were available.

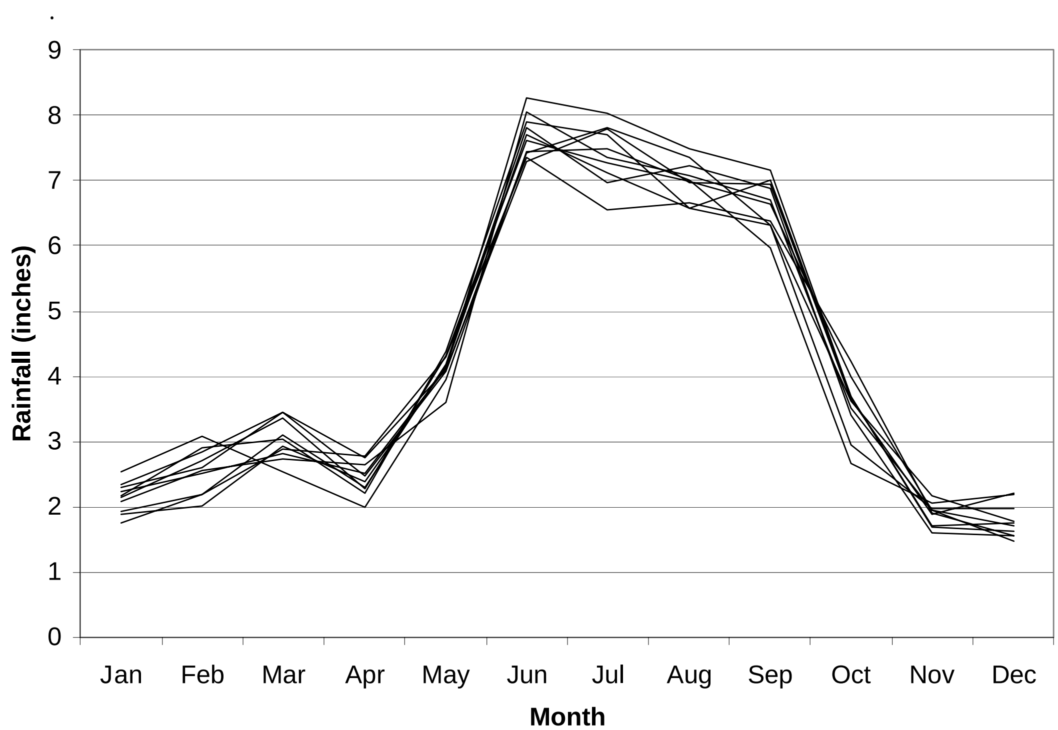


Figure B-2. Mean Monthly Distribution of Rainfall at Eleven Stations in the Kissimmee Basin Planning Area.

Table B-2. Monthly Mean Rainfall (inches) at Archbold Rainfall Station.[a]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SUM
1929	1.13	0.54	1.62	2.01	6.32	9.84	3.96	6.59	14.18	1.70	0.86	2.29	51.04
1930	1.37	2.98	8.53	4.87	12.64	7.94	3.36	8.79	12.37	1.68	0.29	3.21	68.03
1931	3.13	0.86	1.15	6.50	5.09	4.82	2.85	5.15	5.75	1.73	0.00	2.36	39.39
1941	3.90	3.30	3.71	5.10	1.06	9.47	9.13	6.73	4.32	5.32	2.77	1.84	56.65
1943	1.10	0.05	5.84	1.33	2.99	3.54	6.60	2.48	2.99	4.54	1.27	0.00	32.73
1946	0.71	2.47	1.81	0.23	3.26	2.54	3.53	4.71	3.30	1.35	2.62	1.12	27.65
1948	4.50	0.21	0.66	4.99	1.94	1.27	4.21	5.25	16.99	1.22	0.46	0.78	42.48
1949	0.00	0.05	0.45	3.89	6.09	5.36	8.99	8.76	10.14	0.39	1.20	1.01	46.33
1950	0.00	0.96	1.45	2.72	1.92	2.95	2.15	9.99	2.98	3.66	0.83	1.13	30.74
1951	0.00	1.98	0.40	5.94	0.56	4.21	6.69	6.42	5.96	15.31	2.52	0.06	50.05
1952	0.81	4.15	2.22	0.60	5.20	2.78	4.51	9.85	2.62	9.12	0.62	0.95	43.43
1953	3.10	1.75	1.81	3.49	2.21	16.46	6.91	11.18	11.05	6.22	1.27	0.85	66.30
1954	0.09	2.78	1.28	3.12	3.16	6.52	8.15	8.81	5.81	1.20	2.21	1.90	45.03
1955	2.09	0.99	1.41	1.15	4.21	5.79	8.32	3.24	5.65	1.04	0.25	0.47	34.61
1956	0.92	0.99	0.28	1.69	2.25	4.21	13.09	6.37	3.14	1.18	0.70	0.06	34.88
1957	1.31	4.69	4.13	2.81	4.28	12.91	9.37	10.26	8.66	2.03	1.41	3.45	65.31
1958	5.60	1.09	4.73	3.33	6.99	6.81	6.08	9.04	2.25	2.88	0.00	3.05	51.85
1959	1.38	1.42	5.94	1.19	4.39	10.19	5.68	6.08	8.86	11.17	0.78	1.98	59.06
1960	0.78	4.75	6.96	1.85	5.31	7.45	11.22	6.06	9.37	3.25	0.52	1.20	58.72
1961	3.34	0.99	4.15	2.04	5.51	2.35	6.03	9.56	1.56	1.30	0.31	0.26	37.40
1962	0.64	0.37	4.39	1.02	4.73	12.67	2.86	6.66	13.83	0.36	3.30	0.40	51.23
1963	1.40	4.28	1.01	0.32	8.21	4.36	2.81	3.70	11.12	0.45	4.39	2.43	44.48
1964	2.19	4.98	0.64	0.52	1.66	5.45	4.82	4.71	5.23	1.58	0.74	0.80	33.32
1965	0.20	2.15	4.72	1.34	3.53	10.24	4.91	8.65	6.22	8.29	0.12	0.43	50.80
1966	1.93	2.36	0.80	2.45	5.44	11.56	3.51	7.75	10.98	0.77	0.10	1.09	48.74
1967	1.19	3.71	0.26	0.51	1.77	12.57	9.43	4.91	6.12	2.99	0.29	1.94	45.69
1968	0.92	1.56	0.73	0.15	8.05	12.11	6.11	5.46	4.13	7.63	2.91	0.25	50.01
1969	1.26	1.56	7.43	1.79	4.19	12.21	6.09	5.99	9.65	8.40	2.69	2.83	64.09
1970	4.78	3.57	8.85	0.19	4.97	8.62	8.94	4.24	4.93	3.16	0.12	0.31	52.68
1971	0.57	1.80	1.06	0.08	2.42	7.89	5.79	9.06	7.22	3.20	1.28	1.08	41.45
1972	0.25	2.99	0.78	5.90	2.25	10.53	3.90	5.35	4.27	3.35	3.52	1.97	45.06
1973	5.11	2.86	2.93	4.90	4.41	5.47	8.27	6.43	9.97	3.47	0.29	2.39	56.50
1974	0.33	1.09	0.05	1.41	5.39	14.12	16.89	10.23	4.87	0.56	0.53	2.93	58.40
1975	0.13	0.49	1.04	1.81	6.97	8.63	8.76	5.84	5.55	3.07	0.13	0.60	43.02
1976	0.08	0.76	2.45	1.88	4.98	9.75	6.50	7.65	6.61	3.42	1.75	1.19	47.02
1977	1.91	0.53	1.02	0.69	6.53	6.60	4.68	9.17	9.87	3.29	4.17	4.90	53.36
1978	1.81	2.38	3.16	0.43	7.00	9.04	10.00	7.71	4.24	3.63	1.76	4.16	55.32
1979	7.91	1.09	2.21	1.37	4.81	1.70	10.58	12.76	14.15	0.96	0.90	2.45	60.89
1980	3.72	1.65	1.47	3.90	3.90	2.40	6.64	4.71	2.92	0.40	3.21	1.34	36.26
1981	0.36	3.46	1.24	0.16	2.82	10.38	7.50	10.54	6.02	0.98	1.35	0.22	45.03

Table B-2. (Continued) Monthly Mean Rainfall (inches) at Archbold Rainfall Station.[a]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SUM
1982	1.16	2.06	6.52	4.15	6.96	11.14	7.79	5.97	10.65	2.59	1.57	0.51	61.07
1983	4.41	10.85	4.83	2.63	1.01	5.44	7.31	6.74	2.37	5.18	1.84	2.45	55.06
1984	0.45	2.93	6.42	2.75	5.09	7.39	13.09	2.71	3.70	0.13	3.13	0.61	48.40
1985	0.40	0.76	2.29	3.47	2.77	7.20	7.10	4.93	6.46	4.37	2.62	1.60	43.97
1986	1.33	0.78	6.03	0.21	1.56	15.85	7.75	8.14	5.06	4.05	0.08	3.35	54.19
1987	3.10	1.14	6.61	0.52	2.44	3.27	4.52	3.50	9.92	6.63	5.94	1.23	48.82
1988	2.39	2.37	6.21	1.47	2.90	3.01	9.29	10.20	2.41	1.81	3.80	1.73	47.59
1989	2.03	0.33	4.11	2.98	2.21	4.79	7.60	7.80	8.10	4.35	0.97	2.54	47.81
1990	2.21	3.27	1.79	1.34	1.72	9.20	10.89	9.40	3.88	0.53	0.45	1.01	45.69
1991	5.17	1.48	4.61	2.03	5.87	7.37	8.66	7.39	4.04	2.98	0.86	0.88	51.34
1992	0.36	4.73	2.26	4.91	3.84	15.77	4.67	12.12	6.71	1.91	4.37	0.58	62.23
1994	3.82	1.84	3.49	2.00	4.30	11.35	3.64	9.03	8.31	2.57	4.16	3.83	58.34
1995	2.89	2.99	4.72	3.27	2.05	8.35	7.56	8.15	6.92	7.15	1.20	0.68	55.93
Mean	1.92	2.19	3.11	2.29	4.19	7.81	6.98	7.22	6.88	3.41	1.61	1.56	49.16

a. More recent data for these data series can be obtained from the hydrologic data base DBHYDRO. For more information contact Angela Chong (SFWMD) at (561) 682-6514.

Table B-3. Monthly Mean Rainfall (inches) at Avon Park Rainfall Station.[a]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SUM
1902	0.27	5.49	3.29	1.44	3.71	5.70	8.68	4.43	9.03	7.77	1.77	2.44	54.02
1903	5.22	5.40	5.85	0.16	1.98	5.63	6.61	4.85	8.84	1.42	4.69	1.40	52.05
1904	4.09	2.73	0.96	2.42	3.82	10.25	7.56	5.96	5.39	11.25	2.90	1.46	58.79
1905	0.60	0.61	3.51	3.01	6.99	4.48	13.70	12.72	5.66	3.86	0.19	11.09	66.42
1906	4.54	3.14	0.61	0.98	4.44	9.36	7.91	9.56	1.28	0.94	0.05	0.18	42.99
1907	0.36	0.30	0.24	1.27	7.72	9.43	8.50	7.48	4.59	3.83	0.97	2.91	47.60
1908	3.14	0.92	0.02	1.73	3.01	5.98	4.92	7.43	10.30	1.62	2.48	1.02	42.57
1915*	6.73	4.06	1.79	2.86	4.38	4.32	7.11	13.62	6.04	6.05	1.66	2.70	61.32
1916	0.20	0.12	0.26	4.37	3.25	8.83	8.02	8.38	5.36	2.72	2.94	1.87	46.32
1917	0.78	1.14	0.51	1.07	1.78	7.83	4.38	3.73	10.64	4.03	0.64	0.47	37.00
1918	4.09	0.23	2.29	2.64	0.61	5.95	5.77	9.50	8.11	3.82	2.01	1.16	46.18
1919	2.44	4.22	1.62	0.87	6.04	8.46	18.71	6.50	7.01	0.85	1.46	1.51	59.69
1920	1.73	2.44	0.76	7.57	1.58	7.40	13.65	2.03	8.01	2.36	3.67	2.25	53.45
1921	0.65	2.65	0.22	1.12	5.66	3.12	6.84	5.46	3.52	7.19	3.63	0.92	40.98
1922	2.17	2.62	0.83	0.14	8.56	6.87	6.67	7.47	7.54	9.35	1.52	1.37	55.11
1923	0.92	1.37	1.09	2.44	11.61	9.04	7.63	12.68	4.63	2.28	0.41	0.44	54.54
1924	3.53	3.48	4.18	1.32	1.71	7.47	12.17	7.94	3.40	6.52	0.17	0.11	52.00
1926*	3.81	0.88	2.93	5.93	6.45	11.31	8.32	10.28	11.77	1.18	1.94	0.21	65.01
1927	0.10	1.87	2.29	1.52	0.31	8.59	5.39	5.93	3.98	3.80	0.40	1.71	35.89
1928	0.26	1.14	3.12	3.66	3.51	6.90	13.01	9.66	10.64	2.05	1.03	0.35	55.33
1929	1.70	1.45	1.35	2.78	5.62	8.42	5.61	10.55	11.59	2.40	0.56	2.29	54.32
1930	4.00	4.17	6.59	3.95	7.55	11.37	4.49	7.06	18.22	2.42	1.25	4.13	75.20
1931	3.92	2.36	3.75	5.25	6.10	3.74	8.15	6.37	7.84	2.98	0.18	1.47	52.11
1932	0.63	0.14	1.99	2.08	5.95	9.29	4.68	2.80	4.06	4.50	2.48	0.07	38.67
1935	0.41	1.15	0.81	6.03	2.87	6.87	6.14	9.93	11.35	2.99	1.05	2.39	51.99
1937*	2.63	5.13	3.31	4.06	1.65	1.11	5.29	6.27	6.47	6.47	5.44	0.87	48.70
1938	1.44	1.43	1.45	0.42	3.43	4.64	8.13	4.24	2.81	6.44	2.50	0.19	37.12
1939	1.52	1.20	1.34	4.66	5.85	7.91	8.22	19.85	6.22	4.63	0.50	0.61	62.51
1940	3.83	3.66	3.58	1.54	5.30	8.43	11.76	4.02	9.94	0.68	0.10	4.43	57.27
1941	4.01	3.02	2.92	4.73	1.04	9.52	15.20	3.11	4.89	2.62	2.49	1.98	55.53
1942	4.48	4.72	3.86	2.67	6.43	8.52	8.76	5.19	5.37	0.13	0.00	3.54	53.67
1943	1.21	0.46	4.94	1.69	8.83	5.76	7.86	10.02	3.98	4.35	1.32	0.59	51.01
1945*	1.95	0.03	0.40	1.61	2.45	14.09	14.48	2.79	8.43	5.94	0.49	2.00	54.66
1946	1.14	2.11	1.08	0.20	6.03	8.02	9.88	6.04	8.09	4.74	2.06	1.31	50.70
1947	1.92	3.82	6.18	4.65	3.57	12.77	10.50	9.30	14.31	2.97	2.65	1.65	74.29
1948	4.03	0.51	0.83	6.00	2.34	4.39	18.99	6.72	16.10	6.99	1.99	1.50	70.39
1949	0.13	0.08	0.92	3.30	2.66	6.74	6.48	16.12	8.18	0.70	1.79	0.41	47.51
1950	0.00	0.66	1.46	3.15	2.42	2.08	3.38	5.90	7.83	7.56	0.32	1.79	36.55
1952*	1.30	4.61	5.49	0.97	5.48	7.38	7.23	8.46	5.42	6.80	1.60	1.15	55.89
1953	3.27	2.58	6.90	7.45	0.83	13.16	5.52	11.00	12.71	6.82	7.44	2.40	80.08
1954	1.78	1.96	1.62	4.71	3.12	18.95	4.73	6.31	6.20	1.60	1.60	1.97	54.55
1955	2.73	1.06	1.67	1.31	1.62	5.27	6.65	1.86	8.93	2.46	0.56	0.74	34.86
1956	0.26	0.94	1.54	2.23	1.95	9.13	4.76	10.95	6.76	7.78	0.22	0.22	46.74

Table B-3. (Continued) Monthly Mean Rainfall (inches) at Avon Park Rainfall Station.[a]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SUM
1957	2.14	5.10	4.77	6.07	10.91	9.37	12.74	6.99	7.08	1.45	1.30	2.12	70.04
1958	8.33	3.50	5.55	3.43	4.16	6.77	4.45	6.31	4.97	2.75	0.91	3.96	55.09
1959	1.23	3.60	7.35	3.06	6.47	15.17	7.03	8.20	12.06	11.26	1.73	2.47	79.63
1960	0.55	6.54	5.52	3.00	2.28	7.06	13.67	8.07	14.82	3.06	0.28	1.02	65.87
1961	2.30	3.22	3.02	2.06	4.18	9.56	4.09	4.77	2.86	2.11	0.58	0.78	39.53
1962	1.62	1.53	3.38	3.30	1.21	10.80	2.96	8.42	7.07	1.23	2.68	1.42	45.62
1963	2.35	6.13	1.22	0.81	13.06	7.28	7.24	6.29	10.10	0.45	5.28	3.59	63.80
1964	2.97	4.58	3.81	2.28	3.24	6.08	9.44	5.28	7.31	0.61	0.77	1.08	47.45
1965	1.08	4.37	6.85	2.91	1.44	9.53	13.66	4.75	7.67	4.26	1.19	2.39	60.10
1966	5.95	6.05	0.77	2.98	5.08	9.68	8.27	8.98	7.85	2.02	0.15	1.36	59.14
1967	0.65	2.81	0.51	0.00	0.85	5.63	9.74	9.94	7.15	0.86	0.36	2.42	40.92
1968	0.58	1.91	1.29	0.43	8.73	16.73	8.19	6.32	4.40	3.94	2.73	0.35	55.60
1969	1.89	1.80	6.89	0.97	1.86	11.92	5.34	8.88	7.84	7.91	1.64	4.35	61.29
1970	2.99	2.03	5.23	0.22	3.92	4.51	14.93	5.33	5.84	2.25	0.54	1.06	48.85
1971	0.22	2.52	0.95	0.49	2.34	6.22	5.59	8.29	6.17	7.11	0.63	1.92	42.45
1972	0.93	3.47	3.74	2.24	4.75	8.30	9.67	7.23	0.36	1.98	4.95	2.80	50.42
1973	4.56	1.57	3.06	5.61	2.06	3.64	8.50	10.71	7.59	4.43	0.80	1.25	53.78
1974	0.05	1.26	2.19	1.12	2.22	20.14	9.64	3.53	3.22	0.36	0.23	2.20	46.16
1975	0.50	1.93	1.98	0.23	5.30	5.45	5.90	8.52	9.14	6.23	0.49	0.28	45.95
1976	0.51	0.54	2.46	1.59	6.20	7.66	8.84	7.80	6.29	2.08	1.81	1.91	47.69
1977	2.69	1.66	0.46	0.26	3.99	4.95	8.27	4.38	4.03	1.62	4.39	2.61	39.31
1978	2.96	4.32	2.29	0.13	5.17	10.05	13.36	4.13	2.02	1.42	0.49	3.23	49.57
1979	6.53	1.12	2.44	1.87	7.76	10.17	4.05	4.92	13.37	1.18	1.23	1.58	56.22
1980	2.42	3.46	1.80	5.41	3.15	5.09	4.60	6.55	3.88	4.19	2.68	1.09	44.32
1981	0.57	4.16	2.13	0.17	2.21	7.56	6.57	6.49	8.01	0.61	1.03	0.55	40.06
1982	1.94	1.83	4.74	3.07	6.90	15.04	9.68	11.07	7.95	1.32	2.69	1.14	67.37
1983	3.60	9.66	5.67	3.09	1.97	4.40	7.37	6.99	4.51	5.58	2.23	4.33	59.40
1984	0.79	2.83	2.83	2.26	8.74	2.26	6.17	6.58	4.31	0.37	3.57	0.34	41.05
1985	0.65	0.32	1.49	3.36	1.64	9.07	5.80	5.22	8.91	2.62	1.31	0.94	41.33
1986	3.38	0.77	4.55	0.00	1.22	10.74	5.20	5.56	5.08	2.54	0.20	3.39	42.63
1987	1.93	1.20	6.84	0.15	2.15	9.39	2.80	2.73	7.01	11.71	5.96	0.29	52.16
1988	3.27	3.41	4.34	0.18	3.95	5.26	8.61	9.31	5.41	1.08	3.32	0.79	48.93
1989	3.84	0.33	2.78	1.67	0.65	9.88	6.39	10.59	4.39	4.41	1.50	4.11	50.54
1990	0.17	3.86	1.17	2.00	1.56	3.22	9.16	15.03	4.24	3.96	0.36	0.71	45.44
1991	2.59	0.81	3.96	2.84	6.77	12.56	8.13	6.97	2.66	2.45	0.51	0.57	50.82
1992	0.86	3.46	1.63	3.73	1.24	16.29	3.66	7.66	4.53	1.76	1.20	0.62	46.64
1993	5.27	2.22	5.46	3.67	3.09	4.08	2.64	9.61	6.09	3.87	0.35	0.60	46.95
1994	2.40	1.86	2.30	3.82	3.14	11.85	6.24	4.25	11.82	4.40	3.05	3.53	58.66
1995	2.26	2.09	3.06	4.18	2.23	10.34	7.04	10.73	7.29	7.93	3.26	0.31	60.72
Mean	2.24	2.51	2.82	2.52	4.12	8.27	8.03	7.49	7.15	3.70	1.71	1.76	52.25

a. More recent data for these data series can be obtained from the hydrologic data base DBHYDRO. For more information contact Angela Chong (SFWMD) at (561) 682-6514.

Table B-4. Monthly Mean Rainfall (inches) at Brooks Property Rainfall Station.[a]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SUM
1963	2.41	7.67	2.03	0.63	8.05	7.71	3.15	5.19	3.35	1.20	9.69	2.63	53.71
1964	4.85	3.86	3.38	1.23	2.67	5.03	9.55	5.87	6.28	2.88	0.97	1.26	47.83
1965	1.64	5.42	1.44	1.75	0.36	9.56	11.21	7.41	7.42	3.21	0.68	2.74	52.84
1966	5.95	6.90	0.75	1.36	5.40	8.86	3.46	5.03	9.73	0.69	0.32	1.21	49.66
1967	2.02	3.57	1.07	0.00	0.18	5.76	11.38	9.97	6.54	0.46	0.04	2.84	43.83
1968	0.19	2.36	1.34	0.54	5.88	19.87	4.72	3.23	4.56	3.46	3.26	0.38	49.79
1969	4.65	1.38	5.93	1.99	2.09	4.45	7.67	9.03	5.60	5.64	1.77	4.98	55.18
1970	2.61	2.73	5.76	0.73	5.49	3.03	9.34	2.06	4.54	2.24	0.24	0.91	39.68
1971	0.17	3.83	1.65	0.88	2.93	5.46	6.34	5.24	1.92	6.01	2.13	2.36	38.92
1972	1.48	4.42	2.68	2.17	3.27	11.22	7.20	10.10	0.59	0.87	2.44	2.24	48.68
1973	3.41	2.74	2.40	1.83	5.03	2.95	5.08	4.74	9.28	3.86	0.75	2.01	44.08
1974	0.25	0.57	1.21	0.82	3.25	15.05	15.74	9.27	9.42	0.86	0.14	1.86	58.44
1975	0.93	1.79	0.70	1.30	7.57	4.41	8.19	3.34	7.25	1.41	0.95	0.63	38.47
1976	0.43	0.51	2.20	1.97	6.06	11.51	3.28	8.89	8.20	2.71	0.66	2.94	49.36
1977	2.58	1.94	0.78	0.26	1.52	1.85	9.36	10.03	5.92	1.65	2.26	2.99	41.14
1978	2.69	4.98	1.92	0.17	2.68	7.65	7.95	6.81	2.89	2.06	0.77	3.75	44.32
1979	6.22	1.13	1.93	1.37	6.46	3.59	6.45	8.32	12.68	1.64	2.02	1.36	53.17
1980	2.48	2.44	1.66	2.52	8.30	2.13	4.34	4.55	5.87	1.23	2.33	3.31	41.16
1982	1.73	1.37	5.70	3.23	4.68	12.93	11.02	7.22	8.04	1.34	1.20	1.71	60.17
1983	2.06	9.47	5.41	3.19	1.34	9.10	5.08	4.46	5.00	5.47	2.05	5.27	57.90
1984	1.22	3.99	1.09	3.52	5.31	5.77	12.20	2.31	6.01	0.85	2.86	0.31	45.44
1985	0.63	0.70	3.53	2.31	2.61	6.35	5.83	8.58	6.56	1.28	1.17	3.30	42.85
1986	4.83	2.89	2.61	0.35	2.14	6.47	6.46	9.42	3.71	2.89	1.67	3.59	47.03
1989	3.96	0.04	2.51	2.44	3.39	10.33	5.58	10.51	4.77	1.93	2.36	5.48	53.30
1990	0.12	4.54	1.99	1.48	3.25	3.71	8.76	5.73	1.95	4.14	3.15	0.72	39.54
1991	1.89	0.48	4.83	5.61	7.39	4.90	6.11	4.96	4.70	3.63	0.16	0.03	44.69
1992	1.00	3.86	1.75	5.75	0.93	14.05	5.04	8.61	6.60	2.48	4.40	0.48	54.95
1993	7.02	0.57	4.21	2.37	0.00	3.52	8.09	4.03	5.96	1.49	2.30	0.96	40.52
1994	5.10	5.22	2.23	5.66	6.85	9.37	6.46	9.06	8.91	6.42	7.23	2.92	75.43
1995	1.44	1.08	1.18	2.40	3.58	6.76	9.76	16.08	5.05	5.85	1.71	0.21	55.10
Mean	2.53	3.08	2.53	1.99	3.96	7.45	7.49	7.00	5.98	2.66	2.06	2.18	48.91

a. More recent data for these data series can be obtained from the hydrologic data base DBHYDRO. For more information contact Angela Chong (SFWMD) at (561) 682-6514.

Table B-5. Monthly Mean Rainfall (inches) at Fort Drum Rainfall Station.[a]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SUM
1956	1.10	2.26	0.55	2.92	3.44	7.15	5.92	6.77	6.23	11.28	0.61	0.16	48.39
1957	0.88	2.35	5.47	6.60	4.82	4.08	9.51	8.78	9.84	3.51	1.25	3.36	60.45
1958	6.52	1.98	4.60	2.67	3.37	8.39	5.34	5.85	1.48	2.93	0.47	2.36	45.96
1959	2.68	1.62	7.41	4.90	5.92	9.42	5.37	6.11	5.51	12.06	1.55	1.34	63.89
1960	0.40	5.05	6.20	2.68	2.26	6.28	8.41	3.66	13.85	3.93	0.46	0.78	53.96
1961	2.27	0.95	2.13	2.09	4.12	4.17	3.51	9.72	0.68	4.14	1.44	0.16	35.38
1962	0.53	1.52	2.83	1.55	4.38	13.92	5.55	14.04	7.83	0.34	3.43	0.36	56.28
1963	1.90	5.36	1.28	1.38	5.35	6.65	2.68	2.99	17.57	2.27	4.28	3.72	55.43
1964	1.65	3.99	1.54	3.58	4.15	2.09	5.09	9.42	8.82	2.64	0.32	3.01	46.30
1965	0.38	3.55	4.71	0.64	0.05	4.55	8.13	5.72	5.94	7.77	0.69	1.61	43.74
1966	4.34	4.10	0.85	2.01	7.37	8.24	4.59	6.95	5.71	3.29	0.82	0.39	48.66
1967	0.31	3.88	1.10	0.00	0.47	8.98	12.18	5.13	6.31	1.30	0.77	2.20	42.63
1968	0.93	1.82	0.63	0.25	3.63	14.21	12.68	2.28	2.36	7.46	2.27	0.46	48.98
1969	2.63	1.46	7.11	3.84	4.89	2.42	3.88	10.72	4.00	11.09	2.89	2.08	57.01
1970	4.74	3.52	4.93	0.07	2.21	3.62	4.82	3.51	4.57	2.96	0.11	0.86	35.92
1971	0.11	3.38	1.62	0.53	5.28	12.60	10.44	5.14	6.90	4.27	0.41	1.40	52.08
1972	1.09	4.59	3.17	1.60	6.95	8.66	4.41	9.02	2.09	1.73	3.10	1.68	48.09
1973	4.97	2.52	2.83	2.24	6.41	10.40	13.83	4.93	7.81	2.89	0.12	1.70	60.65
1974	1.02	1.83	0.08	2.50	3.63	10.63	10.54	10.90	8.09	2.46	0.78	1.48	53.94
1975	0.18	1.89	2.22	1.24	10.59	4.71	15.95	4.22	6.39	5.43	1.31	1.00	55.13
1976	0.35	0.62	1.08	3.03	14.52	7.05	7.39	4.44	10.16	0.65	1.48	3.49	54.26
1977	1.10	1.23	0.53	0.55	3.14	6.41	6.24	8.62	7.13	0.84	5.00	4.29	45.08
1978	1.19	2.80	3.34	0.14	6.36	12.09	9.98	5.34	7.96	1.83	2.83	3.34	57.20
1979	6.80	0.77	0.98	2.91	14.33	1.74	5.69	3.80	20.75	0.77	0.89	1.80	61.23
1980	2.52	2.92	3.89	3.36	2.76	6.13	4.38	3.18	2.92	0.79	2.66	2.02	37.53
1981	0.33	3.35	1.85	0.20	1.54	4.29	4.08	8.82	3.54	2.43	1.52	0.79	32.74
1982	1.12	2.92	6.86	5.47	5.55	8.42	8.80	9.20	5.76	2.44	2.93	1.79	61.26
1983	4.02	7.60	5.20	1.15	1.48	10.85	7.20	10.68	4.65	4.46	2.38	4.62	64.29
1984	0.45	4.24	2.41	1.78	5.23	4.53	9.35	9.08	5.63	0.57	3.81	1.52	48.60
1985	0.53	0.40	2.99	2.49	1.75	5.17	6.04	7.38	13.01	1.13	1.17	1.18	43.24
1986	2.89	0.27	2.91	0.00	1.82	12.48	7.93	5.27	2.99	8.43	0.98	2.51	48.48
1987	3.83	0.68	10.76	0.00	3.61	6.82	5.20	1.20	5.97	3.45	6.32	0.26	48.10
1988	2.02	2.70	4.02	1.10	0.95	8.05	7.33	4.63	2.00	0.65	2.75	0.60	36.80
1989	2.10	1.05	5.24	2.67	1.07	6.64	2.93	9.30	7.89	8.24	1.10	2.67	50.90
1990	0.00	4.21	1.10	1.95	4.20	4.40	9.22	6.97	4.77	5.07	0.00	0.00	41.89
1991	4.00	2.23	5.35	6.15	6.55	13.38	9.90	5.90	4.35	2.62	0.00	0.00	60.43
1992	1.70	1.19	0.74	2.91	0.33	17.67	6.10	11.79	3.78	4.30	4.85	1.17	56.53
1993	5.55	2.44	8.53	2.20	4.30	3.45	4.14	5.20	5.52	6.10	1.63	2.50	51.56
1994	4.35	4.61	0.82	6.26	0.94	9.03	4.26	6.66	6.85	2.30	6.43	3.44	55.95
1995	2.50	4.24	4.85	3.10	2.85	4.77	9.70	13.50	7.83	9.11	1.20	0.65	64.30
Mean	2.14	2.70	3.37	2.27	4.31	7.61	7.27	6.98	6.64	4.00	1.94	1.72	50.96

a. More recent data for these data series can be obtained from the hydrologic data base DBHYDRO. For more information contact Angela Chong (SFWMD) at (561) 682-6514.

Table B-6. Monthly Mean Rainfall (inches) at Kissimmee Rainfall Station.[a]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SUM
1901	0.92	2.26	3.51	3.23	2.96	8.78	2.84	9.91	12.95	1.18	0.67	1.35	50.56
1902	0.19	6.07	1.88	1.73	0.37	5.85	5.36	7.27	6.35	3.07	1.15	0.96	40.25
1903	4.76	5.04	5.84	0.25	6.68	10.12	8.07	4.31	12.06	1.02	3.56	1.51	63.22
1904	4.16	5.16	0.80	2.25	0.51	8.19	8.56	4.53	4.66	6.75	3.15	0.80	49.52
1905	0.70	0.91	3.88	1.82	7.15	4.46	13.45	13.90	5.04	3.19	0.00	9.43	63.93
1906	6.43	1.49	2.74	1.48	6.77	10.21	6.65	2.59	3.26	2.00	0.16	0.04	43.82
1907	0.10	0.05	0.00	1.66	3.89	6.91	12.51	4.06	5.79	1.45	0.40	3.81	40.63
1908	3.81	1.46	0.26	6.13	3.08	4.32	4.74	9.40	8.48	2.18	2.36	0.26	46.48
1914*	5.14	3.75	1.00	1.38	4.50	5.53	4.19	4.98	5.10	1.10	0.60	3.60	40.87
1915	4.70	5.45	1.80	1.99	8.62	3.75	8.05	6.40	2.59	8.45	2.37	1.90	56.07
1916	0.63	0.39	0.49	1.69	5.22	9.02	7.63	4.67	6.08	2.56	4.08	5.21	47.67
1917	0.55	1.94	1.19	0.94	3.23	2.45	6.22	7.35	7.27	5.67	0.10	0.79	37.70
1918	4.29	0.68	4.16	6.99	1.59	2.04	9.99	8.05	6.34	5.04	5.35	1.33	55.85
1922*	0.75	1.27	0.55	0.20	7.98	4.99	5.65	8.88	4.57	5.14	1.08	2.36	43.42
1923	1.47	0.66	0.95	0.80	10.77	11.89	12.77	7.30	3.84	1.43	0.24	1.04	53.16
1930*	0.88	3.00	12.69	3.53	5.25	10.02	2.66	4.57	4.93	2.12	1.87	4.09	55.61
1931	2.71	0.97	4.15	4.57	2.29	2.57	5.90	6.53	3.05	1.60	0.27	3.50	38.11
1932	1.44	0.21	2.91	0.21	8.76	8.34	5.51	8.77	2.27	0.72	7.94	0.03	47.11
1933	1.53	3.64	3.81	4.11	4.80	8.38	13.08	6.45	14.42	2.82	1.99	0.41	65.44
1934	1.37	3.25	5.12	5.96	8.70	15.75	7.03	3.46	4.23	2.54	0.43	0.66	58.50
1935	1.43	2.46	1.42	2.78	2.77	3.38	7.38	4.15	9.96	0.60	0.79	3.33	40.45
1936	2.07	6.64	4.31	1.58	6.40	7.30	4.01	4.87	2.67	3.42	1.20	1.12	45.59
1937	0.51	4.83	4.53	3.61	1.96	3.77	8.43	11.34	3.29	8.16	3.75	0.70	54.88
1938	0.64	1.19	1.98	0.34	5.73	3.89	8.84	3.37	1.90	4.27	0.80	0.08	33.03
1939	0.97	0.41	1.80	5.99	3.34	14.09	10.08	11.01	4.61	1.18	0.50	0.87	54.85
1940	2.31	3.28	4.91	2.19	0.97	4.34	12.01	9.22	5.44	0.74	0.09	4.08	49.58
1941	4.85	3.86	3.81	5.31	2.71	11.61	13.88	3.76	4.33	2.96	3.31	2.71	63.10
1942	2.40	2.61	7.51	2.67	1.40	14.59	1.68	5.65	4.21	0.36	0.11	2.31	45.50
1943	1.41	0.45	5.39	2.52	3.04	2.34	11.13	7.90	3.18	2.47	1.07	0.60	41.50
1944	1.17	0.21	6.61	2.79	1.28	6.46	7.05	5.51	3.87	8.07	0.14	0.18	43.34
1945	3.35	0.19	0.43	2.76	0.55	17.13	5.86	3.25	9.41	3.01	0.98	3.21	50.13
1946	1.69	3.07	1.60	0.58	5.72	5.30	9.91	7.80	7.43	2.92	1.75	0.98	48.75
1947	0.79	4.71	4.75	6.59	5.70	8.65	7.17	4.24	13.84	3.16	3.94	1.01	64.55
1948	6.74	0.66	3.99	1.32	3.59	2.85	6.04	8.07	11.82	2.14	0.86	2.08	50.16
1949	0.40	0.92	2.20	2.87	0.67	13.19	8.52	15.97	8.96	1.90	1.21	7.57	64.38
1950	0.00	0.00	4.41	5.51	1.11	5.47	4.38	6.19	9.35	10.14	0.22	3.52	50.30
1951	0.46	2.45	1.05	4.26	3.12	6.25	10.48	3.72	11.97	3.39	6.27	1.38	54.80
1952	0.46	4.95	4.13	1.72	4.03	3.08	7.50	5.40	5.89	5.25	1.36	1.08	44.85
1953	2.00	3.06	5.41	5.95	2.14	8.62	11.62	13.13	10.42	4.76	5.08	4.08	76.27
1954	1.02	1.19	1.41	2.25	4.99	7.01	8.12	3.64	4.03	2.92	3.60	0.48	40.66
1955	1.97	1.26	1.84	3.28	2.48	8.17	9.00	2.10	5.57	2.08	1.65	0.98	40.38
1956	2.61	0.45	0.58	3.63	2.73	5.57	3.31	8.75	6.31	17.47	0.65	0.35	52.41
1957	1.07	4.13	3.24	4.95	6.97	9.68	12.18	4.21	7.96	0.80	1.16	3.67	60.02

Table B-6. (Continued) Monthly Mean Rainfall (inches) at Kissimmee Rainfall Station.[a]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SUM
1958	5.17	3.29	6.13	4.08	3.45	3.79	5.68	4.01	5.61	3.81	0.79	2.53	48.34
1959	1.79	2.33	8.92	3.82	3.46	10.02	8.49	13.34	10.78	8.63	0.42	1.90	73.90
1960	1.25	5.68	12.46	1.97	3.35	10.94	7.67	9.00	20.61	5.84	0.00	1.61	80.38
1961	2.13	3.56	0.82	1.69	1.62	4.14	3.47	4.82	2.37	2.33	0.32	0.80	28.07
1962	0.85	1.05	3.84	1.38	3.31	5.82	7.39	5.97	7.12	1.35	2.55	1.90	42.53
1963	2.73	7.21	2.07	0.20	4.88	4.87	7.10	6.13	5.93	3.75	8.72	2.55	56.14
1964	3.65	3.80	2.56	5.34	3.70	5.04	6.89	9.81	5.27	0.65	0.60	1.89	49.20
1965	0.31	3.96	2.20	1.05	0.00	8.40	8.47	4.15	4.72	2.11	0.93	2.62	38.92
1966	5.16	7.07	0.45	1.93	4.39	9.82	5.11	7.04	6.10	2.25	0.12	1.68	51.12
1967	0.78	4.14	0.55	0.04	0.45	9.71	10.68	6.41	7.08	0.25	0.08	2.90	43.07
1968	0.27	3.10	0.88	0.47	5.02	15.42	9.38	4.74	3.56	3.12	2.65	0.31	48.92
1969	2.20	1.89	5.76	2.73	3.00	3.69	4.57	6.59	13.07	6.21	1.75	4.59	56.05
1970	2.73	3.09	5.59	1.09	4.43	4.95	9.04	3.89	2.97	2.07	0.82	1.21	41.88
1971	0.40	4.10	3.25	0.82	3.37	3.12	3.97	6.67	3.21	8.05	1.13	1.37	39.46
1972	0.88	3.90	1.22	1.65	2.64	9.90	5.08	8.23	0.96	2.13	3.90	1.90	42.39
1973	4.89	2.38	2.42	2.19	4.39	6.42	8.20	7.99	11.65	0.98	0.70	1.90	54.11
1974	0.32	1.23	2.10	0.67	2.48	11.93	6.62	4.07	4.22	0.38	1.06	1.63	36.71
1975	0.76	1.48	0.88	3.28	7.56	7.86	6.79	5.27	9.18	5.87	0.72	0.42	50.07
1976	0.20	0.40	2.26	1.43	7.70	5.89	4.09	6.80	4.52	0.94	1.77	4.08	40.08
1977	1.64	2.01	2.06	0.23	2.15	3.03	5.69	12.69	7.47	1.96	4.38	5.04	48.35
1978	3.02	3.36	1.69	0.25	2.63	9.01	10.20	6.77	1.20	1.90	0.26	3.19	43.48
1979	6.42	1.57	2.48	1.92	10.91	2.85	3.29	7.32	12.52	0.12	1.71	1.45	52.56
1980	2.22	2.51	2.33	3.43	5.85	1.48	3.86	2.99	1.32	0.58	3.94	0.45	30.96
1981	0.22	5.08	1.59	0.11	3.34	7.98	2.91	8.71	6.15	4.47	1.73	3.07	45.36
1982	1.75	1.53	5.81	3.28	4.04	2.60	9.34	4.30	8.28	2.41	0.70	1.03	45.07
1983	1.92	9.62	6.11	2.45	1.94	6.93	8.58	5.32	5.48	8.84	1.44	4.64	63.27
1984	2.20	3.22	1.70	1.15	5.30	2.84	10.53	8.96	3.09	1.11	2.12	0.15	42.37
1985	1.17	0.96	4.15	0.73	4.32	6.32	7.06	6.68	6.70	2.87	0.85	2.62	44.43
1986	4.44	1.94	3.08	0.45	0.56	6.00	4.63	8.36	3.15	3.99	0.84	3.32	40.76
1987	2.92	1.91	12.11	0.53	2.65	4.87	5.98	4.01	6.06	4.09	10.26	0.44	55.83
1988	2.95	1.99	3.56	0.38	3.24	3.92	15.73	10.55	4.79	0.89	8.29	1.10	57.39
1989	3.10	0.07	2.39	1.84	2.89	6.29	9.60	8.39	7.22	2.57	1.69	6.96	53.01
1990	1.49	5.45	1.91	1.81	0.94	5.29	6.48	7.65	6.44	4.47	0.74	0.81	43.48
1991	1.87	0.41	6.12	5.09	8.58	5.69	10.13	6.11	4.56	2.72	0.25	0.37	51.90
1992	1.36	2.87	2.01	5.65	3.30	7.91	2.75	10.73	9.91	3.85	3.19	0.53	54.06
1993	3.63	1.60	6.41	3.08	1.36	5.66	2.74	1.22	4.94	5.79	0.26	0.94	37.63
1994	4.41	3.78	1.34	5.97	5.05	11.49	6.84	8.78	11.29	3.68	7.25	3.13	73.01
1995	1.78	1.75	1.46	1.38	0.99	6.52	9.66	10.45	7.94	4.93	0.96	0.75	48.57
Mean	2.12	2.67	3.31	2.49	3.90	6.97	7.46	6.81	6.51	3.38	1.95	2.06	49.63

a. More recent data for these data series can be obtained from the hydrologic data base DBHYDRO. For more information contact Angela Chong (SFWMD) at (561) 682-6514.

Table B-7. Monthly Mean Rainfall (inches) at Lake Placid Rainfall Station.[a]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SUM
1933	2.28	1.72	1.85	7.08	2.50	3.81	13.87	7.18	11.64	4.83	1.65	0.03	58.44
1938	0.10	0.78	0.73	2.92	2.38	6.55	12.77	0.85	4.18	4.29	1.90	0.08	37.53
1939	0.75	1.11	1.40	5.34	8.15	4.73	8.21	8.48	7.84	2.22	1.37	0.74	50.34
1944	0.90	0.55	1.72	3.01	1.03	4.56	7.29	8.78	3.76	3.51	0.64	0.93	36.68
1945	1.11	0.29	0.05	3.52	3.90	9.82	9.31	3.84	12.13	6.17	0.99	2.52	53.65
1946	2.02	2.02	0.53	0.27	5.81	4.92	4.78	3.76	5.34	1.99	2.63	0.50	34.57
1947	0.55	2.99	7.90	7.47	3.58	13.44	12.65	5.08	10.17	2.77	4.16	2.07	72.83
1948	6.51	0.72	1.08	4.15	5.43	4.79	10.89	7.94	15.18	3.74	1.03	0.83	62.29
1949	0.00	0.20	1.76	6.16	0.95	8.83	4.62	6.46	6.62	0.76	1.58	0.60	38.54
1951	0.22	2.52	1.20	8.86	0.76	4.01	10.68	2.59	8.59	11.90	3.07	0.31	54.71
1952	0.89	4.18	3.97	0.87	8.24	1.22	8.95	8.17	3.63	7.65	0.72	0.83	49.32
1953	1.87	2.06	2.05	3.89	1.25	27.27	6.63	8.87	9.48	6.67	3.00	1.67	74.71
1954	0.18	1.58	1.57	4.27	4.01	12.18	9.83	6.13	4.63	2.32	4.43	1.64	52.77
1955	3.10	1.67	0.78	0.97	4.50	9.20	4.85	6.76	3.18	1.48	0.24	2.37	39.10
1956	1.37	1.40	2.39	1.34	1.03	9.19	5.69	5.05	3.26	8.77	0.27	0.32	40.08
1957	1.66	3.95	6.08	5.43	5.75	4.65	7.98	8.10	12.39	1.47	1.12	3.96	62.54
1958	6.98	2.58	7.50	2.89	5.49	4.77	3.48	7.00	3.03	5.08	0.60	3.25	52.65
1959	1.28	3.11	6.91	3.26	3.53	8.01	4.53	11.74	9.19	10.66	1.40	2.36	65.98
1960	0.50	5.22	6.31	4.30	4.63	5.74	15.63	7.91	15.20	5.26	0.67	1.40	72.77
1961	4.95	1.39	2.44	2.51	4.59	6.37	5.89	8.30	1.96	1.25	0.74	0.29	40.68
1962	0.95	1.20	3.14	1.02	2.09	25.10	6.62	9.58	7.30	0.43	4.40	0.41	62.24
1963	1.24	5.38	0.65	0.11	8.78	3.27	7.12	4.21	4.30	1.09	3.76	2.19	42.10
1964	2.46	5.38	1.06	0.49	4.24	5.04	5.57	11.03	9.87	1.68	0.45	2.41	49.68
1965	0.70	3.25	1.77	0.92	1.99	9.15	6.70	9.85	7.59	4.72	0.53	1.32	48.49
1966	4.03	3.55	0.53	1.66	2.82	8.85	8.36	10.90	8.41	1.66	0.20	0.93	51.90
1967	0.65	3.79	0.48	1.96	0.13	8.94	4.29	2.42	4.23	2.51	0.49	2.57	32.46
1968	0.75	1.55	1.16	0.70	6.71	12.10	6.77	6.87	4.47	7.18	2.99	0.38	51.63
1971	0.52	2.66	3.73	1.08	4.95	5.09	5.68	9.45	6.77	4.70	1.39	0.26	46.28
1972	2.23	3.34	4.60	0.64	3.94	7.53	8.43	8.26	0.41	3.38	5.55	2.08	50.39
1973	5.38	1.35	2.06	2.86	3.11	6.74	6.50	10.09	5.65	1.28	1.80	1.54	48.36
1974	0.59	2.17	0.26	0.44	6.66	13.89	9.37	7.42	5.99	0.28	0.60	2.47	50.14
1976	0.31	1.46	1.39	1.19	5.93	11.04	11.30	7.63	11.08	1.65	2.93	1.45	57.36
1977	1.69	1.06	1.51	0.70	1.02	4.10	8.99	4.99	5.57	1.59	4.35	3.69	39.26
1978	2.20	3.45	2.66	0.21	4.60	5.88	15.17	2.87	1.89	4.08	1.25	2.48	46.74
1979	7.31	1.38	2.19	2.53	4.78	6.79	0.00	7.99	13.35	0.18	1.29	1.83	49.62
1980	2.75	2.53	2.14	3.54	5.21	2.40	6.38	1.52	3.22	3.05	3.08	1.19	37.01
1981	0.27	4.42	0.97	0.35	3.54	4.50	3.49	12.75	6.98	1.43	1.76	0.17	40.63
1983	3.01	10.54	4.85	2.48	1.13	7.84	4.55	4.40	3.13	3.05	2.23	4.31	51.52
1984	0.50	3.93	4.44	2.61	7.77	5.11	8.96	5.32	4.11	0.27	3.46	0.74	47.22
1985	0.65	0.54	2.24	2.23	2.14	7.24	7.66	7.62	9.28	2.66	2.00	0.77	45.03

Table B-7. (Continued) Monthly Mean Rainfall (inches) at Lake Placid Rainfall Station.[a]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SUM
1986	1.66	1.82	6.96	0.24	1.66	14.15	3.41	4.86	7.06	1.93	1.67	1.76	47.18
1987	3.77	1.06	6.23	0.18	0.81	5.24	5.11	3.53	6.38	5.97	4.17	1.06	43.51
1988	3.41	2.76	4.20	0.17	3.71	5.75	7.18	3.47	4.67	0.40	3.47	1.15	40.34
1989	2.25	0.92	2.71	3.65	2.55	4.65	4.81	10.85	8.24	4.65	0.69	2.88	48.85
1990	0.33	4.05	3.14	2.30	1.52	7.52	6.73	11.74	3.36	1.04	0.68	1.14	43.55
1991	4.42	1.94	3.05	3.10	4.94	11.43	10.22	6.39	2.15	3.19	1.32	0.45	52.60
1992	0.76	4.53	2.50	3.81	0.55	13.56	3.95	12.12	2.59	1.71	3.97	0.60	50.65
1993	6.70	3.85	4.37	4.14	1.56	7.57	6.03	7.25	7.89	5.59	0.42	0.90	56.27
1994	2.83	1.73	1.49	4.17	2.19	9.75	4.74	7.28	11.65	2.44	2.27	3.11	53.65
1995	2.26	2.25	1.93	4.09	1.13	8.22	5.76	7.99	6.73	8.90	1.75	0.52	51.53
Mean	2.08	2.56	2.73	2.64	3.59	8.05	7.37	7.07	6.71	3.51	1.94	1.47	49.73

a. More recent data for these data series can be obtained from the hydrologic data base DBHYDRO. For more information contact Angela Chong (SFWMD) at (561) 682-6514.

Table B-8. Monthly Mean Rainfall (inches) at Moore Haven Rainfall Station.[a]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SUM
1940	2.37	3.07	5.55	2.06	3.36	4.96	7.92	10.43	14.13	0.32	0.42	3.91	58.50
1941	5.73	3.86	3.68	5.62	3.30	4.87	13.23	6.71	8.54	2.92	1.66	1.52	61.64
1942	2.80	3.51	4.55	5.64	1.99	9.51	4.81	5.66	4.16	0.03	0.46	1.62	44.74
1943	0.35	0.37	2.72	3.91	3.43	5.02	8.04	8.07	3.07	2.67	1.69	0.20	39.54
1944	0.98	0.12	2.35	5.41	1.52	5.50	8.36	5.42	9.23	3.47	0.07	0.27	42.70
1945	1.82	0.27	0.17	3.20	2.22	7.07	9.47	6.86	8.38	4.92	0.53	0.57	45.48
1946	0.68	0.76	2.53	0.27	7.52	5.74	6.90	4.49	7.77	1.16	2.16	0.90	40.88
1947	0.70	1.64	8.73	0.55	4.80	15.02	6.43	10.74	10.57	6.18	4.33	1.51	71.20
1948	4.16	0.38	0.62	3.15	2.24	4.67	6.00	3.94	21.55	2.42	0.57	0.57	50.27
1949	0.05	0.03	0.46	1.64	3.13	6.56	9.40	12.51	10.22	0.73	0.96	2.74	48.43
1950	0.06	0.72	1.40	2.88	3.29	4.55	7.53	8.86	2.77	5.54	1.57	1.45	40.62
1951	0.15	1.99	0.82	3.31	4.47	5.02	11.63	5.03	6.20	7.74	1.36	0.11	47.83
1952	0.92	5.02	1.50	2.25	10.74	7.56	7.05	8.09	6.35	11.11	0.19	0.46	61.24
1953	1.45	2.57	0.76	4.03	2.78	6.52	9.13	5.65	14.16	9.67	0.55	1.25	58.52
1954	0.38	1.72	2.24	3.52	11.96	12.53	10.58	5.96	6.48	2.63	1.19	1.89	61.08
1955	2.78	1.27	1.26	1.72	3.91	13.17	5.80	3.59	7.07	2.55	0.28	1.18	44.58
1956	0.86	1.04	0.40	1.58	1.13	5.43	3.53	4.67	5.18	6.47	0.13	0.52	30.94
1957	1.74	3.73	6.09	4.06	5.58	4.35	6.59	7.59	9.50	1.20	0.24	7.58	58.25
1958	6.04	0.84	7.03	5.84	4.91	5.93	8.32	4.12	3.09	4.59	0.47	5.77	56.95
1959	1.09	1.08	5.82	1.99	6.07	10.16	5.60	6.12	12.00	12.36	1.29	1.02	64.60
1960	0.31	4.31	1.37	6.55	2.77	11.35	11.11	6.37	11.30	5.99	1.21	0.69	63.33
1961	2.71	2.16	3.56	2.44	6.12	7.17	3.74	4.73	2.64	0.66	1.41	0.33	37.67
1962	0.88	0.47	3.57	2.60	2.33	11.46	5.46	7.71	8.78	1.20	4.03	0.22	48.71
1963	0.86	3.64	0.49	0.80	8.82	6.92	1.08	6.06	3.52	0.65	2.68	4.20	39.72
1964	2.55	4.75	0.61	0.67	2.34	5.20	4.78	8.89	3.46	2.74	0.65	0.72	37.36
1965	0.42	3.59	3.16	1.76	1.11	10.16	5.57	2.78	4.71	9.06	0.34	1.89	44.55
1966	5.47	3.67	0.42	3.01	5.97	9.26	10.93	11.19	6.76	2.62	0.11	0.40	59.81
1967	0.84	1.69	0.24	0.14	2.58	11.27	7.02	3.74	8.53	3.37	0.08	1.95	41.45
1968	0.58	1.72	1.03	0.85	8.64	10.73	7.13	4.23	6.81	3.21	2.25	0.21	47.39
1969	1.76	2.28	6.19	0.69	4.10	10.09	3.68	10.04	8.49	11.75	1.46	3.82	64.35
1970	3.55	2.40	12.63	0.02	2.98	8.74	5.91	7.35	3.46	4.70	0.13	0.28	52.15
1971	0.25	0.51	0.37	0.14	1.50	13.86	7.28	8.29	7.18	6.35	0.90	1.20	47.83
1972	0.30	1.55	2.24	2.34	7.52	10.50	2.77	6.40	0.93	0.40	2.21	1.39	38.55
1973	2.72	2.73	3.34	1.02	5.88	10.48	8.01	5.58	8.43	1.38	0.03	1.52	51.12
1974	0.14	1.36	0.08	0.97	3.00	14.91	18.56	7.99	5.91	1.35	1.64	1.71	57.62
1975	0.20	1.95	0.74	1.22	4.89	5.29	7.00	3.13	11.11	4.88	0.27	0.38	41.06
1976	0.65	1.41	1.59	1.81	4.43	3.10	9.98	12.31	5.74	0.80	1.88	1.99	45.69
1977	4.87	1.38	1.12	0.20	5.17	3.74	6.19	5.51	6.29	1.01	5.33	4.74	45.55
1978	1.78	1.39	2.64	2.06	8.38	5.43	9.32	2.67	6.40	2.23	2.13	4.39	48.82
1979	5.83	0.23	2.30	0.84	7.64	1.09	1.45	5.66	17.69	2.06	1.83	1.96	48.58

Table B-8. (Continued) Monthly Mean Rainfall (inches) at Moore Haven Rainfall Station.[a]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SUM
1980	2.76	1.08	2.32	5.29	2.23	3.10	7.58	7.61	6.88	1.47	2.20	0.62	43.14
1981	0.87	1.52	1.28	0.38	2.06	3.33	3.70	10.29	4.54	0.24	1.27	0.15	29.63
1982	0.55	2.81	6.70	3.04	10.13	11.07	10.81	3.09	5.07	5.38	0.26	0.76	59.67
1983	4.22	8.04	5.57	1.75	0.38	7.46	4.36	5.95	3.36	4.29	1.61	2.78	49.77
1984	0.33	4.06	5.20	2.63	6.50	4.92	11.34	6.32	2.84	0.46	2.97	0.09	47.66
1985	0.60	0.41	2.11	7.04	1.11	4.51	8.15	5.34	6.17	1.88	1.41	3.22	41.95
1986	2.34	0.91	6.48	0.24	1.59	12.04	3.59	7.89	6.04	4.91	0.41	2.48	48.92
1987	3.65	1.93	6.59	0.00	1.33	4.18	6.42	3.77	9.91	6.06	8.53	0.59	52.96
1988	1.50	2.57	2.92	0.76	1.54	2.87	6.35	5.81	1.62	0.80	4.15	0.72	31.61
1989	1.62	0.10	2.76	5.02	1.62	5.76	6.45	3.01	8.33	2.93	0.35	2.19	40.14
1990	0.04	2.79	0.68	3.03	2.57	5.47	9.23	9.13	5.42	3.02	0.88	0.39	42.65
1991	5.57	0.90	3.93	4.47	6.58	6.18	6.93	8.02	3.05	4.90	1.85	0.33	52.71
1992	1.02	3.54	3.25	2.79	1.65	28.02	1.77	8.29	1.33	1.33	13.40	0.60	66.99
1993	2.42	0.09	1.56	0.00	1.36	2.54	3.18	6.07	4.09	1.87	0.79	0.90	24.87
1994	3.56	1.88	4.53	2.07	4.62	7.60	3.68	3.09	10.55	3.34	3.26	4.41	52.59
1995	2.56	3.55	1.71	1.99	2.33	6.92	11.44	9.34	5.24	8.03	0.27	0.54	53.92
Mean	1.88	2.02	2.93	2.38	4.15	7.69	7.11	6.57	7.02	3.68	1.68	1.60	48.72

a. More recent data for these data series can be obtained from the hydrologic data base DBHYDRO. For more information contact Angela Chong (SFWMD) at (561) 682-6514.

Table B-9. Monthly Mean Rainfall (inches) at Mountain Lake Rainfall Station.[a]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SUM
1935	0.16	0.50	0.34	4.10	4.89	3.20	5.96	3.40	10.93	1.37	0.72	2.62	38.19
1936	4.79	9.14	4.50	0.39	3.00	8.63	3.37	5.47	7.69	3.42	1.05	1.43	52.88
1937	0.44	5.52	4.20	6.38	2.19	4.51	9.75	9.87	4.71	4.06	6.67	1.52	59.82
1938	1.65	1.14	1.69	0.53	5.38	6.39	9.59	4.65	6.68	8.36	1.24	0.18	47.48
1939	1.19	1.32	1.00	3.81	5.09	14.23	7.32	14.36	5.02	1.92	0.86	0.66	56.78
1940	6.11	4.29	4.01	2.52	0.72	5.36	9.04	7.76	7.60	1.28	0.06	3.16	51.91
1941	4.15	4.71	2.80	6.35	0.81	9.90	10.17	2.44	4.44	2.66	2.87	5.18	56.48
1942	2.58	3.48	5.71	2.73	3.26	8.28	5.43	3.88	6.18	0.42	0.25	4.36	46.56
1943	0.81	0.75	4.77	0.92	6.34	5.83	11.17	7.72	3.07	2.62	0.50	0.47	44.97
1944	0.82	0.36	3.74	2.51	4.90	8.28	9.08	9.66	1.73	5.82	0.25	0.14	47.29
1945	3.63	0.09	0.38	0.94	0.75	8.77	13.30	4.29	8.50	3.30	1.25	1.90	47.10
1946	1.33	3.69	1.43	0.09	10.49	7.25	5.89	5.20	3.60	2.67	1.33	0.83	43.80
1947	1.06	4.41	7.55	5.11	6.94	11.08	10.78	5.08	12.25	4.31	2.33	1.52	72.42
1948	6.16	0.58	4.00	7.86	2.51	1.56	11.39	9.08	14.01	2.44	0.91	1.60	62.10
1949	0.03	0.27	3.63	2.00	0.98	10.76	7.68	16.03	10.27	1.34	1.64	2.15	56.78
1950	0.00	0.19	2.09	2.48	1.99	5.15	7.90	6.86	6.73	9.73	0.33	3.90	47.35
1951	0.39	2.33	2.61	5.56	1.17	9.33	9.40	6.76	8.24	2.18	4.21	1.13	53.31
1952	0.88	3.84	7.02	0.68	4.80	5.92	6.80	13.40	2.19	9.28	3.22	1.08	59.11
1953	4.23	2.71	2.99	3.67	4.10	12.15	9.73	10.79	9.13	5.07	5.89	4.45	74.91
1954	1.33	2.19	1.15	5.44	6.32	4.92	11.12	2.83	3.66	2.66	2.91	1.52	46.05
1955	2.38	1.60	3.42	1.28	3.56	8.32	7.28	6.96	5.59	1.06	1.30	1.23	43.98
1956	0.63	0.62	0.33	4.15	3.20	3.87	4.37	10.44	6.55	6.11	0.58	0.50	41.35
1957	2.58	4.02	4.43	5.94	5.05	3.70	8.73	9.97	8.62	1.96	1.38	1.83	58.21
1958	5.38	2.94	5.11	3.20	2.75	8.54	7.60	5.62	4.89	4.05	1.56	3.45	55.09
1959	3.85	3.60	10.92	3.53	6.51	10.10	9.62	5.48	6.86	9.03	0.47	1.45	71.42
1960	0.74	4.72	10.01	3.43	3.85	6.83	14.15	12.28	13.75	2.34	0.00	0.92	73.02
1961	2.10	4.86	3.38	2.32	4.69	3.62	4.97	9.93	1.77	0.37	0.27	2.09	40.37
1962	1.16	0.66	2.61	2.02	3.77	6.88	3.58	8.33	4.59	0.53	3.40	0.16	37.69
1963	1.64	9.44	2.66	0.29	7.29	6.01	5.67	6.25	5.70	0.05	6.13	2.79	53.92
1964	4.58	5.44	3.17	2.14	3.11	2.24	4.40	8.57	6.15	1.25	1.14	2.65	44.84
1965	2.01	4.39	2.82	2.26	0.13	9.75	10.34	4.48	5.26	3.59	0.48	2.03	47.54
1966	6.73	5.60	1.71	2.79	6.43	6.44	4.55	10.84	5.84	0.54	0.02	2.30	53.79
1967	0.84	3.91	1.16	0.00	0.38	11.11	6.86	14.22	3.58	0.76	0.23	2.94	45.99
1968	0.47	1.98	0.84	0.45	7.53	13.24	7.65	6.18	6.91	2.11	2.74	0.12	50.22
1969	5.26	1.53	6.43	0.90	2.53	6.58	5.06	6.93	5.91	6.32	2.85	4.15	54.45
1970	2.89	2.08	5.74	0.48	4.14	5.52	9.17	5.82	3.94	1.32	0.48	1.11	42.69
1971	0.13	4.48	2.34	0.98	3.42	4.42	5.06	4.62	2.53	5.55	2.13	1.33	36.99
1972	1.09	5.26	2.64	1.69	3.25	6.72	4.63	7.37	1.86	1.89	2.07	2.84	41.31

Table B-9. (Continued) Monthly Mean Rainfall (inches) at Mountain Lake Rainfall Station.[a]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SUM
1973	7.15	2.35	5.72	4.41	4.42	4.96	14.76	7.72	9.65	1.16	1.45	1.65	65.40
1974	0.29	1.20	0.56	0.86	2.07	11.84	11.35	6.74	8.21	0.09	0.18	1.80	45.19
1975	0.76	2.04	0.93	0.85	4.08	5.55	5.94	12.02	6.32	5.63	0.99	0.49	45.60
1976	0.29	0.85	1.16	2.30	9.65	10.91	5.76	8.90	9.18	1.20	3.25	2.59	56.04
1977	2.22	1.68	1.59	0.20	2.28	5.50	9.60	10.20	4.69	1.95	2.38	3.34	45.63
1978	2.73	3.65	2.77	0.67	7.62	10.09	9.95	3.78	2.78	1.05	0.50	3.42	49.01
1979	6.51	1.05	1.92	1.41	11.99	8.56	4.04	7.54	15.80	0.04	2.58	1.91	63.35
1980	3.87	2.65	1.96	1.57	6.65	3.04	6.44	4.77	2.41	1.57	3.89	1.11	39.93
1981	0.36	3.78	1.02	0.00	2.26	3.86	6.84	5.73	6.01	0.34	0.95	1.62	32.77
1982	1.31	1.03	7.73	3.90	8.44	11.93	9.50	6.03	8.34	1.21	0.33	1.02	60.77
1983	2.83	9.39	6.37	2.37	1.71	8.28	7.41	3.78	4.72	4.94	4.33	7.80	63.93
1984	0.75	3.32	2.80	1.33	5.52	3.66	11.16	4.65	3.51	0.88	1.61	0.25	39.44
1985	0.75	0.53	2.28	2.36	3.11	8.39	7.72	7.43	8.26	2.30	1.44	1.07	45.64
1986	2.86	1.80	5.52	0.52	0.45	18.65	5.72	8.36	3.22	3.77	0.14	5.80	56.81
1987	2.36	1.49	9.05	1.05	2.85	5.91	4.71	5.39	6.49	5.25	8.98	0.10	53.63
1988	2.60	1.73	5.31	1.02	3.17	4.67	8.99	8.31	4.94	0.80	4.40	0.90	46.84
1989	2.72	0.04	2.77	2.06	3.11	4.99	8.22	5.15	5.10	2.19	3.75	3.84	43.94
1990	0.16	3.57	1.32	2.15	4.68	6.37	6.80	5.00	1.84	4.55	1.65	1.25	39.34
1991	2.03	1.06	4.43	4.51	8.28	6.54	9.31	5.41	1.03	4.52	1.04	0.68	48.84
1992	1.31	3.81	0.84	4.57	3.03	9.08	3.20	11.79	6.26	3.21	3.50	0.76	51.36
1993	5.78	3.09	4.56	4.20	2.36	3.29	5.85	3.82	6.75	2.00	0.31	1.03	43.04
1994	4.20	2.33	2.28	1.84	1.97	12.19	6.06	4.32	11.42	4.04	3.99	3.31	57.95
1995	2.14	2.03	1.43	4.26	1.35	9.56	9.20	8.54	10.90	3.07	2.40	0.41	55.29
Mean	2.33	2.84	3.44	2.46	4.09	7.43	7.82	7.36	6.31	2.94	1.96	1.96	50.95

a. More recent data for these data series can be obtained from the hydrologic data base DBHYDRO. For more information contact Angela Chong (SFWMD) at (561) 682-6514.

Table B-10. Monthly Mean Rainfall (inches) at Okeechobee Rainfall Station.[a]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SUM
1922	0.49	0.84	0.35	0.00	3.81	9.97	6.41	5.20	9.72	8.06	0.83	0.58	46.26
1930*	1.00	4.45	4.58	7.30	7.85	12.85	5.70	3.11	8.86	2.12	1.81	1.98	61.61
1931	1.97	1.17	2.98	7.71	2.59	1.28	2.97	4.85	4.75	2.42	0.27	1.97	34.93
1932	1.14	0.65	2.03	0.73	7.52	8.81	2.94	12.45	4.08	3.62	1.81	0.00	45.78
1933	0.71	0.07	2.41	7.35	3.42	2.97	8.69	5.95	8.00	0.64	1.63	0.35	42.19
1934	0.76	2.47	4.37	4.37	6.69	9.48	6.01	4.41	6.40	2.75	0.74	0.71	49.16
1935	0.39	2.94	0.30	11.63	2.14	6.17	3.95	5.54	6.49	9.24	0.72	1.95	51.46
1936	1.71	6.58	2.70	1.16	5.32	11.58	8.54	5.77	6.24	2.00	2.19	1.67	55.46
1937	0.90	2.03	3.49	5.21	1.53	6.23	6.38	4.30	6.40	5.59	8.27	0.63	50.96
1938	1.45	1.08	1.43	0.55	2.02	10.46	10.08	1.27	7.17	5.06	2.42	0.32	43.31
1939	0.23	0.23	2.60	6.36	8.48	7.21	7.93	8.95	5.38	4.10	2.59	2.14	56.20
1940	4.74	2.30	5.86	2.05	4.97	7.25	6.10	4.23	10.22	0.30	0.00	4.95	52.97
1941	5.32	3.62	2.45	4.90	0.90	3.83	12.82	2.24	3.90	6.95	1.95	4.54	53.42
1942	1.55	4.30	3.97	2.27	2.67	8.88	4.65	2.53	5.10	0.70	0.49	1.57	38.68
1943	0.00	1.30	4.60	1.74	4.90	2.26	6.77	8.20	4.00	3.60	3.67	0.26	41.30
1944	0.44	0.25	1.87	6.98	2.72	5.02	3.98	4.56	3.14	0.00	0.25	0.14	29.35
1945	1.61	0.25	1.90	4.29	1.47	10.30	4.78	5.37	11.32	5.17	1.31	0.90	48.67
1946	1.48	1.02	1.34	0.02	5.59	7.51	4.99	3.75	7.16	1.86	1.50	1.23	37.45
1947	0.80	3.06	8.53	2.35	4.96	11.47	5.30	4.66	13.06	5.79	2.15	2.35	64.48
1948	4.48	0.00	0.69	2.41	1.72	1.59	5.17	5.30	18.80	6.26	2.35	0.16	48.93
1949	0.00	0.15	0.20	2.12	2.83	8.88	8.58	15.07	15.25	0.59	0.30	3.34	57.31
1950	0.00	1.25	4.15	1.50	2.20	2.00	1.91	5.54	1.10	4.30	0.20	0.35	24.50
1951	0.00	2.20	0.25	5.40	2.59	2.97	10.11	6.54	6.09	15.18	2.16	0.12	53.61
1952	0.75	4.98	3.51	3.18	7.77	3.26	7.08	9.84	4.29	12.23	0.60	0.30	57.79
1953	2.27	1.96	3.36	3.92	2.67	7.49	5.50	10.20	6.78	8.23	0.91	1.63	54.92
1954	0.23	1.62	1.66	2.45	7.38	10.97	10.26	6.27	5.79	2.61	2.45	1.05	52.74
1955	1.84	0.67	1.91	0.85	1.54	11.58	3.31	3.77	5.51	2.69	0.26	2.06	35.99
1956	0.75	0.89	0.93	2.54	2.86	2.42	5.25	8.08	4.64	6.37	0.24	1.34	36.31
1957	2.32	3.62	3.26	6.55	9.51	5.89	6.76	6.09	9.60	1.85	1.01	3.38	59.84
1958	6.02	1.30	7.03	3.06	5.95	6.34	4.25	3.23	5.04	2.80	1.61	2.69	49.32
1959	1.98	0.43	6.68	1.31	5.62	13.08	2.55	7.66	5.75	7.01	1.97	0.76	54.80
1960	0.35	4.65	5.59	2.69	2.39	7.06	19.82	9.03	10.71	4.91	1.01	1.18	69.39
1961	2.17	0.89	1.81	0.94	4.85	4.32	2.03	4.43	3.82	1.76	0.40	0.13	27.55
1962	0.40	0.17	3.79	2.02	4.28	11.88	7.59	9.96	5.69	2.12	3.47	0.38	51.75
1963	0.99	5.17	2.06	0.87	4.67	3.58	5.54	2.34	10.40	0.87	4.21	4.57	45.27
1964	1.00	3.57	0.66	3.09	4.49	3.08	6.45	7.59	7.86	2.66	0.15	1.81	42.41
1965	0.24	6.13	2.51	0.70	0.00	6.79	8.57	2.45	2.97	5.05	0.72	1.52	37.65
1966	2.13	3.71	1.03	2.89	6.23	13.18	10.64	10.03	4.29	5.10	0.00	0.38	59.61

Table B-10. (Continued) Monthly Mean Rainfall (inches) at Okeechobee Rainfall Station.[a]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SUM
1967	0.88	3.45	0.41	0.08	0.14	6.06	8.72	4.87	3.01	2.42	0.25	2.30	32.59
1968	1.21	2.06	1.22	0.69	6.44	16.29	9.23	5.62	9.57	7.51	2.00	0.00	61.84
1969	2.82	1.51	6.68	1.43	7.71	7.13	5.39	10.53	5.07	11.44	5.10	2.70	67.51
1970	4.99	3.05	8.35	0.14	5.68	11.72	5.41	5.31	6.47	5.32	0.03	0.42	56.89
1971	0.23	1.17	0.92	0.27	4.93	10.76	7.11	8.79	7.63	5.23	1.72	2.56	51.32
1972	0.58	3.03	0.35	5.38	3.61	6.17	3.11	10.85	2.26	1.68	3.76	1.14	41.92
1973	3.24	1.53	1.99	2.06	3.42	7.19	10.58	4.93	4.78	5.64	0.72	1.57	47.65
1974	1.05	1.00	0.00	2.06	3.77	8.07	12.59	7.13	5.31	2.88	1.42	2.11	47.39
1975	0.16	4.54	1.40	0.66	5.29	6.45	5.65	5.90	3.55	3.04	1.60	0.48	38.72
1976	0.33	0.95	1.19	1.49	13.55	6.09	3.79	6.93	4.45	1.36	2.19	1.70	44.02
1977	2.43	0.44	0.86	0.83	3.31	9.29	5.98	5.64	4.29	1.21	4.52	2.80	41.60
1978	1.92	1.50	3.04	3.48	1.86	6.40	7.91	8.57	3.89	2.02	1.08	4.05	45.72
1979	5.10	0.21	1.75	1.24	15.1	2.92	4.59	5.31	14.35	2.12	1.51	2.09	56.35
1980	2.92	1.75	3.80	4.69	3.49	2.83	6.45	7.39	5.65	0.42	4.85	1.27	45.51
1981	0.60	2.29	0.63	0.56	4.52	3.62	3.60	11.40	6.79	0.36	1.64	0.38	36.39
1982	0.56	2.61	8.61	4.22	3.86	9.18	2.89	8.38	7.55	4.75	2.78	1.07	56.46
1983	3.79	8.23	4.10	1.35	1.75	9.90	5.34	7.45	5.39	10.80	1.18	2.75	62.03
1984	1.05	4.46	2.72	3.06	6.66	6.17	9.31	6.72	4.77	2.44	3.94	0.94	52.24
1985	0.28	0.28	4.49	3.07	1.65	7.30	8.47	7.71	6.71	1.33	1.30	2.14	44.73
1986	1.36	0.40	3.68	0.08	3.84	6.82	6.04	5.62	4.22	4.30	1.99	3.29	41.64
1987	3.36	1.24	5.31	0.25	4.74	8.81	4.57	0.54	4.10	5.52	8.69	0.31	47.44
1988	2.83	3.02	3.55	0.85	7.29	7.97	6.02	9.06	1.80	1.35	2.85	1.03	47.62
1989	1.06	1.00	2.14	4.29	1.41	2.85	11.60	9.83	6.46	5.21	0.36	3.50	49.71
1990	0.51	3.10	0.08	1.37	2.81	4.58	8.69	8.78	2.19	9.81	1.13	0.46	43.51
1991	4.89	1.37	3.58	5.09	3.06	4.68	5.21	5.59	9.23	3.44	1.22	1.01	48.37
1992	0.45	2.94	1.05	2.38	1.41	21.08	4.40	11.10	5.02	1.35	4.78	0.46	56.42
1993	8.64	2.52	6.43	1.19	0.34	7.93	3.99	7.60	5.81	5.02	1.98	1.10	52.55
1994	4.33	3.93	2.99	6.56	3.16	5.30	4.61	10.94	5.33	1.61	4.58	5.22	58.56
1995	2.05	1.31	3.17	1.76	3.58	8.92	6.93	6.34	5.24	11.19	0.45	0.39	51.33
Mean	1.76	2.19	2.89	2.78	4.29	7.35	6.55	6.65	6.37	4.23	1.91	1.56	48.53

a. More recent data for these data series can be obtained from the hydrologic data base DBHYDRO. For more information contact Angela Chong (SFWMD) at (561) 682-6514.

Table B-11. Monthly Mean Rainfall (inches) at Orlando Rainfall Station.[a]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SUM
1900	3.32	2.45	6.93	3.39	4.72	7.62	10.83	7.41	5.53	6.78	1.51	3.36	63.85
1901	1.07	3.27	3.89	2.47	2.15	11.81	4.28	13.18	11.12	2.20	0.54	1.28	57.26
1902	1.25	4.50	1.81	2.27	1.52	6.94	5.43	3.53	13.66	4.90	0.52	1.35	47.68
1903	5.69	5.38	8.37	0.00	3.59	11.05	8.41	3.68	8.08	1.69	2.71	1.00	59.65
1905*	0.41	2.12	5.13	1.71	8.12	8.13	6.15	17.13	14.11	3.42	0.33	8.13	74.89
1906	5.03	0.84	2.80	1.27	9.40	11.75	5.65	3.12	1.87	1.39	0.23	0.05	43.40
1907	0.02	0.10	0.15	2.20	2.75	8.17	9.96	9.20	5.15	1.91	0.29	4.15	44.05
1908	3.57	1.56	0.25	3.74	5.50	4.84	6.91	7.04	9.94	3.18	2.31	0.68	49.52
1914*	5.23	3.31	2.10	2.25	2.39	7.73	2.93	7.51	8.79	4.15	1.30	3.83	51.52
1915	4.36	4.34	1.41	0.86	7.29	1.91	9.13	4.23	5.06	19.10	2.24	2.21	62.14
1916	1.08	0.63	0.28	2.59	5.10	6.87	8.31	5.92	4.95	4.58	4.60	3.61	48.52
1917	1.15	1.17	2.41	0.56	5.78	3.89	11.17	8.15	8.77	3.55	0.19	0.92	47.71
1918	3.72	0.14	1.72	8.24	2.11	5.37	12.30	3.34	6.60	7.25	2.30	3.23	56.32
1919	3.01	4.25	5.68	1.17	10.37	5.19	11.49	5.46	2.38	0.80	3.99	3.45	57.24
1920	1.08	4.85	0.72	6.72	6.67	5.89	7.49	5.35	13.96	1.55	3.62	2.23	60.13
1921	0.52	1.76	0.87	1.51	7.07	6.62	6.46	4.13	1.93	10.57	3.28	2.91	47.63
1922	1.06	1.38	1.27	0.10	5.88	9.75	4.84	9.38	7.78	6.95	0.75	2.06	51.20
1923	0.56	0.27	2.63	0.83	10.42	12.36	7.54	5.85	5.79	3.73	0.17	1.45	51.60
1924	3.08	5.31	7.36	4.02	2.56	8.97	13.37	3.96	6.14	9.58	0.15	1.71	66.21
1925	5.87	1.46	1.89	1.02	4.78	5.67	6.83	10.30	2.55	1.93	1.74	7.96	52.00
1926	4.03	1.67	5.51	4.67	0.57	11.36	9.50	5.35	7.04	1.00	3.66	0.48	54.84
1927	0.11	1.71	2.30	0.62	0.47	3.84	9.03	5.71	4.13	3.89	0.74	1.29	33.84
1928	0.79	0.89	4.07	8.97	3.77	4.06	7.71	10.89	13.22	0.91	0.37	0.69	56.34
1929	1.38	0.34	1.30	2.13	7.37	6.01	12.49	8.03	11.52	3.84	1.63	1.41	57.45
1930	1.96	2.83	12.24	3.37	2.98	13.37	7.50	3.78	6.49	1.87	0.87	4.01	61.27
1931	2.77	0.89	4.93	5.41	3.19	0.88	8.33	5.27	4.92	1.68	0.19	3.66	42.12
1932	1.52	0.11	3.87	0.26	9.05	7.85	3.58	4.93	2.67	0.95	4.93	0.18	39.90
1933	2.19	3.04	2.54	4.33	2.41	8.20	5.46	9.18	14.10	3.84	1.72	0.41	57.42
1934	1.04	3.37	4.33	4.58	8.08	13.35	9.00	1.27	3.14	1.50	0.09	0.55	50.30
1935	1.37	2.79	0.70	2.26	2.42	2.36	10.13	7.61	9.79	4.07	0.85	4.81	49.16
1936	4.11	6.29	2.90	1.58	3.58	11.28	2.63	4.95	5.81	5.07	2.21	1.77	52.18
1937	0.97	5.00	2.97	3.78	4.47	5.22	5.14	13.14	9.37	4.55	3.67	0.82	59.10
1939*	1.21	0.35	1.75	4.97	4.87	15.64	6.34	8.90	5.24	1.67	0.39	1.09	52.42
1940	2.14	2.89	4.23	4.44	1.72	6.67	10.14	8.04	7.35	0.37	0.22	5.81	54.02
1941	4.69	4.16	2.47	5.53	2.73	8.18	9.44	6.46	4.76	5.33	3.61	2.29	59.65
1942	2.32	3.03	5.83	2.32	1.17	10.57	2.01	6.71	4.17	0.24	0.12	2.80	41.29
1943	1.19	0.50	3.92	1.53	5.42	3.66	4.67	5.85	7.18	3.04	0.87	1.28	39.11
1944	2.14	0.10	3.69	3.87	2.83	6.43	11.04	5.39	4.52	8.53	0.11	0.00	48.65
1945	3.86	0.11	0.54	1.47	2.93	13.70	7.06	5.28	15.87	1.61	1.00	2.52	55.95
1946	2.24	2.96	1.15	0.81	4.24	8.59	8.63	10.06	7.75	3.32	0.97	0.28	51.00
1947	0.87	4.78	5.55	4.98	2.81	11.61	13.94	6.71	8.87	4.83	1.90	0.66	67.51
1948	3.99	1.21	3.15	1.41	5.47	3.17	4.88	6.38	7.28	3.00	1.39	2.20	43.53
1949	0.31	0.47	0.29	3.02	2.54	7.97	6.05	8.83	8.25	1.51	1.22	3.82	44.28

Table B-11. (Continued) Monthly Mean Rainfall (inches) at Orlando Rainfall Station.[a]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SUM
1950	0.15	0.48	3.44	4.82	2.93	5.55	8.27	3.48	7.93	14.51	0.09	4.30	55.95
1951	0.52	2.28	0.96	5.99	1.40	5.08	14.51	7.84	9.34	3.08	4.86	2.06	57.92
1952	0.70	5.25	6.67	2.88	2.45	2.32	4.43	6.51	4.94	3.69	0.74	0.65	41.23
1953	2.86	2.89	3.03	6.18	1.87	6.28	6.85	15.19	8.84	3.50	4.78	3.58	65.85
1954	0.45	1.16	0.99	4.44	3.55	5.81	13.64	4.39	3.99	5.07	2.68	1.80	47.97
1955	2.00	1.12	1.59	1.36	3.13	4.73	6.88	6.65	6.97	4.10	2.17	1.56	42.26
1956	1.66	0.90	0.16	4.03	3.70	5.41	5.88	6.10	6.27	8.24	1.26	0.30	43.91
1957	0.91	1.93	3.76	4.74	8.58	4.39	4.35	9.45	7.47	1.68	0.82	2.85	50.93
1958	4.49	2.83	6.16	3.79	2.68	3.83	9.93	3.40	1.65	7.27	2.48	2.69	51.20
1959	2.78	4.55	7.69	4.91	4.44	7.95	8.02	6.77	8.33	5.97	0.99	1.37	63.77
1960	1.49	5.64	10.54	2.55	0.50	9.50	19.57	3.20	11.21	3.17	0.30	0.91	68.58
1961	1.75	2.82	2.21	0.28	0.43	8.08	9.93	6.75	4.40	2.87	0.92	0.66	41.10
1962	1.11	2.08	3.55	1.58	2.74	3.11	12.77	5.11	12.24	1.90	2.46	1.70	50.35
1963	3.17	4.76	2.69	1.23	3.56	6.67	3.83	3.54	6.72	0.46	6.39	2.26	45.28
1964	6.18	3.42	4.65	2.14	2.74	6.11	6.68	9.00	9.47	1.64	0.45	1.91	54.39
1965	1.79	3.67	3.02	0.66	0.52	7.36	11.55	5.49	5.99	4.06	1.06	2.23	47.40
1966	4.45	6.31	2.57	1.92	6.57	9.77	6.73	7.76	6.25	1.88	0.09	0.99	55.29
1967	0.84	5.49	1.31	0.28	1.69	11.16	4.63	6.83	5.88	0.35	0.03	2.42	40.91
1968	0.65	2.55	2.27	0.30	3.72	18.28	5.60	3.44	5.91	5.47	2.82	0.88	51.89
1969	2.22	3.30	5.52	2.38	1.40	5.04	6.73	7.17	6.44	9.45	0.87	4.66	55.18
1970	4.05	6.77	3.66	0.45	4.08	4.92	5.97	5.91	3.25	2.60	0.24	2.06	43.96
1971	0.45	2.98	1.46	1.52	4.31	4.39	8.29	7.51	2.98	3.06	1.21	1.93	40.09
1972	0.99	4.96	5.06	1.39	3.76	6.33	3.98	16.11	0.43	2.34	4.11	1.89	51.35
1973	4.82	2.73	4.13	2.82	4.74	6.63	6.24	7.33	11.53	1.10	0.74	2.56	55.37
1974	0.70	0.70	6.60	0.80	4.20	10.25	8.50	7.50	10.20	0.60	0.50	2.10	52.65
1975	1.80	1.20	1.30	1.70	9.90	9.00	9.40	8.20	7.40	4.60	1.10	0.90	56.50
1976	0.50	0.60	2.40	2.60	9.90	13.00	11.10	7.50	8.70	0.40	2.90	2.80	62.40
1977	2.10	1.76	2.25	0.40	2.40	6.80	9.10	6.60	4.50	0.90	3.40	5.10	45.31
1978	3.00	6.90	2.50	0.70	4.60	6.29	8.19	13.80	2.90	1.60	0.50	6.00	56.98
1979	6.80	1.80	3.70	1.50	8.10	4.10	9.20	6.42	8.70	0.00	3.80	0.90	55.02
1980	3.00	1.90	1.90	4.20	12.50	2.30	3.68	2.20	5.00	0.60	5.60	0.40	43.28
1981	0.40	4.80	2.00	0.40	1.70	11.20	5.00	7.00	10.20	5.60	2.40	4.20	54.90
1982	2.90	1.20	4.80	6.60	5.00	8.00	7.50	8.80	8.40	2.20	1.20	1.80	58.40
1983	2.08	8.32	5.37	3.21	1.77	7.82	6.49	4.83	5.16	3.78	1.36	5.33	55.52
1984	2.01	2.73	1.85	6.21	3.20	5.32	6.19	7.89	6.19	0.56	2.10	0.19	44.44
1985	0.91	1.27	4.59	1.69	3.00	4.54	7.28	11.63	5.45	2.55	0.82	3.46	47.19
1986	7.23	1.84	2.63	0.49	0.88	9.50	5.85	5.99	4.50	5.63	1.69	3.60	49.83
1987	1.27	1.74	11.38	0.59	1.40	3.54	7.95	6.07	8.64	3.41	10.29	0.51	56.79
1988	3.12	1.38	6.07	2.02	2.82	4.17	9.44	7.94	5.48	1.61	7.44	1.00	52.49
1989	3.80	0.06	1.23	1.76	3.11	6.69	4.74	6.30	10.29	1.75	1.44	4.49	45.66
1990	0.23	4.08	1.97	1.73	0.55	6.22	6.68	3.78	2.46	2.10	1.05	0.83	31.68
1991	2.37	0.98	6.66	7.72	9.48	5.98	10.78	7.13	4.43	4.76	0.27	0.24	60.80
1992	1.35	2.42	3.67	9.10	1.19	8.68	2.60	8.03	7.13	5.17	2.74	0.88	52.96

Table B-11. (Continued) Monthly Mean Rainfall (inches) at Orlando Rainfall Station.[a]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SUM
1993	4.89	1.48	6.26	1.78	3.02	4.47	6.49	5.95	5.35	4.61	0.17	0.76	45.23
1994	4.00	3.58	1.21	3.03	2.87	10.28	13.27	6.23	7.84	5.18	7.32	3.04	67.85
1995	1.50	1.13	2.12	0.81	4.24	8.23	5.10	9.48	3.59	4.35	1.74	0.76	43.05
Mean	2.30	2.60	3.45	2.75	4.10	7.30	7.80	6.98	6.95	3.65	1.89	2.20	51.97

a. More recent data for these data series can be obtained from the hydrologic data base DBHYDRO. For more information contact Angela Chong (SFWMD) at (561) 682-6514.

Table B-12. Monthly Mean Rainfall (inches) at S-65 Rainfall Station.[a]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SUM
1965	1.02	4.99	1.21	2.05	1.28	8.14	12.11	4.95	5.97	4.81	0.91	2.46	49.90
1966	5.56	5.82	1.69	1.49	4.58	5.29	6.87	4.86	4.67	3.14	0.08	0.89	44.94
1967	1.33	2.70	0.22	0.00	0.38	6.61	7.00	7.25	6.65	0.46	0.13	1.89	34.62
1968	0.60	2.03	1.31	0.33	9.16	14.64	5.30	2.98	5.71	7.45	2.39	0.20	52.10
1969	1.85	1.34	7.81	1.89	1.89	6.92	8.32	6.67	9.64	10.17	3.17	3.66	63.33
1970	2.34	2.20	5.41	0.79	3.58	5.60	8.79	3.79	2.48	6.05	0.34	1.00	42.37
1971	0.00	4.77	1.15	0.38	1.07	8.34	8.24	5.41	2.31	5.79	0.41	1.39	39.26
1972	2.99	4.21	2.79	2.47	5.52	8.02	2.74	4.46	0.66	1.37	5.58	3.16	43.97
1973	5.23	1.58	2.58	7.26	5.22	4.42	7.98	6.44	7.05	3.86	0.08	1.69	53.39
1974	0.40	1.86	0.08	3.40	8.17	13.98	20.28	10.97	6.84	0.47	0.32	4.69	71.46
1975	1.08	2.71	2.10	2.38	10.18	5.65	9.00	5.15	10.23	6.70	0.17	0.40	55.75
1976	0.57	0.33	0.94	1.40	5.67	11.65	5.08	13.22	7.13	2.70	1.30	2.99	52.98
1977	2.78	1.48	1.42	0.82	10.18	5.65	9.00	4.29	5.85	1.66	3.79	3.05	49.97
1978	3.65	4.18	3.50	0.67	6.74	13.41	10.14	7.89	6.98	4.90	0.49	3.36	65.91
1979	5.45	1.47	1.52	2.26	10.57	3.33	2.50	6.83	19.52	0.52	1.21	1.33	56.51
1980	2.75	5.29	2.60	3.24	5.02	10.32	6.54	10.41	3.88	1.59	7.96	1.70	61.30
1981	0.49	3.51	1.47	0.30	2.61	6.26	6.66	10.13	11.20	1.16	1.58	0.29	45.66
1982	2.15	3.23	6.43	7.47	7.06	8.68	8.05	2.60	7.97	4.60	0.95	1.49	60.68
1983	4.47	8.08	4.77	2.36	1.96	9.52	3.74	3.74	4.79	4.51	1.90	4.15	53.99
1984	0.77	2.52	2.15	2.35	6.36	4.51	8.88	5.64	2.91	1.10	3.99	0.56	41.74
1985	0.69	0.69	1.45	1.92	3.45	7.21	6.72	5.89	4.16	1.26	3.00	1.69	38.13
1986	2.46	1.52	5.15	0.30	0.97	8.93	6.55	5.92	5.57	1.59	1.46	2.32	42.74
1987	2.80	1.92	8.34	0.26	1.38	7.41	5.72	1.81	8.74	6.70	10.39	0.12	55.59
1988	2.16	2.96	6.31	0.44	1.85	5.36	13.09	8.88	4.76	1.07	2.92	1.82	51.62
1989	3.39	0.60	4.47	2.08	4.68	7.28	5.06	3.46	7.81	1.66	2.04	3.39	45.92
1990	0.38	5.14	0.38	1.13	1.18	7.31	9.55	9.00	4.75	2.66	0.88	0.72	43.08
1991	2.63	1.23	5.68	4.16	6.61	4.71	7.15	7.24	4.25	8.26	0.27	0.82	53.01
1992	0.22	2.80	1.35	4.05	2.06	12.87	8.58	12.00	2.76	2.01	0.75	0.48	49.93
1993	4.15	2.44	4.17	3.39	2.97	0.72	3.17	8.01	5.96	4.00	1.17	0.71	40.86
1994	1.44	3.05	1.48	3.17	1.54	13.34	11.68	4.54	8.84	4.75	4.46	2.63	60.92
1995	1.71	3.61	4.47	3.97	2.18	8.93	4.23	9.60	5.41	5.57	2.88	0.26	52.82
Mean	2.18	2.91	3.05	2.20	4.39	7.90	7.70	6.58	6.30	3.63	2.16	1.78	50.79

a. More recent data for these data series can be obtained from the hydrologic data base DBHYDRO. For more information contact Angela Chong (SFWMD) at (561) 682-6514.

FREQUENCY ANALYSIS

1-in-10 Year Drought Event

Water supply needs of existing and future reasonable-beneficial uses are determined based upon meeting the needs of a 1-in-10 year drought event (Section 373.0361, (2)(a)1 F.S.). A 1-in-10 year drought event is defined as rainfall with a probability of exceedance of 90 percent for a 12 month period. This means that there is only a 10 percent chance that such a small amount of rain will fall in any given year. Model simulations were used to analyze potential impacts on wetlands and aquifer levels within the KB Planning Area under both average and 1-in-10 year drought event rainfall conditions.

Statistical Method

The statistical approach utilized here requires selection of an initial month and an analysis of 12 cumulative rainfall data sets following this month. March was selected as the beginning of the rainfall year because it is a critical month in the growth cycle of citrus. The method used to calculate 1-in-10 rainfall is most precise at the beginning of the calculation period, therefore a calculation year starting in March is used. A statistical rainfall frequency analysis was performed on the March rainfall data for each station. Similar analyses were performed on historical rainfall for durations of two months (March through April) through twelve months (March through the following February). Estimates of 10 percent drought frequency rainfall were made for each duration and individual month amounts were obtained by subtraction of consecutive cumulative amounts. For example, the November rainfall amount was obtained by subtracting the cumulative March-November drought frequency estimate from the cumulative March-October estimate. This analysis produces a set of monthly values that has a constant cumulative drought frequency of 10 percent. With the exception of the initial month of March, drought frequencies were not determined using the individual monthly rainfall amounts.

Each rainfall time series was fitted to the logarithmic-normal probability distribution. The logarithmic-normal distribution is useful in defining many hydrologic random variables where the values of the variate are the result of underlying multiplicative factors and are known to be strictly positive (Alfredo et al., 1975). This distribution has been previously used to define rainfall. A nonparametric test was performed on each of the time series to assess the goodness-of-fit to the assumed underlying probability distribution. The values for 1-in-10 year drought events are listed in **Table B-13** and the statistical 1-in-10 year drought event plots for the eleven rainfall stations are presented in **Figure B-3**.

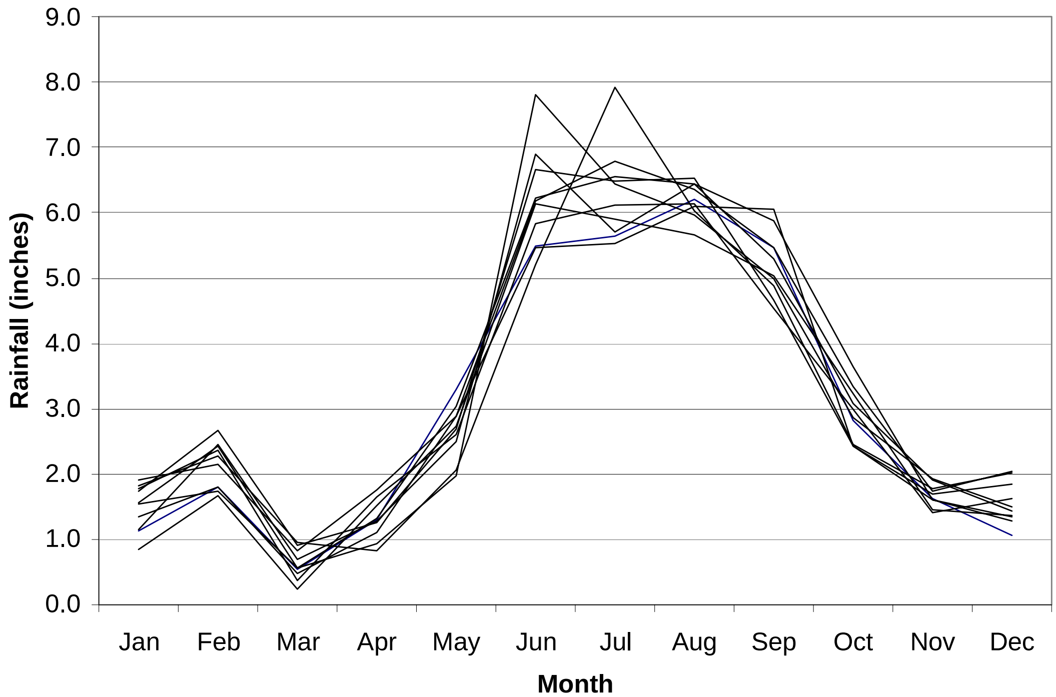


Figure B-3. Statistical 1-in-10 Year Drought Events for Eleven Rainfall Stations.

Table B-13. Statistical 1-in-10 Rainfall (inches) for Eleven Rainfall Stations.[a]

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Sum
Archbold	1.1	1.8	0.5	1.3	3.3	5.5	5.6	6.2	5.5	2.8	1.6	1.1	36.4
Avon Park	1.5	1.7	0.6	1.3	3.0	6.2	6.6	6.4	5.9	3.6	1.6	1.3	39.8
Brooksville	1.8	2.3	1.0	0.8	2.1	5.2	7.9	6.0	4.9	2.5	1.8	2.0	38.3
Fort Drum	1.1	2.4	0.7	1.3	2.5	6.9	5.7	6.5	5.3	3.1	1.9	1.4	38.8
Kissimmee	1.8	2.4	0.4	1.7	2.6	5.8	6.1	6.1	4.5	3.0	1.4	1.6	37.4
Lake Placid	1.3	2.5	0.6	1.2	3.2	6.1	5.8	6.1	4.7	2.7	1.9	1.5	37.6
Moore Haven	1.3	1.8	0.5	1.1	2.9	5.5	5.5	6.1	6.1	2.4	1.6	1.3	36.1
Mountain Lake	1.7	2.7	0.9	1.3	2.7	6.7	6.5	6.5	4.7	2.4	1.7	1.8	39.5
Okeechobee	0.9	1.7	0.2	1.5	2.7	6.1	5.9	5.7	5.0	3.2	1.5	1.4	35.8
Orlando	1.9	2.2	0.8	1.7	2.9	6.2	6.8	6.4	5.5	3.3	1.7	2.0	41.4
S-65	1.6	2.4	0.6	0.9	2.0	7.8	6.5	6.0	5.0	2.9	1.9	1.5	39.0

a. Calculations start with March.

REFERENCES CITED

Alfredo, H., S. Ang, and W.H. Tang. 1975. *Probability Concepts in Engineering Planning and Design*. New York: Wiley and Sons.

Appendix C
SURFACE WATER BASINS

The following sections provide a description of the surface water resources for basins within the Kissimmee Basin (KB) Planning Area. The KB Planning Area is divided at the outlet of Lake Kissimmee into upper and lower basins. The Upper Kissimmee Basin includes 17 subbasins while the Lower Kissimmee Basin includes 9 subbasins (**Figure C-1**).

UPPER KISSIMMEE BASIN

The Upper Kissimmee Basin is dotted with hundreds of lakes, ranging in size from small sinkholes and ponds to large lakes. The surface water drainage pattern includes a series of interconnected lakes in its northern portion, called the Kissimmee Chain of Lakes. Alligator Lake forms the drainage divide of the chain of lakes and water can be released either to the north or to the south. Northward flow goes though several canals and smaller lakes to Lake Mary Jane; the flow proceeds through Lakes Hart, East Tohopekaliga, and Tohopekaliga, then finally to Cypress Lake. Southward flow takes a shorter route through Lake Gentry and then to Cypress Lake. From Cypress Lake, water flows southward to Lake Hatchineha and then to Lake Kissimmee. Most of these lakes are shallow, with mean depths varying from 6 to 13 feet. The subbasins of the Upper Kissimmee Basin are generally bound by the drainage divides of major water bodies (**Table C-1**).

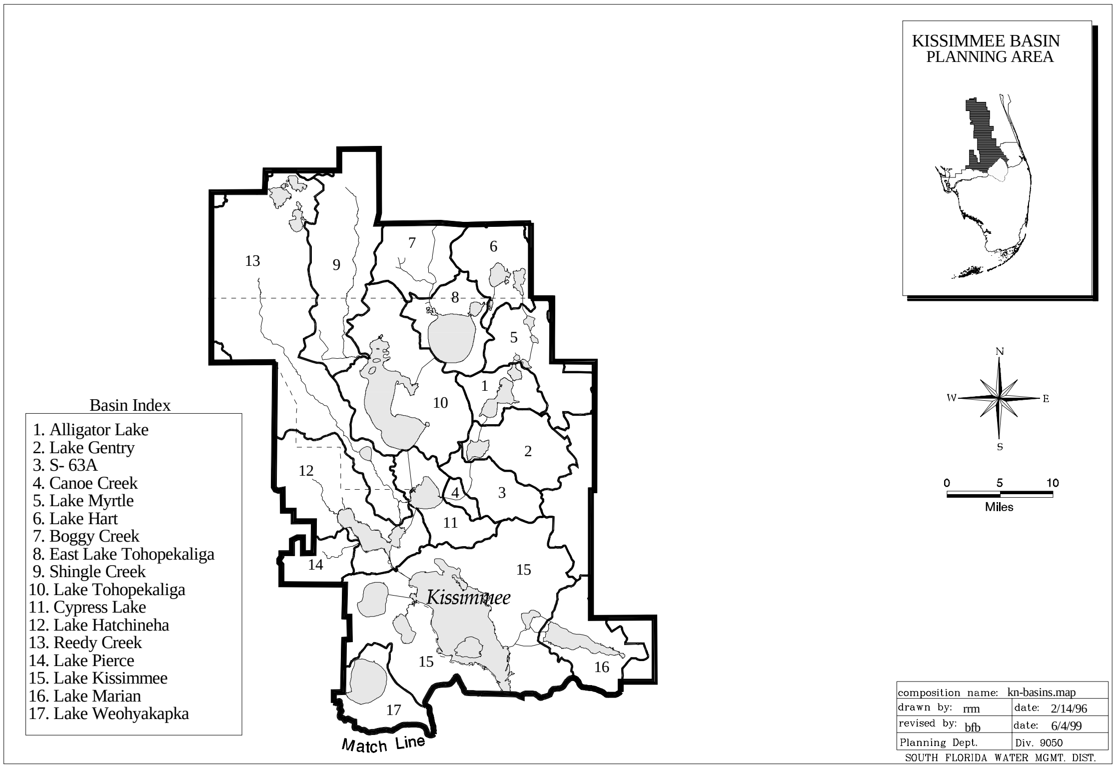
Alligator Lake Subbasin. The Alligator Lake subbasin has several lakes including Alligator Lake, Lake Lizzie, Coon Lake, Trout Lake, Live Oak Lake, Lake Center, Bay Lake, Sardine Lake, Buck Lake, Brick Lake, and Lake Pearl. Several of these lakes are linked by a series of short connecting channels. C-32 and C-33 are outlets of the Alligator Chain of Lakes (controlled by S-58 and S-60). The regulation schedule for the Alligator Lake subbasin is shown in **Figure C-2**.

Lake Gentry Subbasin. The Lake Gentry subbasin is in Osceola County. The main discharge of Alligator Lake is through S-60 via C-33 into Lake Gentry. Big Bend Swamp also drains to Lake Gentry. C-34 is the outlet of Lake Gentry (controlled by S-63). The regulation schedule for Lake Gentry is shown in **Figure C-3**.

S-63A Subbasin. The S-63A subbasin is located between S-63, the outlet for Lake Gentry, and S-63A. Approximately 2.8 miles of Canoe Creek Canal (C-34) are within the S-63A subbasin. The water levels in C-34 are regulated by S-63A.

Canoe Creek Subbasin. The Canoe Creek subbasin is located downstream of S-63A. This subbasin drains into Cypress Lake via Canoe Creek Canal (C-34). S-63A is located 2.8 miles from Cypress Lake

Lake Myrtle Subbasin. Most of the Lake Myrtle subbasin is within Osceola County, except for a small portion located within Orange County. Cat Lake, Lake Conlin, and Lake Preston discharge into Lake Myrtle. Lake Joel, which receives water from Trout Lake (Alligator Lake subbasin) through S-58, discharges into Lake Myrtle as well. Cat Lake also discharges to Buck Lake (Alligator Lake subbasin). These five lakes account for 10.5



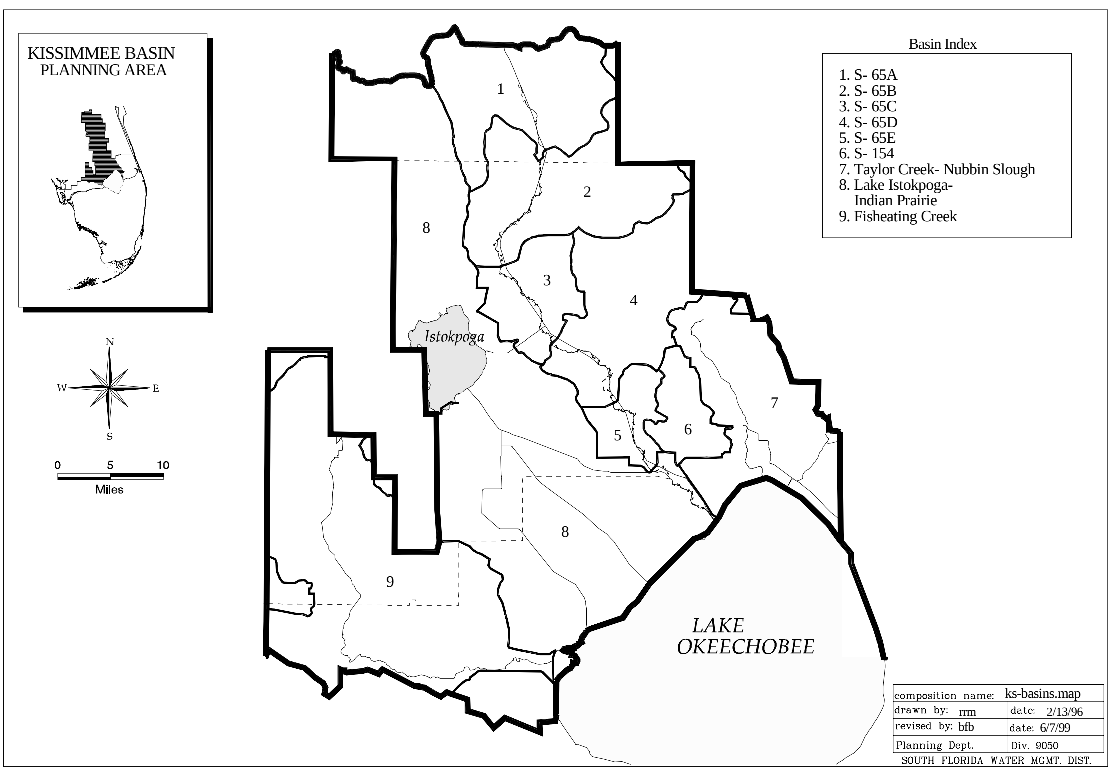
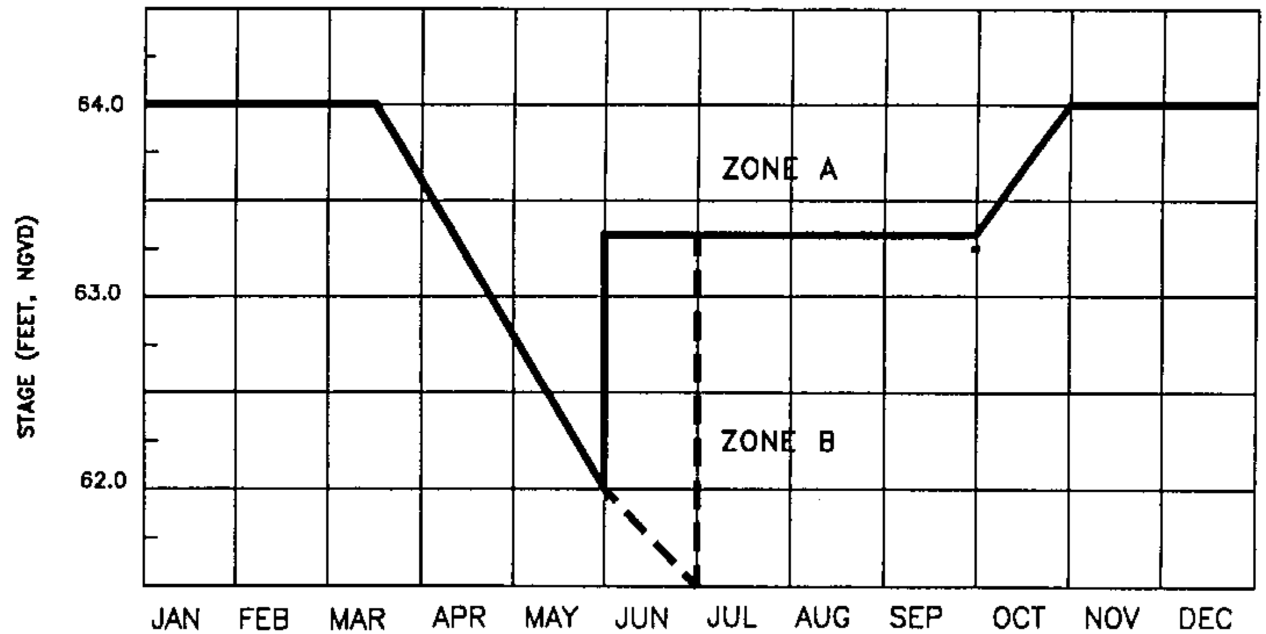


Figure C-1. Surface Water Subbasins in the Upper Kissimmee Basin (**top)** and the Lower Kissimmee Basin (**bottom**).



NOTE: — — — USE THIS SCHEDULE FOR ONE YEAR IN THREE.

ZONE	RELEASES
A	AT DESIGN CAPACITY (610 CFS) EXCEPT WHEN THE LAKE IS WITHIN 0.5 FT. OF DESIRED STAGE. FORECASTS WILL THEN BE MADE AND RELEASES STARTED TO BRING THE LAKE BACK DOWN TO SCHEDULE WITHIN 15 DAYS.
B	TO MAINTAIN MINIMUM FLOWS

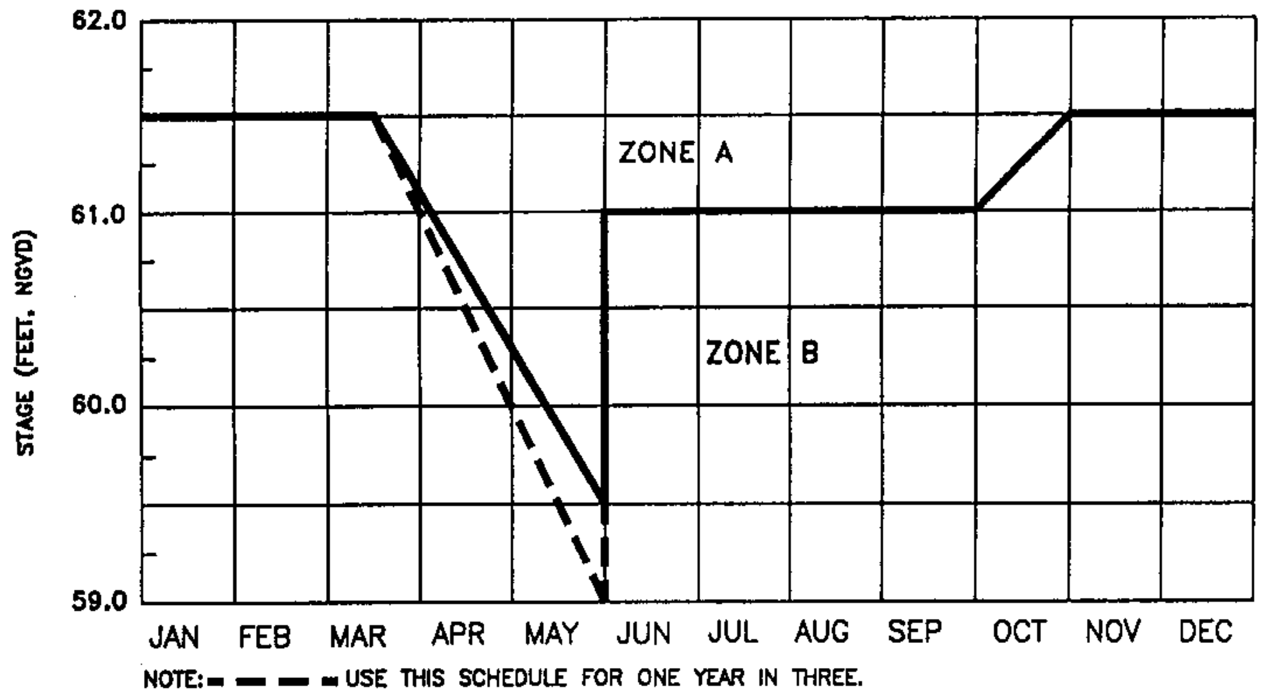
CENTRAL AND SOUTHERN FLORIDA
KISSIMMEE RIVER BASIN

LAKE ALLIGATOR, BRICK LIZZIE, COON, CENTER, & TROUT

INTERIM REGULATION SCHEDULE
U S ARMY ENGINEERING DISTRICT JACKSONVILLE
CORPS OF ENGINEERS, JACKSONVILLE, FLA

DATED 1 DECEMBER 1981

Figure C-2. Regulation Schedule for Alligator Lake Subbasin.



ZONE	RELEASES S-63
A	AT DESIGN CAPACITY (715 CFS) EXCEPT WHEN THE LAKE IS WITHIN 0.5 FT OF DESIRED STAGE. FORECASTS WILL THEN BE MADE AND RELEASES STARTED TO BRING THE LAKE BACK DOWN TO SCHEDULE WITHIN 15 DAYS.
B	TO MAINTAIN MINIMUM FLOWS

CENTRAL AND SOUTHERN FLORIDA
KISSIMMEE RIVER BASIN

LAKE GENTRY

INTERIM REGULATION SCHEDULE
U S ARMY ENGINEERING DISTRICT JACKSONVILLE
CORPS OF ENGINEERS, JACKSONVILLE, FLA

DATED: 1 DECEMBER 1981

Figure C-3. Regulation Schedule for Lake Gentry Subbasin.

Table C-1. Subbasins in the Upper Kissimmee Basin.

Subbasin	Subbasin Area (sq. miles)	Major Water Bodies	Water Body Area (mi^2@ ft. NGVD)	Regulation Range (ft. NGVD)
Alligator Lake	31.5 (31.5 in Osceola County)	Alligator Lake	3.8 mi^2 @ 64.0 ft.	61.5 to 64.0
Lake Gentry	51.7 (51.7 in Osceola County)	Lake Gentry	2.8 mi^2 @ 61.8 ft.	59.5 to 61.5
S-63A	35.3 (35.3 in Osceola County)	Canoe Creek Canal (C-34)	[a]	56.5 to 57.5
Canoe Creek	6.9 (6.9 in Osceola County)	Canoe Creek Canal (C-34)	[a]	51.5 to 53.8
Lake Myrtle	62.9 (61.5 in Osceola County; 1.4 in Orange County)	Lake Myrtle	1.0 mi^2 @ 61.0 ft.	60.0 to 62.0
		Cat Lake	3.2 mi^2 @ 69.0 ft.	[b]
		Lake Conlin	9.8 mi^2 @ 69.0 ft.	[b]
Lake Hart	60.2 (56.5 in Orange County; 3.7 in Osceola County)	Lake Hart	5.7 mi^2 @ 61.0 ft.	59.5 to 61.0
		Lake Mary Jane	1.8 mi^2 @ 60.0 ft.	59.5 to 61.0
Boggy Creek	86.8 (86.8 in Orange County)	Lake Conway	1.7 mi^2 @ 86.9 ft.	[b]
East Lake Tohopekaliga	50.8 (40.7 in Osceola County; 10.1 in Orange County)	East Lake Tohopekaliga	19.9 mi^2 @ 56.3 ft.	54.5 to 58.0
Shingle Creek	111.4 (83.1 in Orange County; 29.4 in Osceola County)	Big Sand Lake	1.7 mi^2 @ 90.0 ft.	[b]
Lake Tohopekaliga	131.5 (125.6 in Orange County; 5.9 in Osceola County)	Lake Tohopekaliga	30.2 mi^2 @ 53.7 ft.	59.5 to 61.5
Cypress Lake	42.5 (42.0 in Osceola County; 0.5 in Polk County)	Cypress Lake	6.4 mi^2 @ 52.0 ft.	48.5 to 54.0
Lake Hatchineha	128.5 (96.5 in Polk County; 32.0 in Osceola County)	Lake Hatchineha	14.8 mi^2 @ 51.8 ft.	48.5 to 54.0
		Lake Marion	5.4 mi^2 @ 67.0 ft.	[b]
Reedy Creek	269.1 (103.2 in Osceola County; 107.3 in Orange County; 34.2 in Polk County; 24.4 in Lake County)	Reedy Creek	[a]	[b]
		Lake Butler	2.6 mi^2 @ 98.0 ft.	[b]
		Lake Tibet	1.8 mi^2 @ 98.0 ft.	[b]
Lake Pierce	76.0 (76.0 in Polk County)	Lake Pierce	6.1 mi^2 @ 76.0 ft.	[b]
Lake Kissimmee	269.3 (178.2 in Osceola County; 91.1 in Polk County)	Lake Kissimmee	55.5 mi^2 @ 50.8 ft.	48.5 to 54.0
		Lake Jackson	1.6 mi^2 @ 51.0 ft.	51.0 to 56.0
		Lake Rosalie	9.1 mi^2 @ 53.8 ft.	[b]
		Tiger Lake	4.8 mi^2 @ 51.0 ft.	49.0 to 52.5
Lake Marian	57.9 (57.9 in Osceola County)	Lake Marian	7.9 mi^2 @ 59.1 ft.	58.0 to 60.0
Lake Weohyakapka	97.8 (97.8 in Polk County)	Lake Weohyakapka	11.9 mi^2 @ 60.0 ft.	[b]

a. Not a lake, therefore surface area not applicable.
b. SFWMD does not regulate.

percent of the total area of the basin. Lake Myrtle discharges into Lake Mary Jane (Lake Hart subbasin) by S-57 via C-30. Lakes Joel, Myrtle, and Preston are regulated by S-57, which is located in C-30 and connects Lakes Myrtle and Mary Jane. The regulation schedule for the Lake Myrtle subbasin is shown in **Figure C-4**.

Lake Hart Subbasin. Lakes in this subbasin in addition to Lake Hart are Lake Mary Jane (connected to Lake Hart by C-29), Lake Nona, Red Lake, Buck Lake, Barton Lake (connected to Lake Hart by Myrtle Bay), Hinden Lake, and Ajay Lake (downstream of S-62, and connected to East Lake Tohopekaliga by C-29B). Lakes account for 11.7 percent of the total subbasin area. The two other major District canals in this subbasin are C-30 and C-29A. C-30 connects Lake Myrtle with Lake Mary Jane. C-29A connects Lake Hart with Ajay Lake. The lakes in this subbasin are regulated by S-62 which is located in C-29A. The regulation schedule for the Lake Hart subbasin is shown in **Figure C-5**.

Boggy Creek Subbasin. The Boggy Creek subbasin is located in Orange County. This subbasin is the largest tributary to East Lake Tohopekaliga. There are 24 named lakes in the subbasin whose sizes vary from 8 acres to 1.7 square miles (Lake Conway). Of the 24 lakes, only three are not landlocked at normal stage.

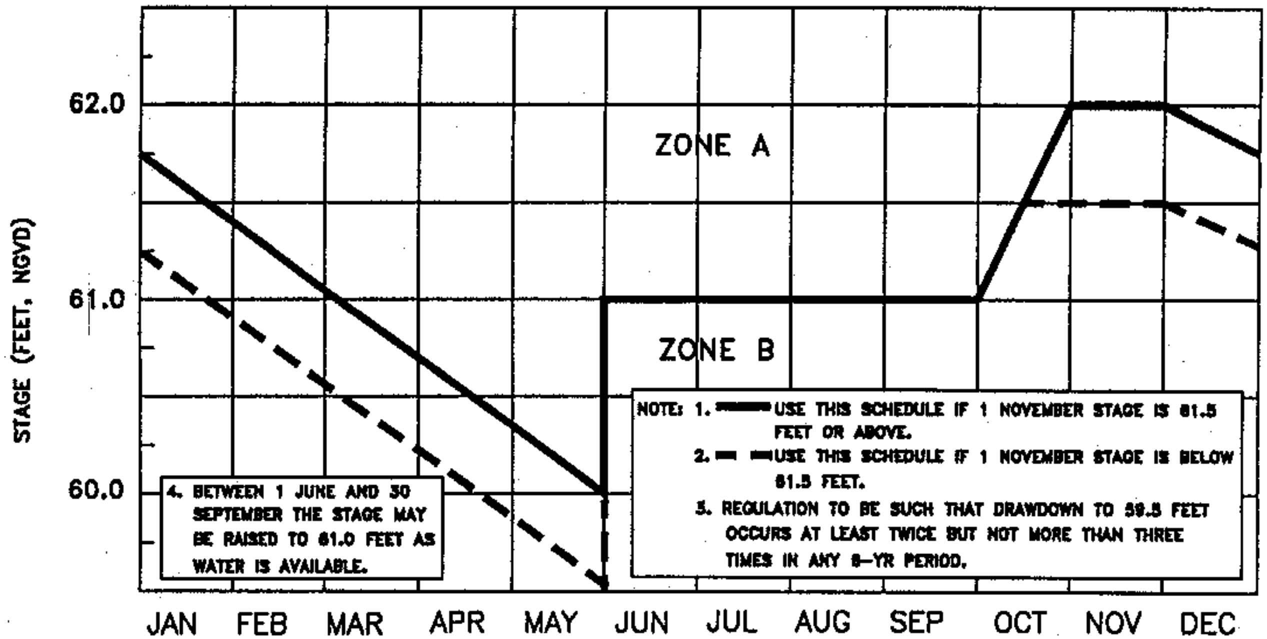
Boggy Creek has two main branches: East and West. The East Branch is the main water course of the Boggy Creek, which is 12 miles in length and whose headwaters originate in the southern lobe of Lake Conway. A canal on the east side of Lake Conway flows eastward to Lake Warren, then flows into a channelized water course southward, discharging into Boggy Creek Swamp, and then into East Lake Tohopekaliga.

The West Branch of Boggy Creek extends from Lake Jessamine to Boggy Creek Swamp. Due to the obstruction of the culverts under Oak Ridge Road, there is no flow through these culverts under normal conditions. During floods, the flow is from areas upstream of Oak Ridge Road into Lake Jessamine, and then continues to drain into Lake Conway.

The upper portion of the Boggy Creek subbasin is within the general urban area of Orlando. This area is experiencing heavy urbanization. Orlando International Airport covers 43 percent of the subbasin; and Boggy Creek Swamp along with other wetlands, lakes, and ponds account for 18 percent of the subbasin area.

East Lake Tohopekaliga Subbasin. The city of St. Cloud, located on the south shore of East Lake Tohopekaliga, is the largest urbanized area in this subbasin. Lake Runnymede is the second largest lake in the subbasin, and has a surface area of 300 acres. Lake Runnymede is connected to East Lake Tohopekaliga by Runnymede Canal. The Boggy Creek subbasin is the major tributary of East Lake Tohopekaliga. C-31 is the outlet of East Lake Tohopekaliga (controlled by S-59). The regulation schedule for the East Lake Tohopekaliga subbasin is shown in **Figure C-6**.

Shingle Creek Subbasin. The Shingle Creek subbasin is a major tributary to Lake Tohopekaliga. There are 22 named lakes in the subbasin with surface areas ranging from 10 acres to 1.7 square miles (Big Sand Lake). Most of these lakes are landlocked at normal



ZONE	RELEASES S-57
A	AT DESIGN CAPACITY (170 CFS) EXCEPT WHEN THE LAKE IS WITHIN 0.5 FT. OF DESIRED STAGE. FORECASTS WILL THEN BE MADE AND RELEASES STARTED TO BRING THE LAKE BACK DOWN TO SCHEDULE WITHIN 15 DAYS.
B	TO MAINTAIN MINIMUM FLOWS

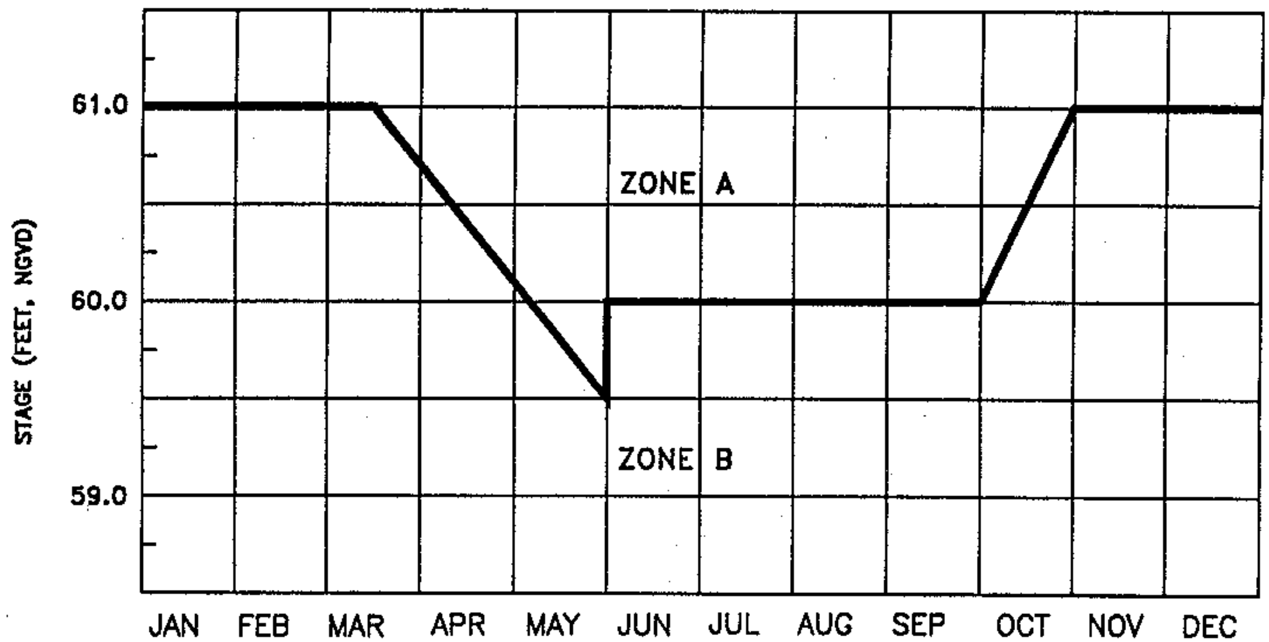
CENTRAL AND SOUTHERN FLORIDA
KISSIMMEE RIVER BASIN

LAKE JOEL, MYRTLE & PRESTON

INTERIM REGULATION SCHEDULE
U S ARMY ENGINEERING DISTRICT JACKSONVILLE
CORPS OF ENGINEERS, JACKSONVILLE, FLA

DATED: 9 FEBRUARY 1978

Figure C-4. Regulation Schedule for Lake Myrtle Subbasin.



ZONE	RELEASES S-65
A	AT DESIGN CAPACITY (640 CFS) EXCEPT WHEN THE LAKE IS WITHIN 0.5 FT. OF DESIRED STAGE. FORECASTS WILL THEN BE MADE AND RELEASES STARTED TO BRING THE LAKE BACK DOWN TO SCHEDULE WITHIN 15 DAYS.
B	TO MAINTAIN MINIMUM FLOWS

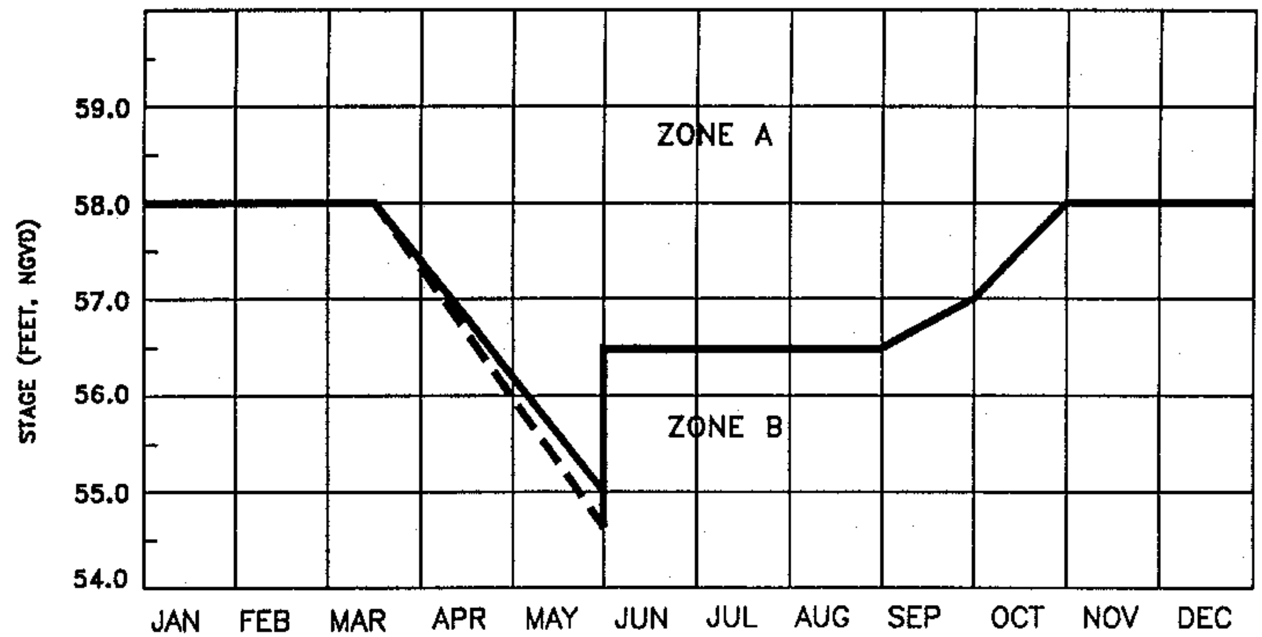
CENTRAL AND SOUTHERN FLORIDA
KISSIMMEE RIVER BASIN

LAKES HART & MARY JANE

INTERIM REGULATION SCHEDULE
U S ARMY ENGINEERING DISTRICT JACKSONVILLE
CORPS OF ENGINEERS, JACKSONVILLE, FLA

DATED: 12 APRIL 1982

Figure C-5. Regulation Schedule for Lake Hart Subbasin.



NOTE: ▬ ▬ ▬ USE THIS SCHEDULE ONE YEAR IN THREE.

ZONE	RELEASES S–59
A	AT DESIGN CAPACITY (820 CFS) EXCEPT WHEN THE LAKE IS WITHIN 0.5 FT. OF DESIRED STAGE. FORECASTS WILL THEN BE MADE AND RELEASES STARTED TO BRING THE LAKE BACK DOWN TO SCHEDULE WITHIN 15 DAYS.
B	TO MAINTAIN MINIMUM FLOWS

CENTRAL AND SOUTHERN FLORIDA
KISSIMMEE RIVER BASIN

EAST LAKE TOHOPEKALIGA

INTERIM REGULATION SCHEDULE
U S ARMY ENGINEERING DISTRICT JACKSONVILLE
CORPS OF ENGINEERS, JACKSONVILLE, FLA

DATED: 1 DECEMBER 1981

Figure C-6. Regulation Schedule for East Tohopekaliga Subbasin.

stages. Several lakes are directly connected to Shingle Creek, including Lake Mann, Clear Lake, Lake Cain, Turkey Lake, Rattlesnake Lake and Lake Catherine.

Shingle Creek begins at the Westside Manor pump station and receives water from Clear Lake. Runoff from the populated areas west and south of the city of Orlando drain into the headwaters of Shingle Creek. The creek then runs southward for 24 miles through Shingle Creek Swamp and the city of Kissimmee, where it combines with the Brown Farm Canal before emptying into Lake Tohopekaliga. Approximately 13 miles of the creek, from its headwaters to just south of the swamp, have been channelized.

The Valencia Water Control District is located within the Shingle Creek subbasin, bordering the Shingle Creek Swamp. This district is heavily populated and intensely developed, and includes Sea World and the commercial developments along International Drive.

Lake Tohopekaliga Subbasin. The subbasin is located within Osceola County except for the northernmost portion, which is in Orange County. The southernmost point of Lake Tohopekaliga is the discharge outlet into Cypress Lake through S-61 via South Port Canal (C-35). Lake Tohopekaliga receives inflow from Shingle Creek, and from East Lake Tohopekaliga via the St. Cloud Canal. The regulation schedule for the Lake Tohopekaliga subbasin is shown in **Figure C-7**.

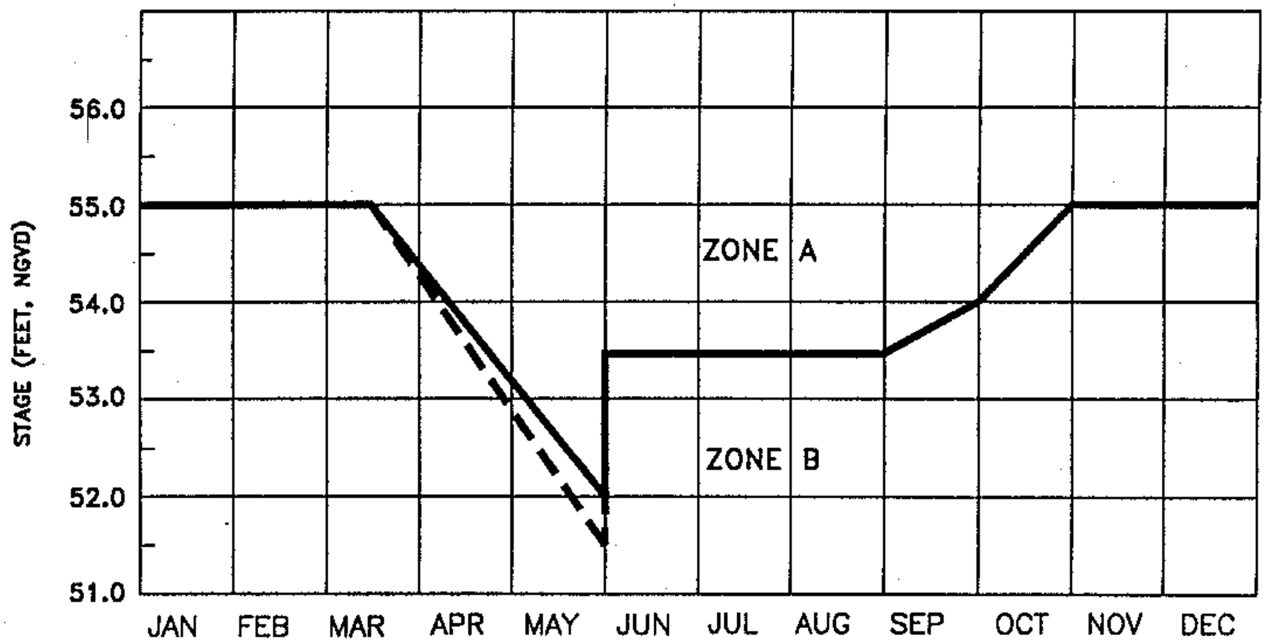
Cypress Lake Subbasin. Cypress Lake is the only lake in this subbasin. This lake receives inflow from Lake Gentry through S-63A via C-34, and from Lake Tohopekaliga through S-61 via C-35 and about 30 percent of Reedy Creek's flow.

Cypress Lake connects with Lake Hatchineha via the Cypress-Hatchineha Canal (C-36). This is the major outflow canal for Cypress Lake; however, flow over the south shore of Cypress Lake into Lake Kissimmee via the Cypress-Kissimmee Canal has occurred in the past during high water level conditions. There is no water control structure in C-36. Cypress Lake, together with Lake Hatchineha, and Lake Kissimmee, is regulated by S-65. This structure is located at the outlet of Lake Kissimmee in the Kissimmee River (C-38).

Lake Hatchineha Subbasin. The Haines City Drainage District is located in the Polk County Area of the Lake Hatchineha subbasin. Inflow to Lake Hatchineha includes water from Cypress Lake via C-36, Reedy Creek subbasin via Dead River, Horse Creek subbasin via Snell Creek and Marion Creek, and Lake Pierce subbasin via Catfish Creek. Outflow from Lake Hatchineha to Lake Kissimmee is through C-37. There are no water control structures in C-36 or C-37.

Lake Marion is the second largest lake in this subbasin. Waters from the Horse Creek subbasin drain into Snell Creek, then join Lake Marion Creek just downstream of Lake Marion before discharging into Lake Hatchineha.

Reedy Creek Subbasin. There are more than 20 named lakes in the Reedy Creek subbasin. Most of them are within the Reedy Creek Improvement District, which operates



NOTE: — — — USE THIS SCHEDULE ONE YEAR IN THREE.

ZONE	RELEASES S-61
A	AT DESIGN CAPACITY (2300 CFS) EXCEPT WHEN THE LAKE IS WITHIN 0.5 FT. OF DESIRED STAGE. FORECASTS WILL THEN BE MADE AND RELEASES STARTED TO BRING THE LAKE BACK DOWN TO SCHEDULE WITHIN 15 DAYS.
B	TO MAINTAIN MINIMUM FLOWS

CENTRAL AND SOUTHERN FLORIDA
KISSIMMEE RIVER BASIN

LAKE TOHOPEKALIGA

INTERIM REGULATION SCHEDULE
U S ARMY ENGINEERING DISTRICT JACKSONVILLE
CORPS OF ENGINEERS, JACKSONVILLE, FLA

DATED: 1 DECEMBER 1981

Figure C-7. Regulation Schedule for Lake Tohopekaliga Subbasin.

and maintains a system of canals and control structures for water management purposes. This district includes Walt Disney World and the associated Disney attractions. Reedy Creek runs southeast for 29 miles before splitting into two branches near Cypress Lake. One branch enters Cypress Lake and the other, known as Dead River, enters Lake Hatchineha. Reedy Creek forms Lake Russell, which is about seven miles upstream of Cypress Lake.

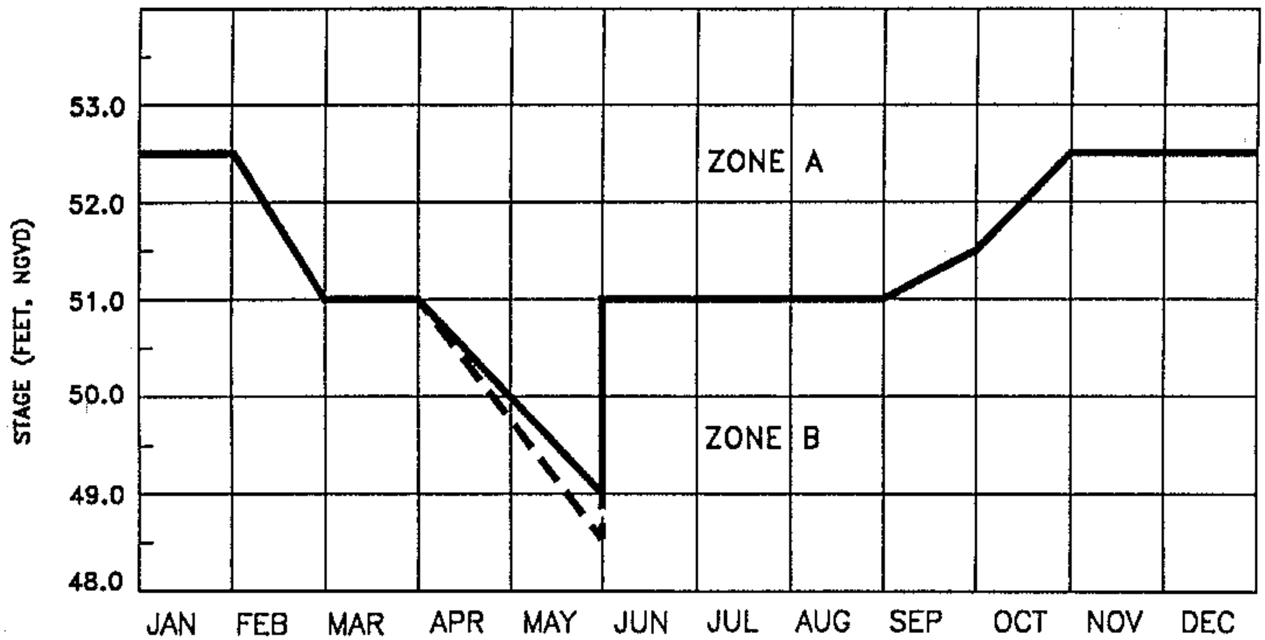
Lake Pierce Subbasin. Lake Pierce, is the major lake in this subbasin. Water from Lake Pierce is a major tributary of Lake Hatchineha via Catfish Creek. The other named lakes in the subbasin are Saddlebags, Thomas, Parks, Cypress, Little Gum and Big Gum lakes. These lakes range in size from 25 to 170 acres. Flow from those lakes contribute to Catfish Creek before discharging into Lake Hatchineha.

Lake Kissimmee Subbasin. The four major lakes in this basin are Lake Kissimmee, Lake Jackson, Lake Rosalie, and Tiger Lake. Lake Jackson receives water from Lake Marian by G-113. The outflow from Lake Jackson to Lake Kissimmee is by way of the Jackson Canal via the Lake Jackson Structure. Lake Rosalie receives inflow from Lake Weohyakapka and discharges into Tiger Lake via Rosalie Creek, and into Zipper Canal via G-103. Lake Kissimmee also receives water from Lake Hatchineha via C-37, and from the Cypress-Kissimmee Canal during extra high water level conditions in Cypress Lake. The S-65 structure located at the southern end of Lake Kissimmee is the sole outlet of Lake Kissimmee and the chain of lakes. Lake Kissimmee as well as Lakes Hatchineha and Cypress are normally regulated by S-65.

The current regulation schedule for Lakes Kissimmee, Hatchineha and Cypress is shown in **Figure C-8**. As part of the Kissimmee River Restoration Project, a new regulation schedule and operational rules were developed (**Figure C-9**). The new schedule is designed to modify the delivery of water from S-65 subbasin to the Kissimmee River, to reflect a more natural rainfall driven flow regime. The new schedule will be implemented in May 2000.

Lake Marian Subbasin. The Lake Marian subbasin is located in the southeast of the Upper Kissimmee Basin. Lake Marian is the only lake in the subbasin, and discharges into Lake Jackson through G-113, which is a culvert that maintains stage in Lake Marian. When the water level in the lake reaches 59.0 feet NGVD, flow also begins into Lake Kissimmee from Lake Marian through Fodderstack Slough.

Lake Weohyakapka Subbasin. The subbasin is located in Polk County. There are four other named lakes in the subbasin, Lakes Wales, Easy, Leonore, and Moody, which have a combined area of 320 acres and are located along the western boundary of the subbasin. Lake Weohyakapka is connected to Lake Rosalie by Weohyakapka Creek. When the lake stage is above 63.5 feet NGVD, water may flow through the Blue Jordan Swamp into Lake Arbuckle, which is located in the Lower Kissimmee Basin.



NOTE: ▬ ▬ ▬ USE THIS SCHEDULE ONE YEAR IN THREE.

ZONE	RELEASES S-65
A	3,000 CFS US TO DESIGN CAPACITY (11,000 CFS) WITHOUT EXCEEDING DESIGN CONDITIONS DOWNSTREAM. WHEN THE LAKE IS WITHIN 0.5 FT. OF DESIRED STAGE, FORECASTS WILL THEN BE MADE AND RELEASES STARTED TO BRING THE LAKE BACK DOWN TO SCHEDULE WITHIN 15 DAYS.
B	TO MAINTAIN MINIMUM FLOWS

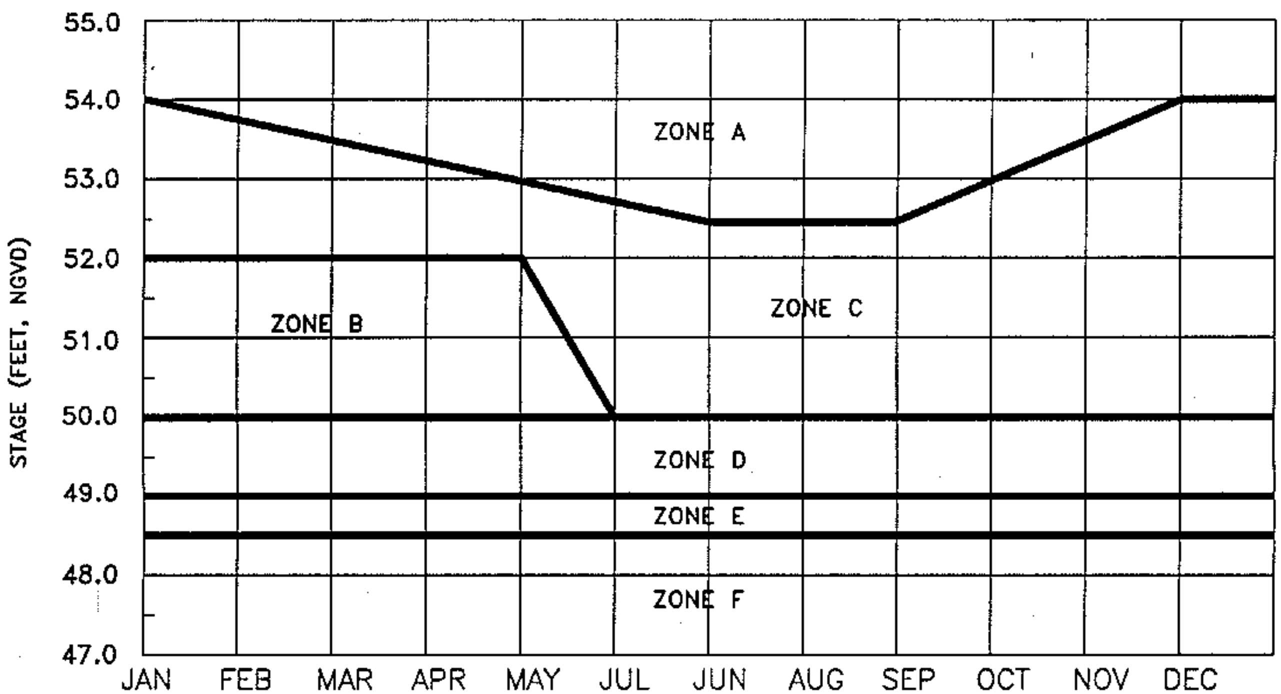
CENTRAL AND SOUTHERN FLORIDA
KISSIMMEE RIVER BASIN

LAKE KISSIMMEE,
HATCHINEHA & CYPRESS

INTERIM REGULATION SCHEDULE
U S ARMY ENGINEERING DISTRICT JACKSONVILLE
CORPS OF ENGINEERS, JACKSONVILLE, FLA

DATED: 1 DECEMBER 1981

Figure C-8. Regulation Schedule for Lake Kissimmee Subbasin.



ZONE	RELEASES
A	AT DESIGN CAPACITY, DISCHARGE RATE EQUALS 2,500 CFS. TO 11,000 CFS.
B	DISCHARGE EQUALS 400 CFS.
C	DISCHARGE EQUALS A RATING CURVE (400 TO 2,500 CFS.)
D	TRANSITION ZONE, DISCHARGE FROM 400 TO 150 CFS.
E	150 CFS ZONE.
F	ZERO FLOW ZONE.

CENTRAL AND SOUTH FLORIDA PROJECT
KISSIMMEE RIVER BASIN

LAKES KISSIMMEE, HATCHINEHA & CYPRESS

ALTERNATE REGULATION SCHEDULE
U S ARMY ENGINEERING DISTRICT JACKSONVILLE
CORPS OF ENGINEERS, JACKSONVILLE, FLA

DATED: 1999

Figure C-9. Proposed Regulation Schedule for Lakes Kissimmee, Hatchinaha, and Cypress.

LOWER KISSIMMEE BASIN

The Lower Kissimmee Basin includes the tributary watersheds of the Kissimmee River between the outlet of Lake Kissimmee (S-65) and Lake Okeechobee. The subbasins of the Lower Kissimmee Basin are generally bound by the drainage divides of major water bodies (**Table C-2**).

Table C-2. Subbasins in the Lower Kissimmee Basin.

Subbasin	Subbasin Area (sq.miles)	Major Water Bodies	Water Body Area (mi^2 @ stage)	Regulation Range (ft. NGVD)
S-65A	161.4 (79.0 in Osceola County; 77.0 in Polk County; 5.4 in Highlands County)	Pool A	[a]	46.3 +/- 2.0
S-65B *(to be removed during Kissimmee River Restoration Project)*	200.4 (98.0 in Okeechobee County; 45.5 in Highlands County; 40.8 in Osceola County; 16.1 in Polk County)	Pool B	[a]	Fluctuates seasonally between 38-42
S-65C *(to be removed during Kissimmee River Restoration Project)*	78.9 (43.4 in Okeechobee County; 35.5 in Highlands County)	Pool C	[a]	34.0 +/- 2.0
S-65D	182.2 (158.7 in Okeechobee County: 23.5 in Highlands County)	Pool D	[a]	26.8 +/- 2.0
S-65E	45.5 (23.7 in Okeechobee County; 21.8 in Highlands County)	Pool E	[a]	21.0 +/- 2.0
S-154	49.4 (49.4 in Okeechobee County)	[a]	[a]	[b]
Taylor Creek - Nubbin Slough	256.2 (199.8 in Okeechobee County; 46.8 in Martin County; 9.3 in St. Lucie; 0.3 in Glades)	[a]	[a]	[b]
Lake Istokpoga-Indian Prairie (within SFWMD)	727.8 (392.6 in Highlands County; 241.8 in Glades County; 87.1 in Polk County; 6.3 in Okeechobee County)	Lake Istokpoga	44.3 mi^2 @ 39.0 ft.	37.0 to 39.5
		Lake Arbuckle	6.0 mi^2	[b]
		Reedy Lake	5.4 mi^2	[b]
Fisheating Creek	441.0 (260.7 in Highlands County; 179.4 in Glades County; 0.9 in DeSoto County)	Fisheating Creek	[a]	[b]

a. Not a lake, therefore surface area not applicable.
b. SFWMD does not regulate.

S-65 Subbasins. There are a series of five subbasins (S-65A through E) along the length of the C-38. These structures divide the C-38 into five pools (**Table C-3**). The water level in each of these pools is regulated according to an interim regulation schedule for the Kissimmee River Pools (**Figure C-10**).

The Kissimmee River Restoration Project includes removal of the S-65B and S-65C spillway structures and locks. S-65B will be removed with the first phase of construction, which began in June 1999. The S-65C structure is scheduled for removal during the third phase of construction. The S-65A lock and spillway will not be removed. However, the west tieback levee will be degraded to an elevation of 49 feet with three, 200 feet gaps at elevations of 48 feet each. The east tieback levee will remain at the present elevation. Culverts will be installed to allow flow through the east levee when water elevations exceed 48 feet. Modifications to S-65D are in the planning phase. Preliminary designs include a new single bay spillway to replace the existing S-65DX structure. This spillway will be used to control normal flows through the restored Kissimmee River. The main spillway will be used to accommodate high discharges as needed. The operational rules for S-65A, S-65D, and S-65E will be modified to provide a more natural, seasonally variable flow regime, reflective of local and regional climatic conditions.

Table C-3. C-38 Pool Characteristics.

Characteristics	Pool				
	A	B[a]	C[a]	D	E
Upstream Structure	S-65	S-65A	S-65B	S-65C	S-65D
Downstream Structure	S-65A	S-65B	S-65C	S-65D	S-65E
Water Surface Elevation (ft) Width (ft)	 46.3 210.0	 40.0 220.0	 34.0 260.0	 26.8 300.0	 21.0 345.0
Bottom Elevation (ft) Width (ft)	 15.5 90.0	 6.5 100.0	 -0.4 140.0	 -6.2 180.0	 -11.0 225.0
Pool Length (mi)	10.6	12.3	8.6	8.9	7.4

a. These structures will be removed during the Kissimmee River Restoration Project.

S-154 Subbasin. The S-154 subbasin is located west of the city of Okeechobee. S-154 is the major water control structure in the subbasin. This structure is operated to maintain an optimum stage of 25 feet NGVD. S-154 is designed to pass about 1,000 cfs discharge from a 30 percent SPF. It also prevents backflow from Lake Okeechobee during excessive stages in the lake caused by high tide or flood. It drains into the C-38 below S-65E.

Taylor Creek-Nubbin Slough Subbasin. This subbasin, located along the northeastern shore of Lake Okeechobee, and includes areas tributary to Taylor Creek-Nubbin Slough, Williamson's Ditch, Lettuce, Little Bimini Creek, Otter Creek, Henry Creek

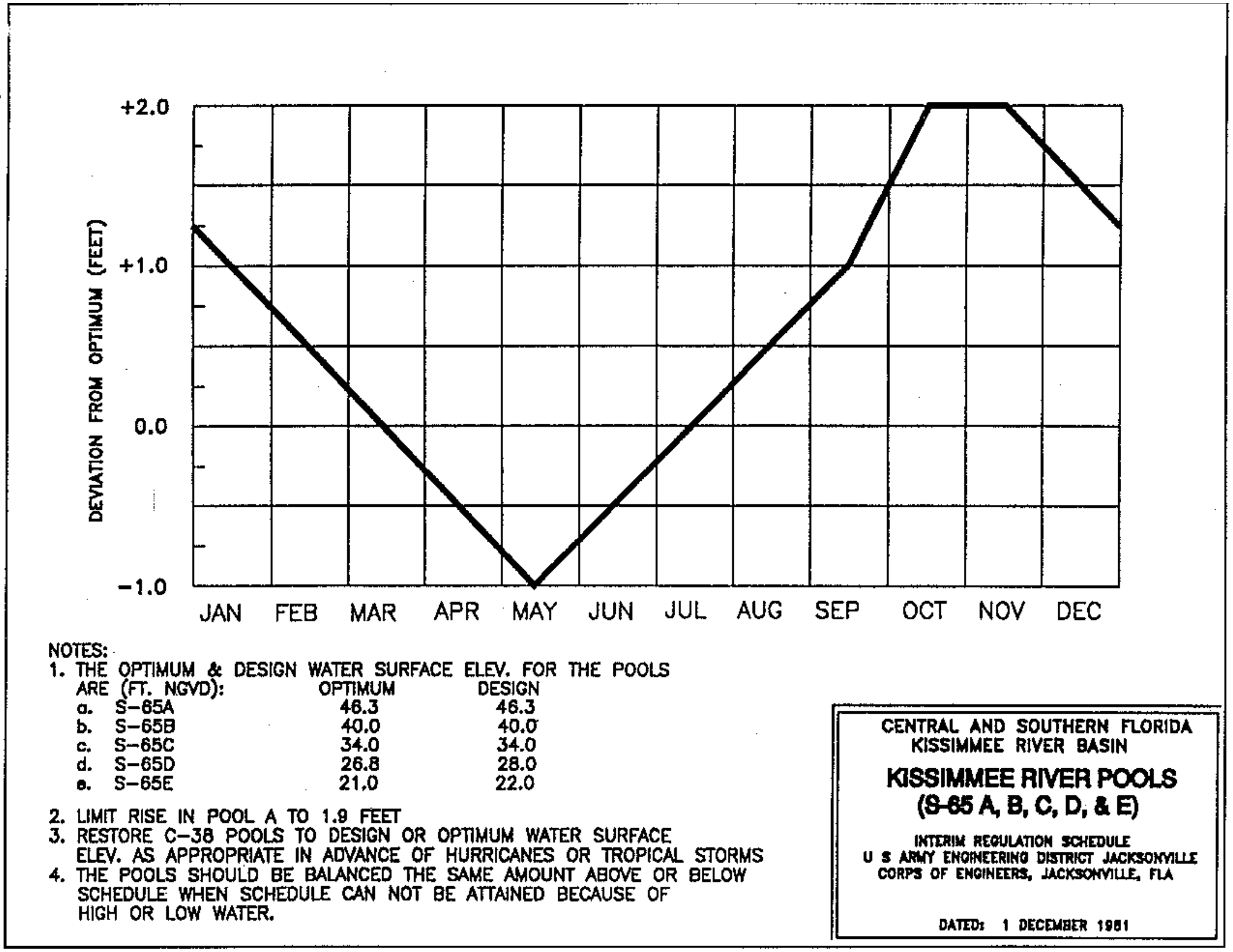


Figure C-10. Regulation Schedule for Kissimmee River Pools (S-65) Subbasin.

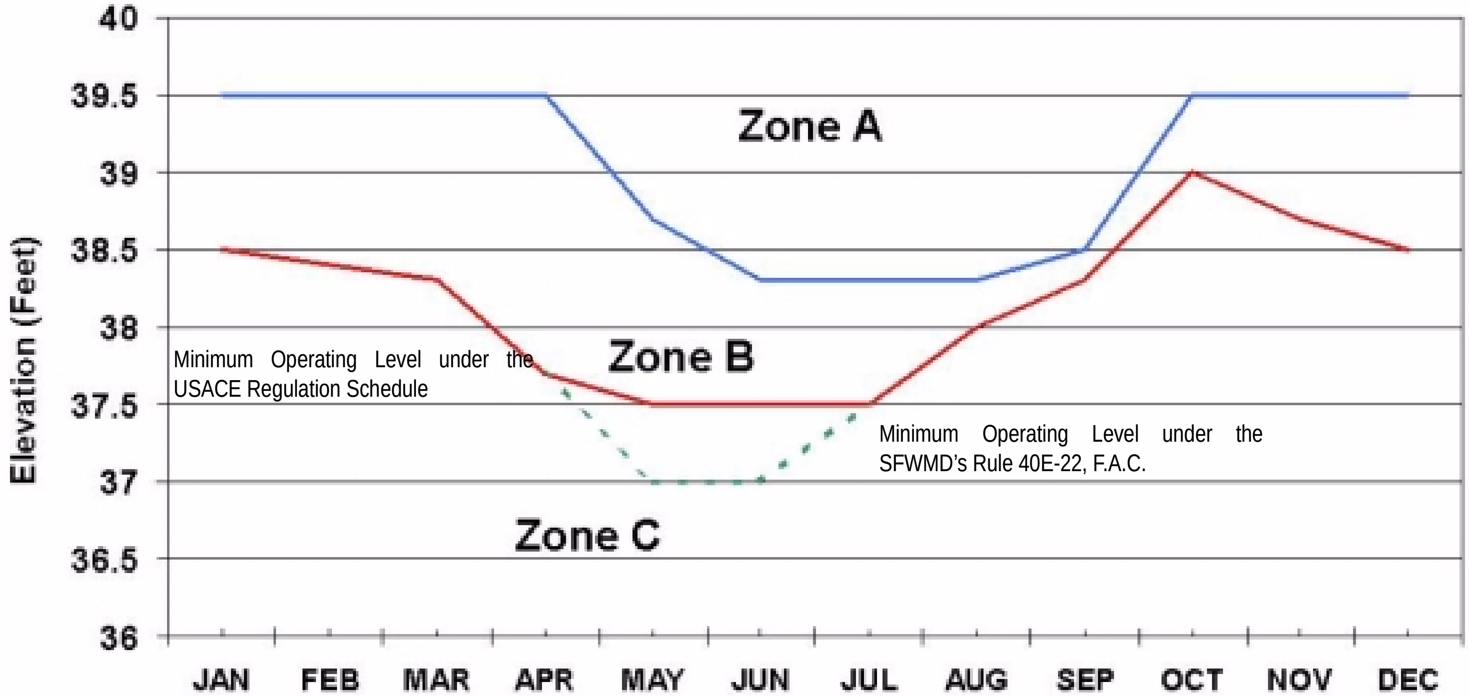
and Mosquito Creek. The majority of flow from Taylor Creek is diverted by S-192 to Nubbin Slough via an interceptor canal. Flow from Nubbin Slough then enters Lake Okeechobee through S-191. The lower reaches of Taylor Creek, downstream of S-192, empty into Lake Okeechobee through L-D4 via Hurricane Gate Structure 6 (HGS-6).

Lake Istokpoga-Indian Prairie Subbasin. The Lake Istokpoga-Indian Prairie subbasin includes Harney Pond Canal, Indian Prairie Canal, and the State Road 70 Canal subbasin. The Lake Istokpoga-Indian Prairie subbasin includes the cities of Avon Park and Sebring. Arbuckle and Josephine Creeks are tributaries to Lake Istokpoga. The regulation schedule for Lake Istokpoga is shown in **Figure C-11**.

S-68 discharges water from Lake Istokpoga into C-41A, then into associated downstream canals: Slough Canal (C-41A), Harney Pond Canal (C-41), and Indian Prairie Canal (C-40) via C-39A. C-40 and C-41 discharge into Lake Okeechobee via S-72 and S-71 respectively, while C-41A discharges into the C-38 via S-84. The Istokpoga Canal connects Lake Istokpoga to C-38, between S-65B and S-65C. Releases from S-68 are made in accordance with an established regulation schedule shown in **Figure C-11**. The regulation schedule has been adopted as part of the District's water shortage rule (40E-22, F.A.C.).

The final Restudy Plan that was forwarded to Congress in April 1999 recommended the District and USACE to review the regulation schedule for Lake Istokpoga, beginning in the summer of 2000. The purpose of this effort is to examine the basin with a view towards enhancing fish and wildlife benefits and developing a long-term comprehensive management plan. The exact timing of this effort is contingent upon successful negotiation of a Preconstruction Engineering and Design Agreement with the federal government.

Fisheating Creek Subbasin. The Fisheating Creek subbasin covers portions of western Highlands and Glades counties. Fisheating Creek originates in western Highlands County and flows southward through Cypress Swamp and into Glades County, with an average gradient of 0.5 feet per mile. From central Glades County, the water leaves the creek channel and flows eastward through Cowbone Marsh into Lake Okeechobee. Levees have been constructed roughly parallel to the creek near its outlet to the lake.



Zone	Releases
A	Through all outlets
B	For agricultural demands only
C	No releases to be made

Figure C-11. Regulation Schedule for the Lake Istokpoga-Indian Prairie Subbasin.

Appendix D
POTABLE WATER AND WASTEWATER TREATMENT FACILITIES

The Kissimmee Basin (KB) Planning Area contains part of six counties: Okeechobee, Orange, Osceola, Polk, Highlands, and Glades counties. The portions of these counties within the KB Planning Area will be referred to as county areas. Only four of these areas, Okeechobee, Orange, Osceola, and Polk county areas, contain regional water treatment facilities.

POTABLE WATER TREATMENT FACILITIES

Most potable water used in the KB Planning Area is produced either by large (>0.50 MGD) or small (<0.50 MGD) water treatment facilities. This section focuses on the larger facilities, which due to their existing or future design capacities, could have an impact on the water resource.

There are 36 existing and four proposed large and/or regional facilities in eight service areas within the KB Planning Area. These water treatment facilities are located mostly in the urbanized areas throughout the KB Planning Area. Five of the facilities are privately owned. Of the 36 existing facilities, 21 use aeration, nine use chlorination, one uses ozonation, and the remaining four use a combination of these and other treatment methods. All five of the proposed facilities plan to use ozonation when they are operational. Several of the facilities plan to convert to ozonation by 2020. Thirty-three of the facilities use the Floridan aquifer for raw water supply while 1 uses water from Lake Okeechobee and one uses water from the Surficial Aquifer System (SAS). In 1995, the total treatment capacity of these facilities was 208.87 million gallons per day (MGD) and they had an average annual demand of 70.19 MGD. The locations for the water treatment facilities within their associated service areas are provided in **Figures D-1** through **D-3**. Key information for each utility is summarized in **Table D-1**.

Summary descriptions for each of the water treatment facilities are presented in this section. Each utility capsule contains the following information:

- Raw Water Supply - This section states the SFWMD permit number with the issue and expiration dates, a summary of withdrawal facilities, and the SFWMD approved allocations. All well depths are measured from land surface.
- Treatment Method - This section presents the current FDEP-rated capacity, the method of treatment, the location of the treatment plant, and the 1995 (October 1994 through September 1995) average daily flow.
- Interconnections - This section describes water distribution system interconnections with other potable water distribution systems.
- Proposed - This section states any current construction or permitting that is underway.

- Future - This section presents projected utility flows (as provided by the utility) and known future treatment plant expansions and plans, including additional facilities and wellfields.

Table D-1. Summary of the Regional Potable Water Treatment Facilities Located within the Kissimmee Basin Planning Area.

Facility	FDEP Rated Capacity (MGD)	1995 Average Daily Flow (MGD)	Method of Treatment				SFWMD Permit Number	Approved Annual Allocation (MGD)	Raw Water Sources		
			Chlorination	Coagulation /Filtration	Aeration	Ozonation			Surface Water	SAS	FAS
Okeechobee											
Okeechobee Utility Authority											
Ground Water Plant	1.00	0.71	X[a]	X	X[b]		47-00004-W	2.57		X	
Surface Water Plant	3.20	1.20	X	X			47-00004-W	[c]	X		
Orange											
Orange County Utilities											
Cypress Walk	2.74	1.38			X		48-00134-W	15.60			X
Hunters Creek	8.21	1.53			X		48-00134-W	[c]			X
Meadow Woods	5.18	0.52			X		48-00134-W	[c]			X
Orangewood	8.75	0.92	X				48-00134-W	[c]			X
Southern Reg (Prop)	N/A	N/A				X	48-00134-W	[c]			X
Southwest Reg (Horizon’s West)	N/A	N/A				X		[c]			X
Vistana	10.80	2.21	X				48-00134-W	[c]			X
Orlando Utilities Commission											
Dr. Phillips	14.00	6.51			X		48-00064-W	110.93			X
Kirkman	15.00	7.50			X		48-00064-W	[c]			X
Lake Nona	1.00	0.18			X		48-00064	[c]			X
Martin	12.00	8.61			X		48-00064-W	[c]			X
Orange (Prop)	N/A	N/A				X	48-00064-W	[c]			X
Sky Lake	10.00	4.65	X[d]				48-00064-W	[c]			X

Table D-1. (Continued) Summary of the Regional Potable Water Treatment Facilities Located within the Kissimmee Basin Planning Area.

Facility	FDEP Rated Capacity (MGD)	1995 Average Daily Flow (MGD)	Method of Treatment				SFWMD Permit Number	Approved Annual Allocation (MGD)	Raw Water Sources		
			Chlorination	Coagulation /Filtration	Aeration	Ozonation			Surface Water	SAS	FAS
Southeast (Prop)	15.00	0.00				X	48-00064-W	[c]			X
Southwest (Horizon's West Prop)	4.00	0.00				X	48-00064-W	[c]			X
Reedy Creek											
Pump station A	14.40	5.36	X				48-00009-W	22.72			X
Pump station B	21.60	4.96	X				48-00009-W	[c]			X
Pump station C	12.24	3.61	X				48-00009-W	[c]			X
Pump station D	8.64	0.00	X				48-00009-W	[c]			X
Pump station 5	0.72	0.20	X				48-00009-W	[c]			X
Irrigation wells (non PWS)		1.06									X
Osceola											
Buenaventura Lakes	4.00	1.90	X		X		49-00002-W	3.17			X
Kissimmee											
Camelot East	2.40	0.97			X		49-00103-W	29.20			X
Camelot West	2.80	1.73			X		49-00103-W	[c]			X
Fountain Park	2.16	0.68			X		49-00103-W	[c]			X
Indian Ridge	1.44	0.70			X		49-00103-W	[c]			X
North Bermuda	6.00	3.13			X		49-00103-W	[c]			X
Northwest	2.80	2.56			X[e]		49-00103-W	[c]			X
Parkway	2.80	0.97			X		49-00103-W	[c]			X
Ruby Street	4.00	2.82			X		49-00103-W	[c]			X
Poinciana											

Table D-1. (Continued) Summary of the Regional Potable Water Treatment Facilities Located within the Kissimmee Basin Planning Area.

Facility	FDEP Rated Capacity (MGD)	1995 Average Daily Flow (MGD)	Method of Treatment				SFWMD Permit Number	Approved Annual Allocation (MGD)	Raw Water Sources		
			Chlorination	Coagulation /Filtration	Aeration	Ozonation			Surface Water	SAS	FAS
#1 (Industrial Park)	1.00	0.26			X		49-00069-W	4.04			X
#2 (V-2 WTP)	1.00	0.52			X		49-00069-W	[c]			X
St. Cloud											
#1	3.31	0.63			X		49-00084-W	4.54			X
#2	3.70	0.87			X		49-00084-W	[c]			X
#3 (Cane Brake)	0.70	0.38	X				49-00084-W	[c]			X
Polk											
Oakhill Estates	N/A	0.33	X				53-00126W	1.12			X
Poinciana											
#3 (Core WTP)	1.00	0.58			X		49-00069-W	4.04			X
#4 (Wilderness WTP)	1.00	0.19			X		49-00069	[c]			X
#5 (V-7 WTP)	0.28	0.19			X		49-00069-W	[c]			X

a. Chlorination and ammonia.
b. Includes filtration.
c. Allocation incorporated into initial permit reference.
d. Chlorine/activated carbon process used to treat for hydrogen sulfide.
e. Includes chlorination.

Okeechobee County Area

Two regional potable water treatment facilities operate within the Okeechobee County Area (**Figure D-1**). Both of these facilities are operated by the Okeechobee Utility Authority. A summary sheet containing permit criteria, raw water supply, treatment methods, interconnections, and proposed or future plans is provided for each facility. Following the summary sheets is a table summarizing all of the source wells for the Okeechobee Utility Authority (**Table D-2**).

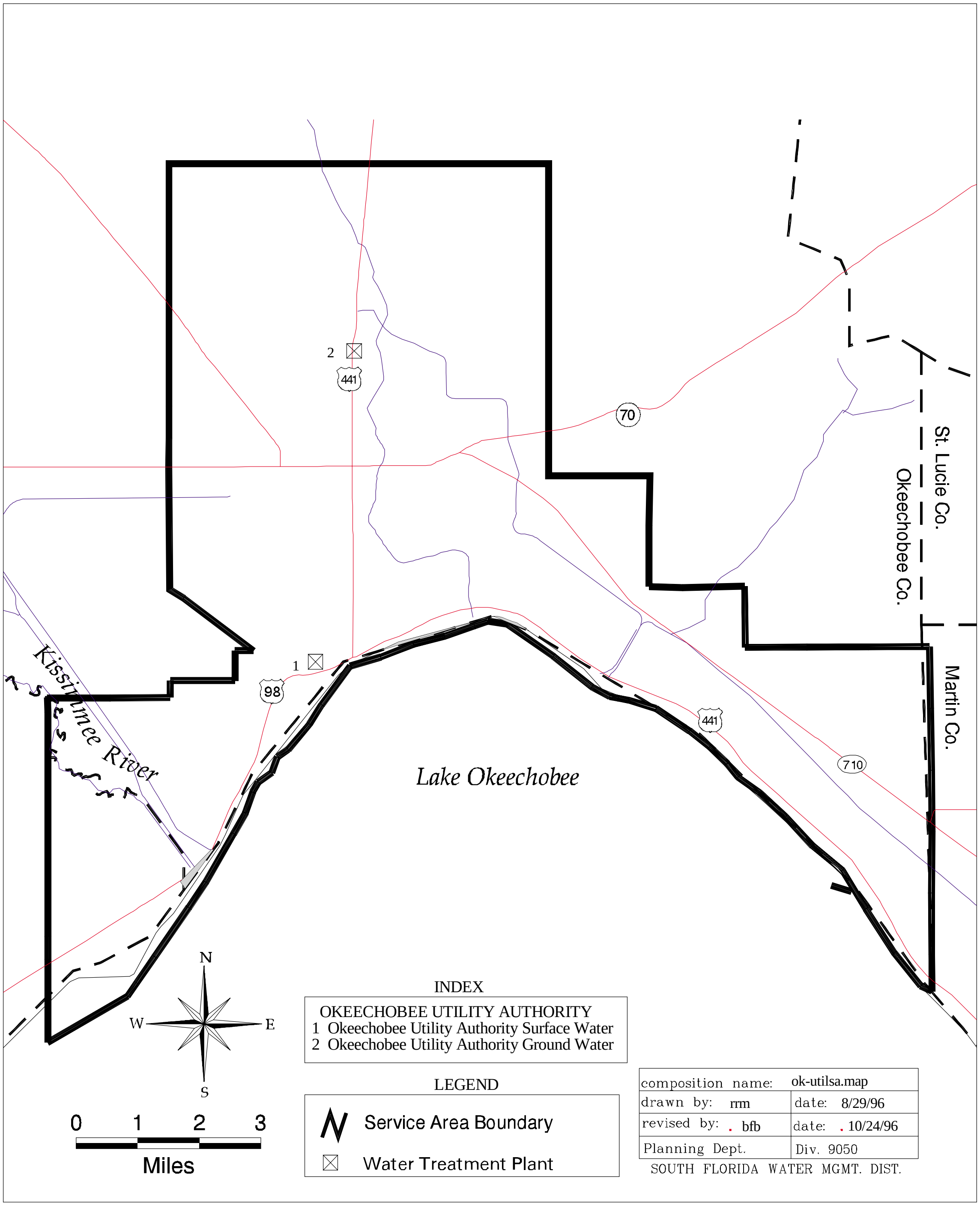


Figure D-1. The Okeechobee County Area Regional Potable Water Treatment Facilities.

Okeechobee Utility Authority Surface Water Treatment Plant

Permits

SFWMD Permit Number: 47-00004-W
FDEP PWS ID: 4470257

The current SFWMD permit was issued June 13, 1991 and expires June 13, 2001.

Raw Water Supply

Raw water is withdrawn from Lake Okeechobee near the northern bank of the lake.

The permitted allocations are as follows:

Annual Allocation:	938.72 MGY (2.57 MGD)
Total Maximum Daily Allocation:	3.47 MGD
Maximum Daily Allocation for SWTP:	2.88 MGD

Annual and total maximum daily allocations include withdrawals from Okeechobee Utility Authority Surface Water Treatment Plant (SWTP) and Ground Water Treatment Plant (GWTP). The 1995 average daily pumpage from Lake Okeechobee was 1.20 MGD. The total 1995 average daily pumpage from both the GWTP and the SWTP was 1.91 MGD.

Treatment

Treatment is provided by a 3.20 MGD rated coagulation/filtration water treatment plant located at 351 Highway 78 West in Okeechobee (**Figure D-1**). The 1995 average daily flow was 1.23 MGD. The unaccounted-for water is not known. The plant adds chlorine and ammonia as a final treatment. Fluorine is also added.

Interconnections

The Okeechobee Utility Authority distribution system is served by two water treatment plants, but is not interconnected with any other utility.

Proposed

There are no proposed facilities at this time.

Source

Information was obtained from the Okeechobee Utility Authority and SFWMD water use permit files.

Okeechobee Utility Authority Ground Water Treatment Plant

Permits

SFWMD Permit Number: 47-00004-W
FDEP PWS ID: 4474494

The current SFWMD permit was issued June 13, 1991 and expires June 13, 2001.

Raw Water Supply

Raw water is withdrawn from seven Surficial Aquifer System (SAS) wells. Four of the wells are equipped with pumps and meters and three wells were without pumps in 1995. The wells are 10 inches in diameter, have total depths between 155 and 172 feet, and cased depths between 88 and 108 feet. The wells were drilled in 1993. The pumps have a capacity of 500 gallons per minute on two wells and 350 gallons per minute on two wells. Specific well information is provided in **Table D-2**.

The permitted allocations are as follows:

Annual Allocation:	938.72 MGY (2.57 MGD)
Total Maximum Daily Allocation:	3.47 MGD
Maximum Daily Allocation for GWTP:	2.20 MGD

Annual and total maximum daily allocations include withdrawals from the Okeechobee Utility Authority SWTP and GWTP. The 1995 average daily pumpage from the wells was 0.71 MGD. The total 1995 average daily pumpage from both the GWTP and the SWTP was 1.91 MGD.

Treatment

Treatment is provided by a 1.00 MGD aeration/filtration water treatment plant located at 1200 NE 12th Street (**Figure D-1**). The 1995 average daily flow is 0.79 MGD. The unaccounted-for water is not known. The plant adds chlorine and ammonia as a final treatment. Fluorine is also added.

Interconnections

The Okeechobee Utility Authority distribution system is served by two water treatment plants, but is not interconnected with any other utility.

Proposed

There are no proposed facilities at this time.

Source

Information was obtained from the Okeechobee Utility Authority and SFWMD water use permit files.

Table D-2. Okeechobee Utility Authority Potable Water Supply Wells.

Well Number	Planar Coordinates		Status	Active	Aquifer	Total Depth (ft)	Cased Depth (ft)	Well Diameter (in)	Pump Capacity (GPM)	Intake Depth (NGVD)	Year Drilled
	Easting	Northing									
1	556500	1062637	Existing	Yes	Surficial	155	88	10	550	25.6	1993
2	556998	1062660	Existing	Yes	Surficial	165	98	10	550	25.6	1993
3	557484	1062649	Existing	No	Surficial	155	108	10	---	---	1993
4	558016	1062649	Existing	No	Surficial	175	108	10	---	---	1993
5	558491	1062649	Existing	No	Surficial	175	108	10	---	---	1993
6	558978	1062649	Existing	Yes	Surficial	175	108	10	350	19	1993
7	559452	1062649	Existing	Yes	Surficial	175	108	10	350	19	1993

Orange County Area

The portion of Orange County within the KB Planning Area (the Orange County Area) has 15 existing and five proposed regional potable water treatment/transmission facilities. These are operated by Orange County Utilities, the Orlando Utilities Commission, or the Reedy Creek Improvement District. The location of these facilities are shown in **Figure D-2**. A summary sheet containing permit criteria, raw water supply, treatment methods, interconnections, and proposed or future plans is provided for each facility. Following the summary sheets for each utility is a table summarizing all of the source wells for the utility (**Tables D-3**, **D-5**, and **D-6**).

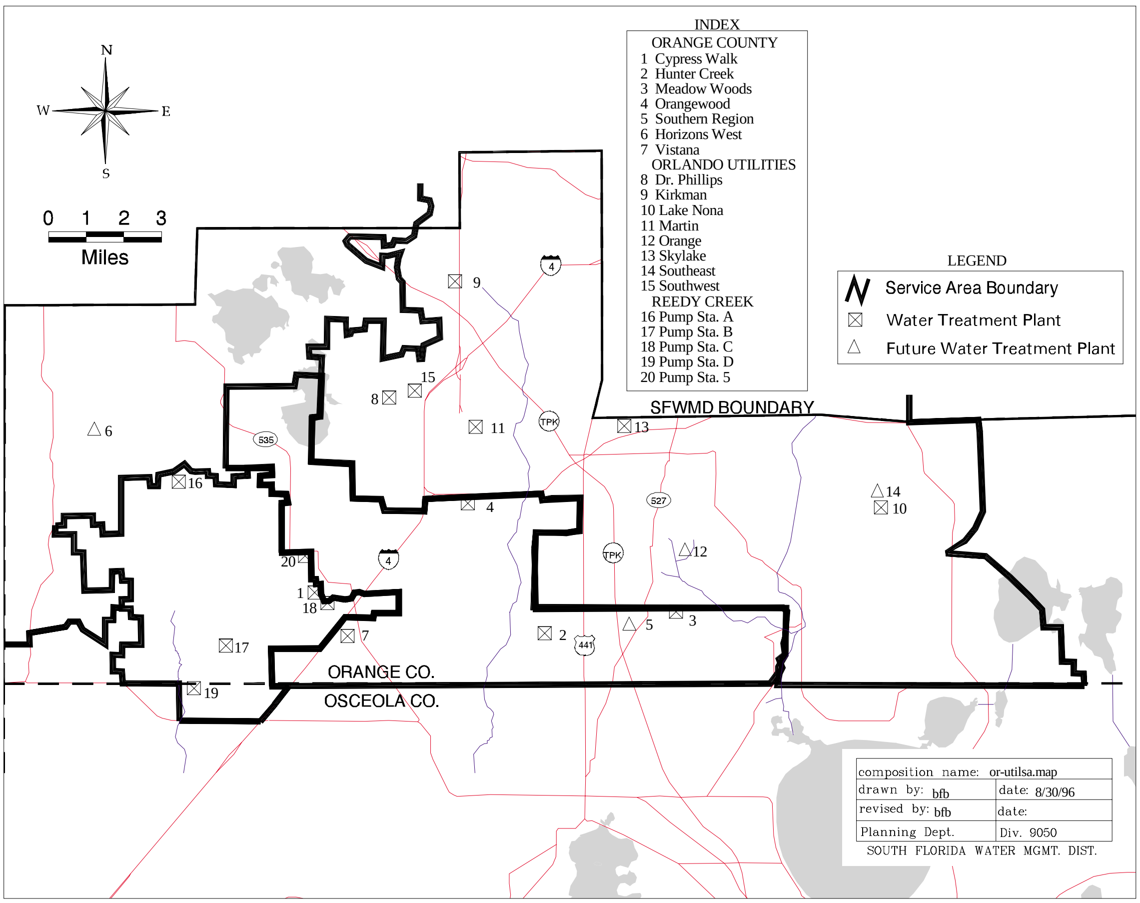


Figure D-2. The Orange County Area Regional Potable Water Treatment Facilities.

Orange County Utilities - Cypress Walk

Permits

SFWMD Permit Number: 48-00134-W
FDEP PWS ID: 3484119

The current SFWMD permit was issued April 11, 1996 and expires April 11, 2006.

Raw Water Supply

Raw water is withdrawn from two upper Floridan wells. The wells are 14 inches in diameter, have total depths of 500 and 600 feet, and cased depths of 171 and 160 feet, respectively. The wells were drilled in 1982. The pumping capacity of each well is 1,250 and 1,265 GPM. Specific well information is provided in **Table D-3**.

The permitted allocations are as follows:

Annual Allocation:	5,694.00 MGY (15.60 MGD)
Maximum Daily Allocation:	39.19 MGD

The annual and maximum daily allocations include withdrawals from the Cypress Walk, Hunters Creek, Meadow Woods, Orangewood, Southern Regional, and Vistana wellfields. The existing allocation for the Cypress Walk Wellfield is 1.80 MGD annually and 3.47 MGD maximum day.

The 1995 average daily pumpage from the Cypress Walk wells was 1.38 MGD. The total 1995 average daily pumpage from all wells was 6.56 MGD.

Treatment

Treatment is provided by a 2.74 MGD aeration water treatment plant located at 60 Grand Cypress Boulevard in Southwest Orange County (**Figure D-2**). The 1995 average daily flow was 1.38 MGD. The unaccounted-for water for the entire Orange County Utilities System is five percent.

Interconnections

The Orange County Utilities water distribution system for each of the water treatment facilities are interconnected. Orange County is discussing the potential of interconnects with the Orlando Utilities Commission and the city of Ocoee.

Proposed

Orange County's consumptive use permit authorizes construction of a Southern Regional Wellfield (four proposed lower Floridan wells) north of the intersection of Orange Avenue and the Florida Turnpike. When this wellfield is operational, the allowable withdrawals from the Cypress Walk Wellfield will be decreased to 1.0 MGD annually.

Source

Information was obtained from Orange County and SFWMD water use permit files.

Orange County Utilities - Hunters Creek

Permits

SFWMD Permit Number: 48-00134-W
FDEP PWS ID: 3484119

The current SFWMD permit was issued April 11, 1996 and expires April 11, 2006.

Raw Water Supply

Raw water is withdrawn from two upper Floridan wells. The wells are 18 inches in diameter, have total depths of 600 feet, and cased depths of 201 and 206 feet. The wells were drilled in 1985. The pumping capacity of each well is 3,500 GPM. Specific well information is provided in **Table D-3**.

The permitted allocations are as follows:

Annual Allocation:	5,694.00 MGY (15.60 MGD)
Maximum Daily Allocation:	39.19 MGD

The annual and maximum daily allocations include withdrawals from the Cypress Walk, Hunters Creek, Meadow Woods, Orangewood, Southern Regional and Vistana wellfields. The existing allocation for the Hunters Creek Wellfield is 5.04 MGD annually and 11.11 MGD maximum day.

The 1995 average daily pumpage from the Hunters Creek well was 1.53 MGD. The total 1995 average daily pumpage from all wells was 6.56 MGD.

Treatment

Treatment is provided by a 8.21 MGD aeration water treatment plant located on Water Plant Drive north of the Orange County line and west of U.S. Highway 441 (**Figure D-2**). The 1995 average daily flow was 1.53 MGD. The unaccounted-for water for the entire Orange County System is five percent.

Interconnections

The Orange County Utilities water distribution system for each of the water treatment facilities are interconnected. Orange County is discussing the potential of interconnects with the Orlando Utilities Commission and the city of Ocoee.

Proposed

Orange County′s consumptive use permit authorizes construction of a Southern Regional Wellfield (four proposed lower Floridan wells) north of the intersection of Orange Avenue and the Florida Turnpike. When this wellfield is operational, the allowable withdrawals from the Hunters Creek Wellfield will be eliminated.

Source

Information was obtained from Orange County and SFWMD water use permit files.

Orange County Utilities - Meadow Woods

Permits

SFWMD Permit Number: 48-00134-W
FDEP PWS ID: 3484135

The current SFWMD permit was issued April 11, 1996 and expires April 11, 2006.

Raw Water Supply

Raw water is withdrawn from two upper Floridan wells. The wells are 16 inches in diameter, have total depths of 500 feet, and cased depths of 185 and 191 feet. The wells were drilled in 1984. The pumping capacity of each well is 1,800 GPM. Specific well information is provided in **Table D-3**.

The permitted allocations are as follows:

Annual Allocation:	5,694.00 MGY (15.60 MGD)
Maximum Daily Allocation:	39.19 MGD

The annual and maximum daily allocations include withdrawals from the Cypress Walk, Hunters Creek, Meadow Woods, Orangewood, Southern Regional, and Vistana wellfields. The existing allocation for the Meadow Woods Wellfield is 2.28 MGD annually and 5.02 MGD maximum day.

The 1995 average daily pumpage from the Meadow Woods well was 0.52 MGD. The total 1995 average daily pumpage from all wells was 6.56 MGD.

Treatment

Treatment is provided by a 5.18 MGD aeration water treatment plant located at 13421 Landstar Road north of the Orange County line and east of State Road 527 (**Figure D-2**). The 1995 average daily flow was 0.52 MGD. The unaccounted-for water for the entire Orange County System is five percent.

Interconnections

The Orange County Utilities water distribution system for each of the water treatment facilities are interconnected. Orange County is discussing the potential of interconnects with the Orlando Utilities Commission and the city of Ocoee.

Proposed

Orange County′s consumptive use permit authorizes construction of a Southern Regional Wellfield (four proposed lower Floridan wells) north of the intersection of Orange Avenue and the Florida Turnpike. When this wellfield is operational, the Meadow Woods Wellfield will be taken off line.

Source

Information was obtained from Orange County and SFWMD water use permit files.

Orange County Utilities - Orangewood

Permits

SFWMD Permit Number: 48-00134-W
FDEP PWS ID: 3484119

The current SFWMD permit was issued April 11, 1996 and expires April 11, 2006.

Raw Water Supply

Raw water is withdrawn from two upper Floridan wells and one lower Floridan well. The upper Floridan wells are 16 inches in diameter, have total depths of 600 and 400 feet, and cased depths of 190 and 150 feet, respectively. The wells were drilled in 1972 and 1979. The pumping capacity of the wells is 2,500 and 2,000 GPM. The lower Floridan well is 16 inches in diameter, has a total depth of 1,380 feet, and a cased depth of 1,110 feet. The well was drilled in 1986. The pumping capacity of the well is 2,100 GPM. Specific well information is provided in **Table D-3**.

The permitted allocations are as follows:

Annual Allocation:	5,694.00 MGY (15.60 MGD)
Maximum Daily Allocation:	39.19 MGD

The annual and maximum daily allocations include withdrawals from the Cypress Walk, Hunters Creek, Meadow Woods, Orangewood, Southern Regional, and Vistana wellfields. The existing allocation for the Orangewood Wellfield is 2.88 MGD annually and 9.17 MGD maximum day. The 1995 average daily pumpage from the Orangewood well was 0.92 MGD. The total 1995 average daily pumpage from all wells was 6.56 MGD.

Treatment

Treatment is provided by a 8.75 MGD chlorination only water treatment plant located at 5707 Sea Harbor Drive east of Interstate 4 and south of the Beeline in Orange County (**Figure D-2**). The 1995 average daily flow was 0.92 MGD. The unaccounted-for water for the entire Orange County System in 1995 was five percent.

Interconnection

The Orange County Utilities water distribution system for each of the water treatment facilities are interconnected. The county is discussing the potential of interconnects with the Orlando Utilities Commission and the city of Ocoee.

Proposed

Orange County′s consumptive use permit authorizes construction of a Southern Regional Wellfield (four proposed lower Floridan wells) north of the intersection of Orange Avenue and the Florida Turnpike. When this wellfield is operational, the allowable withdrawals from the Orangewood Wellfield will be increased to an average of 2.00 MGD annually.

Source

Information was obtained from Orange County and SFWMD water use permit files.

Orange County Utilities - Southern Regional (Proposed)

Permits

SFWMD Permit Number: 48-00134-W
FDEP PWS ID: 3484119

This facility has been permitted and is under construction. The current SFWMD permit was issued April 11, 1996 and expires April 11, 2006.

Raw Water Supply

Raw water will be withdrawn from four lower Floridan wells located on a 180 acre site south of Orlando. The wells will be 16 inches in diameter, have total depths of 1,690 feet, and cased depths of 1,100 feet. The wells will be drilled by 2001. The pumping capacity of each well will be 3,200 GPM. Specific well information is provided in **Table D-3**.

The permitted allocations are as follows:

Annual Allocation:	5,694.00 MGY (15.60 MGD)
Maximum Daily Allocation:	39.19 MGD

The annual and maximum daily allocations include withdrawals from the Cypress Walk, Hunters Creek, Meadow Woods, Orangewood, Southern Regional, and Vistana wellfields. The allocation for the Southern Regional Wellfield will be 12.00 MGD annually and 18.00 MGD maximum day.

Treatment

Treatment will be provided by a 12.00 MGD ozone or membrane softening water treatment plant located north of the intersection of the Florida Turnpike and Orange Avenue in southern Orange County (**Figure D-2**). This facility is expected to be operational in 2001.

Interconnections

The Orange County Utilities water distribution system for each of the water treatment facilities are interconnected. Orange County is discussing the potential of interconnects with the Orlando Utilities Commission and the city of Ocoee.

Proposed

Orange County′s consumptive use permit authorizes construction of a Southern Regional Wellfield (four proposed lower Floridan wells) north of the intersection of Orange Avenue and the Florida Turnpike. This wellfield is part of the county′s effort to centralize its future wellfield operations. When this wellfield is constructed and operational by 2001, the allowable withdrawals (in average annual daily flow) from the other wellfields will be decreased according to the schedule listed in **Table D-4**.

Source

Information was obtained from Orange County and SFWMD water use permit files.

Orange County Utilities - Southwest Regional (Proposed Horizons West)

Permits

SFWMD Permit Number: 48-00134-W
FDEP PWS ID: 3484119

This facility has been permitted and is under construction. The current SFWMD permit was issued April 11, 1996 and expires April 11, 2006.

Raw Water Supply

Raw water will be withdrawn from four lower Floridan wells located on a 180-acre site south of Orlando. The wells will be 16 inches in diameter, have total depths of 1,690 feet, and cased depths of 1,100 feet. The wells will be drilled by 2001. The pumping capacity of each well will be 3,200 GPM. Specific well information is provided in **Table D-3**.

The permitted allocations are as follows:

Annual Allocation:	5,694.00 MGY (15.60 MGD)
Maximum Daily Allocation:	39.19 MGD

The annual and maximum daily allocations include withdrawals from the Cypress Walk, Hunters Creek, Meadow Woods, Orangewood, Southern Regional, and Vistana wellfields. The allocation for the Southern Regional Wellfield will be 12.00 MGD annually and 18.00 MGD maximum day.

Treatment

Treatment will be provided by a chlorination or ozone water treatment plant. This facility is expected to be operational in 2001.

Interconnections

The Orange County Utilities water distribution system for each of the water treatment facilities are interconnected. Orange County is discussing the potential of interconnects with the Orlando Utilities Commission and the city of Ocoee.

Proposed

Orange County′s consumptive use permit authorizes construction of a Southern Regional Wellfield (four proposed lower Floridan wells) north of the intersection of Orange Avenue and the Florida Turnpike. This wellfield is part of the county′s effort to centralize its future wellfield operations.

Source

Information was obtained from Orange County.

Orange County Utilities - Vistana

Permits

SFWMD Permit Number: 48-00134-W
FDEP PWS ID: 3484119

The current SFWMD permit was issued April 11, 1996 and expires April 11, 2006.

Raw Water Supply

Raw water is withdrawn from three upper Floridan wells. The wells are 12 and 16 inches in diameter, have total depths between 580 and 600 feet, and cased depths between 166 and 171 feet. The wells were drilled between 1972 and 1985. The pumping capacity of the wells are between 2,000 to 3,000 GPM. Specific well information is provided in **Table D-3**.

The permitted allocations are as follows:

Annual Allocation:	5,694.00 MGY (15.60 MGD)
Maximum Daily Allocation:	39.19 MGD

The annual and maximum daily allocations include withdrawals from the Cypress Walk, Hunters Creek, Meadow Woods, Orangewood, Southern Regional and Vistana wellfields. The existing allocation for the Vistana Wellfield is 3.60 MGD annually and 10.42 MGD maximum day. The 1995 average daily pumpage from the Vistana well was 2.21 MGD. The total 1995 average daily pumpage from all wells was 6.56 MGD.

Treatment

Treatment is provided by a 8.32 MGD chlorination-only water treatment plant located at 8943 Meadow Creek Drive south of the intersection of Interstate 4 and Apopka-Vineland Road in Southwest Orange County (**Figure D-2**). The 1995 average daily flow was 2.21 MGD. The unaccounted-for water for the entire Orange County System is five percent.

Interconnections

The Orange County Utilities water distribution system for each of the water treatment facilities are interconnected. Orange County is discussing the potential of interconnects with the Orlando Utilities Commission and the city of Ocoee.

Proposed

Orange County′s consumptive use permit authorizes construction of a Southern Regional Wellfield (four proposed lower Floridan wells) north of the intersection of Orange Avenue and the Florida Turnpike. When this wellfield is operational, the allowable withdrawals from the Vistana Wellfield will be decreased to 2.00 MGD annually.

Source

Information was obtained from Orange County and SFWMD water use permit files.

Table D-3. Orange County Utilities Potable Water Supply Wells.

Well Number	Planar Coordinates Easting	Planar Coordinates Northing	Status	Active	Aquifer	Total Depth (ft)	Cased Depth (ft)	Well Diameter (in)	Pump Capacity (GPM)	Intake Depth (NGVD)	Year Drilled
Cypress Walk											
CW-1	333198	1471423	Existing	Yes	Floridan	650	160	14	1,265	N/A	1982
CW-2	334167	1471659	Existing	Yes	Floridan	500	171	14	1,250	N/A	1982
Hunters Creek											
HC-1	364400	1464435	Existing	Yes	Floridan	600	206	18	3,500	N/A	1985
HC-2	364315	1464730	Existing	Yes	Floridan	600	201	18	3,500	N/A	1985
Meadow Woods											
MW-1	382867	1468383	Existing	Yes	Floridan	500	185	16	1,800	N/A	1984
MW-2	382920	1468290	Existing	Yes	Floridan	500	191	16	1,800	N/A	1984
Orangewood											
OW-1	353937	1483826	Existing	Yes	Floridan	600	190	16	2,500	110	1972
OW-2	353927	1483821	Existing	Yes	Floridan	400	150	16	2,000	110	1979
OW-3	353947	1483831	Existing	Yes	Floridan	1,380	1,110	16	2,100	105	1986
Southern Regional											
SR-1	375327	1468390	Proposed	No	Floridan	1,690	1,100	16	3,200	---	---
SR-2	375479	1466530	Proposed	No	Floridan	1,690	1,100	16	3,200	---	---
SR-3	376951	1467551	Proposed	No	Floridan	1,690	1,100	16	3,200	---	---
SR-4	378272	1467596	Proposed	No	Floridan	1,690	1,100	16	3,200	---	---
Southwest Regional											
N/A	---	---	Proposed	No	Floridan	---	---	---	---	---	---
Vistana											
V-3	337125	1466534	Existing	Yes	Floridan	580	166	12	2,000	N/A	1972
V-4	336705	1466226	Existing	Yes	Floridan	600	166	12	2,500	N/A	1985
V-5	336060	1465848	Existing	Yes	Floridan	585	171	16	3,000	N/A	1978

Table D-4. Schedule of Allowable Withdrawals Following the Construction and Operation of the Southern Regional Wellfield.

Wellfield	Withdrawals (average annual daily flow)	
	From	To
Cypress Walk	1.80	1.00
Hunters Creek	5.04	0.00
Meadow Woods	2.28	2.00
Orangewood	2.88	2.00

Orlando Utilities Commission - Dr. Phillips

Permits

SFWMD Permit Number: 48-00064-W
FDEP PWS ID: 3480962

The current SFWMD permit was issued May 11, 1995 and expires August 8, 1999.

Raw Water Supply

Raw water is withdrawn from four upper Floridan wells. The wells are 10 to 24 inches in diameter, have total depths between 420 and 816 feet, and cased depths between 159 and 560 feet. The wells were drilled between 1961 and 1986. The pumping capacity of the wells is between 2,083 and 3,470 GPM. Specific well information is provided in **Table D-5**.

The permitted allocations are as follows:

Annual Allocation:	40,491.00 MGY (110.93 MGD)
Maximum Daily Allocation:	168.62 MGD

The annual and maximum daily allocations include withdrawals from the Orlando Utilities Commission (OUC) Dr. Phillips, Kirkman, Martin, Sky Lake, Lake Nona, and Southwest wellfields. The 1995 average daily pumpage from the Dr. Phillips wells was 6.51 MGD. The total 1995 average daily pumpage from all wells was 27.44 MGD.

Treatment

Treatment is provided by a 14.00 MGD aeration water treatment plant located at 7009 Dr. Phillips Boulevard in Southwest Orlando. The location of this facility is shown in **Figure D-2**. The 1995 average daily flow was 6.51 MGD. The unaccounted-for water for the entire OUC System in 1995 was estimated at 5.6 percent.

Interconnections

The water distribution systems for each of the OUC water treatment facilities (WTFs) are interconnected. OUC has interconnects with other utilities; however, these are for water supply purposes only. None of these are capable of supplying OUC with comparatively large amounts of water.

Proposed

The current consumptive use permit incorporates construction of the Southwest Wellfield to serve that water treatment plant and will have an initial capacity of 24.00 MGD. The Southwest Wellfield will consist of four Lower Floridan wells (24 inches in diameter, 1,400 feet deep, cased to 1,000 feet, and a capacity of 4,166 GPM each).

OUC is also implementing the Water Project 2000, a five-year program to upgrade its system. OUC proposes to construct one new WTF (Southeast); upgrade one existing plant (Kirkman); expand the proposed Southwest WTF; and abandon two existing WTFs (Martin and Dr. Phillips) in the KB Planning Area before the end of year 2000. The new plants and upgrades will include ozonation to treat for hydrogen sulfide. Beyond 2000, OUC plans to expand the Sky Lake and Southwest plants and construct a new Orange (aka. Boggy Creek) WTF.

Future

The Dr. Phillips facility is planned to be abandoned when an expansion to the proposed Southwest WTF is completed and operational.

Source

Information was obtained from the Orlando Utilities Commission and SFWMD water use permit files.

Orlando Utilities Commission - Kirkman Plant

Permits

SFWMD Permit Number: 48-00064-W
FDEP PWS ID: 3480962

The current SFWMD permit was issued May 11, 1995 and expires August 8, 1999.

Raw Water Supply

Raw water is withdrawn from three lower Floridan wells. The wells are 16 inches in diameter, have total depths between 1,346 and 1,410 feet, and cased depths between 982 and 1,045 feet. The wells were drilled in 1969 and 1988. The pumping capacity of each well is 3,470 GPM. Specific well information is provided in **Table D-5**.

The permitted allocations are as follows:

Annual Allocation:	40,491.00 MGY (110.93 MGD)
Maximum Daily Allocation:	168.62 MGD

The annual and maximum daily allocations include withdrawals from the Orlando Utilities Commission (OUC) Dr. Phillips, Kirkman, Martin, Sky Lake, and Southwest wellfields. The 1995 average daily pumpage from the Kirkman wells was 7.50 MGD. The total 1995 average daily pumpage from all wells was 27.44 MGD.

Treatment

Treatment is provided by a 15.00 MGD aeration water treatment plant located at 4070 S. Kirkman Road south of McLeod Road in west-central Orlando. The location of this facility is shown in **Figure D-2**. The 1995 average daily flow was 7.50 MGD. The unaccounted-for water for the entire OUC System for 1995 was estimated at 5.6 percent.

Interconnections

The water distribution system for each of the OUC water treatment facilities (WTFs) are interconnected. OUC has interconnects with other utilities; however, these are for water supply purposes only. None of these are capable of supplying OUC with significant amounts of water.

Proposed

There are no proposed facilities at this time.

Future

The Kirkman WTF has a capacity of 15.00 MGD and no expansions are planned through 2020. However, production from the facility is expected to increase to about 10.74 MGD by 2020. The aeration treatment process will be replaced by ozonation by 2000.

Source

Information was obtained from the Orlando Utilities Commission and SFWMD water use permit files.

Orlando Utilities Commission - Martin

Permits

SFWMD Permit Number: 48-00064-W
FDEP PWS ID: 3480962

The current SFWMD permit was issued May 11, 1995 and expires August 8, 1999.

Raw Water Supply

Raw water is withdrawn from three upper Floridan wells. The wells are 12 to 28 inches in diameter, have total depths between 381 and 700 feet, and cased depths between 228 and 310 feet. The wells were drilled in 1957 and 1981. The pumping capacity of the wells are between 700 and 4,166 GPM. Specific well information is provided in **Table D-5**.

The permitted allocations are as follows:

Annual Allocation:	40,491.00 MGY (110.93 MGD)
Maximum Daily Allocation:	168.62 MGD

The annual and maximum daily allocations include withdrawals from the Orlando Utilities Commission (OUC) Dr. Phillips, Kirkman, Martin, Sky Lake, and Southwest wellfields. The 1995 average daily pumpage from the Martin wells was 8.24 MGD. The total 1995 average daily pumpage from all wells was 27.25 MGD.

Treatment

Treatment is provided by a 12.00 MGD aeration water treatment plant located at 5300 West Sand Lake Road in the vicinity of Kirkman Road in Southwest Orlando. The location of this facility is shown in **Figure D-2**. The 1995 average daily flow was 8.26 MGD. The unaccounted-for water for the entire OUC System is 5.6 percent.

Interconnections

The water distribution systems for each of the water OUC treatment facilities are interconnected. OUC has interconnects with other utilities; however, these are for water supply purposes only. None of these are capable of supplying OUC with significant amounts of water.

Proposed

The current consumptive use permit incorporates construction of the Southwest Wellfield to serve that water treatment plant and will have an initial capacity of 24.00 MGD. The Southwest Wellfield will consist of four lower Floridan wells (24 inches in diameter, 1,400 feet deep, cased to 1,000 feet, and a capacity of 4,166 GPM each). When the Southwest facility is operational, the Martin WTF (12 MGD) will be taken off line.

Source

Information was obtained from the Orlando Utilities Commission and SFWMD water use permit files.

Orlando Utilities Commission - Southeast (Proposed)

Permits

SFWMD Permit Number: 48-00064-W
FDEP PWS ID: 3480962

A request to construct this facility has been submitted to the District.

Raw Water Supply

Raw water will be withdrawn from two upper Floridan wells. Proposed well information is not available.

Treatment

Treatment will be provided by a 15.00 MGD ozonation water treatment plant located in the vicinity of the Greenway along OUC′s power easement (**Figure D-2**). This wellfield and the expansion of the Sky Lake WTP will replace previous plans for the Boggy Creek WTP.

Interconnections

The water distribution systems for each of the OUC water treatment facilities are interconnected. OUC has interconnects with other utilities; however, these are for water supply purposes only. None of these are capable of supplying OUC with significant amounts of water.

Proposed

In November 1995, OUC applied for a modification of their consumptive use permit and it is being reviewed by the District. Their request includes increasing their maximum daily allocation from 168.62 to 186 MGD with no change in the annual allocation. This request initiates implementation of OUC′s Water Project 2000, a five-year program to upgrade the OUC System. OUC proposes to construct one new WTF (Southeast); upgrade one existing plant (Kirkman); expand the proposed Southwest WTF; and abandon two existing WTFs (Martin and Dr. Phillips) in the KB Planning Area before the end of year 2000. The new plant and upgrades will include ozonation to treat for hydrogen sulfide.

Source

Information was obtained from the Orlando Utilities Commission and SFWMD water use permit files.

Orlando Utilities Commission - Sky Lake

Permits

SFWMD Permit Number: 48-00064-W
FDEP PWS ID: 3480962

The current SFWMD permit was issued May 11, 1995 and expires August 8, 1999.

Raw Water Supply

Raw water is withdrawn from two lower Floridan wells. The wells are 16 inches in diameter, have total depths of 1,380 and 1,390 feet, and cased depths of 980 and 960 feet, respectively. The wells were drilled in 1988. The pumping capacity of each well is 3,470 GPM. Specific well information is provided in **Table D-5**.

The permitted allocations are as follows:

Annual Allocation:	40,491.00 MGY (110.93 MGD)
Maximum Daily Allocation:	168.62 MGD

The annual and maximum daily allocations include withdrawals from the Orlando Utilities Commission (OUC) Dr. Phillips, Kirkman, Martin, Sky Lake, and Southwest wellfields. The 1995 average daily pumpage from the Sky Lake wells was 4.82 MGD. The total 1995 average daily pumpage from all wells was 27.44 MGD.

Treatment

Treatment is provided by a 10.00 MGD chlorination/activated carbon water treatment plant located at 502 Sand Lake Road at the intersection of Winegard Road in central Orlando (**Figure D-2**). The 1995 average daily flow was 4.65 MGD. The unaccounted-for water for the entire OUC System is 5.6 percent.

Interconnections

The water distribution systems for each of the OUC water treatment facilities (WTFs) are interconnected. OUC has interconnects with other utilities; however, these are for water supply purposes only. None of these are capable of supplying OUC with significant amounts of water.

Proposed

In November 1995, OUC applied for a modification of their consumptive use permit and currently under review by the District. Their request includes increasing their maximum daily allocation from 168.62 to 186.00 MGD with no change in the annual allocation. This request initiates implementation of OUC′s Water Project 2000, a five year program to upgrade the OUC System. OUC proposes to construct one new WTF (Southeast); upgrade one existing plant (Kirkman); expand the proposed Southwest WTF; and abandon two existing WTFs (Martin and Dr. Phillips) in the KB Planning Area before the end of 2000. The new plant and upgrades will include ozonation to treat for hydrogen sulfide.

The request includes increasing the capacity of the Skylake WTF from 10.00 MGD to 15.00 MGD due to installation of higher capacity pumps and motors for the wells.

Future

The Sky Lake facility is planned to be expanded to 22.00 MGD in 2003.

Source

Information was obtained from the Orlando Utilities Commission and SFWMD water use permit files.

Orlando Utilities Commission - Southwest (Proposed)

Permits

SFWMD Permit Number: 48-00064-W
FDEP PWS ID: 3480962

This facility has been permitted and is under construction. The current SFWMD permit was issued May 11, 1995 and expires August 8, 1999.

Raw Water Supply

Raw water will be withdrawn from four lower Floridan wells. The proposed wells will be 24 inches in diameter, have total depths of approximately 1,400 feet, and cased depths of 1,000 feet. The wells will be constructed by the end of 1996. The pumping capacity of each well will be 4,166 GPM. Specific well information is provided in **Table D-5**.

The permitted allocations are as follows:

Annual Allocation:	40,491.00 MGY (110.93 MGD)
Maximum Daily Allocation:	168.62 MGD

The annual and maximum daily allocations include withdrawals from the Orlando Utilities Commission (OUC) Dr. Phillips, Kirkman, Martin, Sky Lake, and Southwest wellfields.

Treatment

Treatment will be provided by a 24.00 MGD ozonation water treatment plant located on Wallace Road in Southwest Orlando (**Figure D-2**). This facility is planned to be operational in 1997.

Interconnections

The OUC water distribution system for each of the water treatment facilities are interconnected. OUC has interconnects with other utilities; however, these are for water supply purposes only. None of these are capable of supplying OUC with significant amounts of water.

Proposed

The Southwest facility is under construction and when it is completed and fully operational (1997), the Martin WTF (12 MGD) will be abandoned.

In November 1995, OUC applied for a modification of their consumptive use permit and is currently being reviewed by the District. Their request includes increasing their maximum daily allocation from 168.62 to 186.00 MGD with no change in the annual allocation. This request initiates implementation of OUC′s Water Project 2000, a five year program to upgrade the OUC System. OUC proposes to construct one new WTF (Southeast); upgrade one existing plant (Kirkman); expand the Southwest WTF; and abandon two existing WTFs (Martin and Dr. Phillips) in the KB Planning Area before the end of 2000. The new plants and upgrades will include ozonation to treat for hydrogen sulfide. Beyond 2000, OUC plans to expand the Sky Lake and Southwest plants and construct a new Orange (aka. Boggy Creek) WTF.

This request includes a 6.00 MGD expansion to the Southwest WTF (one production well) and when completed, abandonment of the Dr. Phillips WTF (14.00 MGD).

Future

A 10.00 MGD expansion is planned to be completed in 2005.

Source

Information was obtained from the Orlando Utilities Commission and SFWMD water use permit files.

Table D-5. Orlando Utilities Commission Potable Water Supply Wells.

Well Number	Planar Coordinates		Status	Active	Aquifer	Total Depth (ft)	Cased Depth (ft)	Well Diameter (in)	Pump Capacity (GPM)	Intake Depth (NGVD)	Year Drilled
	Easting	Northing									
Dr. Phillips											
DP-1	342107	1500105	Existing	Yes	Floridan	450	159	10	2,083	N/A	1961
DP-2	342465	1515419	Existing	Yes	Floridan	483	457	12	2,083	N/A	1970
DP-3	342105	1499600	Existing	Yes	Floridan	420	201	20	2,083	N/A	1974
DP-4	342376	1500205	Existing	Yes	Floridan	816	560	24	3,470	N/A	1986
Kirkman											
K-1	352162	1515215	Existing	Yes	Floridan	1,346	1,045	16	3,470	N/A	1969
K-2	351538	1515419	Existing	Yes	Floridan	1,410	982	16	3,470	N/A	1976
K-3	351806	1515317	Existing	Yes	Floridan	1,410	983	16	3,470	N/A	1988
Martin											
M-1	355748	1496012	Existing	Yes	Floridan	381	275	12	3,470	N/A	1957
M-2	355570	1496114	Existing	Yes	Floridan	409	228	28	700	N/A	1957
M-3	355569	1495912	Existing	Yes	Floridan	700	310	24	4,166	N/A	1981
Sky Lake											
SL-1	376192	1496446	Existing	Yes	Floridan	1,380	980	16	3,470	N/A	1988
SL-2	376459	1496142	Existing	Yes	Floridan	1,390	960	16	3,470	N/A	1988
Southwest											
SW-1	345623	1498780	Proposed	No	Floridan	1,400	1,000	29	4,166	N/A	1995
SW-2	348300	1500308	Proposed	No	Floridan	1,400	1,000	29	4,166	N/A	1995
SW-3	346441	1499144	Proposed	No	Floridan	1,400	1,000	29	4,166	N/A	1995
SW-4	346441	1498780	Proposed	No	Floridan	1,400	1,000	29	4,166	N/A	1995

Reedy Creek Improvement District - Pump Station A

Permits

SFWMD Permit Number: 48-00009-W
FDEP PWS ID: 3484093

The current SFWMD permit was issued May 15, 1997 and expires May 15, 2007.

Raw Water Supply

The Pump Station A water system is supplied by ground water pumped from Floridan wells 8, 9 and 10 located north of the Magic Kingdom adjacent to the Central Energy Plant. Well No. 8 is only used for emergency service. The wells are 24 inches in diameter, have a total depth of approximately 900 feet for wells 8 and 9, and 340 feet for well 10. The cased depths are 181, 186 and 187 feet, respectively. The pumping capacity of the wells are 3,500 GPM for well 8 and 4,000 GPM for wells 9 and 10. Specific well information is provided in **Table D-6**.

The permitted allocations are as follows:

Annual Allocation:	8,552.00 MGY (23.43 MGD)
Maximum Daily Allocation:	35.61 MGD

The annual and maximum daily allocations include withdrawals from all wells serving Reedy Creek Improvement District (RCID) water plants. The 1995 average daily pumpage from these wells was 5.36 MGD. The total 1995 average daily pumpage from all wells was 15.21 MGD. The average 1998 pumpage from all wells was 18.64 MGD.

Treatment

Treatment is provided by a 14.40 MGD chlorination only facility. The facility is located adjacent to the Central Energy Plant and is shown in **Figure D-2**. The 1995 average daily flow was 5.36 MGD. The unaccounted-for water for the entire system is estimated to be 5 percent. This facility provides water to the northern region of Subdistrict I. Subdistrict I serves the area west of the C-1 Canal, including the Magic Kingdom, EPCOT Center, Disney/MGM Studios, the Caribbean Beach Resort, and the Fort Wilderness Campground.

Interconnections

The RCID water distribution system is served by five existing RCID water treatment plants (Pump Stations A, B, C and 5). A new pump station D came on line in 1997. There are no distribution interconnects with other utilities.

Proposed

Reedy Creek has interconnects planned between all five of its pump stations.

Future

RCID has an aggressive program to encourage water conservation. An extensive reclaimed water system is under construction that will offset potable water demands. RCID is also taking other measures to conserve potable water at Walt Disney World resort complex such as utilizing water conserving plumbing and high pressure systems for wash down.

The 1994 RCID Potable Water Supply and Distribution Master Plan indicates that Subdistrict I operates at a nominal pressure of 90 psi. The station is over 20 years old and there is no room for further expansion of the pump station, although larger pumps can be installed to increase its capacity. Pump Station A has five pumps, each rated at 2,500 GPM. It is planned to replace the existing pumps with 3,000 GPM pumps in 2000/2001 to increase the station's firm capacity to an estimated 15,000 GPM. Existing water supply facilities serving Subdistrict I are identified in **Table D-7**.

Source

Information was obtained from the Reedy Creek Energy Services, Inc.

Reedy Creek Improvement District - Pump Station B

Permits

SFWMD Permit Number: 48-00009-W
FDEP PWS ID: 3484093

Raw Water Supply

The Pump Station B water system is supplied by ground water pumped from Floridan wells 2, 2A, 17, and 18 located north of the Disney/MGM Studios. The wells are located south of Osceola Parkway and west of World Drive. The wells vary from 18 to 24 inches in diameter, having a total depth ranging from 420 to 890 feet. Specific well information is provided in **Table D-6**.

The current SFWMD permit was issued May 15, 1997 and expires May 15, 2007. The permitted allocations are as follows:

Annual Allocation:	8,552.00 MGY (23.43 MGD)
Maximum Daily Allocation:	35.61 MGD

The annual and maximum daily allocations include withdrawals from all wells serving RCID water plants. The 1995 average daily pumpage from these wells was 4.78 MGD. The total 1995 average daily pumpage from all wells was 15.41 MGD. Total average flow for 1998 was 18.64 MGD.

Treatment

Treatment is provided by a 21.60 MGD chlorination only facility. The facility is located adjacent to the Central Energy Plant and is shown in **Figure D-2**. The 1995 average daily flow was 4.96 MGD. The unaccounted-for water for the entire system is estimated to be 5 percent. This facility provides water to the southern region of Subdistrict I. Subdistrict I serves the area west of the C-1 Canal, including the Magic Kingdom, EPCOT Center, Disney/MGM Studios, the Caribbean Beach Resort, and the Fort Wilderness Campground.

Interconnections

The RCID water distribution system is served by five existing RCID water treatment plants (Pump Stations A, B, C and 5). A new pump station D came on line in 1997. There are no distribution interconnects with other utilities.

Proposed

Reedy Creek has interconnects planned between all five of its pump stations.

Future

RCID has an aggressive program to encourage water conservation. An extensive reclaimed water system is under construction that will offset potable water demands. RCID is also taking other measures to conserve potable water at Walt Disney World resort complex such as utilizing water conserving plumbing and high pressure systems for wash down.

The 1994 RCID Potable Water Supply and Distribution Master Plan indicates that Subdistrict I operates at a nominal pressure of 90 psi. The area around Pump Station B is highly developed and limits the expansion opportunities at the site. The existing firm pumping capacity is more than adequate to meet the projected peak hour demands in 2010 of 2,300 GPM. Well 19 was designed and constructed so it can initially deliver water to Pump Station B, then be rerouted to deliver water to Pump Station D. Well 18 can serve as a backup well for both pump stations; this way the firm capacity of the wells connected to Pump Station B will drop to 8,000 GPM, which is sufficient to meet the maximum day demands projected for the service area of Pump Station B through 2009. Existing water supply facilities serving Subdistrict I are identified in **Table D-7**.

Source

Information was obtained from the Reedy Creek Energy Services, Inc.

Reedy Creek Improvement District - Pump Station C

Permits

SFWMD Permit Number: 48-00009-W
FDEP PWS ID: 3484093

The current SFWMD permit was issued May 15, 1997 and expires May 15, 2007.

Raw Water Supply

The Pump Station C water system is supplied by ground water pumped from wells 5, 6, and 16 located on the east of Lake Buena Vista Drive across from the Village Resort. This facility provides water to Subdistrict II. The wells diameters range from 12 to 24 inches at different depths, have a total depth of 950, 485, and 900 feet. The cased depths are 172, 164, and 163 feet respectively. The pumping capacity of the wells are 1,100, 2,000 and 4,000 GPM, respectively. Specific well information is provided in **Table D-6**.

The permitted allocations are as follows:

Annual Allocation:	8,552.00 MGY (23.43 MGD)
Maximum Daily Allocation:	35.61 MGD

The annual and maximum daily allocations include withdrawals from all wells serving RCID water plants. The 1995 average daily pumpage from these wells was 4.78 MGD. The total 1995 average daily pumpage from all wells was 15.41 MGD. Total average flow for 1998 was 18.64 MGD.

Treatment

Treatment is provided by a 12.24 MGD chlorination only facility. The facility is located adjacent to the Village Resort and is shown in **Figure D-2**. The 1995 average daily flow was 3.61 MGD. The unaccounted-for water for the entire system is estimated to be 5 percent. This facility provides water to the southeastern region of Subdistrict II. Subdistrict II serves the development east of the C-1 Canal, including Pleasure Island, Typhoon Lagoon, Lake Buena Vista, Disney Village, Crossroads, Dixie Landings, Port Orleans, and the North Administration Area.

Interconnections

The RCID water distribution system is served by five existing RCID water treatment plants (Pump Stations A, B, C and 5). A new pump station D came on line in 1997. There are no distribution interconnects with other utilities.

Proposed

Reedy Creek has interconnects planned between all five of its pump stations.

Future

RCID has an aggressive program to encourage water conservation. An extensive reclaimed water system is under construction that will offset potable water demands. RCID is also taking other measures to conserve potable water at Walt Disney World resort complex such as utilizing water conserving plumbing and high pressure systems for wash down.

The 1994 RCID Potable Water Supply and Distribution Master Plan indicates that Subdistrict II operates at a pressure of 65 psi. The well supply and firm pumping capacity of Pump Station C and 5 are sufficient to meet the peak day and peak hour demands to the year 2010. In addition, the interconnections with Subdistrict I through pressure reducing valves allow flow from the higher pressure subdistrict to supplement the available supply during emergencies. Existing water supply facilities serving Subdistrict II are identified **Table D-7**.

Source

Information was obtained from the Reedy Creek Energy Services, Inc.

Reedy Creek Improvement District - Pump Station D

Permits

SFWMD Permit Number: 48-00009-W
FDEP PWS ID: 3484093

The current SFWMD permit was issued May 15, 1997 and expires May 15, 2007.

Raw Water Supply

Raw water will be withdrawn from three existing Floridan wells, 18, 19, and 21 located in the southwest part of Subdistrict I on Osceola Parkway. The wells are 24 inches in diameter, have total depths of 700 feet (wells 18 and 19) and 620 feet (well 21) and cased depths of 160, 163, and 220 feet. The pumping capacity of the wells are 4,000 GPM. Specific well information is provided in **Table D-6**. The new Pump Station should also include one additional 4,000 GPM well with a raw line to the pump station.

The permitted allocations are as follows:

Annual Allocation:	8,552.00 MGY (23.43 MGD)
Maximum Daily Allocation:	35.61 MGD

The annual and maximum daily allocations include withdrawals from all wells serving RCID water plants.

Treatment

Treatment will be provided by a 11.52 MGD chlorination only facility. The facility is located between Blizzard Beach and All Star Resorts (**Figure D-2**). This facility provides water to the southwestern portion of Subdistrict I. Subdistrict I serves the area west of the C-1 Canal, including the Magic Kingdom, EPCOT Center, Disney/MGM Studios, the Caribbean Beach Resort, and the Fort Wilderness Campground.

Interconnections

Pump Station D was placed in service in 1997 and interconnected with the RCID water distribution system which is currently served by five existing water treatment plants. There are no distribution interconnects with other utilities, but this may be planned in the future.

Future

RCID has an aggressive program to encourage water conservation. An extensive reclaimed water system is under construction that will offset potable water demands. RCID is also taking other measures to conserve potable water at Walt Disney World resort complex such as utilizing water conserving plumbing and high pressure systems for wash down.

The 1994 RCID Potable Water Supply and Distribution Master Plan indicates that subdistrict I operates at a nominal pressure of 90 psi. This station must be expanded in 2005 to meet projected peak hour demands. The expansion should include modification of the station to accommodate three additional pumps and construction of a second 1.25 million gallon reservoir. Two 3,150 GPM pumps are needed in 2005; the final pump will be required in 2010. Also one additional 4,000 GPM well should be added in 2010 bringing the firm well capacity to 23.0 MGD in order to offset the 0.8 MGD deficit at Pump Station B.

Existing water supply facilities serving Subdistrict I are identified in **Table D-7**.

Source

Information was obtained from the Reedy Creek Energy Services, Inc.

Reedy Creek Improvement District - Pump Station 5

Permits

SFWMD Permit Number: 48-00009-W
FDEP PWS ID: 3484093

The current SFWMD permit was issued May 15, 1997 and expires May 15, 2007.

Raw Water Supply

The Pump Station 5 water system is supplied by ground water pumped from well 5 located adjacent to the North Administrative Area near the junction of Lake Buena Vista Drive and State Road 535. This facility provides water to Subdistrict II. The well diameters is 24 inches, have a total depth of 350 feet. The cased depth is 172 feet. The pumping capacity of the well is 1,100 GPM. Specific well information is provided in **Table D-6**.

The permitted allocations are as follows:

Annual Allocation:	8,552.00 MGY (23.43 MGD)
Maximum Daily Allocation:	35.61 MGD

The annual and maximum daily allocations include withdrawals from all wells serving RCID water plants. The 1995 average daily pumpage from these wells was 0.22 MGD. The total 1995 average daily pumpage from all wells was 15.41 MGD.

Treatment

Treatment is provided by a 0.72 MGD (FDEP rated capacity) chlorination only facility. The facility is located adjacent to the North Administrative Area and is shown in **Figure D-2**. The 1995 average daily flow was 0.20 MGD. The unaccounted-for water for the entire system is estimated to be 5 percent. This facility provides water to the northern region of Subdistrict II. Subdistrict II serves the development east of the C-1 Canal, including Pleasure Island, Typhoon Lagoon, Lake Buena Vista, Disney Village, Crossroads, Dixie Landings, Port Orleans, and the North Administration Area.

Interconnections

The RCID water distribution system is served by five existing RCID water treatment plants (Pump Stations A, B, C, and 5). A new pump station D came on line in 1997. There are no distribution interconnects with other utilities.

Proposed

Reedy Creek has interconnects planned between all five of its pump stations.

Future

RCID has an aggressive program to encourage water conservation. An extensive reclaimed water system is under construction that will offset potable water demands. RCID is also taking other measures to conserve potable water at Walt Disney World resort complex such as utilizing water conserving plumbing and high pressure systems for wash down.

The 1994 RCID Potable Water Supply and Distribution Master Plan indicates that subdistrict II operates at a pressure of 65 psi. The well supply and firm pumping capacity of Pump Station C and 5 are sufficient to meet the peak day and peak hour demands to the year 2010. In addition, the interconnects with Subdistrict I through pressure reducing valves allow flow from the higher pressure subdistrict to supplement the available supply during emergencies. Existing water supply facilities serving Subdistrict II are identified in **Table D-7**.

Source

Information was obtained from the Reedy Creek Energy Services, Inc.

Table D-6. Reedy Creek Improvement District Potable Water Supply Wells.

Well Number	Planar Coordinates		Status	Active	Aquifer	Total Depth (ft)	Cased Depth (ft)	Well Diameter (in)	Well Capacity (GPM)	Intake Depth (NGVD)	Year Drilled
	Easting	Northing									
Pump Station A											
8	1471790	486013	Existing	Standby	Floridan	900	181	24	3,500	50	1969
9	1489581	469861	Existing	Yes	Floridan	900	186	24	4,000	60	1969
10	1489859	470175	Existing	Yes	Floridan	340	187	24	4,000	60	1969
Pump Station B or D											
2	1462686	475052	Existing	Yes	Floridan	420	200	20	1,500	43	1980
2A	1461899	175026	Existing	Yes	Floridan	500	157	18	3,500	60	1980
17	1437432	498015	Existing	Yes	Floridan	890	153	24	3,000	30	1987
Pump Station D											
18	1459140	473074	Existing	Standby	Floridan	700	160	24	4,000	60	1993
19	1459643	470536	Existing	Yes	Floridan	700	163	24	4,000	60	1993
21	1459618	468709	Proposed	No	Floridan	620	220	24	4,000	60	1996
Pump Station C											
5	1477293	4487431	Existing	Yes	Floridan	950	172	24	1,100	62	1969
6	1470865	490047	Existing	Yes	Floridan	485	164	24	2,000	53	1969
16	1452867	511998	Existing	Yes	Floridan	900	163	24	4,000	60	1973

Table D-7. Existing Reedy Creek Improvement District Potable Water Supply Facilities.

Subdistrict	Pump Station	Number and Type of Pumps	Firm Pump Station Capacity[a] (GPM)	Storage Capacity (million gallons)	Well Number	Well Capacity (GPM)
I (90 psi)	A	5 high service	10,000	3.0	8[b] 9 10	3,500 4,000 4,000
	B	6 high service	15,000	2.0	2 2A 17	1,500 3,500 3,000
	B or D			1.0	18 19	4,000 4,000
II (65 psi)	C	6 high service	8,500	2.0	6 7[b] 16	2,000 1,000 4,000
	5	1 high service 1 booster	500	0.23	5	1,100

a. Capacity with largest pump at each station out of service, all others in operation.
b. Well used for emergency service only.

Osceola County Area

Four utilities operate regional potable water treatment facilities within the Osceola County Area: Buenaventura Lakes, city of Kissimmee, Poinciana, and St. Cloud. The location of these facilities are shown in **Figure D-3**. A summary sheet containing permit criteria, raw water supply, treatment methods, interconnections, and proposed or future plans is provided for each facility. Following the summary sheets for each utility is a table summarizing all of the source wells for the utility (**Tables D-8**, **D-9**, **D-10**, and **D-11**). Three of Poinciana Utilities water treatment facilities (3, 4, and 5 on **Figure D-3**) are located in Polk County and are discussed in the Polk County Area section beginning on **page D-60**.

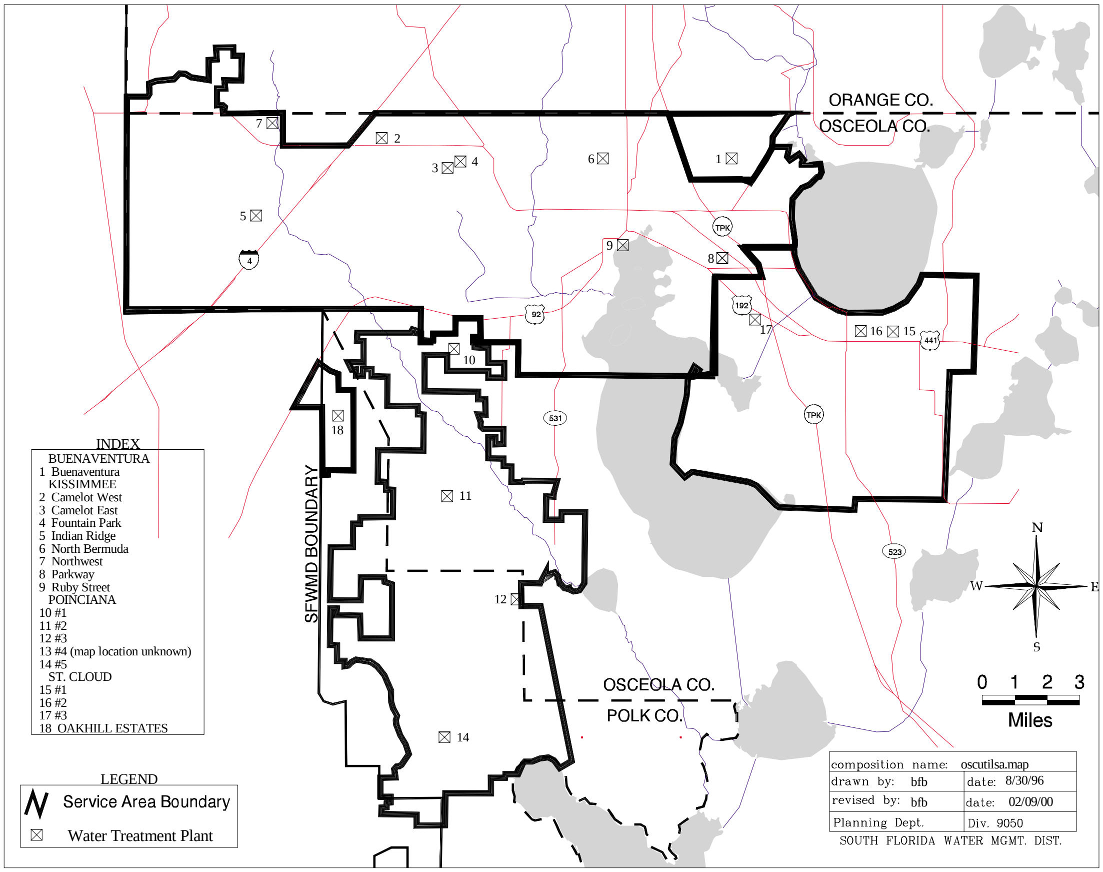


Figure D-3. Regional Potable Water Treatment Facilities in the Portions of Osceola and Polk Counties within the Kissimmee Basin Planning Area.

Buenaventura Lakes

Permits

SFWMD Permit Number: 49-00002-W
FDER PWS ID: 3490184

The current SFWMD permit was issued January 12, 1995 and expires January 12, 2005.

Raw Water Supply

Raw water is withdrawn from two deep drinking water wells on site from the Floridan aquifer. The wells are 12 and 16 inches in diameter, with total depths of 689 and 749 feet, and cased depths of 250 and 251 feet. The wells were drilled in 1975 and 1980 respectively. The pumping capacity of the wells are 2,100 and 2,500 GPM. Specific well information is provided in **Table D-8**.

The permitted allocations are as follows:

Annual Allocation:	1,158.00 MGY (3.17 MGD)
Maximum Daily Allocation:	4.00 MGD

The 1995 average daily pumpage was 1.90 MGD.

Treatment

Treatment is provided by a 4.00 MGD aeration facility located at 401 Buenaventura Boulevard in Kissimmee (**Figure D-3**). The 1995 average daily flow was 1.90 MGD. The unaccounted-for water for the entire system is estimated to be 8 percent.

Interconnections

Buenaventura Lakes is not presently interconnected to other utilities.

Proposed

There are no proposed facilities at this time, but in 1998 Buenaventura Lakes expanded its service area.

Source

Information was obtained from Southern States Utilities and SFWMD water use permit files.

Table D-8. Buenaventura Lakes Potable Water Supply Wells.

Well Number	Planar Coordinates		Status	Active	Aquifer	Total Depth (ft)	Cased Depth (ft)	Well Diameter (in)	Pump Capacity (GPM)	Intake Depth (NGVD)	Year Drilled
	Easting	Northing									
1	382890	1458100	Existing	Yes	Floridan	689	250	12	2,100	-30	1975
2	382,720	1458200	Existing	Yes	Floridan	749	251	16	2,500	-30	1980

City of Kissimmee - Camelot East

Permits

SFWMD Permit Number: 49-00103-W
FDEP PWS ID: 3494302

The current SFWMD permit was issued August 15, 1991 and expires August 15, 2001.

Raw Water Supply

Raw water is withdrawn from two Floridan aquifer wells located in northern Osceola County. The wells are 10 inches in diameter, have total depths of 410 and 405 feet, and cased depths of 185 and 197 feet. The wells were drilled in 1973. The pumping capacity of the wells are 762 and 1,000 GPM. Specific well information is provided in **Table D-9**.

The permitted allocations are as follows:

Annual Allocation:	10,650.00 MGY (29.20 MGD)
Maximum Daily Allocation:	38.54 MGD

The annual and maximum daily allocations include withdrawals from wells serving the city of Kissimmee water treatment plants Camelot, Camelot West, Fountain Park, Indian Ridge, North Bermuda, Northwest, Parkway, and Ruby. The 1995 average daily pumpage from the Camelot wells was 0.97 MGD. The total 1995 average daily pumpage for all city of Kissimmee wells was 13.56 MGD.

Treatment

Treatment is provided by a 2.40 MGD aeration water treatment plant located at 2750 Scott Boulevard in the city of Kissimmee (**Figure D-3**). The 1995 average daily flow was 0.97 MGD.

Interconnections

The Camelot WTP is located in the Camelot System. The Camelot (Camelot, Camelot West, Fountain Park WTFs), City, (North Bermuda, Ruby Street WTFs) and Parkway systems are interconnected.

Proposed

The current water use permit allows construction of four additional Floridan aquifer wells as indicated in **Table D-9** and **Figure D-3**.

Future

The 1995 Kissimmee Water Master Plan calls for the two wells at Fountain Park WTP to be converted to supply wells for Camelot in 1997, and two additional wells constructed, one in 2001 and 2006. The pumping capacity for these wells will be 2,000 GPM each for the new wells and 750 GPM for the Fountain Park wells. The projected 2020 average daily pumpage for all city of Kissimmee wells is 29.68 MGD.

Source

Information was obtained from the city of Kissimmee and SFWMD water use permit files.

City of Kissimmee - Camelot West

Permits

SFWMD Permit Number: 49-00103-W
FDEP PWS ID: 3494302

The current SFWMD permit was issued August 15, 1991 and expires August 15, 2001.

Raw Water Supply

Raw water is withdrawn from one Floridan aquifer well located in Northwest Osceola County. The well is 16 inches in diameter, has a total depth of 385 feet, and a cased depth of 201 feet. The well was drilled in 1987. The pumping capacity of the well is 2,000 GPM. Specific well information is provided in **Table D-9**.

The permitted allocations are as follows:

Annual Allocation:	10,650.00 MGY (29.20 MGD)
Maximum Daily Allocation:	38.54 MGD

The annual and maximum daily allocations include withdrawals from wells serving the city of Kissimmee water treatment plants Camelot, Camelot West, Fountain Park, Indian Ridge, North Bermuda, Northwest, Parkway and Ruby. The 1995 average daily pumpage from the Camelot West well was 1.73 MGD. The total 1995 average daily pumpage for all city of Kissimmee wells was 13.56 MGD.

Treatment

Treatment is provided by a 2.80 MGD aeration water treatment plant located at 2965 Parkway Boulevard in the city of Kissimmee (**Figure D-3**). The 1995 average daily flow was 1.73 MGD. The unaccounted-for water is not known.

Interconnections

The Camelot West WTP is located in the Camelot System. The city's Camelot (Camelot, Camelot West, Fountain Park WTFs), City (North Bermuda, Ruby Street WTFs) and Parkway systems are interconnected.

Proposed

The current water use permit allows construction of an additional Floridan aquifer well as indicated in **Table D-9** and **Figure D-3**.

Future

The 1995 Kissimmee Water Master Plan indicates no additional modifications to this facility through the year 2020. The projected 2020 average daily pumpage for all city of Kissimmee wells is 29.68 MGD.

Source

Information was obtained from the city of Kissimmee and SFWMD water use permit files.

City of Kissimmee - Fountain Park

Permits

SFWMD Permit Number: 49-00103-W
FDEP PWS ID: 3494302

The current SFWMD permit was issued August 15, 1991 and expires August 15, 2001.

Raw Water Supply

Raw water is withdrawn from two Floridan aquifer wells located in northern Osceola County. The wells are 10 inches in diameter, have total depths of 445 feet, and cased depths of 179 and 205 feet. The wells were drilled in 1980. The pumping capacity of the wells are 750 GPM each. Specific well information is provided in **Table D-9**.

The permitted allocations are as follows:

Annual Allocation:	10,650.00 MGY (29.20 MGD)
Maximum Daily Allocation:	38.54 MGD

The annual and maximum daily allocations include withdrawals from wells serving the city of Kissimmee water treatment plants Camelot, Camelot West, Fountain Park, Indian Ridge, North Bermuda, Northwest, Parkway, and Ruby. The 1995 average daily pumpage from the Fountain Park wells was 0.68 MGD. The total 1995 average daily pumpage for all city of Kissimmee wells was 13.56 MGD.

Treatment

Treatment is provided by a 2.16 MGD aeration water treatment plant located at 2705 N. Poinciana in the city of Kissimmee (**Figure D-3**). The 1995 average daily flow was 0.67 MGD. The unaccounted-for water is not known.

Interconnections

The Fountain Park WTP is located in the Camelot System. The city's Camelot (Camelot, Camelot West, Fountain Park WTFs), City (North Bermuda, Ruby Street WTFs) and Parkway systems are interconnected.

Proposed

There are no proposed facilities at this time.

Future

The city of Kissimmee indicated that the Fountain Park WTP will continue operations at the same production rate through 2020. The two wells at this site will then be connected to the Camelot WTP. The projected 2020 average daily pumpage for all city of Kissimmee wells is 29.68 MGD.

Source

Information was obtained from the city of Kissimmee and SFWMD water use permit files.

City of Kissimmee - Indian Ridge

Permits

SFWMD Permit Number: 49-00103-W
FDEP PWS ID: 3494299

The current SFWMD permit was issued August 15, 1991 and expires August 15, 2001.

Raw Water Supply

Raw water is withdrawn from two Floridan aquifer wells located in west central Osceola County. The wells are 10 inches in diameter, have total depths of 480 and 820 feet, and case depths of 411 and 245 feet. The wells were drilled in 1987. The pumping capacity of the wells are 800 GPM each. Specific well information is provided in **Table D-9**.

The permitted allocations are as follows:

Annual Allocation:	10,650.00 MGY (29.20 MGD)
Maximum Daily Allocation:	38.54 MGD

The annual and maximum daily allocations include withdrawals from wells serving the city of Kissimmee water treatment plants Camelot, Camelot West, Fountain Park, Indian Ridge, North Bermuda, Northwest, Parkway, and Ruby. The 1995 average daily pumpage from the wells was 0.70 MGD. The total 1995 average daily pumpage for all city of Kissimmee wells was 13.56 MGD.

Treatment

Treatment is provided by a 1.44 MGD aeration water treatment plant located at 7640 Sandhill Road in the city of Kissimmee (**Figure D-3**). The 1995 average daily flow was 0.63 MGD. The unaccounted-for water is not known.

Interconnections

The Indian Ridge WTP is not interconnected with any other potable water distribution systems.

Proposed

The city of Kissimmee anticipates to increase withdrawals from the Indian Ridge Wellfield to an estimated 4.24 by 2020.

Future

The 1995 Kissimmee Water Master Plan indicates additional wells will be constructed at this site: one in 1996, 2000, and 2004. The pumping capacity for these wells is estimated at 2,000 GPM each. The projected 2020 average daily pumpage for all city of Kissimmee wells is 29.68 MGD.

Source

Information was obtained from the city of Kissimmee and SFWMD water use permit files.

City of Kissimmee - North Bermuda

Permits

SFWMD Permit Number: 49-00103-W
FDEP PWS ID: 3490751

The current SFWMD permit was issued August 15, 1991 and expires August 15, 2001.

Raw Water Supply

Raw water is withdrawn from two Floridan aquifer wells located within Northeast Osceola County. The wells are 16 inches in diameter, have total depths between 458 and 1,200 feet, and cased depths of 278 and 281 feet. The wells were drilled in 1969. The pumping capacity of the wells are 2,100 GPM each. Specific well information is provided in **Table D-9**.

The permitted allocations are as follows:

Annual Allocation:	10,658.00 MGY (29.20 MGD)
Maximum Daily Allocation:	38.54 MGD

The annual and maximum daily allocations include withdrawals from wells serving the city of Kissimmee water treatment plants Camelot, Camelot West, Fountain Park, Indian Ridge, North Bermuda, Northwest, Parkway, and Ruby. The 1995 average daily pumpage from the North Bermuda wells was 2.56 MGD. The total 1995 average daily pumpage for all city of Kissimmee wells was 13.56 MGD.

Treatment

Treatment is provided by a 6.00 MGD aeration water treatment plant located at 2760 N. Bermuda Avenue in the city of Kissimmee (**Figure D-3**). The 1995 average daily flow was 2.56 MGD.

Interconnections

The North Bermuda WTP is located in the City System. The city′s Camelot (Camelot, Camelot West, Fountain Park WTFs), City, (North Bermuda, Ruby Street WTFs) and Parkway systems are interconnected.

Proposed

The current water use permit allows construction of two additional Floridan aquifer wells as indicated in **Table D-9** and **Figure D-3**.

Future

The 1995 Kissimmee Water Master Plan indicates additional wells will be constructed at this facility through 2010: two wells in 1999, one well in 2002, and one well in 2007. The pumping capacity for these wells will be 2,000 GPM each. The projected 2020 average daily pumpage for all city of Kissimmee wells is 29.68 MGD.

Source

Information was obtained from the city of Kissimmee and SFWMD water use permit files.

City of Kissimmee - Northwest

Permits

SFWMD Permit Number: 49-00103-W
FDEP PWS ID: 3491011

The current SFWMD permit was issued August 15, 1991 and expires August 15, 2001.

Raw Water Supply

Raw water is withdrawn from two Floridan aquifer wells located in northwestern Osceola County. The wells are 12 inches in diameter, have total depths of 375 and 376 feet, and cased depths of 147 and 195 feet. The wells were drilled in 1971. The pumping capacity of the wells are 2,200 GPM each. Specific well information is provided in **Table D-9**.

The permitted allocations are as follows:

Annual Allocation:	10,650.00 MGY (29.20 MGD)
Maximum Daily Allocation:	38.54 MGD

The annual and maximum daily allocations include withdrawals from wells serving the city of Kissimmee water treatment plants Camelot, Camelot West, Fountain Park, Indian Ridge, North Bermuda, Northwest, Parkway, and Ruby. The 1995 average daily pumpage from the Northwest wells was 2.56 MGD. The total 1995 average daily pumpage for all city of Kissimmee wells was 13.09 MGD.

Treatment

Treatment is provided by a 2.80 MGD aeration and chlorination water treatment plant located at 3230 Reedy Creek Road in the city of Kissimmee (**Figure D-3**). The 1995 average daily flow was 2.56 MGD. The unaccounted-for water is not known.

Interconnections

The Northwest WTP is not interconnected with any other potable water distribution system.

Proposed

The current water use permit allows construction of two additional Floridan aquifer wells as indicated in **Table D-9** and **Figure D-3**. Production from this wellfield is expected to be reduced to 2.25 MGD by 2020.

Future

The 1995 Kissimmee Water Master Plan indicates no additional modifications to this facility through the year 2020. The projected 2020 average daily pumpage for all city of Kissimmee wells is 29.68 MGD.

Source

Information was obtained from the city of Kissimmee and SFWMD water use permit files.

City of Kissimmee - Parkway

Permits

SFWMD Permit Number: 49-00103-W
FDEP PWS ID: 3491282

The current SFWMD permit was issued August 15, 1991 and expires August 15, 2001.

Raw Water Supply

Raw water is withdrawn from two Floridan aquifer wells located in eastern Osceola County. The wells are 12 inches in diameter, have total depths of 414 and 430 feet, and cased depths of 290 feet. The wells were drilled in 1973. The pumping capacity of the wells are 1,000 GPM each. Specific well information is provided in **Table D-9**.

The permitted allocations are as follows:

Annual Allocation:	10,650.00 MGY (29.20 MGD)
Maximum Daily Allocation:	38.54 MGD

The annual and maximum daily allocations include withdrawals from wells serving the city of Kissimmee water treatment plants Camelot, Camelot West, Fountain Park, Indian Ridge, North Bermuda, Northwest, Parkway, and Ruby. The 1995 average daily pumpage from the Parkway wells was 0.97 MGD. The total 1995 average daily pumpage for all city of Kissimmee wells was 13.56 MGD.

Treatment

Treatment is provided by a 2.80 MGD aeration facility located at 918 Shady Lane in the city of Kissimmee (**Figure D-3**). The 1995 average daily flow was 0.97 MGD.

Interconnections

The Parkway WTP is located in the Parkway System. The city′s Camelot, (Camelot, Camelot West, Fountain Park WTFs), City, (North Bermuda, Ruby Street WTFs) and Parkway systems are interconnected.

Proposed

The current water use permit allows construction of three additional Floridan aquifer wells as indicated in **Table D-9** and **Figure D-3**. Production from this plant is expected to increase an estimated 3.00 MGD by 2020.

Future

The 1995 Kissimmee Water Master Plan indicates an additional well will be constructed in 2005. The pumping capacity for this well will be 2,000 GPM. The projected 2020 average daily pumpage for all city of Kissimmee wells is 29.68 MGD.

Source

Information was obtained from the city of Kissimmee and SFWMD water use permit files.

City of Kissimmee - Ruby Street

Permits

SFWMD Permit Number: 49-00103-W
FDEP PWS ID: 3490751

The current SFWMD permit was issued August 15, 1991 and expires August 15, 2001.

Raw Water Supply

Raw water is withdrawn from two Floridan aquifer wells located in eastern Osceola County. The wells are 10 and 14 inches in diameter, have total depths of 467 and 410 feet, and cased depths of unknown and 194 feet, respectively. The wells were drilled in 1965 and 1969. The pumping capacity of the wells are 1,800 and 2,100 GPM. Specific well information is provided in **Table D-9**.

The permitted allocations are as follows:

Annual Allocation:	10,658.00 MGY (27.20 MGD)
Maximum Daily Allocation:	38.54 MGD

The annual and maximum daily allocations include withdrawals from wells serving the city of Kissimmee water treatment plants Camelot, Camelot West, Fountain Park, Indian Ridge, North Bermuda, Northwest, Parkway, and Ruby.

The 1995 average daily pumpage from the Ruby Street wells was 2.82 MGD. The total 1995 average daily pumpage for all city of Kissimmee wells was 13.56 MGD.

Treatment

Treatment is provided by a 4.00 MGD aeration water treatment plant located at 102 Lakeshore in the city of Kissimmee (**Figure D-3**). The 1995 average daily flow was 2.82 MGD. The unaccounted-for water is not known.

Interconnections

The Ruby Street WTP is located in the City System. The city′s Camelot, (Camelot, Camelot West, Fountain Park WTFs), City, (North Bermuda, Ruby Street WTFs), and Parkway systems are interconnected.

Proposed

There are no proposed facilities at this time.

Future

According to the 1995 Kissimmee Water Master Plan the Ruby Street WTP will be decommissioned in the year 1999, due to concerns raised by the proposed Wellhead Protection Ordinance.

Source

Information was obtained from the city of Kissimmee and SFWMD water use permit files.

Table D-9. City of Kissimmee Potable Water Supply Wells.

Well Number	Planar Coordinates		Status	Active	Aquifer	Total Depth (ft)	Cased Depth (ft)	Well Diameter (in)	Pump Capacity (GPM)	Intake Depth (NGVD)	Year Drilled
	Easting	Northing									
Camelot East											
C-1	340925	1451128	Existing	Yes	Floridan	410	185	10	762	N/A	1973
C-2	340925	1451128	Existing	Yes	Floridan	405	197	10	1,000	N/A	1973
C-3	340925	1451128	Proposed	No	Floridan	500	200	16	1,000	---	---
C-4	340925	1455081	Proposed	No	Floridan	500	200	16	1,000	---	---
C-5	340925	1455081	Proposed	No	Floridan	500	200	16	1,000	---	---
C-6	340925	1455081	Proposed	No	Floridan	500	200	12	760	---	---
Camelot West											
CW-1	337456	1455081	Existing	Yes	Floridan	385	201	16	2,000	N/A	1987
CW-2	337456	1455081	Proposed	No	Floridan	500	201	16	2,000	---	---
Fountain Park											
FP-1	342265	1451122	Existing	Yes	Floridan	445	179	10	750	N/A	1980
FP-2	342265	1451122	Existing	Yes	Floridan	445	205	10	750	N/A	1980
Indian Ridge											
IR-1	3130975	441104	Existing	Yes	Floridan	480	411	10	800	?80	1987 or 88
IR-2	3130975	441104	Existing	Yes	Floridan	820	245	10	800	?80	1987 or 88
North Bermuda											
NB-1	365861	1451741	Existing	Yes	Floridan	458	278	16	2,100	N/A	1969
NB-2	365861	1451741	Existing	Yes	Floridan	1,200	281	16	2,100	N/A	1969
NB-3	365861	1451741	Proposed	No	Floridan	1,200	280	16	2,300	---	---
NB-4	365861	1451741	Proposed	No	Floridan	1,200	280	16	2.3	---	---
Northwest											
NW-1	311102	1456817	Existing	Yes	Floridan	375	147	12	2,200	62	1971?
NW-2	311102	1456817	Existing	Yes	Floridan	376	195	12	2,200	62	1971?
NW-3	311102	1456817	Proposed	No	Floridan	500	200	16	2,000	---	---
NW-4	311102	1456817	Proposed	No	Floridan	500	200	16	2,000	---	---
Parkway											
P-1	385943	1799718	Existing	Yes	Floridan	414	290	12	1,000	N/A	1973
P-2	385943	1799718	Existing	Yes	Floridan	430	290	12	1,000	N/A	1973
P-3	385943	1799718	Proposed	No	Floridan	500	290	16	1,500	---	---
P-4	385943	1799718	Proposed	No	Floridan	500	290	16	1,500	---	---
P-5	385943	1799718	Proposed	No	Floridan	500	290	16	1,500	---	---
Ruby Street											
RS-3	369037	1439409	Existing	Yes	Floridan	467	N/A	10	1,800	N/A	1965
RS-4	369037	1439409	Existing	Yes	Floridan	410	193'8"	14	2,100	N/A	1959

Poinciana #1 (Industrial Park)

Permits

SFWMD Permit Number: 49-00069-W
FDEP PWS ID: 3490507

The current SFWMD permit was issued October 12, 1989 and expires October 12, 1999.

Raw Water Supply

Raw water is withdrawn from two Floridan wells located in the industrial park area. The wells are 12 inches in diameter, have total depths of 450 and 390 feet, and cased depths of 115 and 127 feet. The wells were drilled in 1980 and 1972. The pumping capacity of each well is 1,000 GPM. Specific well information is provided in **Table D-10**.

The permitted allocations are as follows:

Annual Allocation:	1,475.00 MGY (4.04 MGD)
Maximum Daily Allocation:	5.20 MGD

The annual and maximum daily allocations include withdrawals from wells serving Poinciana's water plants #2, #3, and #5. The 1995 average daily pumpage from this wellfield was 0.26 MGD. The total 1995 average daily pumpage from all wells was 1.62 MGD.

Treatment

Treatment is provided by a 1.00 MGD aeration facility located at 5299 Robert McLane Road in the Poinciana Industrial Park Area (**Figure D-3**). The 1995 average daily flow was 0.26 MGD. The unaccounted-for water for the entire Poinciana System is estimated to be 5 percent.

Interconnections

There are no distribution interconnections with other utilities.

Proposed

There are no proposed facilities at this time.

Future

There are no future plans available.

Source

Information was obtained from the Poinciana Utilities and SFWMD water use permit files.

Poinciana #2 (V2 Water Treatment Plant)

Permits

SFWMD Permit Number: 49-00069-W
FDEP PWS ID: 3494315

The current SFWMD permit was issued October 12, 1989 and expires October 12, 1999.

Raw Water Supply

Raw water is withdrawn from two Floridan wells located in the Village 2 Area of Poinciana. The wells are 12 inches in diameter, have total depths of 500 feet, and cased depths of 146 and 148 feet. The wells were drilled in 1988 and 1990. The pumping capacity of each well is 1,000 GPM. Specific well information is provided in **Table D-10**.

The permitted allocations are as follows:

Annual Allocation:	1,475.00 MGY (4.04 MGD)
Maximum Daily Allocation:	5.20 MGD

The annual and maximum daily allocations include withdrawals from wells serving Poinciana's water plants #1, #3, and #5. The 1995 average daily pumpage from these wells was 0.52 MGD. The total 1995 average daily pumpage from all wells was 1.62 MGD.

Treatment

Treatment is provided by a 1.00 MGD aeration facility located at 1010 Peabody Road in the Village 2 Area (**Figure D-3**). The 1995 average daily flow was 0.52 MGD. The unaccounted-for water for the entire Poinciana System is estimated to be 5 percent.

Interconnections

The Poinciana water distribution system's #2 and #3 are interconnected.

Proposed

There are no proposed facilities at this time.

Future

There are no future plans available.

Source

Information was obtained from the Poinciana Utilities and SFWMD water use permit files.

Table D-10. Poinciana Potable Water Supply Wells.

Well Number	Planar Coordinates		Status	Active	Aquifer	Total Depth (ft)	Cased Depth (ft)	Well Diameter (in)	Pump Capacity (GPM)	Intake Depth (NGVD)	Year Drilled
	Easting	Northing									
1-1A	341393	1420543	Existing	Yes	Floridan	450	115	12	1,000	N/A	1980
1-2	340535	1420114	Existing	Yes	Floridan	390	127	12	1,000	N/A	1972
2-1	341107	1396983	Existing	Yes	Floridan	500	146	12	1,000	N/A	1988
2-2	340821	1397412	Existing	Yes	Floridan	500	148	12	1,000	N/A	1990

St. Cloud Water Plant #1

Permits

SFWMD Permit Number: 49-00084-W
FDEP PWS ID: 3491373

The current SFWMD permit was issued February 11, 1986 and expired February 11, 1993.

Raw Water Supply

Raw water is withdrawn from one Floridan well located in the northern portion of the city of St. Cloud. The well is 16 inches in diameter, has a total depth of 491 and a cased depth of 405 feet. The well was drilled in 1960. The pumping capacity of the well is 2,300 GPM. Specific well information is provided in **Table D-11**.

The permitted allocations are as follows:

Annual Allocation:	1,657.00 MGY (4.54 MGD)
Maximum Daily Allocation:	7.72 MGD

The annual and maximum daily allocations include withdrawals from wells serving St. Cloud's water plants 2 and 3. The 1995 average daily pumpage from the Plant 1 well was 0.63 MGD. The total 1995 average daily pumpage from all wells was 1.88 MGD.

Treatment

Treatment is provided by a 3.31 MGD aeration water treatment plant located at 3010 10th Street in northern St. Cloud (**Figure D-3**). The capacity of the St. Cloud System with the largest well out of service is 7.50 MGD. The 1995 average daily flow was 0.63 MGD. The unaccounted-for water for the entire St. Cloud System is estimated to be 4.5 percent.

Interconnections

The St. Cloud water distribution system is served by three water treatment plants. There are no distribution interconnections with other utilities. An interconnect with the city of Kissimmee is anticipated within two years.

Proposed

The city has applied for a permit renewal to the District. The request is for a 10-year permit and an allocation as follows:

Annual Allocation:	1273.37 MGY (3.49 MGD)
Maximum Daily Allocation:	7.33 MGD

These allocations include withdrawals from wells serving St. Cloud's water plants 1, 2 and 3 and future Water Plant 4. Three additional wells are proposed. One well will serve Water Plant 3 and two will serve a future Water Plant 4. Specific well information is provided in **Table D-11** and the location of the proposed wells can be found in **Figure D-3**. The existing permit included four proposed wells; however, these were never constructed. The application is under review.

Future

This plant is not planned to be expanded through 2020. To meet future demands, the city plans to expand Water Plant 3 by 2.00 MGD (adding one well) and construct a new Water Plant 4, between 2000 and 2005. Water Plant 4 will have a capacity of 4.00 MGD, two wells, and will be located in the vicinity of the canal between Lakes Tohopekaliga and East Tohopekaliga.

Source

Information was obtained from the city of St. Cloud and SFWMD water use permit files.

St. Cloud Water Plant #2

Permits

SFWMD Permit Number: 49-00084-W
FDEP PWS ID: 3491373

The current SFWMD permit was issued February 11, 1986 and expired February 11, 1993.

Raw Water Supply

Raw water is withdrawn from two Floridan wells located in the northern portion of the city of St. Cloud. The wells are 16 inches in diameter, have total depths of 692 and 676 feet, and cased depths of 382 and 376 feet. The wells were drilled in 1954. The pumping capacity of the wells are 2,600 and 2,400 GPM. Specific well information is provided in **Table D-11**.

The permitted allocations are as follows:

Annual Allocation:	1,657.00 MGY (4.54 MGD)
Maximum Daily Allocation:	7.72 MGD

The annual and maximum daily allocations include withdrawals from wells serving St. Cloud′s water plants 1 and 3. The 1995 average daily pumpage from these wells was 0.85 MGD. The total 1995 average daily pumpage from all wells was 1.88 MGD.

Treatment

Treatment is provided by a 3.70 MGD (FDEP rated capacity) aeration facility located at the intersection of 10th Street and Connecticut Avenue in northern St. Cloud (**Figure D-3**). The capacity of the St. Cloud System with the largest well out of service is 7.50 MGD. The 1995 average daily flow was 0.85 MGD. The unaccounted-for water for the entire St. Cloud System is estimated to be 4.5 percent.

Interconnections

The St. Cloud water distribution system is served by three water treatment plants. There are no distribution interconnections with other utilities. An interconnect with the city of Kissimmee is anticipated within two years.

Proposed

The city has applied for a permit renewal to the District. The request is for a 10-year permit and an allocation of:

Annual Allocation:	1,273.37 MGY (3.49 MGD)
Maximum Daily Allocation:	7.33 MGD

These allocations include withdrawals from wells serving St. Cloud′s water plants 1, 2 and 3 and future Water Plant 4. Three additional wells are proposed. One well will serve Water Plant 3 and two will serve a future Water Plant 4. Specific well information is provided in **Table D-11** and the location of the proposed wells can be found in **Figure D-3**. The existing permit included four proposed wells; however, these were never constructed. The application is under review.

Future

This plant is not planned to be expanded through 2020. To meet future demands, the city plans to expand Water Plant 3 by 2.00 MGD (adding one well) and construct a new Water Plant 4, between 2000 and 2005. Water Plant 4 will have a capacity of 4.00 MGD, two wells, and will be located in the vicinity of the canal between Lakes Tohopekaliga and east Tohopekaliga.

Source

Information was obtained from the city of St. Cloud and SFWMD water use permit files.

St. Cloud Water Plant #3 (Cane Brake S/D)

Permits

SFWMD Permit Number: 49-00084-W
FDEP PWS ID: 3494303

The current SFWMD permit was issued February 11, 1986 and expired February 11, 1993.

Raw Water Supply

Raw water is withdrawn from one Floridan well located in the western portion of the city of St. Cloud. The well is 8 inches in diameter, has a total depth of 395 and a cased depth of 149 feet. The well was drilled in 1987. The pumping capacity of the well is 500 GPM. Specific well information is provided in **Table D-11**.

The permitted allocations are as follows:

Annual Allocation:	1,657.00 MGY (4.54 MGD)
Maximum Daily Allocation:	7.72 MGD

The annual and maximum daily allocations include withdrawals from wells serving St. Cloud's water plants 1 and 2. The 1995 average daily pumpage from this well was 0.38 MGD. The total 1995 average daily pumpage from all wells was 1.88 MGD.

Treatment

Treatment is provided by a 0.70 MGD chlorination only facility located on Emperor Drive in the Crane Brake Development in western St. Cloud (**Figure D-3**). The capacity of the St. Cloud System with the largest well out of service is 7.50 MGD. The 1995 average daily flow was 0.38 MGD. The unaccounted-for water for the entire St. Cloud System is estimated to be 4.5 percent.

Interconnections

The St. Cloud water distribution system is served by three water treatment plants. There are no distribution interconnections with other utilities. An interconnect with the city of Kissimmee is anticipated within two years.

Proposed

The city has applied for a permit renewal to the District. The request is for a 10-year permit and an allocation of:

Annual Allocation:	1273.37 MGY (3.49 MGD)
Maximum Daily Allocation:	7.33 MGD

These allocations include withdrawals from wells serving St. Cloud's water plants 1, 2 and 3 and future Water Plant 4. Three additional wells are proposed. One well will serve Water Plant 3 and two will serve a future Water Plant 4. Specific well information is provided in **Table D-11** and the location of the proposed wells can be found in **Figure D-3** The existing permit included four proposed wells; however, these were never constructed. The application is under review.

Future

This plant is planned to expanded by 2.00 MGD (adding one well) between 2000 and 2005. In addition, the city plans to construct a new Water Plant 4 during this same period to meet future demands. Water Plant 4 will have a capacity of 4.00 MGD, two wells, and will be located in the vicinity of the canal between Lakes Tohopekaliga and East Tohopekaliga.

Source

Information was obtained from the city of St. Cloud and SFWMD water use permit files.

Table D-11. St. Cloud Potable Water Supply Wells.

Well Number	Planar Coordinates		Status	Active	Aquifer	Total Depth (ft)	Cased Depth (ft)	Well Diameter (in)	Pump Capacity (GPM)	Intake Depth (NGVD)	Year Drilled
	Easting	Northing									
#1											
1	411537	1425973	Existing	Yes	Floridan	491	405	16	2,300	N/A	1960
#2											
2	409110	1425894	Existing	Yes	Floridan	692	382	16	2,600	N/A	1954
3	406531	1426212	Existing	Yes	Floridan	676	376	16	2,400	N/A	1954
#3											
4	393257	1427960	Existing	Yes	Floridan	395	149	8	500	N/A	1987
5	393257	1427960	Proposed	No	Floridan	500	300	16	1,400	---	---
#4											
6	394698	1424384	Proposed	No	Floridan	500	300	16	1,400	---	---
7	393561	1421762	Proposed	No	Floridan	500	300	16	1,400	---	---

Polk County Area

Poinciana is the only utility operating regional potable water treatment facilities within the Polk County Area. The location of these facilities is shown on the same map which shows the Osceola County Area facilities (**Figure D-3**). A summary sheet containing permit criteria, raw water supply, treatment methods, interconnections, and proposed or future plans is provided for each facility. Following the summary sheets is a table summarizing all of the source wells for the utility (**Table D-12**)

Oakhill Estates

Permits

SFWMD Permit Number: 53-00126-W

The current SFWMD permit was issued March 15, 1990 and expires March 15, 2000.

Raw Water Supply

Raw water is withdrawn from one well located in the Floridan aquifer. The well is 12 inches in diameter, has a total depth of 750 feet and a cased depth of 350 feet. The well was drilled in 1993. The pumping capacity of the well is 950 GPM at 80 psi. Specific well information is provided in Table D-13.

The permitted allocations are as follows:

Annual Allocation: 410 MGY

Maximum Daily Allocation:1.680 MGD

These annual and daily allocations include withdrawals from one well serving one water plant. The 1995 average daily pumpage from this well was 0.3318 MGD.

Treatment

Treatment is provided by chlorination. The facility is located on Kinney Harmon Road in Loughman (Section 18, Township 26S, Range 28E). The 1995 average daily flow was 0.3318 MGD. The unaccounted-for water is estimated to be 5 percent.

Interconnections

The Oak Hills Estates water distribution system is served by one water treatment plant. Oak Hill Estates are interconnected with Loma Linda water plant within the Polk County Utilities System. Loma Linda has two wells.

Proposed

The utility is in the process of applying for a permit renewal to the District. An additional 12-inch diameter well has been permitted for the Oak Hills water plant, but has not been installed to date. The installation of this well is scheduled in the Capital Projects Plan.

Future

Future expansion will include the Loma Linda/Oak Hills System being interconnected with the Northeast Regional system which has five water plants: Edgehill, Holiday Inn, Regal Inn, Van Fleet, and Polo Davenport. The total permitted annual average allocation for the Northeast Regional Permit is 1.337 MGD.

Source

Information was obtained from SFWMD water use permit files and Polk County Utilities.

Poinciana #3 (Core WTP)

Permits

SFWMD Permit Number: 49-00069-W
FDEP PWS ID: 3531421

The current SFWMD permit was issued October 12, 1989 and expires October 12, 1999.

Raw Water Supply

Raw water is withdrawn from three Floridan wells located in the Core Area of Poinciana. The wells are between 6 and 12 inches in diameter, have total depths between 400 and 497 feet, and cased depths between 146 and 209 feet. The wells were drilled between 1972 and 1983. The pumping capacity of each well is between 275 and 1,000 GPM. Specific well information is provided in **Table D-12**.

The permitted allocations are as follows:

Annual Allocation:	1,475.00 MGY (4.04 MGD)
Maximum Daily Allocation:	5.20 MGD

The annual and maximum daily allocations include withdrawals from wells serving Poinciana's water plants #1, #2, and #5. The 1995 average daily pumpage from these wells was 0.58 MGD. The total 1995 average daily pumpage from all wells was 1.62 MGD.

Treatment

Treatment is provided by a 1.00 MGD aeration facility located at 500 South Country Club Road in the Core Area in Poinciana (**Figure D-3**). The 1995 average daily flow was 0.56 MGD. The unaccounted-for water for the entire Poinciana System is estimated to be 5 percent.

Interconnections

The Poinciana water distribution system's #2 and #3 are interconnected.

Proposed

There are no proposed facilities at this time.

Future

There are no future plans available.

Source

Information was obtained from the Poinciana Utilities and SFWMD water use permit files.

Poinciana #4 (Wilderness WTP)

Permits

SFWMD Permit Number: 49-00069-W
FDEP PWS ID: 3531421

The current SFWMD permit was issued October 12, 1989 and expires October 12, 1999.

Raw Water Supply

Raw water is withdrawn from one Floridan well. The permitted allocations are as follows:

Annual Allocation:	1,475.00 MGY (4.04 MGD)
Maximum Daily Allocation:	5.20 MGD

The annual and maximum daily allocations include withdrawals from wells serving Poinciana's water plants #1, #2, and #5. The 1995 average daily pumpage from these wells was 0.08 MGD. The total 1995 average daily pumpage from all wells was 1.62 MGD.

Treatment

Treatment is provided by a 1.00 MGD aeration facility located at 500 South Country Club Road in the Core Area in Poinciana (**Figure D-3**). The 1995 average daily flow was 0.08 MGD. The unaccounted-for water for the entire Poinciana System is estimated to be 5 percent.

Interconnections

The Poinciana water distribution system's #2 and #3 are interconnected.

Proposed

There are no proposed facilities at this time.

Future

There are no future plans available.

Source

Information was obtained from the Poinciana Utilities and SFWMD water use permit files.

Poinciana #5 (V7 WTP)

Permits

SFWMD Permit Number: 49-00069-W
FDEP PWS ID: 3535076

The current SFWMD permit was issued October 12, 1989 and expires October 12, 1999.

Raw Water Supply

Raw water is withdrawn from one Floridan well located in the Village 7 Area of Poinciana. The well is 12 inches in diameter, has a total depth of 502 feet, and a cased depth of 225 feet. The well was drilled in 1988, and has a pumping capacity of 1,000 GPM. Specific well information is provided in **Table D-12** and the location of the well can be found in **Figure D-3**.

The permitted allocations are as follows:

Annual Allocation:	1,475.00 MGY (4.04 MGD)
Maximum Daily Allocation:	5.20 MGD

The annual and maximum daily allocations include withdrawals from wells serving Poinciana′s water plants #1, #2, and #3. The 1995 average daily pumpage from these wells was 0.19 MGD. The total 1995 average daily pumpage from all wells was 1.62 MGD.

Treatment

Treatment is provided by a 0.28 MGD aeration facility located at 2000 Hemlock Avenue in the Village 7 Area in Poinciana (**Figure D-3**). The 1995 average daily flow was 0.19 MGD. The unaccounted-for water for the entire Poinciana System is estimated to be 5 percent.

Interconnections

There are no distribution interconnections with other utilities.

Proposed

There are no proposed facilities at this time.

Future

There are no future plans available.

Source

Information was obtained from the Poinciana Utilities and SFWMD water use permit files.

Table D-12. Poinciana (Polk County) Potable Water Supply Wells.

Well Number	Planar Coordinates		Status	Active	Aquifer	Total Depth (ft)	Cased Depth (ft)	Well Diameter (in)	Pump Capacity (GPM)	Intake Depth (NGVD)	Year Drilled
	Easting	Northing									
#3											
3-1	351680	1379992	Existing	Yes	Floridan	400	182	6	275	N/A	1972
3-2	351823	1378992	Existing	Yes	Floridan	435	209	8	500	N/A	1974
3-3	350394	1378992	Existing	Yes	Floridan	497	146	12	1,000	N/A	1983
#4	---	---	---	---	---	---	---	---	---	---	---
#5											
5-1	340535	1357432	Existing	Yes	Floridan	502	225	12	1,000	N/A	1988
5-2	338393	1353434	Existing	Yes	Floridan	425	150	12	1,000	N/A	1991

WASTEWATER TREATMENT FACILITIES

Wastewater treatment facilities are not permitted by the SFWMD but are of interest as the treated wastewater can be used for irrigation and other beneficial uses, which offsets the demands on other water resources. The primary means of wastewater treatment is through wastewater treatment facilities and septic tanks. This section concentrates only on wastewater treatment facilities with FDEP-rated capacities of 0.50 MGD or greater.

The KB Planning Area currently has 18 large wastewater treatment facilities and one more is proposed (**Figures D-4** through **D-6**). Most are located in urbanized areas, where reuse demand is relatively high. Thirteen of the facilities are municipally/publicly owned, and all the facilities use the activated sludge treatment process. The reclaimed water/effluent disposal methods consist of discharge to surface waters, and reuse via green space (golf courses, residential lawns, medians, parks, etc.) and citrus irrigation and ground water recharge.

These facilities have a total rated capacity of 100.93 MGD. The 1995 average daily flow (ADF) for these facilities was 60.59 MGD. The wastewater flows for these facilities are projected to increase to approximately 136 MGD by the year 2020. Some types of reuse are more beneficial than others than others. Direct reuse, rapid infiltration basins (RIBs), percolation ponds in high or moderate recharge areas, and direct injection are generally more beneficial than surface water discharges and percolation ponds in low recharge areas (**Table D-13**)

Disposal Methods

There are three potential methods of effluent disposal that could be used in the KB Planning Area: surface water discharge, deep well injection, and reuse. There are no deep well injection systems currently used for effluent disposal in the KB Planning Area.

Surface Water Discharge

This method of effluent disposal consists of discharging the effluent to surface waters. Effluent prior to discharge is required to have received at least secondary treatment (20 mg/L carbonaceous biochemical oxygen demand [CBOD], 20 mg/L total suspended solids [TSS] or 90 percent removal, whichever is more stringent) and basic level disinfection. Additional levels of treatment may be required and are based upon the characteristics of the effluent and the receiving water, as well as other regulatory requirements and standards. Effluent standards derived from this method are known as water quality based effluent limitations (WQBELs). A WQBEL is a means of determining the available assimilative capacity of a water body and setting effluent limits utilizing appropriate procedures for simulation and prediction of water quality impacts. WQBELs are established to ensure that water quality standards in a receiving body of water will not be violated (Chapter 62-650, F.A.C.). There are two facilities in the KB Planning Area that use a surface water discharge for all or part of their effluent disposal.

Table D-13. Summary of the Wastewater Treatment Facilities within the Kissimmee Basin Planning Area.

Facility	FDEP Rated Capacity (MGD)	1995 Average Daily Flow (MGD)	Disposal Method		2020 Projected Flow (MGD)	2020 Projected High Beneficial Reuse (MGD)
			Low Beneficial Discharge (MGD)[e]	Higher Beneficial Reuse (MGD)[f]		
Okeechobee County						
Okeechobee Utility Authority	0.60	0.47	0.24	0.23	0.47[a]	0.24
Orange County						
Orange County Public Utilities						
Cypress Walk	2.69	0.46	0.00	0.46	0.79[a]	0.33
Meadow Woods	0.79	0.65	0.00	0.65	0.65[a]	0.00
Sand Lake Road	30.50	17.15	0.00	17.15	40.00	23.18
Orlando						
Conserv I	7.50	3.70	2.26	1.44	7.50	3.80
McLeod Road	25.00	15.29	0.00	15.29	25.00	9.71
Reedy Creek	15.00	9.03	0.00	9.03	25.00	15.97
Osceola County						
Buenaventura Lakes	1.93	1.48	1.31	0.17	1.98	1.31
Kissimmee						
Camelot	3.00	2.35	0.00	2.35	26.00[b]	23.92
Parkway	1.50	0.56	0.00	0.56	[b]	[b]
Sandhill Road	1.86	1.15	0.00	1.15	[b]	[b]
South Bermuda	7.00	4.59	4.27	0.32	[b]	[b]
Western	1.50	0.80	0.80	0.00	[b]	[b]
Poinciana						
#1	0.35	0.19	0.19	0.00	0.19[a]	0.19
#2	0.50	0.39	0.00	0.39	3.84	3.33
St. Cloud						[d]
Lakeshore	2.20	1.65	1.53	0.12	2.20	[d]
Southside (Proposed)	[c]	[c]	c	c	2.40	
Polk County						
Poinciana						
#3	0.35	0.22	0.22	0.00	[d]	[d]
#5	0.66	0.46	0.46	0.00	[d]	[d]
Kissimmee Basin Total	100.93	60.59	11.28	48.99	136.02	88.06

a. No 2020 projection available. Assumed to be at least equal to 1995 flow.
b. 2005 projection for entire Kissimmee System.
c. Proposed facility.
d. Poinciana facilities #2, #3, and #5 are interconnected and the system has a 2020 projected flow of 3.84.
e. Includes surface water discharge and percolation ponds in low recharge areas.
f. Includes direct reuse, RIB or ponds in high or moderate recharge areas, and direct injection.

As regulatory requirements become more stringent, these dischargers may choose to find alternative means for effluent disposal. In addition, any new discharge or expansion of an existing discharge must justify compliance with the state's antidegradation standards prior to issuance of a permit for such a discharge. The antidegradation rule requires a utility proposing to construct a new discharge, or expanding an existing discharge, to demonstrate that an alternate disposal method such as reuse is not feasible in lieu of a discharge to surface water, and that such a discharge is clearly in the public interest.

Deep Well Injection Class I Wells

This method of disposal consists of injecting secondary treated (20 mg/L CBOD, 20 mg/L TSS) effluent (no disinfection required) through a steel conduit (casing) to an appropriate geologic formation. There are no deep well injection systems used for effluent disposal in the KB Planning Area.

Reuse

This method of disposal consists of using treated wastewater (reclaimed water) for a beneficial purpose. There are 18 facilities in the KB Planning Area that reused all or a portion of their 1995 flow. In 1995, reclaimed water was used for golf course, residential lawn, park, green space, and citrus irrigation, and for ground water recharge via rapid-rate infiltration basins (RIBs). Many of the facilities use their reclaimed water/effluent for plant process water, and some for irrigation of the utility site (which also could be considered reuse). In 1995, 98 percent (60.27 MGD) of the treated wastewater was reused, with 81 percent going to higher beneficial purposes.

Effluent disposal via discharge to surface waters and discharge to percolation ponds in lower recharge areas to the Floridan aquifer results in a net loss from the water supply inventory. These methods of effluent disposal accounted for 11.28 MGD of water lost from the water supply inventory in 1995.

Okeechobee County Area

The Okeechobee Utility Authority operates one wastewater treatment facility in the Okeechobee County Area (**Figure D-4**). A sheet summarizing the facility's treatment and disposal methods, location, and proposed or future plans is provided on the next page.

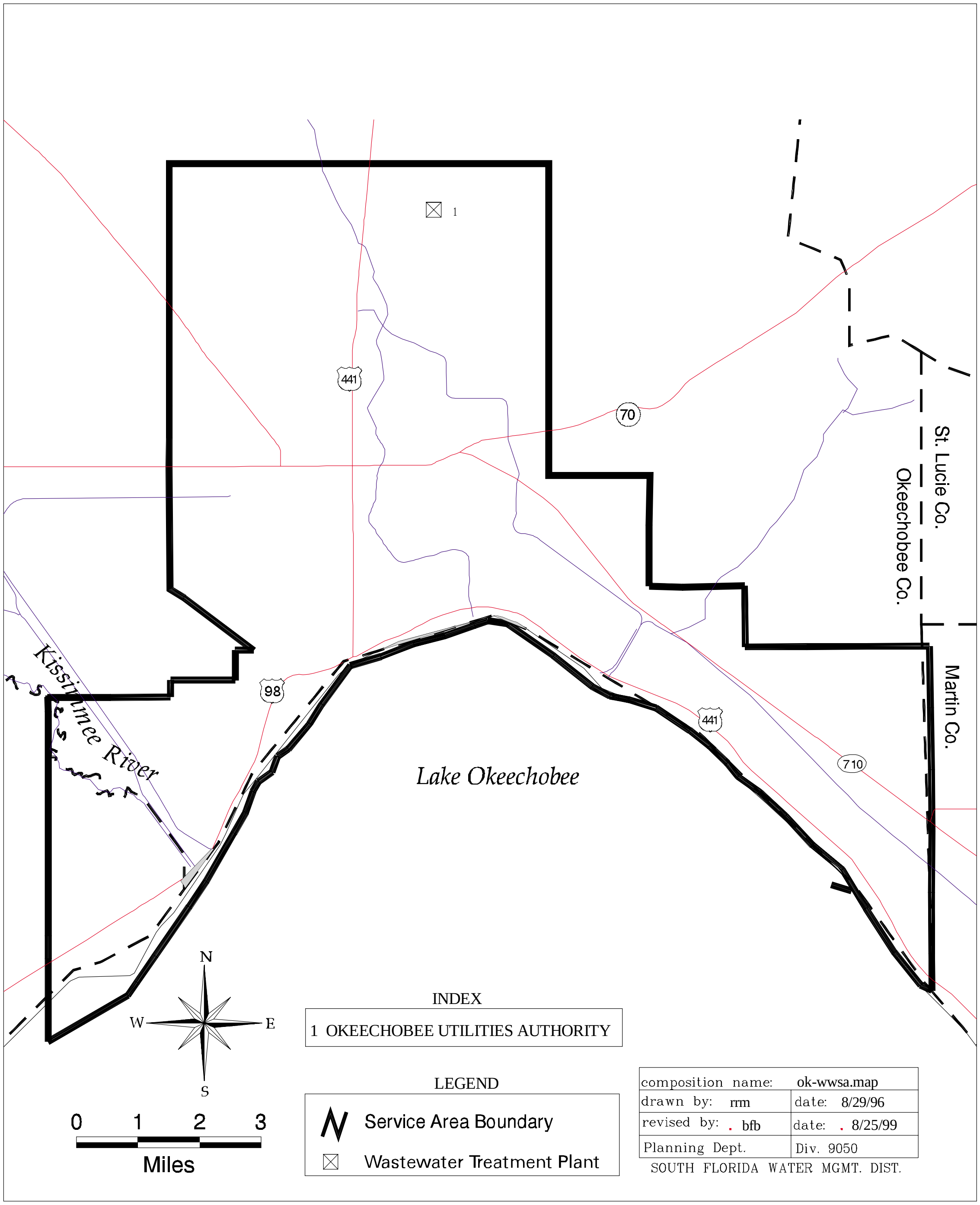


Figure D-4. Regional Wastewater Treatment Facilities in the Okeechobee County Area.

Okeechobee Utility Authority

Treatment/Disposal

The wastewater treatment facility consists of an existing 0.60 MGD wastewater treatment plant and a 1.0 MGD treatment plant with reclaimed water disposal via reuse by spray irrigation on an on-site spray field and nearby citrus groves.

The facility is operated by the Okeechobee Utility Authority. The 1995 average daily wastewater flow was 0.47 MGD.

Location

The wastewater treatment facility is located at 1338 NE 39th Boulevard in the city of Okeechobee.

Proposed

There are no proposed facilities at this time.

Future

There are no future plans available.

Source

Information supplied by the Okeechobee Utility Authority.

Orange County Area

Six wastewater treatment facilities are located within the Orange County Area (**Figure D-5**). In this section, a sheet summarizing treatment and disposal methods, location, and proposed or future plans is provided for each facility.

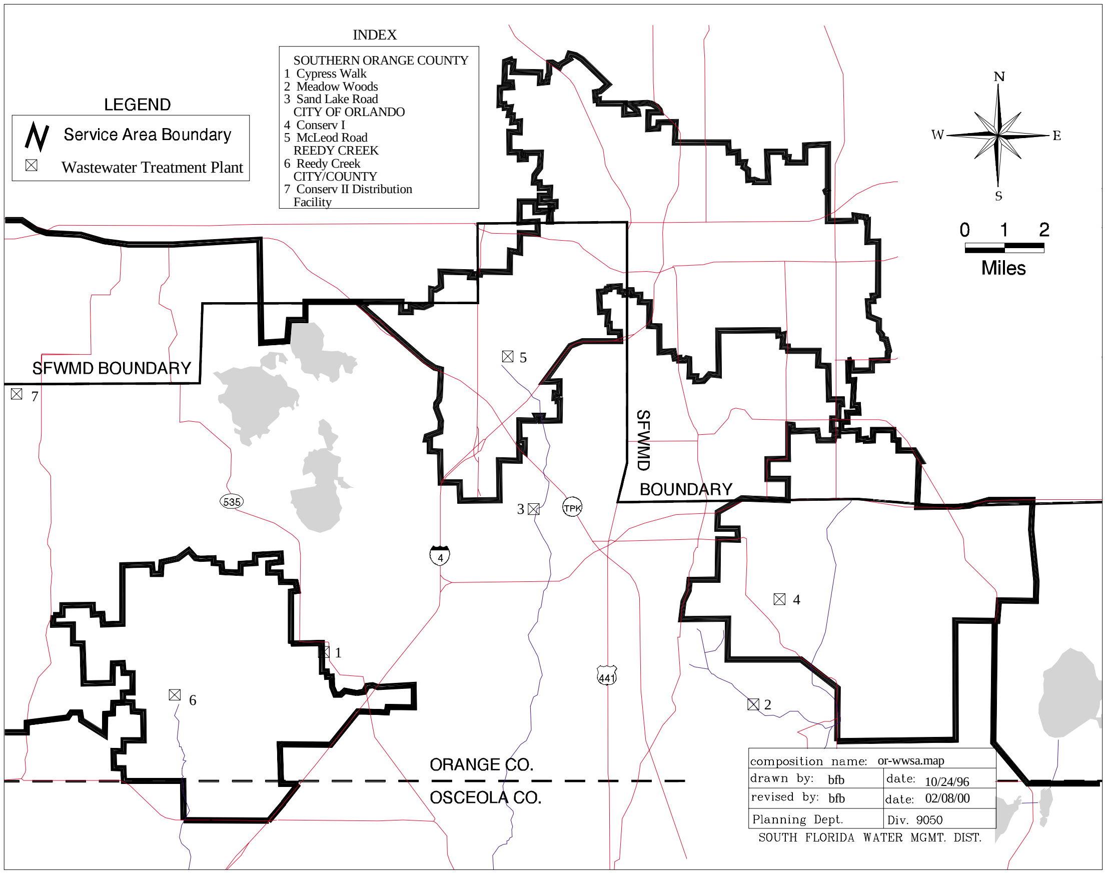


Figure D-5. Regional Wastewater Treatment Facilities in the Orange County Area.

Orange County Utilities - Cypress Walk

Treatment/Disposal
The wastewater treatment facility consists of an existing 1.00 MGD activated sludge wastewater treatment plant (limited to 0.69 MGD because of reclaimed water disposal) with reclaimed water disposal via reuse by public access irrigation. Public access irrigation consists of irrigation of the Cypress Walk Golf Course (343 total acres, 158 irrigated acres) with a design disposal capacity of 0.69 MGD. The facility is operated by Orange County.

The 1995 average daily wastewater flow was 0.46 MGD.

Location
The wastewater treatment facility is located in the Cypress Walk planned use development, north of Highway 535 in Lake Buena Vista.

Proposed
There are no proposed facilities at this time.

Future
There are no future plans available at this time.

Source
Information supplied by Orange County.

Orange County Utilities - Meadow Woods

Treatment/Disposal

The wastewater treatment facility consists of an existing 1.00 MGD activated sludge wastewater treatment plant (limited to 0.79 MGD because of reclaimed water disposal) with reclaimed water disposal via reuse by public access and restricted public access irrigation, and rapid exfiltration basins. Public access irrigation consists of irrigation of the Meadow Woods Golf Course with a design disposal capacity of 0.44 MGD. The restricted public access irrigation consists of a 75 acre irrigation field with a design disposal capacity of 0.19 MGD. The rapid exfiltration basins encompass an area of 23 acres and have a design disposal capacity of 0.16 MGD. The facility is operated by Orange County.

The 1995 average daily wastewater flow was 0.65 MGD.

Location

The wastewater treatment facility is located at State Road 527 and Rhode Island Woods Circle in the Meadow Woods Subdivision in southern Orange County.

Proposed

There are no proposed facilities at this time.

Future

This facility is planned to be abandoned by the end of 1998.

Source

Information supplied by Orange County.

Orange County Utilities - Sand Lake Road (South)

Treatment/Disposal

The wastewater treatment facility consists of an existing 30.50 MGD activated sludge wastewater treatment plant with reclaimed water disposal via reuse by public access irrigation, and edible crop irrigation and rapid-rate infiltration basins (RIBs) at Conserv II, and RIBs at the Westerly site. Public access irrigation consists of irrigation of golf courses (Hunter's Creek, Marriot) with a design disposal capacity of 1.20 MGD. Conserv II includes irrigation of approximately 7,000 acres of citrus with a design disposal capacity of 14.00 MGD; and 46 RIBs (1,530 acres) consisting of 1 to 5 cells with a design disposal capacity of 8.00 MGD, located at Conserv II. Orange County's Westerly Effluent Disposal System (consisting of two sites) has a total of 14 basins with a design disposal capacity of 4.40 MGD. The wastewater treatment facility and Westerly RIBs are operated by Orange County while Conserv II is operated jointly by the county and city of Orlando.

The 1995 average daily wastewater flow was 17.15 MGD.

Conserv II is shared with the city of Orlando-McLeod Road Wastewater Treatment Facility.

Location

The wastewater treatment facility is located at 4760 Sand Lake Road in Southwest Orlando. Conserv II is located south of Winter Garden in west Orange County. The Westerly Effluent Disposal System is located in Southwest Orange County adjacent to Shingle Creek Swamp and east of the intersection of Interstate 4 and State Road 535.

There are no proposed facilities at this time.

Future

Estimated plant capacity at this facility by the year 2020 will be 40.00 MGD. Reclaimed water disposal will be through expansion of the reuse system.

Source

Information supplied by Orange County.

Orlando - Conserv I

Treatment/Disposal

The wastewater treatment facility consists of an existing 7.50 MGD activated sludge wastewater treatment plant with reclaimed water disposal via reuse by public access irrigation and RIBs. Public access irrigation consists of irrigation of a golf course, nursery, and other green space and use in a cement plant with an existing and future reuse capacity of 4.70 MGD. The RIBs consists of 19 ponds totaling 176 acres with a design disposal capacity of 7.50 MGD. The facility is operated by the city of Orlando. The 1995 average daily wastewater flow was 3.70 MGD.

Location

The wastewater treatment facility is located at 11401 Boggy Creek Road, south of the International Airport in southeastern Orlando.

Proposed

There are no proposed facilities at this time.

Future

There are no future plans available.

Source

Information supplied by the city of Orlando.

Orlando - McLeod Road

Treatment/Disposal

The wastewater treatment facility consists of an existing 25.00 MGD activated sludge wastewater treatment plant with reclaimed water disposal via reuse by public access irrigation, and edible crop irrigation and RIBs at Conserv II. Public access irrigation consists of irrigation of a golf course, nursery, and other green space with a design disposal capacity of 2.50 MGD. Conserv II includes irrigation of approximately 7,000 acres of citrus with a design disposal capacity of 14.00 MGD; and 46 RIBs (1,530 acres), consisting of 1 to 5 cells, with a design disposal capacity of 8.00 MGD. The wastewater treatment facility is operated by the city of Orlando while Conserv II is operated jointly by the city and Orange County. The 1995 average daily wastewater flow was 15.29 MGD.

Conserv II is shared with Orange County Sandlake wastewater treatment facility.

Location

The wastewater treatment plant is located at 5100 L.B. McLeod Road in Southwest Orlando. Conserv II is located south of Winter Garden in west Orange County.

Proposed

There are no proposed facilities at this time.

Future

There are no future plans available.

Source

Information supplied by the city of Orlando.

Reedy Creek Improvement District (RCID)

Treatment/Disposal

The wastewater treatment facility consist of an existing 15.00 MGD annual average daily flow activated sludge advanced wastewater treatment plant with reclaimed water disposal via reuse by REBs and public access irrigation. The rapid infiltration basins (RIBs) encompass 1,000 acres and have a permitted average annual disposal capacity of 12.50 MGD. They are located in Southwest Orange County, east of State Road 545. Public access irrigation includes irrigation of five golf courses, the vicinity of the wastewater treatment facility and a 100 acre tree farm. Public access irrigation has a firm disposal capacity of 2.50 MGD and an ultimate reuse capacity of 16.70 MGD. The facility is operated by the Reedy Creek Improvement District. The 1995 average daily wastewater flow was 9.03 MGD (7.58 MGD RIBs, 1.45 MGD Irrigation). The 1998 average daily flow was 10.7 MGD.

Location

The wastewater treatment facility is located at 2151 Bear Island Road, Lake Buena Vista.

Proposed

There are no proposed facilities at this time, but a re-rating of the facility for a higher permitted capacity is anticipated in 2001/2002.

Future

The existing WWTP components whose capacities are less than 30 MGD are going to be replace in order to reach that capacity at all the times after the year 2000. Also wastewater collection and transmission system improvements will be made in order to satisfy proposed future growth of Walt Disney World resort complex.

The 1994 wastewater master plan indicates that flows in the RCID Service Area are anticipated to increase between 24 and 26 MGD by 2020. The existing plant capacity will be reached in about 2004. The plant capacity can be increased in increments beyond 15 MGD by enlarging the individual components which limit the flow. A number of major components of the WWTP will not need to be expanded, including the BNR treatment system, the sludge composing facilities, and the sludge thickening and dewatering systems.

Source

Reedy Creek Energy Services, Inc.

Osceola County Area

Nine existing and one proposed wastewater treatment facilities are located within the Osceola County Area (**Figure D-6**). In this section a sheet summarizing treatment and disposal methods, location, and proposed or future plans is provided for each facility. Two of the wastewater treatment facilities in **Figure D-6** (9 and 10) are located in Polk County and are discussed in the Polk County Area section beginning on **page D-89**.

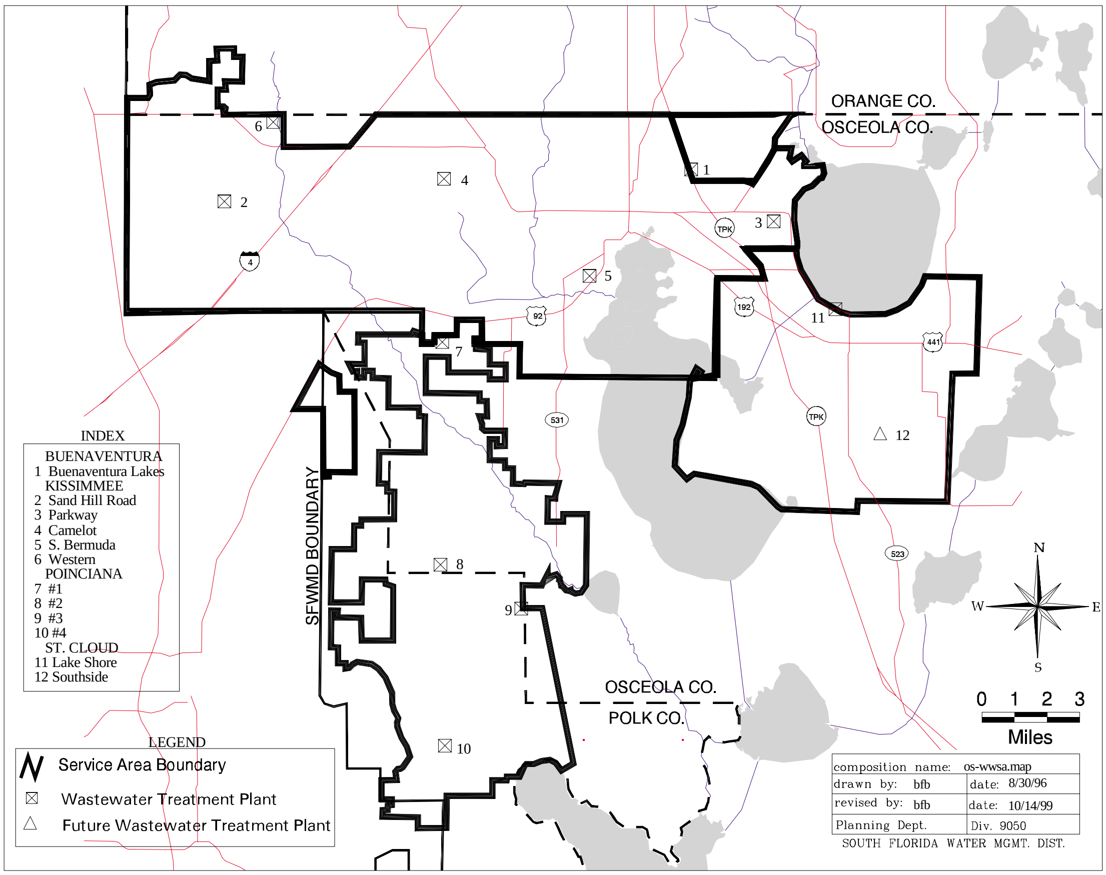


Figure D-6. Regional Wastewater Treatment Facilities in the Osceola and Polk County Areas.

Buenaventura Lakes

Treatment/Disposal

The permitted capacity of the waste treatment facility is 1.8 MGD and the total permitted capacity of the effluent disposal system is 1.93 MGD. Reuse includes wetlands enhancement and public access irrigation. Wetlands enhancement includes using reclaimed water to maintain water levels in a 169-acre nonjurisdictional, treatment wetland with a 0.10 MGD permitted disposal capacity. Public access irrigation consists of irrigation of the 65 acre Buenaventura Golf Course, with a 0.50 MGD permitted disposal capacity.

Effluent is discharged to surface water by seepage through four existing RIBs to an adjacent stormwater canal, which discharges to Bass Slough and sequential to Lake Tohopekaliga. These four RIBs have a 1.33 MGD permitted capacity and a seepage length of 520 linear feet each. These facilities are owned and operated by Florida Water Services.

The 1995 average daily wastewater flow was 1.48 MGD

Location

The wastewater treatment facility is on nine acres situated located at 689C Birchwood Circle, Kissimmee.

Proposed

Conducted in 2000 to determine future plans for the wastewater treatment and effluent disposal facility expansion.

Future

There are no future plans available.

Source

Information supplied by Southern States Utilities (October 1996) and Florida Water Services (March 1999).

City of Kissimmee - Camelot

Treatment/Disposal

The wastewater treatment facility consists of a 3.00 MGD advanced activated sludge wastewater treatment plant with reclaimed water disposal by reuse via RIBs at the Pine Island and Imperial sites. The Pine Island site has a capacity of 1.40 and consists of 300 acres located south of the Camelot plant. The Imperial site has a capacity of 1.60 MGD and consists of 149 acres located 12 miles west of Kissimmee.

The facility is operated by the city of Kissimmee. The 1995 average daily wastewater flow was 2.35 MGD.

Location

The wastewater treatment plant is located on Scott Boulevard, about one mile south of U.S. 192 west of Kissimmee.

Proposed

An expansion has been proposed to increase the treatment capacity of the facility from 3.00 MGD to 5.00 MGD. The actual capacity will be limited by the reuse systems.

Future

There are no future plans available.

Source

Information supplied by the city of Kissimmee.

City of Kissimmee - Parkway

Treatment/Disposal

The wastewater treatment facility consists of a 1.50 MGD activated sludge wastewater treatment plant with reclaimed water disposal by reuse via RIBs, seepage trenches, and public access irrigation at the sites listed in **Table D-14**.

Table D-14. Reuse Capacities at Public Access Irrigation Sites.

Irrigation Site	Reuse Capacity
Kissimmee Bay Golf Course	0.353 MGD
Kissimmee Bay Subdivision	0.600 MGD
Pebble Point Subdivision	0.180 MGD
Country Crossing Subdivision	0.051 MGD
Westminster Gardens Subdivision	0.021 MGD
Rose Hill Cemetery	0.205 MGD
Osceola (Astros) Sports Complex	0.044 MGD

The facility is operated by the city of Kissimmee. The 1995 average daily wastewater flow was 0.56 MGD.

Location

The wastewater treatment plant is located at 2550 Fortune Road, Kissimmee.

Proposed

There are no proposed facilities at this time.

Future

There are no future plans available.

Source

Information supplied by the city of Kissimmee.

City of Kissimmee - Sand Hill Road

Treatment/Disposal

The wastewater treatment facility consists of a 1.86 MGD activated sludge wastewater treatment plant with reclaimed water disposal by reuse via RIBs and irrigation. The RIBs have a total wetted area of 8.3 acres and spray irrigation consists of irrigation of the plant site.

The facility is operated by the city of Kissimmee. The 1995 average daily wastewater flow was 1.15 MGD.

Location

The wastewater treatment plant is located at 8000 Sandhill Road, off Oak Island Road, west of Kissimmee.

Proposed

There are no proposed facilities at this time

Future

There are no future plans available.

Source

Information supplied by the city of Kissimmee.

City of Kissimmee - South Bermuda

Treatment/Disposal

The wastewater treatment facility consists of an existing 7.00 MGD activated sludge wastewater treatment plant with reclaimed water disposal by reuse via: 16 RIBs located at the Imperial Site (149 +/- acres including buffer zone) with an annual average design reuse capacity of 8.00 MGD; and diversion of 320,000 GPD/AADF from the reuse main of the treatment facility to the FPC/Intercession City Power Plant, with 130,000 GPD/AADF returned to the reuse main for disposal at Imperial Site RIBs, for net reuse capacity gain of 190,000 GPD/AADF.

The facility is operated by the city of Kissimmee. The 1995 average daily wastewater flow was 4.59 MGD.

Location

The wastewater treatment plant is located at 1616 South Bermuda Avenue. The Imperial Site percolation ponds are located one-half mile west of I-4, off Gentile Road, near the Osceola/Polk County line.

Proposed

There are no proposed facilities at this time.

Future

There are no future plans available.

Source

Information supplied by the city of Kissimmee.

City of Kissimmee - Western

Treatment/Disposal

The wastewater treatment facility consists of a 1.50 MGD activated sludge wastewater treatment plant with reclaimed water disposal via reuse by the sites listed in **Table D-15**.

Table D-15. Reuse Capacities at Public Access Irrigation Sites.

Irrigation Site	Irrigated Acreage	Reuse Capacity
Sand Hill Road	+/- 8	1.00 MGD
Fisher Island	+/- 10	0.66 MGD
Fisher Island spray irrigation system	27	0.13 MGD

The facility is operated by the city of Kissimmee. The 1995 average daily wastewater flow was 0.80 MGD.

Location

The wastewater treatment plant is located on Reedy Creek Road, north of U.S. 192 and west of I-4 in Osceola County.

Proposed

There are no proposed facilities at this time.

Future

There are no future plans available.

Source

Information supplied by the city of Kissimmee.

Poinciana #1

Treatment/Disposal

The wastewater treatment facility consists of an existing 0.35 MGD activated sludge wastewater treatment plant with reclaimed water disposal by reuse via five acres of percolation ponds. The facility is operated by Poinciana Utilities, Inc.

The 1995 average daily wastewater flow was 0.19 MGD.

Location

The wastewater treatment facility is located at 1001 West Robert McLane Road in the Poinciana Industrial Park Area, Poinciana.

Proposed

There are no proposed facilities at this time.

Future

There are no future plans available.

Source

Information supplied by Poinciana Utilities.

Poinciana #2

Treatment/Disposal

The wastewater treatment facility consists of an existing 0.50 MGD activated sludge wastewater treatment plant with reclaimed water disposal by reuse via restricted public access irrigation of a 375 acre sod farm. This facility is operated by Poinciana Utilities, Inc.

The 1995 average daily wastewater flow was 0.39 MGD.

Location

The wastewater treatment facility is located at 1000 North Rhododendron Avenue in the Village 2 Area of Poinciana.

Proposed

There are no proposed facilities at this time.

Future

The wastewater collection systems for Poinciana's wastewater treatment facilities #2, #3, and #5 are interconnected and will be considered as a system. The capacity analysis report for this system anticipates an 8.79 percent per year increase in wastewater flows, such that system flows would increase to 2.32 MGD by 2004. It is planned to expand Poinciana #5 from 0.66 MGD to 1.20 MGD to treat these future flows. Using this growth rate, the 2020 wastewater flows would be approximately 3.84 MGD.

Source

Information supplied by Poinciana Utilities.

St. Cloud - Lakeshore

Treatment/Disposal

The wastewater treatment facility consists of an existing 2.20 MGD activated sludge wastewater treatment plant with reclaimed water disposal via reuse by public access irrigation and restricted public access irrigation. Restricted public access irrigation consists of irrigation of a 365 acre spray field with a rated disposal capacity of 1.78 MGD. Public access irrigation consists of irrigation of residential areas, medians and parks in the City with an existing reuse capacity of 0.12 MGD and a future reuse capacity of 3.30 MGD. The facility is operated by the city of St. Cloud.

The 1995 average daily wastewater flow was 1.65 MGD.

Location

The wastewater treatment facility is located at 2800 Lakeshore Boulevard in northeastern St. Cloud. The restricted public access irrigation spray field is located east of State Road 523 (Canoe Creek Road) and south of Creek Woods Drive.

Proposed

This facility is not planned to be expanded through 2020. Flows in excess of 2.20 MGD will be treated at a proposed Southside facility, which is planned to be constructed in 1996. Additional reclaimed water users will be connected as necessary.

Future

Wastewater flows in the St. Cloud Service Area are anticipated to increase to 4.60 MGD by 2020. Wastewater treatment is planned to be provided by the Lakeshore facility and a proposed Southside facility. The Lakeshore facility will remain at 2.20 MGD and additional flows will be treated at the Southside facility, which is planned to be constructed in 1996, will have an initial capacity of 0.80 MGD and a 2020 capacity of 2.40 MGD. Disposal in 2020 will be reuse via public access irrigation and restricted public access irrigation.

Source

Information supplied by the city of St. Cloud.

St. Cloud - Southside (Proposed)

Proposed

The wastewater treatment facility (WWTF) initially will consist of a 0.80 MGD activated sludge wastewater treatment plant with reclaimed water disposal via the reuse system approved for the St. Cloud Lakeshore WWTF, which consists of public access irrigation and restricted public access irrigation. The restricted public access irrigation consists of irrigation of a 365 acre spray field with a rated disposal capacity of 1.78 MGD. Public access irrigation consists of irrigation of residential areas, medians and parks in the city with an existing reuse capacity of 0.12 MGD and a future reuse capacity of 3.30 MGD. The facility will be operated by the city of St. Cloud, and is planned to be operational by December 1999.

Location

The wastewater treatment facility will be located east of State Road 523 (Canoe Creek Road) and south of Creek Woods Drive, in the vicinity of the restricted public access irrigation spray field.

Future

Wastewater flows in the St. Cloud Service Area are anticipated to increase to 4.60 MGD by 2020. Wastewater treatment is planned to be provided by the Lakeshore facility and this Southside facility. The Lakeshore facility will remain at 2.20 MGD and this facility will be expanded 2.40 MGD by 2020. Disposal in 2020 will be reuse via public access irrigation and restricted public access irrigation.

Source

Information supplied by the city of St. Cloud.

Polk County Area

Two wastewater treatment facilities are located within the Polk County Area. The location of these facilities is shown on the same map that shows the Osceola County Area facilities (**Figure D-6**). In this section a sheet summarizing treatment and disposal methods, location, and proposed or future plans is provided for each facility.

Poinciana #3

Treatment/Disposal

The wastewater treatment facility consists of an existing 0.35 MGD activated sludge wastewater treatment plant with effluent disposal by discharge to an unaltered 115 acre treatment wetland with an emergency overflow to the M-7 Canal to London Creek to Lake Hatchineha. This facility is operated by Poinciana Utilities, Inc. The 1995 average daily wastewater flow was 0.22 MGD.

Location

The wastewater treatment facility is located on 601 South Country Club Road in the Core Area of Poinciana.

Proposed

There are no proposed facilities at this time.

Future

The wastewater collection systems for Poinciana′s wastewater treatment facilities #2, #3, and #5 are interconnected and will be considered as a system. The capacity analysis report for this system anticipates an 8.79 percent per year increase in wastewater flows, such that system flows would increase to 2.32 MGD by 2004. It is planned to expand Poinciana #5 from 0.66 MGD to 1.20 MGD to treat these future flows. Using this growth rate, the 2020 wastewater flows would be approximately 3.84 MGD.

Source

Information supplied by Poinciana Utilities.

Poinciana #5

Treatment/Disposal

Consists of an existing 0.66 MGD activated sludge wastewater treatment plant with reclaimed water disposal by reuse via 8.75 acres of RIBs. The facility is operated by Poinciana Utilities, Inc. The 1995 average daily wastewater flow was 0.46 MGD.

Location

The wastewater treatment facility is located on 1001 Lake Marion Creek Drive in the Village 7 Area of Poinciana.

Proposed

There are no proposed facilities at this time.

Future

The wastewater collection systems for Poinciana's wastewater treatment facilities #2, #3, and #5 are interconnected and will be considered as a system. The capacity analysis report for this system anticipates an 8.79 percent per year increase in wastewater flows, such that system flows would increase to 2.32 MGD by 2004. It is planned to expand Poinciana #5 from 0.66 MGD to 1.20 MGD by 1998 to treat these future flows. An expansion of the existing RIBs is planned for future disposal. Using this growth rate, the 2020 wastewater flows would be approximately 3.84 MGD.

Source

Information supplied by Poinciana Utilities.

Appendix E
NATURAL RESOURCES

FACTORS AFFECTING WETLANDS

Factors, which influence wetland systems, include hydrology, fire, geology and soils, climate, and ecological succession. This section presents an overview of each of these factors.

Hydrology

Hydrology is the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes (Mitsch and Gosselink, 1986). Hydraulic inflows and outflows, such as precipitation, surface runoff, ground water inputs, and in some cases, tides and river flooding, provide the energy to transport nutrients and other organic material to and from wetlands. Water depth, hydroperiod, flow patterns, stage, duration, frequency of flooding, and water quality all influence the biochemistry of wetlands and ultimately, the species composition and type of wetland community that develops. The hydrology of a wetland acts both as a limit and a stimulus for determining the numbers and types (species) of flora and fauna that can live within or utilize a specific wetland. Hydrology also strongly affects aquatic primary production, organic accumulation, and the cycling of nutrients (Mitsch and Gosselink, 1986).

Precipitation

The Kissimmee Basin (KB) Planning Area experiences wide variations in annual rainfall, resulting in both flooding and extended drought periods. During heavy rainfall years, there is overland flow and discharge to the many lakes in the area and to the Kissimmee River, which ultimately discharges into Lake Okeechobee. During extended drought years, however, the natural system is stressed by decreased spring flow, increased frequency of fires, loss of organic soils, and invasion of wetlands by exotics.

Evapotranspiration

Evapotranspiration (ET) is the combined process of evaporation from land and water surfaces, and from plants. ET rates vary as a function of solar radiation, air and water temperature, relative humidity, wind velocity and duration and the type and density of vegetation (Duever et al., 1986). In South Florida, ET ranges from 70 to 95 percent of annual rainfall. During the dry season and drought years, ET exceeds rainfall inputs (Klein et al., 1975). Temperature is often regarded as the most important factor controlling ET. Minimum ET rates occur during the winter months of December and January, with highest values experienced during the spring months of April and May. Typical ET values for South Florida range from 40 to 45 inches a year, up to a maximum of 60 inches a year (Parker et al., 1955). ET rates frequently account for virtually all water losses in a wetland because of their slow rate of flow and high surface area to depth ratio (Mitsch et al., 1988). As a result, ET plays a very important role in the development of any hydrologic model that might be developed for a particular wetland system and is usually the most difficult parameter to estimate. Wetlands have higher ET rates than other habitats largely because they store water at or near the ground surface where it can be lost to the atmosphere (Duever, 1988).

Hydroperiod

Hydroperiod refers to the annual period of water level inundation, specifically the depth and length of time (duration) that a wetland contains water above ground level. **Figure E-1** presents examples of typical hydroperiods experienced by three different South Florida plant communities. Duever et al. (1986) reports that hydroperiod is the dominant factor controlling both the existence, plant community composition and succession of South Florida wetland systems. Hydroperiod is often expressed in terms of the range of the number of days that a wetland is normally inundated. Each wetland type is thought to have a hydrologic signature that describes the rise and fall of water levels from year to year (Mitsch and Gosselink, 1986). In contrast, O'Brian and Ward (1980) state that from a hydrological point of view, the most significant feature of a wetland is the level of the ground water table. They point out that the depth to the ground water table is more significant than the hydroperiod or time the wetland is flooded.

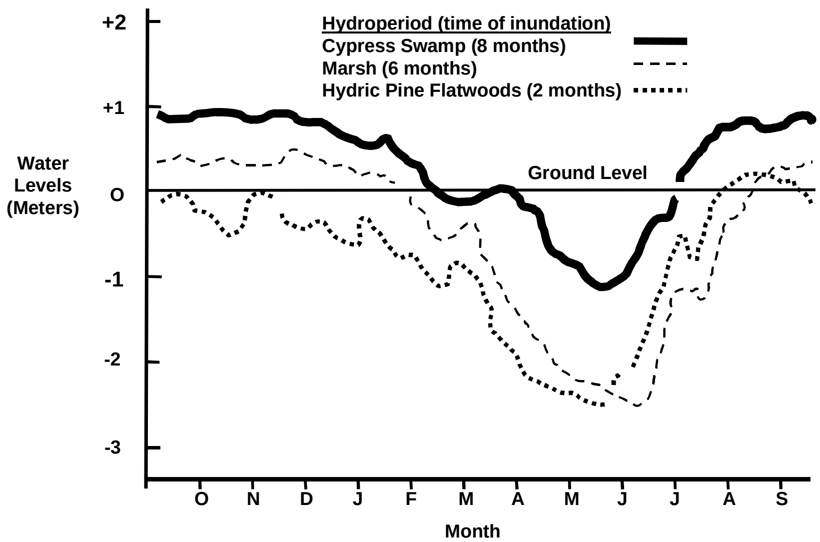


Figure E-1. Hydrographs and Hydroperiod Ranges for Three Different South Florida Vegetation Types (From Duever et al., 1986).

Water Level Depth and Timing

In South Florida's freshwater wetlands, wading bird nesting success is highly dependent on present and past water level conditions, which influence the amount and availability of wading bird prey items, such as crayfish and small forage fish (Kushlan, 1976, 1978, 1979, 1980, 1986; Powell, 1987. Kahl (1964) found that the timing and initiation of wood stork breeding attempts was predictable from the measurement of marsh surface water levels. Kushlan et al. (1975) found that wading bird nesting success was directly related to the rapid winter/spring recession of water levels (drying rate) of South Florida wetlands. Therefore, maintenance of appropriate water depths and timing of wetland water level fluctuations is a critical factor in determining wading bird nesting success.

Topography

In general, wetlands in temperate and tropical regions tend to develop in areas of low topographic relief and high rainfall inputs. Topography also controls the shape and size of watersheds, and affects the timing and quantity of runoff. Topography is also an important factor in controlling the vertical and horizontal extent of seasonal water level fluctuations within a wetland. At the site-specific level, wetlands are determined by the depth and duration of inundation, which in turn are influenced by site micro topography (differences in water depth of only a few centimeters), soil type, and vegetative cover (Duever et al., 1986).

Vegetation Type

Vegetation type can affect the hydrologic cycle of a wetland, primarily through ET. Vegetation also influences water movement and water quality. Plant leaves, leaf litter, and attached periphyton (algae) communities tend to impede water flow which: (1) increases the period of inundation, (2) reduces surface water runoff and erosion, (3) allows more time for aquifer recharge, and (4) assimilates nutrients and chemical exchanges between the soil vegetation and water (Duever et al., 1986).

Tropical Storms and Hurricanes

Hurricanes, tropical storms that generate winds in excess of 75 miles per hour, are recurrent events in South Florida and are important physical processes that affect the regional ecology (Craighead and Gilbert, 1962). Hurricanes normally cause the greatest amount of damage when wind velocities average greater than 111 miles per hour. They also have the potential of producing massive quantities of precipitation in a very short period of time.

Fire

Fire is also an important factor controlling the species composition, distribution, and succession of wetland communities in the KB Planning Area. Within the constraints of wetland hydrology, fires occur with variable frequency and severity affecting plant succession.

Theoretically, hardwood hammocks represent the climax plant community for South Florida (Alexander and Crook, 1973; Wharton et al., 1977; Duever, 1984).

Hammocks develop when fire is absent or infrequent, and organic soils are allowed to build up over time to support the succession of hardwoods. However, fire is a common component of the South Florida landscape.

Ewel and Mitsch (1978) investigated the effects of fire on a cypress dome in Florida. They found that fire had a cleansing effect on the dome, selectively killing almost all of the pines and hardwoods and yet killing relatively few pond cypress, suggesting a possible advantage of fire to some shallow cypress ecosystems in eliminating competition that is less water tolerant (Mitsch and Gosselink 1986).

Geology and Soils

Two primary factors which affect the hydrogeology of wetlands are the porosity and permeability of its underlying soils (Duever, 1988). A highly porous soil can hold or store large amounts of water, while a highly permeable soil allows water to flow to the underlying aquifer. The high capillary action of peat or clay soils enable wetlands to store large quantities of water, somewhat similar to how a sponge takes up water.

Some wetlands contain perched water tables. A perched water table exists where a saturated soil layer is found above a water table and is separated from it by an unsaturated zone (Freeze and Cherry, 1979). This can occur where a relatively impermeable clay or organic soil layer is present near the ground level and restricts the downward movement of water. Perched water tables come in various sizes and can influence surface water levels over large areas or have only local, temporary effects (Duever, 1988). A common misconception is that wetlands can only occur on sites containing a perched water table.

Climate

In addition to hydrology and fire, climate also plays an important role in controlling plant community succession. The areal extent, species composition, and existence of wetlands are all affected by long-term climatic changes. In addition to normal cyclic drought and flood conditions, long-term cycles have the ability to produce gradual, and nevertheless, major shifts in the normal year-to-year range of hydrologic conditions. As climatic cycles become wetter, wetlands will tend to cover larger areas of the landscape. Wetland communities would also tend to become more diverse as a result of the presence of greater ranges of hydroperiods on different topographic sites. A wetter climate might also increase the rate of peat accretion in wetlands, thus encouraging the development of edaphic plant communities. Long-term drier conditions might produce the opposite effects. A wetter or dryer climate might also affect the frequency of fire, shifting plant community succession. A major difficulty in managing wetlands is our inability to distinguish between shifts in hydrologic conditions that result from man’s activities and those that result from occasional natural events or long-term shifts in climate (Duever, 1984).

Succession

Over drainage of wetlands and reduction of hydroperiod length influences the direction of plant community succession within a wetland. McPhearson (1973) reported that “differences of only a few inches in depth or changes in period of inundation will determine, in time, what plant communities are present [in the Everglades].” Numerous investigators have documented changes in the species composition of South Florida plant communities resulting from altered water level conditions (Davis, 1943; Loveless, 1959; Kolipinski and Higer, 1969; Dineen, 1972, 1974; Alexander and Crook, 1973, 1988; Schortemeyer, 1980; Worth, 1983). The successional relationships of South Florida wetland and upland plant communities have been discussed by Alexander and Crook (1973), Craighead (1971), Davis, (1943), Wharton et al. (1977), and Duever, et al. (1986). This successional relationship is presented in **Figure E-2**. These data are useful for making a general assessment of the direction that succession may take as a result of increasing or decreasing hydroperiod in a Florida wetland.

THREATENED, ENDANGERED, AND SPECIES OF SPECIAL CONCERN

Loss of habitat and habitat fragmentation are the major causes of the decline in a number of listed rare, threatened, or endangered (RTE) wildlife species in South Florida. Reduction in population is due largely to conversion of natural habitats to agricultural and urban uses. Some species, such as the Florida panther and black bear, require large expanses of land to successfully survive as a breeding population. Other species are restricted to one particular type of habitat, such as the Florida scrub jay (pine/oak scrub) or red-cockaded woodpecker (mature pine flatwoods). Listed RTE species within the KB Planning Area depend on both wetland and upland communities for survival. For example, the Florida panther inhabits uplands, but it frequents wetlands. The reverse is true for other species, such as the wood stork.

Agricultural and urban development have gradually fragmented and reduced the quality and size of existing wildlife habitat. Continued fragmentation of upland and wetland ecosystems has the potential to cause problems for the survivorship of many species. **Table E-1** presents a list of the rare, threatened, and endangered species and species of special concern that are found within the KB Planning Area. The following is a summary of selected species listed in the table.

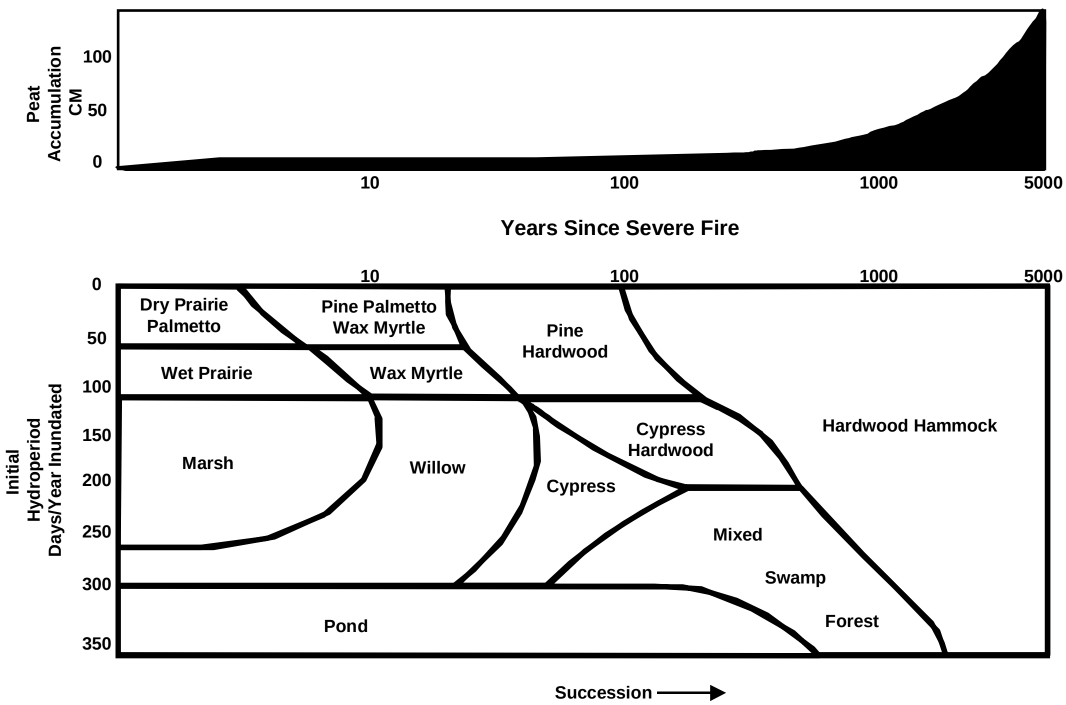


Figure E-2. Successional Patterns and Rates within South Florida Inland Plant Communities (after Duever, 1976).

Table E-1. Threatened, Endangered, and Species of Special Concern, by County.

Species	County	Species Designation by Agency		
		FWC	FDA	USFWS
Mammals Florida Black Bear *Ursus americanus floridanus*	G, H, Or, Os, P	T		C2
Florida Mouse *Podomys floridanus*	H, Or, Os, P	SSC		C2
Florida Panther *Felis concolor coryi*	G, H	E		E
Round-tailed Muskrat *Neofiber alleni*	G, H, Ok, Or, Os, P			C2
Sherman's Fox Squirrel *Sciurus niger shermani*	G, H, Ok, Or, Os, P	SSC		C2
Southeastern Big Eared Bat *Plecotus rafinesquii*	H, Ok, Or, Os, P			C2
West Indian Manatee *Trichechus manatus*	G, Ok	E		E
Birds Bachman's Sparrow *Aimophila aestivalis*	G, H, Ok, Or, Os, P			C2
Bald Eagle *Haliaeets leucocephalus*	G, H, Ok, Or, Os, P	T		E
Black Rail *Laterallus jamaicensis*	Ok, Os, Or			C2
Crested Caracara *Polyborus plancus audubonii*	G, H, Ok, Os, P	T		T
Florida Grasshopper Sparrow *Ammodromus savannarum floridanus*	G, H, Ok, Os, P	E		E
Florida Sandhill Crane *Grus canadensis pratensis*	G, H, Ok, Or, Os, P	T		
Florida Scrub Jay *Aphelocoma coerolescens coerulescens*	G, H, Ok, Or, Os, P	T		T
Least Tern *Sterna antillarum*	H, Ok, Or	T		
Limpkin *Aramus guarauna*	G, H, Ok, Or, Os, P	SSC		
Little Blue Heron *Egretta caerulea*	G, H, Ok, Or, Os, P	SSC		
Peregrine Falcon *Falco peregrinus*	G, H, Ok, Or, Os, P	E		T
Red Cockaded Woodpecker *Picoides borealis*	G, H, Or, Os, P	T		E
Snail Kite *Rostrhamus sociabilis plumbeus*	G	E		E
Snowy Egret *Egretta thula*	G, H, Ok, Or, Os, P	SSC		

Table E-1. (Continued) Threatened, Endangered, and Species of Special Concern, by County.

Species	County	Species Designation by Agency		
		FWC	FDA	USFWS
Southeastern American Kestrel *Falco sparverius paulus*	G, H, Ok, O, Os, P	T		C2
Tricolor Heron *Egretta tricolor*	G, H, Ok, Or, Os, P	SSC		
Wood Stork *Mycteria americana*	G, H, Ok, Or, Os, P	E		E
Reptiles American Alligator *Alligator mississippiensis*	G, H, Ok, Or, Os, P	SSC		T(S/A)
Blue-tailed Mole Skink *Eumeces egregius lividus*	H, P	T		T
Eastern Indigo Snake *Drymarchon corais couperi*	G, H, Ok, Or, Os, P	T		T
Florida Pine Snake *Pituophis melandeucus mugitus*	H, Or, P	SSC		C2
Florida Scrub Lizard *Scelaporus woodi*	H, Or, Os, P			C2
Gopher Tortoise *Gopherus polyphemus*	G, H, Ok, Or, Os, P	SSC		C2
Sand Skink *Neoseps reynoldsi*	H, Or, Os, P	T		T
Short Tailed Snake *Stilosoma extenuatum*	H, Or, P	T		C2
Suwannee Cooter *Pseudemys concinna suwanniensis*	P	SSC		
Amphibians Gopher Frog *Rana areolata aesopus*	H, G, Or, Os, P	SSC		C2
Fish Lake Eustis Pupfish *Cyprinodon variegatus hubbsi*	Or	SSC		
Plants Ashe's Savory *Calamintha ashei*	H, Or, P		T	C1
Auricled Spleenwort *Asplenium auritum*	H		E	
Avon Park Rabbit Bells *Crotalaria avonensis*	H		E	
Banded Wild-pine *Tillandsia flexuosa*	H		T	
Beautiful Paw Paw *Deeringothamnus pulchellus*	Or		E	E
Britton's Bear Grass *Nolina brittoniana*	H, Or, Os, P		E	E
Carter's Warea *Warea carteri*	H, P		E	E

Table E-1. (Continued) Threatened, Endangered, and Species of Special Concern, by County.

Species	County	Species Designation by Agency		
		FWC	FDA	USFWS
Chaffseed *Schwalbea americana*	H		E	E
Clasping Warea *Warea amplexifolia*	Or, Os, P		E	E
Craighead's NoddinF-Caps *Triphora craigheadii*	H		T	C2
Curtiss' Milkweed *Asclepias curtissii*	H, Or, Os, P		E	
Cutthroat Grass *Panicum abscissum*	H, Os, P		T	C2
Edison's Ascyrum *Hypericum edisonianum*	H, G		T	C2
Fall Flowering Ixia *Nemastylis floridana*	Ok, Or, Os		E	C2
Florida Bear Grass *Nolina atopocarpa*	Or		E	C2
Florida Bonamia *Bonamia grandiflora*	H, Or, Os, P		E	T
Florida Gay Feather *Liatris ohlingerae*	H, P		E	E
Florida Jujube *Ziziphus celata*	H, P		E	E
Florida Lantana *Lantana depressa*	H, P			C2
Florida Spiny Pod *Matelea floridana*	Or		E	C2
Florida Willow *Salix floridana*	Or		T	C2
Gulf Spikemass *Selaginella ludoviciana*	H, D		T	
Garrett's Scrub Balm *Dicerandra christmanii*	H		E	
Hairy Jointweed *Polygonella basiramia*	H		E	E
Hand Fern *Ophioglossum palmatum*	Or, P		E	
Hartwrightia *Hartwrightia floridana*	H, P		T	C2
Highlands Scrub Hypericum *Hypericum cumulicola*	H, P		E	E
Incised Groove-Bur *Agrimonia incisa*	P			C2
Large Flowered Rosemary *Conradina grandiflora*	Or, Os		E	C2

Table E-1. (Continued) Threatened, Endangered, and Species of Special Concern, by County.

Species	County	Species Designation by Agency		
		FWC	FDA	USFWS
Lewton's Polygala *Polygala lewtonii*	H, Or, Os, P		E	E
Lowland Loosestrife *Lythrum flagellare*	G, Ok, Os			C2
Meadow Spikemoss *Selaginella apoda*	Os, P		T	
Night Scented Orchid *Epidendrum nocturnum*	Ok		T	
Nodding Pinweed *Lechea cernua*	H, Os, P		E	C2
Okeechobee Gourd *Cucurbita okeechobeensis*	G		E	E
Paper-Like Nail-Wort *Paronychia chartacca*	Or, P		E	T
Perforate Cladonia (lichen) *Cladonia perforata*	H			E
Piedmont Jointgrass *Coelorachis tuberculosa*	H, Or			C2
Piedmont Water-Milfoil *Myriophyllum laxum*	Os			C2
Pigeon Wing *Clitoria fragrans*	H		T	T
Pigmy Fringe-Tree *Chionanthus pygmaeus*	H, Os, P		E	E
Pine Pinweed *Lechea divaricata*	H		E	C2
Pinesap *Monotropa hypopithys*	Or		E	
Rain Lily *Zephyranthes simpsonii*	G, H, Ok, Os, P		E	
Sand-Dune Spurge *Chamaesyce cumulicola*	H			C2
Scrub Bluestem *Schizachyrium niveum*	H, P			C2
Scrub Buckwheat *Eriogonum longifolium var gnaphalifolium*	H, Or, Os, P		T	T
Scrub Lupine *Lupinus aridorum*	Or, P		E	E
Scrub Mint *Dicerandra frutescens*	H, P		E	E
Scrub Plum *Prunus geniculata*	P		E	E
Short-Leaved Rosemary *Conradina brevifolia*	H, P		E	

Table E-1. (Continued) Threatened, Endangered, and Species of Special Concern, by County.

Species	County	Species Designation by Agency		
		FWC	FDA	USFWS
Small's Jointweed *Polygonella myriophylla*	H, Or, Os, P		E	
Southern Maidenhair Fern *Adiantum capillus-veneris*	H		T	
Southern Red-lily *Lilium catesbaei*	H, Ok, Os, P		T	
Spoon-Leaved Sundew *Drosera intermedia*	H		T	
Star Anise *Illicium parviflorum*	Or, P		T	C2
Terrestrial Peperomia (Pepper) *Peperomia humilis*	Or		E	
Wedge-Leaved Button-Snakeroot *Eryngium cuneifolium*	H, P		E	E
Wild Coco *Pteroglossaspis ecristata*	H		T	C2
Yellow Fringeless Orchid *Platanthera integrilabia*	Or, Os		T	C2

County: G = Glades; H = Highlands; Ok = Okeechobee; Or = Orange; Os = Osceola; P = Polk.

Species Designations: E = Endangered; T = Threatened; SSC = Species of Special Concern.

C1 = A candidate for federal listing for which there is enough substantial information on biological vulnerability and threats to justify listing.

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

C1 and C2 species are not federally protected under the Endangered Species Act, but the USFWS “encourages their consideration in environmental planning” (US FR Vol. 55, No. 35, pp. 6184-6229).

Agencies: FWC = Florida Wildlife Commission - Jurisdiction over Florida’s animals (vertebrates and invertebrates); FDA = Florida Department of Agriculture and Consumer Services - Jurisdiction over Florida’s plants; USFWS = United States Fish and Wildlife Service - Jurisdiction over nation’s plants and animals.

Source: The Nature Conservancy, 1990 and Florida Game and Fresh Water Fish Commission, 1994.

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Appendix F
METHODOLOGY FOR DEMAND ESTIMATES AND PROJECTIONS

CATEGORIES OF WATER USE

An important aspect in the development of water supply plans is the development of reliable water use estimates and projections. In the Kissimmee Basin (KB) Planning Area, demand assessments were made for 1995 and 2020 for the following water use categories:

- Public Water Supply
- Domestic Self-Supply
- Recreational Self-Supply
- Thermoelectric Power Generation Self-Supply
- Agricultural Self-Supply

The following discussion provides the details on how the District approached the development of projections for each of these water use categories. The first four categories are urban water uses and are discussed in the Urban Demand section of this appendix. The Agricultural Demand section contains the discussion of the agricultural self-supply water use category.

Water demand projections for the year 2020 included analyses under both 1-in-2 (average) rainfall conditions and 1-in-10 drought year conditions. Rainfall analysis is presented in Appendix B. Projections are based on current trends and circumstances and therefore imply an extension of current production, market, and legal circumstances.

The KB Planning Area contains part of six counties: Okeechobee, Orange, Osceola, Polk, Highlands, and Glades. The portions of these counties within the KB Planning Area will be referred to as county areas. Much of the data used to estimate water demands is available only at the county level. This data was adjusted so that the demands reported within this document are for the KB Planning Area only.

URBAN DEMAND

Public Water Supply and Domestic Self-Supplied

Public water supply (PWS) and domestic self-supply (DSS) demand assessments and projections have been developed for the District for 1995 and 2020. The DSS category includes small public supply systems with projected demands of less than 100,000 GPD as well as residents that supply their own water needs. Self-supplied residents may be either within utility boundaries or outside of utility boundaries (rural self-supplied).

The utility service areas used in this analysis were retrieved from the individual service utilities and interpolated into the District Geographic Information Systems (GIS) database. These service areas are shown in **Figures 12** through **14** in Chapter 9 of the Support Document. Adjustments were made to account for the future expansion of the current service areas. It was assumed that all new population growth within utility service area will be connected to a public water supply (PWS) system. Current domestic self-supplied (DSS) demand within a utility service areas was assumed to remain constant.

Population Estimates

1995 Estimates

U.S. Census data for 1995 were used as the basis for the 1995 permanent population and the distribution of that population. Block group level information from the 1995 estimated census count was used as the basic unit of analysis. Total population, total housing units, occupied housing units, and persons per occupied housing unit were retrieved from census data. The total units connected to a PWS system and total units self-supplied were obtained from the census data (U.S. Bureau of the Census, 1995).

Estimates of occupied units connected to PWS systems and occupied units that are self-supplied were calculated for each block group. It was assumed that the percentages of units occupied and the number of occupants per unit were the same for both PWS connected and DSS units. PWS and DSS block group populations were calculated by multiplying the number of occupied units by the number of persons per occupied unit for the respective block group (**Equation F-1**).

Block group population = Occupied units x *Persons per occupied unit* *(F-1)*

The geographic areas represented by the census block groups and the utility service areas were input as polygon coverages into the District's Geographic Information System (GIS). Population density for those areas served by a PWS and those self-supplied were calculated for each block group generally assuming a uniform density within each. Satellite imagery was used to review decisions if necessary. The two coverages, census block group populations and utility service areas, were overlaid to create a polygon coverage with the attribute data from both coverages. PWS and DSS population assessments were then calculated for the new polygon coverage by multiplying the polygon area by the population density (**Equation F-2**). The permanent populations for each area were then totaled.

Permanent population for area = Polygon area x *Population density* *(F-2)*

Any growth in population within a utility service area was assigned to that utility and the DSS population was assumed to remain the same. Any growth in population within an area not being served by a utility was assigned to the rural self-supplied category. The method assumes a uniform density in the polygons. In certain area where urban densities are adjacent to very low intensity development or undeveloped areas and where the block group is split by a service area boundary, it is possible to underestimate the population in the developed area and to overestimate the population in the less developed area. For purposes of this analysis, no adjustments were made to redistribute populations in urbanized Orange County and in areas served by larger PWS utilities in Osceola County. However, adjustments were made for smaller PWS utilities in Osceola, Polk and Okeechobee counties. Application of the GIS was determined to be unnecessary for rural and low density areas in Glades, Highlands, Okeechobee, and Polk counties.

2020 Projections

Local comprehensive plan population data were used as the basis for population projections for 2020 (**Table F-1**). The geographic distribution of the 2020 population was determined using Traffic Analysis Zone (TAZ) population projections for the portion of the region covered by TAZs. The geographic distribution of the 2020 population for areas not covered by TAZs was determined from information in the individual county's comprehensive plans. Total population was controlled to the total from these local government comprehensive plans.

Table F-1. Population Estimates and Projections.[a]

County Area	1995 Population	2020 Population	% Change
Glades	3,289	5,640	71
Highlands	7,700	11,590	51
Okeechobee	28,737	45,244	57
Osceola	130,605	260,937	100
Orange	186,131	349,453	88
Polk	6,375	13,832	117
Total	362,837	686,696	89

a. Population numbers are from those county portions within the Kissimmee Basin Planning Area.

Source: SFWMD, Districtwide Water Supply Assessment, 1998.

The geographic areas represented by the TAZs, cities and the utility service areas were input as polygon coverages into the District's GIS. Population density was calculated for each TAZ assuming a uniform density within each zone. The coverages were joined to create a new polygon coverage with the attribute data from the original coverages. Population estimates were then recalculated for the new polygon coverage by multiplying the area of the polygon by the population density. The populations for each service area were then totaled and controlled to local comprehensive plan projections totals. Since Glades, Highlands and Okeechobee counties do not have TAZs, 2020 population distribution, where necessary, was made on the basis of the future land use maps of the counties' comprehensive plans.

Per Capita Rates

Per capita water use rates for each utility were estimated by dividing raw water pumped by the population served by public water supply utilities:

Per capita water use rates = Raw water pumped/Population served *(F-3)*

It was determined that water exchanged between utilities as a result of wholesale agreements was not a significant portion of the total water use and is therefore not factored into this estimate. Raw water withdrawal data was provided by the U.S. Geological Survey (USGS) who in turn obtained the information from the FDEP and the local utilities. Population and the number of individuals served by the utilities were determined by the above-mentioned methodology. Per capita rates were estimated for 1995 and were used for 2020 projections. For Reedy Creek PWS system, "per day visitor" rate was estimated and used for 2020 projection.

Self-supplied water use rates were assumed to be the same as the utility in that service area. The per capita rates for these areas were assumed to be the same as the PWS per capita rates for the adjoining county/city utility service area.

In estimating the per capita water rates for 1995, water used by seasonal residents was included in the use data. Irrigation demand for PWS served households using private well water for their irrigation is considered to be very small and was not estimated.

Demand

Demand was defined as population times per capita water use rate:

Demand = Population x *Per capita rate* *(F-4)*

For each service area, a PWS demand and a DSS demand were estimated for 1995. A PWS and DSS demand for each service area were also projected for 2020. For 2020, it was assumed that all population growth within each service area will be provided potable water by the PWS utility. Current self-supplied demand within the service areas was assumed to remain at its 1995 levels. In addition to the utility service areas, demand estimates for 1995 and demand projections for 2020 for self-supplied areas were made. These self-supplied areas are not currently served by a PWS utility and no utility has been identified that will serve these areas in the future.

Summary

Using the above-stated methodology, the total population estimates for the KB Planning Area for 1995 was 362,837. The projected total population for 2020 is projected to increase to 686,696. In 1995, the estimated total water demand for PWS and DSS was 71.3 and 8.26 million gallons per day (MGD), respectively. In 2020, it is projected that the PWS demand will increase to 145.3 MGD and the DSS demand will increase to 11.8 MGD.

Table F-2 shows the per capita water use rate for each service area, the population estimates, and the resulting water demand for 1995. **Table F-3** shows the per capita water use rate for each service area, the population projections, and the resulting water demand for 2020.

Table F-2. Population and Actual Water Use for 1995.

Service Areas	PWS Population	PWS Use (MGD)	GPCD	DSS Population	DSS Use	Total Service Area Population	Total Service Area Use (MGD)
Osceola County							
Florida Water Services[a]	0	0.00	101	3,189	0.37	3,189	0.37
Poinciana	9,724	1.74	178	0	0	9,724	1.74
Buenaventura Lakes	19,481	1.82	98	366	0.04	19,847	1.9
St. Cloud	20,387	2.21	93	0	0	20,387	2.21
Kissimmee	52,588	13.54	265	0	0	52,588	13.54
Rural	0	0.00	156	28,059	4.4	28,059	4.4
Orange County							
Taft	0	0.00	135	2,073	0.28	2,073	0.28
Orlando Utilities Commission	131,530	27.45	208	0	0	131,530	27.45
Orange County Utilities[b]	54,601	6.56	158	0	0	54,601	6.56
Reedy Creek[c]	0	15.21	0	0	0.00	0	15.21
Rural	0	0.00	319	4,687	1.50	4,687	1.50
Highlands County							
Rural	0	0.00	105	7,700	0.81	7,700	0.81
Glades County							
Rural	0	0.00	127	3,289	0.42	3,289	0.42
Okeechobee County							
Okeechobee Utility Authority	21,200	1.92	92	0.00	0	0	1.92
Rural	0	0.00	92	7,537	0.69	7,537	0.69
Polk County							
Oak Hill Estates	5,212	0.79	152	0	0	5,212	0.79
Rural	0	0.00	152	6,375	0.18	6,375	0.18

a. Florida Water Utilities includes seven smaller utilities in addition to Buenaventura Lakes.
b. Rural in county is a part of county service area.
c. Reedy Creek's use is based on 99,700 "Day Visitors".

Commercial and Industrial

The employment by sector was evaluated regarding the predominant types of employment found in the county, and if these employment types could be expected to

Table F-3. Population and Projected 2020 Average Water Use.

Service Areas	PWS Population	PWS Use (MGD)	GPCD	DSS Population	DSS Use	Total Service Area Population	Total Service Area Use (MGD)
Osceola County							
Florida Water Services[a]	6,500	0.64	100	0	0	6,500	0.65
Poinciana	36,718	3.27	93	889	0.08	37,607	3.42
Buenaventura Lakes	20,380	2.12	98	0	0	20,380	2.2
St. Cloud	35,788	3.06	93	0	0	35,788	3.16
Kissimmee	114,787	28.92	265	0	0	114,787	29.42
Rural	0	0.00	156	52,375	6.8	52,375	6.8
Orange County							
Taft	0	0.00	135	2,175	0.29	2,175	0.29
Orlando Utilities Commission	210,827	43.35	208	3,688	0	210,827	44.2
Orange County Utilities[b]	138,218	21.84	158	10,714	0	138,218	20.23
Reedy Creek[b]	0	34.0		0		0	34.0
Rural		0.00	319	3,920	1.25	3,920	1.25
Highlands County							
Rural	0	0.00	105	11,590	1.28	11,590	1.28
Glades County							
Rural	0	0.00	127	3,289	1.16	3,289	1.18
Okeechobee County							
Okeechobee Utility Authority	33,258	3.64	90	4,839	0	33,258	3.06
Rural	0	0.00	92	11,976	1.09	11,976	1.09
Polk County							
Oak Hill Estates	12,238	1.85	152	0	0	12,238	1.85
Rural	0	0.00	152	1,594	0.24	1,594	0.24

a. Florida Water Utilities includes seven smaller utilities in addition to Buenaventura Lakes.
b. Rural in county is a part of county service area.

grow at the same rate and in the same direction as the population. In the KB Planning Area, the majority of the employees are found in the service and retail sales sectors, indicating that water demand by these sectors will generally grow along with the population. Water used for commercial and industrial purposes supplied by utilities are included with other utility demands. Self-supplied commercial and industrial demands are shown in **Table F-4**. Industrial self-supplied water use was assumed to increase at the same rate as the county population, with 1995 used as the base year.

Table F-4. Commercial and Industrial Self-Supplied Demand (MGY).

County Area	1995	2020	% Change
Orange	799	1,263	58
Osceola	266	533	100
Polk	234	321	37
Highlands	0	0	0
Okeechobee	0	0	0
Glades	0	0	0
Total Kissimmee Basin	1,299	2,117	63

Recreation Self-Supplied

Landscape

Demand projections for this section include irrigated acreage permitted for landscaping and recreation, excluding golf courses. Landscaping water use was assumed to increase at the same rate as the county population, with 1990 used as the base year. Projections for landscaping self-supplied demand are outlined in **Table F-5**.

Table F-5. Landscape and Recreational Self-Supplied Demand (MGY).

County Area	1995	2020	% Change
Orange	3,106	4,071	11
Osceola	497	2,147	276
Polk	278	436	44
Highlands	1,268	1,918	52
Okeechobee	100	122	22
Glades	0	0	0
Total Kissimmee Basin	5,249	8,694	66

Golf Course

There are golf courses in the Orange, Osceola, Polk, and Okeechobee county areas. Highlands and Glades counties also have golf courses, but they are in other planning areas or in areas outside of the District.

Historical irrigated golf course acreage data were gathered from the Florida Golf Guide (Florida Dept. of Commerce, 1990, 1991), Golf Guide To The South (Florida Golfweek, 1989), The Golf Course (Cornish and Whitten, 1988), and personal communication with several of the golf courses listed. Golf course irrigation requirement estimates were made by time horizon and month.

Orange County

As of 1995, there were 37 golf courses with a combined irrigated acreage of 4,655 acres in Orange County. These golf courses are outlined in **Table F-6**. Of these 37 golf courses, 20 lie within the KB Planning Area and eight are supplied be with reclaimed water.

Table F-6. Golf Courses in Orange County.

Name	Year Open	Total Acres	Irrigated Acres
Bay Hill Golf Course[a]	1964	200	180
Country Club of Orlando	1921	166	120
Cypress Creek Country Club[a]	1970	120	120
Deer Run South	1972	100	80
Disney World (Magnolia)[a]	1971	180	160
Disney's Bonnet Lakes[a]	1991	160	145
Disney's Lake Buena Vista Club[a]	1972	145	145
Dubsdread	1922	100	50
Errol Country Club	1971	150	150
Fairways Country Club	1972	540	540
Golf World Driving Range and Par 3	1988	18	13
Grand Cypress Golf Course[a]	1983	1,531	477
Greens Golf, The (Cannongate)[a]	1968	60	35
Hunter's Creek Golf Course[a]	1986	150	149
Interlachen Country Club, The[a]	1985	270	110
International Golf Course[a]	1987	138	110
Isleworth Golf and Country Club[a]	1986	179	179
Lake Nona Club[a]	1986	100	100
Mariott's Orlando World Golf Course[a]	1986	193	95
McCoy Annex[a]	1981	40	30
Meadow Woods Country Club[a]	1985	105	105
Metro West[a]	1987	180	109
Naval Training Center Golf Course (Crows nest)	1962	45	35
Naval Training Center Golf Course	1990	40	30
Orange Lake Country Club[a]	1982	350	238

Table F-6. (Continued) Golf Courses in Orange County.

Name	Year Open	Total Acres	Irrigated Acres
Orange Tree Country Club[a]	1973	104	85
Orangewood East Golf Course[a]	1987	196	138
Rio Pinar Country Club	1958	150	100
Rosemont Golf and Country Club	1972	120	120
Sweetwater Country Club	1974	136	105
Ventura Country Club	1980	500	150
Wedgefield Golf and Country Club (Cape Orlando)	1965	120	100
West Orange Country Club	1967	146	100
Windermere Country Club[a]	1986	155	140
Winter Park Country Club	1916	27	27
Winter Pines Golf Course	1965	90	26
Zellwood Station and Country Club	1974	121	59
Total		7,125	4,655

a. In the Kissimmee Basin Planning Area.

Historical golf courses were ordered by year of golf course opening and irrigated acres in existence. When this had been done the model shown in **Equation F-5** was estimated:

$$CUMACRES_t = f(Pop_t, d) \qquad (F\text{-}5)$$

where:

$CUMACRES_t$ = *the cumulative irrigated golf course acreage present in year t*

Pop_t = *the permanent resident population in year t*

d = *a dichotomous variable equal to 1 from 1972 through 1974, and 0 otherwise*

Golf courses open in discrete units, so that acreage tends to increase in jumps, rather than increasing along a smooth path. Thus, the acreage present at any point in the future will be sensitive to the timing of future golf course openings, which cannot be predicted with accuracy. The projections presented here should be interpreted in the light of the absence of specific data on the timing of the opening of new golf courses. However, these projections depict the long-term trends in Orange County golf course acreage.

Equation F-5 was estimated using ordinary least squares regression analysis, resulting in **Equation F-6**, which was used to develop the primary projection for irrigated golf course acreage in Orange County. Projected self-supplied (using fresh water) golf course acreage is expected to increase from the 3,592 acres in 1995 to an estimated 3,749 acres in 2020.

$$CUMACRES_t = -2884.401 + 11.501 * Pop_t + 246.811 * d \qquad (F\text{-}6)$$

$$(33.42) \quad (2.32)$$

Goodness of fit statistics:

R^2=.9739
F= 79.21
Pr F > 0 >.999
D-W = 0.901
t-statistics in parentheses

Osceola County

In 1995 there were nine golf courses in Osceola County, all within the District. Three of these courses were supplied by reclaimed water. The remaining six courses totaled 541 irrigated acres. These are described in **Table F-7**.

Table F-7. Golf Courses in Osceola County.

Name	Year Opened	Total Acres	Irrigated Acres
Kissimmee Golf Course (Airport Inn)	1965	100	100
Buenaventura Lakes Country Club	1975	65	65
Crystal Brook Golf Course	1979	18	2
Buenaventura Lakes Country Club West	1983	130	130
Overoaks Country Club	1985	170	159
Kissimmee Bay	1990	270	85
Total		753	541

Osceola County irrigated golf course acreage has increased rapidly in recent years, increasing from 100 acres in 1965 to 753 acres in 1995. During this same period, there was also a large increase in Osceola County population. In order to project Osceola County golf course acreage, a model of the form shown in **Equation F-7** was developed.

$$LOGACRES_t = f(LOGTIME_t, LOGPOP_t) \qquad (F\text{-}7)$$

where:

$LOGACRES_t$ = *common logarithm of cumulative golf course acreage in Osceola County in year t*

$LOGTIME_t$ = *common logarithm of the variable TIME in year t, where TIME takes on a value of one in 1965 and increases by one unit each year thereafter*

$LOGPOP_t$ = *common logarithm of Osceola County population in year t. Historic data came from the Bureau of Economic and Business Research (BEBR) and the U. S. Bureau of the Census; projected population came from the BEBR. Years for which populations were not available were linearly interpolated.*

When **Equation F-7** was estimated empirically using ordinary least squares the results shown in **Equation F-8** were obtained.

$$LOGACRES_t = -1.285 + .2277 * LOGTIME_t + .7558 * LOGPOP_t \qquad (F\text{-}8)$$

$$(3.84) \; (6.17)$$

<u>Goodness of fit statistics:</u>

$R^2 = .9880$
$F = 164.82$
$Pr\ F > 0 > .999$
$D\text{-}W = 2.676$
t-statistics in parentheses

In order to calibrate the projections to 1990 acreage, the residual between predicted and actual acreage for 1990 (17 acres) was subtracted from the projections for 1991 and thereafter. When Osceola County irrigated golf course acreage was projected using **Equation F-8**, adjusted as described. The results of this analysis show that 2,704 acres are projected for the year 2020.

Polk County Area

There are currently three golf courses within the District in eastern Polk County totalling about 215 irrigated acres. These are described in **Table F-8**.

No meaningful trend can be developed due to the small number of golf courses in the Polk County Area. District staff have been notified that one course is planned by a community over the next 20 years. This will bring the total irrigated acreage to an estimated 365 acres for the year 2020.

Table F-8. Golf Courses in the Polk County Area.

Name	Year Open	Total Acres	Irrigated Acres
Grenelefe Golf and RC	1972	184	15
Poinciana Golf and RC	unknown	200	120
Sun Air Country Club	1976	80	80
Total		464	215

Okeechobee County Area

There are currently two golf courses in Okeechobee County, both of which are within the District. These are described in **Table F-9**.

Table F-9. Golf Courses in Okeechobee County.

Name	Year Open	Total Acres	Irrigated Acres
Okeechobee Golf and Country Club	1966	69	31
Okeechobee KOA (Crystal Lakes)	1968	57	57
Total		126	88

No meaningful trend can be developed due to the small number of golf courses in Okeechobee County. Therefore, irrigated golf course acreage was projected to remain constant through the year 2020.

AGRICULTURAL DEMAND

There are no whole counties contained entirely within the KB Planning Area. Orange, Osceola, Polk, Glades, Highlands, and Okeechobee counties are divided between the SFWMD and other water management districts and other planning areas of the SFWMD. Crop acreage projections were needed specifically for those county portions which fall in the KB Planning Area. To do this often necessitated projecting crop acreages for the entire county and then apportioning these projections between water management districts and planning areas within the SFWMD. This was done by assuming changes in crop acreage were proportional to the most recently reported acreage ratios. Acreage ratios were developed with the use of District land use maps and with the cooperation of the local IFAS extension offices.

The techniques chosen to project crop acreages were those judged to best reflect the specific crop scenario in each county. This led to some variation in projection techniques between crop types, and in method between counties. While it would have been ideal if a comprehensive functional form could have been found which produced tangible projections universally, no such functional form was found. The acreage projections developed here reflect a combination of methods, each of which deemed appropriate where used.

In some cases, a single mathematical model could be chosen as it accurately explained past trends, and was judged as clearly the most reasonable scenario for the future. In other cases, several models accurately explained past trends, and none of these provided explicitly more likely projections than the others. In these cases, the projections of several statistically valid and empirically sound models were averaged. This approach was justified by research performed at the Bureau of Economic and Business Research (Mahmoud, 1984) which showed that taking the average of a number of different projections reduces the chances of making large errors and leads to more reliable projections.

When no statistically valid trend was found, or any convincing empirical knowledge of future changes in a crop's acreage, then the specific crop's acreage was projected at its most recently reported value (+/- 15 percent) for future time horizons. Usually these situations arose from relatively insignificant.

Agricultural irrigation and cattle watering demand estimates were made by time horizon and month. Average and 1-in-10 irrigation requirements were calculated by month using the District's modified Blaney-Criddle permitting model. Historical weather data from the rainfall station most frequently used by the District to permit each crop/county combination were used to calculate irrigation requirements.

A crop's supplemental water requirement is the amount of water used for evapotranspiration minus effective rainfall, while irrigation requirement includes both the supplemental water requirement and the losses incurred in getting irrigation to the crop's root zone. Irrigation efficiency refers to the average percent of total water applied that is stored in the plant's root zone. This relationship is expressed as follows:

Irrigation requirement = Supplemental water requirement / Irrigation efficiency *(F-9)*

Projections of irrigation system type, and the effect of the corresponding irrigation efficiencies, were based on the interpretation of current ratios and trends. There are three basic types of irrigation systems currently used in crop production. These are seepage (50 percent), overhead sprinkler (75 percent), and micro irrigation (85 percent) systems. The irrigation efficiencies estimated by the District are shown in parentheses.

Soil type, with regard to water use permitting by the District, refers to the soil's usable soil water capacity. Usable soil water capacity has a direct affect on effective rainfall. For each crop type assumptions for soil type were made for present and future acreage based on the most commonly District permitted crop/soil type combination in the county. The District classifies five types of soil with regard to usable soil water capacity in inches, i.e., 0.2, 0.4, 0.8, 1.5, and 3.6. The percentage of each soil type in each county area is indicated in **Table F-10**. The locations of these soils in the KB Planning Area are shown in **Figures F-1a** and **F-1b**.

Table F-10. Soil Types in the Kissimmee Basin Planning Area.

Soil Type (in.)	Percentage of Total for Each County Area					
	Orange	Osceola	Okeechobee	Polk	Highlands	Glades
0.2	51	19	0	1	0	0
0.4	30	0	0	8	6	2
0.8	7	49	77	73	70	91
1.5	10	32	19	18	11	6
3.6	2	0	4	0	13	1
Total[a]	100	100	100	100	100	100

a. Percent of total county area within the Kissimmee Basin Planning Area.

Crop Types

The irrigated commercially grown crops in the KB Planning Area are citrus, vegetables, sod, blueberries, caladiums, and ornamental nursery. Improved pasture is rarely irrigated, but there are some demands for cattle watering.

Citrus

All categories of citrus (oranges, grapefruit, tangerines, etc.) were grouped together for projection purposes. Historical citrus acreage data were gathered from volumes of the Commercial Citrus Inventory (Florida Agricultural Statistics Service, Various Issues), which is published biennially.

In counties with declining citrus acreage a curvilinear model of the form shown in **Equation F-10** was used to project citrus acreage. The precise functional form varies from county to county, but in general a logarithmic or semi-logarithmic functional form was used. A dichotomous variable is included to reflect the importance of unique events, particularly freezes, in determining the pattern of decline. The importance of these unique events must be kept in mind in interpreting acreage projections, since future freezes or other dramatic events are not incorporated in the models.

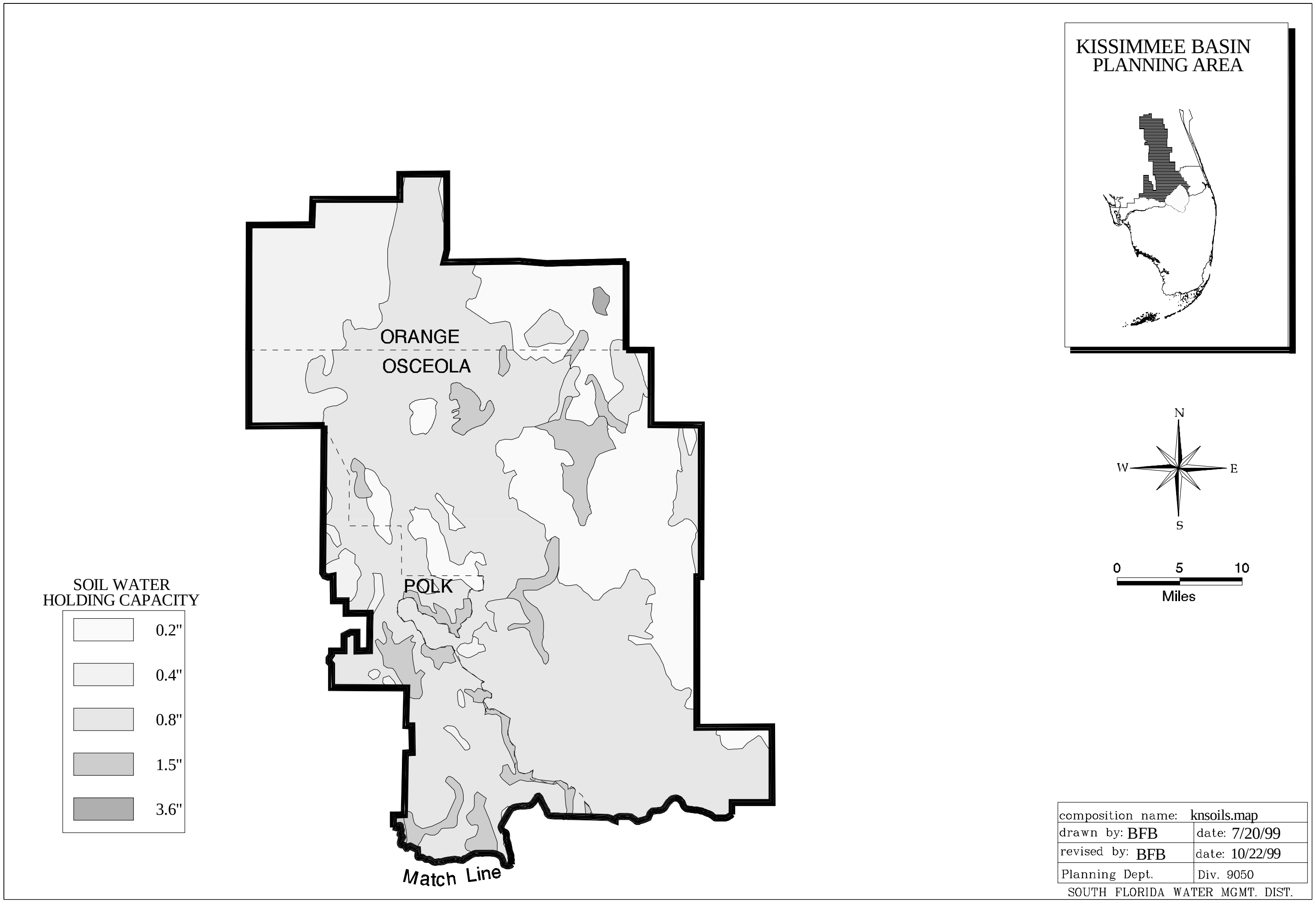

Figure F-1a. Location of Soil Types in the North Kissimmee Planning Area.

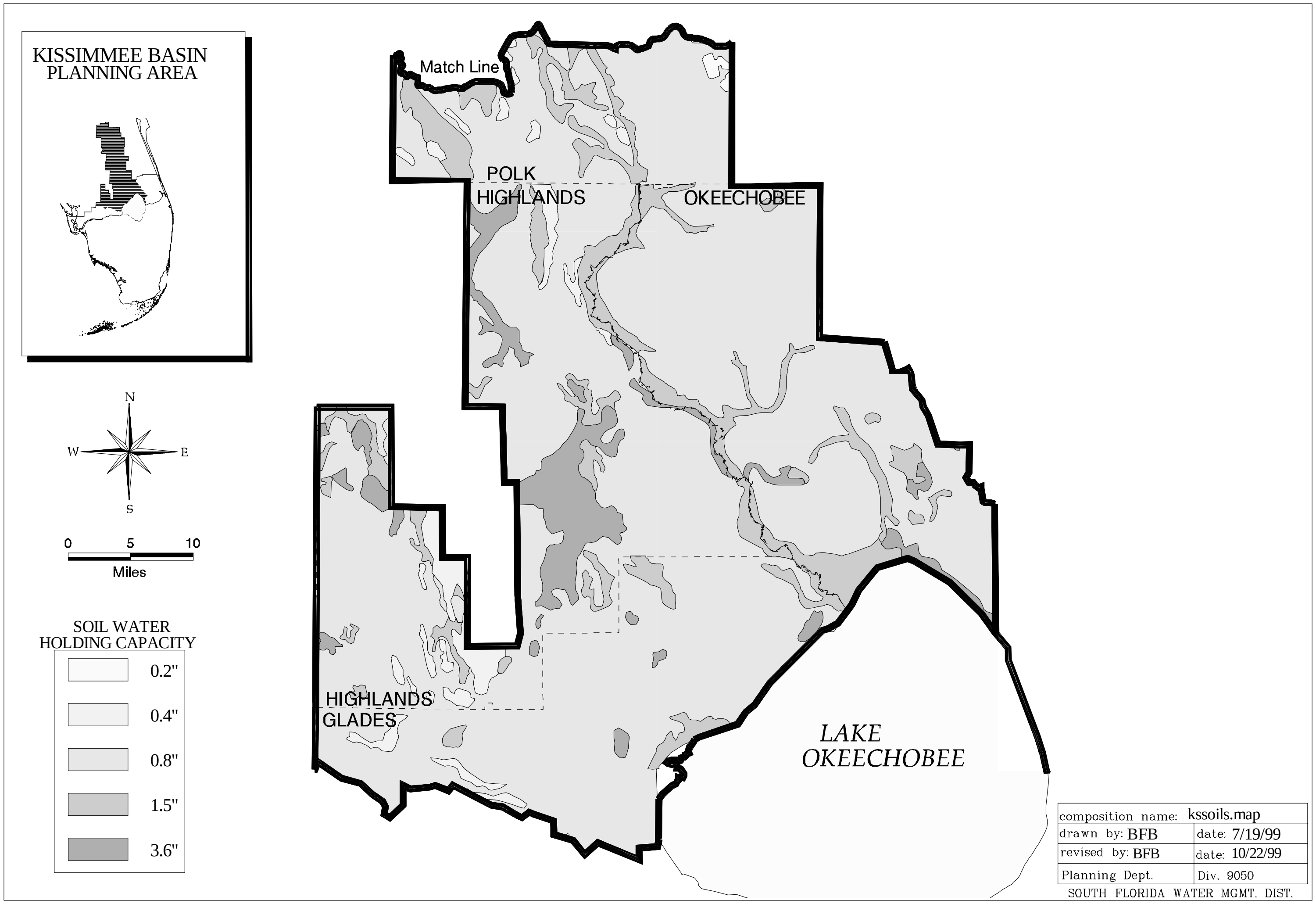

Figure F-1b. Location of Soil Types in the South Kissimmee Planning Area.

$$LOGA_t = f(time, d) \tag{F-10}$$

where:

$LOGA_t$ = *the common logarithm of citrus acreage in year t*

time = *One in 1966 and increases one unit each year thereafter*

d = *a dichotomous variable*

In counties where citrus acreage is increasing, models of the general form of **Equation F-11** were used for projection purposes.

$$A_t = f(P_p, P_w, P_o, t, d) \tag{F-11}$$

where:

A_t = *County citrus acreage in year t*

P_p = *the real price of pink grapefruit (by region) in year t*

P_w = *the real price of white grapefruit (by region) in year t*

P_o = *the real price of round oranges (by region) in year t*

t = *time trend variable, one in 1966 and increasing by one unit per year*

d = *a dichotomous variable*

The dichotomous (d) variable was designed to capture the interregional shift in citrus production as a result of severe winters in the citrus producing areas of Central Florida. Models were run which weighted all observations equally, and also with the weight declining geometrically with time - with the lowest weight being assigned to the earliest observation (denoted as $WCIT_t$). Eight specific sub-models were estimated as shown in **Equations F-12** through **F-19**.

$$CIT_t = f(time, RP_o, RP_p, RP_w, d) \quad (F\text{-}12)$$

$$WCIT_t = f(time, RP_o, RP_p, RP_w, d) \quad (F\text{-}13)$$

$$CIT_t = f(time, d) \quad (F\text{-}14)$$

$$WCIT_t = f(time, d) \quad (F\text{-}15)$$

$$CIT_t = f(time, RP_o, RP_p, RP_w) \quad (F\text{-}16)$$

$$WCIT_t = f(time, RP_o, RP_p, RP_w)(\quad (F\text{-}17)$$

$$CIT_t = f(time) \quad (F\text{-}18)$$

$$WCIT_t = f(time) \quad (F\text{-}19)$$

Note that for the initial sets of projections, there were no attempts made to project changes in the exogenous variables (other than time) the major difference in forecasts results from differences in the estimates of the coefficient on the time variable.

Orange County Area

Citrus acreage in Orange County has been severely reduced by freezes and a general model of the form shown in **Equation F-10** was utilized for projection purposes. Models were estimated using both ordinary least squares and robust regression. The two models estimated for Orange County are given in **Equation F-20** (ordinary least squares) and **Equation F-21** (robust regression).

$$LOGORA_t = 4.883 -.0138 * time -.4594 * d \quad (F\text{-}20)$$

$$(-3.41) \qquad (-6.42)$$

Goodness of fit statistics

$R^2 = .9659$
$F = 169.73$
$Pr\ F > 0 > .999$
$D\text{-}W = 1.860$
t-statistics in parentheses

where:

$LOGORA_t$ = *the common logarithm of Orange County citrus acreage in year t*

time = *One in 1966 and increases one unit each year thereafter*

d = *a dichotomous variable equal to zero in 1984 and before and one in years after 1984*

$$LOGORA_t = 4.8646 - .0115 * time - .4838 * d \qquad \text{(F-21)}$$

$$(-7.09) \qquad (-14.96)$$

Goodness of fit statistics

$R^2 = .9910$
$F = 604.72$
$Pr\ F > 0 > .999$
$D\text{-}W = 1.819$
t-statistics in parentheses

Table F-11. Historical Citrus Acreage in Orange County.

Year	Historical
1966	65,817
1968	68,005
1970	65,961
1972	60,567
1974	56,320
1976	54,007
1978	51,174
1980	50,673
1982	48,547
1985[a]	16,670
1986	14,692
1988	17,356
1990	8,399
1991[b]	8,098
1992	9,470
1994	10,402
1995	10,072

a. Because of severe freezes, no 1984 acreage data for Orange County was reported by the Florida Agricultural Statistics Service.
b. Special survey for 1991.

Osceola County Area

As in other counties with declining citrus acreage a curvilinear model of the form shown in **Equation F-10** was used to project citrus acreage. The two models estimated for Osceola County are given in **Equation F-22** (ordinary least squares) and **Equation F-23** (robust regression).

$$LOGOSC_t = 4.300 -.0790 * logtime - .0661 * d \qquad (F\text{-}22)$$

$$(-5.39) \qquad (-5.21)$$

Goodness of fit statistics

$R^2 = .8682$
$F = 39.52$
$Pr\ F>0 = .999$
$D\text{-}W = 2.029$
t-statistics in parentheses

where:

$LOGOSC_t$ = *the common logarithm of Osceola County citrus acreage in year t*

logtime = *the common logarithm of the variable time, where time takes on a value of 1 in 1966 and increases one unit each year thereafter*

d = *a dichotomous variable equal to 1 in 1986 and 1988 and 0 in other years*

$$LOGOSC_t = 4.3002 -.0707 * logtime - .0729 * d \qquad (F\text{-}23)$$

$$(-9.09) \qquad (-3.59)$$

Goodness of fit statistics

$R^2 = .9019$
$F = 50.57$
$Pr\ F > 0 > .999$
$D\text{-}W = 1.916$
t-statistics in parentheses

To generate estimates of citrus acreage in the Osceola County Area, it was assumed that changes is acreage will be proportional to the 1990 acreages within the two districts. The 1990 IFAS estimate is that 7.5 percent of the citrus acreage in Osceola County is within the SJRWMD portion of the county, and the rest in the SFWMD. This ratio was used to project future citrus acreage for the Osceola County Area within the

District, which is shown in Table F-12. Citrus acreage is forecast to decline by an estimated 431 acres from 1995 to 2020.

The acreage ratio of the three different types of irrigation systems currently in use for citrus was assessed from District water use permits.

Polk County Area

In Polk County, as in other counties with declining citrus acreage a curvilinear model of the form in **Equation F-10** was used to project citrus acreage. Models were estimated using both ordinary least squares, shown in **Equation F-24**, and robust regression shown in **Equation F-25**.

$$LOGPOLK_t = 5.192 - .0525 * time - .1322 * d \qquad (F\text{-}24)$$

$$(-2.54) \qquad (-7.94)$$

Goodness of fit statistics

$R^2 = .9257$
$F = 80.94$
$Pr\ F > 0 > .999$
$D\text{-}W = 1.829$
t-statistics in parentheses

where:

$LOGPOLK_t$ = *the common logarithm of Polk County citrus acreage in year t*

time = *one in 1966 and increases one unit each year thereafter*

d = *a dichotomous variable equal to zero in 1985 and before and one in years after 1985*

$$LOGPOLK_t = 5.196 -.0564 * time - .1356 * d \qquad (F\text{-}25)$$

$$(-4.41) \qquad (-12.11)$$

Goodness of fit statistics

$R^2 = .9598$
$F = 155.38$
$Pr\ F > 0 > .999$
$D\text{-}W = 1.739$
t-statistics in parentheses

Table F-12 shows the historical citrus acreage in Polk County as a whole. To generate estimates of citrus acreage in the Polk County Area it was assumed that changes is crop acreage will be proportional to the current acreages within the two districts. Very little of the citrus acreage in Polk County is within the SFWMD. Appraisals from SWFWMD are that only 2.5 percent Polk County's citrus is within the District's boundaries. This percentage was used to project future citrus acreage for the Polk County Area. The estimated citrus acreage in the Polk County Area is shown in **Table F-13**. Citrus acres are expected to decline by approximately 440 over the next 20 years.

Table F-12. Historical Citrus Acreage in Polk County.

Year	Historical
1966	149,287
1968	150,244
1970	150,122
1972	144,153
1974	141,475
1976	137,693
1978	134,261
1980	132,124
1982	133,545
1984	129,912
1986	93,014
1988	108,546
1990	99,732
1991	86,882
1992	91,889
1994	104,007
1995	103,836

Table F-13. Historical Citrus Acreage in the Polk County Area.

	1985	1990	1995
Polk County Area	2,787	2,493	2,596

Highlands County Area

Citrus acreage is increasing in Highlands County. **Equations F-12** through **F-19**, estimated for Highlands County citrus acreage are presented in **Equations F-26** through **F-31**.

$$A_{ct} = 21534.61 + 866.9568 * t - 458.0132 * RP_o + 389.7242 * RP_p + 1744.513 * RP_w + 18551.82 * \quad (F\text{-}26)$$

$$(3.18) \quad (-0.33) \quad (0.22) \quad (1.32) \quad (3.63)$$

Goodness of fit statistics

$R^2 = .8876$
$F = 14.22$
$Pr\ F > 0 > .999$
$D\text{-}W = 2.08$

$$WAct = -10235.54 + 2005.71 * t - 494.9358 * RPo - 418.8051 * RPp + 1693.219 * RPw + 19378.5 * d \quad (F\text{-}27)$$

$$(7.98) \quad (-0.39) \quad (-0.26) \quad (1.39) \quad (4.11)$$

Goodness of fit statistics
$R^2 = .9733$
$F = 65.72$
$Pr\ F > 0 > .999$
$D\text{-}W = 2.16$

$$A_{ct} = 33502.46 + 598.3515 * t + 17870.26 * d \quad (F\text{-}28)$$

$$(3.56) \quad (4.18)$$

Goodness of fit statistics

$R^2 = .8593$
$F = 36.64$
$Pr\ F > 0 = .999$
$D\text{-}W = 1.63$

$$WA_{ct} = -3853.116 + 1806.578 * t + 19249.52 * d \qquad \text{(F-29)}$$

(11.58) (4.85)

Goodness of fit statistics

$R^2 = .9663$
$F = 172.04$
$Pr\ F > 0 > .999$
$D\text{-}W = 2.00$

$$Act = 28306.57 + 1196.031 * t - 2660.984 * RPo + 217.4507 * RPp + 2510.438 * RPw \qquad \text{(F-30)}$$

(3.12) (-1.46) (0.08) (1.29)

Goodness of fit statistics

$R^2 = .7224$
$F = 6.50$
$Pr\ F > 0 = .993$
$D\text{-}W = 0.80$

$$WAct = -3161.817 + 2349.448 * t - 2796.072 * RPo - 598.7551 * RPp + 2496.273 * RPw \qquad \text{(F-31)}$$

(6.15) (-1.54) (-0.23) (H-26) (1.28)

Goodness of fit statistics

$R^2 = .9231$
$F = 30.04$
$Pr\ F > 0 > .999$
$D\text{-}W = 0.74$

$$A_{ct} = 29662.48 + 1013.177 * t \qquad \text{(F-32)}$$

(4.95)

Goodness of fit statistics

$R^2 = .6540$
$F = 24.57$
$Pr\ F > 0 > .999$
$D\text{-}W = 0.33$

$$WA_{ct} = -\ 7989.471 + 2253.44 * t \qquad (F\text{-}33)$$

$$(10.81)$$

<u>Goodness of fit statistics</u>

$R^2 = .9000$
$F = 117.06$
$Pr\ F > 0 > .999$
$D\text{-}W = 0.3569$

Table F-14 shows the historical citrus acreage in Highlands County as a whole. To generate estimates of citrus acreage in the Highlands County Area it was assumed that changes is crop acreage will be proportion to the most recently reported ratio of acreage within the two districts.

Table F-14. Historical Citrus Acreage in the Highlands County Area.

Year	Historical
1966	37,409
1968	39,110
1970	38,803
1972	37,765
1974	37,996
1976	37,375
1978	37,105
1980	37,767
1982	37,661
1984	44,030
1986	46,012
1988	48,569
1990	57,048
1992	62,217
1994	74,035
1995	76,138

In 1987, there were 30,800 acres of citrus in the SWFWMD portion of Highlands County (Reynolds et. al., 1990). This figure is 65 percent of the total acreage of citrus in Highlands County in 1987, and infers that the remaining 35 percent was in the District in 1987.

This ratio was used to project future citrus acreage for the Highlands County Area within the District. The estimated citrus acreages in the Highlands County Area are shown in **Table F-14**.

Citrus Nursery

The Highlands County Area is the only county area with significant citrus nursery acreage. Ordinary least squares regression analysis was used to project citrus nursery acreage in Highlands County as a function of Highlands County citrus acreage and a time trend variable. The model estimate took the general form of **Equation F-34**.

$$A_t = f\,(Y, d) \qquad \text{(F-34)}$$

where:

A_t = *citrus nursery acreage in Highlands County in year t*

Y = *numeric value of the year under consideration (for example Y = 1975 in 1975)*

d = *a dichotomous variable equal to one from 1974 to 1978 inclusive and zero otherwise*

The functional form represented in **Equation F-34** was estimated using ordinary least squares regression analysis, resulting in **Equation F-35**.

$$A_t = -\,21458.3 + 10.92 * Y - 37.77 * d \qquad \text{(F-35)}$$

$$(8.19) \qquad (-2.03)$$

<u>Goodness of fit statistics</u>

$R^2 = .8801$
$F = 69.76$
$Pr\ F > 0 > .999$
t-statistics in parentheses
$D\text{-}W = 1.93$

Equation F-35, adjusted for the actual 1994 acreage, was used to make the primary citrus nursery acreage projections by applying the primary citrus acreage projections derived above.

To generate estimates of citrus nursery acreage in the Highlands County Area, it was assumed that changes in crop acreage will be proportional to the most recently reported acreage ratio between the two districts. The local IFAS extension office estimates that approximately 10 percent of the citrus nurseries in Highlands County are in the SFWMD and this estimate was used to make projections for the Highlands County Area.

The estimated citrus nursery acreages in Highlands County and the Highlands County Area for the six time horizons are shown in **Table F-15**.

Table F-15. Historical Citrus Nursery Acreage in the Highlands County Area.

Year	Historical
1972	84
1973	88
1974	100
1975	72
1976	66
1977	55
1979	83
1980	108
1981	172
1982	183
1983	144
1984	224
1985	198
1986	249
1987	288
1988	268
1989	207
1990	314
1991	305
1992	324
1993	284
1994	276
1995	287

Okeechobee County Area

Citrus acreage is increasing in Okeechobee County. When **Equations F-12** through **F-19** were estimated using ordinary least squares regression the results shown in **Equations F-36** through **F-43** were obtained.

$$OKEECIT_t = 3629.19 + 164.3937 * time - 54.4395 * RP_p + 69.9666 * RP_w \quad (F\text{-}36)$$
$$- 224.6156 * RP_o + 2382.359 * d($$

(2.38) (-0.19) (0.32) (-1.10) (2.72)

where:

D = a dichotomous variable equal to zero in 1980 and before and one after 1980.

<u>Goodness of fit statistics</u>

R^2 = .9526
F = 36.14
Pr F>0>.999
D-W = 1.22
t-statistics in parentheses

$$WTOKEEt = - 468.8769 + 307.2401 * time - 44.417 * RPp + 293.675 * \quad (F\text{-}37)$$
$$RPw - 397.464 * RPo + 1578.984 * d$$

(2.89) (-0.10) (0.90) (-1.27) (1.17)

<u>Goodness of fit statistics</u>

R^2 = .9309
F = 24.26
Pr F>0>.999
D-W = 0.778
t-statistics in parentheses

$$OKEECIT_t = 2115.318 + 201.382 * time + 1941.607 * d \quad (F\text{-}38)$$

(4.70) (2.61)

<u>Goodness of fit statistics</u>

R^2 =.9473
F = 100.59
Pr F>0>.999
D-W = 0.765
t-statistics in parentheses

$$WTOKEE_t = -1481.958 + 323.8302 * time + 1110.425 * d \quad (F\text{-}39)$$

$$(4.88) \qquad (0.96)$$

Goodness of fit statistics

R^2= .9167
F= 66.04
Pr F>0>.999
D-W=0.365
t-statistics in parentheses

$$OKEECIT_t = 1014.923 + 314.3923 * time + 42.976 * RP_p + 125.953 * RP_w - 93.180 * RP_o \quad (F\text{-}40)$$

$$(5.90) \qquad (0.12) \qquad (0.46) \qquad (-0.36)$$

Goodness of fit statistics

R^2 = .9135
F = 26.41
Pr F >0 > .999
D-W = 1.162
t-statistics in parentheses

$$WTOKEE_t = -2201.565 + 406.6564 * time + 20.147 * RP_p + 330.7824 * RP_w - 310.352 * RP_o \quad (F\text{-}41)$$

$$(6.25) \qquad (0.04) \qquad (1.00) \qquad (-1.00)$$

Goodness of fit statistics

R^2 = .9203
F = 28.88
Pr F > 0 >.999
D-W = 0.820
t-statistics in parentheses

$$OKEECIT_t = 1565.196 + 298.4625 * time \qquad (F\text{-}42)$$

$$(11.57)$$

Goodness of fit statistics

R^2 = .9116
F = 134.00
Pr F>0>.999
D-W = 0.937
t-statistics in parentheses

$$WTOKEE_t = - 1796.578 + 379.351 * time \qquad (F\text{-}43)$$

$$(11.48)$$

Goodness of fit statistics

R^2 = .9102
F = 131.79
Pr F > 0 > .999
D-W = 0.412
t-statistics in parentheses

Equations F-36 through **F-43** were used to project citrus acreage in Okeechobee County. To generate estimates of citrus acreage in the Okeechobee County Area, it was assumed that changes is crop acreage will be proportion to the current acreages within the two districts.

The most recent District land use maps (1986-1988) show that approximately 90 percent of the citrus mapped in Okeechobee County was within the District, and 68 percent of this acreage in the District was within the Okeechobee County Area. These ratios were used to divide acreage projections, and the estimated citrus acreages are shown in **Table F-16**.

Table F-16. Historical Citrus Acreage in the Okeechobee County Area.

Year	Historical
1966	2,508
1968	3,329
1970	3,597
1972	3,676
1974	4,087
1976	4,162
1978	4,171
1980	4,281
1982	6,954
1984	8,044
1986	7,449
1988	8,124
1990	8,541
1992	10,439
1994	11,270
1995	11,623

Glades County Area

Citrus acreage is increasing in Glades County. **Equations F-12** through **F-19** were estimated for Glades County citrus acreage and resulted in **Equations F-44** through **F-51**.

where:

D = a dichotomous variable equal to zero before 1970 and one in the period 1970 and after.

$$GLCIT_t = -835.3118 + 400.94 * time - 412.0758 * RP_o + 254.319 * RP_w + 406.0648 * RP_p - 2388.293 * d \quad (F\text{-}44)$$

(10.55) (-2.30) (1.30) (1.61) (-3.39)

Goodness of fit statistics

$R^2 = .9643$
$F = 48.66$
$Pr\ F > 0 > .999$
t - statistics in parentheses
$D\text{-}W = 1.89$

$$WGLCITt = -464.5248 + 408.2684 * time - 547.5291 * RPo + 259.1371 * RPw + 295.6929 * RPp - 2843.594 * d \quad (F\text{-}45)$$

$$(8.64) \quad (-2.46) \quad (1.05) \quad (0.94) \quad (-3.25)$$

<u>Goodness of fit statistics</u>

$R^2 = .9523$
$F = 35.98$
$Pr\ F > 0 > .999$
$D\text{-}W = 1.73$
t - statistics in parentheses

$$GLCIT_t = 715.4822 + 360.7589 * time - 2317.46 * d \quad (F\text{-}46)$$

$$(12.59) \quad (-3.18)$$

<u>Goodness of fit statistics</u>

$R^2 = .9394$
$F = 93.08$
$Pr\ F > 0 > .999$
$D\text{-}W = 1.18$
t - statistics in parentheses

$$WGLCIT_t = -669.5979 + 384.7645 * time - 2516.91 * d \quad (F\text{-}47)$$

$$(10.76) \quad (-2.76)$$

<u>Goodness of fit statistics</u>

$R^2 = .9186$
$F = 67.74$
$Pr\ F > 0 > .999$
$D\text{-}W = 0.72$
t - statistics in parentheses

$$GLCIT_t = -3943.802 + 382.4059 * time - 361.0439 * RP_o + 419.2195 * RP_w + 457.4512 * RP_p \quad \text{(F-48)}$$

$$(7.09) \qquad (-1.41) \qquad (1.53) \qquad (-1.27)$$

<u>Goodness of fit statistics</u>

$R^2 = .9185$
$F = 23.20$
Pr F > 0 >.999
D-W = 0.80
t - statistics in parentheses

$$WGLCIT_t = -4165.612 + 386.201 * time - 486.7685 * RP_o + 451.9017 * RP_w + 356.8755 * RP_p \quad \text{(F-49)}$$

$$(5.90) \qquad (-1.57) \qquad (1.35) \qquad (0.81)$$

<u>Goodness of fit statistics</u>

$R^2 = .8963$
$F = 21.62$
Pr F > 0 > .999
D-W = 0.65
t - statistics in parentheses

$$GLCIT_t = -486.0107 + 306.9607 * time \quad \text{(F-50)}$$

$$(10.17)$$

<u>Goodness of fit statistics</u>

$R^2 = .8883$
$F = 103.46$
Pr F > 0 > .999
D-W = 0.42
t - statistics in parentheses

$$WGLCIT_t = -\ 1974.499 + 326.3361 * time \qquad (F\text{-}51)$$

$$(9.19)$$

<u>Goodness of fit statistics</u>

$R^2 = .8666$
$F = 84.47$
$Pr\ F > 0 > .999$
$D\text{-}W = 0.26$
t - statistics in parentheses

The most recent District land use maps (1986-1988) show that 31 percent of the citrus acreage in Glades County is within the KB Planning Area. This ratio was used to divide acreage projections, and the estimated citrus acreages are shown in **Table F-17**.

Table F-17. Historical Citrus Acreage in the Glades County Area.

Year	Historical
1966	1,413
1968	1,461
1970	1,572
1972	1,639
1974	1,661
1976	1,615
1978	1,613
1980	3,395
1982	4,026
1984	5,141
1986	6,076
1988	6,235
1990	7,523
1992	9,136
1994	9,270
1995	9,675

The acreage ratio of the three different types of irrigation systems in 1991 in use for citrus was assessed from District permits. Permitted citrus acreage (as of March 1991) in Glades County had irrigation systems in the ratio shown in **Table F-18**.

Table F-18. Ratio of Permitted Irrigation System Type on Citrus in Glades County.

Type of System	Percent of Permitted citrus	Estimated Efficiency
Micro irrigation	77	0.85
Overhead sprinkler	3	0.75
Seepage	20	0.50

Vegetables

Commercial vegetables are produced in the Osceola, Polk, Highlands, and Okeechobee county areas. There is a small amount of vegetable production in Glades County outside the KB Planning Area. Vegetable crops include squash, cucumbers, peppers, tomatoes, watermelons, potatoes, and latin vegetables.

Osceola County Area

Vegetable production in Osceola County is relatively small, and there is very limited data available on historical production. Empirical knowledge of agricultural production in Osceola County provided by the local IFAS extension office was considered the best source for projection purposes.

Vegetable crops grown in Osceola County are grown interchangeably, and double cropped. Although the location of specific vegetable crops varies from year to year, the total acreage of vegetables production is quite stable, and has been estimated at 1,200 acres per year by IFAS for the entire county, all of this acreage within the District. The primary projection for vegetable production in the Osceola County Area is at 1,200 acres, and the primary range from 1,020 to 1,380 acres. **Table F-19** shows the supplemental water requirements and irrigation requirements for vegetable crops using a generalized cultivation schedule which is weighted for all the relevant crops, and an irrigation efficiency of 50 percent.

Table F-19. Supplemental Water Requirements, Generalized Cultivation Schedule and Irrigation Requirements for Vegetable Crops in the Osceola County Area.

Rainfall Station = Kissimmee: Soil Type = 0.8 in: Acreage = 1,200: Efficiency = 50%.					
Month	**Average (in.)**	**2-in-10 (in.)**	**Approx. Percent in Ground**	**Average (mg)**	**2-in-10 (mg)**
January	1.11	1.27	50	36	41
February	0.92	1.11	100	60	73
March	1.58	1.80	100	103	117
April	2.40	2.60	100	156	170
May	2.78	3.08	50	90	100
June	1.82	2.34	0	0	0
July	1.98	2.53	0	0	0
August	2.10	2.59	50	68	84
September	1.66	2.11	100	108	138
October	1.92	2.19	100	125	143
November	1.72	1.87	100	112	122
December	1.21	1.36	50	39	44
Total	21.18	24.84		898	1,031

Polk County Area

Watermelons are the only vegetable crops grown commercially in the Polk County Area, and are generally grown once a year between January and May. Cultivation primarily takes place on sandy soil with a usable soil moisture capacity of 0.8 in., and uses seepage irrigation systems with an estimated irrigation efficiency of 50 percent. Production does not take place on the same land each year due to the viral infestation which occurs in fields after one season of production. The local IFAS extension office estimates that there are approximately 500 acres of land used for watermelon production each year in Polk County Area, and this is forecast to remain fairly constant through 2010.

Table F-20. Supplemental Water Requirements, Generalized Cultivation Schedule and Irrigation Requirements for Vegetable Crops in the Polk County Area.

Rainfall Station = Avon Park: Soil Type = 0.8 in: Acreage = 500: Efficiency = 50%.					
Month	**Average (in)**	**2-in-10 (in)**	**Approx. Percent in Ground**	**Average (mg)**	**2-in-10 (mg)**
January	1.39	1.53	50	19	21
February	1.17	1.34	100	32	36
March	1.96	2.14	100	53	58
April	2.47	2.67	100	67	73
May	2.69	3.00	50	37	41
Total	21.71	25.31		207	229

Highlands County Area

Watermelon is a significant vegetable crop grown commercially in Highlands County, and therefore production does not take place on the same land each year. Although the location varies from year to year, the total acreage of watermelon production is quite stable, and has been estimated at 750 acres per year by IFAS for the entire county, approximately half of which takes place within the District. The primary projection for vegetable production in the Highlands County Area is at its 1990 level of 375 acres, and the primary range from 319 to 431 acres. Watermelons in the Highlands County Area are generally grown once a year between January and May, following the schedule shown in **Table F-21**. Watermelons in the Highlands County Area are grown using seepage irrigation on sandy soil.

Table F-21. Supplemental Water Requirements, Generalized Cultivation Schedule and Irrigation Requirements for Vegetable Crops in the Highlands County Area.

Rainfall Station = Lake Placid: Soil Type = 0.8 in: Acreage = 375: Efficiency = 50%.					
Month	**Average (in)**	**2-in-10 (in)**	**Approx. Percent in Ground**	**Average (mg)**	**2-in-10 (mg)**
January	0.88	1.01	50	9	10
February	1.18	1.35	100	24	27
March	2.62	2.82	100	53	57
April	2.50	2.74	100	51	56
May	2.36	2.65	50	24	27
Total	9.54	10.57		161	178

Okeechobee County Area

Watermelons, potatoes, and a small amount of latin vegetables are the vegetable crops presently grown commercially in Okeechobee County. In 1990 there were 665 acres used for vegetable production, and this vegetable acreage is forecast to remain at that level through 2010. All of the vegetable crops grown commercially in Okeechobee County are grown within the KB Planning Area. The supplemental water requirements, generalized cultivation schedule and irrigation requirements for vegetable crops in the Okeechobee County Area are shown in **Table F-22**.

Table F-22. Supplemental Water Requirements, Generalized Cultivation Schedule and Irrigation Requirements for Vegetable Crops in the Okeechobee County Area.

Rainfall station = Okeechobee: Soil type = 0.8 in: Acreage = 665: Efficiency = 50%.					
Month	**Average (in.)**	**2-in-10 (in.)**	**Approx.% in ground**	**Average (mg)**	**2-in-10 (mg)**
January	0.95	1.07	80	27	31
February	1.13	1.27	100	41	46
March	2.05	2.27	80	59	66
April	3.28	3.52	70	83	89
May	4.17	4.51	30	45	49
June	3.34	3.93	0	0	0
July	3.97	4.53	0	0	0
August	4.03	4.54	0	0	0
September	2.62	3.16	0	0	0
October	2.43	2.78	60	53	60
November	2.22	2.33	60	48	50
December	1.35	1.45	60	29	31
Total	31.54	35.36		386	422

Sod

Sod is harvested from both irrigated and non-irrigated fields. Non-irrigated sod production usually entails the harvesting of sod from land which is normally used for pasture. This non-irrigated sod is not quantified in this report as no water is added to supplement rainfall.

Irrigation requirements are calculated for irrigated sod. Irrigated sod is produced commercially in the Osceola, Polk, Highlands, and Okeechobee county areas. Sod is also produced in Glades County outside the KB Planning Area.

Irrigated sod acreage estimates were obtained from the local IFAS extension offices in each county for 1995. No meaningful trend could be identified due to the lack of historical sod acreage data in each county area, and acreage was projected to remain relatively constant through the year 2020.

Table F-23. Irrigated Sod Production in Kissimmee Basin Planning Area.

County Area	Irrigated sod acreage	Rainfall station	Soil type (in.)	Irrigation Efficiency
Osceola	500	Kissimmee	0.8	75%
Polk	1,000	Avon Park	0.8	50%
Highlands	900	Lake Placid	3.6	50%
Okeechobee	250	Okeechobee	0.8	50%
Total	2,650			

Blueberries

The Highlands County Area is the only county region in the KB Planning Area in which blueberries are grown commercially. Blueberry production is a relatively new industry in Highlands County, and appears to be well suited to local conditions. IFAS is presently promoting blueberry production in Highlands County and there are several growers expressing active interest in producing this crop.

The local IFAS extension office estimates that there were 100 acres of blueberry production in Highlands County in 1990, all within the KB Planning Area. This number has increased to 300 acres in 1995, 200 of which are in the KB Planning Area. Blueberry acreage in Highlands County is forecast to increase by 150 acres every five years through the year 2010, two thirds of which is anticipated to be within the KB Planning Area. **Table F-24** shows the blueberry acreage for the Highlands County Area over the projection period.

Currently the District's modified Blaney-Criddle permitting model has no category for blueberries. The crop with characteristics most like blueberries for which the District does have a permitting category is citrus. Blueberries in Highlands County are grown on sandy soil with a usable soil moisture capacity of 0.8 in. and use micro irrigation systems with an estimated irrigation efficiency of 85 percent. These water requirements were applied to the blueberry acreage projections to calculate the irrigation requirements shown in **Table F-24**.

Table F-24. Projected Blueberry Acreage for the Highlands County Area.

	1985	1990	1995	2000	2005	2010
Acreage	0	100	200	300	400	500

Caladiums

The Highlands County Area is the only county region in the KB Planning Area in which caladiums are grown commercially. Highlands County produces over 90 percent of the world's caladium bulbs. The acreage used by this industry has stabilized and IFAS believes that the acreage will probably remain relatively constant through 2020. Currently there are between 1,100 and 1,200 acres of land used annually for caladium production. This acreage is not included as nursery acreage by the Division of Plant Industry (DPI). The primary projection for the six time horizons is 1,150 acres, and the primary range is from 977 to 1,322 acres. Practically all of this acreage exists within the boundaries of the District.

Currently the District's modified Blaney-Criddle permitting model has no category for caladiums, and the value for grass is used for permitting purposes. Caladiums in the Highlands County Area are currently grown on muck soil with a usable soil moisture capacity of 3.6 in. Supplemental water requirements for grass on soil with a 3.6 in. soil water holding capacity in Highlands County were applied to the caladium acreage projection of 1,150 acres to calculate the irrigation requirements shown in **Table F-25**. Caladium farms in Highlands County use sprinkler systems for irrigation with an estimated irrigation efficiency of 75 percent. Planting usually takes place in April, and about one-third of the acreage is harvested in each of the months of November, December and January. This means that in February and March, caladium fields are usually vacant.

Table F-25. Supplemental Water and Irrigation Requirements for Caladiums in the Highlands County Area.

Rainfall Station = Lake Placid: Soil type = 3.6 in: Acreage = 1,150: Efficiency = 75%.					
	Average (in.)	**2-in-10 (in.)**	**Percent in Ground**	**Average (mg)**	**2-in-10 (mg)**
January	0.58	0.76	33	8	10
February	0.55	0.79	0	0	0
March	1.83	2.11	0	0	0
April	2.70	3.06	100	112	127
May	3.72	4.18	100	155	174
June	1.44	2.35	100	60	98
July	1.94	2.83	100	81	118
August	2.36	3.15	100	98	131
September	1.29	2.05	100	54	85
October	1.99	2.40	100	83	100
November	1.72	1.90	100	72	79
December	1.08	1.22	66	30	34
Total	21.20	26.80		752	957

Ornamental Nursery

Commercial ornamental nursery plants are produced in the Orange, Osceola, Highlands, and Okeechobee county areas. There are ornamental nurseries in Polk and Glades county outside the KB Planning Area.

Currently the District's modified Blaney-Criddle permitting model has no category of ornamental nursery, and the value for grass is used for permitting purposes. The majority of ornamental nurseries in the KB Planning Area use sprinkler systems for irrigation. Normally, sprinkler irrigation systems are estimated by the District to have an irrigation efficiency of 75 percent. However, an indeterminable number of nurseries containerize their plants, and this reduces the irrigation efficiency to approximately 20 percent. To account for this range of efficiencies, an overall irrigation efficiency of 50 percent was assumed for historic acreage. Micro irrigation systems will be required on all new container nursery projects, raising the estimated efficiency of these projects to 85 percent, and the post 1993 overall average efficiency to 80 percent (SFWMD, 1993). This often means that, even with increased acreage, the overall ornamental nursery irrigation demands are reduced.

A model of the form shown in **Equation F-52** was used to estimate ornamental nursery acreage.

$$ORN_t = f(YEAR_t, D) \qquad (F\text{-}52)$$

where:

ORN_t = *Ornamental nursery acreage in a county in year t.*

$YEAR$ = *numeric value of the year under consideration (e.g., year = 1976 for 1976).*

D is a dichotomous variable equal to one in a year experiencing a major one-time increase in acreage, zero otherwise.

Equation F-52 was initially estimated for each county empirically using ordinary least squares (OLS). If the OLS method did not yield a satisfactory statistical fit and/or reasonable acreage projections then the robust regression method was used to develop county projections. If the robust regression method did not yield a satisfactory statistical fit and/or reasonable acreage projections then more complex regression methods were used to develop projections.

For Okeechobee and Osceola counties, neither ordinary least squares nor robust regression yielded models which adequately captured the highly non-linear pattern of ornamental nursery growth. For Okeechobee County, a model of the form shown in **Equation F-53** was estimated.

$$ORN_t = f(time_t, D, logtime_t) \qquad (F\text{-}53)$$

This formulation allows for a non-linear growth pattern in acreage, beyond the piecewise linear pattern implied by **Equation F-52**. For Osceola County, there has not been a distinct linear pattern to ornamental nursery acreage. Rather there was a period of irregular increase through 1989 and a pattern of irregular decline thereafter. Major freeze events are thought to play a major role in this pattern, but the issue is complicated by the uneven pattern of ornamental nursery growth and decline in Osceola County. Given this pattern, an auto regressive moving average model such as that shown in **Equation F-54** was estimated.

$$ORNt = ø1ORNt\text{-}1 + . . . + øpORNt\text{-}p + a1 - q1at\text{-}1 . . . - qqat\text{-}q. \qquad (F\text{-}54)$$

where:

ø's are auto regressive parameters

q's are the moving average parameters

a's are random error terms

In order to calibrate model projections to 1995 data, the residual between the predicted value and the observed value for 1995 was added to the projections derived from the projection equations.

Orange County Area

Ornamental nursery acreage in Orange County increased from 682 acres in 1972 to 1,319 acres in 1987. Between 1987 and 1995 this growth has leveled, with slight variations from year to year. **Equation F-52** was estimated empirically using ordinary least squares, the results shown in **Equation F-55** were obtained.

$$ORNt = 685.3262 + 35.7630 * YEARt - 143.2196 * D \qquad (F\text{-}55)$$

$$(11.03) \qquad (-3.00)$$

Goodness-of-fit statistics

$R^2 = .9165$
$F = 155.26$
$Pr\ F > 0 > .999$
$D\text{-}W = 1.394$
t - statistics in parentheses.

The local IFAS extension office estimates that about one-fourth of the ornamental nursery acreage in Orange County is within the SFWMD. This estimate was used for all time horizons to develop the demand

Osceola County Area

Between 1972 and 1989, Osceola County ornamental nursery acreage grew from approximately 30 acres to 498 acres. From 1989 to 1995, nursery acreage in Osceola County declined continuously. **Equation F-56** was estimated using the auto regressive moving average estimation technique as described in **Equation F-54**. Rather than R-squared, a different goodness of fit statistic is applicable to the ARIMA model, pseudo R-squared. Pseudo R-squared is calculated as one minus the ratio of the error sum of squares for the model under consideration to the error sum of squares for the (0,0) model, a constant predictor at the mean of the series. Neither the mean of the series nor a time-trend was fit. For this model, one auto regressive term is used (ø=1), as shown in **Equation F-56**.

$$OSCNUR_t = .9607*OSCNUR_{t-1} \qquad (F\text{-}56)$$

<u>Goodness-of-fit statistics:</u>

Pseudo R-Squared = 80.99026
Residual sum of squares = 110627.1
Root Mean Square Error = 70.91194

In order to calibrate the model projections to historic 1995 data, the residual between the predicted value and the observed value for 1995 (3 acres) was subtracted from the projections derived from equation H-51.

All the ornamental nursery acreage in Osceola County is within the SFWMD. Supplemental water requirements using rainfall and ET data at the Kissimmee rainfall station for grass on soil with a 0.8 in. soil water holding capacity were applied to the primary ornamental nursery acreage.

Highlands County Area

When **Equation F-52** was estimated empirically using ordinary least squares, the results shown in **Equation F-57** were obtained.

$$ORNt = 169.4499 + 4.1198 * YEARt + 1256.606 * D \qquad (F\text{-}57)$$

$$(1.04) \qquad (19.81)$$

<u>Goodness-of-fit statistics</u>

$R^2 = .9756$
$F = 340.21$
$Pr\ F > 0 > .999$
$D\text{-}W = 1.557$
t - statistics in parentheses.

Equation F-57 adjusted for the 1995 acreage was used to develop the projections. The local IFAS extension office estimates that about one-fifth of the ornamental nursery acreage in Highlands County is within the SFWMD.

Okeechobee County Area

When **Equation F-54** was estimated empirically using ordinary least squares, the results shown in **Equation F-58** were obtained.

$$ORN_t = 17.6485 + 19.3803 * TIME_t - 80.7765 * logTIME_t + 335.442 * D \qquad (F\text{-}58)$$

$$(2.95) \qquad (-1.70) \qquad (6.67)$$

where:

time = *one in 1968 and increases one unit per year thereafter*

Logtime = *natural log of time*

D = *one for 1992 and after*

<u>Goodness-of-fit statistics</u>

$R^2 = .9238$
$F = 76.88$
$Pr\ F > 0 > .999$
$D\text{-}W = 1.888$
t - statistics in parentheses.

Equation F-58 adjusted for the 1995 acreage was used to develop the projections. All of the ornamental nursery acreage in Okeechobee County is within the SFWMD, and the demand projections for all time.

Cattle Watering

Water required for cattle watering was calculated as a function of the number and type of cattle (beef or dairy). Demand is based on the District allocated amount of 12 gal/

cow/day for beef cattle, and 185 gal/cow/day for dairy cattle (35 gal/cow/day for drinking and 150 gal/cow/day for barn washing). Demand levels for cattle watering in the KB Planning Area are kept constant throughout the projection period.

Table F-26. Cattle Watering in the Kissimmee Basin Planning Area.

County Area	Year	Total Head of Cattle	Total Head Dairy Cattle	Total Head Beef Cattle	MGD	MGY
Orange	1990	1,450	0	1,450	0.02	6
Osceola	1990	60,600	0	60,600	0.73	265
Polk	1990	35,909	500	35,409	0.52	189
Highlands	1990	98,100	8,100	90,000	2.58	941
Okeechobee	1990	98,100	32,643	106,723	7.32	2,672
Glades	1990	45,160	850	44,310	0.69	251
Total Planning Area	1990	339,319	42,093	338,492	11.85	4,325

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Appendix G
WATER QUALITY

WATER QUALITY PARAMETER MAPS

The distribution of total chloride (mg/L) in the Floridan Aquifer System (FAS) in the Kissimmee Basin (KB) Planning Area is displayed in **Figure G-1**. The distribution of total dissolved solids (mg/L) in the FAS in the KB Planning Area is displayed in **Figure G-2**.

WATER QUALITY STANDARDS

Drinking Water Standards

Current Florida Department of Environmental Protection (FDEP) primary and secondary drinking water standards are shown in **Tables G-1** through **G-3**. Primary drinking water standards include contaminants which can pose health hazards when present in excess of the maximum contaminant level (MCL). Secondary drinking water standards, commonly referred to as aesthetic standards, are those parameters that may impart an objectionable appearance, odor or taste to water, but are not necessarily health hazards.

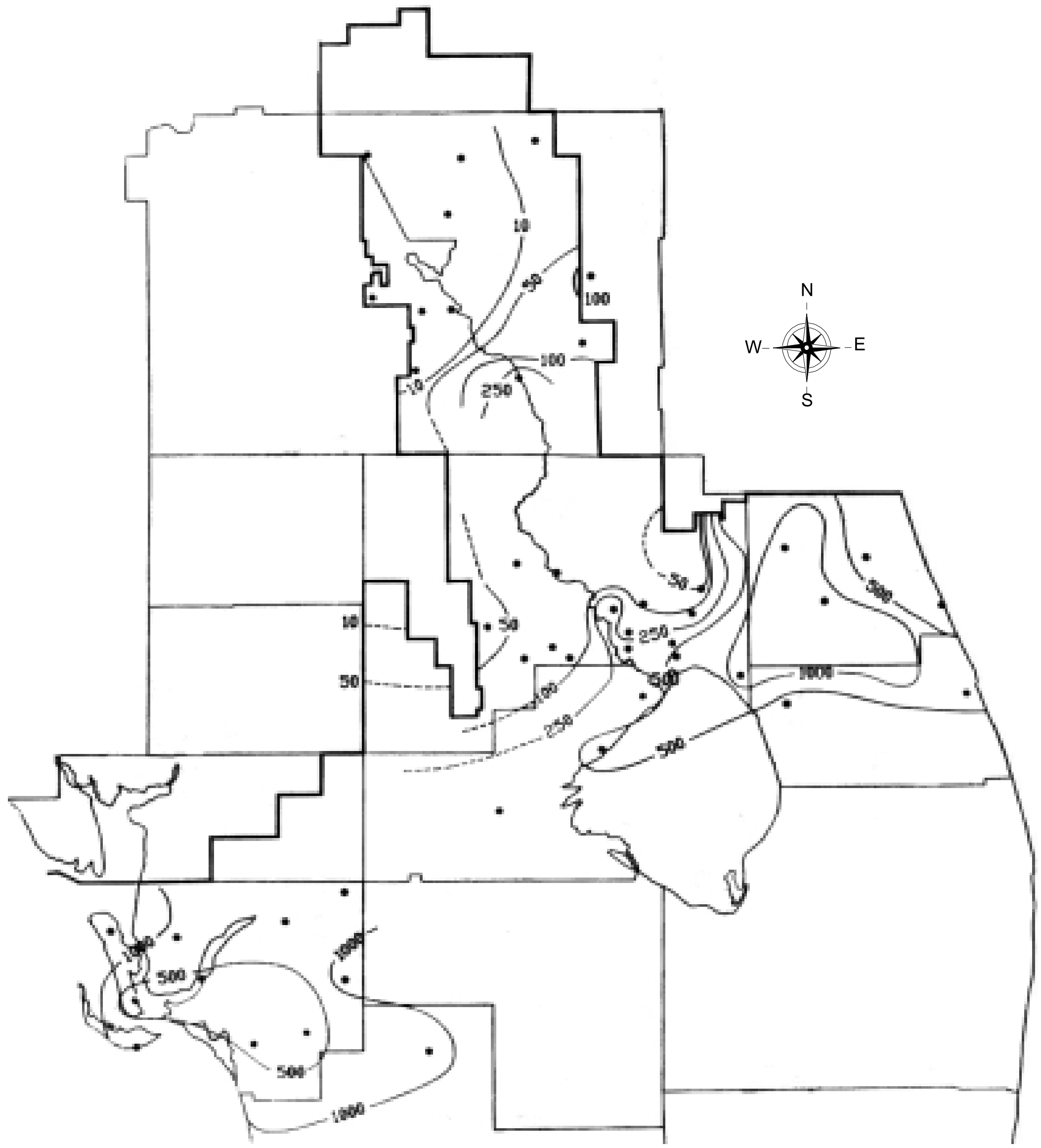

Figure G-1. Distribution of Total Chloride (mg/L) in the Floridan Aquifer System, Kissimmee Basin Planning Area (FGS, 1992).

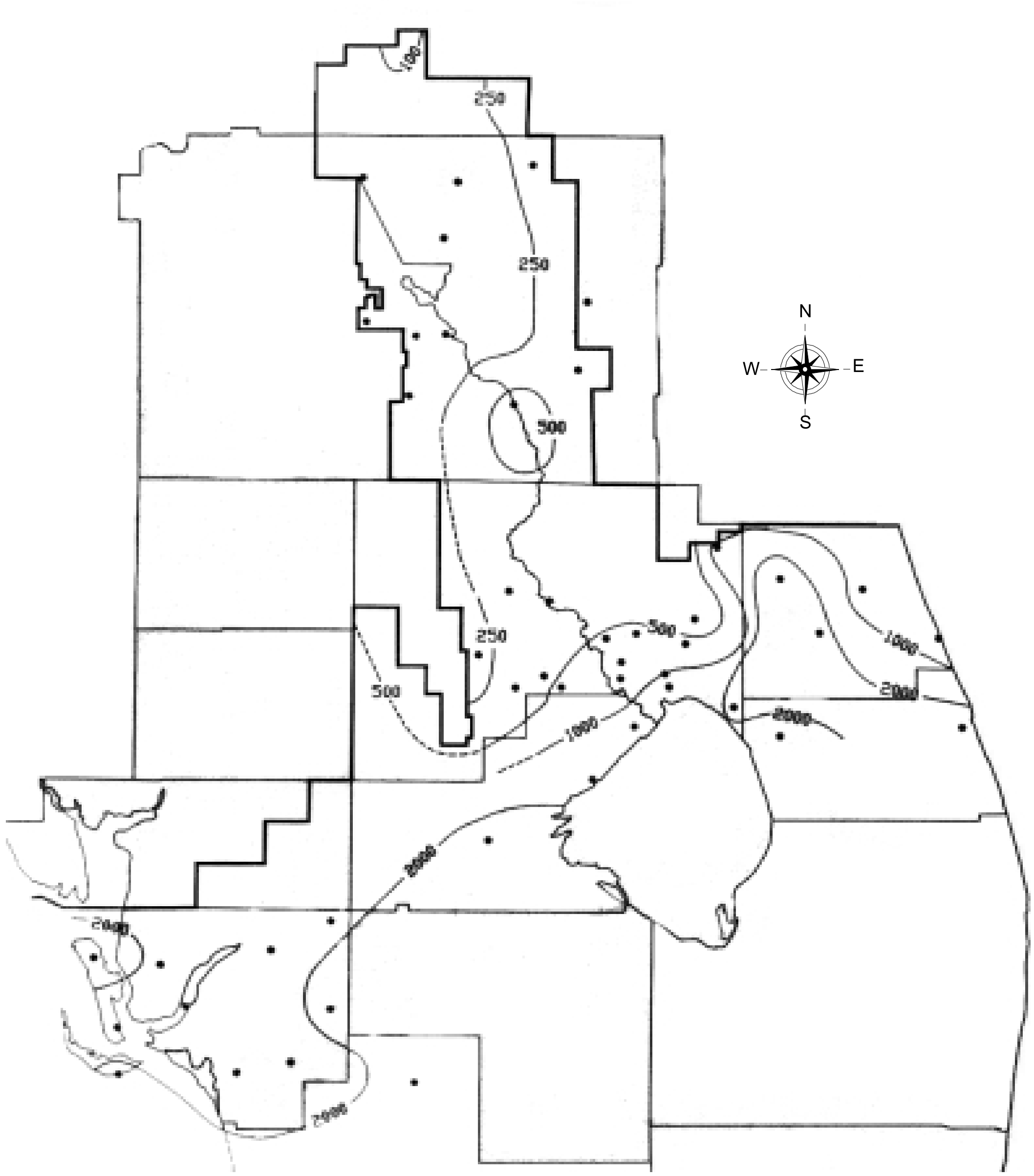

Figure G-2. Distribution of Total Dissolved Solids (mg/L) in the Floridan Aquifer System, Kissimmee Basin Planning Area (FGS, 1992).

Table G-1. FDEP Primary Drinking Water Standards (Chapter 62-550, F.A.C., revised November 22, 1999).

ORGANICS	MCL* (mg/L)	INORGANICS	MCL* (mg/L)
Volatile Organics		Contaminant	
Vinyl chloride	0.001	Antimony	0.006
Benzene	0.001	Arsenic	0.05
Carbon tetrachloride	0.003	Asbestos	7 MFL**
1,2-Dichloroethane	0.003	Barium	2
Trichloroethylene	0.003	Beryllium	0.004
para-Dichlorobenzene	0.075	Cadmium	0.005
1,1-Dichloroethylene	0.007	Chromium	0.1
1,1,1-Trichloroethane	0.2	Cyanide	0.2
cis-1,2- Dichloroethylene	0.07	Fluoride	4.0***
1,2-Dichloropropane	0.005	Lead	0.015
Ethylbenzene	0.7	Mercury	0.002
Monochlorobenzene	0.1	Nickel	0.1
o-Dichlorobenzene	0.6	Nitrate	10 (as N)
Styrene	0.1	Total Nitrate and Nitrate	10 (as N)
Tetrachloroethylene	0.003	Nitrite	1 (as N)
Toluene	1	Selenium	0.05
trans-1,2-Dichloroethylene	0.1	Sodium	160
Xylenes (total)	10	Thallium	0.002
Dichloromethane	0.005		
1,2,4-Trichlorobenzene	0.07		
1,1,2-Trichloroethane	0.005	TURBIDITY	
Total Trihalomethanes		Surface Water	
The sum of concentrations of bromodichlormethane, dibromochloromethane, tribromomethane (bromoform), and trichloromethane (chloroform).		- 1 turbidity unit (NTU) when based on a monthly average. - 5 NTU when based on an average for two consecutive days.	
		Ground Water	
		- 1 NTU	
PESTICIDES & PCBS	MCL* (mg/L)		
2,3,7,8- TCDD (Dioxin)	3×10^{-8}		
Alachlor	0.002		
Atrazine	0.003	MICROBIOLOGICAL	
Carbofuran	0.04	*Coliform Bacteria*	
		- Presence/Absence	
Chlordane	0.002	*Escherichia coli*	
		- Presence/Absence	
Dibromochloropropane (DBCP)	0.0002	*Giardia lamblia*	
		- Presence/Absence	
2,4-D	0.07	*Cryptosporidium*	
		- Presence/Absence	
Endrin	0.002		
Ethylene dibromide (EDB)	0.00002	RADIONUCLIDES	MCL*
Heptachlor	0.0004	- Combined radium-226 and radium-228	5 pCi/L
Heptachlor epoxide	0.0002		
Lindane	0.0002	- Gross alpha activity, including radium-226, but excluding radon and uranium	15 pCi/L
Methoxychlor	0.04		
Polychlorinated biphenyl (PCB)	0.0005		
Pentachlorophenol	0.001		
Toxaphene	0.003	- Manmade radionuclides	4 millirem/yr
2,4,5-TP (Silvex)	0.05	- Tritium/total body	20,000 pCi/L
Dalapon	0.2	- Strontium-90/bone marrow	8 pCi/L
Di(2-ethylhexyl)phthalate	0.006		
Di(2-ethylhexyl)adipate	0.4		
Dinoseb	0.007		
Diquat	0.02		
Endothall	0.1		
Glyphosate	0.7		
Hexachlorobenzene	0.001	*MCL = maximum contaminant level. **MFL = million fibers per liter >10 micrometers. ***Fluoride also has a secondary standard.	
Hexachlorocyclopentadiene	0.05		
Oxamyl (vydate)	0.2		
Benzo(a)pyrene	0.0002		
Picloram	0.5		
Simazine	0.004		

Table G-2. FDEP Secondary Drinking Water Standards (Chapter 62-550, F.A.C., revised November 22, 1999).

Contaminant	MCL (mg/L)[a]
Aluminum	0.2
Chloride	250
Color	15 color units
Copper	1
Fluoride	2.0
Foaming Agents	0.5
Iron	0.3
Manganese	0.05
Odor	3[b]
pH (at collection point)	6.5-8.5
Silver	0.1
Sulfate	250
Total Dissolved Solids	500[c]
Zinc	5
Total Trihalomethanes	0.10

a. Except color, odor, corrosivity, and pH.
b. Threshold odor number.
c. May be greater if no other MCL is exceeded.

Table G-3. MCLGS and MCLS for Disinfection By-products (Federal Register, 40 CFR, December 1998).

Disinfection By-products	MCLG (mg/L)	MCL (mg/L)
Total Trihalomethanes (TTHM)[a]	N/A[b]	0.080
Chloroform	0	
Bromodichloromethane	0	
Dibromochloromethane	0.06	
Bromoform	0	
Haloacetic acids (five) (HAA5)[c]	N/A[b]	0.060
Dichloroacetic acid	0	
Trichloroacetic acid	0.3	
Chlorite	0.8	1
Bromate	0	0.010

a. Total Trihalomethanes is the sum of the concentrations of chloroform, bromodichloromethane, dibromchloromethane, and bromoform.

b. Not available because there are no individual MCLGs for TTHMs or HAAs.

c. Haloacetic acids (five) is the sum of the concentrations of mono-, di-, and trichloroacetic acids and mono- and dibromoacetic acids.

Irrigation Water Quality Parameters

Chemical parameters of an irrigation water that affect plant growth, yield, and appearance, soil conditions, and the ground water quality governs the applicability of a water. The University of California Cooperative Extension Service has developed a useful and widely accepted guide to evaluate the suitability of an irrigation water and identifying potential areas of concern. Problems and related constituents include salinity, permeability, specific ion toxicity (sodium, chloride, boron), nitrogen, bicarbonate, and pH. These guidelines can be found in “Water Treatment Principles and Design” (J.M. Montgomery Consulting Engineers, 1985).

In addition to these guidelines, recommended maximum concentration for trace elements have been developed and can be found in J.M. Montgomery Consulting Engineers, 1985.

Salinity

Salinity is a measure of the soluble salts, or the ionic activity of a solution in terms of its capacity to transmit current, in a water and is determined by measuring the water's electrical conductivity (EC) or specific conductance. Water salinity is the most important parameter in determining the suitability of water for irrigation. As salinity increases in irrigation water, the probability for certain soil, water, and cropping problems increases. There are several dissolved salts found in water, the principal salts being the chloride and sulfate salts of sodium, calcium, and magnesium (Augustin et al., 1986). Many salts, such as nitrogen, phosphorus, calcium, and potassium are necessary for normal plant growth.

Salt is added continuously via the irrigation water to the soil. Over time, a salinity problem to the plant may occur if the accumulated soil salt concentration increases to where it is harmful to the plant. The accumulation is dependent on the quantity of salt applied and the rate at which salt is removed by leaching. Leaching is essential to successfully irrigate with highly saline water. To assure that salt leaching occurs, additional irrigation water could be applied. Establishment of a net downward movement of water and salts is the only practical way to manage a salinity problem. In addition, under these circumstances, good drainage and/or percolation is essential in allowing movement of the water and salt below the root zone. The climate in an area also affects soil salt accumulation. Evaporation and transpiration remove water and leave the salts behind. Climate also influences the salt tolerance of plants, which will be discussed later.

Ground water salt content increases due to upconing or saline water intrusion. For reclaimed water, salts enter the wastewater stream in many different ways. Salts are contained in drinking water, are introduced through domestic and industrial activities, through water softeners, and through infiltration and inflow (I/I) into the wastewater collection system. Infiltration is where ground water enters the collection system through defective joints, cracked and broken pipes and manholes, whereas inflow is where storm water enters the collection system through combined sewers, manhole covers, foundation drains and roof drains. In coastal areas, I/I of seawater can be major source of salts in the reclaimed water. The advanced secondary wastewater treatment process has little effect on removal of salts from the wastewater stream.

Knox and Black (n.d.) provide a table indicating the degree of salt tolerance of many of the landscape plants adapted to South Florida, including trees, palms, shrubs, ground covers, and vines. Many of the salts are necessary for healthy plant growth; however, excessive concentrations of these salts can have a negative impact on the plant. Salts affect plant growth by: (1) osmotic effects, (2) specific ion toxicity, and (3) soil particle dispersion.

Osmotic Effects

Osmosis is the attraction of dissolved salts which causes water to move from areas of low salt concentration to areas of high salt concentration. Roots selectively absorb compounds that the plant needs to grow. The normal osmotic flow causes water to move from the soil, which is usually an area of low salt concentration, into the roots which is an area of higher salt concentration. Excessive salts in the soil can reverse the normal osmotic flow of water into the plant by reversing the salt concentration gradient, thus causing dehydration of the plant. Increased plant energy is also needed to acquire water and make biochemical adjustments necessary to survive, which will decrease plant growth and crop production. In addition, osmotic effects indirectly create plant nutrient deficiencies by decreasing the nutrient absorption. The salt tolerance of common turf grass species in South Florida can be found in “Saline Irrigation of Florida Turf grasses” (Augustin et al., 1986).

Deposition of salts on foliage through spray irrigation may also cause problems, especially to sensitive ornamental plants. Much work has been devoted to quantify the tolerance of many of the plants. Many researchers have identified the salt tolerance of plants through field observation and have categorized them as having poor, moderate, or good salt tolerance. Several of their publications are available from the Florida Cooperative Extension Service Institute of Food and Agricultural Sciences (IFAS).

Specific Ion Toxicity. Ion toxicity is due to excessive accumulations of specific ions in a plant that result in damage or reduced yield. Toxicity problems may or may not occur in the presence of a salinity problem. Specific ions of concern include boron, chloride, sodium, and bicarbonate. Ion toxicity potential is increased in hot climates. The ions can be absorbed by the plant through the roots or the foliage, but with sprinkler irrigation, sodium and chloride frequently accumulates by direct adsorption through the leaves. Such toxicity occurs at concentrations that are much lower than toxicity caused by surface irrigation. Toxicity associated with overhead sprinkling is sometimes eliminated with night irrigation when lower temperatures and higher humidity exists. Tolerances of these ions vary from plant to plant.

Sodium. Sodium is not considered essential for most plants; however, it has been determined that sodium does positively affect some plants lower than the salt tolerance threshold. The amount of sodium is of concern because it is usually found in the largest amount. Sodium directly and indirectly affects plants. Direct affects of sodium toxicity involves the accumulation of this ion to toxic levels, which is generally limited to woody species (Maas, 1990). Indirect effects resulting from sodium toxicity include nutritional imbalance and impairment of the physical conditions of the soil. Sodium can affect the plant's uptake of potassium. Ornamental sodium toxicity is characterized by burning of the outer leaf edges of older leaves and progresses inward between the veins as severity increases. Sodium is usually introduced into the wastewater stream by I/I. With adequate care, sodium toxicity should not be a problem.

Chloride. Chloride is an essential micro nutrient for plants and is relatively nontoxic. Most nonwoody crops, such as turf grass, are not specifically sensitive to chloride. However, many woody, perennial shrubs and fruit tree species are susceptible to chloride toxicity. In addition, chloride contributes to osmotic stress. Ornamentals express chloride toxicity by leaf burn starting at the tip of older leave and progressing back along the edges with increasing severity. Chloride is usually introduced into the wastewater stream by I/I. With adequate care, chloride toxicity should not be a problem except possibly for irrigation of salt sensitive plants.

The City of St. Petersburg investigated the effect of reclaimed irrigation water on the growth and maturation of commonly used ornamental plants and trees in the St. Petersburg area. The study, called “Project Greenleaf” was also used to determine the chloride tolerance of those plants and trees (Parnell, 1987). The study suggested a chloride threshold of 400 mg/L be established for reclaimed water that is utilized for green space irrigation. This threshold protects salt sensitive ornamentals from the effects of chlorides, which generally have a lower salt tolerance than turf grasses.

Boron. Boron is an essential element to plants but can become toxic when concentrations of soil water slightly exceed the amount required for optimum growth. Boron is usually not a problem to turf grasses because boron accumulates in the leaf tips, which are removed by mowing; however, other landscape plants may be more sensitive to boron levels. Boron toxicity may be expressed by leaf tip burn or marginal burn accompanied by chlorosis of the interveinal tissue. Boron is commonly introduced to the wastewater stream from household detergents or from industrial discharges.

Water Infiltration Rate

In addition to other concerns with high sodium content, it can lead to deterioration of the physical condition of the soil by formation of crusts, water logging and reducing the soil permeability and nutritional problems induced by the sodium. An excess of sodium in the soil could displace nutrients such as calcium, iron, phosphorus, and magnesium from the soil particles and thereby creating a nutritional deficiency that the plant requires in addition to creating soil permeability problems (Knox, n.d.). Infiltration problems occur within the top few inches of the soil and is mainly related to the structural stability of the surface soil and is related to a relatively high sodium or very low calcium content in this zone or in the irrigation water. Reclaimed water usually contains sufficient amounts of both salt and calcium, such that dissolving and leaching of calcium from the surface soil is minimized.

Salt Levels in Soil

Good drainage is essential to leach soluble salts through the soil profile. To maintain a certain soil salt level, irrigation rates exceeding evapotranspiration are required to leach excess salts through the soil.

Salt Tolerance of Plants

Research has found that salt tolerance of plants usually relates to its ability to: (1) prevent absorption of chloride and sodium ions, (2) tolerate the accumulation of chloride or sodium ions in plant tissue, or (3) tolerate osmotic stress caused by soil or foliar salts. Plant tolerance to salts can be influenced differently based on the age of the plant, the stage of growth, irrigation management, and soil fertility. In addition, some plants are tolerant to soil salts but intolerant to salt deposits on the foliage, or vice versa.

The salt tolerance of plants varies greatly. Some plants avoid salt stress by either excluding salt absorption, extruding excess salts, or diluting absorbed salts. Other plants adjust their metabolism to withstand direct or indirect injury. Most plants utilize a combination of these. Turf grass salt stress is indicated by faster wilting than normal due to the osmotic stress, shoot and root growths are reduced to direct and indirect salt injury, leaf burn, general thinning of the turf and ultimately turf death. Landscape plant salt stress could be expressed by burning of the margins or tips of leaves followed by defoliation and death of salt sensitive plants.

Salt tolerance depends on many factors, conditions, and limits including type of salt, crop growing conditions, and the age and species of the plant. The type and purpose of the plant needs to be considered when evaluating salt tolerance. For example, for edible crops, yield is of primary importance and salt tolerance would be based on growth and yield. However, to establish permissible levels of salinity for ornamental plant species, the aesthetic characteristic of the plant is more important than its yield. The loss or injury of leaves due to salt stress is unacceptable for ornamentals, even if growth is unaffected. Accordingly, landscape plants can tolerate relatively higher levels of salts, since reduced growth and yield are the initial effects of excess salts and appearance of plants is not immediately affected (Knox and Black, n.d.).

Climate is a major factor affecting salt tolerance. Most crops can tolerate greater salt stress if the weather is cool and humid rather than hot and dry. Rainfall also reduces salinity problems by diluting salt concentration and enhancing leaching by adding additional water. Nighttime irrigation reduces foliar absorption and injury. In addition, some plants may be tolerant to soil salinity but are not tolerant to salt deposition on the leaves and vice versa. Use of an irrigation technique that applies water directly to the soil surface rather than on the leaf surfaces is preferred when using irrigation water which contains excessive salts.

Nutrients

Reclaimed water contains nutrients that provide a fertilizer value to the crop or landscape, which when accounted for, can reduce the amount of fertilizer applied, thus reducing fertilizer costs. The nutrients found in reclaimed water occurring in quantities important to agriculture and landscape management include nitrogen and phosphorus, and occasionally potassium, zinc, boron, and sulfur.

Municipal wastewaters usually contain sufficient amounts of micro nutrients to prevent deficiencies. The trace elements of boron (B), copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo), zinc (Zn), sodium (Na), and chlorine (Cl) are essential for plant growth; however, intake of excessive concentration of these elements can be toxic and detrimental to some plants.

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Appendix H
GROUND WATER MODELING REPORTS

I. Osceola Regional Model

David Butler
Water Supply Planning and Development Department

II. Glades, Okeechobee, and Highlands (GOH) Model

Jeff Herr
Water Supply Planning and Development Department

I. OSCEOLA REGIONAL MODEL

Purpose and Scope

This section describes the development and calibration of a three-dimensional ground water flow model of the Upper Floridan aquifer (UFA) in Osceola County. Portions of the surrounding counties were used to help minimize the effects of the boundary conditions in the Osceola County Area.

Figures H-1 and **H-2** depict the location of the study area. The study area is located in east-central Florida.

Major Aquifer Systems

There are two major aquifer systems within the study area: the Surficial Aquifer System (SAS) and the Floridan Aquifer System (FAS). Both aquifers are laterally continuous throughout the study area. **Figure H-3** provides a generalized hydrogeologic column of the study area.

In addition to the reconnaissance work associated with this project, the following is a listing of the major reports used to develop the hydrogeologic framework: Barcelo (1998), CH2M Hill (1993), Dames and Moore, Inc. (1988), Geraghty and Miller, Inc (1977), Planert and Aucott (1985), PBSJ (1987), PBSJ (1990a), PBSJ (1990b), PSI (1994), Shaw and Trost (1984a), Shaw and Trost (1984b), Tibbals and Grubb (1982), and Yobbi (1996).

The SAS is composed of low to moderately permeable clastic and carbonate sediments. Ground water in the SAS can exist under confined, semi-confined, or unconfined conditions.

The intermediate confining unit (ICU) consists of fine clastic and carbonate sediments, which acts as an aquitard. In this report, the top of the ICU corresponds with the top of the Hawthorn Group. In the study area the top of the Hawthorn Group is identified by an increase in content of green clay.

The FAS underlies the ICU within the study area. Schiner (1993) separates the FAS into 3 separate units: the UFA, the middle confining unit (MCU), and the Lower Floridan aquifer (LFA). The following formations make up the FAS:

- UFA - Ocala Limestone and upper portion of the Avon Park Formation
- MCU - lower portion of the Avon Park Formation
- LFA - Oldsmar Formation

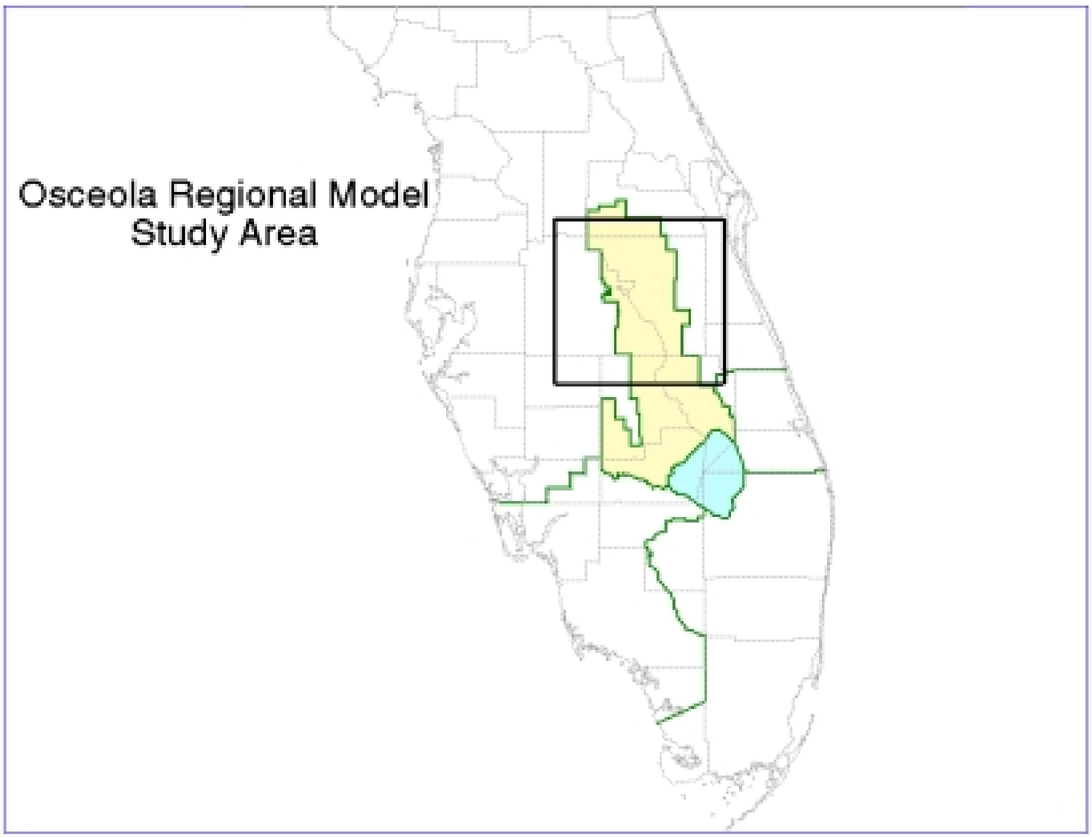

Figure H-1. Location Map of Study Area.

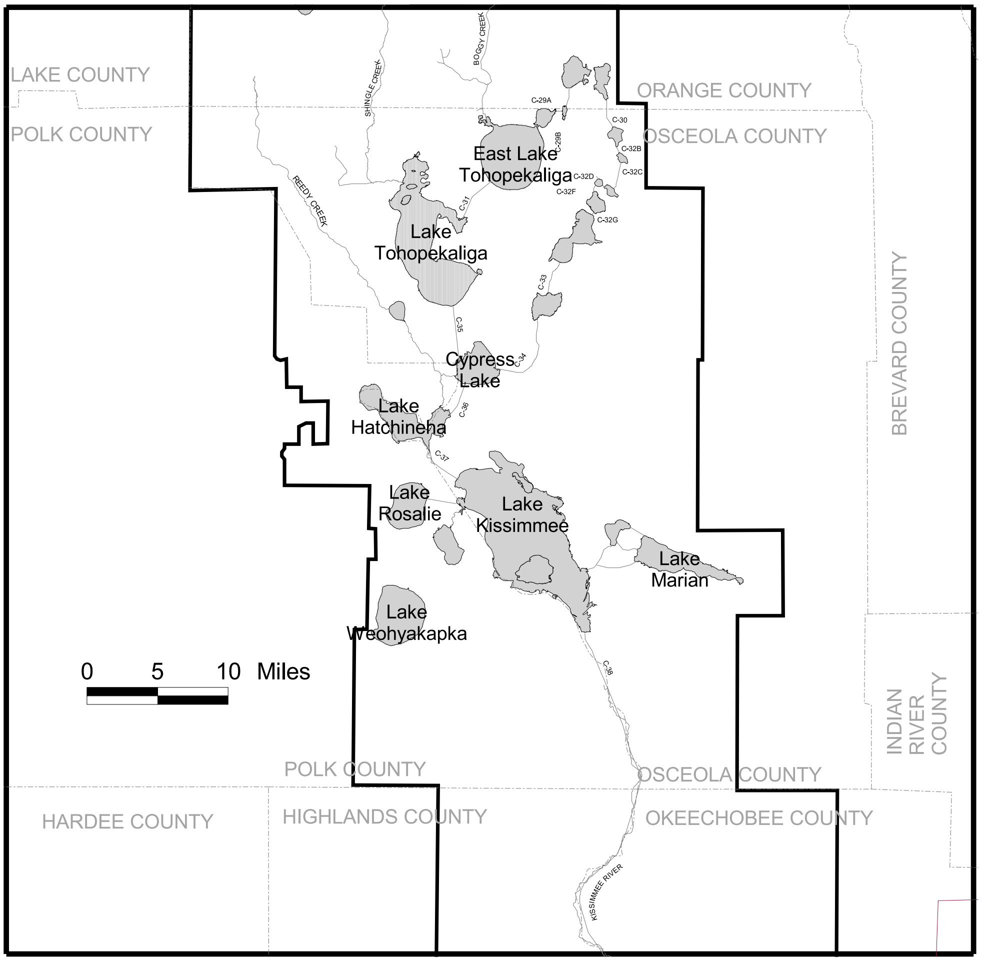

Figure H-2. Map of Study Area.

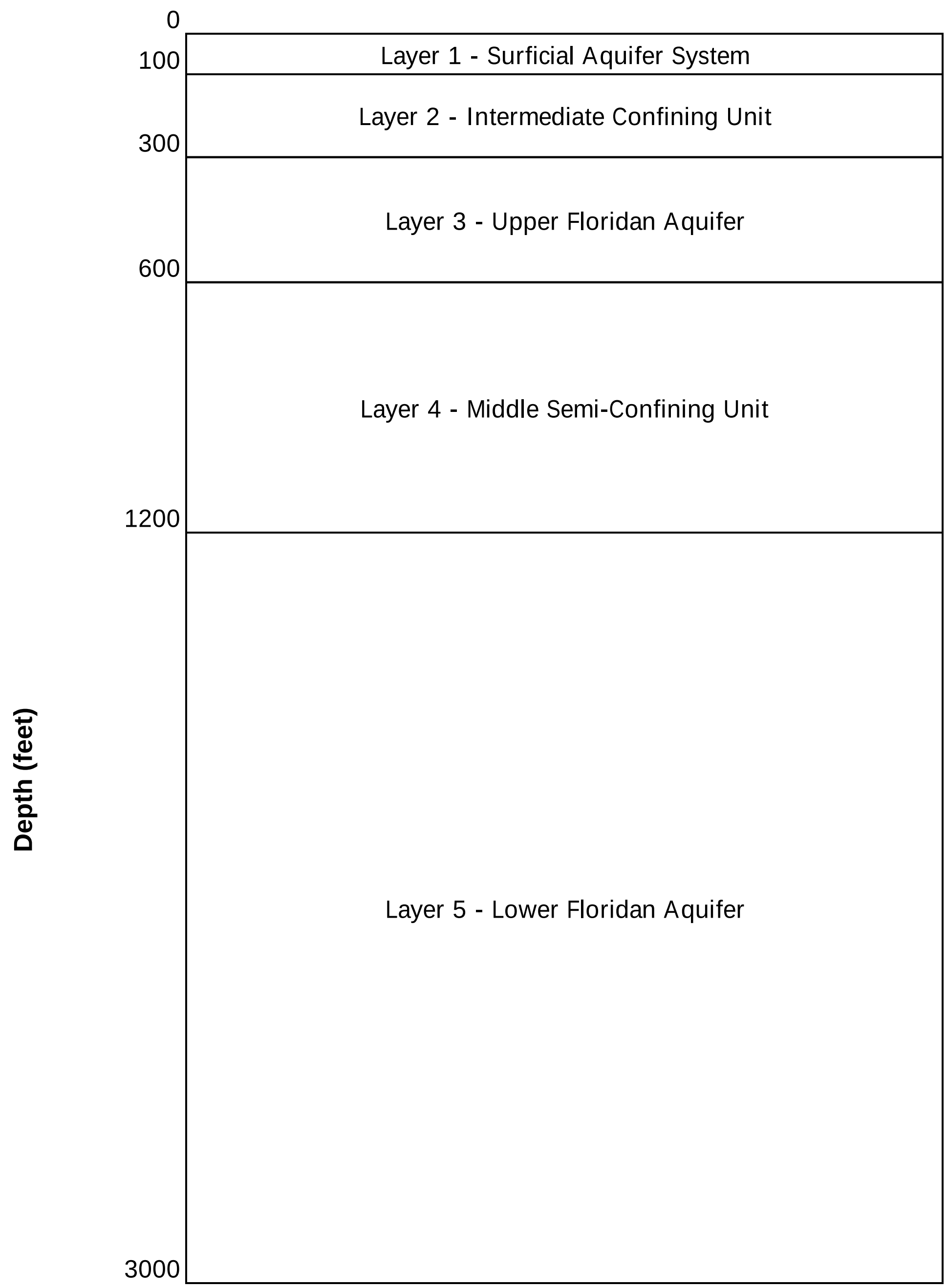

Figure H-3. Vertical Discretization of Osceola Regional Model.

Since the UFA is the most widely used aquifer in the study area, the majority of the reconnaissance work focused on this aquifer. District staff developed 6 test sites in Osceola County. These sites were used to obtain geologic and hydrologic data.

Model Development

Overview

The code used in this study to simulate the ground water flow is the U.S. Geological Survey (USGS) modular three-dimensional finite-difference ground water flow code MODFLOW (McDonald and Harbaugh, 1988). Most of the information for model development, calibration, and sensitivity analysis was derived from Butler (1999). Readers desiring more detail on the Osceola model are referred to this publication. Since the model is still in draft form, some change may occur between this report and the final documentation.

Horizontal and Vertical Discretization

The horizontal model grid consists of 134 rows and 137 columns. The grid spacing is a uniform 2,640 feet throughout the model area. **Figure H-4** displays the model grid.

Vertically, the model was discretized into 5 separate hydrologic units: the SAS, ICU, UFA, MCU, and the LFA. This study focuses on the Upper Floridan. Figure 3 depicts the model layers with their corresponding hydrogeologic units.

Hydraulic Characteristics

An initial value of 15 ft/d will be used for the hydraulic conductivity of the SAS. An initial estimate of 0.15 ft/d was estimated for the vertical conductivity.

Layer one is modeled as an unconfined layer and assigned a specific yield of 0.2. This value is within the range for specific yield measurements of unconfined sediments as indicated by Fetter (1980, p. 68).

The ICU separates the SAS from the FAS.

MODFLOW uses the Vcont parameter to estimate vertical flows between layers. According to McDonald and Harbaugh (1988), when the is a great discrepancy between the vertical conductivity of two adjacent layers, the Vcont may be estimated by the following formula:

$$Vcont(i,j,k) = 2\, vc(i,j,k \,/\, thick(i,j,k) \qquad (1)$$

where

vc(i,j,k) = the vertical conductivity of the lower permeability layer

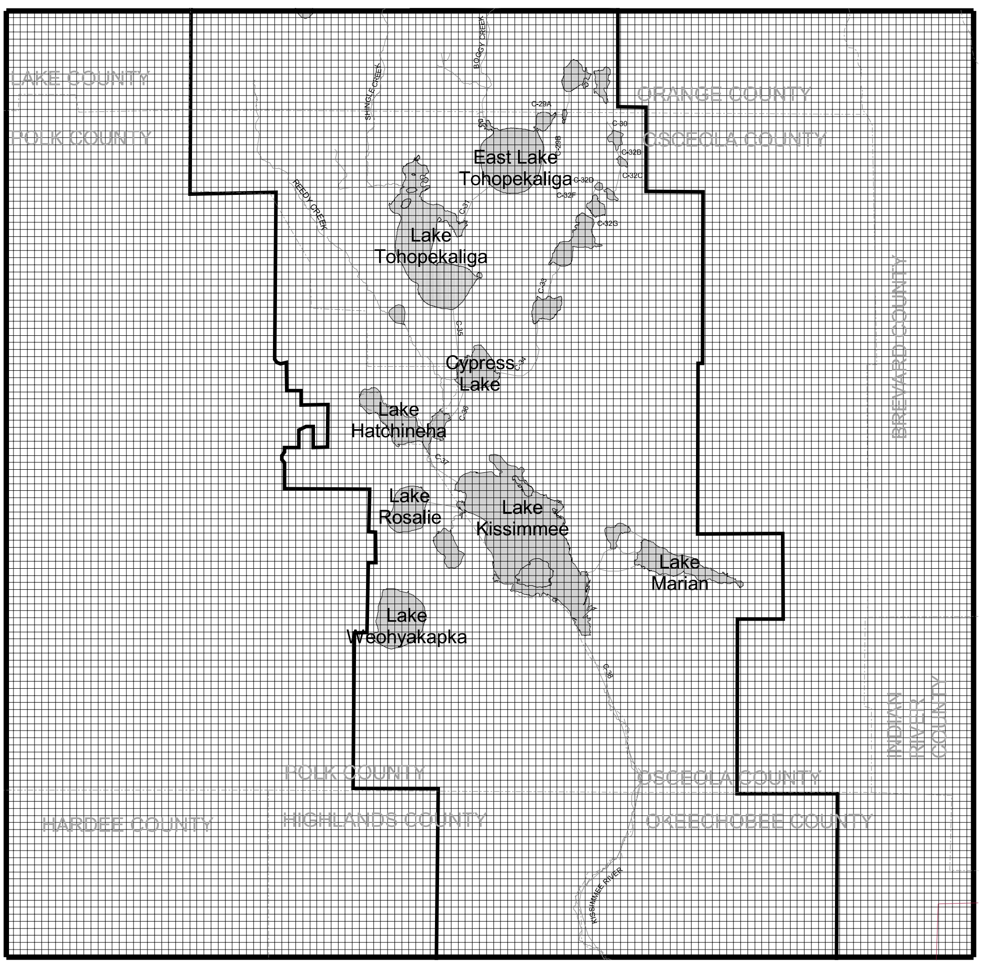

Figure H-4. Model Grid.

and

thick(i,j,k) = the thickness of the lower permeability layer.

This situation exists between layers 1 and 2, and between layers 2 and 3. Using the available hydrogeologic data, a vertical conductivity of 0.0135 ft/d was derived.

There are areas in the study area where the Hawthorn is fairly thin. In these areas the Hawthorn may not act as a confining unit. Therefore, layer 2 was modeled as a confined/unconfined layer where the transmissivity may vary.

Several aquifer performance tests and specific capacity tests were conducted in the study area. The results from these tests used to derive the hydraulic conductivity for the UFA. Initially, the vertical conductivity for the UFA will be 1/100 of the hydraulic conductivity.

The MCU is modeled as a confined layer in this study. An initial value of 0.21 ft/d was used for the vertical conductivity and 6,500 ft^2/d was used for the transmissivity. This corresponds to a hydraulic conductivity of 13 ft/d with an average thickness of 500 ft.

Tibbals (1990) utilized a value transmissivity of 60,000 ft^2/d for most of the study area. The LFA was modeled as a confined layer.

Water Levels

The SFWMD, in cooperation with the USGS and SJRWMD established water level monitoring network for the UFA in the study area. The study period was may 1992 through September 1995. **Figure H-5** is an averaged water level map of the UFA for the study area.

The District also established a map of the SAS. Since data for the SAS is sparse, surface water data from lakes, canals, and other surface water bodies sere used to supplement the data.

Very few monitoring wells penetrate the LFA within the study area. At the Bull Creek site, the SJRWMD has monitored a dual zone UFA/LFA monitor well for an extensive period of time. Results from the data indicate that the water level for the LFA ranges between 0.4 to 2.54 feet below the UFA. A uniform difference of 0.25 feet provided good model results.

Very few wells were finished within layers 2 or 4. For layer 2, the water level was set to the average value between the SAS and UFA. The water level for layer 4 was set equal to layer 5.

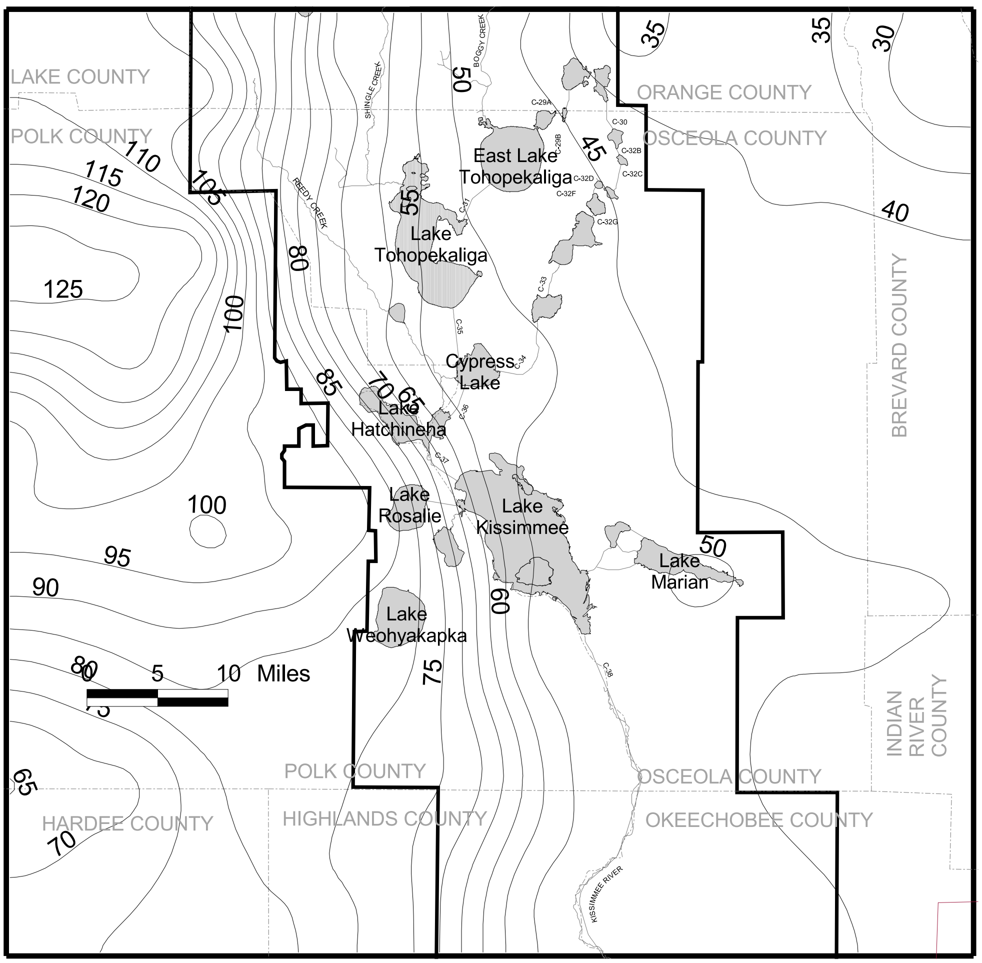

Figure H-5. Water Level Map of UFA.

Boundary Conditions

Many factors affect the water levels in layer 1. Some of the major factors are ground water withdrawals, rainfall, evapotranspiration, and the stages for the surface water bodies. It is not the intent of this study to simulate all of the effects. Therefore, layer 1 was modeled as a constant head boundary using the averaged water levels.

Since the UFA water level map, **Figure H-5**, has the most extensive network, it was used to establish the boundary conditions for layers 2, 3, 4, and 5. **Figure H-6** illustrates the boundary conditions for layers 2, 3, 4, and 5. The following discussion details how the boundaries were developed.

A review of **Figure H-5** reveals a potentiometric high in the western portion of the study area. The potentiometric mound acts as a ground water divide. Therefore, the apex of the mound is modeled as a constant head boundary. The cells west of the apex are modeled as no-flow boundaries.

A review of **Figure H-5** shows that the northern boundary intersects the equipotential line at approximately right angles. This implies that very little flow enters or leaves the study area from the north. Therefore, the northern boundary was modeled as a no-flow boundary.

The southern boundary was established approximately 10 miles south of the Osceola/Okeechobee border to minimize any potentially erroneous boundary effects. Similar to the northern boundary, the equipotential lines intersect the boundary at right angles; therefore it is modeled as a no-flow boundary.

A review of **Figure H-5**, indicates that ground water flows eastward in the study area. Furthermore, the figure reveals a relatively flat potentiometric surface in eastern Osceola and western Brevard counties. A constant head boundary was simulated near the eastern boundary of the study area.

Ground Water Use Estimates

As part of the 1995 calibration effort and again for future water use simulations, water use estimates were developed for entry into the constructed model. Development of the 1995 and 2020 water use database was completed in a series phases in order to capture the total water use picture. Water use was broken into areas of public water supply, permitted agriculture, non-permitted agriculture and water use outside the planning basin. The details on how each of these databases were developed is described in Appendix F, Water Use Estimates.

Water use from each of the developed databases were compiled to form the standard MODFLOW entry files. As estimated 6,000 wells were included with the model.

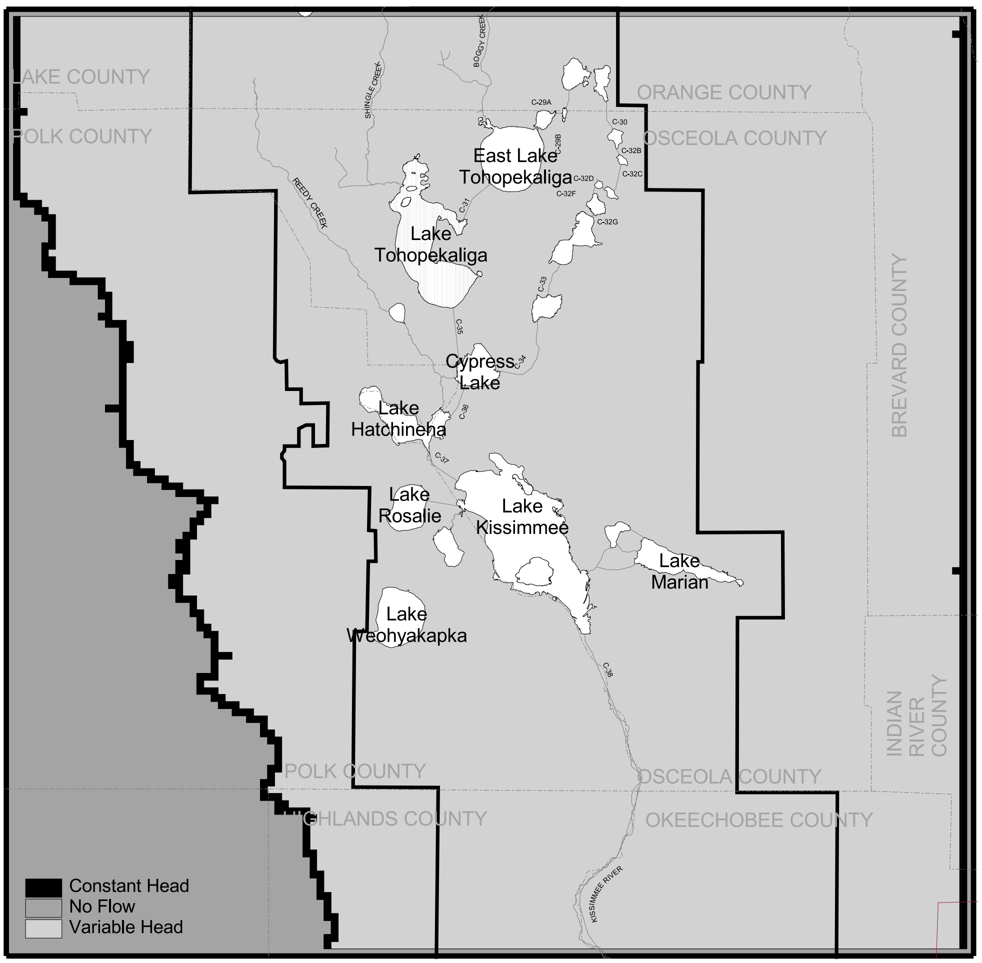

Figure H-6. Boundary Conditions.

Calibration

Introduction

Calibration is the process of adjusting the parameters of the numerical model so that the model responds similarly to the physical system. The Osceola County model was calibrated to steady-state conditions. Due to time constraints, a transient calibration was not performed.

"Steady-state" can be viewed as an average condition achieved over a long period of time. It presumes that no major changes in stress rates occur during that time. When the stresses that drive ground water flow change very slowly in time relative to the rate of change within the aquifer system, steady-state assumptions are justified. The basic statistics, including the standard deviation and variance, were estimated for each monitoring well. In most cases the standard deviation and variance are relatively small. This infers that there is little deviation from the mean water level. Based on the following it can be concluded that "quasi steady-state" conditions existed during the calibration period.

The basic procedure for calibrating the model is as follows. First, initial calibration criteria were developed for the model. Next, the model was initialized with reasonable parameters based on the results from hydrologic studies. Steady-state runs were used to make the adjustments to the model.

In order to measure the success of the calibration, the model results were compared to the actual water levels obtained from the monitoring well network. The monitoring network consisted of 53 wells that were distributed throughout the study area. Water levels from the wells were obtained on a monthly basis. Only layer 3 was calibrated using water levels.

In addition to examining the water levels, the calibration procedure also examines the vertical flow between the UFA and the SAS, and the model budget.

Water Level Calibration

The steady-state calibrations were based on comparison of simulated water levels under averaged conditions. Three criteria were used to measure the steady-state calibration:

1. The steady-state water level must be within one standard deviation of the averaged water level. At least 50% of the observation nodes must meet this criterion for the model to be considered calibrated.
2. The simulated steady-state water level for the observation node must be within the range of the maximum and minimum observed water levels for the corresponding well. At least 50%

of the observation nodes must meet this criterion for the model to be considered calibrated.

3. The modeled water level for the observation node must be within one foot of the averaged water level of the corresponding well. At least 50% of the observation nodes must meet this criterion for the model to be considered calibrated.

A more restrictive time period of October 1994 through September 1995 was used for Criterion 3. This time period coincides with the base conditions used for the Kissimmee Basin (KB) Water Supply Plan. There are some wells where the data for this restrictive period are missing. In these cases, the average value for the entire study period was used.

Table H-1 presents the results of the steady-state simulation. According to **Table H-1**, 35 observation nodes (66%) meet the first calibration criterion, 44 observation nodes (83%) meet the second criterion and 27 observation nodes (51%) meet the third criterion. Also 22 observation nodes (41%) met all 3 criteria. Only 9 observation nodes failed to meet any of the criteria.

Test runs were made with the model using the entire calibration period for Criterion # 3. The results were similar to above.

Figure H-7 is a map of the steady-state water levels. The steady-state water level map exhibits the same general trends as the average water level map (**Figure H-5**).

Anderson and Woessner (1992) recommend that a quantitative analysis of the distribution error be conducted as part of the calibration assessment. In addition, they provided levels for the calibration assessment. For Level 1, the simulated values fall within the calibration target. For this study, if the simulated steady-state water level is within ± 1-foot of the average value, it is defined as meeting the Level 1 calibration criteria for steady-state conditions. Similar definitions apply for calibration levels 2, 3, and 4.

Figure H-8 is a residual map of the UFA. The residuals were determined by subtracting the steady-state head from the mean observed water level. **Figure H-8** reflects the absolute value from this difference. ARCINFO was used to help determine the areas for levels 1, 2, and 4. Only the variable head cells were used in the computation. The results are as follows:

- 69% of the study area meets level 1 criterion (steady-state water levels are within 1.0 foot of the observed average value)
- 86% of the study area meets level 2 criterion (steady-state water levels are within 2.0 feet of the observed average value)
- 91% of the study area meets level 3 criterion (steady-state water levels are within 3.0 feet of the observed average value)

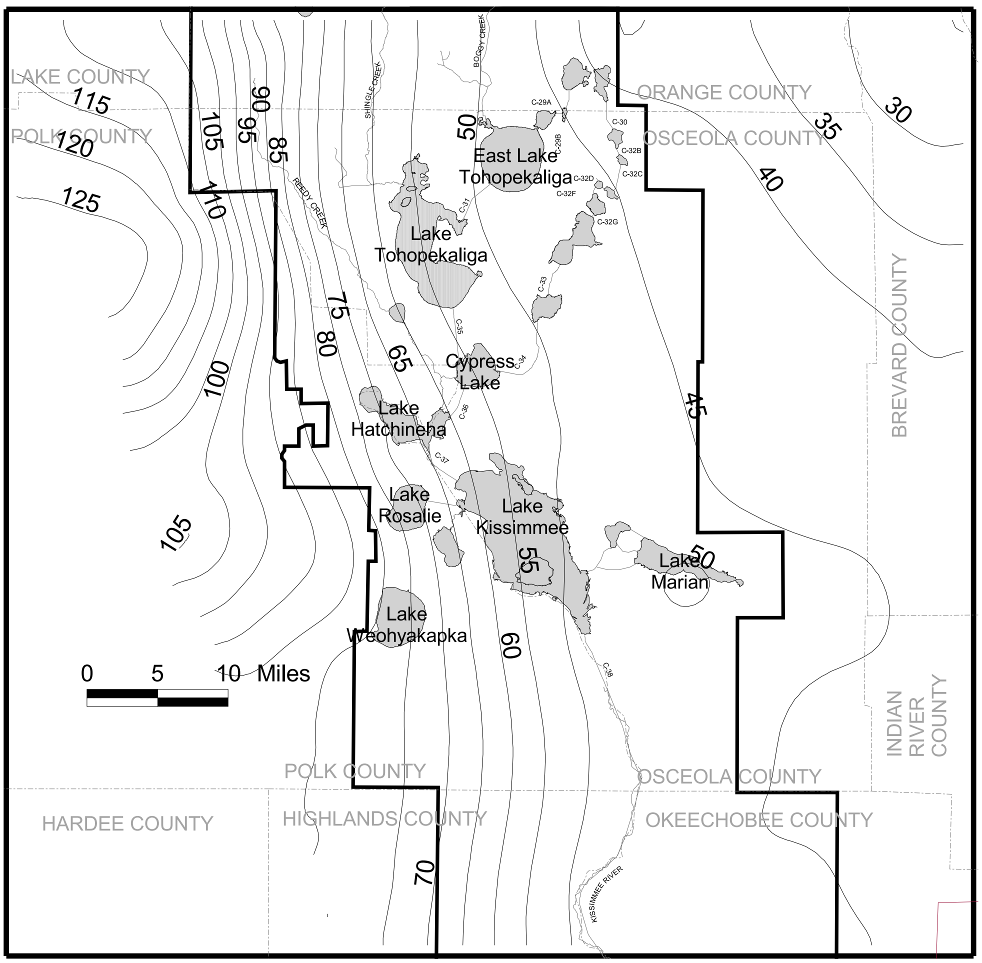

Figure H-7. Steady-State Water Level Map.

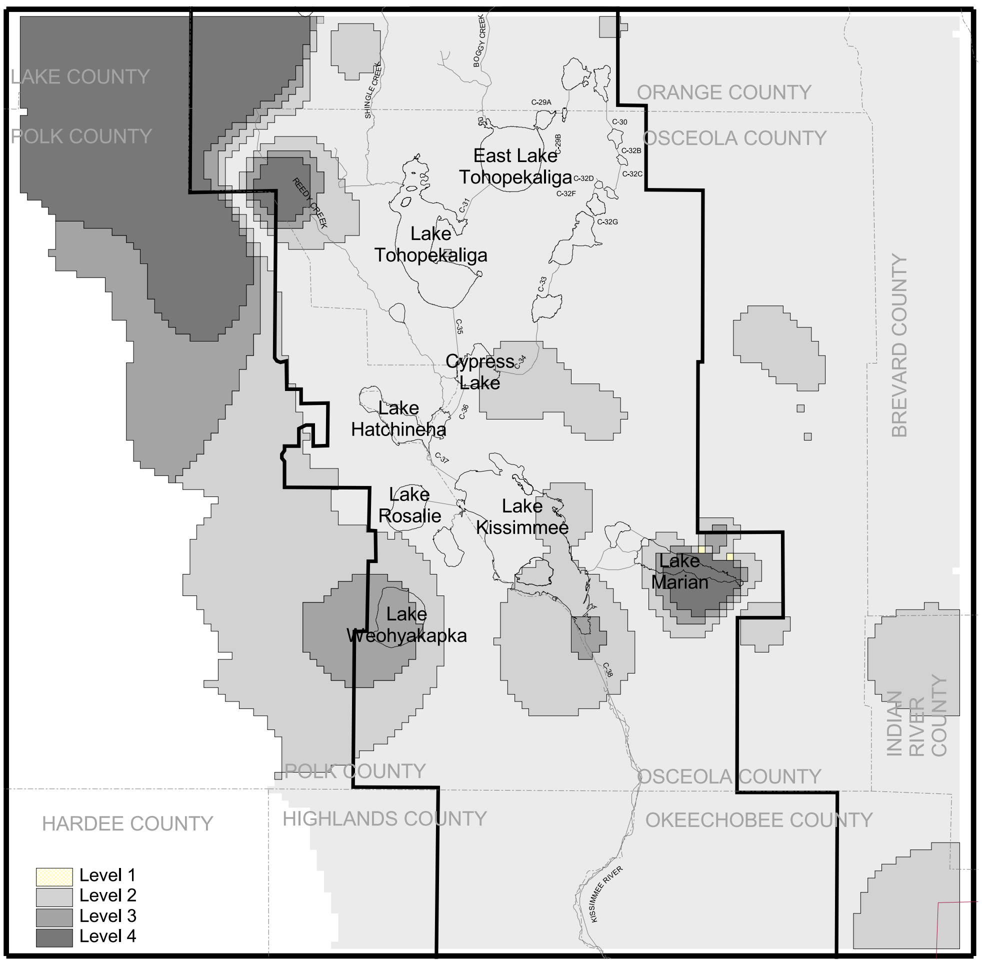

Figure H-8. Residual Water Level Map.

Table H-1. Steady-State Calibration Results.

Layer	Row	Column	ID	SS Value	Mean	Minimum	Maximum	Results
3	100	110	1	45.21	44.89	42.61	46.76	Criteria 2 and 3
3	89	82	3	48.64	46.38	43.21	48.08	Uncalibrated
3	87	107	4	47.50	45.90	41.86	47.27	Uncalibrated
3	80	100	5	50.06	58.63	54.28	58.64	Uncalibrated
3	71	80	6	49.25	47.94	44.66	50.13	Criteria 2
3	65	99	8	45.01	44.62	41.60	46.38	Criteria 2 and 3
3	59	113	10	42.99	42.11	40.15	44.14	Criteria 1, 2 and 3
3	50	118	11	41.92	42.18	39.31	43.95	Criteria 1, 2 and 3
3	43	64	13	53.66	53.00	49.60	55.03	Criteria 1, 2 and 3
3	39	52	15	63.20	63.40	60.34	65.63	Criteria 1, 2 and 3
3	39	73	17	49.52	49.17	46.76	51.20	Criteria 1, 2 and 3
3	35	63	21	52.73	51.72	49.07	53.82	Criteria 1 and 2
3	29	48	23	65.71	64.34	62.33	66.27	Criteria 2
3	28	78	24	46.78	46.68	44.13	48.95	Criteria 1, 2 and 3
3	28	72	25	47.89	47.50	43.27	49.84	Criteria 1, 2 and 3
3	26	40	26	79.94	75.15	73.08	76.54	Uncalibrated
3	25	54	27	58.43	59.06	56.60	62.33	Criteria 1, 2 and 3
3	24	108	28	39.58	40.04	36.77	41.87	Criteria 1, 2 and 3
3	24	101	29	41.68	42.01	39.10	43.91	Criteria 1, 2 and 3
3	22	87	31	44.38	45.20	41.72	47.20	Criteria 1, 2 and 3
3	22	79	32	46.16	45.80	40.18	48.47	Criteria 1, 2 and 3
3	14	79	37	44.91	45.25	42.89	47.31	Criteria 1, 2 and 3
3	43	100	38	43.26	42.75	40.33	44.65	Criteria 2 and 3
3	104	119	40	43.08	42.11	39.30	43.68	Criteria 2 and 3
3	76	101	41	48.36	45.40	41.98	47.11	Uncalibrated
3	52	73	42	51.61	53.54	49.23	55.31	Criteria 1 and 2
3	58	84	43	48.45	49.66	45.50	52.80	Criteria 1 and 2
3	38	90	44	45.15	44.15	39.88	46.21	Criteria 2 and 3
3	27	67	45	49.88	50.04	46.51	52.74	Criteria 1, 2 and 3
3	51	113	46	42.62	43.96	39.97	45.94	Criteria 1 and 2
3	51	115	47	42.42	43.88	39.79	45.50	Criteria 1 and 2
3	57	113	48	42.91	44.01	39.86	45.88	Criteria 1 and 2
3	61	114	49	42.97	44.07	39.98	46.10	Criteria 1 and 2
3	46	106	50	42.79	44.21	39.00	45.47	Criteria 1 and 2
3	109	90	51	46.82	46.99	43.46	48.56	Criteria 1, 2 and 3
3	11	28	52	103.94	109.42	107.80	110.46	Uncalibrated
3	8	99	53	37.28	37.69	34.04	39.55	Criteria 1, 2 and 3
3	6	49	54	63.50	61.92	55.54	65.23	Criteria 1 and 2

Table H-1. (Continued) Steady-State Calibration Results.

Layer	Row	Column	ID	SS Value	Mean	Minimum	Maximum	Results
3	4	95	55	36.21	37.15	32.77	39.47	Criteria 1, 2 and 3
3	3	37	56	78.54	87.24	81.95	89.83	Uncalibrated
3	3	87	57	34.29	35.60	30.17	38.71	Criteria 1 and 2
3	3	91	58	34.84	34.75	29.85	37.63	Criteria 1, 2 and 3
3	3	90	59	34.46	34.53	28.99	38.49	Criteria 1, 2 and 3
3	14	69	61	49.27	50.06	44.45	52.59	Criteria 1, 2 and 3
3	89	80	63	49.69	47.85	44.90	49.12	Uncalibrated
3	88	53	64	79.73	82.20	77.25	84.56	Criteria 2
3	49	19	66	120.43	122.94	116.75	125.31	Criteria 1 and 2
3	38	17	67	126.65	128.83	124.63	130.12	Criteria 2
3	34	27	68	117.81	126.60	123.11	128.01	Uncalibrated
3	73	125	69	43.03	43.66	40.08	44.78	Criteria 1, 2 and 3
3	10	133	70	27.03	27.27	25.54	29.08	Criteria 1, 2 and 3
3	94	128	71	43.17	44.86	38.79	45.49	Criteria 1 and 2
3	128	131	81	44.33	45.73	42.09	47.17	Criteria 1 and 2

Number of nodes within one standard deviation= 35 or 66%.
Number of nodes within range = 44 or 83% percent.
Number of nodes where the difference is less than 1 ft = 27 or 51%.
Number of nodes meeting all criteria = 22 or 41%.

There are a few areas where the residuals exceed 3 feet. These areas seem to be associated with relatively high ground water gradients in either the SAS or the UFA.

Based on the given discussion, the model adequately simulates the water levels in the UFA.

UFA Recharge

Another calibration test is to see if the model simulates the interaction between the SAS and the UFA. **Figure H-9** is a recharge map of the UFA. It depicts areas of recharge and discharge based on the model. This map was compared with the recharge map from Tibbals (1990) report. This comparison is qualitative in nature.

An examination of **Figure H-9** indicates that most of the study area is a recharge area for the UFA. However, there are 2 major discharge areas. One are of discharge is located near the Osceola/Polk County border. This area contains portions of Lake Kissimmee, the Kissimmee River, and several large lakes. The other major discharge area is located near the eastern boundary of the study area. A review of the SAS water level map indicates that the water levels are fairly low in this area. The recharge maps from Tibbals (1990) reveals similar patterns for the discharge areas.

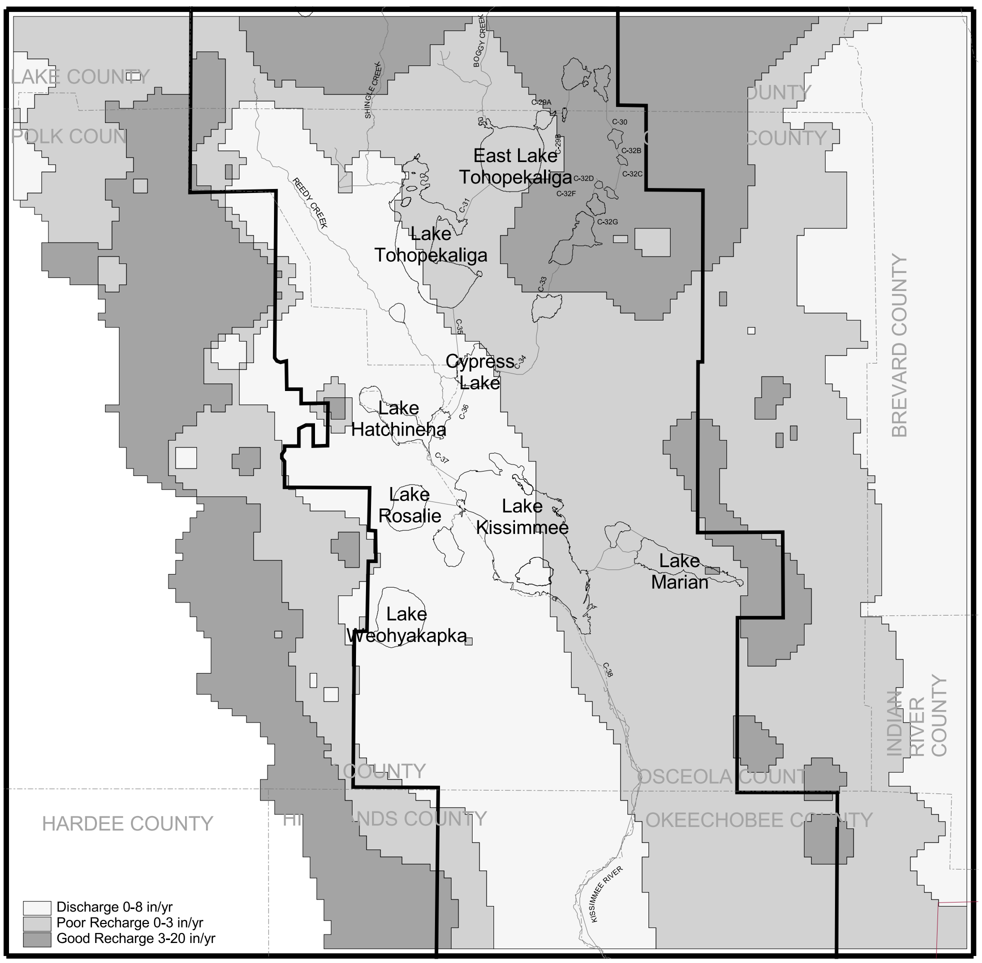

Figure H-9. Recharge Map.

According to **Figure H-9**, there is an area of high recharge located in the western portion of the study area. In this area both the SAS and UFA have fairly high water levels. However, the water levels in the SAS are higher. Also, the Hawthorn Group is fairly thin throughout most of this area. The recharge map by Tibbals has a similar pattern.

There are some differences between the two maps. **Figure H-9** depicts two other high recharge areas. On area is located in the north central portion of the study area. When compared to Tibbals (1990), the high recharge area in **Figure H-9** extends further south. Also, another high recharge area exists in the south central portion of the study are that does not have a have counter part on the recharge maps by Tibbals (1990). A review of the SAS and UFA water level in these areas indicates that the SAS is fairly high in these areas, which accounts for the extra recharge.

Overall, there is a good comparison between the recharge map by Tibbals (1990) and **Figure H-9**. Since different wells and observation points were used to make the two maps, the maps will not be exactly alike. However, a review of the SAS and UFA water level maps in conjunction with the isopach map for the Hawthorn, helps to justify **Figure H-9**.

Based on the given discussion, it can be concluded that the model adequately simulates the flows between the SAS and the UFA. It can be concluded that the estimated SAS water levels and the Vcont for the Hawthorn Group are reasonable.

Volumetric Budget

Table H-2 and **Figure H-10** present the results of the budget analysis. According to Table 2, $5.44*10^7$ ft^3/d enters the model and leaves the model area. The volumetric error is 0.53%.

Table H-2. Steady-State Withdrawal Rates.

Parameter	Flow Rate (million ft^3/day)
Constant Head (input)	54.441
Constant Head (output)	19.611
PWS Withdrawal (output)	7.262
Agricultural Withdrawals (output)	10.124
Non-SFWMD Withdrawals (output)	17.130
Input – Output	0.288

Percent Discrepancy = 0.53%

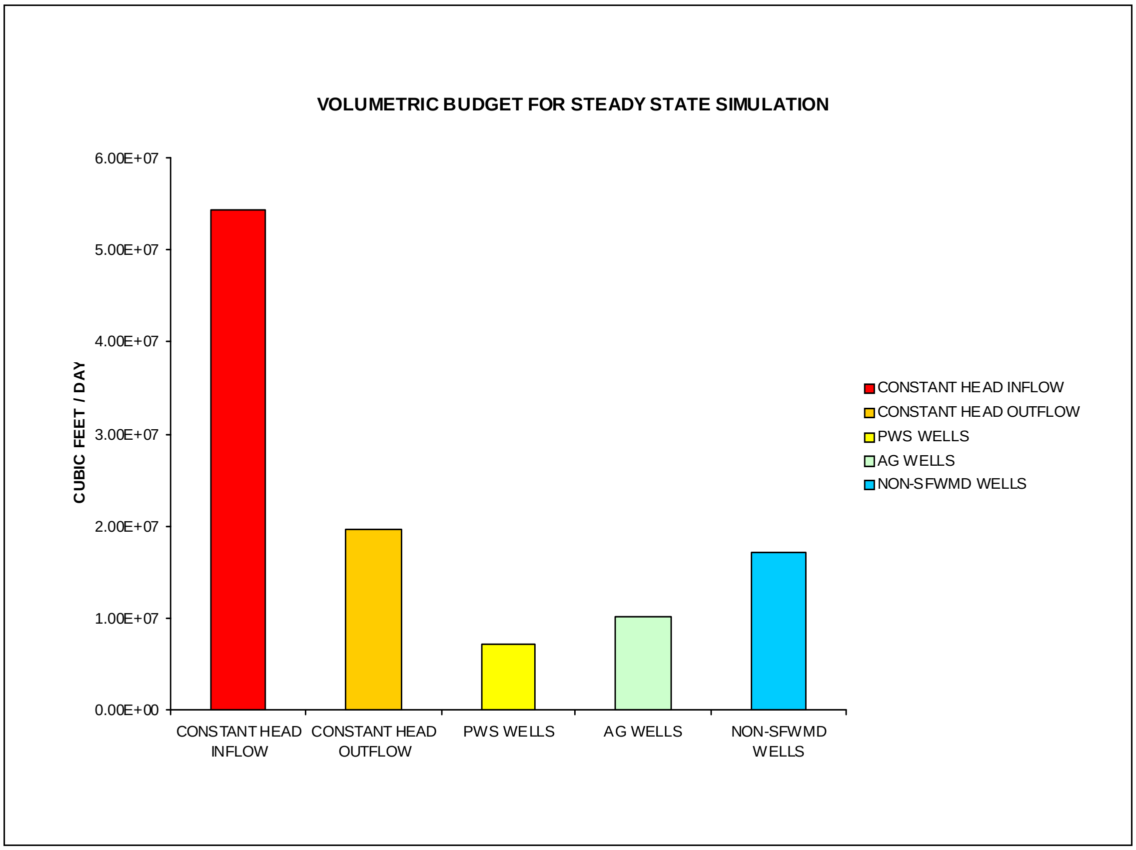

Figure H-10. Volumetric Budget for Steady-State Simulation.

Sensitivity Analysis

A preliminary sensitivity analysis was done for the KB Water Supply Plan. **Table H-3** presents the results from the analysis. The head changes in Table 3 only apply to layer 3.

Table H-3. Results from Sensitivity Analysis.

Parameter	Maximum Change	Average Change	Minimum Change	Standard Deviation
Starting Heads for Layer 1 increased by 2 feet	0.44	0.11	0.00	0.06
Starting Heads for Layer 1 decreased by 2 feet	0.00	-0.11	-0.44	0.06
Starting Heads for Layer 3 increased by 2 feet	2.01	1.06	0.34	0.38
Starting Heads for Layer 3 decreased by 2 feet	-0.22	-1.07	-2.00	0.39
Starting Heads for Layer 5 increased by 2 feet	1.47	0.71	0.00	0.35
Starting Heads for Layer 5 decreased by 2 feet	0.00	-0.69	-1.40	0.34
Multiply VCONT(Layer 2) by 10.0	15.03	2.28	-8.98	4.89
Multiply VCONT(Layer 2) by 2.0	1.89	0.21	-1.04	0.50
Multiply VCONT(Layer 2) by 0.5	0.61	-0.13	-1.33	0.30
Multiply VCONT(Layer 2) by 0.1	1.19	-0.27	-3.02	0.62
Multiply VCONT(Layer 4) by 10.0	1.57	-0.05	-1.01	0.21
Multiply VCONT(Layer 4) by 2.0	0.45	-0.03	-0.43	0.09
Multiply VCONT(Layer 4) by 0.5	0.60	0.04	-0.38	0.10
Multiply VCONT(Layer 4) by 0.1	1.94	0.13	-1.01	0.32
Multiply Kh of UFA by 2.0	3.88	0.05	-0.61	0.29
Multiply Kh of UFA by 0.5	0.87	-0.06	-6.64	0.38
Multiply T of LFA by 5.0	0.46	-0.02	-0.33	0.05
Multiply T of LFA by 2.0	0.27	-0.01	-0.19	0.03
Multiply T of LFA by 0.5	0.28	0.01	-0.42	0.05
Multiply T of LFA by 0.2	0.74	0.03	-1.13	0.12
Multiply all pumpage by 1.30	0.00	-0.07	-2.66	0.13
Multiply all pumpage by 1.10	0.00	-0.02	-0.89	0.04
Multiply all pumpage by 0.90	0.88	0.02	0.00	0.04

The starting heads for layers 1, 3, and 5 were each changed by ±2 feet. According to Table 3, the model is most sensitive to changes in the starting heads for layer 3. It is the least sensitive to the starting heads for layer 1.

The sensitivity analysis for Vcont was examined by varying the vertical conductivity of layers 2 and 4. The model is more sensitive to the vertical conductivity of layer 2 that it is for layer 4.

Multiplying and dividing the hydraulic conductivity by a factor of 2 has some effect on the model. The average heads changes are small 0.05 feet and -0.06 feet respectively. However, the maximum and minimum changes for doubling the starting heads are 3.88 feet to -0.61 feet respectively; and the results of halving the hydraulic conductivity are 0.87 feet to -6.64 feet respectively.

According to **Table H-3**, doubling and halving the hydraulic conductivity for layer 3 affects the model more than doubling and halving the vertical conductivity for Layer 4.

Altering the transmissivity for layer 5 had little impact on the model.

Altering the pumpage by factors of 1.3, 1.1, and 0.9 had little impact on the model.

Conclusions and Recommendations

1. There is a good correlation between the averaged water level and the steady-state water levels. Also, the model acceptably simulates the flows between the SAS and the UFA.
2. District staff should finish the modeling process. This includes completing the QA/QC procedures and preparing the final documentation. Also, the reconnaissance work for the model should be documented.
3. From the preliminary sensitivity analysis, the model is most sensitive to changes in the starting heads of layer 3, the hydraulic conductivity of layer 3, and the vertical conductivity of layer 2. District staff should calculate the relative sensitivities for these parameters. Relative sensitivities allow comparison across parameters.
4. Future work in the Osceola area should include installing more observation wells in the LFA, testing the vertical conductivity of the MCU, and analyzing the relationship between the water levels of the UFA and LFA.
5. The model is more sensitive the vertical conductivity of Layer 2 than of layer 4. Future work in the study area should include testing the vertical conductivity of layer 2. District staff should also examine the relationship between the lakes in the study area and the water levels in the UFA.

6. Prior to developing a transient model for the Upper Floridan, the District should develop a model of the SAS.
7. District staff should calculate the relative sensitivities for the parameters used in the sensitivity analysis. This will allow comparison across parameters.

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II. GLADES, OKEECHOBEE, AND HIGHLANDS (GOH) MODEL

Purpose and Scope

The purpose of the Glades, Okeechobee, Highlands (GOH) model development was to develop a calibrated steady-state three-dimensional ground-water flow model to simulate the UFA underlying the southern Kissimmee River Basin. The model developed was used to evaluate the effects of projected increases in ground water withdrawals from the UFA. Pumpage estimates from 1995, and projected pumpage estimates from 2020 were used to evaluate the effects of projected increases in pumpage. These effects are defined in terms of simulated steady-state drawdown of UFA water levels relative to 1995 conditions.

The model was developed to provide support for the development of a regional comprehensive water supply plan for the Kissimmee Basin by the SFWMD Water Supply and Planning Department.

Location of Model Area

The area encompassed by this model is located in the southern Kissimmee River Basin and surrounding areas and is shown in **Figure H-11**. Portions of Glades, Okeechobee, and Highlands counties comprise the GOH model area. For this reason, the model is commonly referred to as the GOH model. The exterior areas of the GOH model also include small portions of the following counties: Polk, Osceola, Indian River, St. Lucie, Martin, Palm Beach, Charlotte, Desoto, and Hardee counties. The extension of the model into these surrounding counties allows for more accurate modeling of conditions within the "core" of the model. Typically, with any model, the best model results are obtained away from the periphery of the model where boundary conditions tend to limit a model's flexibility to accurately mimic the natural system.

Early in the model development process, during the data collection phase, the model focused on Okeechobee County. The data coverage within Okeechobee County is consequently better than in the other areas in the model.

Aquifers in the areas immediately surrounding the GOH model have previously been modeled by several different agencies. The models reviewed to aid in the conceptualization and development of the GOH model were: Butler and Padgett (1995), Lukasiewicz (1992), Planert and Aucott (1985), Murray and Halford (1999), and Yobbi (1994). In addition, a Floridan Aquifer model for Osceola, southern Orange and eastern Polk counties was being developed concurrently with the GOH model (Butler, 2000). To insure continuity of several model parameters including conceptualization, lithologic interpretation, and water level information, SFWMD staff coordinated modeling efforts.

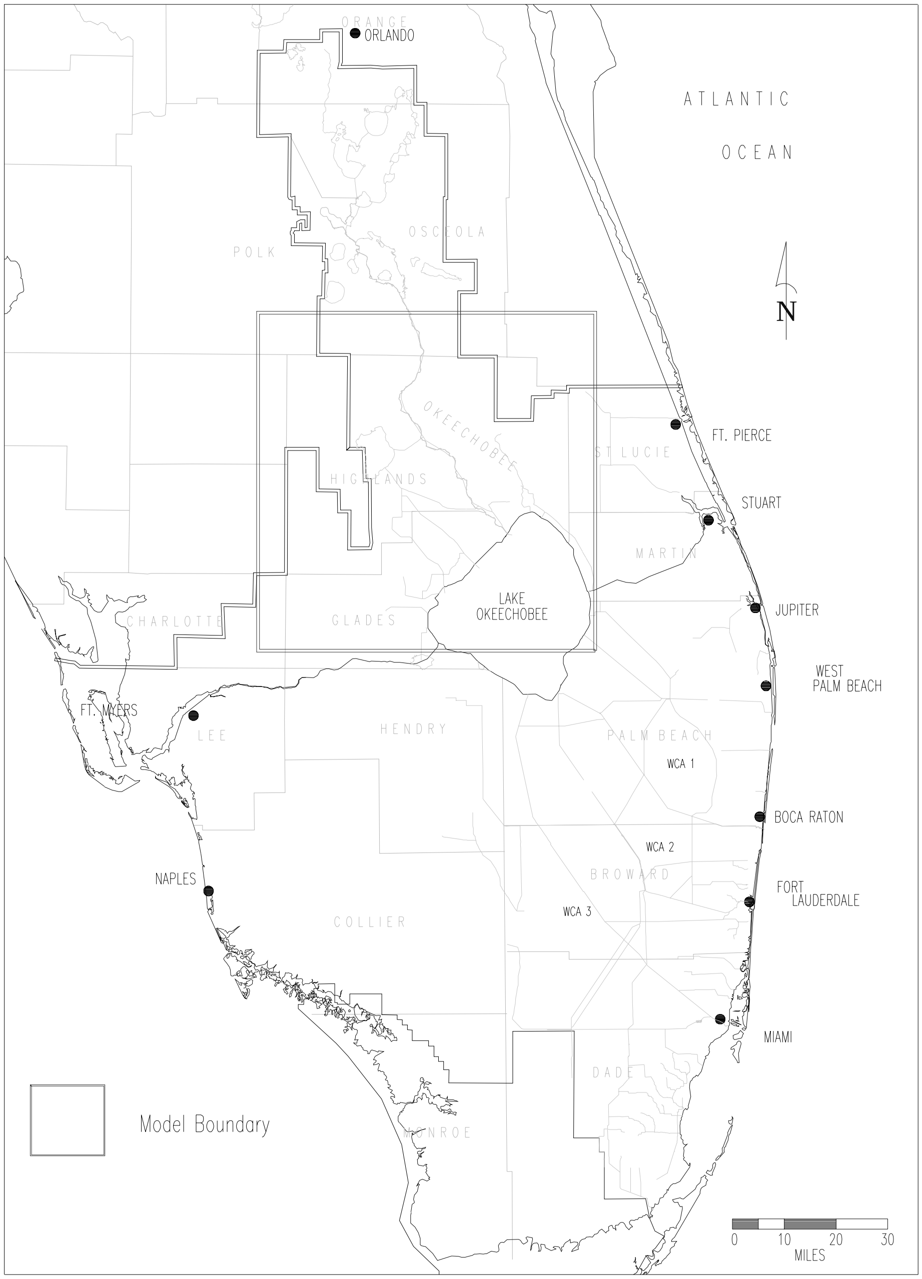


Figure H-11. Map of Study Area.

Data Collection

The area encompassed by the GOH model is one of the least populated areas of the SFWMD, with most of the population concentrated along the Lake Wales Ridge and on the northern shore of Lake Okeechobee. In addition, the agricultural development within the basin is, in general, less intensive than other areas of the SFWMD. The majority of work conducted in the area by the SFWMD has focused on surface water runoff/nutrient loading especially with regards to Lake Okeechobee; therefore, there is less historic ground water data available in the study area. In addition, available water resources have been adequate to supply existing water supply needs. Because this has not been an area of water shortage concern, there have been less historic studies focusing on the area, and consequently less data is available. Several publications proved valuable in providing lithologic and hydrogeologic data necessary for model development (Shaw and Trost, 1984a; Shaw and Trost, 1984b; CH2M Hill, 1989; Bradner, 1992; and Schiner, 1993).

Despite the publications listed above, available ground water and lithologic data was sparse in the model area. Because of this dearth, the SFWMD collected necessary data between 1994-1997 to develop a more representative GOH model. This included the construction of ten FAS wells at four sites and 52 SAS wells at 15 sites. Multiple wells were installed at most sites to monitor distinct zones, and to collect data for aquifer performance tests. The results of these efforts are unpublished to date.

Hydrogeology of the Model Area

Two major aquifer systems underlie the study area; the SAS and the FAS. Both aquifer systems are continuous throughout the study area and contain discreet production zones and/or aquifers. For the GOH model development, the SAS was depicted as one model layer, while the FAS was split into two distinct production zones separated by the MCU. **Figure H-12** depicts the generalized layering that was used for the model development

The SAS (model layer 1) yields potable water throughout the majority of the study area and is commonly used as a source of private drinking water supply. However, the transmissivity of the SAS is relatively low throughout most of the study area, and when large quantities of water are required for irrigation, commercial supply, or public water supply, the FAS is the water supply source that is most frequently utilized. Three distinct production zones are present within the SAS in the study area, these range from unconfined to semi-confined and confined.

Underlying the SAS is the upper confining unit (model layer 2) composed of a thick sequence of silty-sandy clays comprising the Hawthorn Group and overlying Plio-Pleistocene silty-clays. This unit is an aquitard that limits the interaction of water between the SAS and the FAS. Because silty-clays at the base of the SAS are contiguous with the Hawthorn Group, they are considered to be part of this confining layer. The confining unit is not synonymous with the Hawthorn Group, however the Hawthorn Group, does constitute the bulk of the layer.

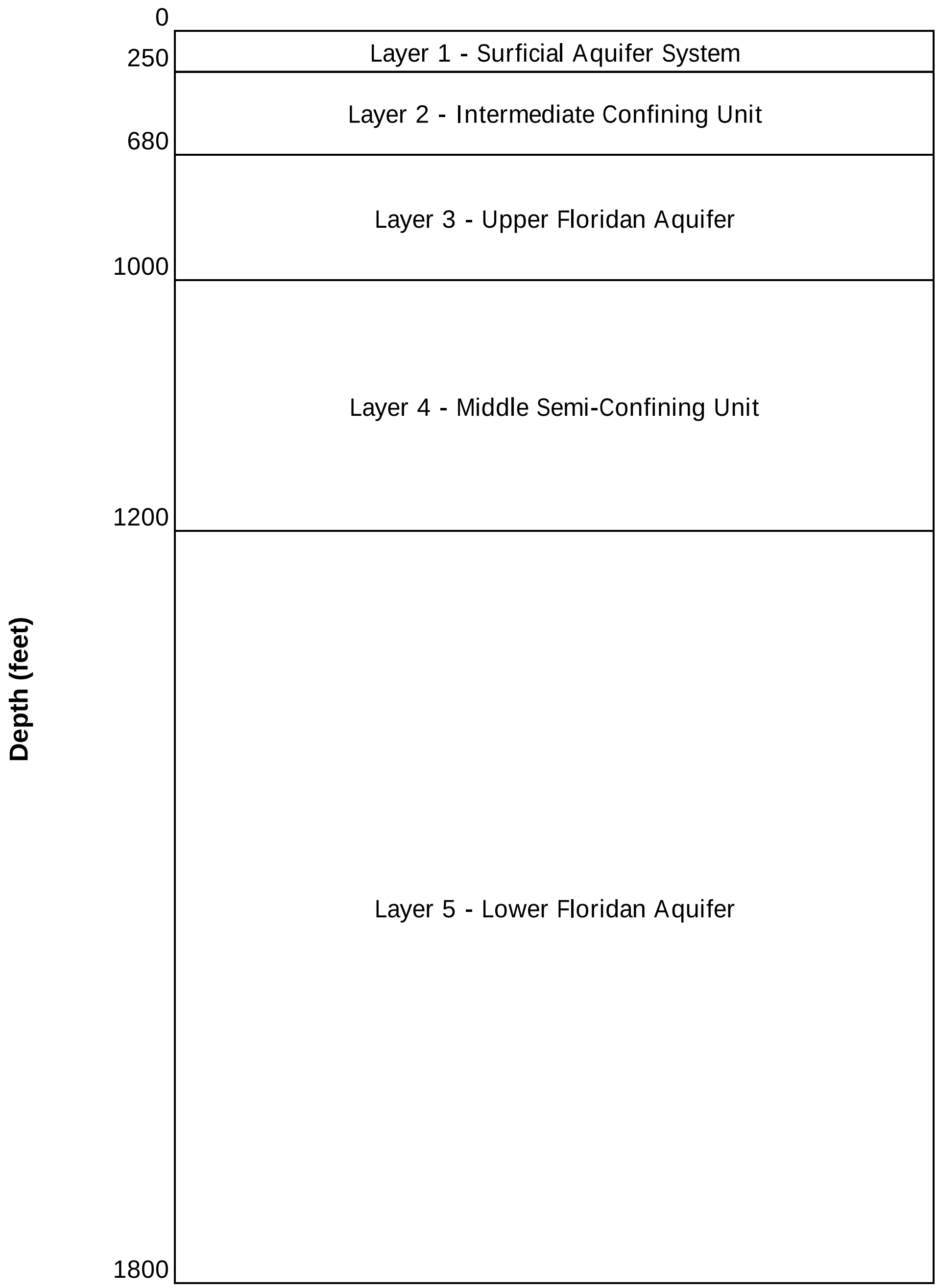


Figure H-12. Vertical Discretization of GOH Model.

Beneath the upper confining unit is the FAS. Previous models (Lukasiewicz, 1992; Planert and Aucott, 1985; Murray and Halford, 1999) developed for Central and South Florida have divided the FAS into three distinct layers, this is the approach used for the GOH model. These layers are, from top to bottom, UFA (model layer 3), MCU (model layer 4), and LFA (model layer 5).

The UFA in the model area is composed of the Ocala Group and upper, more-permeable portion of the Avon Park Formation. The decision as to how much of the Avon Park Formation was incorporated into Layer 3 was determined based on lithologic and geophysical data available from individual wells.

The UFA underlies the entire study area, and yields water that is acceptable for most uses in most areas. The presence of acceptable water quality and relatively high yields from wells has combined to make the UFA the primary source of ground water withdrawal within the study area. Water quality within the UFA degrades to the south and east. Water quality within the UFA also often degrades (primarily with increasing levels of chlorides and total dissolved solids) with depth; this is especially true to the south and east.

Immediately below the UFA is the MCU, which is a portion of the FAS with lower horizontal and vertical permeability. This unit is composed of the lower, less-permeable portion of the Avon Park Formation and acts as a semi-confining unit that separates the UFA from the LFA. Because of the depth, and the lower permeability in the MCU, few wells are drilled into or through this unit. This has limited the amount of data available to accurately assess and map the position and thickness of this layer. Based on a review of the wells with adequate data, it was decided that a uniform thickness of 200 feet would be applied across the model area. This uniform thickness was added to the base of the UFA (Layer 3). The limited number of wells penetrating the MCU and the difficulty of performing field tests to evaluate the degree of confinement, limits the amount of field data available to evaluate the degree of confinement.

The LFA (Layer 5) underlies the MCU, and is present beneath the entire the study area, however, it is not used significantly in most areas for two reasons: high cost of wells, and poor water quality. The LFA is the deepest freshwater aquifer in the study area, therefore it is more expensive to complete wells into this aquifer. In addition, the presence of cavities (both open and sand filled) complicates the drilling process and can greatly increase drilling costs.

The water quality of the LFA varies significantly throughout the study area. In general, the water quality of the LFA underlying the Lake Wales Ridge and the extreme northern portion of the study area (southern Osceola and Polk counties) is acceptable for most uses. The water quality decreases to the south and to the east in the study area to the point where it is unacceptable for most uses away from the aforementioned areas. Water quality within the LFA also generally degrades with depth in this study area. Heavy pumpage from the LFA can cause upconing of lower quality water from deeper zones within the aquifer; this is especially true to the south and east in the study area.

Both the UFA and LFA in this study area are karstic limestone aquifers whose principal productivity is from secondary permeability. This secondary permeability originates from the solutioning of limestone by water flowing through the aquifer over long periods of time. Recharge water typically follows the past of least resistance, which is generally along bedding planes, formation contacts, and fractures/faults in the rock matrix. Over geologic time, these features are enlarged enough so that large diameter conduits exist. These conduits can act similarly to a pipe network and move large volumes of water over long distances very quickly. This type of flow, often referred to as conduit flow, complicates data collection and interpretation.

If a well is drilled into the FAS (either Upper or Lower) and intersects a conduit, the well will likely be highly productive. A nearby well drilled into the exact same formation, that misses these cavities may have a productivity that is more than an order of magnitude lower. The local variability makes it difficult to predict results at a small scale (e.g. at a specific well), however, at a larger scale (e.g. a regional model), the local variability averages out and FAS models have proved accurate in the past at estimating aquifer impacts on a regional basis.

The thickness of the Hawthorn Group and Floridan aquifer sediments are generally thinnest to the north, along the northern boundary of the study area, and increase in thickness to the south. The SAS is thickest along the east central edge of the model, where there is a deeper production zone that increases the thickness of the aquifer. The SAS also thickens beneath the Lake Wales Ridge due to thick sand deposits associated with the ridge.

Model Development

Overview

The code used in this study to simulate ground water flow is the U. S. Geological Survey modular three-dimensional finite-difference ground water flow code MODFLOW (McDonald and Harbaugh, 1988). The model development process was aided significantly through the use of Groundwater Vistas (Environmental Simulations Inc., 1996), a unique ground water modeling environment for Microsoft Windows that couples a model design system with comprehensive graphical analysis tools.

The information used to determine the aquifer/confining unit parameters varied throughout the model area. In Okeechobee County the majority of the information is unpublished data collected by the SFWMD in direct support of this model development process. Previously existing data was also incorporated. Between 1992 and 1995, the District installed ten upper FAS monitoring wells at four sites, and 52 SAS wells at 15 separate sites. These wells were used for aquifer performance tests to determine aquifer parameters and for ground water level measurements that were used for model input, and/or calibration targets.

In Glades and Highlands counties, the predominant source of information for aquifer parameters was previously published data from the SFWMD, the USGS, or other Florida water management districts. Previously existing data were also used for Okeechobee County, but it was supplemented with more recent information collected for the model.

Water level data used for model calibration and for estimating constant heads and boundary conditions were from several sources. The majority of the data was collected specifically for the modeling effort, however data from both the SFWMD and the USGS were used to supplement the model specific data. Unfortunately, due to personnel and budgetary constraints, all wells were not monitored as frequently, or for as long as would have been preferred for the model development. Ideally, for the model development, it would have been preferred to have two years worth of data collected at a monthly interval for all of the wells. Many of the FAS wells had only wet and dry season water level measurements, while some of the SAS wells had less than a full year of data when the monitoring was stopped.

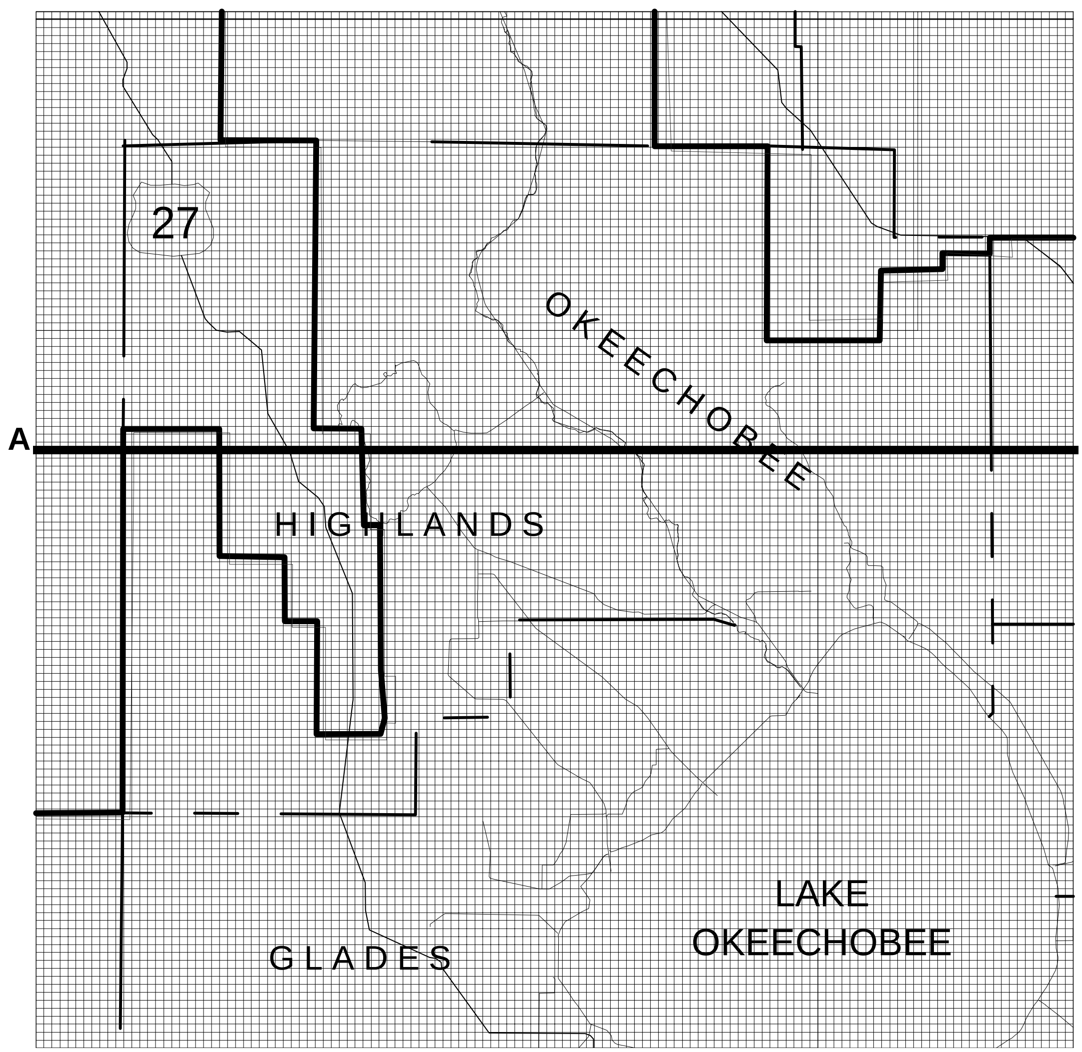
Horizontal and Vertical Discretization

The horizontal model grid consists of 130 rows by 130 columns. The grid cell size is 2,640 feet by 2,640 feet (one-half mile). The model covers an area of 4,225 square miles. The one-half mile spacing was chosen because it is fine enough to satisfactorily assess the model area without overtaxing the computers that were available at the time for the model runs. This spacing also corresponded to that used for the Osceola County model that was being developed concurrently. The availability of data for the various model parameters would also limit the usefulness of utilizing a finer model; there would be little gain in model accuracy by going to a smaller grid size. **Figure H-13** displays the model grid overlain over a base map of the area.

Vertically, the model was discretized into five distinct hydrologic units as shown in **Figure H-12**. These five units are: The SAS, the upper confining unit, the UFA, the MCU, and the LFA.

The top and bottom elevations of all layers were determined by reviewing all available lithologic and geophysical data, and selecting the elevation picks for each model layer at each well. The layer elevations and the well locations were then input into the software package Surfer for Windows (a contouring and 3-D surface mapping software package). A grid file was then generated by Surfer that had the elevations at all grid points contoured based on the existing known information. This grid file was identical to the GOH model grid file in terms of X and Y coordinates, grid spacing, and units. This allowed for the formation top and bottom elevation information to be imported directly into the model by using Groundwater Vistas. **Figure H-14** shows the top elevation for layer 3, the FAS.

This approach worked well for the upper three layers, however, a shortage of available data from the deeper formations precluded its use for the base of the MCU, the top of the LFA, and the base of the LFA. For these lower two layers, uniform thickness



A to A' shows the location of the profile depicted in Figure H-17

Figure H-13. Model Grid.

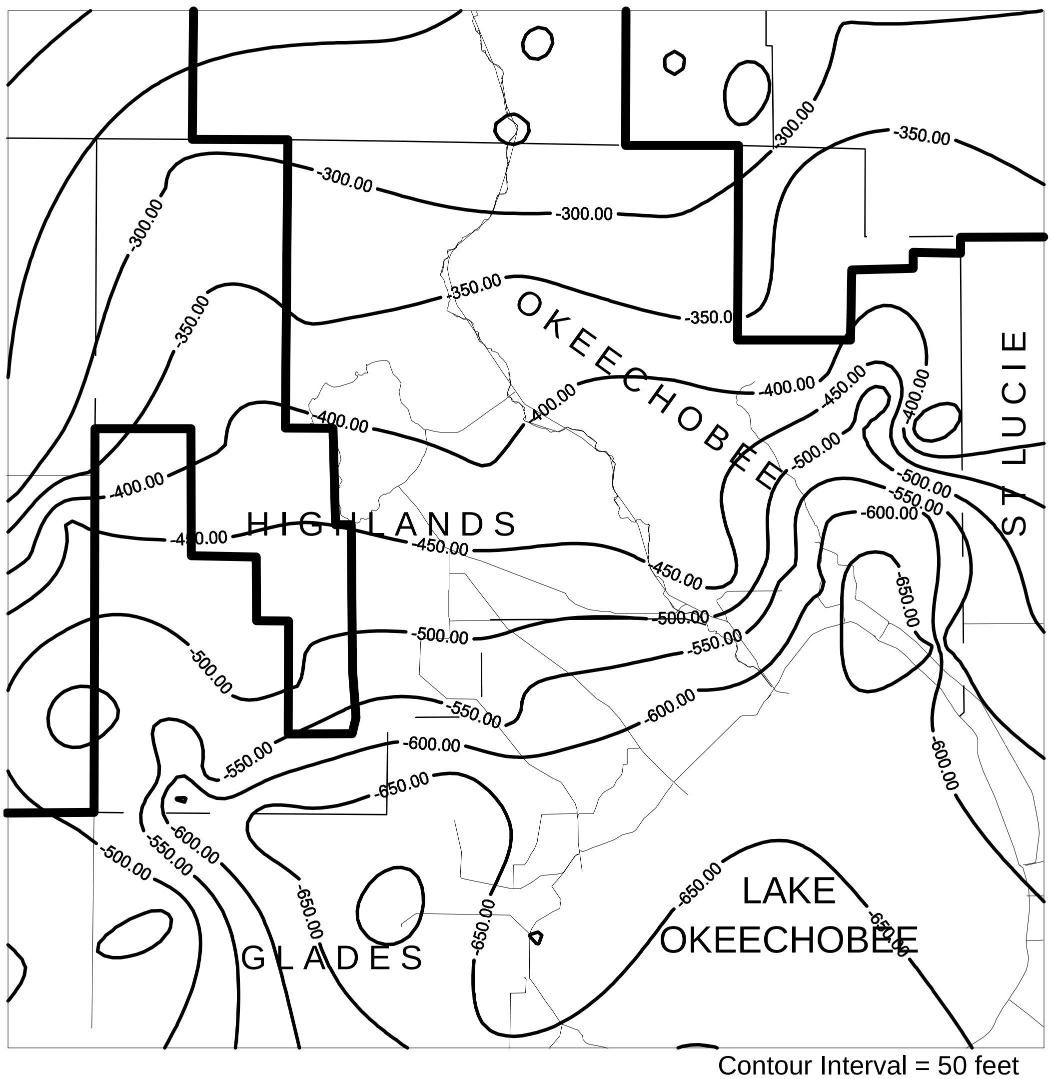


Figure H-14. Elevation of the Top of Layer Three (Top of Floridan Aquifer System).

values were assigned, a 200 ft. thickness for the MCU and a 400 ft. thickness for the LFA. These thickness values were added to the base of the UFA for these deepest layers. The 200 ft. thickness for the MCU was based on the available existing data, and the approach used by other models. The LFA is much thicker than 400 ft. However the since the LFA is being modeled as a constant head layer, the thickness of the zone does not affect the model.

The elevations of the layers that were modeled range from a high of 160 feet above Mean Sea Level (MSL) for the top of the Layer 1, to a low of 1,800 feet below MSL for the base of Layer 5.

Hydrologic Characteristics

SAS

The SAS was evaluated thoroughly during the data collection phase of the model development. There are three distinct producing horizons within the SAS that are present within various portions of the study area.

The original District plan was to model the SAS as an “active layer”. However, that scope changed in response to a shift in District resources away from this model development.

The focus of this model is the UFA. The current and projected water use from the SAS in the study area did not justify the human resources necessary to thoroughly model the SAS. Instead, it was modeled as one layer with constant head values determined from measured water levels.

During the model development process it became apparent that it would be necessary to input accurate constant head water level elevations for the SAS in order to get calculated UFA water levels to calibrate to observed UFA water levels. This is especially true in the western portion of the model area near the Lake Wales Ridge where the SAS supplies recharge to the UFA. To do this, stage data from lakes, canals, and streams were used to supplement water level measurements from SAS monitoring wells.

Upper Confining Unit

The upper confining unit of the model (Layer 2, the Hawthorn Group and overlying plio-pleistocene clays) has a significant affect on calculated heads because it, to a large part, determines the interaction (recharge and discharge) between the UFA and the SAS. MODFLOW usually requires the model developer to input the vertical leakance or V_{CONT} term. However, Groundwater Vistas utilizes a different approach and calculates the vertical leakance from the vertical hydraulic conductivity and the layer thickness. This approach is better suited for the data available for the GOH model development as accurate formation thickness information exists, but leakance information is sparse and the accuracy is questionable. The estimates of horizontal and vertical conductivity for the upper confining unit were derived from Fetter, 1980. A value of 0.01 ft/day was used for the vertical hydraulic conductivity of the upper confining unit. This value was selected because it is in the high range of values for clay (the Hawthorn Group in the model area is predominantly a clay with high sand and silt, the permeability is expected to be in the high range for clay).

UFA

Hydraulic conductivity values for the UFA were estimated by gathering all available transmissivity data (both published and unpublished). Hydraulic conductivity values (horizontal) were then calculated by dividing the transmissivity values by the aquifer thickness. The thickness of the aquifer values were determined from the lithologic and geophysical data collected at the aquifer performance test sites during monitoring well installation. The hydraulic conductivity data was, in turn, gridded and imported into Groundwater Vistas.

Vertical hydraulic conductivity was assumed to be one-tenth of the horizontal value. This is a common ratio of vertical to horizontal conductivity in sedimentary aquifers. Because grains and bedding plains orient themselves horizontally in a sedimentary aquifer, horizontal conductivity is generally ten times greater than vertical permeability. This relationship of horizontal to vertical permeability is also likely true where the majority of the permeability is due to secondary permeability for the solutioning of limestone. This solutioning generally occurs along previously established flow paths, such as along horizontal bedding planes and formation contacts. Horizontal hydraulic conductivity values ranged from a low of 2.5 ft/day to a high of 33 ft/day.

Boundary Conditions

As mentioned earlier, it was beyond the scope of this model project to develop a fully active Layer 1 (SAS). Instead, layer 1 was modeled as a constant head source, with the head values derived from the average of measured water levels. These water levels were measured from between October 1993 and September 1994 (a one year period with relatively average precipitation). Constant head values for layer 1 are displayed in **Figure H-15**.

No boundary conditions were used for Layer 2, the upper confining unit. This unit is a confining layer with low permeability. Because of this low permeability, it was assumed that the inflow and outflow along the periphery of the model would be negligible.

For Layer 3, the FAS, the predominant direction of water flow in the model area is west to east. Constant head cells were inserted along the easternmost and westernmost columns of the model. By inserting constant heads into these cells, the model can simulate lateral inflow and outflow. These constant head values were calculated by contouring the average water levels for the FAS, and then inserting the values corresponding with the easternmost and westernmost columns into the model.

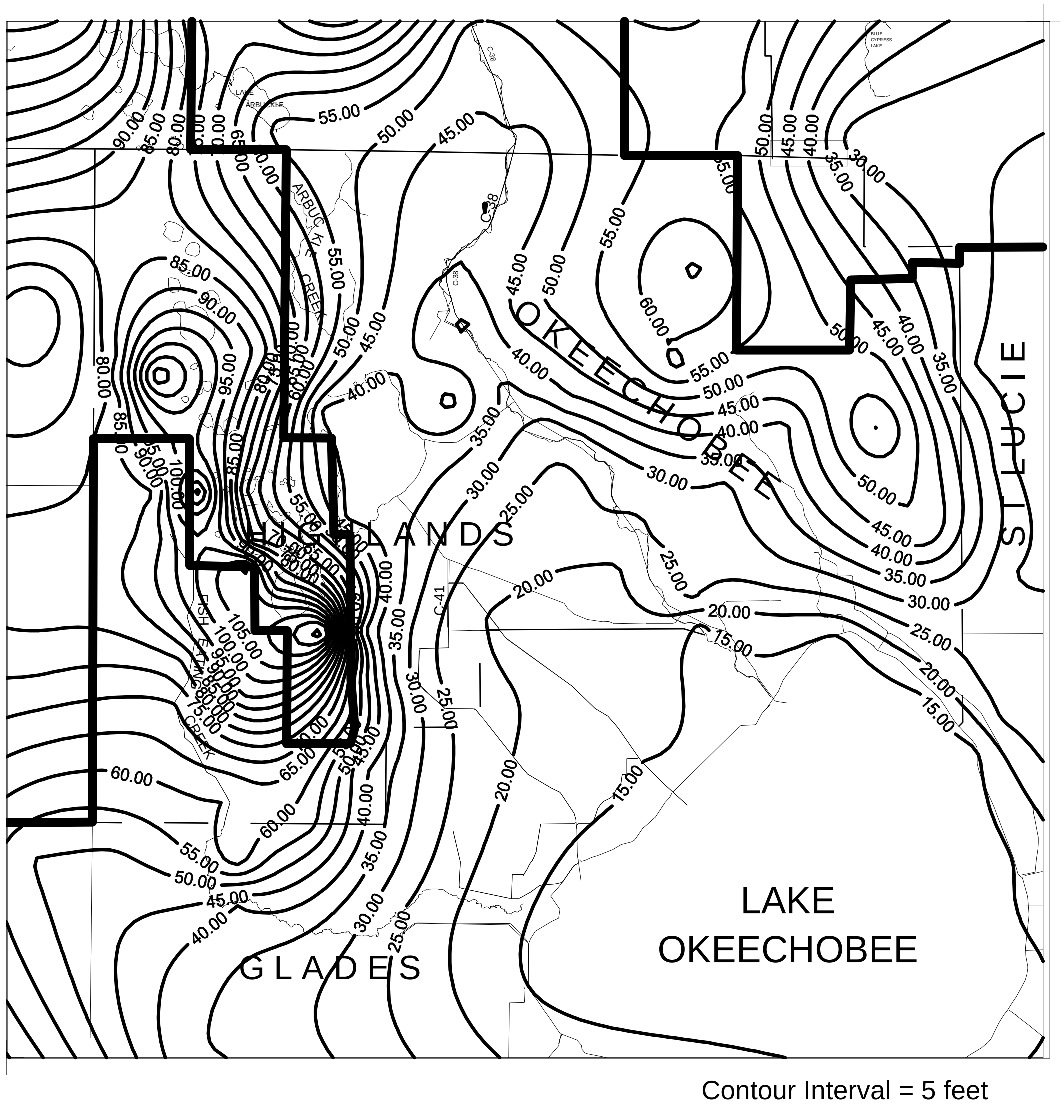


Figure H-15. Constant Head Values for Layer 1 (Water Table Elevation).

An attempt was made to run the model with Layer 5 (LFA) as a fully active layer with constant heads along only the periphery of the model, however the model would not converge despite significant efforts at adjusting model parameters within reasonable ranges. The algorithms used for ground water flow models are designed to mimic water movement through a porous media. The conduit (pipe-like) type flow present in the LFA likely allows for faster movement of water over longer distances than the model algorithms (Darcian-flow based) allow. It is believed that this is the reason the model did not converge with Layer 5 as a fully active variable head layer.

The Floridan model of St. Lucie and Martin counties (Lukasiewicz, 1992) that was previously developed by the SFWMD experienced similar difficulties. The only workable solution to this non-convergence is to make layer 5 a constant head layer. Conceptually this is appropriate, making Layer 5 a constant head layer allows the model to provide, or remove more water. This is exactly the effect that the conduit flow present in the natural system has.

Water level data for the LFA was extremely sparse, therefore these levels were estimated based on the relationship between the UFA and the LFA water levels observed at the few locations where this data was available. After correcting for the effects of variable water density in the wellbores related to variable water quality from the different aquifers, two distinct relationships were observed. In known UFA recharge areas, water levels in the UFA were approximately two feet higher than levels in the LFA. In known discharge areas, water levels in the LFA were approximately two feet higher than the levels in the UFA. These relationships were applied using water levels from the UFA to develop the constant head matrix for the LFA. Conceptually this method can be explained by the semi-permeable nature of the MCU unit that separates the LFA from the UFA. This approach was also applied by Lukasiewicz (1992) and Tibbals (1990) in their previous models. All Floridan water level measurements were used as corrected head levels to remove any density affect on water levels. Higher levels of dissolved minerals can slightly increase the density of the water, which can suppress the water levels.

Ground Water Use Estimates

As part of the 1995 model calibration effort and again for the future water use simulations, water use estimates were developed for entry into the constructed model. Development of the 1995 and the 2020 water use databases were compiled as urban and agricultural components to ease calculation. Urban use includes public water supply, landscape irrigation, golf course use, and commercial/industrial uses. Agricultural uses include crop irrigation and all other associated agricultural activities. For the development of the 1995 urban use, actual water use records were utilized where available. The remaining uses were estimated using permitted water use values. Projections of urban water use growth were made based upon U.S. Bureau of the Census and the Bureau of Economic and Business Research population projections. Commercial use and landscape increases were also estimated based upon the urban population growth.

Agricultural water use was addressed in a slightly different fashion. Estimates of 1995 crop acreage were based upon aerial photography that has been integrated into a GIS database. The identified acreage was then combined with source code, irrigation system identification and well location information found in the SFWMD regulatory database. This information, along with soils and local rainfall records, were utilized to calculate supplemental irrigation requirements using a Blaney-Criddle based model. Areas located outside of existing permit boundaries were also identified and their estimated water use applied to the most common surrounding source. Projections of 2020 agricultural acreage were made using a combination of industry, IFAS, and local grower information to estimate growth in acres for each crop type. This revised acreage was then distributed among either existing permitted facilities or to areas identified though a specific IFAS study on citrus distribution in Highland County. Details on the methods of water use estimates and projections can be found in Appendix F of the KB Water Supply Plan.

The location and aquifer of ground water withdrawals was based upon information obtained in the regulatory database. Water use from outside the SFWMD was obtained from the SWFMWD who has maintained an annual water use survey since 1990. Similar information was also obtained from SJRWMD for the eastern portions of the modeled area that are within the SJRWMD. An estimated 2,482 wells were incorporated into the model.

Calibration

Calibration is the process of adjusting parameters of a numeric model so that the model results closely approximate observed values. The GOH model was calibrated to steady-state conditions. Due to time, personnel, and fiscal constraints, a transient calibration was not performed. Steady-state can be viewed as an average condition achieved over a long period of time. It presumes that no major changes in stress rates occur during the time period.

Because of land access difficulties, personnel and budget constraints during the data collection process, the amount of water level data available for the FAS calibration was limited to 50 wells. The requirement to expand the model into Glades and Highlands counties took place after the data collection phase. Therefore, most of the data that was used in these two counties was not collected specifically for the model. Many of the FAS wells in these areas had only one wet and one dry season measurement per year.

The limited data available for these calibration points limits the calibration procedures. It was not possible to statistically evaluate water level elevations for the FAS wells as was done in the Osceola model. Calculated water levels were compared to observed water levels for the for the Osceola model, and one of the calibration checks involved determining if the calculated water level value was within one standard deviation of the measured value. The limited number of measurements from most of the FAS wells in the GOH model was not adequate for determining standard deviations for these wells consequently this type of calibration check could not be performed.

Water Level Calibration

Three criteria were used to assess if the model was in calibration:

1. Comparison of calculated to measured steady-state water level. At least 50 percent of the calculated averaged water levels should be within two feet of the calculated water levels at the same location.
2. Calculated recharge and discharge areas should correspond with known recharge and discharge areas.
3. The model generated contour map for the FAS (steady-state) should approximate the contour map generated from the average of the observed FAS water levels for the same period (1995).

The model was calibrated by comparing calculated levels from Layer 3 (UFA) to measured water levels. Average values for measured water levels from 50 monitor wells (1995 data) were compared to calculated water levels at the same locations. The differences between the two values, known as a residual, demonstrates how well the model is calibrated. Initial review of the residuals showed a clustering of high residuals along the Lake Wales Ridge indicating that the model was not well calibrated in this area. In some areas along the ridge, the calculated values were higher than the observed values. In other areas along the ridge, the observed values were higher than the calculated values.

A review of model input parameters revealed that the high residuals along the ridge were likely due to insufficient detail in the constant heads for Layer 1, the SAS, in the Lake Wales Ridge area. The ridge area has significantly more topographic relief than the other areas of the model. This topographic relief, in turn, allows for greater variability in SAS water level elevations. Water level elevation of the SAS (especially relative to FAS water levels) is one of the primary driving forces for recharge/discharge to and from the FAS.

After the high residuals in the ridge area were noted, more detail and accuracy was added to the constant head values used in Layer 1. This improvement in the constant head values for Layer 1 significantly reduced the residuals.

Many of the parameters used for the model development, especially the geologic parameters, are not exact in nature and values are often expressed in ranges. This is due to the heterogeneity of the material, the variable interpretation of some of the testing methodologies and variability of results due to the scale of measurement that is used. For instance, laboratory tests of permeability likely will not accurately account for secondary permeability.

Because of the fact that many parameters are not known precisely, it is possible in the calibration process to go back and modify any of several different model input parameters such as vertical conductivity of a given layer to try to obtain a lower residual. This type of "tweaking" of model parameters to get a better calibration might generate a model that appears to be highly accurate while in reality the model may not represent or predict the natural system any better than the earlier "non-tweaked" version of the model. For this reason, tweaking of the model to obtain lower residuals on a well by well basis was not done based solely on the residual value. However, if a high residual was noted at a well, the model and data sets were reviewed to determine the reason for the high residual. In some cases it was possible to determine what might be accounting for the high residual value, and improvements could be made to model parameters or data. An example of this was the improved accuracy and detail in the constant heads for the SAS.

Table H-4 lists the calibration results for the UFA. **Table H-5** provides summary statistics for the calibration results.

Table H-4. Calibration Results, GOH Model Layer 3, UFA.

Station Name	Model Layer	Observed Water Level	Computed Water Level	Residual
OK-1	3	41.74	44.12	-2.38
OKF-7	3	45.46	46.91	-1.45
OKF-9	3	46.03	48.48	-2.45
OKF-17	3	44.97	46.33	-1.36
OKF-18	3	46.33	48.40	-2.07
OKF-23	3	42.34	44.71	-2.37
OKF-25	3	47.04	47.14	-0.10
OKF-31	3	48.52	47.42	1.10
OKF-40	3	43.97	45.95	-1.98
OKF-53	3	38.65	42.25	-3.60
OKF-54	3	38.58	41.66	-3.08
OKF-56	3	47.42	47.48	-0.06
COOK	3	40.61	42.35	-1.74
MAXCYJ-1	3	37.90	39.96	-2.06
OKF-74	3	41.00	40.18	0.82
OKF-34	3	45.60	48.12	-2.52
OKF-81	3	43.83	46.15	-2.32
OKF-82P	3	40.77	42.43	-1.66
OKF-89	3	43.96	44.55	-0.59
OKF-94	3	44.21	45.99	-1.78
OKF-96W1	3	44.92	48.13	-3.21
HIF-3	3	51.79	49.79	2.00
HIF-4	3	46.39	44.80	1.59
HIF-5	3	47.23	52.77	-5.54
HIF-8	3	45.54	51.46	-5.92
HIF-13	3	47.03	48.36	-1.33
HIF-14	3	47.72	50.03	-2.31
HIF-16	3	62.86	64.69	-1.83
HIF-26	3	48.80	50.31	-1.51
HIF-37	3	45.76	46.75	-0.99
LYKESBRO	3	47.00	45.66	1.34
IR-373	3	38.00	39.06	-1.06
GL-155	3	47.35	47.20	0.15
PALMDALE	3	49.80	50.63	-0.83
ROMP28F	3	65.85	64.37	1.48
ROMP43F	3	81.43	79.85	1.58
729114	3	46.39	44.80	1.59
73111501	3	51.79	49.79	2.00
Dresslers	3	78.10	78.26	-0.16
PRAIREOA	3	68.45	72.58	-4.13
NARANATHA	3	78.11	78.14	-0.03
CTYSEBRI	3	75.87	78.12	-2.25
JOHNMCCU	3	75.54	76.81	-1.27
BONNETLK	3	75.96	77.99	-2.03
FLOYD	3	79.37	79.62	-0.25
ROBERTRI	3	73.69	75.12	-1.43
CLENNY	3	75.45	77.26	-1.81
OSF-42	3	44.23	46.34	-2.11
OSF-60	3	40.63	43.29	-2.66
S65-A	3	44.98	47.10	-2.12

Table H-5. Summary Statistics for Calibration.

Residual Mean	-1.29
Res. Std. Dev.	1.76
Sum of Squares	239.43
Abs. Res. Mean	1.84
Min. Residual	-5.92
Max. Residual	2.00
Head Range	43.53
Head Range/Std	0.04

Model Results

After the model was calibrated to 1995 average water level data, the 1995 well pumpage data sets were replaced with estimates of well pumpage for the year 2020 under average conditions, and later by data sets of estimated 2020 well pumpage in a 1-in-10 year drought scenario.

The 2020 public water supply well pumpage estimates were generated by applying the 1995 per capita water usage to population projections from the U.S. Census and the KB Water Supply Plan population and land use projections for the year 2020. The 1995 agricultural water usage was generated by estimating agricultural acreage from satellite imagery and then multiplying the acreage for a given crop type by the irrigation demand as estimated from the Modified Blainey Criddle Formula. The 2020 agricultural use was estimated by contacting the county agricultural extension offices to obtain projections of crop acreage changes for the year 2020 and again using the Modified Blainey Criddle Formula to estimate irrigation demand.

The model was run under each of the 2020 well pumpage scenarios and the resultant UFA potentiometric surface levels were compared to the levels generated from the 1995 well pumpage files. Maps showing the changes in the potentiometric surface of the UFA were then generated from this comparison to show where, and by how much the UFA water level may be impacted by increased withdrawals.

Figure H-16 is a three-dimensional contour map depicting the top of the potentiometric surface for the UFA generated from measurements taken in 1993. The potentiometric surface depicted in this map is very similar to the two dimensional potentiometric surface maps shown in **Figure 18** and is intended to assist the reader in visualizing the UFA potentiometric surface. The map clearly shows the mounding of the aquifer beneath the primary recharge areas in the northeastern portion of the model area. The recharge area is the topographic highs along the Lake Wales Ridge and areas extending to the north into Polk County. These topographic highs coincide with areas where the confining units above the UFA are thinner, more permeable, and frequently breached by sinkholes. These factors allow surface water and SAS water to more easily recharge the UFA in these areas.

Figure H-17, an east to west head profile passing through Lake Istokpoga along row 55 of the GOH model, shows the head levels for all five layers across the profile. Areas of recharge to the UFA area characterized by head levels in the surficial aquifer that are higher than UFA head levels, distance levels less than 90,000 on the plot and also in the range of 270,000 to 290,000. The western (left) recharge area in the plot corresponds with the Lake Wales Ridge, while the eastern recharge area corresponds with the topographic high associated with the Penholoway Terrace.

The low, 30-foot water levels for the SAS at around the 200,000 mark in the center of the graphic corresponds with the Kissimmee River floodplain. The dip in UFA water levels at the 160,000 thousand distance mark is related to UFA withdrawal by agricultural wells.

Figure H-18 depicts the potentiometric surface of the UFA as generated from the calibrated model using 1995 pumpage data sets. Based on this map, and the well pumpage data sets, it is possible to determine the affect on the potentiometric surface due to well withdrawals. There appears to be three areas where withdrawals have had a measurable, though not significant, effect on the UFA. Eastern Highlands County and northeastern Glades County have several depressions in the surface of the UFA. Northwestern Glades and southwestern Highlands counties, as well as western St. Lucie County also show slight depressions in the surface of the UFA related to agricultural withdrawal of water from the UFA. **Figure H-19** shows the surface of the UFA under average conditions in the year 2020. **Figure H-20** shows the UFA surface as it is likely to appear based on increased UFA withdrawals during a 1-in-10 year drought event. (As mentioned earlier, this scenario does not account for the decreased recharge from the surficial aquifer that is likely to occur during a drought event).

It is difficult to visualize the change in head from 1995 to 2020 by looking at **Figures H-18** through **H-20**. In order to more clearly show the change in UFA head, figures 11 and 12 were generated. **Figure H-21** shows the change in head (due to UFA pumpage) from 1995 to 2020 average conditions, while **Figure H-22** shows the change in head (due to UFA pumpage) from 1995 to 2020 under a 1-in-10 year drought situation. Note that the contours on these last two figures are in two-foot increments, while the contours on the previous maps were in five-foot increments.

Figure H-21, change from 1995 to 2020 average conditions, shows that the area most affected by increased withdrawals is the eastern Highlands and northeastern Glades areas that were already affected in 1995. **Figure H-22**, change from 1995 to 2020 1-in-10 year drought, shows similar effects, with some additional areas showing increased drawdowns. These additional areas are in southeastern Highlands and eastern Okeechobee counties.

These impacts do not appear to be significant, and will likely cause no hardships on other UFA users. Most of the withdrawal wells in these areas are located on large

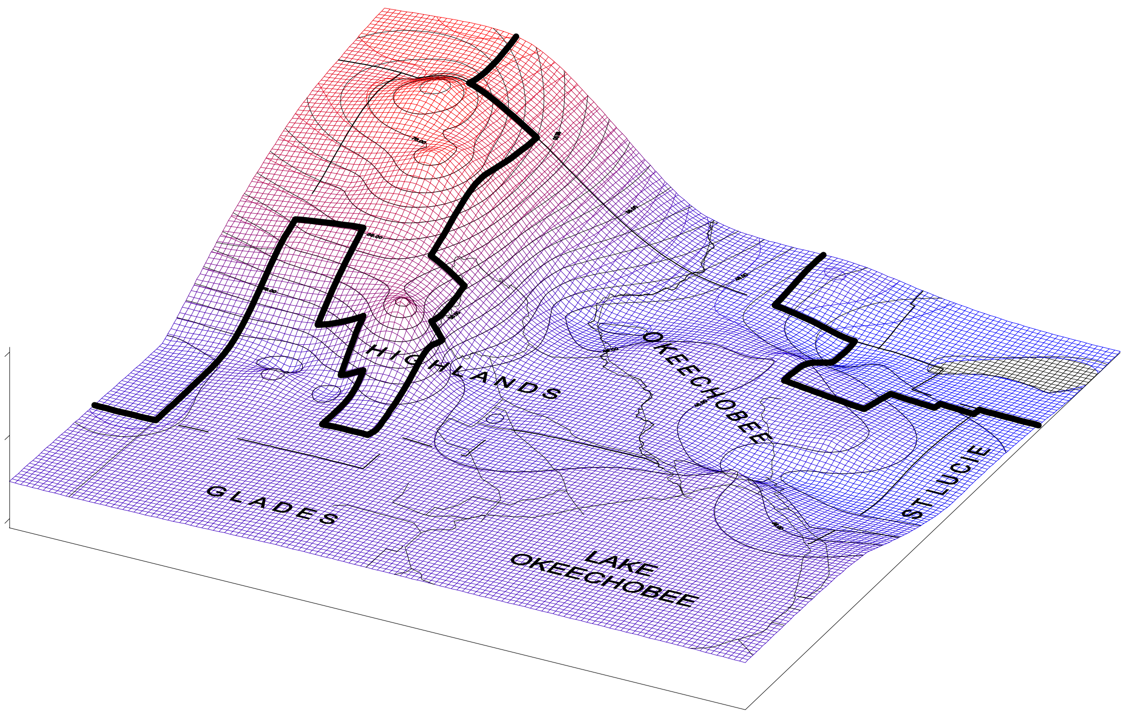


Figure H-16. Potentiometric Surface of the Upper Floridan Aquifer.

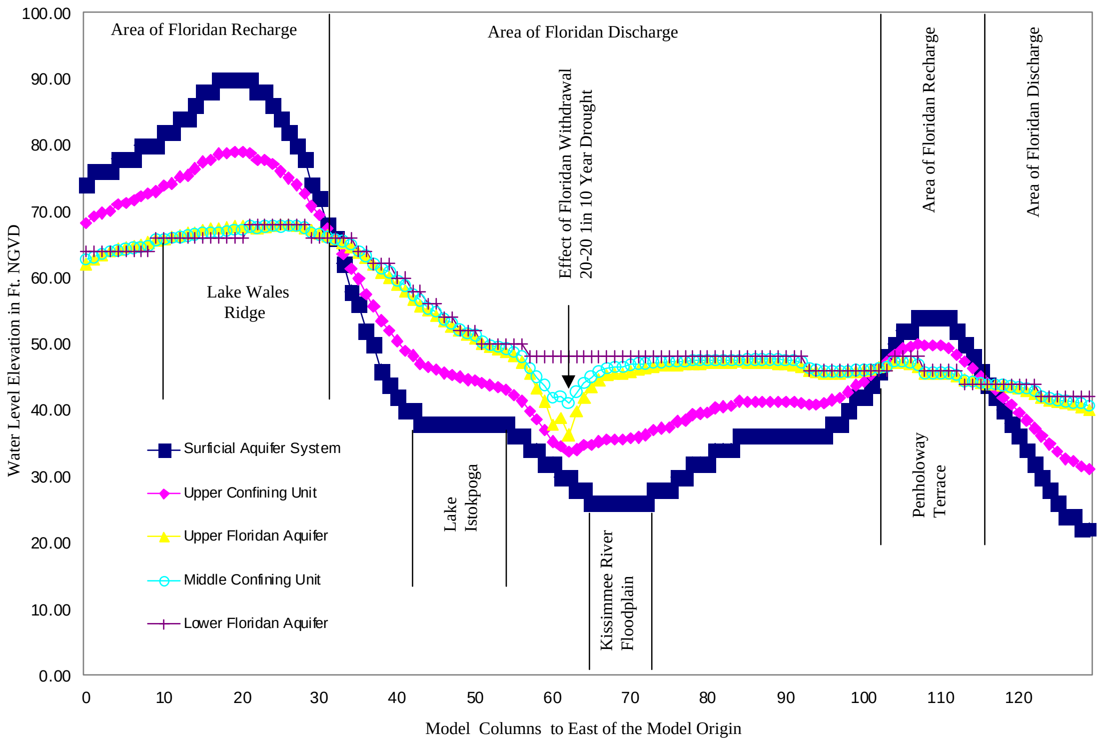
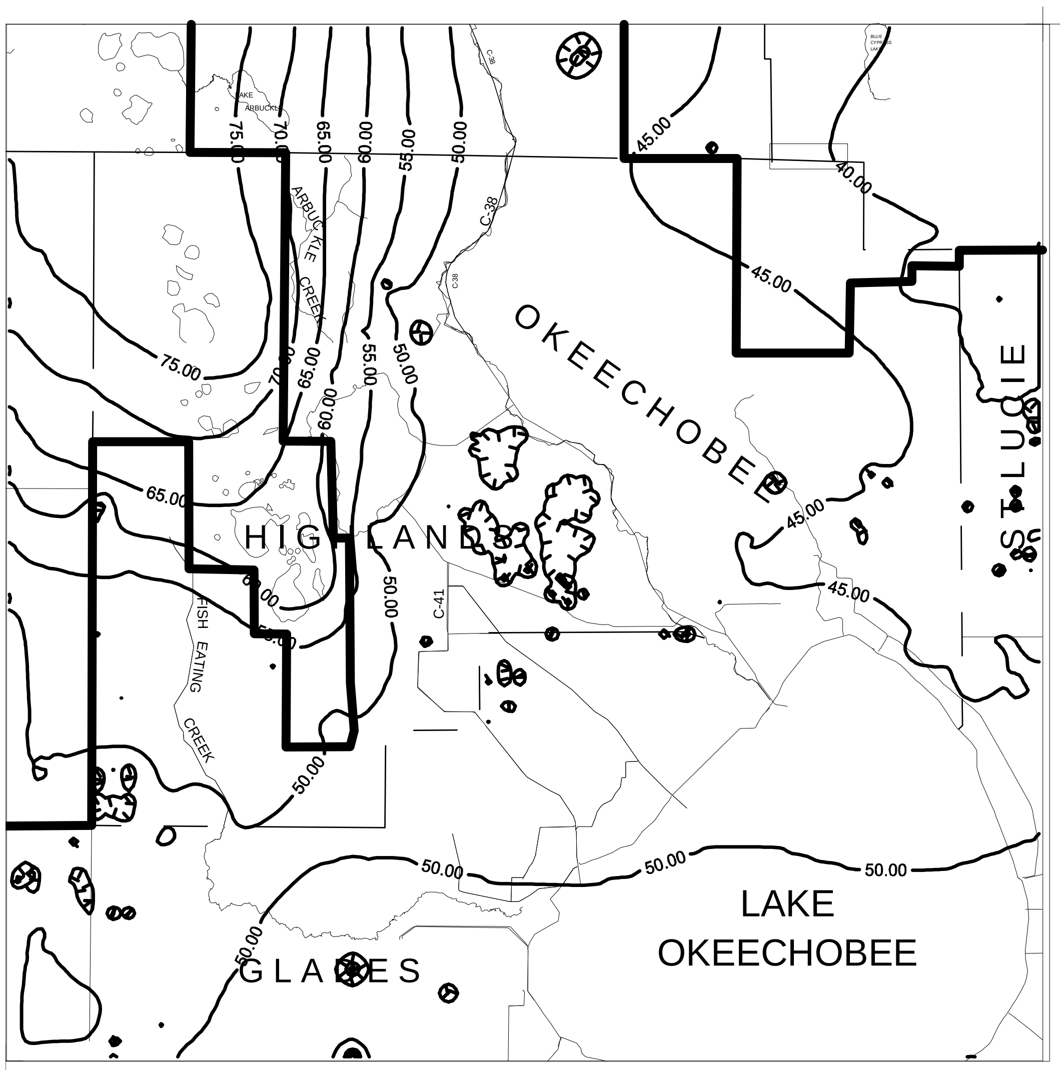


Figure H-17. East to West Head Profile Passing through Lake Istokpoga.



Contour Interval = 5 feet

Figure H-18. Potentiometric Surface of the UFA as Generated from the Calibrated Model Using 1995 Pumpage Data Sets.

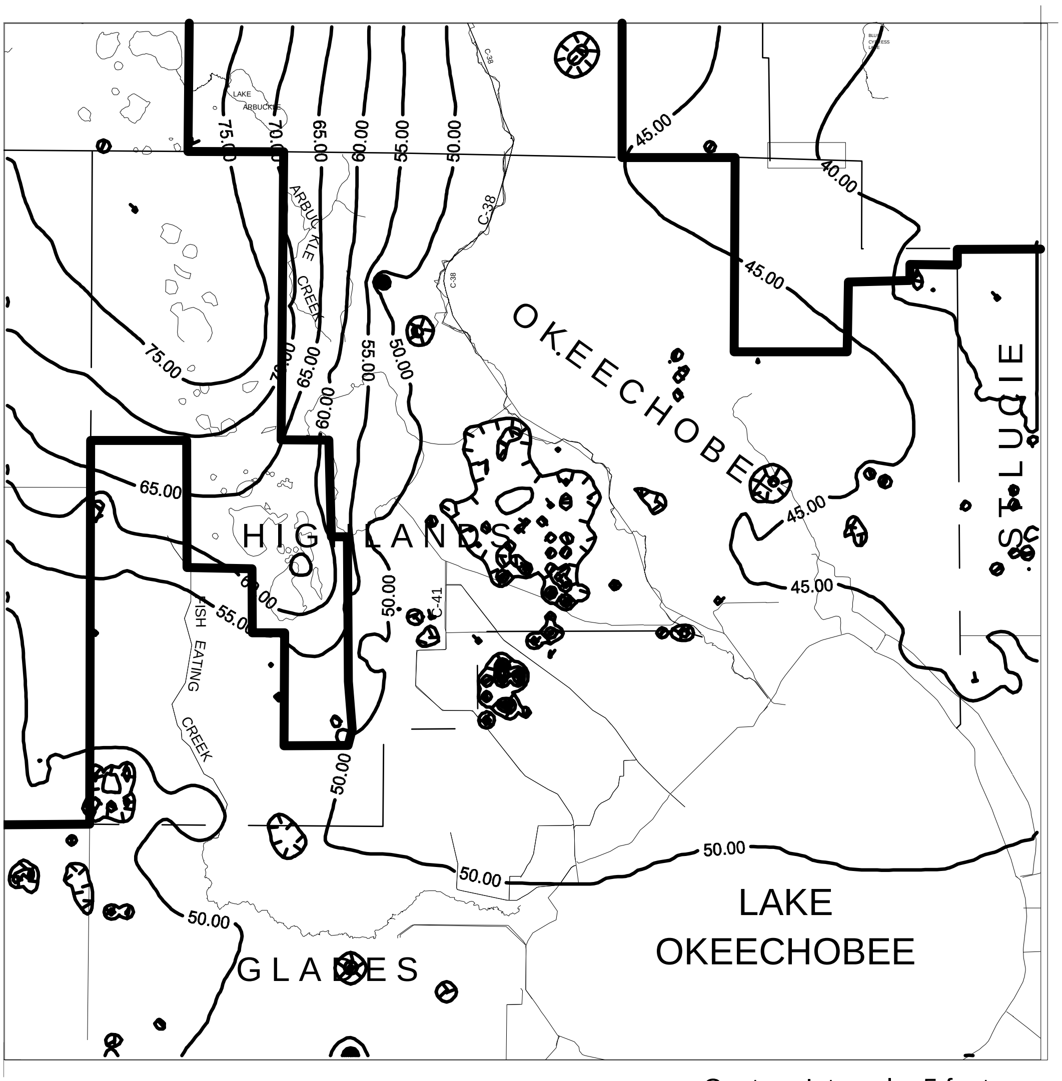
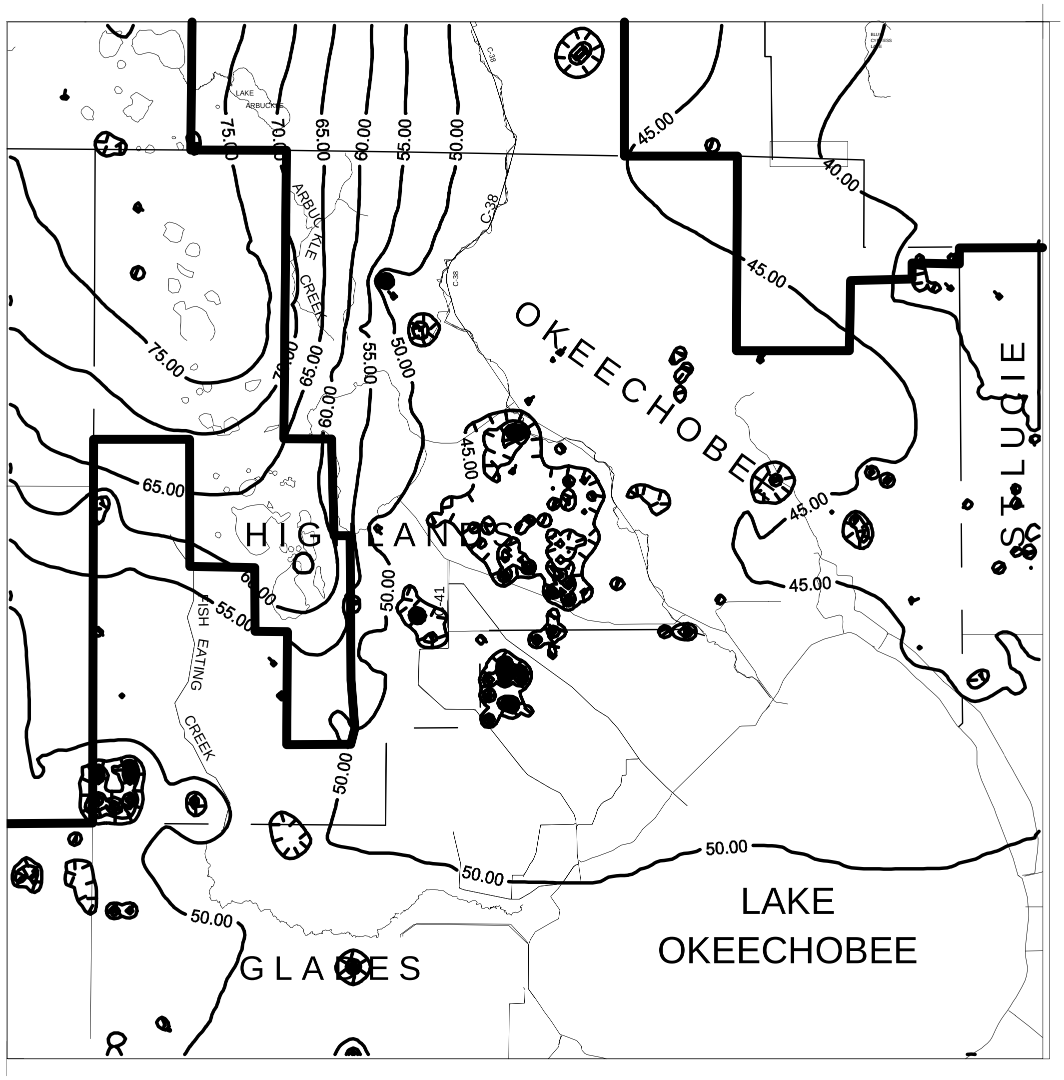
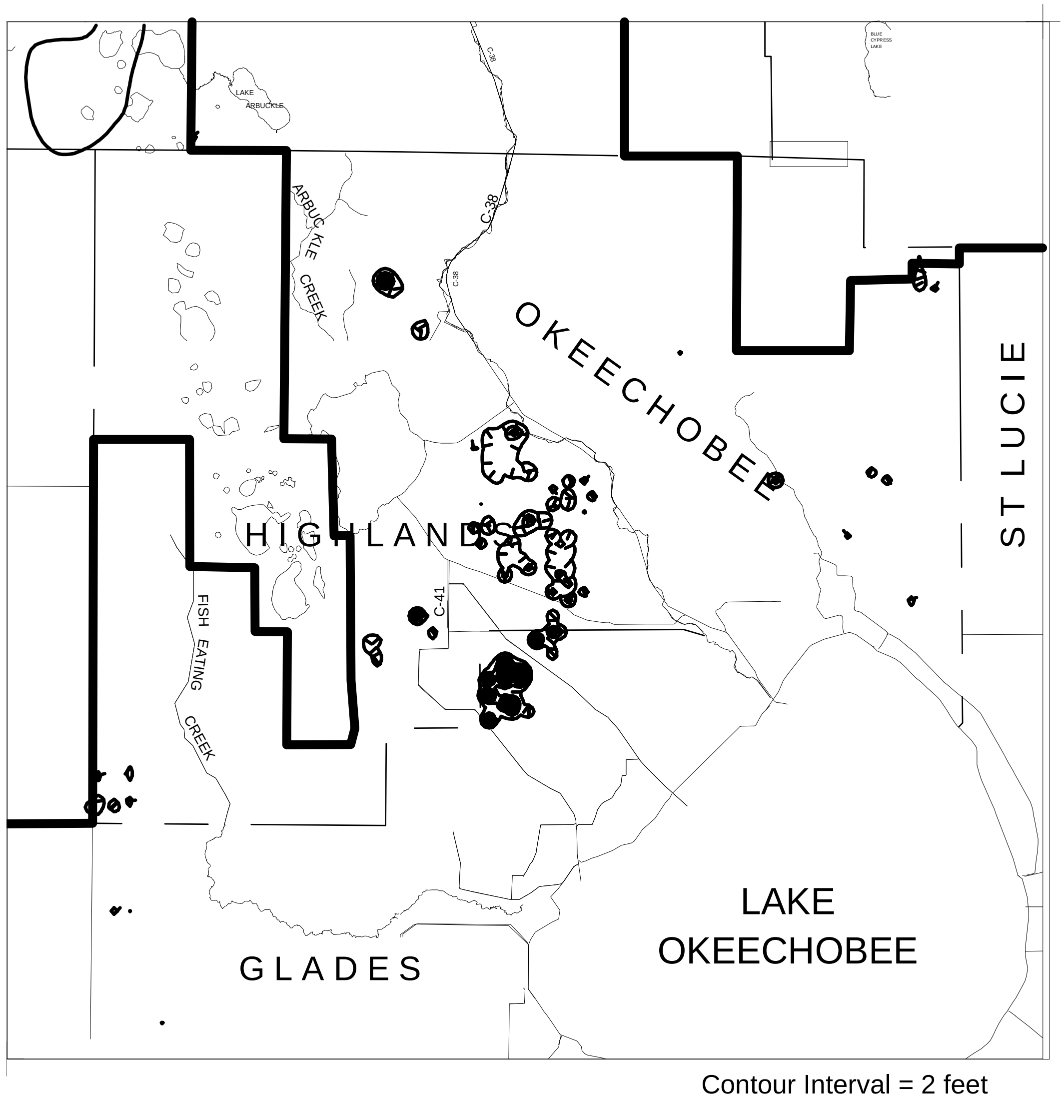


Figure H-19. Surface of the UFA under Average Conditions in the Year 2020.



Contour Interval = 5 feet

Figure H-20. UFA Surface Based on Increased UFA Withdraws during a 1-in-10 Drought Event.



Areas enclosed by contours indicate a decline in Floridan Water Levels of two or more feet.

Figure H-21. Change from 1995 to 2020 Average Conditions.

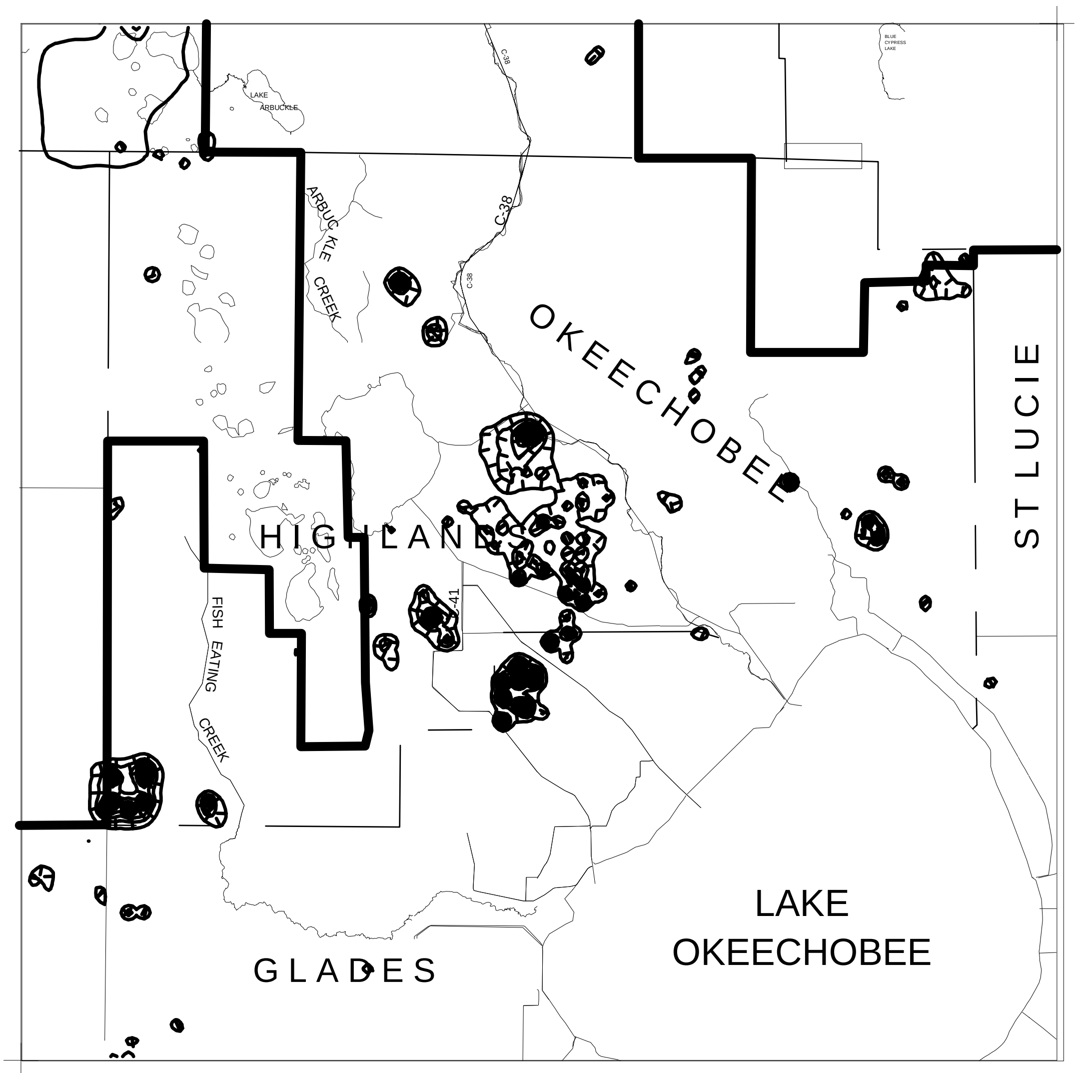


Figure H-22. Change from 1995 to 2020 1-in-10 Year Drought Conditions.

parcels of agricultural properties. Therefore, it is unlikely that off-property impacts would be noticeable to other UFA users. Also, because most of these impacts are in areas of artesian flow and the aquifer is over three hundred feet deep, there is no possibility of wells going dry. The worst possible impact even in these most impacted areas would likely be only slightly decreased natural flow from artesian wells near areas of major withdrawal.

Summary and Conclusions

The GOH model development shows that the current level of usage from the Floridan aquifer in the GOH model area does not appear to be detrimentally impacting the FAS. There are no areas of significant water level depression due to current groundwater withdrawal. The areas where there were cones of depression due to Floridan aquifer withdrawals were generally limited in extent and the amount of drawdown. The Floridan aquifer impacts in the modeled area appear to be less than in other areas of central/south Florida. This is due to the relatively low Floridan water usage (current and projected) as compared to the other areas.

The year 2020 average conditions and 2020 1 in 10-year drought projections indicate that the changes due to pumpage will be limited to only moderate increases in the extent and depth of the current cones of depression. The model indicates that the projected Floridan aquifer withdrawals for the year 2020 should not impact surface water bodies such as the lakes located on the Lake Wales Ridge. This is of course contingent upon the accuracy of water use projections. Also one very important factor to consider is that the model projections for the one in ten year drought are only for the increased drawdown due to increased well pumpage. These projections do not take into account the decreased recharge to the Floridan aquifer during a drought and the possibly increased upward leakance in areas of discharge due to lower "suppression" heads in the overlying strata. Any decline in water levels due to these factors would have an additive impact in addition to the impact from well withdrawals.

The model runs that were made did not attempt to allow for the possible decreased upward leakance due to the increased water levels in the SAS near the Kissimmee River due to the Kissimmee River Restoration project. Because Layer 1 (the SAS) is not active, it is not possible for the model to estimate the impact of the restoration on the UFA.

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Appendix I
LAKE ISTOKPOGA SURFACE WATER MANAGEMENT ASSESSMENT

Mariano Guardo, Ph.D., P.E.
Water Supply Planning and Development

I-2

LAKE ISTOKPOGA-INDIAN PRAIRIE BASIN WATER AVAILABILITY AND SUPPLY FOR 2020 DEMAND CONDITIONS

Introduction

This report was prepared in support of the Kissimmee Basin (KB) Water Supply Planning effort. The described analysis evaluates the availability of local sources in the Lake Istokpoga-Indian Prairie Basin to meet the 2020 projected demand conditions during a 1-in-10 year drought. The projected water supply demands from 1995 to 2020 are found to be met through the combined use of unused storage in Lake Istokpoga above its current minimum operation schedule and through the use of Lake Okeechobee employing pump stations G-207 and G-208. Figures cited in this report begin on page I-13.

Rainfall Data

An analysis of 26 years of data for the period of 1972 to 1997 for the Lake Istokpoga-Indian Prairie Basin indicated that an estimate of a 1-in-10 year drought event would total 36.19 inches annually. This rainfall is not distributed evenly throughout the year. As part of the rainfall analysis, the seasonal variation was also estimated. Three years from 1972 to 1997 were found (1981, 1985, and 1996) to have approximately 1:10 year drought rainfall amounts during dry and wet seasons as shown in **Table I-1**. Estimates of the seasonal nature of a 1-in-10 year drought include 11.14 inches during the dry season (November through May) and 21.68 inches during the wet season (June through October). Further details of this rainfall analysis are located at the end of this report.

Table I-1. Representative Years of 1-in-10 Year Drought Conditions for Seasonal Rainfall.

Season	Rainfall (in)			
	1-in-10 (Drought)	1981	1985	1996
Dry	11.14	9.31	11.18	14.66
Wet	21.68	23.72	25.50	21.34
MSE (in^2)	---	13.64	12.46	9.62

Mean Square Error (MSE) analysis showed that the closest rainfall distribution month by month of the 1-in-10 year drought conditions occurred in 1996 (MSE = 9.62 in^2). Since October is the last month of the wet season, its average stage was taken as initial condition for the selected years.

Lake Istokpoga Stage Data

Monthly stages for Lake Istokpoga for the period of 1972 through 1997 are shown in **Figure I-1**. **Figure I-2** shows the current regulation schedule and minimum operating level for the lake. Stage-Duration curves for Lake Istokpoga preregulation (October 1983 through March 1990) and for current regulation (April 1990 through December 1997) are shown in **Figures I-3** and **I-4**. Comparison of **Figures I-3** and **I-4** indicate that higher stages in the lake occur after the current regulation schedule was implemented in 1990.

Table I-2 shows the effect of dry conditions for 1996. The mean stage for October of the previous year (1995) is considerably higher than 1996 (almost 0.9 feet).

Table I-2. Lake Istokpoga Stage for Month of October for the Selected and Previous Years.

Mean Stages (ft NGVD)						1972-1997		
1980	**1981**	**1984**	**1985**	**1995**	**1996**	**Maximum**	**Mean**	**Minimum**
38.19	39.06	38.42	39.52	39.36	38.48	39.52	39.13	38.17

Table I-3 provides a summary of the monthly average water elevations for Lake Istokpoga during the period of the pre-1990 regulation schedule (1972-1990) and the post-1990 regulation schedule (1990-1997). The column under Line A is the elevations for flood control releases while Line B represents the current minimum operational level for the lake.

Table I-3. Summary of Monthly Average Water Elevations for Lake Istokpoga.

Month	1972-1990 Ave. Stage	1990-1997 Ave. Stage	Line A Regulation Schedule (NGVD)	Line B Regulation Schedule (NGVD)
January	39.10	39.12	39.50	38.50
February	39.08	39.11	39.50	38.37
March	38.88	39.12	39.50	38.25
April	38.34	38.96	39.50	37.75
May	37.65	38.50	39.50	37.50
June	37.45	38.35	38.75	37.50
July	37.80	38.40	38.25	37.50
August	38.21	38.55	38.25	38.00
September	38.72	38.87	38.25	38.25
October	39.07	39.28	38.50	39.00
November	39.04	39.28	39.50	38.75
December	39.05	39.16	39.50	38.50

Water Availability for 2020 Conditions

Water availability for 2020 demands and 1:10 year drought conditions were analyzed. This analysis considers two possible sources to meet the projected surface water demands. The first source is the storage in Lake Istokpoga above the current minimum operation levels as shown in column 3 of **Table I-5**. The other possible source is backpumping from Lake Okeechobee using pumping stations G-207 located on the C-41 Canal and G-208 located on the C-40 Canal. These pumps are located adjacent to structures S-71 and S-72 respectively. Each pump has a rated capacity of 60,000 GPM.

Water moved from Lake Okeechobee into the basin was not moved above structures S-70 and S-75. **Figure I-5** shows the locations of the structures and canals in this basin. Currently, pump G-207 can supply the C-41 Basin between structures S-71 and S-70, and pump G-208 can supply the C-40 basin between structures S-72 and S-75 .

The first analysis was initiated with a stage for October equal to the average stage for the months of October between 1972 and 1997 (i.e., 39.13 ft NGVD) as depicted in **Table I-5**. A detailed description of the computations is given in **Table I-4**.

An additional component of the water budget within Lake Istokpoga is its change in storage. The change in storage represents the balance of inflows and outflows coming in and leaving the lake and other components such as rainfall, evapotranspiration, seepage, aquifer recharge, etc. A general indication on how all the components affect the Lake Istokpoga storage can be evaluated by using mean stages of the lake. In this case, monthly time steps are utilized for that purpose for the three years with similar rainfall to 1:10 year dry conditions (i.e., 1981, 1985, and 1996). **Table I-3** shows the monthly estimates of the change in storage component for the three considered years for Lake Istokpoga. The average monthly values for 1981, 1985, and 1996, represent the amount of water gained (positive, inflows larger than outflows) or lost (negative, outflows larger than inflows). This factor was estimated by determining the difference in monthly mean lake stage and removing the amount of water released through S-68. The gain/loss is used to balance the stages in the lake every month after the deficit has been supplied from Lake Istokpoga and/or G-207 and G-208 pumping stations. A gain (positive value) will increase the stage in the lake for the following month in that value. On the contrary, a loss (negative value) will decrease the stage in the lake for the following month in that value.

Table I-4. Description of Computations (for Table I-4).

[1] Calculations begin in October, the last month of the wet season, where the lake has recovered and most likely will reach high stage. [2] These values represent the increase in monthly 2020 demand amounts under 1-in-10 drought conditions that remain after existing discharges from Lake Istokpoga and Indian Prairie Basin (also under 1-in-10) were assumed to be used to meet a portion of the total demand. The estimates were based upon water use estimates determined as part of the KB Water Supply Plan effort. [3] Average monthly stages of the current regulation schedule of Lake Istokpoga (line between zones B and C of Figure 2). [4] Stages at the end of the month (EOM). The initial stage is the stage in the lake assumed for the initial month (October). The deficit that could be supplied by the lake is estimated month by month without exceeding the minimum regulation schedule (column [3]). [5] Percents of the deficit that could be supplied by the additional storage in the lake without exceeding the minimum regulation. [6] Change in storage in the lake such as ET loss, unknown discharges, seepage, rainfall and inflows into the lake. [7] Volumes (capacities in the lake) at the end of the month after supplying the optimum percent of the deficit. The initial volume corresponds to the capacity in the lake for the initial stage for the month of October. These volumes are estimated from the Stage-Capacity **(Figure I-6**) equation developed for Lake Istokpoga once the EOM stage is computed. [8] Stages EOM - Minimum Regulation ([4]-[3]). a) If this value is positive, 100% of the deficit can be supplied by the additional storage in the lake without exceeding the minimum regulation. b) If this value is zero, less than 100% of the deficit can be supplied by the additional storage in the lake without exceeding the minimum regulation. The difference in deficit could be supplied by an additional source (Pumps G-207 and G-208, in this case [10]). c) If this value is negative, the lake can not supply the deficit, unless that surplus is available (e.g., deficit is negative as in August). Note that in this case the additional water (surplus) will replenish the capacity in the lake for the next month (e.g., September) increasing the capacity of August with respect to July in that surplus amount (e.g., 8,300 acre-ft). [9] Deficit supplied by additional storage in Lake Istokpoga without exceeding the minimum regulation schedule. [10] Remaining deficit supplied by Pumps G-207 and G-208. [11] Number of days per month of G-207 and G-208 operation based on 270 cfs combined capacity and 24 hours of operation per day.

Table I-5. Water Deficit for 2020 Conditions (1-in-10 Dry) Supplied by Available Storage in Lake Istokpoga and G-207 and G-208 Pump Stations (from Lake Okeechobee). Initial stage = Average Oct. (72-97).

[1] Month	[2] Deficit (acre-ft)	[3] Min. Stg. Reg. Sch. (ft NGVD)	[4] Stage EOM (ft NGVD)	[5] % Def from LI	[6] Gain/Loss of Storage (ft)	[7] Vol LI EOM (acre-ft)	[8] Stg EOM Reg. Sch. (ft)	Supply (acre-ft) [9] from LI	Supply (acre-ft) [10] G207_8	[11] # Days per Month
Initial Stage			39.13				Initial Volume			
October	-274	38.83	39.50	100	0.39	178,530	0.7	0	0	0
November	5,174	38.75	39.50	20	0.03	188,787	0.77	1,033	4,131	7.7
December	4,148	38.54	39.33	50	-0.12	187,582	0.79	2,074	2,074	3.9
January	6,630	38.45	39.22	33	-0.04	181,920	0.77	2,188	4,442	8.3
February	7,878	38.35	39.14	22	-0.02	179,092	0.79	1,733	6,145	11.5
March	12,353	38.18	38.92	22	-0.12	175,732	0.74	2,718	9,635	18.0
April	9,547	37.75	38.63	24	-0.21	169,967	0.88	2,291	7,256	13.5
May	7,759	37.50	38.04	22	-0.53	162,181	0.54	1,707	6,052	11.3
June	6,128	37.50	37.87	13	-0.15	146,040	0.37	797	5,331	9.9
July	1,364	37.67	38.12	40	0.38	141,152	0.45	546	818	1.5
August	-8300	38.03	38.60	100	0.27	151,769	0.57	0	0	0
September	3,966	38.46	39.04	50	0.51	160,787	0.58	1,983	1983 ,	3.7

Figures

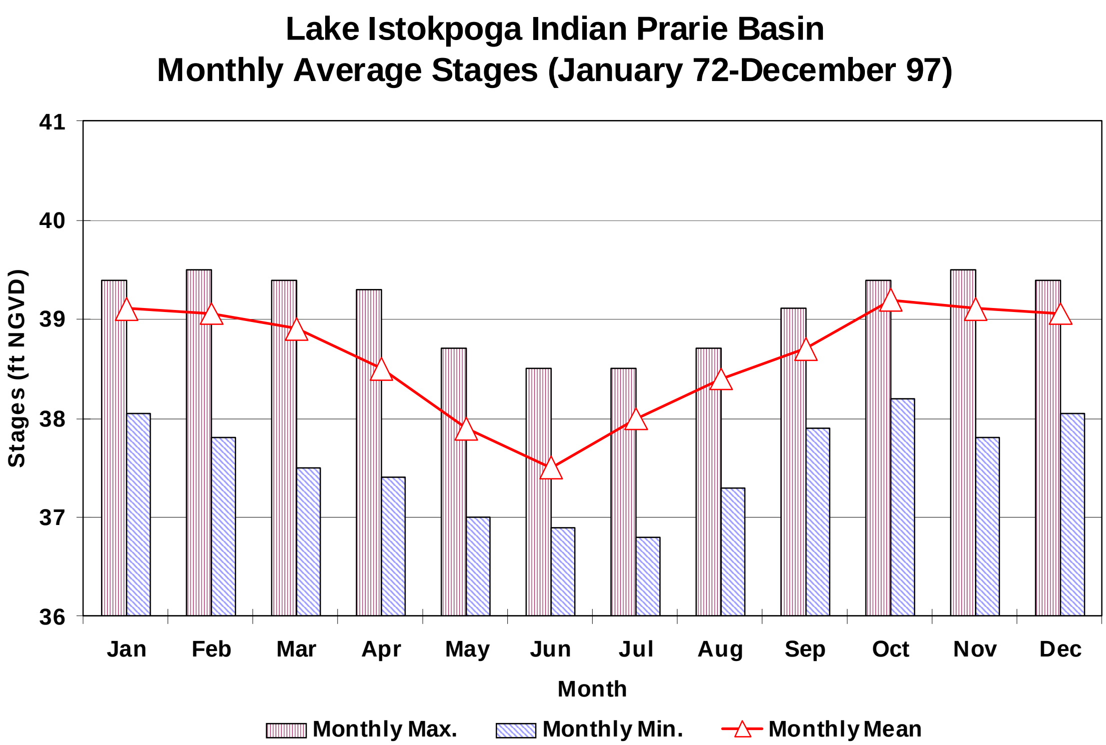
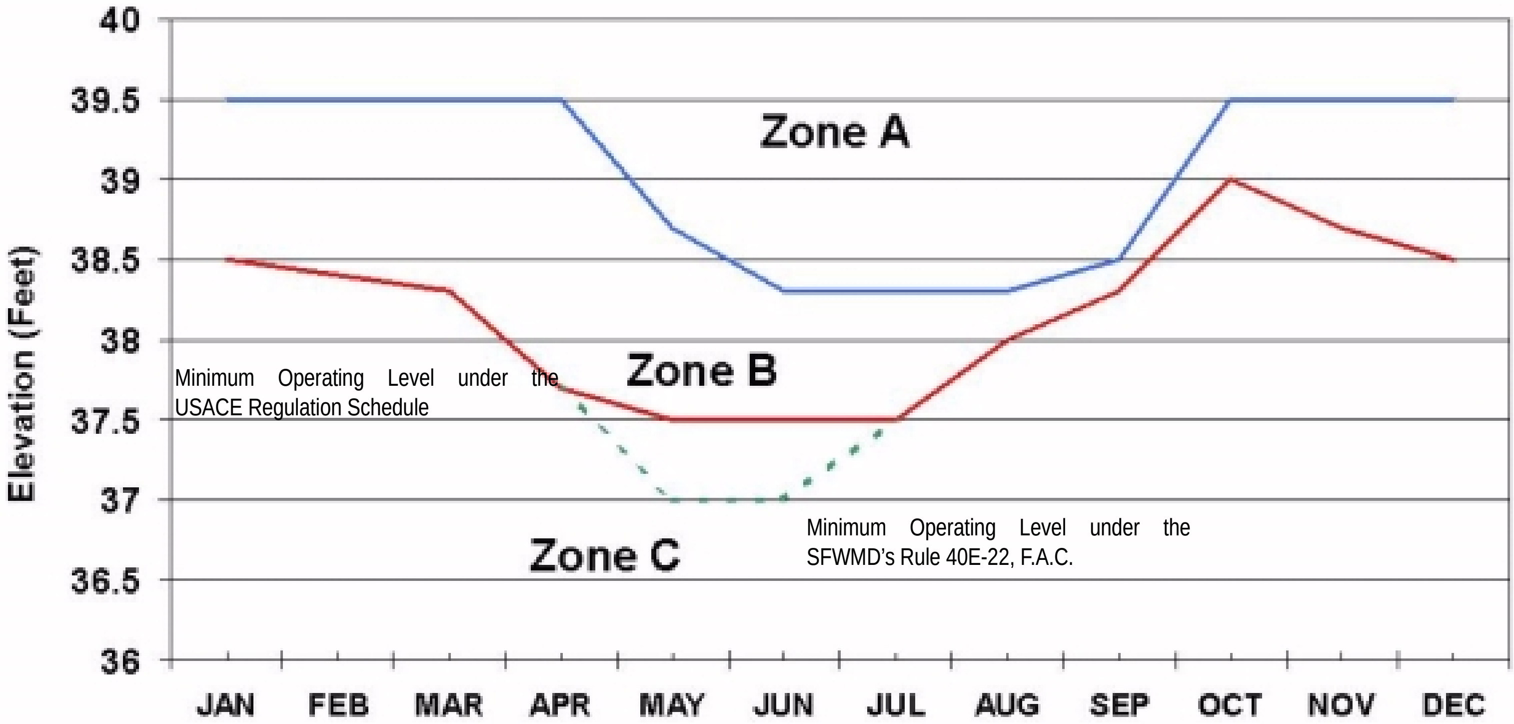


Figure I-1. Monthly Stages for Lake Istokpoga for the Period of 1972 through 1997.



Zone	Releases
A	Through all outlets
B	For agricultural demands only
C	No releases to be made

Figure I-2. Current Regulation Schedule and Minimum Operating Level for Lake Istokpoga.

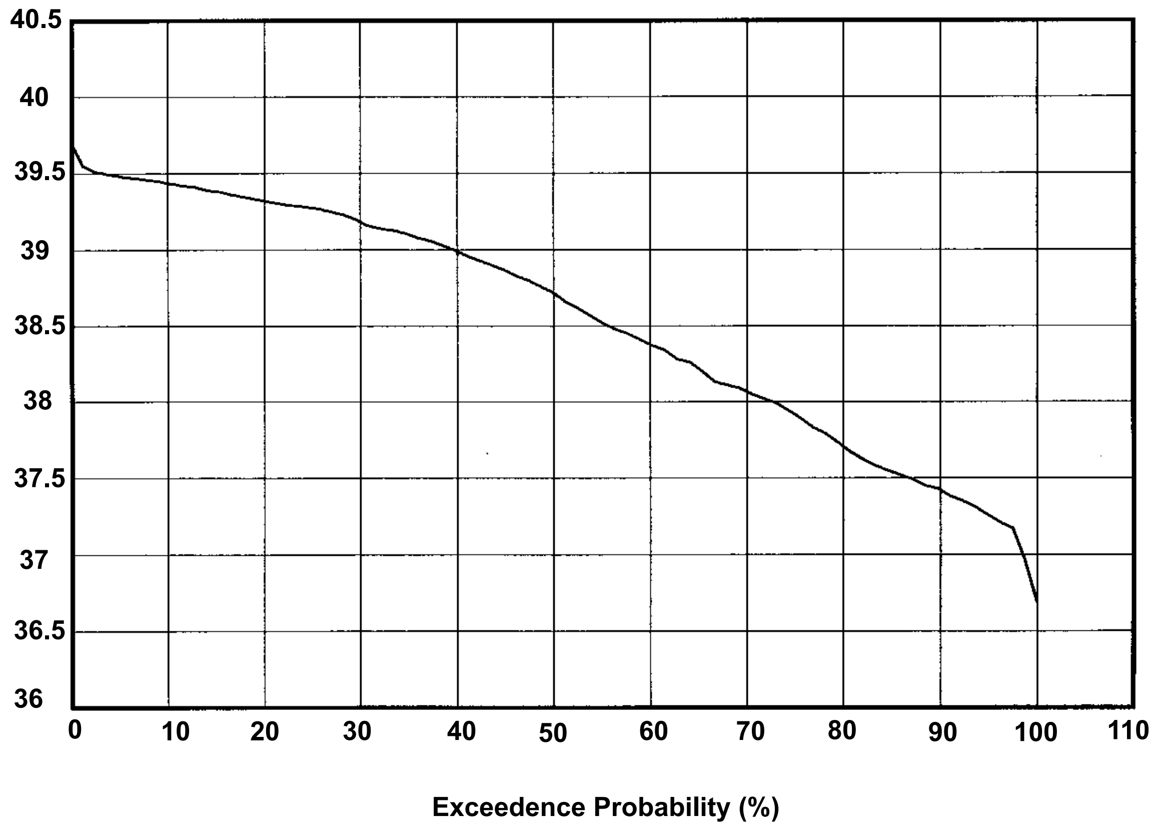


Figure I-3. Stage-Duration Curve for Lake Istokpoga (prior to current regulation schedule, October 1983 through March 1990).

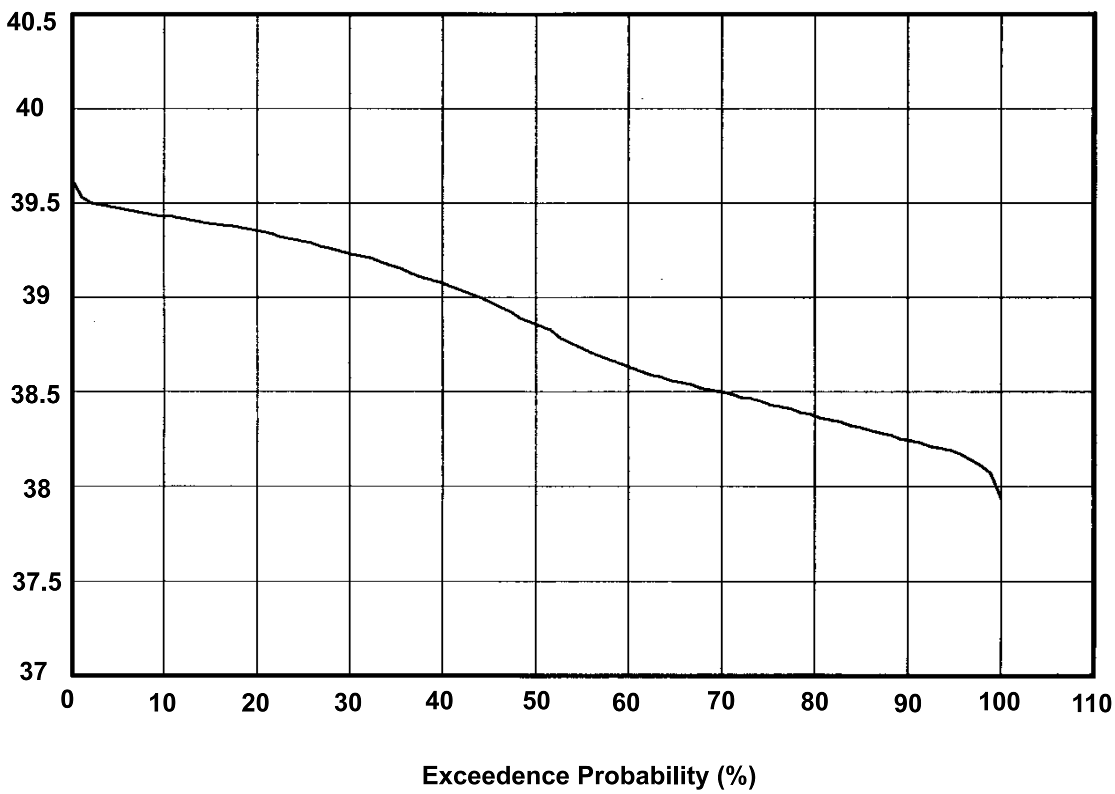


Figure I-4. Stage-Duration Curve for Lake Istokpoga (current regulation schedule, April 1990 through December 1997).

Figure I-5
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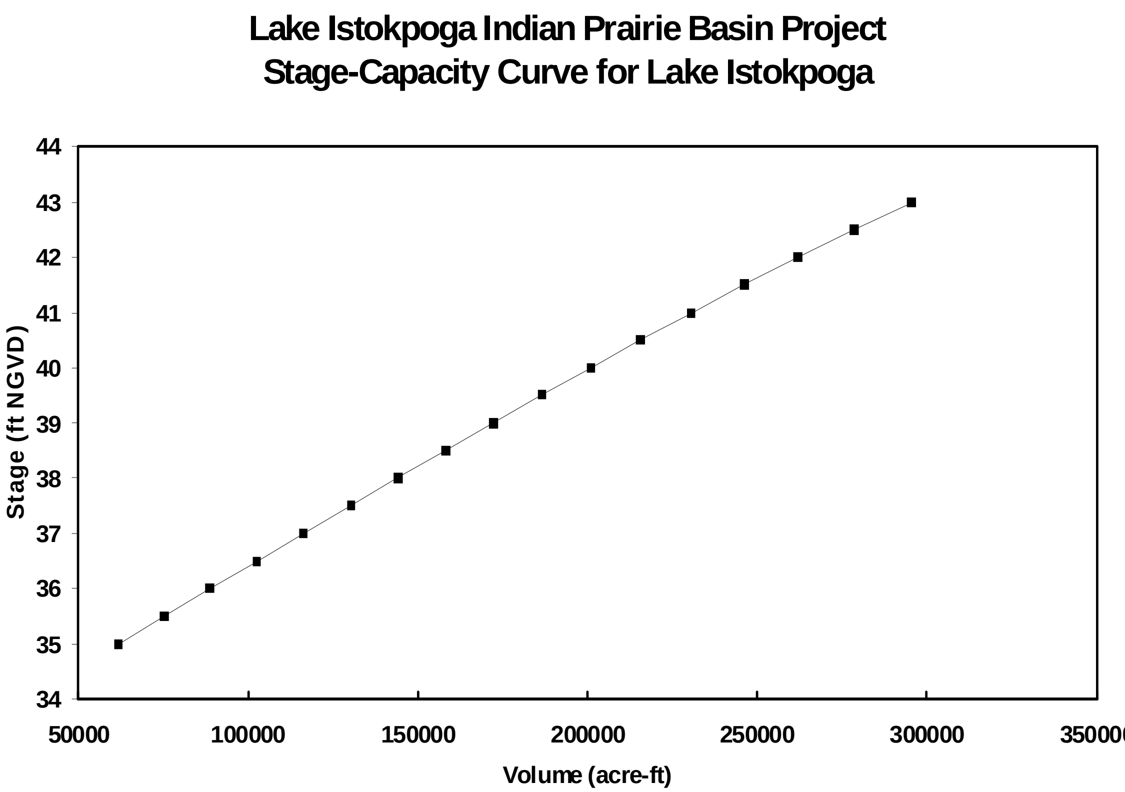

Figure I-6. Stage-Capacity Equation Developed for Lake Istokpoga.

LAKE ISTOKPOGA-INDIAN PRAIRIE BASIN RAINFALL ANALYSIS

Estimates of the 1-in-10-year dry and wet conditions (drought and flood, respectively) as well as 1-in-2-year average rainfall per season and per calendar annual year were obtained. Monthly values from 1977 to 1997 were used with the wet season consisting of the months of June through October, and dry season of November through May. Histograms for the selected 21 years are shown in **Figure I-7** for wet and dry seasons and calendar annual year. From the three histograms the probability density function (PDF) and subsequently the cumulative distribution function (CDF) for each of the three conditions were obtained (**Figures I-8** through **I-13**). The final results are included in **Table I-6.**

Table I-6. Lake Istokpoga-Indian Prairie Basin Rainfall Magnitude and Frequency.

Rainfall Period	Weather Conditions		Return Period (years)
	Dry (Drought) (in)	Wet (Flood) (in)	
Wet Season	27.12 21.68	27.12 32.56	2 10
Dry Season	16.64 11.14	16.64 22.17	2 10
Calendar Annual Year	44.24 36.19	44.24 53.30	2 10

By normalizing the monthly values of the 21-year period of time, the normal rainfall was obtained. The normal rainfall has to be very similar to the 1-in-2 return period rainfall for which the dry and wet conditions coincide. The results are shown in **Table I-7**. The seasonal and total annual rainfall amounts from **Table I-6** coincide well with the obtained amounts from the previous analysis (**Table I-5**). The monthly amounts for dry and wet season (**Table I-6**) were used to estimate the percentages and monthly rainfall distributions for the 1-in-2, 1-in-10 dry (drought) and wet (flood) conditions as shown in **Table I-8**. **Figure I-14** depicts the monthly amounts for the 1-in-10 year rainfall for both dry and wet conditions.

Table I-7. Lake Istokpoga-Indian Prairie Basin Normal Monthly Rainfall Analysis.

Month	Mean Intercept (in)	Standard Deviation Slope (in)	Skewness
January	1.95	1.57	1.52
February	2.25	1.87	2.19
March	2.92	1.53	0.49
April	2.44	1.59	0.15
May	3.78	1.72	0.33
June	6.62	2.54	0.45
July	6.66	2.26	1.15
August	6.15	2.12	0.08
September	5.47	2.78	1.31
October	2.71	2.17	1.76
November	2.00	1.71	1.64
December	1.78	1.60	0.96
Total Annual	44.72		
Total Dry Season	17.11		
Total Wet Season	27.61		

Table I-8. Monthly Rainfall Amounts for 1-in-2, 1-in-10 Dry, and 1-in-10 Wet Return Periods.

Month	Percent Rainfall		Monthly Rainfall (in)		
	Dry Season	Wet Season	1-in-10 Dry (Drought)	1-in-2	1-in-10 Wet (Flood)
January	11.41		1.27	1.90	2.53
February	13.16		1.47	2.19	2.92
March	17.05		1.90	2.84	3.78
April	14.24		1.59	2.37	3.16
May	22.08		2.46	3.67	4.90
June		23.99	5.20	6.51	7.81
July		24.12	5.23	6.54	7.85
August		22.27	4.83	6.04	7.25
September		19.80	4.29	5.37	6.45
October		9.82	2.13	2.66	3.20
November	11.69		1.30	1.94	2.59
December	10.38		1.16	1.73	2.30
Total	100.00	100.00	32.82	43.76	54.73
Dry Season	*These amounts from Table I-1*		11.14	16.64	22.17
Wet Season			21.68	27.12	32.56

Figures

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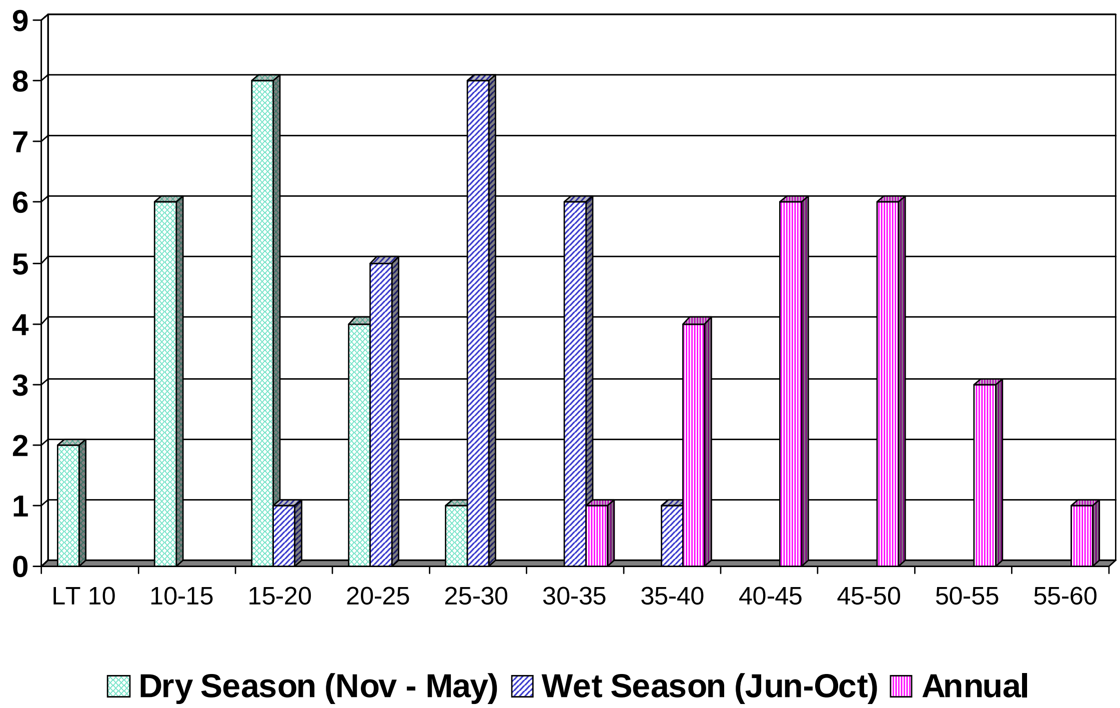

Figure I-7. Monthly Rainfall Amounts for the 1-in-10 Year Rainfall (Dry and Wet Conditions).

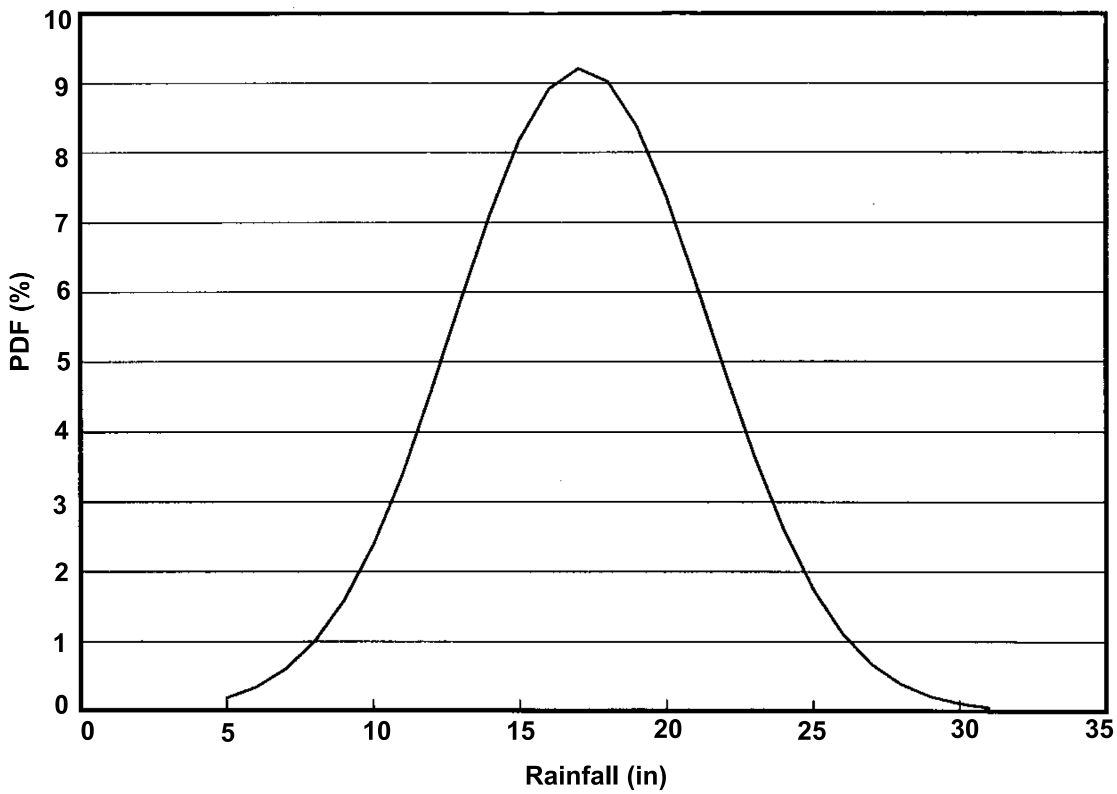

Figure I-8. Dry Season Probability Density Function.

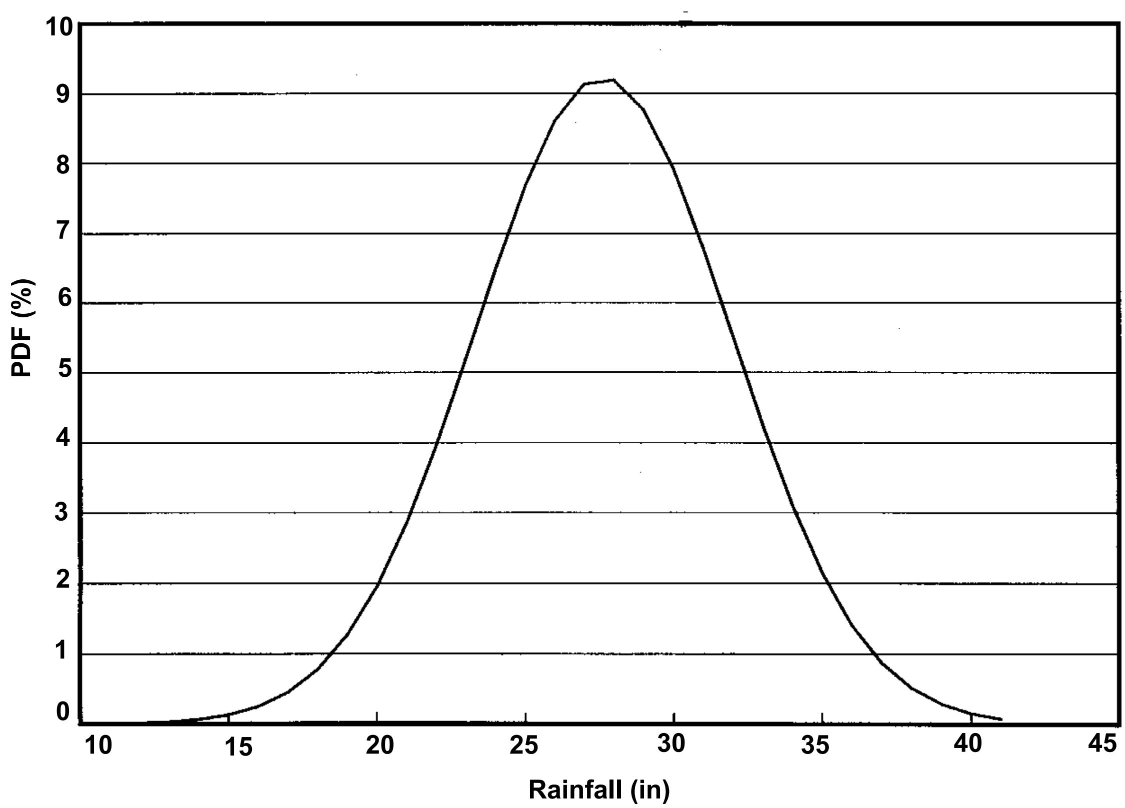

Figure I-9. Wet Season Probability Density Function.

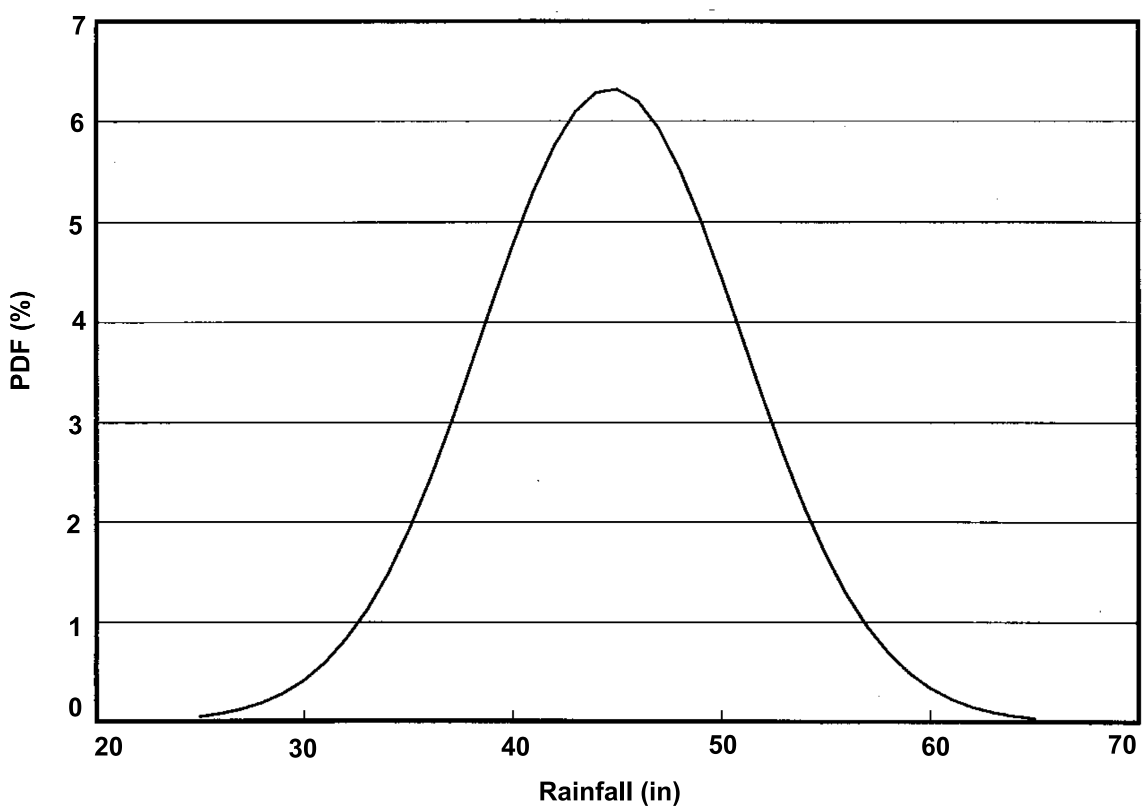

Figure I-10. Annual Probability Density Function.

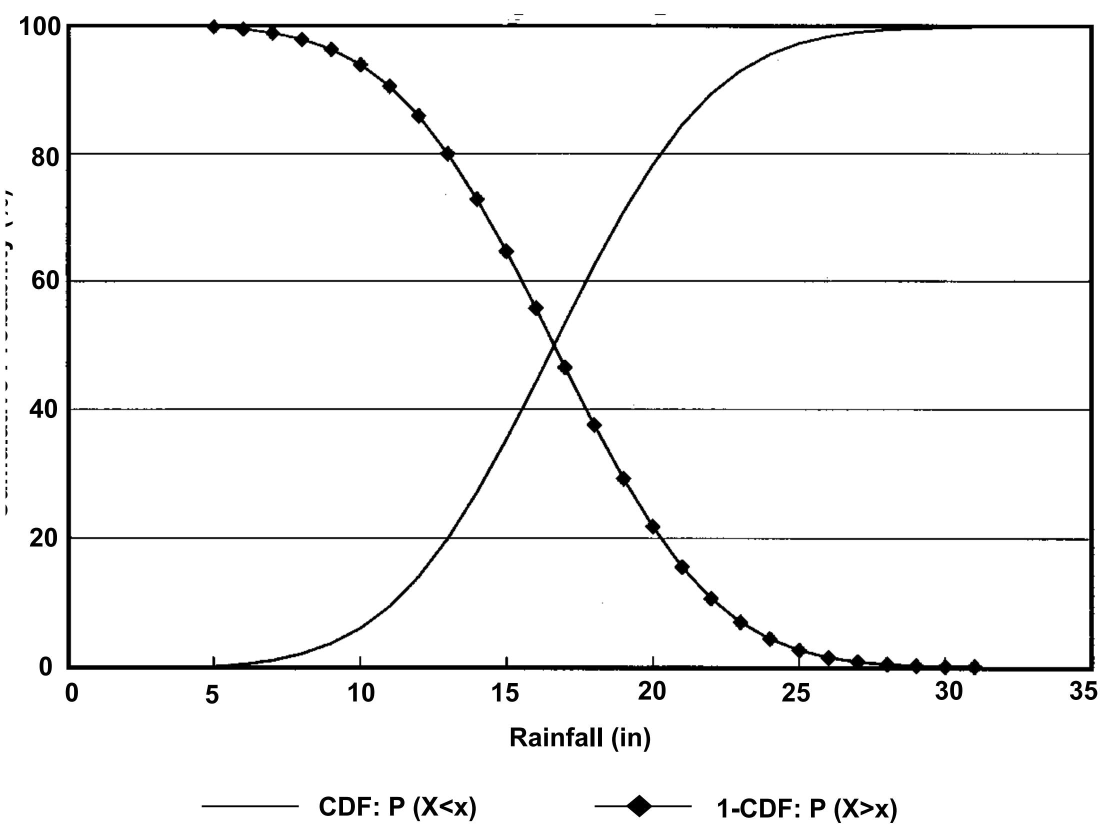

Figure I-11. Dry Season Cumulative Distribution Function.

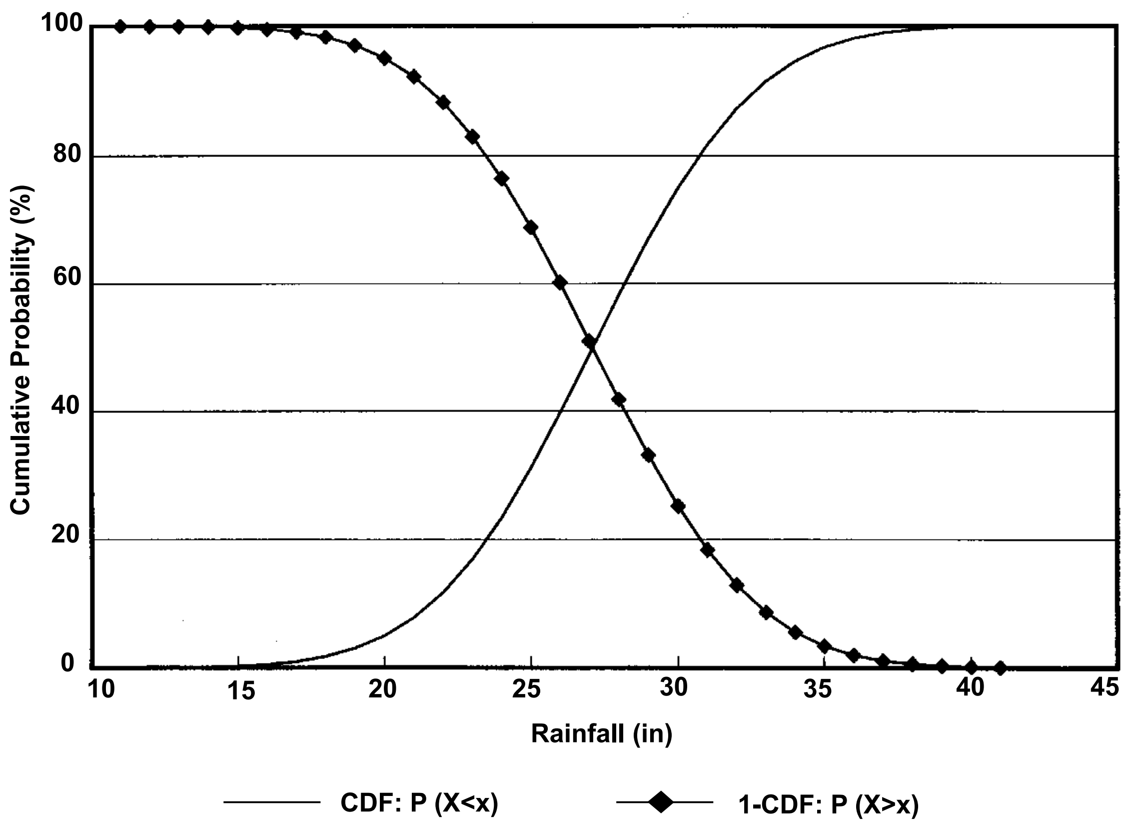

Figure I-12. Wet Season Cumulative Distribution Function.

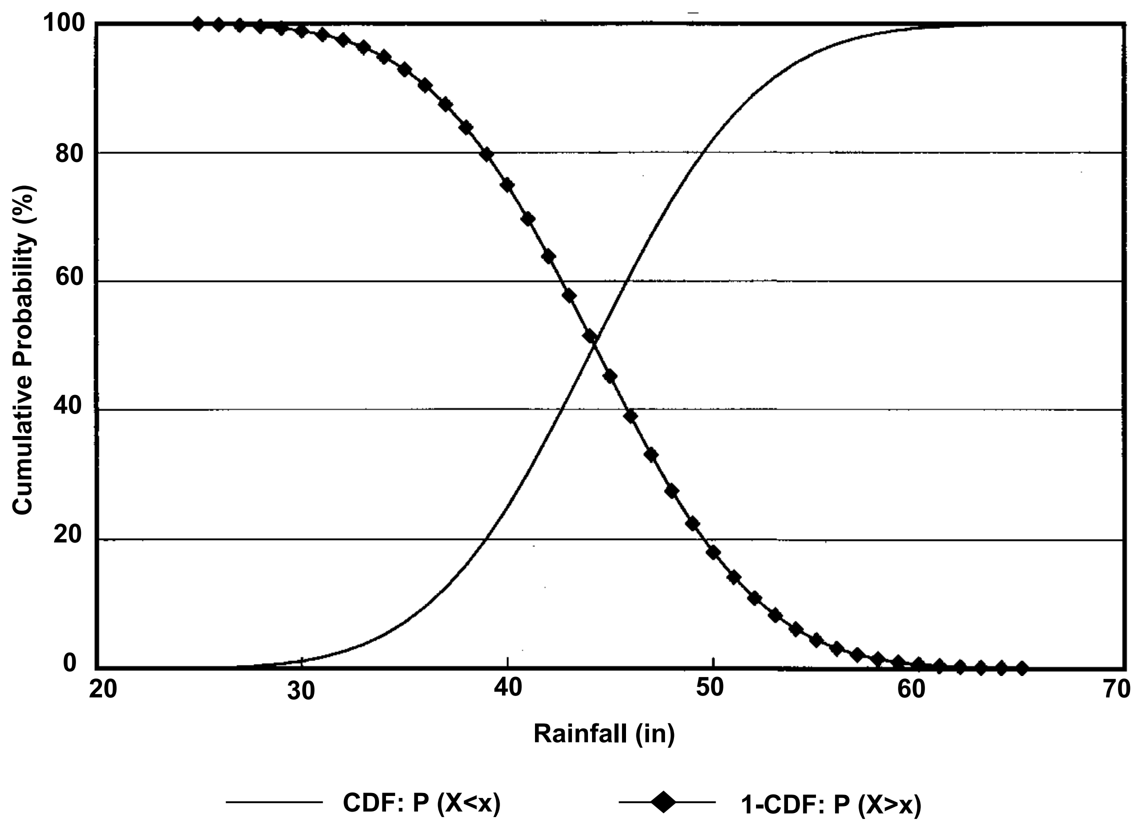

Figure I-13. Annual Cumulative Distribution Function.

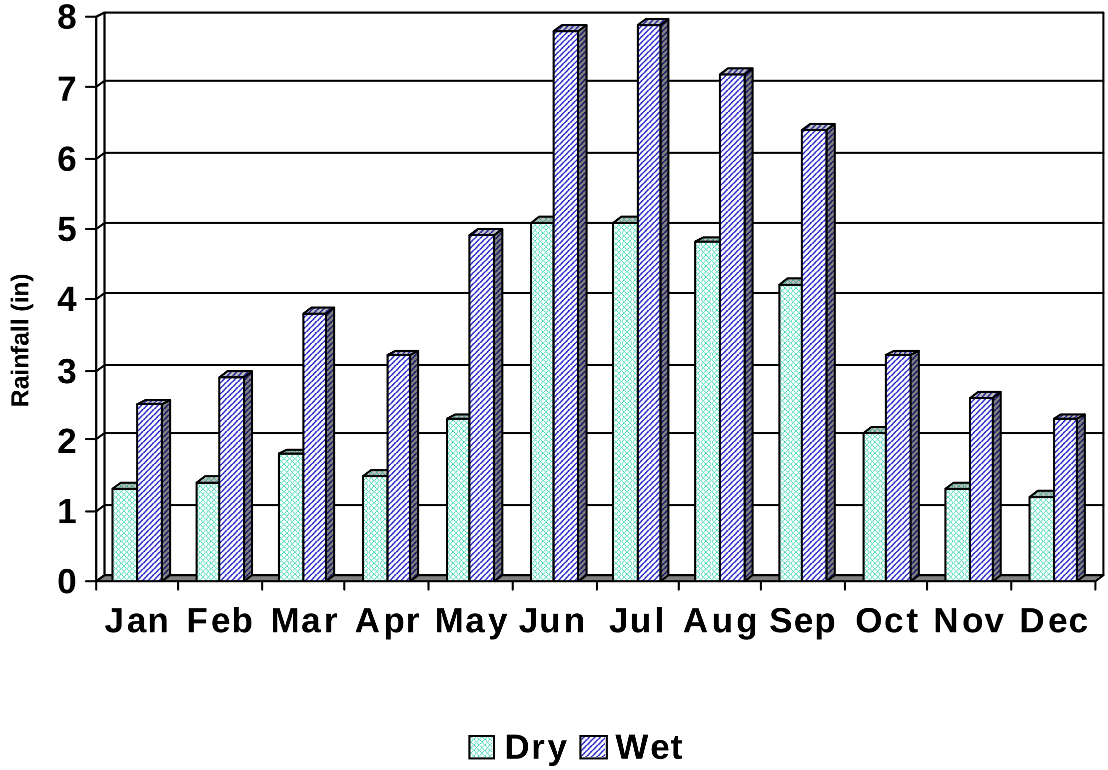

Figure I-14. Monthly Rainfall for 1-in-10 Year Conditions.

Appendix J
GEOGRAPHICALLY BASED VULNERABILITY ANALYSIS OF WETLANDS WITHIN THE KISSIMMEE BASIN WATER SUPPLY PLANNING AREA

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A geographically based vulnerability analysis was performed to determine which wetlands in the Kissimmee Basin (KB) Planning Area were the most and least vulnerable to harm from projected increases in ground water withdrawals from 1995 to 2020. This analysis was done in support of the KB Water Supply Plan effort and was undertaken to evaluate the effects of the projected drawdown on the wetlands resource protection criteria developed under the plan. Results of the analysis will be used in the decision making process on water supply options and to focus the work of more detailed wetland studies in the future.

The Wetlands Vulnerability Analysis (WVA) is an approach taken as alternative to specifying a fixed numeric criteria for a given wetland. Instead, the WVA approaches the issue of potential wetland harm by assessing those factors that influence the change in water levels within the aquifer controlling wetland water levels. These factors include: the ability of water to move vertically though the intermediate (Miocene) unit, location of wetland features, and the change in potentiometric head within the Upper Floridan Aquifer System due to changes in water use from 1995 to 2020. This work is designed to be a planning level analysis and is not intended to identify specific wetland impacts.

The geographic analysis technique used was first developed by Dr. Ian McHarg in the 1970s. This technique has been substantially facilitated by Geographic Information System (GIS) software. The technique involves generating a series of digital maps with each map representing a separate factor used in the analysis. Each map is divided into a series of rectangular grids with each assigned a score based upon a weighting criteria. The scores are summed and averaged and displayed as resultant map. For this analysis, the technique was carried out in three general steps. These steps included: 1) assigning numeric scores to each gridded variable; 2) applying a weighted score system; and 3) combining the selected variable grids.

DESCRIPTION OF SELECTED VARIABLES

Three variables were selected for this analysis. These included thickness of the intermediate (Miocene) unit, location of wetland features, and the change in potentiometric head within the Upper Floridan Aquifer System due to changes in water use from 1995 to 2020.

The thickness of the confining Miocene unit was used to represent the factor controlling potential vertical water movement. The confining unit thickness is directly related to, and is the best defined, of the variables controlling vertical movement. Using confining unit thickness in the analysis assumes that the other variables influencing the rate of vertical water movement, such as hydraulic conductivity, are uniform.

Information collected to define the thickness of the confining unit was obtained from the U.S. Geological Survey (USGS) and from District records and was the same information used in the construction of the MODFLOW models developed for the KB Water Supply Plan effort. **Figure J-1** shows an isopach map of the confining unit thickness in and surrounding the planning basin.

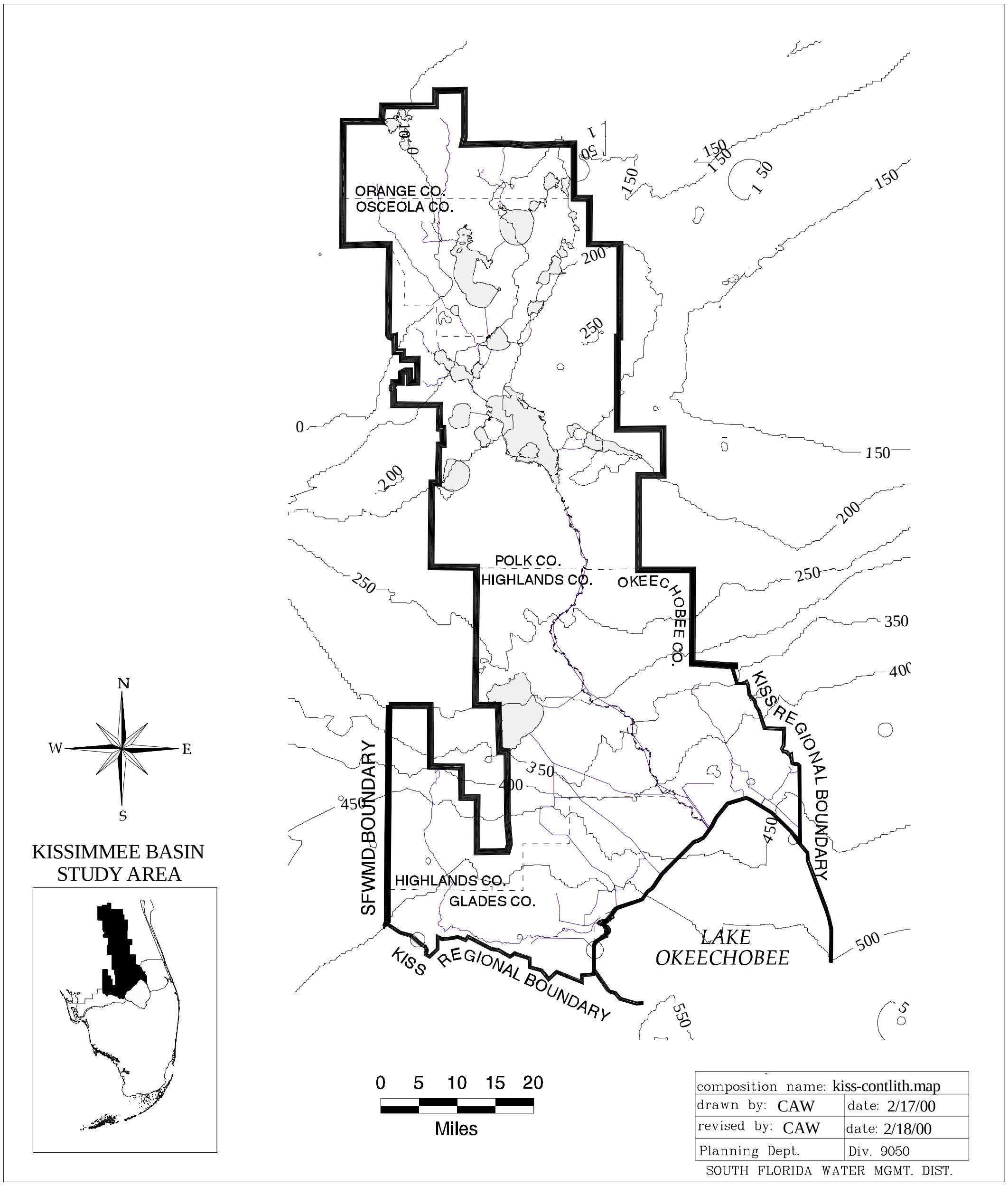

Figure J-1. Thickness of Confining Units in the Kissimmee Basin Planning Area.

The change in potentiometric head in the Floridan aquifer is used as the second factor in the analysis. The water level changes used are from the predictive results of the modeling simulation conducted under the planning effort. These water levels represent the change in water levels (drawdown) within the Floridan Aquifer System as a result of changes in withdrawals from 1995 to 2020 under average conditions. **Figure J-2** shows the projected change in Floridan aquifer levels for average conditions from 1995 to 2020.

The third variable selected for the analysis was wetland locations. The National Wetland Inventory, 1988 (NWI) was used as the base information for identification of the location of existing wetlands. The NWI coverage used in this analysis was combined in a previous analysis with the 1995 Land Use/Land Cover coverage to remove wetlands that have been lost to the effects of urbanization. Although the use of a wetlands coverage is not necessary in defining regions susceptible to transmission of Floridan aquifer drawdown, it is used in this analysis as a filter to eliminate areas where wetlands do not exist. **Figure J-3** shows the wetland coverage used for the analysis.

ASSIGNMENT OF VALUES TO THE THREE INPUT VARIABLES

The first step in the vulnerability analysis was to translate the data sets for each of the three input variables (layers) used in the study to a format of geographically referenced grids. The gridding process subdivided each layer into equally spaced cells of 1,131 feet by 1,131 feet. Each of the grid cells were assigned numeric scores based on the three identified variables describing the differing hydrologic characteristics. For example, if the average thickness of the confining unit was 100 feet at the georeferenced location of a grid cell, that cell would be assigned a value of 100. The same would be true for the change in water levels of the Floridan aquifer. In the case of identified wetlands, the area within a cell had to be predominately wetlands to be given a score.

WEIGHTED SCORING OF THE THREE VARIABLES

The second step in the process was to weight the three variables according to their estimated effect on the output variable. **Table J-1** describes the weighting scores applied to each of the variables. The wetland location layer was assigned a 0 for no wetlands and a 10 if the grid was cell was predominantly wetlands. If there were no wetlands in a grid, the likelihood of wetland harm would be zero. The range of scores for wetlands were purposely set to one-half that of the other factors to reduce the influence of that variable on the resultant scores. These scores assigned to each layer were based upon professional judgement and a limited amount of reference material. **Figures J-4**, **J-5**, and **J-6** show the resultant weighted scoring.

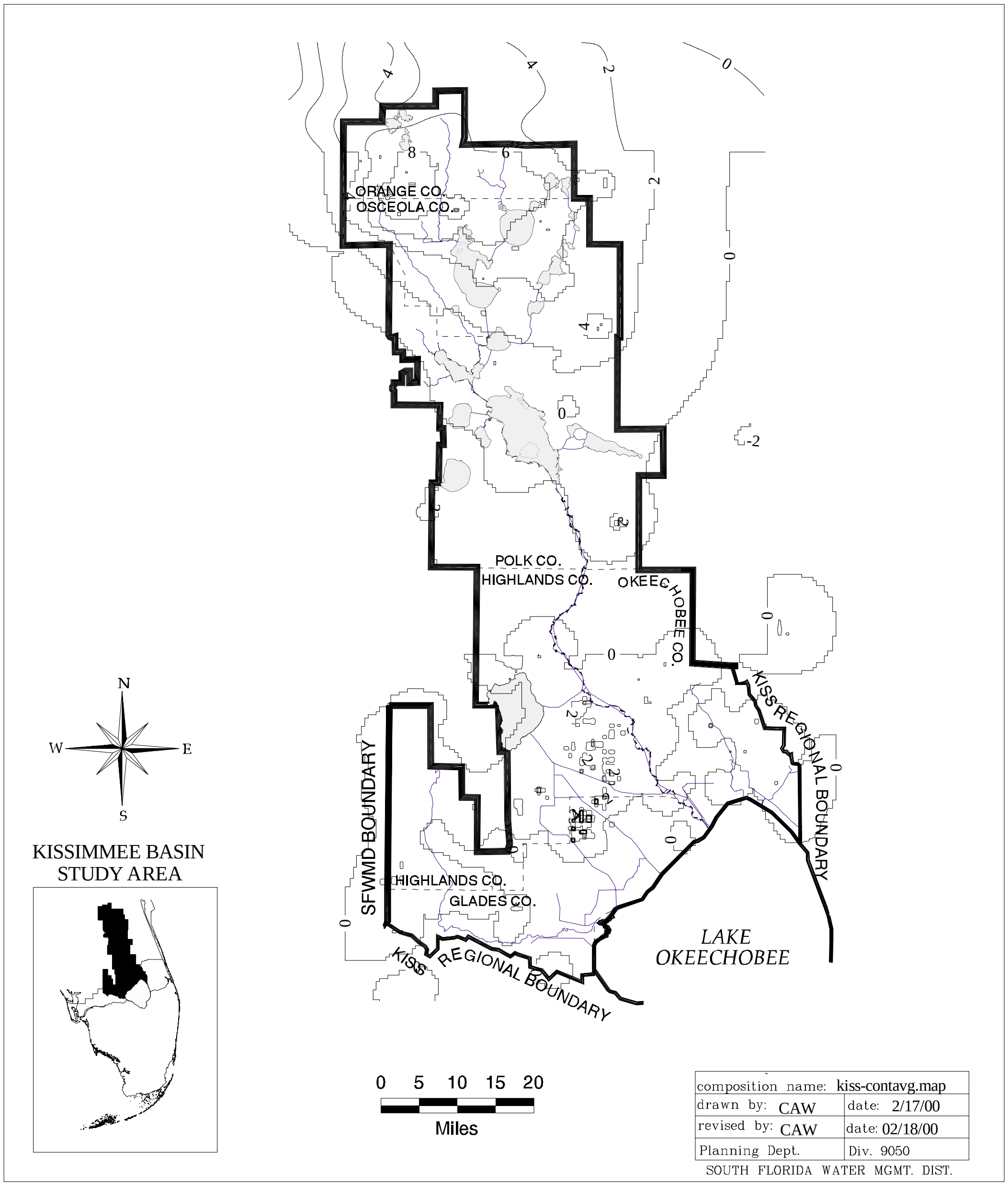

Figure J-2. Change in Upper Floridan Water Levels, 1995 to 2020.

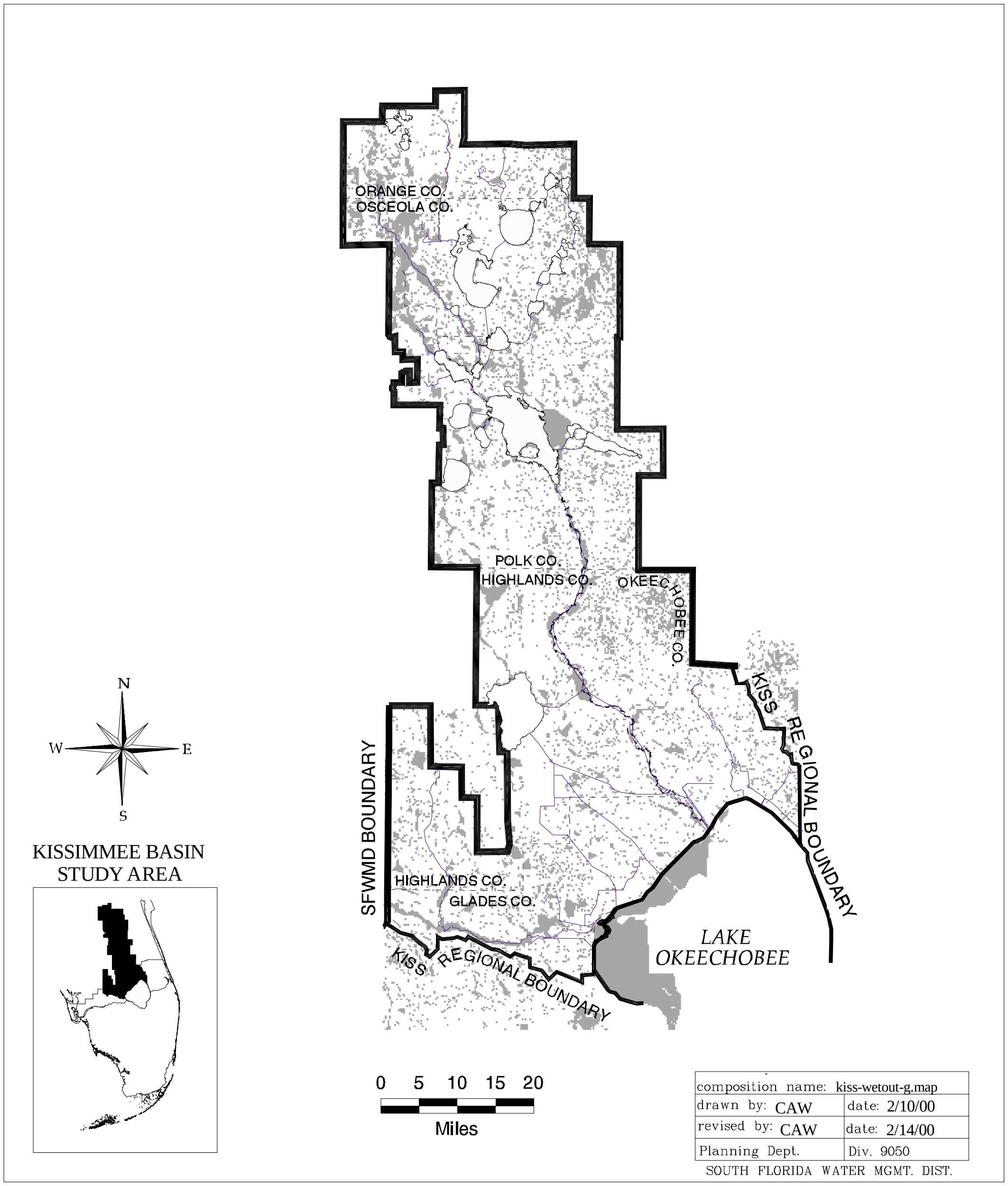

Figure J-3. Identified Wetland Systems (denoted by gray areas).

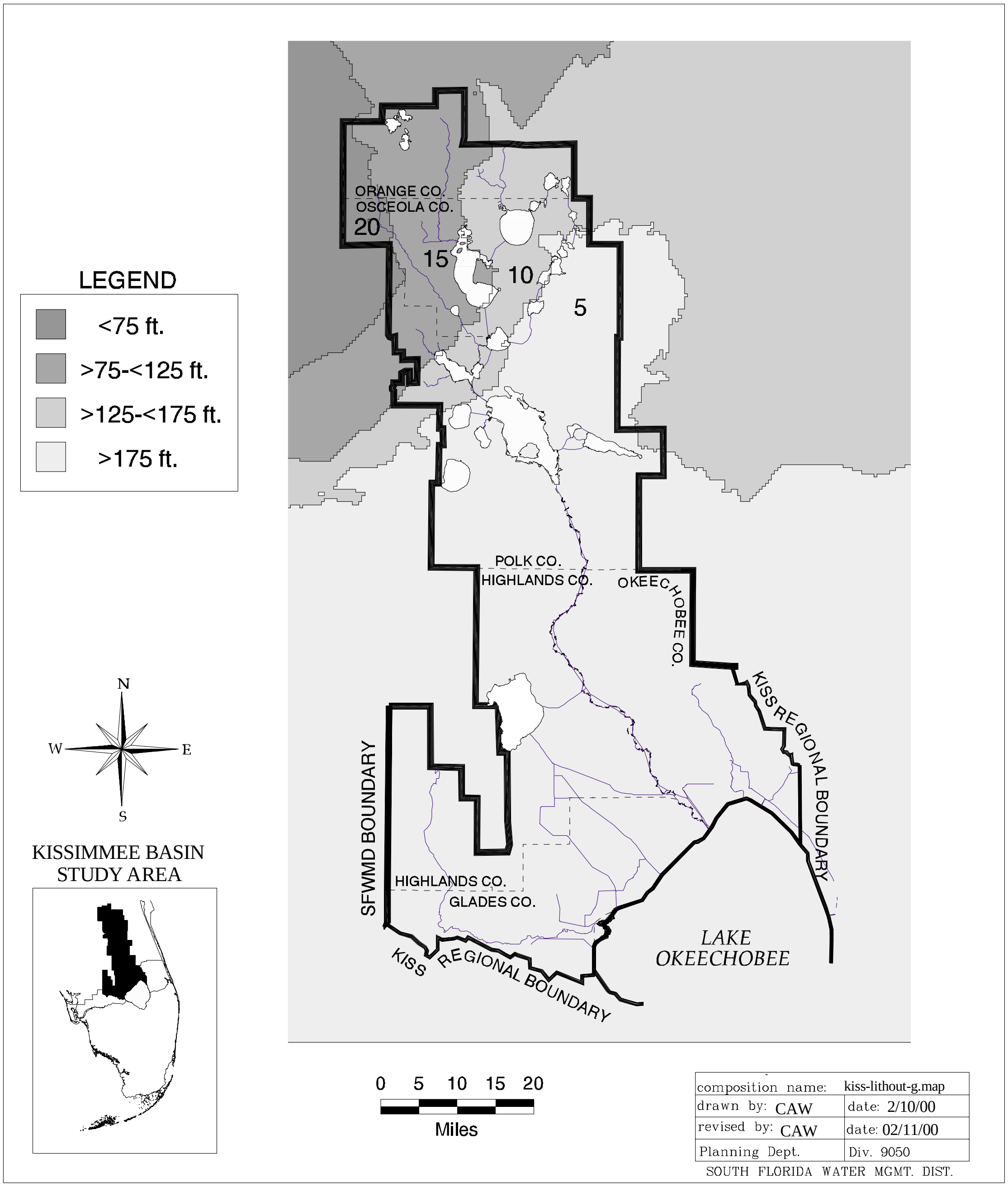

Figure J-4. Thickness Scores.

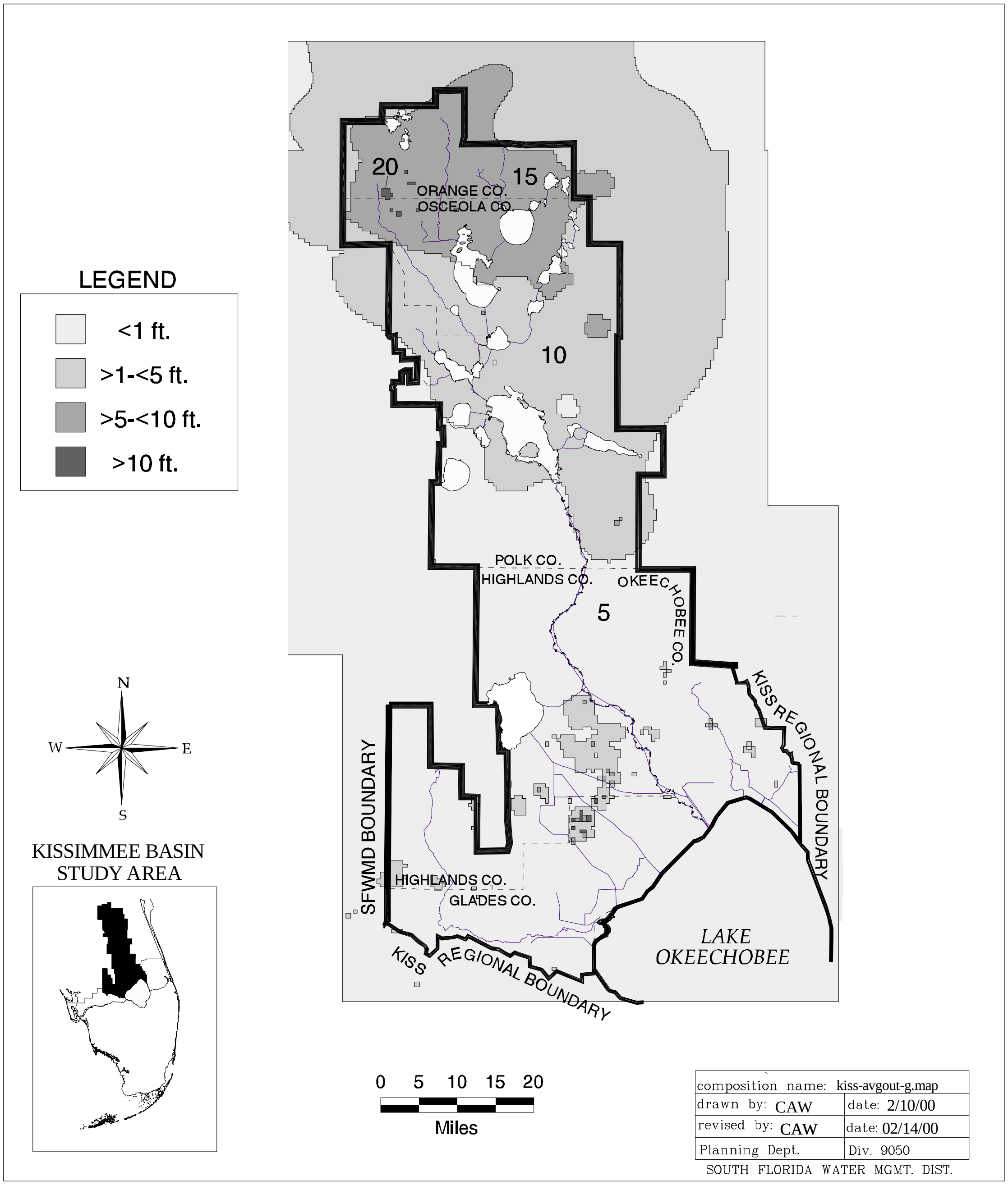

Figure J-5. Drawdown Scores.

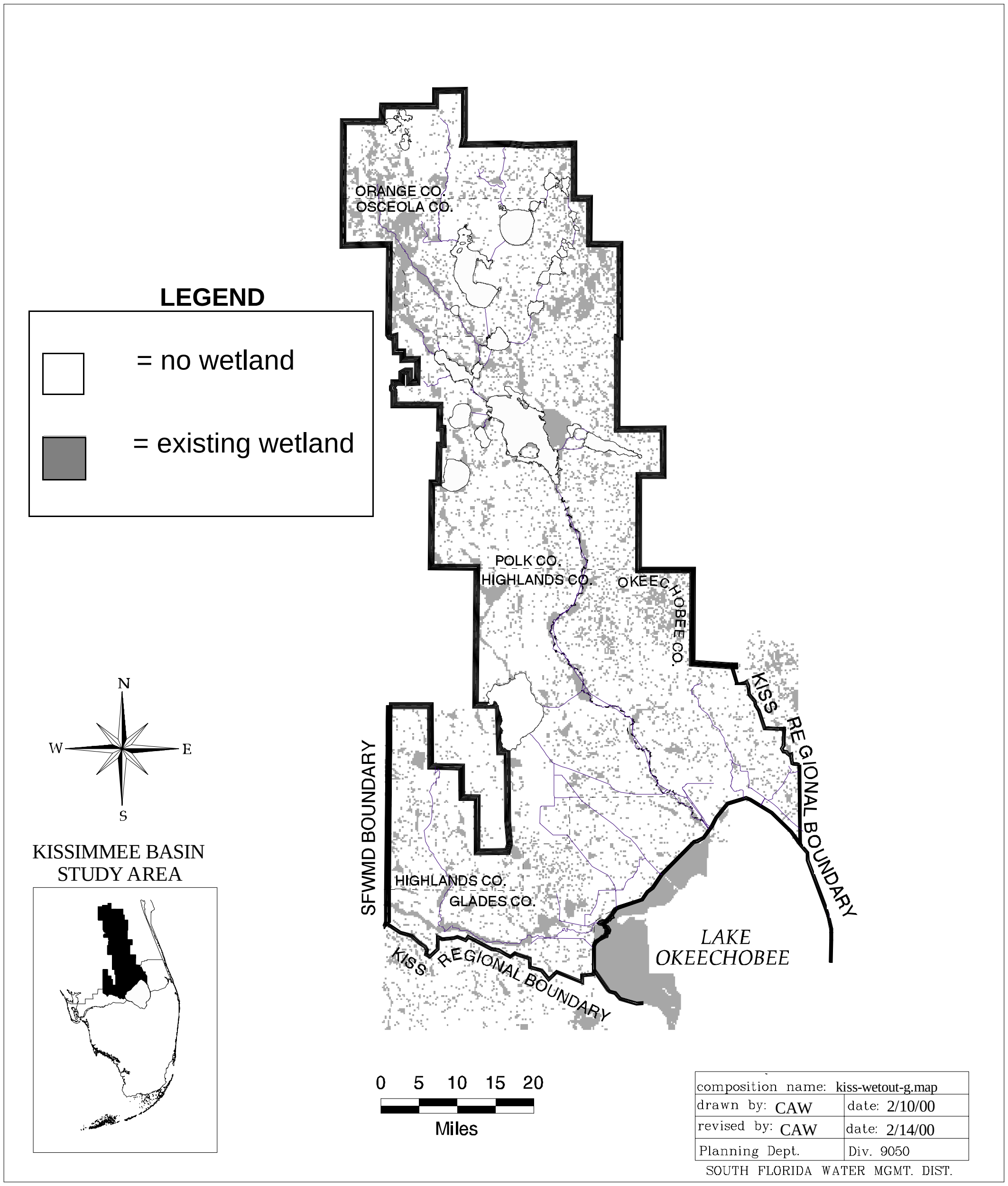

Figure J-6. Wetland Scores.

Table J-1. Variable Scoring Assignments.

Layer	Measurement	Score
Confining Unit Thickness	<75 feet	20
	>75 - <125 feet	15
	>125 - <175 feet	10
	>175 feet	5
Wetland Location	No Wetland in Cell	0
	Wetland in Cell	10
Aquifer Drawdown (2020 minus 1995)	> 10 feet	20
	> 5 - <10 feet	15
	>1 - <5 feet	10
	<1 foot	5

COMBINING OF SCORES

The weighted score for each cell for each layer was summed and divided by three to create single output layer. The resultant output layer had scores ranging from 3.3 to 16.7 points. The range of points for the output layer was divided equally into three categories identifying the high, middle and low range of vulnerability. Areas having points of 3.3 to 7 were identified as having a lower vulnerability; 8-11 points were given a vulnerability of medium; and the range of 12 to 16.7 were identified as having a higher vulnerability. **Figure J-7** shows the resultant output layer and scores.

RESULTS OF THE ANALYSIS

The purpose of this analysis was to identify areas most vulnerable to possible harm to wetland features resulting from projected drawdowns in the Floridan Aquifer System (FAS) due to changes in water use from 1995 to 2020. Areas in Southwest Orange and Northwest Osceola counties received the highest resultant score and are therefore identified as being the most vulnerable. This analysis does not predict that harm to wetlands will occur, but rather identifies areas which would have the greatest potential for harm if it were to occur as a result of projected drawdowns in the Floridan aquifer.

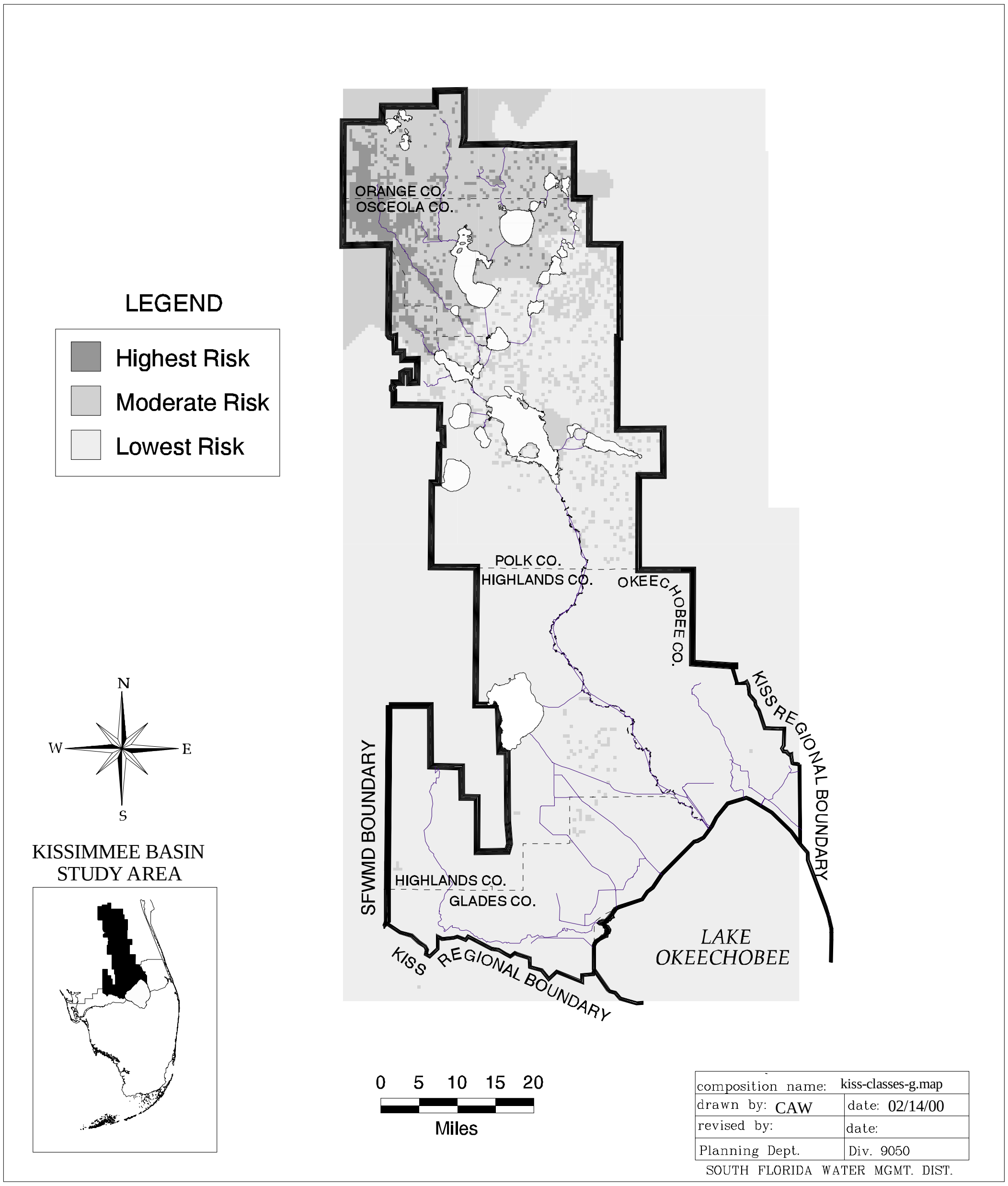

Figure J-7. Locations Vulnerable to Wetland Harm.