Shell Creek and Prairie Creek Watersheds Management Plan

Reasonable Assurance Documentation

Shell, Prairie, and Joshua Creeks
Watershed Management Plan Stakeholders Group

Final Plan

December – 2004

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Prepared by:

Shell, Prairie, and Joshua Creeks
Watershed Management Plan Stakeholders Group

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Acknowledgements

The completion of this Plan and the Stakeholders Agreement is a result of the dedication of the Shell, Prairie, and Joshua Creeks Watershed Management Plan Stakeholders Group and the many growers that volunteered their time to participate in the partnership process in order to collaboratively address the water quality issues in these creek basins. District staff Eric DeHaven, David Brown, Roberta Starks, Scott Laidlaw, Carole Estes, and Suzanne Chwala are to be given credit for their many hours in preparing and finalizing the Plan. William Bartnick, Florida Department of Agricultural and Consumer Services, Office of Agricultural Water Policy, is credited with writing the Best Management Practices section of the Plan. Andy Neuhofer and Matt Harrison, Florida Farm Bureau Federation, for providing the information on the C.A.R.E.S. program.

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Harbor National Estuary Program, Florida Department of Environmental Protection, Florida Department of Agriculture and Consumer Services, Southwest Florida Water Management District, Peace River Basin Board, South Florida Water Management District, University of Florida-Institute of Food and Agriculture Services, DeSoto County, Charlotte County, City of Punta Gorda, Charlotte County Soil and Water Conservation District, Peace River Soil and Water Conservation District, East Charlotte Drainage District, Joshua Water Control District, Charlotte Harbor Environmental Center, Florida Farm Bureau Federation, DeSoto/Charlotte County Farm Bureau, Florida Citrus Mutual, Florida Fruit and Vegetable Association, Peace River Valley Citrus Growers Association, 2X4 Ranch, 4N1, LLP, American Citrus Products Corporation, B&D Veach, Inc., Bailey Branch, Inc., Ben Hill Griffin, Inc., Bright Hour Ranch, Carlton Bar A, Doe Hill, Horton & Veach Groves, LLP, I-5 Groves, LLP, RO-Len Properties, Ryals Cattle Company, Short-80, LLP, Symons' Groves, Inc., TRB Groves, LLC, V.C.H. Citrus and Cattle, and Williams Farms Partnership.

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Also, thanks go to Joe Haber, Catherine Wolden, and Karen Diez for their work on the Plan.

Also, thanks go to all other individuals who have assisted in the preparation of this Plan that have not been recognized above.

With sincere appreciation to all involved,

Steven Minnis, Senior Community Affairs Coordinator

Shell, Prairie, and Joshua Creeks
Watershed Management Plan
Stakeholders Agreement

Background

Whereas, the Parties to this Agreement are interested in preserving and improving water quality and ecology of Shell Creek, Prairie Creek, and Joshua Creek; and

Whereas, the Parties to this Agreement recognize that a comprehensive watershed approach is needed to address water quality issues within Shell Creek, Prairie Creek, and Joshua Creek; and

Whereas, a multitude of regulatory, technical assistance, research, and education programs has been developed which must be better coordinated and be used in combination with incentives and other non-regulatory tools to form a comprehensive approach to address the full scope of water quality issues within Shell Creek, Prairie Creek, and Joshua Creek; and

Whereas, a substantial level of state, federal and private resources are being sought and committed to and a new coordinated approach must recognize and build upon effort and progress from the work of all of these programs; and

Whereas, the resource management actions referenced in Table 3.1 in the Plan are deemed effective in improving water quality within the Shell Creek, Prairie Creek, and Joshua Creek watersheds.

Now therefore, in consideration of the foregoing premises, which are made part of this Agreement, the Parties hereby agree to the following. This commitment is based on mutual cooperation, shared objectives, fairness, and support and participation from the Parties to this Agreement.

Mission

The signatories agree to assess sources of salinity to Shell Creek, Prairie Creek and Joshua Creek to optimize reductions in concentrations to waters of these watersheds emphasizing voluntary, incentive-based programs for protecting the environment and public health.

Guiding Principles

The signatories agree to adopt the following guiding principles in achieving the mission:

1. Implement water quality measures to the greatest extent practicable throughout the Shell Creek and Prairie Creek watersheds to achieve Class I surface water standards.

2. Avoid duplication and maximize the efficient coordination of agency resources and programs, including consolidated and coordinated funding of projects.

3. Use a comprehensive watershed management approach to address Class I surface water quality standards and encourage implementation within the watersheds.

4. Seek reasonable, incentive based solutions that can be embraced by leaders and stakeholders at all levels of government and the community.

Shell, Prairie, and Joshua Creeks Watershed Management Plan Stakeholders Agreement (cont.)

5. Focus on management approaches which are technically feasible, economically practicable, and protective of the environment and public health.

6. Develop consensus measures of success that include recognized risk management techniques.

7. Achieve results that satisfy regulatory requirements.

8. Ensure water quality monitoring to measure the effectiveness of implemented water quality improvement measures.

9. Continue to make good faith efforts in funding incentive-based programs.

Organization

The signatories agree to create and participate in the Shell, Prairie, and Joshua Creeks Watershed Management Plan (SPJCWMP) that shall be chaired by the Southwest Florida Water Management District (District). The District will continue to function as the chair of the group to address the specific impairments to water quality recognized at the time of signature. Future impairment to water quality, due to other parameters documented by the FDEP through the Impaired Waters Rule, might require other stakeholders to take the lead responsibility of the group for those specific parameters. The SPJCWMP Stakeholders shall meet as agreed upon by the members, or at the call of the chair.

Education, Outreach and Implementation

For the SPJCWMP Stakeholders to accomplish their mission, education on the issues and solutions, including effective transfer of knowledge and technology, are essential components of implementation of the efforts of the Technical Working Groups.

Stakeholder Involvement

For the SPJCWMP Stakeholders to be successful, the involvement of stakeholders is critical. As part of this framework agreement, a process for stakeholder involvement is developed and will be implemented by the signatories.

Measures of Success

Water quality issues in the Shell, Prairie, and Joshua Creeks watersheds have developed from various inputs over an extended period of time. Successfully addressing these issues will require sufficient time to implement management changes and evaluate their effect. The signatories will make a good faith effort in implementing the recovery projects referenced in the SPJCWMP to restore and maintain water quality conditions to the levels set forth in the Impaired Waters Rule, Chapter 62-303, Florida Administrative Code.

The Undersigned Agree, on December 3, 2004 to the above.

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Charlotte Harbor National Estuary Program
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Appendix 1 - excerpts from F.A.C. 62-302.400; FDEP Classification of Surface Waters

Appendix 2 - F.A.C. Chapter 62-302.530; pg's. 3 & 4 provides *Criteria for Surface Water Classifications* with regards to chloride, conductance, and dissolved solids as applied to Class I surface waters in the Shell and Prairie Creek watersheds.

Appendix 3 - CGWQMN Report, ROMP 12 Exploratory Coring Report, and ROMP 13 Exploratory Coring Report

Appendix 4 – Documentation of the impact of mineralized groundwater on the Shell and Prairie Creek watersheds

Appendix 5. SWFWMD Back Plugging Program Board Procedure No. 61-7A.

Appendix 6. First Annual Report on the Status of the SPJC Well Back-Plugging Program

Appendix 7. Resource Regulation well construction and Water Use Permitting conditions.

Appendix 8. FARMS Board Procedure 13-9, Memorandum of Agreement, Operating Agreements, program guidelines, project application and evaluation forms.

Appendix 9. SWFWMD Regional Water Supply Plan and Draft SWUCA Recovery Strategy.

Appendix 10. A summary of the nutrient management chapters from "*Water Quality / Quantity Best Management Practices for Peace River Valley / Manasota Basin Area Citrus Groves".*

Appendix 11. QWIP Policy and Procedures and the QWIP Artesian Well Plugging Annual Work Plan 2004.

Appendix 12. Florida Forever Work Plan; Annual Update 2003 and Resource Evaluation of the Long Island Marsh; Final Report

Appendix 13. An outline of the education and outreach activities associated with Shell, Prairie, and Joshua Creek watersheds and water quality impairment.

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Appendix 15. Copies of written agreements committing participants to the management actions.

Appendix 16. Sample Collection Standard Operating Procedures (SOP).

Shell Creek and Prairie Creek Watersheds
Reasonable Assurance Documentation

Purpose of Document

The purpose of this document is to provide "reasonable assurance" that the Shell Creek and Prairie Creek Watersheds Management Plan (SPCWMP) will restore and maintain water quality conditions to the water quality criteria set forth in Chapter 62-302, Florida Administrative Code (F.A.C.). This document identifies management plans and projects specifically developed by the Shell, Prairie, and Joshua Creeks Watershed Management Plan Stakeholders Group to address impairment due to elevated concentrations of chloride, total dissolved solids (TDS), and specific conductance. In addition, the SPCWMP includes documentation regarding Best Management Practices (BMPs) that address potential nutrient impairment. The SPCWMP is comprehensive in scope and not only includes management strategies to address water quality conditions due to elevated chloride, TDS, and specific conductance in the Shell and Prairie Creek watersheds, but the adjacent Joshua Creek watershed as well.

The stakeholders group was originally formed in 2001 to address water quality issues related to elevated TDS concentrations in the City of Punta Gorda's in-stream, potable water supply reservoir as a result of the 1999-2001 drought. This group consists of 18 different state and local governments, as well as private agricultural interests and other associations and commodity groups. The stakeholders group was initially convened under guidance provided by the Florida Department of Environmental Protection (FDEP). Supervision has subsequently been relegated to the Southwest Florida Water Management District (District) after it was decided to pursue the SPCWMP as the key management tool to address water quality conditions in this area. All management options and projects presented in the SPCWMP are for those portions of the watersheds located upstream of the Hendrickson Dam at the reservoir.

The specific goal of the stakeholders group is to:

Improve surface water quality within the Shell and Prairie Creek watersheds, with specific emphasis placed on identified Total Maximum Daily Load (TMDL) Program impaired sub-basins or Water Body ID's (WBIDs), to consistently meet Class I standards. Class I waters are designated for potable water supplies under F.A.C. Rule 62-302.400. Generally, the most stringent water quality criteria is assigned to Class I waters. Currently, water quality is impaired due to elevated levels of chloride, TDS, and specific conductance derived from the use of mineralized lower intermediate aquifer and Upper Floridan aquifer wells to irrigate agricultural land in the watershed. The goal of the Reasonable Assurance Plan (and the specific projects and plans outlined within the document) is to reduce levels of specific conductance, chloride, and TDS below the maximum Class I criterion of 1275 uS/cm, 250 mg/l, and 1000 mg/l, respectively, at all times throughout the watersheds. In addition, the goal of the plan is to reduce TDS below the Class I standard of 500 mg/l as a monthly average. To achieve these goals, specific conductance will be used as a surrogate measure for chloride and TDS. Specific conductance must be below 775 uS/cm, based upon historical data analysis in the watershed, to insure compliance with Class I standards for chloride and TDS. A specific conductance value of 775 uS/cm equates to a chloride concentration of approximately 150 mg/l and a TDS concentration of 500 mg/l. Specific conductance will be measured hourly and reported as a weekly median and monthly average value from

key surface water stations instrumented with specific conductance data sondes. Quarterly water quality samples will be collected to confirm the surrogate specific conductivity estimates of chloride and TDS. The time frame to achieve this goal is ten years, or by 2014.

The adjacent Class III Joshua Creek watershed will also be included in this effort due to the identification of similar problems in the watershed; however, at a lower priority level. It is important to note that the stakeholders group is applying the management actions detailed in this plan throughout the entire watershed areas of Shell, Prairie, and Joshua Creeks. Thus, the stakeholders group considers that there is a potential for chloride, TDS and specific conductance impairment in additional WBIDs not specifically identified by the FDEP as impaired. This plan proposes to address this potential impairment, as well as the documented impairment, for these parameters within the Shell, Prairie, and Joshua Creek watersheds. However, WBIDs already identified as impaired will receive the highest priority.

This document has been formatted to closely follow elements described in the FDEP February 2002 memorandum "Guidance Document for Development of Documentation to Provide Reasonable Assurance that Proposed Pollution Control Mechanisms will Result in the Restoration of Designated Uses in Impaired Waters".

1. Description of the Impaired Waterbody

The Shell, Prairie, and Joshua Creek (SPJC) watersheds are located in the southern region of the Peace River Basin (Figure 1.1). With a total surface area of approximately 2,400 mi^2, the Peace River Basin is the largest drainage basin in the District. Combined, the SPJC watersheds comprise a surface area of 487 mi^2 (102 mi^2 - Shell Creek, 265 mi^2 - Prairie Creek, and 120 mi^2 - Joshua Creek), or approximately 20% of the Peace River Basin.

Within the Prairie and Shell Creek watersheds, land use is predominantly agriculture and is composed largely of citrus, improved and semi-improved pasture for cattle grazing, row crop, and sod operations. There are approximately 179 water-use permits located in the upstream regions of the reservoir that are permitted for roughly 62.6 million gallons per day (mgd). Approximately 89% of current water use permits are for agricultural use.

The City of Punta Gorda (City) obtains its potable water supply from the Shell Creek in-stream reservoir (est. 1964). In the mid 1970's, Prairie and Shell Creeks (and their associated tributaries), were designated as Class I waters. Class I waters, pursuant to Chapter 62-302.400, F.A.C., are designed for use as potable water supplies. These creeks converge at, and sustain, the City's reservoir. The City is currently authorized by the District to withdraw up to 5.38 million gallons per day (mgd) of surface water, on an annual average daily basis, under Water Use Permit No. 200871.06. As shown on Figure 1.2, there are three FDEP assigned WBIDs, representing sub-basins, in the Prairie Creek watershed and four within the Shell Creek watershed. After discussions with FDEP, an eighth WBID was specifically created for the actual reservoir area due to its "lake-like" or impounded nature. This WBID has been added to the Shell Creek watershed. Of the eight WBIDs comprising the two watersheds, the FDEP has determined that WBID #1962 within the Prairie Creek watershed is impaired for specific conductance and TDS and WBIDs #2040 and #2041 within the Shell Creek watershed are impaired due to elevated chloride, TDS and specific conductance concentrations. The FDEP subsequently proposed to place these WBIDs on the state's draft verified list

of impaired waters, but the waters will not be included on the final, adopted list if FDEP agrees that this document provides reasonable assurance that the impaired waters will be restored.

1.a. Name of Waters Listed on the Verified List

This document addresses Myrtle Slough (WBID #2040; Shell Creek Watershed), Shell Creek (WBID #2041; Shell Creek Watershed), and Prairie Creek (WBID #1962; Prairie Creek Watershed) each of which are Class I water bodies that have been listed as "verified impaired" based on FDEP's evaluation using methodologies from the Impaired Surface Waters Rule (IWR) (Chapter 62-303, F.A.C.). Table 1.1 provides a comprehensive list describing the information given in the following sub-sections: 1.a. - 1.f. Table 1.2 summarizes the FDEP's results from the IWR Run 17. Figure 1.3 shows the location of these WBIDs in the Shell and Prairie Creek watersheds:

The additional twelve water bodies listed below are also contained in the SPJC watersheds. These waters are not listed by FDEP as impaired at this time, but will also be addressed in this document due to evidence of potential impairment:

Shell Creek Reservoir; WBD 2041B; Shell Creek Watershed
Cypress Slough; WBID #2044; Shell Creek Watershed
Unnamed Ditch; WBID #2058; Shell Creek Watershed
Cow Slough; WBID #1964; Prairie Creek Watershed
Myrtle Slough; WBID #1995; Prairie Creek Watershed
Joshua Creek above Peace River; WBID #1950A; Joshua Creek Watershed
Joshua Creek above Honey Run; WBID # 1950B; Joshua Creek Watershed
Lake Slough; WBID #1963; Joshua Creek Watershed
Unnamed Branch; WBID #1974; Joshua Creek Watershed
Honey Run; WBID #1977; Joshua Creek Watershed
Hawthorne Creek; WBID #1997; Joshua Creek Watershed
Hog Bay; WBID #2001; Joshua Creek Watershed

These twelve water bodies generally do not have a sufficient data record to allow for an assessment of impairment for chloride, TDS and specific conductance under the IWR. However, there are reasonable data that exists, such as well water quality data and short-term surface water quality data that indicates these WBIDs need to be included within the SPCWMP. The proposed management actions within this plan will also be applied within these WBIDs.

1.b. Location of the Water Bodies and Watersheds

Please refer to Figures 1.2 and 1.3 for the location of all significant water bodies in the Shell, Prairie, and Joshua Creek Watersheds.

1.c. Watershed / 8-Digit Cataloging Unit Code (HUC)

All water bodies in the Shell, Prairie, and Joshua Creek watersheds, and addressed in this document, are located in the Peace River Basin / 8-digit cataloging unit code (HUC) #03100101.

1.d. Water Body Type

All water body types addressed in this document are streams, with exception of the Shell Creek Reservoir, WBID #2041B, which is classified as a lake due to the impoundment of the Shell and Prairie Creek systems.

1.e. Water Use Classification

The three impaired water bodies listed in section 1.a are designated as Class I waters from their headwaters to the Shell Creek Reservoir / Hendrickson Dam. Appendix 1 (excerpts from Chapter 62-302.400, F.A.C.) defines Class I waters in Florida and specifically, in Charlotte and Desoto County).

The additional water bodies that will be addressed in this document, but are not at this time listed as impaired, are also designated as Class I and include WBIDs #2041B, #1964, #1995, #2044, and #2058. Other Class III waters in the Joshua Creek watershed are not currently listed as impaired, but are also addressed in the SPCWMP. Class III waters, pursuant to Chapter 62-302.400, F.A.C., are designated for use as recreation, propagation and maintenance of a healthy, well balanced population of fish and wildlife.

1.f. Designated Use Not Being Attained

Class I: Drinking Water Use Attainment

In recent years water quality in the City's reservoir has shown abnormal degradation. This situation was amplified during 1999-2001 when central and southwest Florida experienced prolonged drought conditions. During this time period the water quality of flowing surface water systems within the Shell and Prairie Creek watersheds periodically exceeded Class I standards for chloride, TDS, and specific conductance as defined in F.A.C. 62-302.530.

Appendix 2 (Chapter 62-302.530; F.A.C., pg's. 3 & 4) provides *Criteria for Surface Water Classifications* with regards to chloride, conductance, and dissolved solids as applied to Class I surface waters in the Shell and Prairie Creek watersheds.

1.g. Length of Impaired Area

The length of each impaired water body is given below (these measurements were determined using PCArcView3.2):

Myrtle Slough; WBID #2040; Shell Creek Watershed; 6 mi.
Shell Creek; WBID #2041; Shell Creek Watershed;10.5 mi.
Prairie Creek; WBID #1962; Prairie Creek Watershed; 29 mi.

1.h. Pollutants of Concern

The pollutants of concern have been identified as chloride, conductance, and TDS. The three Class I creek systems in the Shell and Prairie Creek watersheds exhibiting elevated levels of these parameters have been affecting the ability of the City's water treatment facility to meet secondary drinking water standards pursuant to Chapter 62-

550, F.A.C. Elevated concentrations of these constituents are indicative of groundwater supplementation to the upstream surface-water systems (Table 1.2).

1.i. Suspected or Documented Sources of Pollutants of Concern

Stream flows in Prairie and Shell Creeks were generally above historical median daily discharge rates throughout the drought of 1999 - 2000. Refer to Figure 1.4 for representative Prairie Creek stream flow data. Periodic increases in stream flow during this time were short in duration and corresponded to increases in specific conductance. These instances have also been documented during typical dry season months when stream flows should be correspondingly low. Contributions of mineralized groundwater from the Class I WBIDs in the Shell and Prairie Creek watersheds are directly affecting the ability of the City's surface water treatment facility to meet secondary drinking water standards for chloride, sulfate, and TDS. Section 62-550.320, F.A.C., establishes secondary drinking water standards maximum levels that are applicable to community water systems. In April 2001, the FDEP authorized an Emergency Final Order (OGC Case No. 01-0467) that allowed the City of Punta Gorda to temporarily exceed secondary drinking water standards in water withdrawn for the Reservoir (WBID 2041B) as a result of severe drought conditions.

Historical ground water quality data collected from monitor wells in the SPJC region indicate that water quality degrades with depth (Appendix 3). This condition is naturally occurring and inherent to the SPJC region. Groundwater investigations in the Prairie Creek watershed indicate that mineralized concentrations increase rapidly below depths of 1,200 feet (below land surface) and often exceed specific conductance concentrations of 1,000 uS/cm. A review of irrigation well construction records within the watersheds indicates that approximately 195 wells in the Prairie Creek Watershed exceed 1,200 feet in total depth. In the Shell Creek Watershed, high mineral concentrations can occur at depths in excess of 450 feet below land surface. Wells deeper than 1,400 feet in the Joshua Creek watershed are considered to intersect highly mineralized water.

Figure 1.5 displays the compilation of ground water quality data collected in the region that exceeds the depth criteria listed above, as well as exceeding the 500 mg/l TDS water quality standard. This figure shows the existence of a number of wells, both in impaired and non-impaired WBIDs that potentially contribute to surface water impairment. Figure 1.6 also displays dry season average specific conductivity data from surface water monitoring stations established for this management plan. These figures demonstrate the necessity for the stakeholders group to take a comprehensive watershed approach to the implementation of management actions and not limit actions to only those WBIDs identified as impaired.

Ground water withdrawals from mineralized zones used for irrigation contribute to surface water systems through direct runoff and/or leaching. Figure 1.7A-D, reflects historical surface water quality trends within the three impaired WBIDs (2041, 2040, 1962) and WBID # 2041B (Shell Creek Reservoir) within the Shell and Prairie Creek watersheds. Typical farming practices for flatwoods soils may help facilitate these contributions. In addition, the use of highly mineralized ground water can exert stresses on crops and, counter-productively, require additional irrigation to overcome evaporative concentration of salts in soils. Several reports have documented the impact of mineralized groundwater on the Shell and Prairie Creek watersheds including "Shell Creek HBMP Summary Report 2001" prepared by PBS & J, Inc. for the City of Punta Gorda as required by Water Use Permit 200872.04, the "Peace and Myakka River

Water Quality Summary" prepared by the Charlotte Harbor Environmental Center (CHEC), and the "Peace River Comprehensive Watershed Management Plan" prepared by the SWFWMD (Appendix 4).

The policies relating to groundwater withdrawals and the construction of irrigation wells throughout the District, including the Shell, Prairie and Joshua Creek watersheds, are promulgated by District Rules 40D-2 and 40D-3, F.A.C. which implement the provisions of Parts II and III of Chapter 373, Florida Statutes. Part II of Chapter 373 stipulates that in order to obtain a Water Use Permit the applicant must demonstrate that the proposed water use is reasonable and beneficial, will not interfere with existing legal users, and is consistent with the public's interest. Furthermore, the applicant must provide reasonable assurance that the proposed water use meets all of the Conditions for Issuance on both an individual and cumulative basis, as specified in Rule 40D-2.301. Several of these conditions provide assurances to prevent offsite discharge of mineralized ground water into the receiving water bodies and/or causing environmental impacts to natural resources.

Increased water use as a result of the severe drought were allowed under Part B The Basis of Review, which stipulates that a permittee's water use may vary both below, and occasionally above, permitted quantities, dependant upon climatic conditions. As such, the extraordinarily dry weather conditions were taken into consideration in compliance reviews of agricultural Water Use Permits. The drought compliance considerations were discontinued when climatic conditions returned to normal in 2001-2002. However, additional measures have been enacted as a result of the drought impacts to the creek water quality, including more restrictive well construction stipulations for new irrigation wells, additional ground water quality sampling, more rigorous Water Use Permit review, and the promotion of several management options including both the Facilitating Agricultural Resource Management Systems (FARMS) and Back-Plugging programs. The Resource Regulation management options are discussed in more detail in Section 3.

2. Description of the Water Quality Goals

2.a. A description of the water quality-based targets or aquatic ecological goals (both interim and final) that have been established for the pollutant(s) of concern.

The specific final goal of the stakeholders group is to improve surface water quality within the Shell and Prairie Creek watersheds, with specific emphasis placed on identified impaired sub-basins, to consistently meet Class I standards. Currently, water quality is impaired due to elevated levels of chloride, TDS, and specific conductance derived from the use of mineralized groundwater to irrigate agricultural lands for crop production. The goal of the Reasonable Assurance Plan (and the specific projects and plans outlined within the document) is to reduce levels of specific conductance, chloride, and TDS below the maximum Class I criterion of 1275 uS/cm, 250 mg/l, and 1000 mg/l, respectively, at all times throughout the SPJC watersheds. In addition, the goal of the plan is to reduce TDS below the Class I standard of 500 mg/l as a monthly average. To achieve these goals, specific conductance will be used as a surrogate measure for chloride and TDS. Specific conductance must be below 775 uS/cm to ensure compliance with Class I standards for chloride (250 mg/l maximum value) and TDS (1000 mg/l maximum value and 500 mg/l as a monthly average).

The key index stations used to measure progress towards this goal are:

1) Shell Creek near Punta Gorda (reservoir) (WBID # 2041B)
2) Shell Creek at Washington Loop Road (WBID # 2041)
3) Shell Creek @ SR 31 (WBID # 2041)
4) Prairie Creek at Washington Loop Road (WBID # 1962)
5) Prairie Creek @ SR 31 (WBID # 1962)
6) Myrtle Slough @ SR 31 (WBID # 2040)

There currently are 16 additional specific conductance stations established in the region to assist in directing and prioritizing resource management actions identified in Section 3.b of this plan. Additional stations will be added as needed. The time frame to achieve this goal is ten years, or by 2014. The adjacent Class III Joshua Creek watershed will also be included in this effort due to the identification of similar problems in the watershed; however, at a lower priority level.

The 775 uS/cm specific conductance level has been chosen as a surrogate level to ensure that TDS concentrations are less than 500 mg/L. Based on extensive surface water sampling conducted by the District and the FDEP, this conductance will result in a chloride concentration of approximately 150 mg/L. The 775 uS/cm level is well below the Class I surface water specific conductance concentration level of 1,275 uS/cm established by FDEP (Chapter 62.302.530, F.A.C.). Review of historical data concentrations in the Shell and Prairie Creek surface water basins have established a TDS/specific conductance ratio relationship of 0.65 (specific conductance X .65 = TDS) and a chloride/specific conductance ratio 0.20 (specific conductance X .20 = chloride) (Figure 2.1). The ratio relationships for both TDS and chloride do exhibit greater inaccuracies when concentrations are extremely elevated. Specific conductance can also be measured accurately using field methods, which allows for the establishment of an extensive data collection network using continuous recording data sondes. This increases the ability of the stakeholders group to accurately target areas for management activities that have significant poor water quality contributions. Water quality samples will be collected quarterly to insure the TDS/specific conductance ratio remains accurate and to assess other water quality parameters that contribute to the overall elevated TDS signature, such as sulfate.

Interim targets have also been set based upon resource management activities. Several programs have been specifically developed by the stakeholders group to formally address the increased chloride, TDS, and conductance concentrations noted in the Shell, Prairie, and Joshua Creek watershed area such as the Well Back-Plugging Program and the FARMS program. Other existing management strategies include the District's Water Use Permit, Well Construction, and Quality of Water Improvement Program (QWIP), the National Resource Conservation Services (NRCS) Resource Priority Area strategies, as well as land management options (such as land purchases). Table 2.1 lists the resource management strategies that are in-place to address the impaired parameters identified by FDEP in the region with interim target levels for each action, if available.

Concentration based load reductions that need to occur by 2014 are presented in the following table. Interim goals are designed to ensure measurable decreases in concentration for all three impaired parameters by 2009. These reductions are calculated by determining the percent reduction needed to meet the water quality goals

of 250 mg/l chloride (at all times) and 500 mg/l TDS (as a monthly average) based upon values that exceed this level at these long-term data collection stations.

Concentration based load reductions that need to occur by 2014 are presented in the following table. These reductions are calculated by determining the percent reduction needed to meet the water quality goals of 250 mg/l chloride (at all times), 1000 mg/l TDS (at all times) and 500 mg/l TDS (as a monthly average) based upon values that exceed these levels at long-term data collection stations.

	Median Percent Reduction Needed		
Water Segment and Stations	**TDS – 500 mg/l monthly average[a]**	**TDS – 1000 mg/l at all times[b]**	**Chloride – 250 mg/l at all times[c]**
WBID 1962			
Prairie Creek at Washington Loop Rd.	25.6%	10.2%	Not Impaired
Prairie Creek at SR 31	32.6%	29.3%	Not Impaired
WBID 2041			
Shell Creek at Washington Loop Rd.	28.8%	5.4%	19.7%
Shell Creek at SR 31	24.8%	10.4%	29.3%
WBID 2040			
Myrtle Slough at SR 31	43.4%	16.5%	34.6%

[a] Median of monthly average percent reductions needed to meet Class I criteria of 500 mg/L.

[b] Median of individual percent reductions needed to meet Class I criteria of 1000 mg/l

[c] Median of individual percent reductions needed to meet Class I criteria of 250 mg/L.

Interim goals of the plan are management based and are designed to show progress on management actions that lead to the long-term water quality based goals detailed above.

Load-based long-term targets for chloride and TDS have also been approximated based upon historical load calculations and projected improvements to water quality within the watersheds. Typically, chloride and TDS have not been evaluated in terms of their loading contributions to a watershed. Instead, the traditional approach is to focus on concentration exceedances as related to water quality standards (in this case, Class I potable supply standards). This plan will focus specifically on concentration-based improvement to water quality in response to the need to meet Class I water quality standards as applied to a potable drinking water reservoir system. However, load-based calculations have also been included to better identify load reductions due to management activities.

Figures 2.2A and 2.2B display the historical chloride and TDS loading estimates as measured at the Shell Creek Reservoir dam. These figures also differentiate loadings that do and do not exceed the Class I concentration standards. As can be seen, concentration exceedances can occur during both high and low flow conditions and often occur in the dry spring months (March-June) and into early wet season months (July-August). The chloride and TDS loads are influenced heavily by a number of factors including; 1) rainfall, 2) irrigation well pumping in response to rainfall and frost/freeze events, and 3) drainage/seepage of irrigation land. These factors make it difficult to predict load estimates in relation to concentration levels.

To estimate load reductions, the average chloride and TDS load was calculated from the subset of load data that demonstrated concentration exceedances over the period of record from 1973-2003 (Tables 2.2 and 2.3). This was done in order to establish an average chloride and TDS load concurrent with concentration exceedances. The following table reflects the historical average concentration-exceeded load value:

Historical Average Concentration-Exceeded Load Value

Parameter	Monthly Average Discharge (cfs)	Monthly Average Concentration (mg/l)	Load (tons/month)
Average Chloride	194.02	286.88	4332.11
Average TDS	150.63	642.18	7772.22

In order to calculate the projected loading that was acceptable for these watersheds, the monthly average discharge from the periods where exceedances were documented was applied to the concentration level that is needed to be achieved, namely the Class I water quality standards of 500 mg/l TDS (499 mg/l actually used) and 250 mg/l chloride (249 mg/l actually used). The average flow used assumes similar flow conditions will occur in the next 30 years that have occurred over the past 30 years. This results in the following load estimates:

Average Concentration-Exceeded Load Goal

Parameter	Monthly Average Discharge (cfs)	Monthly Average Concentration (mg/l)	Load (tons/month)
Average Chloride	194.02	249.00	3904.47
Average TDS	150.63	499.00	6074.75

As a result of this analysis it is apparent that the chloride and TDS load to the watershed will have to be reduced by approximately 427.64 tons/month (9.87%) and 1697.47 tons/month (21.84%), respectively. This reduction, on average, needs to occur only at those times when concentrations have exceeded Class I standards. The load reductions (9.87% chloride and 21.84% TDS) are relatively low due to the fact that there are a low number of instances where monthly average chloride and TDS values have exceeded Class I Drinking Water Standards. As noted on Figure 2.2A, monthly average chloride concentrations have only exceeded drinking water standards approximately eight times over the period of record. These exceedances have all been since January, 2000 and all exceedances can be related to excessive drought conditions during this period when base flow of the stream systems was overwhelmed by groundwater from agricultural pumping. This reduction will occur through the continued implementation of management actions described in Section 3. The following table indicates actual load reductions needed based upon those periods when concentrations exceeded standards.

Average Concentration-Exceeded Load Reduction Needed

Parameter	Historical Concentration Exceeded Load Value	Average Concentration Exceeded Load Goal	Load Reduction Needed (tons/month)
Chloride	4332.11 tons/month	3904.47 tons/month	427.64 (9.87%)
TDS	7772.22 tons/month	6074.75 tons/month	1697.47 (21.84%)

The key water quality based targets that are proposed in this plan and presented in the goal statement will be concentration based due to the need to compare to Drinking water Standards in the Class I Shell and Prairie Creek watersheds. The prioritization of WBIDs for the implementation of management actions is as follows:

1) WBID # 2040 – Shell Creek Myrtle Slough
2) WBID # 2041 – Shell Creek
3) WBID # 1962 – Prairie Creek
4) WBID # 2041B – Shell Creek Reservoir
5) WBID # 2044 – Shell Creek Cypress Slough
6) WBID # 1964 – Prairie Creek Cow Slough
7) WBID # 1995 – Prairie Creek Myrtle Slough
8) WBID # 2058 - Shell Creek Unnamed Ditch
9) WBID # 2001 – Joshua Creek Hog Bay Slough
10) Remainder of Joshua Creek WBIDs

The management actions presented in this plan will be prioritized within the WBIDs as listed above. However, the stakeholders group considers that the entire area of the Shell, Prairie, and Joshua Creeks is potentially impaired and management actions will be pursued throughout the area as opportunities arise.

2.b. The averaging period for any numeric water quality goals.

The recommended averaging period for a detailed analysis of the effects of the various watershed management activities is weekly and monthly. Weekly median values are required as a part of the IWR when multiple samples are collected within a one-week period. The weekly median value will be calculated from all hourly specific conductance values collected within a week for proper reporting following IWR requirements. Monthly average values are used extensively by FDEP as "Criteria for Surface Water Quality Classification", including the established criteria for TDS of <500 mg/l as a monthly average (Chapter 62-302.530, F.A.C.). Hourly specific conductance data will be used to develop monthly averages for long-term performance monitoring. In addition, the ability to identify individual hourly values over the 1,275 uS/cm threshold will be provided in the data management stage for reporting to FDEP. Finally, flow-weighted monthly averages can also be tracked to assist in evaluating progress in response to seasonal rainfall/discharge patterns.

Water quality samples are currently and will continue to be collected from the key index surface water stations (Prairie Creek @ Washington Loop Road, Shell Creek @ Washington Loop Road, Shell Creek Reservoir, Prairie Creek @ SR 31, Myrtle Slough @ SR 31, and Shell Creek @ SR 31) as well as at a number of additional stations in the watersheds. These data will not be averaged but will be reported as a straight concentration per quarter using graphical methods. The following table represents the responsible agency and parameters to be monitored at the key stations (parameter information and site locations can also be found in Section 4 of this plan):

Southwest Florida Water Management District - Resource Data Section	Quarterly (Jan., Apr., Jul., Oct.)	**Field:** sp. conductance, pH, water temp., DO, salinity, total water depth. **Laboratory:** Cl, TDS, SO_4, Si, alkalinity, Ca, Fe, Mg, K, Na, Sr.
City of Punta Gorda Permit Compliance	Monthly	**Field:** sp. conductance, pH, water temp., DO, salinity, total water depth. **Laboratory:** TKN, NO_3, NO_2, TPO_4, OPO_4, Si, color, turbidity, TSS, Cl, chl *a*, alkalinity, TOC.
Florida Department of Environmental Protection - Punta Gorda Office	Weekly, Bi-Weekly, or Monthly	**Field:** sp. conductance, pH, water temp., DO, salinity, total water depth. **Laboratory:** NO_3, NO_2, TPO_4, OPO_4, Cl, TDS, SO_4, Si, alkalinity, Ca, chl *a*.

2.c. Discussion of how goals will result in restoration of the water bodies impaired designated uses.

A Class I water body designation (potable water supplies) has been applied to Shell and Prairie Creeks as stated (Chapter 62-302, F.A.C.):

> Shell Creek – Headwaters to Hendrickson Dam (east of Myrtle Slough, in Section 20, T40S, R24E)
> Prairie Creek – Desoto County Line and headwaters to Shell Creek

Shell and Prairie Creeks have been verified impaired for chloride, specific conductance, and TDS. Reducing specific conductance concentrations, with a corresponding decrease in chloride and TDS concentrations, will restore the Shell and Prairie Creek Basins to Class I Standards. This, in turn, will improve and protect water quality conditions in the Shell Creek Reservoir and Punta Gorda water supply for continued use as a public supply drinking water source.

2.d. Description of procedures to determine whether additional (back-up) corrective actions are needed.

The District, FDEP, City of Punta Gorda, and private landowners have monitoring networks in-place to assess the effectiveness of the management programs designed to improve water quality. This information is tracked closely to assist in directing priorities for the implementation of voluntary management programs (FARMS and Well Back-Plugging Program) as well as for reporting the water quality conditions as a part of this plan and other initiatives. The continuous data sonde specific conductance monitoring platforms are critical in the ability to pinpoint specific stream and canal segments for management priorities. These data collection platforms are the backbone of the plan in relation to identifying priority stream segments, assigning corrective management actions, and assessing the effectiveness of those corrective actions.

Specific conductivity data is downloaded and reviewed on a monthly basis to determine the status of the surface water systems. A general decrease in specific conductance is expected through time due to the direct assignment of resource management activities. A deviation from that trend will result in increased management activity efforts upstream of that particular data sonde location. Additionally, annual reporting of performance data as a part of this plan and independent reporting of individual management activities (QWIP annual work plan, Well Back-Plugging Annual Report, FARMS Annual Report)

will determine the need for focused management actions and additional corrective actions.

3. Description of the Proposed Management Actions to be Undertaken

3.a. Names of the responsible participating entities (governmental, private, others).

Members of the Shell, Prairie, and Joshua Creeks Watershed Management Plan Stakeholders Group are:

2X4 Ranch
4N1, LLP
American Citrus Products Corporation
B & D Veach, Inc.
Bailey Branch, Inc.
Ben Hill Griffin, Inc.
Bright Hour Ranch
Carlton Bar A
Charlotte County
Charlotte County Soil and Water Conservation District
Charlotte Harbor Environmental Center (CHEC)
Charlotte Harbor National Estuary Program (CHNEP)
City of Punta Gorda (City)
Desoto County
Desoto/Charlotte County Farm Bureau
Doe Hill
East Charlotte Drainage District
Florida Citrus Mutual (FCM)
Florida Department of Agriculture and Consumer Services (FDACS)
Florida Department of Environmental Protection (FDEP)
Florida Farm Bureau Federation (FFBF)
Florida Fruit and Vegetable Association (FFVA)
Horton & Veach Groves, LLP
I-5 Groves, LLP
Joshua Water Control District
Peace River Basin Board
Peace River Valley Citrus Growers Association (PRVCGA)
Peace River Soil and Water Conservation District
RO-Len Properties
Ryals Cattle Company
Short-80, LLP
South Florida Water Management District (SFWMD)
Southwest Florida Water Management District (District)
Symons' Groves, Inc.
TRB Groves, LLC
United States Department of Agriculture – Natural Resources Conservation Service (USDA – NRCS)
University of Florida Institute of Food and Agricultural Sciences (UF-IFAS)
V.C.H. Citrus and Cattle
Williams Farms Partnership

There are numerous private agricultural operations that are signatory members of the SPCWMP stakeholders agreement. These agricultural operations represent 31.4% of the acreage within Shell, Prairie, and Joshua Creeks. They also represent 30.0% of the total Water Use Permit (WUP) quantities within this area.

3.b. A summary and list of existing proposed management activities designed to restore water quality

The following list of management activities is expected to measurably improve chloride, specific conductance, and TDS concentrations in the Shell, Prairie and Joshua Creek watersheds.

1) Shell, Prairie, and Joshua Creek (SPJC) Well Back Plugging Program,
2) District Resource Regulation,
    a. Well Construction Permitting,
    b. Water Use Permitting,
3) Facilitating Agricultural Resource Management Systems (FARMS) projects,
4) Federal Environmental Quality Incentives Program (EQIP),
5) Best Management Practices Manuals,
    a. BMPs for Peace River Valley / Manasota Basin Area Citrus Groves
    b. Water Quality BMPs for Cow/Calf Operations
    c. Water Quality/Quantity BMPs for Florida Vegetable and Agronomic Crops
6) Regional Water Supply Plan (RWSP) and Southern Water Use Caution Area (SWUCA) Recovery Strategy,
7) Quality of Water Improvement Program (QWIP),
8) Land Acquisition Programs,
9) Mobile Irrigation Labs,
10) Education and Outreach Activities,
11) Research Activities.

Table 3.1 lists these management actions prioritized by projected effectiveness and the anticipated benefit. Table 3.2 lists the management actions with the approximate load-based and concentration-based improvements that are expected. The estimated concentration reductions were calculated by determining the percent reduction needed to meet the water quality goals of 250 mg/l chloride and 500 mg/l TDS based upon values that exceed this level at the Shell Creek near Punta Gorda (reservoir) data collection station. The percent concentration reduction per management goal was estimated using the percent effectiveness goals associated with each action. A summary of each of these efforts is presented below:

Shell, Prairie, and Joshua Creek Well Back-Plugging Program

On July 10, 2002, the District's Executive Director signed the Board approved Back-Plugging Funding Assistance Initiative (see Appendix 5 for a copy of Board Procedure No. 61-7A). This funding assistance initiative is designed to locate, "back-plug" and improve water quality in wells that exhibit elevated levels of chloride, TDS, and specific conductance. Irrigation well water quality testing indicates that water quality in the region is highly dependant on well construction and deteriorates rapidly with depth. Therefore, wells that exhibit poor water quality can be reduced in depth or "back-plugged" to improve water quality. Section 373.206 F.S. grants the FDEP and/or the District statutory authority to plug artesian wells in accordance with FDEP or District

specifications, if the well is determined to be of such poor water quality as to have an adverse impact upon an aquifer or other water body, which serves as a source of public drinking water. It is under these auspices that the program operates.

A comparison of post back-plugging results and vertical water quality profile data collected from local Regional Observation Monitor Well Program (ROMP) sites indicates that post back-plugging water qualities can generally be improved to specific conductance values of approximately 1,000 uS/cm. Therefore, this value is chosen as the interim groundwater conductivity target and corresponds to the qualifying threshold for the District's Back-Plugging Funding Assistance Initiative. Post back-plugged irrigation water quality can be further reduced to the overall management goal of 775 uS/cm through dilution with the underlying water table and/or by mixing with impounded surface water. Back-plugging is seen as particularly useful in achieving load reductions in the Prairie and Joshua Creek watersheds. Conversely, geophysical investigations of wells in the Shell Creek watershed indicate less water quality stratification. In addition, due to inherent poor water quality in the region, irrigation wells within the Shell Creek watershed are generally shallower in depth than wells to the north and have shorter open-hole intervals. These types of conditions are generally not conducive to back-plugging. Therefore, alternative irrigation source development, anticipated to occur largely associated with the FARMS and NRCS-EQIP Programs (discussed in following subsections), is critical for the Shell Creek watershed.

Back-plugging is seen as an immediate remediation technique for poor water quality wells. Water quality improvement results can be dramatic and properties where back-plugging has been successful have shown substantial improvement in crop growth and yield. As of March 2004, post back-plugging results indicate average reduction in chloride concentration of approximately 62%, with reductions in TDS and conductance averaging approximately 44% and 46%, respectively. Water quality testing of back-plugged wells indicates that pumping well conductance values average approximately 2,400 uS/cm, but can be in excess of 8,000 uS/cm. Testing indicates that back-plugging is most effective on wells that exhibit conductance values in excess of 2,000 uS/cm or greater. These wells generally have direct access to poor water quality zones, which are often associated with the highly fractured sections of the Avon Park Formation. Wells with conductance levels between 1,000 and 2,000 uS/cm are more apt to be characterized by less direct introduction of poor water quality and percent improvements vary from 20 to 50%. Back-plugging investigations include pre- and post- water quality sampling, pre- and post- yield comparisons, geophysical logging, and downhole video investigations. These investigations are performed under the oversight of a Professional Geologist. As of March 2004, two irrigation wells have been back-plugged in the Shell Creek watershed, 14 in the Prairie Creek watershed, and 18 in the Joshua Creek watershed (Figure 3.1). Four additional wells have been back-plugged in the general Peace River Basin and one in the Horse Creek Basin. Qualifying wells are eligible for up to $5,000, based on the total of length of borehole back-plugging, and up to $1,500 for pumping equipment removal and replacement. See Table 3.3 for a summary of back-plugging results. Typically, well yield is reduced by approximately 23%, but can be partially regained by alterations to pumping equipment. The success of implemented well back-plugging projects is further demonstrated through the use of two specific case studies that have been included within this plan (Case Study Tab – Case Study #1 and #2).

Back-plugging performance monitoring of pollutant load reductions will be based on water quality data and source load reduction monitoring. Pre- and post back-plugging

water quality testing allows for quantification of chloride, TDS, and specific conductance improvement on an individual well basis. In addition, source load reduction analyses for individual properties with back-plugged wells can be performed through use-weighted monitoring of individual irrigation sources. These data can be used to calculate annual source load reductions for downstream receiving waters. Pumpage data used for these calculations will be taken from reported flow meter readings, required under water use permit special conditions. Appendix 6 is the first Annual Report on the Status of the SPJC Well Back-Plugging Program.

SWFWMD Resource Regulation

The legislative basis for Water Use Permitting and Well Construction are codified in Chapter 373, Parts II and III, F.S. District rules Chapter 40D-2, Consumptive Use of Water and Chapter 40D-3, Well Construction, Florida Administrative Code (FAC) were adopted by the District to implement these two Regulatory Programs. Under these programs, an applicant must meet the three-prong test of Chapter 373 and the Conditions for Issuance in order for a permit to be issued for well construction or water use. If the application meets the Conditions for Issuance and the permit is issued with the appropriate standard and special conditions, the District is provided with the reasonable assurance that the well construction and water use will meet the District's regulatory program responsibilities and the Class I water quality standards.

Well Construction Permitting

The District regulates the construction, repair, modification or abandonment of any water well through Chapter 40D-3, Regulation of Wells. Through this regulatory program, which covers all 16 counties of the District with the exception of Manatee and Sarasota Counties, the District has the authority to stipulate construction standards for new wells or those wells slated to be modified through the back-plugging program. As the District has oversight of the construction of all water wells in this geographic area, assurances regarding water quality standards can be met through construction standards and stipulations. Professional Geologists mandate a minimum casing depth and maximum total depth based upon best available information regarding site-specific geohydrology of the area obtained through water quality testing and geotechnical data gathered under the current back-plugging program and other geologic publications.

Within the Shell, Prairie, and Joshua Creek watersheds, District staff have set maximum total depths for all proposed wells in order to avoid tapping the highly fractured and highly mineralized zones of the Upper Floridan and Intermediate aquifer systems, which contain poor water quality and contribute to adverse affects to surface water bodies in this area. In addition to the maximum total depth stipulations, water quality limits are also set for all proposed wells. When specific conductance reaches a maximum value of 1,000 uS/cm during construction of a proposed well, the depth of the well cannot be advanced further, regardless of whether the maximum total depth set on the permit has been achieved. This water quality trigger has been set to ensure that future groundwater sources do not contribute to the impairment of the designated Class I water bodies.

Approximately 159 wells are proposed to be constructed through approved Water Use Permits within the Prairie Creek and Shell Creek watersheds. Of this total, 54 wells have proposed total depths of 1,200 feet or greater. Because the 1,200-foot depth could potentially intersect highly mineralized zones within the Upper Floridan aquifer system, water quality limits have been imposed for all proposed wells. The remaining 105 proposed wells in these two watersheds that have total depths less than 1,200 feet also

have a maximum total depth stipulated with the same water quality limits as for the deeper wells.

In order to construct a well, a well construction permit (WCP) application must be submitted and reviewed by staff. All WCP's issued by the District will contain the following limitations and requirements for wells constructed in the Shell, Prairie, and Joshua Creek watersheds: 1) maximum total depth limits, 2) required water quality sampling with depth, and 3) a maximum water quality limit of 1,000 uS/cm. Two WCP Stipulations are used to ensure these criteria are followed: 1) Stipulation No. 31 – Special Well Construction and 2) Stipulation No. 41 – Special Well Construction – Water Quality Sampling. Copies of these two stipulations are attached in Appendix 7.

The on-going well back-plugging program previously mentioned provides staff with detailed information regarding poor water quality zones within the aquifer systems through geophysical techniques and water quality sampling. This information has been made available to regulatory staff to assist them in making appropriate decisions regarding well construction to avoid continued use of highly mineralized water as a permanent irrigation source.

Water Use Permitting

The District regulates the use of groundwater and surface water for irrigation, as well as other uses through Chapter 40D-2, Consumptive Use of Water. Under this regulatory program, an individual requesting the use of water for irrigation, or other use, must demonstrate that the use of water is reasonable and beneficial, is in the public interest, and will not interfere with any existing legal use of water by providing reasonable assurances, on both an individual and a cumulative basis that the water use meets the Conditions for Issuance. A key component of these criteria is that the use of water will not cause quantity or quality changes, which adversely impact the water resources, including both surface and ground waters. Should the application meet the Conditions for Issuance, the District staff will issue the water use permit (WUP) based upon the requested quantities, or provide a recommendation to the Governing Board for approval if the requested quantities require Board approval for issuance. The District determines the duration of a permit based on the degree and the likelihood of potential adverse impacts to the water resource or existing users. The duration of a WUP typically ranges from six to ten years. Prior to expiration of the WUP, the Permit holder may apply for a renewal, if the continued use of the water is warranted. The District will renew the WUP provided all of the Conditions of Issuance are met.

There are currently 179 water use permits issued by the Water Management District in the Shell Creek and Prairie Creek watersheds for agriculture, mining/dewatering, and public supply uses. Approximately 62.6 million gallons per day (mgd) is permitted for these three use types. Of that total volume, approximately 89% is permitted for agriculture, <1% for mining/dewatering, and 11% for public supply (Figure 3.2).

Of the approximately 11% for public supply, 99% is surface water from the Shell Creek Reservoir for the City of Punta Gorda. The remaining percentage is groundwater that is treated through a lime softening process or other similar process to meet drinking water standards prior to consumption.

The quantities of water for mining/dewatering are based upon that volume of water that is transported off-site as moisture contained within the product mined, generally sand or shell. The shallow water table aquifer water contained within the sand or shell does not

contribute to the declining water quality in these two basins and is not considered an integral contributor to the water quality issue in these basins.

The majority of groundwater use in this geographic area is agriculture (89%). The District has issued 168 water use permits with an annual average daily quantity of 57 mgd of groundwater for irrigation of citrus, pasture and row crops, which typically includes melons or other small vegetables. The wells associated with these agricultural permits have been the target of the back-plugging program to date. As each WUP is renewed the District will re-evaluate 89% of the water use permits in Shell, Prairie, and Joshua Creeks during the next 10 years (2014). This equates to approximately 98% of the permitted quantities in these basins. Figure 3.3 indicates the numbers of permits and associated quantities to be renewed each year.

The permits that have been renewed in the past several years contain all of the necessary special conditions designed to meet the water quality issues associated with this management plan. Appendix 7 provides an example of the special conditions attached to a recent WUP to address water quality impairment in the Shell, Prairie, and Joshua Creek watersheds.

Within the renewal process, each applicant must address the issue of groundwater quality, the potential effects on the surface water bodies within each WBID in which it is located and address the composite water quality potentially leaving each site. An integral part of that analysis includes water quality sampling of ground water from existing wells and potentially modifying the construction of the existing well if the water quality does not meet the standard of 1,000 uS/cm. In addition, if a new well is proposed under the water use permit the District will stipulate the construction standard in order to meet all of the requirements of the SPCWMP.

Resource Regulation activities have already shown the ability to account for a significant improvement in surface water quality. As an example, District staff, performing water quality monitoring in tributaries that flow into Shell Creek to identify potential water quality "hot spots", located an uncontrolled flowing artesian well. This well contributed high specific conductance water to the stream that comprises WBID # 2058 – Unnamed Ditch. This well was referred to the District's Resource Regulation Department for enforcement of Water Use Permitting rules. Case Study #3, located at the end of this report, details the success of the Resource Regulation activities.

Facilitating Agricultural Resource Management Systems (FARMS)

In October and December 2001, respectively, the District Executive Director and the FDACS Commissioner of Agriculture signed a memorandum of Agreement to provide cost-share financial assistance for the implementation of irrigation conservation BMP projects. In October 2002, the District's Executive Director signed Board Procedure No. 13-9, creating the Facilitating Agricultural Resource Management Systems (FARMS) Program. Subsequently, the District and the FDACS signed an Operating Agreement, in accordance with the above mentioned Memorandum of Agreement. The Operating Agreement recognized the Shell, Prairie and Joshua Creek watersheds as resource priority areas. In January 2004, the Operating Agreement was renewed by both parties and extended until December 2014. The renewed Operating Agreement expanded the scope of the FARMS program to cover the Southern Water Use Caution Area (SWUCA), but still recognizes the Shell, Prairie and Joshua Creek watersheds as one of two priority

areas. (See Appendix 8 for FARMS Board Procedure 13-9, Memorandum of Agreement, Operating Agreements, program guidelines, project application and evaluation forms).

FARMS is a voluntary public/private partnership designed to provide financial assistance for BMP projects that provide water quality improvement, and/or reductions in upper Floridan withdrawals, and/or conservation, restoration, or augmentation of an area's water resources and ecology. Project cost-share rates are generally capped at 50% for water quality or water quantity BMPs, and at 75% for projects that incorporate both water quality and quantity. Participants are required to enter into a contractual agreement with the District, from five-to-twenty years in duration. Contractual lifetime is based on the type of project, the service life of the components, and specified cost-benefit ratios provided in the District's 2001 Regional Water Supply Plan. A copy of the Water Supply Plan is provided in Appendix 9. Cost-shared BMP performance monitoring will occur for the duration of each FARMS contract.

Management decisions for FARMS projects located within impaired WBIDs are predicated upon individual irrigation source water quality testing. Irrigation well water quality testing indicates that water quality in the region is highly dependant on well construction and deteriorates rapidly with depth. Therefore, analyses of well construction depths can be used to identify potential sources of pollutant loading. Geographic Information Systems (GIS) analyses of the District's well construction database indicate that there are approximately 528 irrigation wells within the Shell and Prairie Creek watersheds. Of these wells, approximately 341 exceed a prescribed depth. Approximately 80 wells exceed the depth criteria in the Joshua Creek Watershed (Figure 3.4).

Additional GIS well construction depth analyses indicate that there are 173 and 191 wells located in the impaired WBIDs of Shell Creek and Prairie Creek, respectively (Figure 3.5). Of these wells approximately 113 exceed depth criteria chosen for verified impaired WBIDs #2040 and #2041 and approximately 101 exceed depth criteria chosen for verified impaired WBID #1962. Due to their location, these wells may directly contribute to pollutant loading in area surface waters from mineralized ground water. Within the impaired WBIDs, these "deeper" wells are associated with 31 Water Use Permits in the Prairie Creek watershed and 31 Water Use Permits in the Shell Creek watershed. Consequently, a minimum of 65 properties may be directly contributing to pollutant loading within the impaired WBIDs. These properties are considered a priority within the SPCWMP and will be given all possible assistance under the FARMS program. Three of these priority properties located in the Shell Creek watershed have already been addressed by FARMS projects. Of the 31 properties that have wells exceeding the prescribed depth criteria within the Prairie Creek watershed, all are proposed to be addressed by FARMS and/or back-plugging programs. Breakdowns of the well construction queries are given below.

Approximate Number of Irrigation Wells Potentially Contributing to Impairment

Watershed	Total No. of Wells	Depth Criteria**	Wells Exceeding Criteria
Shell	189	450 ft.	147
Prairie	339	1,200 ft.	194
Joshua*	413	1,400 ft.	80

* Wells located in the Joshua Creek watershed are listed due to their inclusion in the FARMS program.

** Note: Total depth criteria used in the well construction queries were taken from average depths of post back-plugged irrigation wells per watershed and Regional Observation Monitor Well Program (ROMP) well site vertical water quality profile data.

Additional queries of deep wells located within the impaired WBIDs indicate that approximately 214 wells may be directly contributing to pollutant loading of mineralized water. Testing of these irrigation wells is considered a priority effort in support of the FARMS program and property owners will be given all possible assistance to expedite this task. A summary of well construction queries within the impaired WBIDs is given below.

Potential Number of Irrigation Wells Directly Contributing to Impairment

Watershed	WBID No.	No. of Irrigation Wells	Depth Criteria*	Wells Exceeding Criteria
Shell	2040	119	450 ft.	77
Shell	2041	54	450 ft.	36
Prairie	1962	191	1,200 ft.	101

* Total depth criteria used in the well construction queries were taken from average depths of post back-plugged irrigation wells per watershed and ROMP well site vertical water quality profile data.

It is anticipated that water quality testing of all irrigation sources within the impaired WBIDs be completed by 2008. The District has already initiated detailed water quality sampling of permitted withdrawal points within the Shell, Prairie and Joshua Creek watersheds and has completed testing of over 280 irrigation sources as of March 1, 2004 (Table 4.1 provides information on wells sampled). Water quality sampling prioritization is given for properties with wells located within impaired WBIDs.

FARMS projects will realize water quality improvements through the development of alternative irrigation sources, primarily supported by surface water and/or tailwater recovery. FARMS projects are seen as a means to offset and/or dilute mineralized groundwater sources and can serve as a primary means for addressing impairment, or as an enhancement to other management activities. This enhancement is critical to sites where previous management strategies have been unsuccessful in achieving the interim conductance goal of 775 uS/cm. These type of projects are seen as particularly useful in achieving load reductions in the Shell Creek watershed, since hydrogeologic conditions make individual source load reductions through well back-plugging difficult. Additional water quality improvements are expected through projects that increase irrigation system efficiency, thereby resulting in an overall reduction in irrigation quantities and prolonging alternative source supplies. As of August 2004, FARMS has already cost-shared the construction of three projects within the Shell Creek watershed. Two additional projects are Board approved and in the construction phase. Two of the completed projects are located in verified impaired WBID #2040 and one within verified

impaired WBID #2041. The two projects under construction are located in WBID # 2040 (verified impaired) and WBIDs # 2001 and # 1997 (not impaired) in the Joshua Creek watershed. Total annual average daily groundwater offsets, as a result of the completed projects, are estimated at approximately 400,000 gallons per day. See Figure 3.6 for the location of Board approved and proposed FARMS projects as of March 2004. In addition, Case Studies 4, 5 and 6 detail each of the three implemented FARMS projects and the surface water/ground water offsets. To date, over 312 million gallons of ground water has been offset by the three completed FARMS projects. The offset quantities are the initial key tracking mechanisms for demonstrating water quality improvement. As each project area flushes, the actual water quality data is anticipated to reflect improvement and correspond to reduced ground water use.

FARMS project performance monitoring of chloride, TDS, and specific conductance pollutant load reductions will be accomplished by monitoring surface water discharges and by calculating project source load reductions. Surface water discharge performance monitoring will be made by direct conductance measurements taken at a project's surface water discharge points and/or downstream receiving water bodies. Source load reduction monitoring for individual projects will be calculated through weighting individual irrigation source water qualities by its percent use. Use-weighted monitoring will not only be used to track monthly source load reductions per project, but also to assess overall contractual performance. Pumpage data used for these calculations will be taken from monthly irrigation source flow meter readings, required under water use permit special condition. Flow meter reporting conditions will be required for all FARMS project sites involving alternative source development or increased irrigation efficiency.

The Operating Agreement commits the District and the FDACS to manage and fund the FARMS program until 2014. The expanded FARMS program estimates 15 - 20 projects per year, with prioritization of project development within the Shell, Prairie, and Joshua creek watersheds. Further prioritization will be given to projects within impaired WBIDs. As of August 2004, there are 17 FARMS projects proposed, 10 within impaired WBIDs (Figure 3.6). However, the acceptance of this program within the agricultural community in providing reasonable assurance is predicted to greatly accelerate future project development. With the expectant increase in workload, the District has reassigned three additional full-time positions to supplement current staff managing the FARMS program.

USDA – NRCS Environmental Quality Incentives Program

The Environmental Quality Incentives Program (EQIP) is a voluntary program that provides financial and technical assistance to farmers and ranchers who face threats to soil, water, air and related natural resources on their land. Through EQIP, the NRCS provides assistance to agricultural producers in a manner that will promote agricultural production and environmental quality as compatible goals, optimize environmental benefits and help farmers and ranchers meet federal, state, tribal and local environmental requirements.

EQIP was reauthorized in the Farm Security and Rural Investment Act of 2002 (Farm Bill). The 2002 Farm Bill provides the funds, facilities and authorities of the Commodity Credit Corporation (CCC) to NRCS for carrying out EQIP and working with landowners to implement conservation practices on their property.

National priorities will be used to guide which producers will be selected to receive EQIP funding. The national priorities are:

- Reduction of non-point source pollution such as nutrients, sediment, pesticides or excess salinity in impaired watersheds, consistent with TDML's where available; as well as reduction of groundwater contamination and conservation of ground and surface water resources.
- Reduction of emissions, such as particulate matter, nitrogen oxides, volatile organic compounds and ozone precursors and depleters that contribute to air quality impairment violations of National Ambient Air Quality Standards.
- Reduction in soil erosion and sedimentation from unacceptable levels on agricultural land; and
- Promotion of at-risk species habitation conservation.

The NRCS State Conservationist, with advice from the State Technical Committee, decides how funds will be allocated, what practices will be offered, what cost-share rates will be and the ranking process used to prioritize contracts.

EQIP Eligibility

Persons engaged in livestock or agricultural productions are eligible for the program. Eligible land includes cropland, rangeland, pasture, private non-industrial forestland and other farm or ranch land. Land that has been irrigated two of the last five years is eligible for EQIP assistance to improve irrigation efficiency. NRCS works with the participant to develop the EQIP Plan of Operations. This plan becomes the basis of the cost-share agreement between NRCS and the participant. NRCS provides cost-share payments to landowners under these agreements that can be up to 10 years in duration.

The 2002 Farm Bill limits the total amount of cost-share and incentive payments paid to an individual or entity to an aggregate of $450,000, directly or indirectly, for all contracts entered into during fiscal years 2002 through 2007.

Table 3.4.a. lists conservation practices that were designed to protect water quality and were used in past EQIP contracts in Charlotte and Desoto Counties and Table 3.4.b lists additional water quality practices available for EQIP.

2004 EQIP Action Item Timeline

- EQIP has a continuous signup period.
- Stakeholder and local working group meetings are conducted to develop ranking criteria and resource concerns.
- Ranking criteria reviewed by area resource conservationist and material is posted on the web by January 15, 2004.
- The 2004 batching period ended on February 20, 2004.
- All EQIP applications will be evaluated on a county basis using the criteria established by the local working group.
- Each county will receive a funding allocation based on a formula that considers potential for program activities, need and identified resource problems. Once the EQIP state allocations are received, county allocations will be distributed. Allocations are expected to arrive by April 15, 2004.
- Contracts developed and entered into computer system by September 30, 2004.

History of Funding in Charlotte County

Since 1997, there have been eleven farms funded under EQIP totaling 3,263 acres. The total cost-share funding for the eleven farms was $346,847. Figure 3.7 shows the location of EQIP funded projects.

Year	Acres	Cost-Share Funding
1997	848.6	$ 65,924
2000	263.3	$ 13,626
2002	912.5	$ 82,491
2003	1,238.6	$184,806

FDACS Best Management Practices (BMPs)

The implementation of Best Management Practices (BMPs) within the Shell, Prairie, and Joshua Creek watersheds is predicted to improve water quality conditions with respect to a wide variety of parameters, including specific conductance, chloride, and TDS. However, it's main intent is to improve water quality conditions with respect to nutrient and pesticide related parameters.

Best Management Practices Scope & Application:

In general, the term BMPs refers to a practice or combination of practices based on research, sound science and best professional judgment to be the most effective and practicable on-site means, including economic and technological considerations, of improving water quality. Recognizing that the development and subsequent adoption of BMPs may require several years due to research/data gaps, commodity differences, and/or other regional production nuances, the Florida Legislature has also recognized the value associated with the utilization of Interim Measures. In essence, Interim Measures are a set of logically implemented conservation-based agricultural practices employed largely through best professional judgment. Interim Measures ultimately evolve into more formal BMPs once the supporting scientific research proves the effectiveness of such practices in protecting the state's water resources.

Section 4.1 of the 2001 Technical Advisory Committee *Report to the Governor and Legislature on the Allocation of Total Maximum Daily Loads in Florida* states that the comparable, minimum treatment for agricultural nonpoint sources should be the BMPs developed and adopted by rule for that activity. As such, BMPs have emerged as the cornerstone of restoration efforts for waters impaired by contributing nonpoint sources. The report's recommendations are consistent with the general approach that has evolved to address nonpoint sources and, more specifically, are consistent with the 1999 Florida Watershed Restoration Act, which clearly indicates that BMP development and implementation is the preferred way to deal with nonpoint source discharges**.**

Background on BMPs for Agriculture and the FDACS BMP Program

Properly designed and implemented BMPs have been shown to be effective, reasonable tools for controlling potential nonpoint source water quality impacts associated with agricultural production and have been routinely used in Florida for nearly two decades. However, it is critical in the development and implementation of agricultural BMPs that they are compatible with the agricultural activity for which they are intended and that they strike a balance between water quality improvement and agricultural productivity.

Recognizing the increasingly important role that BMPs will play in the future as Total Maximum Daily Loads (TMDLs) are established and loads subsequently allocated,

several sectors of Florida's agricultural industry have already worked in a proactive manner to develop and adopt BMPs. These BMPs are further described and briefly discussed in the next section. Most farms in Florida are implementing some type of BMPs. In fact, the Florida citrus and strawberry industries have been very successful in converting their irrigation systems to low volume ones that deliver water in gallons per hour as opposed to gallons per minute. In general, current on-farm management practices include erosion control and sediment management, nutrient management, water resource management, and/or integrated pest management. It is generally recognized that successful BMP implementation will ultimately exist as a mosaic of practices collectively and synergistically working together to mitigate adverse impacts to the environment.

Water Quality Authorities

In the last eight years, the Florida Legislature has enacted several new laws endorsing BMP development and implementation as the preferred means of addressing water quality concerns associated with agricultural production. These laws also provided the FDACS the authority for BMP development for nonpoint source water quality impacts associated with agricultural production. Specifically, FDACS' BMP water quality rulemaking authority exists within sections 403.067, 373.4595 and 373.406(9), F.S. Additionally, as authorized under the nitrate legislation from 1994 and 2003 pursuant to section 576.045, F.S., FDACS has existing BMP authority related to the protection of groundwater from potential impacts associated with the use of fertilizers and other nutritional materials containing nitrogen.

Agricultural Land Use Analysis

The success of the TMDL program in addressing all nonpoint source impacts in Florida will be affected in large part by the accurate determination and relative contributions of the land uses within the targeted watersheds. Undoubtedly, one of the more dominant land uses within most watersheds will be agriculture. Within this land use category, there are myriad forms and types of agriculture, each with its own set of practices that vary across the state. As such, it will be essential to assess the impaired waterbody's predominant land use categories, identify the current level of BMP implementation in the target watershed, and project a future land use schematic within the basin in order to make sound TMDL apportionment analyses and recommendations. FDACS has committed to this level of analysis by hiring an in-house System Project Consultant to construct a comprehensive web-based BMP tracking system that includes a Geographic Information Systems component.

BMP Manual Development and Primary Components

Voluntary participation by agriculture producers in Florida's TMDL program largely rests with the successful development of a logical and comprehensive set of BMPs, codified within the context of a written manual. Given the inter-relationship between soil and water matrices and their effects on many types of production agriculture, technical criteria developed as part of a BMP manual must analyze these relationships. It is recommended that all BMP manuals designed to address TMDL water quality concerns include, at a minimum, certain key chapters. Examples of key chapters would include, but are not limited to, General Use BMPs, Nutrient and Irrigation Management, Water Resources Considerations, Erosion and Sediment Control, Specific Technical Standards and Recordkeeping Strategies.

Implementation

The success of widespread implementation of BMPs in affected watersheds is directly related to the amount of grower participation and endorsement of the BMPs. The BMP development process described above must be based on effectively communicating to the grower community the nature of the water quality concern and why it is in the best long-term interest of the agricultural industry to be an active participant in the development of the BMPs. FDACS has found that agricultural producers are willing to participate in water resource protection programs if they understand the nature of the concern and have the opportunity to participate in the development of strategies to address that concern. As of March 2004, BMP implementation of citrus BMPs has been accelerated in certain areas around the state.

BMP Manuals for Florida

Commodity-specific BMP manuals have been developed in accordance with Florida Law, and many of these manuals have been printed in bulk and have been distributed to the agricultural community. A summary of these manuals is arranged chronologically and appears in Table 3.5. The manuals can also be downloaded at www.floridaagwaterpolicy.com **.**

Targeted BMP Initiatives in Shell and Prairie Creek Basins

A. Nitrate Rule

In the early 1990's, the FDACS in cooperation with FDEP, UF - IFAS and representatives from the Florida citrus industry began addressing concerns with elevated nitrate levels in shallow drinking water wells in ridge soils. These discussions led to the development of a Nitrogen Interim Measure Rule for Florida Citrus. Participation in this program, which addressed timing and amount of nitrogen applied to a citrus grove per acre, was voluntary and offered incentives to the approximately 2000 citrus producers who availed themselves of this rule. Subsequently, representatives from the same group reconvened in January 2001, to develop a BMP (Final Rule) for citrus grown on the Lake Wales Ridge. The Final Rule was adopted in 2002 and enumerates nitrogen BMPs for Florida Ridge Citrus. The BMP addresses key issues such as timing and amount of nitrogen growers should apply per acre per application in order to reduce the likelihood of nitrates leaching into groundwater. In addition, the BMP has an irrigation section that provides the grower with guidelines to help determine the amount of water to apply to each tree as well as the appropriate timing of each irrigation cycle. These recommendations are designed to account for evapotranspiration (ET), soil type, and emitter size.

In November 2003, the Department working in conjunction with the FDEP began a verification project to determine the effectiveness of the Ridge Citrus BMP. The project entails the placement and sampling of multi-level wells on nine commercial groves, determined to be representative of the ridge production area. Although in its preliminary stages, this study will be used to verify positive water quality trends in post BMP implementation.

B. BMPs for Peace River Valley / Manasota Basin (PRVMSB) Area Citrus Groves Manual

The Peace River Valley Citrus Growers Association, in cooperation with area citrus growers and federal, state, regional and local agencies have developed a "BMP for PRVMSB Area Citrus Groves" manual that will address and protect the area's water resources while maintaining the viability of the area's citrus groves. This BMP manual is composed of four main chapters including, water resource management, erosion control

and sediment management, pest management, and nutrient management. A summary of the nutrient management chapter and 'Managing Salinity' section from the water resource management chapter is arranged chronologically and appears in Appendix 10. The anticipated completion date of this manual is March 2004 and public workshops are anticipated to begin in the summer of 2004 with final rule adoption to follow.

C. Water Quality BMPs for Cow/Calf Operations

The Florida Cattlemen's Association worked cooperatively with several state, federal, and local agencies in the development of the "Water Quality Best Management Practices for Cow/Calf Operations" which was published in June 1999. Under the auspices of an EPA Section 319 grant, 6000 manuals were printed and distributed in April 2000, and cattle operators have been trained in the use of this manual statewide. The manual and supporting procedures have been adopted in the Lake Okeechobee watershed as part of the Everglades Restoration Project and are also being noticed for rule adoption statewide.

D. Water Quality / Quantity BMPs for Florida Vegetable and Agronomic Crops

The FDACS is now completing a two-year effort to develop a water quality and water quantity BMP manual that will cover most row, agronomic and field crops grown in Florida. The anticipated completion date of this manual is fall of 2003, with rule adoption expected in 2004.

BMP Validation / Quality Assurance

The BMP Quality Assurance Program helps verify that implemented practices are operated and maintained properly over time. FDACS, working in concert with District staff under the auspices of the FARMS program, visually verify that BMPs are being maintained and operated through routine, systematic inspections. When deficiencies are identified, local farmers are notified to correct operation and maintenance problems. The FDACS BMP validation and quality assurance program generally consists of three cornerstones: a Notice of Intent to Implement form; a guarantee of minimum BMP participation rates; and, routine follow-up inspections at cooperating farms to ensure compliance with BMPs and associated cost-share reimbursement. These three processes are more fully described below.

Notice of Intent (NOI) to Implement

Once BMPs have been adopted by rule and an on-farm assessment has been performed, participating growers may then submit a NOI to FDACS. This data is then entered into a BMP database for future reference and tracking. The database also has a GIS interface that allows for spatial analyses and mapping functions. In addition, the NOI data is imperative in determining the number of acres implementing BMPs in impaired watersheds, and is further used to derive grower participation rates as discussed below.

Minimum Participation Rates

As mentioned earlier in this section, the FDACS working in cooperation with regional agricultural stakeholders have been instrumental in getting citrus producers in affected areas to participate in the BMP program(s). For example, in the Indian River Lagoon/St. Lucie Estuary, approximately 90% of the total citrus acreage for that area has been enrolled in the program. Moreover, this participation rate was realized in the short span of a one-year time frame. Given that growers in the PRVMSB area used the Indian River Lagoon BMP program as a template and to date have been equally involved in the process, FDACS foresees similar participation rates once the BMP manual is adopted by

rule. Lastly, growers who opt to participate in Florida BMP programs developed for nonpoint source agricultural discharges only have to meet participation rate thresholds in order to attain the presumption of compliance with state water quality standards.

Follow-Up Inspections

A successful quality assurance program must contain a credible follow-up inspection element that includes defined procedures. One very good model for BMP implementation validation and follow-up inspections is the Middle Suwannee River Partnership. FDACS' Regional Ag-Team working in the PRVMSB should adopt the procedures used in the Middle Suwannee River in order to ensure program integrity and to achieve water quality goals.

Regional Water Supply Plan and Southern Water Use Caution Area Recovery Strategy

The District Governing Board established the Southern Water Use Caution Area (SWUCA) in October 1992. The SWUCA was identified in response to the need to manage water resources basin-wide due to the wide-spread impact of ground water withdrawals across the southern area of the District. The SWUCA encompasses the southern half of the District and includes the entire area of the Shell, Prairie, and Joshua Creek Watersheds, within the District jurisdiction. The SWUCA area was one of two areas targeted in the District that required water supply plan development because "*sources of water are not adequate for the planning period to supply water for all reasonable-beneficial uses and to sustain the water resources and related natural systems*" (Chapter 373.0361(1), F.S.).

In August 2001, the District Governing Board approved the "Regional Water Supply Plan" (RWSP). This plan (Appendix 9) is an assessment of projected water demands and potential water sources available to meet those demands. The purpose of the plan is to provide a framework for future water management decisions in areas of the District where the hydrologic system is stressed due to ground water withdrawals.

In the SWUCA, long-term water level declines in the Upper Floridan Aquifer have been documented since the area first began to develop. The current major users of ground water in the area are agricultural irrigation and public supply (SWFWMD, 2003). Estimated ground water withdrawals in 2000, a period of record drought, were 836 million gallons per day (mgd). Of this amount, 69% was for agriculture and 17% was for public supply. One of the principal concerns of these ground water withdrawals is salt-water intrusion in the Upper Floridan aquifer along the coastal margin. Model derived estimates have predicted that in order to halt salt-water intrusion, annual average ground water withdrawals would have to be reduced from 650 mgd to less than 400 mgd, and possibly close to 200 mgd.

The Draft SWUCA Recovery Strategy (Appendix 9) indicates that agricultural water-use is expected to remain stable or decline over the next several decades. Agricultural water-use steadily increased over the past half-century and has become the dominant water use in the SWUCA. However, in recent years several developments have adversely impacted or displaced agricultural operation in the SWUCA including: 1) expansion of urban areas, 2) full implementation of the North American Free Trade Agreement (NAFTA) and other global competition issues, 3) more stringent regulations, and 4) destructive insect and disease outbreaks. The general trend of agricultural operations and ground water use identified in the Draft SWUCA Recovery Strategy

within the SWUCA will directly assist in the improvement of surface water quality conditions within the SPJC watersheds.

Sufficient sources of water are available within the SWUCA to meet the projected needs if other potential sources of water are developed as an alternative to Upper Floridan aquifer ground water withdrawals. These sources include: 1) surface water and storm water, 2) reclaimed water, 3) agricultural water conservation, 4) non-agricultural water conservation, 5) brackish ground water and, 6) seawater desalination. An estimated 41 mgd could be saved through agricultural conservation using the most water-conserving irrigation system technologies with all applicable BMPs.

The Draft SWUCA Recovery Strategy is currently in development to accomplish the following goals in an economically, environmentally and technologically feasible manner: 1) restore minimum levels to priority lakes in the Lake Wales Ridge by 2015, 2) restore minimum flows to the Upper Peace River by 2015, 3) reduce the rate of saltwater intrusion in coastal Hillsborough, Manatee, and Sarasota counties by achieving the proposed minimum aquifer levels for saltwater intrusion by 2020, and 4) ensure that there are sufficient water supplies for all existing and projected reasonable-beneficial uses. The Draft SWUCA Recovery Strategy specifically references agricultural conservation efforts through the implementation of Facilitating Agricultural Resource Management Systems (FARMS) projects and similar type project within the SWUCA to help achieve these goals. Also mentioned are well plugging programs like the Quality of Water improvement Program (QWIP) and Land Acquisition Programs. Regulatory efforts also play a large role in the SWUCA Recovery Strategy.

Both the RWSP and SWUCA Recovery Strategy focus extensively on reducing Upper Floridan aquifer ground water withdrawals. The focus of reducing Upper Floridan aquifer water use, as applied in the Shell, Prairie and Joshua Creek watersheds, results in a reduction in the use of Upper Floridan aquifer zones that are potentially mineralized due to elevated concentrations of chloride, TDS, and specific conductance. A reduction in ground water use lowers the potential for poor water quality ground water to enter area surface water bodies. This strongly links the RWSP and SWUCA Recovery Strategy with the Class I water quality impairment issues described within this plan.

Quality of Water Improvement Program

The Quality of Water Improvement Program (QWIP) was established in 1974 to restore hydrologic conditions and improve water quality altered by improper well construction through the plugging of abandoned artesian wells (Appendix 11 – SWFWMD Policy and Procedures for QWIP). This program attempts to prevent inter-aquifer exchange of varying water quality types. As of October 1, 2003, the QWIP has inspected 5,721 wells and plugged 3,349 wells throughout the District's southern ground water basin. Specifically, in Charlotte County a total of 252 wells have been plugged and in Desoto County an additional 68 wells have been plugged. Wells plugged in the Shell, Prairie, and Joshua Creek watersheds are shown on Figure 3.8. The QWIP directly supports the goals of the SPCWMP due to the complete abandonment of wells that contribute increased concentrations of chloride, TDS and specific conductance to area surface waters. More information on the QWIP program can be found in the QWIP "Artesian Well Plugging Annual Work Plan 2004" in Appendix 11.

Land Acquisition Programs

Funding for land acquisitions are possible through the Florida Forever program. This program was established by the Florida Legislature in 1999 and provides funding to several state agencies and the five Water Management Districts for land acquisition (including less-than-fee (LTF) interests). The District is projected to receive approximately 25% of the state's funding distribution to be allocated for project funding ($26 million per year) over a ten-year period.

The Florida Forever program is a performance-based program with measurable goals to evaluate the resource protection benefits of acquired lands. The goals that apply to acquisition of lands by the Water Management Districts include the following:

a) Enhance the coordination and completion of land acquisition projects;
b) Increase the protection of Florida's biodiversity at the species, natural community, and landscape levels;
c) Protect, restore, and maintain the quality and natural functions of land, water, and wetland systems of the state;
d) Ensure that sufficient quantities of water are available to meet the current and future needs of natural systems and the citizens of the state;
e) Increase natural resource-based public recreational and educational opportunities.

To date, the District has acquired approximately 32,000 acres in the Prairie and Shell Creek Watersheds through either fee or LTF interests. Proposed land acquisition projects in these watersheds total approximately 48,000 acres through fee or LTF interests (Figure 3.9). The Long Island Marsh project may also be eligible for federal funding through the USDA Wetlands Reserve Program. Table 3.6 summarizes the acreage totals associated with these land acquisition projects.

As of March 1, 2004 there are sixteen water-use permits that have been issued in the Long Island Marsh and Prairie / Shell Creek proposed project areas. Daily water use averages for all sixteen permits totals approximately 2,168,880 gallons per day. Considerable water use savings and surface water quality improvement will be realized if these proposed property acquisitions are made through fee interests.

Additional information can be found in Appendix 12, "Florida Forever Work Plan; Annual Update 2003" and "Resource Evaluation of the Long Island Marsh; Final Report". The acquisition of the Long Island Marsh property is currently under additional review. It has been proposed that a portion of the 7,023-acre (fee) parcel be acquired through LTF interests. Terms under this agreement would allow for the construction of surface water retention and storage areas. These projects would provide supplies of good water quality for augmentation of the Montgomery Canal/Prairie Creek system during dry season periods.

USDA/NRCS Mobile Irrigation Lab

The District maintains a contract with the National Resources Conservation Service's (NRCS) Mobile Irrigation Lab (MIL), which is able to assess the efficiencies of irrigation systems for agricultural entities on a case-by-case basis. An evaluation of an irrigation system by a MIL team incorporates site-specific data about the soil, crop and irrigation system to identify problems with system design and operation. The MIL provides

recommendations for system improvements and scheduling and shows growers how to use soil moisture measuring devices like tensiometers and water table observation wells. System improvements to increase uniformity and efficient scheduling can help growers conserve significant amounts of irrigation water while still providing the water required to meet crop needs. Increased irrigation efficiency not only saves water, but also reduces the potential for leaching and runoff of mineralized water, nutrients and agricultural chemicals. Such leaching may lead to groundwater and/or surface water contamination.

All the data, calculated information, problems and recommended improvements in system design, operation and maintenance are presented in a written report to the grower or landowner. The MIL team is then available to answer questions, discuss problems and recommend improvements, and to pursue further technical assistance through NRCS or the University of Florida - IFAS Extension Service.

Use of the MIL can provide the District with additional assurances that the landowners meet the reasonable and beneficial use of water aspect of Chapter 373, Part II, F.S., of the water use permitting program. Through better management of irrigation water, run-off is minimized, consumption is reduced, and potential adverse effects from poor quality groundwater can be minimized.

There is a maximum potential water use savings of up to 15% if all MIL recommendations are followed, including updated irrigation management techniques. From October 1, 2002 - September 30, 2003 the MIL provided assistance to 32 growers, testing 19 irrigation systems that served 771 acres across the southern region of the District. Furthermore, a total of 21 follow-up visits were conducted to review irrigation plans, make system improvements, and/or install management equipment. Overall, MIL services were provided over this period for irrigation systems serving 6,000 acres. Since it's inception in 1986, the MIL has reviewed 979 irrigation systems serving 41,217 acres across the District.

The MIL has also been used to compliment new and/or existing programs. For example, the MIL provided the FARMS Team with irrigation efficiency information on an approved project for 2003 in SPJC in order to maximize the type of surface water components the landowner could qualify for. Additionally, between November 2003 and January 2004, the MIL was called on to evaluate five groves in SPJC in order to assist in the site selection process for the placement of three irrigation-scheduling weather stations which are part of a three-year joint agency research project between UF/IFAS, SWFWMD, and FDACS. Due to their broad involvement throughout SWUCA and SPJC, the MIL is currently being targeted for additional funding for private outsourcing to reduce response time.

Education and Outreach

Education and outreach activities are an integrated collaborative approach at state, regional, and local levels. These cooperative efforts involve FDEP, FDACS, District, City of Punta Gorda, CHNEP, PRVCGA, UF/IFAS, USDA–NRCS, and FFB. Activities have and continue to focus on State Legislative Delegations, Regional Policy Boards, and grower associations. Also, articles and press releases concerning this issue and associated recovery strategies are an on-going activity. Additionally, display booths and presentations are provided at relevant conferences and commodity trade organizations. Furthermore, the American Water Works Association Research Foundation (AWWARF) recognized the back-plugging strategy in a project titled "Source Water Protection

Alliances Between Water Utilities and Agricultural Operations". The AWWARF final report is anticipated to be published by May 2004. Appendix 13 outlines the education and outreach activities to-date.

The Florida Farm Bureau's County Alliance for Responsible Environmental Stewardship (CARES) program was implemented in 2001 to promote environmentally sound and economically viable farming. It focuses on recognizing producers who have voluntarily implemented BMPs on their operations. CARES was first introduced in conjunction with the Suwannee River Partnership and later extended into the Santa Fe River Basin. Florida Farm Bureau is developing similar CARES initiatives in other areas of the state where it is important that agricultural producers are positively recognized for their environmental stewardship. It also serves as a public relations tool demonstrating to the public that the agriculture industry is actively involved in utilizing sound environmental management. CARES brings agricultural associations, public agencies, institutions and farmers together to increase environmental awareness. CARES is a county-based program open to all farmers. It is completely voluntary and industry participation may help avoid more stringent regulation. Florida Farm Bureau believes that this program will demonstrate that voluntary BMP programs are an effective means of improving water quality.

To participate in CARES the following steps must be completed:

1. Local county Farm Bureaus promote program.
2. Farmers attend CARES orientation workshop.
3. Farmer completes self-evaluation on farming operation to assess environmental practices.
4. Farmers sign up for CARES. Participating agencies help farmers select and implement farm plans, which include a nutrient management plan.
5. Farmers implement BMPs and conservation practices.
6. Farmers are recognized as participants in CARES.
7. After farmers implement BMPs that have been adopted by rule through the FDACS and participating agencies verify that implemented BMPs are protective of water quality, a Presumption of Compliance with state water quality standards can be established.

A considerable education and outreach effort is tied to the FARMS and Well Back-Plugging Programs. Each of these programs entails numerous site visits with potential program applicants, which allows for an opportunity to educate individual growers on the water quality issues within the Shell, Prairie, and Joshua Creeks watersheds. Growers who have participated in these cost share programs have realized significantly improved quality of water available for irrigation use. This, in turn, has resulted in improved tree quality and fruit yield as documented in Case Studies 1 and 2 (see Case Studies Tab in this plan). This education and outreach effort, coupled with the ability to demonstrate both environmental and economic impact improvements, provides the greatest opportunity to involve additional growers within the region in management actions.

Research Activities

Numerous research activities have been completed historically that contribute to water quality management in the Shell, Prairie, and Joshua Creek Basins. These research activities can be broadly grouped into diagnostic/conditions investigations and grower resource management investigations. Historical investigations and new investigations that contribute to improving water quality conditions directly and indirectly in the region

are listed in Table 3.7. Several of the historical investigations are noteworthy such as the UF - IFAS study funded by the District in 1994 *"Water Requirements and Crop Coefficient For Flatwood Citrus".* This investigation contributes specific information to the citrus grower on the best methods for managing grove irrigation requirements. This, in turn, reduces overall ground water use and lowers the potential for water of elevated specific conductance to enter area surface waters.

Several new investigations have been funded or are scheduled to be funded in direct response and support of the development of this plan and the associated management actions. UF - IFAS is leading a $970,000, three-year investigation that is scheduled to begin in 2004 on "T*he Implementation of BMPs for Flatwoods Citrus"* that will be directly applicable to reducing poor water quality use in citrus areas (Appendix 14). The District and the University of South Florida have funded a master's student thesis to investigate the leaching of poor water quality from a grove area once the poor water quality source has been eliminated through other management actions such as back plugging of wells (Appendix 14). Another cooperative effort between FDACS, SWFWMD, IFAS, USGS and area growers is the improvement of irrigation methods and cold protection tools via a three-year project to develop a web-based irrigation-scheduling tool for citrus. Finally, the RA plan process has produced several investigative studies that will be used to support reporting requirements associated with the plan such as an annual status of wells back-plugged (Appendix 6).

3.c. The geographic scope of any proposed management activities.

The following figures provide the geographic scope of each proposed management action in the Shell, Prairie, and Joshua Creek Watersheds and impaired WBIDs:

Figure 3.1 - Location of wells back-plugged and available for back-plugging as of February 18, 2004.
Figure 3.2 – Location of Water Use Permits (WUPs).
Figure 3.4 and 3.5 – Location of agricultural wells permitted.
Figure 3.6 – Location of current and proposed FARMS projects received as of February 18, 2004.
Figure 3.7 – Location of Federal NRCS EQIP projects.
Figure 3.8 – Location of wells plugged by the QWIP program in the watersheds as of October 2003.
Figure 3.9 – Location of land acquisition projects.

Management actions associated with the District's SWUCA Recovery Strategy and Regional Water Supply Plan, citrus BMPs, as well as research and education/outreach efforts are targeted across the entire area of the Shell, Prairie, and Joshua Creek Watersheds. The focus of this plan is the Class I Shell and Prairie Creek watersheds. However, Joshua Creek (Class III water body) has been included due to the identification of similar water quality impairment in this basin.

Implementation of the management actions proposed in this plan have already begun in the Shell, Prairie, and Joshua Creek watersheds. The following table presents a breakdown of the participating area and associated permitted irrigation quantities already implementing the management actions listed within this plan.

Management Action	Acreage	% of Total Acreage (310,424 Acres)	% of Permitted Acreage (259,917 Acres)
Stakeholder Signatory Member	97,156	31.4%	37.4%
Operational FARMS Project	11,209	3.6%	4.3%
Completed Well Back Plugging Project	24,319	7.8%	9.4%
Public Lands (Cecil Webb Wildlife Management Area)	6,435	2.1%	2.5%
Operational EQIP Projects	4,523	1.5%	1.7%
Total	**143,642**	**46.3%**	**55.3%**

This table emphasizes that 55.3% of the Shell, Prairie, and Joshua Creek watersheds that have permitted ground water withdrawals, are already actively involved in resource management actions to address the impaired water quality identified in area surface waters. To date, a total of 13.7% of the permitted area has implemented management actions in the form of FARMS Projects or Well Back-Plugging Program Projects. Figure 3.10 demonstrates the areas where completed management actions have occurred, as well as the area represented by stakeholder involvement.

The following table indicates the area of each identified, impaired WBID that has had management actions implemented or has direct participation in this plan by way of stakeholder involvement (as indicated by participation as a signatory member of the plan). This table indicates that 43.7% of the area of the three impaired WBIDs (1962 – Prairie Creek, 2040 – Shell Creek Myrtle Slough, 2041 – Shell Creek) have implemented management actions or direct stakeholder involvement as shown by participation in the plan as a signatory member.

Management Action	WBID # 1962 Prairie Creek	WBID # 2040 Shell Creek - Myrtle Slough	WBID # 2041 Shell Creek	Total Acres
Stakeholder Signatory Member	25,855	7,239	1,392	34,486
Operational FARMS Project	0	3,867	1,042	4,909
Completed Well Back Plugging Project	2,790	0	565	3,355
Public Lands (Cecil Webb Wildlife Management Area)	0	0	4,362	4,362
Operational EQIP Projects	561	1,600	2,018	4,179
Total Managed Action Acreage	29,206	12,706	9,379	51,291
WBID Acreage	64,490	21,296	31,681	117,467
Percent of WBID with Management Actions	**45.3%**	**59.7%**	**29.6%**	**43.7%**

3.d. Documentation of the estimated pollutant load reduction and other benefits anticipated from implementation of individual management actions.

Specific pollutant removal efficiencies have been documented for some of the individual management actions developed in response to water quality issues in the watershed, as well as established water resource management actions. Table 3.8 summarizes the current knowledge of the removal efficiencies for each management action, noting cases where actual pollutant reductions have been noted. These actions are also listed in Table 3.2 with an estimate of the pollutant load reduction (concentration and load–based). Table 3.1 presents information on the anticipated effectiveness of all management actions in reducing pollutant concentrations and loads. Other management actions are reasonably projected to have an impact on pollutant load/concentration reductions due to the removal of point sources. Many management actions such as the FARMS Program, Resource Regulation activities, land acquisition efforts, and the QWIP specifically target a 100% pollutant removal efficiency due to the ultimate removal of the source of the poor water. These efficiencies are documented at the point source (well head) and examples of this are well represented in this document. Quantification of the removal of the point source and those impacts on the actual water quality on the creek systems is difficult to achieve due to the effects of hydrologic conditions and the time needed to flush soils, the surficial aquifer and the canal systems. The SPJCWMP Stakeholders Group is confident that this plan provides reasonable assurance that water quality criteria will be met in the watershed because the plan specifically removes known anthropogenic sources of the pollutants of concern.

An important concept that needs to be understood is that many management actions focus specifically on reducing the volume of ground water used for irrigation. The reduction in ground water use also results in a reduction in ground water available as runoff to surface water systems. Therefore, that portion of ground water use that has naturally poor water quality will also be reduced resulting in an overall improvement in surface water quality conditions. While the ability to quantify the actual improvement in water quality as a result of decreased ground water use is limited at this time, the monitoring networks that have been designed to document the effectiveness of the various management actions will provide quantifiable results for the annual progress report (submitted to the FDEP) associated with this plan.

3.e. Copies of the written agreements committing participants to the management actions.

Several management actions have specific written agreements associated with the participation in the particular project. See Appendix 15 for copies of executed FARMS contracts with several participants. Example agreements for participation in the SPJC Well Back-plugging Program are also attached in Appendix 15.

It is important to note that growers in this region have an economic incentive to improve water quality used to irrigate citrus and other crops. Currently, the poor water quality used often results in reduced tree fruit yields and also affects tree/crop growth. Therefore, area citrus and crop growers have an incentive to cooperate in the offered management actions to improve their economic conditions.

3.f. Discussion on how future growth and new sources will be addressed

The District Regional Water Supply Plan (RWSP) predicts that agricultural irrigation water use is expected to increase 23% in Charlotte County and 33% in Desoto County from 1995 to 2020. Sufficient sources of water have been identified to meet this increase through a variety of sources including agricultural water conservation and surface water use. These new sources of water do not include additional withdrawals from the Upper Floridan aquifer. This will correspondingly result in a decrease in the use of mineralized water that can potentially impact surface water in the area watersheds. With the current management actions in place (such as the FARMS Program and District Resource Regulation functions) and with the RWSP guidance, no new sources of mineralized water should be introduced into the Shell, Prairie, and Joshua Creek watersheds. More information on future growth and water need projections, is included in the attached RWSP and Draft SWUCA Recovery Strategy (Appendix 9).

3.g. Confirmed sources of funding

Table 3.9 presents confirmed and proposed funding sources and amounts for each management action as of March 2004.

3.h. Implementation schedule (including interim milestones and the date by which designated uses will be restored).

The following implementation schedule has been established for specific management actions to achieve an interim milestone of measurable decreases in the concentrations of chloride, TDS, and specific conductance by 2009 and achieving the overall goal of this plan by 2014:

1. SPJC Well Back Plugging Program
    a. Back plug 40 wells per year beginning 2003.
2. District Resource Regulation
    a. The District will re-evaluate 89% of the water use permits during the next 10 years (2014) with the addition of water quality improvement conditions applied as needed. This equates to approximately 98% of the permitted quantities within the Shell, Prairie, and Joshua Creek Basins. Section 3.b Resource Regulation provides details on the number of permits and associated quantities to be re-evaluated.
3. Facilitating Agricultural Resource Management Systems (FARMS) projects
    a. Initiate 5 projects per year beginning 2003 and increase to 20 projects per year beginning 2005.
4. USDA - NRCS EQIP Program
    a. The EQIP program is largely dependent upon funding allocation that can vary from year to year. However, the Shell and Prairie Creek watersheds are a priority for project implementations as evidenced by funding increases in Charlotte County and specific funding that has been allocated for this region to address water quality concerns.
5. FDACS BMPs for citrus
    a. The *BMPs for Peace River Valley/Manasota Basin Area Citrus Groves* Manual is anticipated to be adopted by rule in the spring or summer of 2004. Farmer participation rates are expected to be approximately 85% within five years from rule adoption.

6. District Southern Water Use Caution Area (SWUCA) Recovery Strategy and Regional Water Supply Plan
    a. Final goals of these efforts are beyond the ten-year time frame established for the SPCWMP. However, specific actions mentioned (such as reducing the rate of salt-water intrusion by 2020) will be on-going within the time frame of the SPCWMP and will result in a reduction in Upper Floridan Aquifer use and a corresponding water quality improvement.
7. Quality of Water Improvement Program (QWIP)
    a. Plug 10 wells per year beginning 2003 (specific to SPJC Basins).
8. Land Acquisition Programs
    a. No specific implementation schedule has been set for land acquisitions. Potential land acquisitions in this region are a priority and are continually evaluated.
9. USDA/NRCS Mobile Irrigation Lab
    a. Approximately 30-40 properties will be evaluated using the MIL each year.
10. Education and Outreach Activities
    a. No specific implementation schedule has been adopted. Stakeholder meetings will occur at a monthly or bi-monthly frequency through 2004 as the SPCWMP is finalized and implemented.
11. Research Activities
    a. No specific implementation schedule has been adopted.

3.i. Any enforcement programs or local ordinances, if the strategy is not voluntary

Enforcement programs, as applied to this plan, are the responsibility of the District through the Resource Regulation Department. Desoto and Charlotte County have the ability to enact local ordinances but none, directly related to this issue, have been pursued to date. Charlotte County does have a surface water protection ordinance that applies to Shell Creek (Ordinance 65-1367) but it is considered obsolete.
The District Resource Regulation Department has the ability to regulate water use. The legislative basis for Water Use Permitting and Well Construction are codified in Chapter 373, Parts II and III, F.S. District rules Chapter 40D-2, Consumptive Use of Water and Chapter 40D-3, Well Construction, Florida Administrative Code (FAC) were adopted by the District to implement these two regulatory programs. The District Resource Regulation has staff specifically dedicated to enforcement of these regulation efforts. The enforcement staffs are charged with the verification of well specifications to meet well construction permit stipulations. This also applies to proper well abandonment and back plugging. In addition, enforcement staff also field-verify the construction of permitted activities often associated with Environmental Resource Permits (ERPs) and Water Use Permits (WUPs). An additional component of the District's regulatory enforcement program includes semi-annual helicopter and airplane aerial reconnaissance. Through this program staff are able to identify activities that may not be visible during traditional land surveillance. When it is determined that a potential violation exists on a site, staff set up a site visit to determine the nature and extent of the possible violation and make determinations if additional enforcement is necessary.

The Florida Department of Environmental Protection, through the TMDL process, also provides a key regulatory component to the improvement of the impaired waters. The implementation of TMDLs, which are adopted by rule, could have severe consequences on agricultural operations within the Shell and Prairie Creek watersheds such as further

controls on ground water pumping. This has been noted within the stakeholders group and has provided further incentive for the cooperation evident in this plan. However, the FDEP has provided strong guidance and support in the development of this plan, which indicates their support of the cooperative nature of the solutions to improve surface water quality in this region.

4. Procedures for Monitoring and Reporting Results

4.a. Description of Procedures for Monitoring and Reporting Results

The District, FDEP, United States Geological Survey (USGS), and City of Punta Gorda currently have surface and/or ground water quality monitoring networks in place that can be used to demonstrate reasonable progress in the SPJC watersheds. Refer to Table 4.1 for a comprehensive table describing station locations, parameters analyzed, and sampling frequencies for the monitoring network information given in the following sub-sections. A description for each of monitoring networks is given below.

Description of Monitoring Networks

In-Stream Data Sonde - Conductance Logging Network (District & USGS)

Purpose

The purpose of the specific conductance-logging network is: 1) to determine surface water systems (streams, canals) that may be showing ground water signature characteristics so that management actions can be developed, and 2) to track the success of re-use projects and other management actions at site-specific locations to meet performance-monitoring objectives.

Network Description

During dry season events (November thru May) the District currently has YSI® 600XLM data sondes deployed at seventeen surface water streams and canals throughout the SPJC watersheds. An additional two stations are monitored and maintained by the USGS under contract with the District (Figure 4.1).

The data sondes are programmed to record (unattended) temperature and specific conductance measurements on an hourly frequency. Data downloads and maintenance of the sondes occurs either on a monthly (dry season) or bi-monthly (rainy season) basis. All data records for each specific site location are reviewed for quality assurance and currently maintained in an excel spreadsheet format (refer to Appendix 16 - Detail No. 9).

During the rainy season (June thru October) data sondes that are not highway accessible are removed. Five "key site" sonde locations remain deployed during the rainy season (Prairie Creek @ Highway 31; WBID 1962, Joshua Creek @ Nocatee; WBID 1950A, Prairie & Shell Creeks @ Washington Loop Rd; WBIDs 1962 and 2041, and Shell Creek Reservoir; WBID 2041B). Funding is available for the purchase of additional data sondes, so as new projects come on-line YSI equipment will be purchased to meet these needs. These five sites are co-located with USGS discharge or stage-height stations that will allow project managers to determine flow-weighted data results for specific conductance and other water quality constituents. Additionally, the District is purchasing SonTek® Doppler Flow Meters that can log (unattended) flow

measurement values in shallow canal and stream systems. These meters will be co-located with data sondes at project-specific sites.

Specific Conductance Reconnaissance Network (SWFWMD)

Purpose

The purpose of the specific conductance reconnaissance network is to track changes or declines in water quality of surface water streams and canals throughout the SPJC watersheds and in other areas of the adjacent to these watersheds. This network will assist in identifying surface waters that are showing ground water signature characteristics and will also provide information on surface waters that are entering the SPJC watersheds from outside study area boundaries.

Network Description

Field parameters (temperature, specific conductance, pH, total station depth, and salinity) are currently collected at sixty-eight surface water stations for the Specific Conductance Reconnaissance Network (Figure 4.2). Additional stations may be added to this network as more sites are identified. Each of the sixty-eight stations is visited twice per year; dry and rainy season periods. Station locations have been selected based on ease of public accessibility (bridge/culvert crossings, etc.) for efficiency purposes.

SPJC – Water Quality Monitoring Networks:
Pre- and Post Back-Plug Well Monitoring Network (District)
Surface-Water Quality Monitoring Networks (District & FDEP)

Purpose

Water quality sample collection in the SPJC has been initiated for the following reasons:

1) Water quality data collected from agricultural water-use-permit wells allows project managers to determine which wells in the SPJC watersheds exhibit poor water quality (e.g. elevated levels of specific conductivity, chloride, and TDS). These wells, if proven to have poor water quality, are then scheduled for back plugging.
2) Following back-plugging activities, water quality data are collected to determine if the well back-plugs have resulted in an improvement in water quality.
3) Water quality data collected from surface water stations throughout the SPJC watersheds allow project managers to determine which agricultural areas may be contributing poor water quality to surface water bodies. These data collection efforts can assist in determining the success of re-use projects and management actions at site-specific locations.
4) Water quality data results obtained from the SPJC ground and surface-water quality networks can be used for performance monitoring reporting.

Data results from surface water stations monitored by the FDEP are used in support of TMDL monitoring requirements.

Network Description

A network consisting of approximately sixteen back-plugged wells is sampled on a quarterly frequency. Wells in the SPJC watersheds that are potential candidates for back plugging are scheduled for sampling on an "as need" basis that is dependant on what areas have been selected for further investigation. Approximately 108 wells were sampled as part of the back-plug network during 2002-2003. Surface water stations that are associated with potential FARMS projects are also sampled on an as needed basis.

Additionally, the District collects samples from six surface water stations on a quarterly frequency and the FDEP-Punta Gorda office currently collects samples at ten surface water sites (rivers and canals) throughout the SPJC watersheds. The FDEP sites are monitored on either a bi-weekly (rainy season), weekly (dry season), or bi-monthly basis (Figure 4.3).

Field parameters collected for the above District networks include temperature, specific conductance, pH, dissolved oxygen, total station depth (for surface water), and purge volume and depth-to-water (for wells). Chemical parameters include chloride, sulfate, TDS, silica, iron, strontium, sodium, magnesium, calcium, potassium, and alkalinity. The field and chemical parameter list for the FDEP sites is similar to the District's list with the exception of nutrients and bacteria data that are collected at select FDEP sites.

The District also performs sample collection for other long-term surface-water quality monitoring networks. Two of these networks: Peace River Nutrient Assessment and Comprehensive Watershed Management have stations located District-wide. Three sites that are in these networks are located in the Prairie Creek watershed (Figure 4.3). Samples are collected at these stations on a monthly frequency. Parameters include temperature, specific conductance, pH, dissolved oxygen, total station depth, nutrients, major ions, and chlorophyll. Data from these networks will also be utilized for SPJC performance monitoring reviews and reporting.

Habitat Assessment and Stream Condition Index Monitoring (District & FDEP)

Purpose

Results from monitoring the biology of rivers and streams provide a comprehensive depiction of the overall health of a flowing surface-water system. Habitat assessment (HA) and stream condition index (SCI) monitoring can assist in determining if anthropogenic factors, such as run-off from surrounding land-use practices and/or disruption of riparian zone buffer areas, are impairing macroinvertebrate habitat and populations.

Network Description

There is not a defined network at this time for biological monitoring. Staff at the FDEP-Punta Gorda office has performed SCI monitoring over the past few years in the Joshua, Shell, and Prairie Creek watersheds. The District also has staff members that are FDEP certified in HA and SCI monitoring. The District will work cooperatively with FDEP in determining which systems need SCI's and if needed, provide field staff to perform the monitoring. All data from habitat assessment and SCI monitoring efforts done in the SPJC will be provided to FDEP for incorporation to the SBIO database.

Coastal Ground Water Quality Monitoring Network (District)
Water-Use Permitting Ground Water Quality Monitoring Network (District)

Purpose

The Coastal Ground water Quality Monitoring Network (CGWQMN) was developed to determine the quality of ground water in coastal regions of the SWFWMD. Primary use of the data is to track any apparent landward movement of salt-water intrusion resulting from major agricultural, industrial, and municipal ground water withdrawals. The network is also designed to monitor up-coning of sulfate rich waters in coastal areas and limited inland areas.

The Water Use Permitting Ground water Quality Monitoring Network (WUPNET), located in the SWUCA, was developed to upgrade the quality of data obtained from permitted irrigation and public supply wells. Well permit conditions require that permit holders provide water quality information about their wells to the District. Historically, data received for some of the permitted wells have not been reliable. This network provides a continuous, reliable data collection effort that will assist with water resource management decisions. Data from these two networks can also be utilized for SPJC performance monitoring reviews and reporting.

Network Description

Approximately 197 wells (District-wide) in the CGWQMN are sampled once each year during the months of December, January, February, and March. Of these 197 wells, 21 are located in the SPJC watersheds. A sub-network consisting of 48 wells (which have been chosen from the original list of 197 wells) is sampled additionally in May and September. Sixteen of these sub-network wells are located in the SPJC area (Figure 4.4).

Wells that are sampled for the WUPNET have been chosen using statistical techniques to determine well density and sampling frequency. From these statistical results a sentinel or "fixed" well network has been established for water quality monitoring of the WUPNET. Monitoring of the sentinel portion of the WUPNET is done concurrently with the CGWQMN. Approximately 147 wells (District-wide) in the sentinel WUPNET are sampled three times each year during the months of January, May, and September. Of these 147 wells, 19 are located in the SPJC watersheds (Figure 4.4).

Field parameters collected for the above District well networks include temperature, specific conductance, pH, depth-to-water, and purge volume. Chemical parameters for the CGWQMN include chloride, sulfate, TDS, silica, iron, strontium, sodium, magnesium, calcium, potassium, and alkalinity. Parameters collected for the WUPNET are the same as the CGWQMN with the exception of TDS.

Shell Creek Hydrobiological Monitoring Program (City of Punta Gorda)

Purpose

The City of Punta Gorda is currently permitted to withdraw 5.38 mgd annual average for public supply from the Shell Creek Reservoir. In 1991, under conditions of the original WUP, the District required the City to implement a Hydrobiological Monitoring Program (HBMP) to ensure the long-term protection of Shell Creek and lower Peace River estuarine systems. The overall objectives of this monitoring program are to determine whether biological communities are adversely impacted by either existing or projected permitted freshwater withdrawals from the reservoir. The City has been performing these monitoring efforts and reporting results to the District on an annual basis since 1991 (Appendix 4).

Network Description

Water quality monitoring is performed at nineteen surface water stations located throughout the Shell and Prairie Creek systems, as wells as the reservoir. Three of these stations (freshwater-upstream of Hendrickson Dam) are located within the SPJC study area boundaries (Figure 4.5). Data collection is currently performed on a monthly frequency by Earth Balance, North Port, Fl. under contract with the City. Chemical analysis for HBMP water quality samples is also conducted by Earth Balance.

Field parameters collected at the three freshwater HBMP monitoring sites include temperature, specific conductance, pH, dissolved oxygen, salinity, secchi depth, total station depth, and sample collection depth. Chemical parameters include color, turbidity, total suspended solids, nitrate+nitrite, ammonia, kjeldahl nitrogen, orthophosphate, total phosphate, chlorophyll *a*, silica, alkalinity, chloride, and total organic carbon.

Data collected for the HBMP has been essential in providing water quality information for historical review and trend analysis with regards to the SPCWMP. Data are also available that were collected for a HBMP which was initiated in 1975. The entire period of record for these data sets will also be utilized for SPJC performance monitoring reviews and reporting.

4.b. Quality Assurance/Quality Control Elements that Demonstrate Monitoring will Comply with Chapter 62-160, F.A.C.

The analyzing laboratory (District Laboratory, Brooksville Fl.) for the District monitoring networks listed in section 4.a. has a State-approved Quality Assurance Plan on file (#870100-G), which complies with FDEP's Quality Assurance (QA) rule, Chapter 62-160 F.A.C., including FDEP approved Standard Operating Procedures. The District laboratory is NELAC certified (Lab ID #E44149). The Resource Data Section at the District will be responsible for collecting all District ground and surface-water quality field parameters and samples. This section also has an internal Standard Operating Procedures Manual (SOP) (Appendix 16) that is updated on an annual basis.

Water quality monitoring and laboratory analysis that is performed by the FDEP-Punta Gorda office (section 4.a.) falls under FDEP's Quality Assurance Plan and SOP guidelines.

Water quality monitoring and laboratory analysis that is performed for the City of Punta Gorda – Shell Creek Hydrobiological Monitoring Program is conducted by Earth Balance in North Port, Fl. This laboratory has a State-approved Quality Assurance Plan on file (#200062), which complies with DEP's QA rule, Chapter 62-160, including DEP approved Standard Operating Procedures. Earth Balance is NELAC certified (Lab ID #E84167).

4.c. Procedures for entering all Appropriate Data into STORET

The Resource Data Section will upload all surface water quality data for the District's monitoring networks to the EPA National STORET Database. The FDEP Tallahassee STORET section also receives a copy of these uploads. The District currently has a contractor developing programming methodologies using ADaPT / EDMS formatting, which will allow STORET uploads to occur directly from the District laboratory LIMS system. Ground water quality data will also accompany the STORET uploads when the new data-flow convention is completed.

The City of Punta Gorda HBMP monitoring data are uploaded to STORET via a contracted entity. Recently, these uploads have been performed by PBS&J.

Data collected from each site location for the Data Sonde Conductance Logging Network will be uploaded to STORET as individual, raw data values, assuming the upload process can be developed with the FDEP to handle this large volume of data. At a minimum, ACCESS tables consisting of the raw data values and associated station

metadata will be made available to the FDEP and other interested parties to perform data analysis of hourly values. Currently these data sondes record unattended specific conductance values on an hourly frequency. The District, with FDEP assistance, will be responsible for the upload of these data results.

4.d. Responsible Monitoring and Reporting Entity

The four agencies described in 4.a are responsible for the collection of water quality data for their respective monitoring programs. All data collected for the projects listed in section 4.a. will be utilized for reporting the status and progress of the SPCWMP.
The District will be responsible for compiling the SPJC water quality monitoring data on an annual basis. All data collected for the District monitoring networks will be checked for quality assurance and reviewed internally on either a monthly or quarterly basis. The District has the responsibility of providing annual reports to the FDEP regarding the status and progress of the SPCWMP.

4.e. Frequency and Reporting Format for Reporting Monitoring Results

Reporting will be submitted in written, spreadsheet, and graphical formats. Frequency of reporting results by management activity is given below:

Monitoring Networks	***Reporting Frequency***
Data Sonde Conductance Logging	Monthly (dry season), Bi-Monthly (wet season)
Specific Conductance Reconnaissance	Bi-annually (twice per year)
Pre- and Post Back-Plug Wells	Quarterly
CGWQMN & WUPNET Wells	Bi-yearly (every 2 years)
Surface Water Quality – Peace Rv. & CWM	Bi-yearly (every 2 years)
FARMS Performance Monitoring	Annually
Shell Creek HBMP	Monthly

The District, as the responsible agency, and stakeholders group, will provide an annual summary report each January regarding the status and progress of the SPCWMP that incorporates monitoring results.

4.f. Frequency and Format for Reporting on the Implementation of all Proposed Management Activities

The District, as the responsible agency, and the stakeholders group will report on the implementation of management activities through an annual summary report generated each January. The District will update stakeholder group members on the progress and results of monitoring networks and FARMS projects at monthly stakeholder group meetings. District and stakeholder group members will also consider overall SPJC Reasonable Assurance Plan activities during the monthly meetings.

4.g. Methods for Evaluating Progress Towards Goals

The District will use water quality data results from all networks listed in 4.a. to evaluate the progress of well back plugging and FARMS re-use project efforts. These data will be interpreted using graphical and statistical methodologies. The key element in the

overall monitoring strategy is the data sonde specific conductance monitoring network. A total of sixteen key stations have been established, including at least one site in each verified impaired WBID. The following stations have been designated as key index stations used to measure progress towards this goal:

1) Shell Creek near Punta Gorda (reservoir) (WBID # 2041B)
2) Shell Creek at Washington Loop Road (WBID # 2041)
3) Shell Creek @ SR 31 (WBID # 2041)
4) Prairie Creek at Washington Loop Road (WBID # 1962)
5) Prairie Creek @ SR 31 (WBID # 1962)
6) Myrtle Slough @ SR 31 (WBID # 2040)

These stations are considered most important in the monitoring program due to their good historical data record, locations at the downstream base of the Shell and Prairie watersheds, and close relationship with actual water quality used by the City of Punta Gorda from the Shell Creek Reservoir. In addition, the two stations located at Washington Loop Road have the ability to adjust concentrations with flow to remove seasonal influences from the data. Section 2.b. contains additional information on data analysis methods that will be used to evaluate progress towards goals.

5. A Description of Proposed Corrective Actions

5.a. A description of proposed corrective actions (and any supporting documents) that will be undertaken if water quality does not improve after implementation of the management actions or if management actions are not completed on schedule.

It is anticipated that corrective actions will not be necessary as applied to the water quality impairment associated with the Shell and Prairie Creek watersheds. Unlike many other areas that have been identified as impaired under the IWR, the cause of the impairment in this area originates from a known point source; namely, mineralized water quality from individual wells that are used to irrigate agricultural lands. The management actions previously described are largely focused on the elimination or improvement of the point sources (wells) associated with existing agricultural water use. New water use in the area will only be permitted if there are no impacts to the existing impairment. Therefore, direct improvement to the surface water quality of the creek systems, based upon chloride, TDS and specific conductance concentrations, can be reasonably predicted to occur. In addition, the agricultural community of this area strongly supports the management actions that have been implemented due to the resulting improvement in water quality available to be used. This, in turn, supports improved fruit yields and the overall economic viability of citrus and other agronomic production in the region.

The potential exists that the management actions implemented currently and proposed for implementation over the next ten years will not correct water quality impairment as quickly as proposed (stated goal of no impairment by 2014). Historical data suggest that area surface waters have experienced elevated levels of specific conductance, chloride, and TDS for several decades as a result of agricultural irrigation practices. This has resulted in a storage of "salts" in soils and the surficial aquifer system in the region. The amount of time required to flush the hydrologic system of these salts is unknown at this time. Several research activities are currently in progress in an attempt to better quantify the time needed to flush individual properties after management actions have been established (well back plugging and/or FARMS projects) (Section 3.b. - Research

Activities). Therefore, it is anticipated that a ten-year period will be sufficient to restore the impaired WBIDs to Class I standards but additional time may be required.

5.b. Process for notifying the Department that these corrective actions are being implemented

The FDEP is an active member in the Shell and Prairie Creek Watershed Management Plan Stakeholders group and will be aware of all actions of the group, including the status of the implementation of corrective management actions. The annual report will be the formal mechanism for reporting the progress of various management actions, the overall success of the plan, and the need for corrective actions. This annual report will be transmitted to the FDEP – Tallahassee as well as the local Punta Gorda and Ft. Myers offices. Corrective actions that are implemented will be documented in the annual report as a separate category to ensure the FDEP is provided sufficient information on the plans implementation and success. If a corrective action is deemed overly significant, such as the introduction of a new management action to address the failure of an existing management action, the FDEP will be notified formally through written correspondence of this significant change to the plans implementation. In addition, this plan will be updated and resubmitted to the FDEP-Tallahassee and the local FDEP offices to address the proposed changes.

Case Study No. 1

Watershed and WBID:	Prairie Creek Watershed WBID No. 1962
Type of Management Action Employed:	Well Back-Plugging Program
Management Action Timeline:	December 2001 to present

Background

This project involves a 560 acre citrus grove within the Prairie Creek watershed, more specifically located within WBID No. 1962. The site is immediately north of Prairie Creek and is bisected by Myrtle Slough, a tributary of Prairie Creek. After conversations with the landowner, the District was granted permission to take samples of all onsite irrigation wells and determine the quality of water used for irrigation. In June 2001 the wells were sampled and pumping discharge rates determined. All water quality testing was performed by the District's certified water quality lab. Upon review of the water quality results, the owner allowed the District to further investigate the three poorest water quality wells with downhole geophysical methods. The pumping equipment was removed and the wells geophysically and video logged in October 2001 to determine the vertical extent of poor water quality. Upon review of logs, a professional geologist determined the interval to plug in order to improve water quality. This information was then used to calculate the volume of cement and gravel necessary to back-plug each well, and to write well construction modification permit stipulations specific to each well. Well construction modification permits were then issued by the District for each well to be back-plugged. District personnel then witnessed and documented all work performed and by December 2001, back-plugging activities were completed. The pumping equipment was reinstalled and each well resampled to determine the percent improvement in water quality and the affect on the well's pumping rate.

Results

The three back-plugged wells were resampled in January 2002 to determine the extent of water quality improvement. As shown in the table below, the results of the back-plugging on ground water quality were substantial. Percent reductions in TDS and chloride ranged from 44% to 64% and 59% to 83%, respectively.

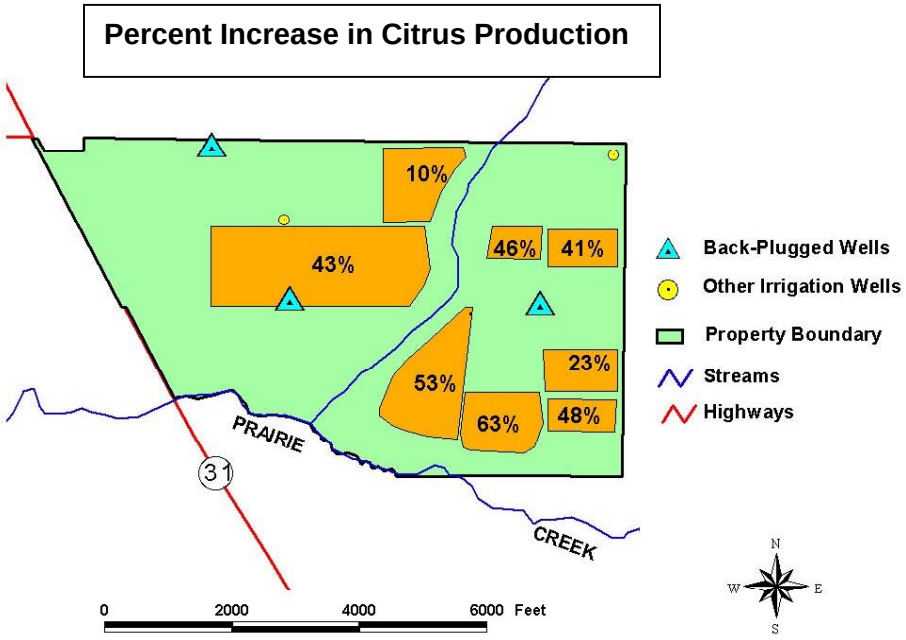
	Pre Back-Plugging Results		Post Back-Plugging Results			
Well No.	TDS (mg/l)	Chloride (mg/l)	TDS (mg/l)	Chloride (mg/l)	% Reduction TDS	% Reduction Cl
2	1,120	448	627	184	44%	59%
6	1,387	584	443	101	68%	83%
7	1,565	691	569	138	64%	80%

In order to investigate the sustainability of improved water quality as a result of back-plugging, the three wells have been resampled on a quarterly basis through May 2004. Testing results indicate that the three wells have maintained their improved water quality. The District intends to continue quarterly sampling of the three wells, as well as other back-plugged wells in the area, to examine long-term water quality improvement trends.

Benefits

The rehabilitated irrigation wells are predicted to have a substantial impact in improving water quality in WBID 1962 due to the property's close proximity to the creek and the surface water drainage system utilized on the farm. Additional resource benefits as a result of the back-plugging program include a better understanding of site-specific ground water quality and aquifer producing zones. Resource Regulation utilized these data in designing the construction of a replacement for an old well that collapsed in the extreme northeast corner of the property. Water quality in the replacement well is almost identical to the back-plugged wells. Another well, located in the central section of the property, is proposed for future back-plugging. In the interim, the property owner has taken this well offline due to poor water quality. In all, the management actions related to back-plugging have greatly improved water quality on the site.

The dramatic improvement in water quality has already affected tree growth in several blocks serviced by the back-plugged wells. It appears that near surface soils have been flushed by the improved irrigation water and rainfall to the extent that the trees have responded very favorably. Fruit harvest records and statements made by the owner indicate that well back-plugging is by and large responsible for a dramatic increase in fruit production. The attached graphic portrays the percent increase in fruit harvests from 2002 to 2003. The owner publicly addressed the District's Governing Board and stated that the improved water quality as a result of back-plugging program saved the grove.



Case Study No. 2

Watershed and WBID:	Joshua Creek Watershed - WBID No. 2001
Type of Management Action Employed:	Well Back-Plugging Program
Management Action Timeline:	November 2001 to present

Background

This project involves a 1,615 acre citrus grove within the Joshua Creek watershed, more specifically located within WBID No. 2001. The property is bisected by Hog Bay Slough, a tributary of Joshua Creek. In June 2001, the District was granted permission to take irrigation water quality samples and determine pumping discharge rates of all onsite irrigation wells. All water quality analyses were performed by the District's certified water quality lab. Upon review of the water quality results, the owner allowed the District to further investigate one of the worst quality wells, No. 8, with downhole geophysical methods. The pumping equipment was removed and the well geophysically and video logged in October 2001 to determine the vertical extent of poor water quality. Upon review of logs, a professional geologist determined the interval to plug in order to improve water quality. This information was then used to calculate the volume of cement and gravel necessary to back-plug the well, and to write a well construction modification permit stipulation. The District then issued a well construction modification permit. District personnel witnessed and documented all work performed and by November 2001, back-plugging activities were completed. After the back-plugging procedure was completed, the pumping equipment was reinstalled and the well resampled for water quality and pumping yield. The favorable results of back-plugging this well resulted in the owner requesting similar procedures for seven additional poor water quality irrigation wells. Back-plugging activities continued until September 2003.

Results

As shown in the table below, the improvements for six of the eight back-plugged wells is substantial, with percent reductions in TDS and chloride ranging from 48% to 94% and 84% to 99%, respectively. One of the remaining back-plugged wells showed no improvement in water quality and another developed sanding problems due to a severely corroded well casing and is no longer in use.

	Pre Back-Plugging Results		Post Back-Plugging Results			
Well No.	TDS (mg/l)	Chloride (mg/l)	TDS (mg/l)	Chloride (mg/l)	% Reduction TDS	% Reduction Cl
8	9,384	4,880	541	64	94%	99%
10	2,524	1,170	507	89	80%	92%
11	9,450	4,850	584	64	94%	99%
12	9,336	4,940	583	N/A	94%	98%
13	3,826	1,505	667	83	83%	91%
15	1,040	508	538	133	48%	84%

In order to investigate the sustainability of improved water quality as a result of back-plugging, five of the above wells have been resampled on a quarterly basis through May 2004. Testing results indicate that all five wells have maintained their improved water

quality. The District intends to continue quarterly sampling of the five wells, as well as other back-plugged wells in the area, to examine long-term water quality improvement.

Benefits

The improved ground water quality is predicted to have a substantial impact in improving surface water quality on site as well as the downstream receiving water bodies. In addition, the improved water quality has also affected tree growth in several blocks serviced by the back-plugged wells. The impacts of high salinity irrigation water on citrus are well documented and include tree twig die-back, reduced root growth, reduced nutrient uptake, and a wilt-like appearance on leaves. Improvements in irrigation water quality can dramatically revitalize tree growth and appearance. Pre- and post- back-plugging photographs of a tree located onsite illustrate this dramatic affect. Please note that the photographs provided below are taken at different times of the year.

Photograph of citrus tree impacted by high salinity irrigation water. Note small canopy in relation to trunk diameter and twig dieback. Also, note lack of branches at base of tree near spray jet emitter.

Photograph taken in Jan. 2003.

Photograph of the same citrus tree pictured above after back-plugging. Note dramatic increase in tree canopy and twig growth in lower limbs subject to direct contact with irrigation water from spray jet.

Photograph taken in Sept. 2004.

Case Study No. 3

Watershed WBID:	Shell Creek Watershed WBID No. 2058
Type of Management Action Employed:	Resource Regulation
Management Action Timeline:	June 2002 to present

Background

To assist with determining the source(s) of elevated specific conductance, chloride, and dissolved solids concentrations in the City of Punta Gorda's in-stream reservoir, the District initiated an assessment of tributaries providing flows to Shell and Prairie Creeks (Class I waters) in January 2001. These assessments include field measurements of specific conductance at numerous canals and stream systems. Site locations that show elevated specific conductance values are investigated further by deploying in-situ YSI® data sondes to log (unattended) specific conductance values on an hourly basis.

In June 2002 an unnamed tributary located in the southern portion of the Shell Creek watershed (WBID 2058), and providing flows to Shell Creek (WBID 2041), had elevated specific conductance values. A YSI® data sonde was deployed in this tributary on June 4, 2002. Results from this logging effort throughout the month of June 2002 showed a maximum monthly specific conductance value of 2346 uS/cm. On June 12, 2002 the source of these elevated conductance values was discovered. A flowing (non-permitted), 10-inch diameter intermediate aquifer artesian well was being used to augment a recreational lake. Specific conductance measured at the wellhead on this day was 3885 uS/cm. A spillway on the northern end of the lake was allowing waters from the lake to enter Shell Creek via the unnamed tributary. Naturally, the tributary would drain fresh-water marshlands.

Artesian well with gate valve.

Discharge pipe from artesian well to center of lake.

Spillway located on north side of lake - flows then enter Shell Creek.

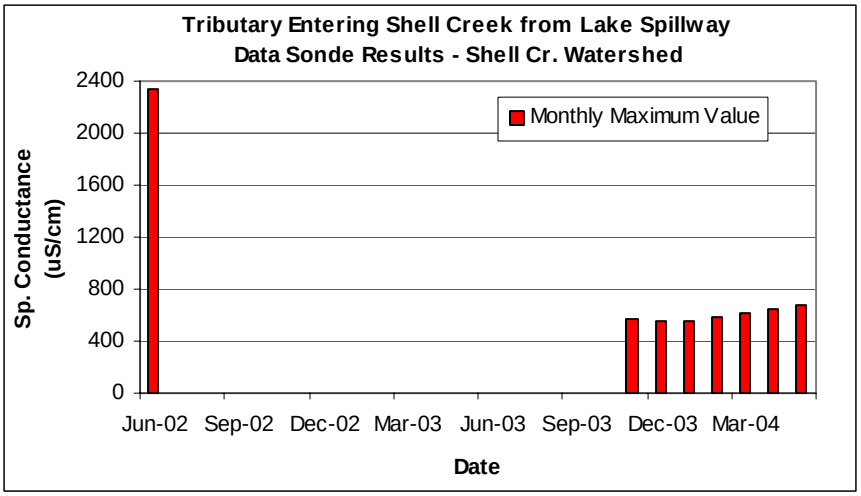
Results

Water quality samples were collected from the artesian well on June 19, 2002. Results from this sample event confirmed that high-mineralized waters were discharging from this well and impacting water quality in the unnamed tributary and subsequently Shell Creek.

Sp. Conductance (uS/cm)	Chloride (mg/L)	Sulfate (mg/L)	TDS (mg/L)
3800	1010	234	2300

District staff immediately contacted the lake property owners and the well was turned off. Water levels in the tributary receiving flows from this lake were reduced significantly within days after the well was turned off. The data sonde could not be re-deployed throughout the following year because water levels were too low.

On June 27, 2002 District Regulatory staff met with the lake property owners to discuss permit and compliance issues related to this well. In July 2002 the property owners began the application submittal process for District issuance of a Water Use Permit. The property owners will retain the right to use this well for fire protection and augmentation of the lake during extended drought periods, as long as flows are not allowed to exit via the spillway and impact water quality in Shell Creek. Specific conductance measured in the tributary from November 2003 through May 2004 show that values have dramatically been reduced since the regulatory/management actions were enacted.



Benefits

The reconnaissance and specific conductance-logging networks in the Shell and Prairie Creek watersheds are very beneficial. These efforts not only assist in determining surface water systems (streams, canals) that may be showing ground water signature characteristics, but also allow management and regulatory actions to be developed as a result. This case study is a good depiction of how water quality monitoring and management /regulatory actions have resulted in the permanent removal of a poor water quality source that was impacting Shell Creek.

Case Study No. 4

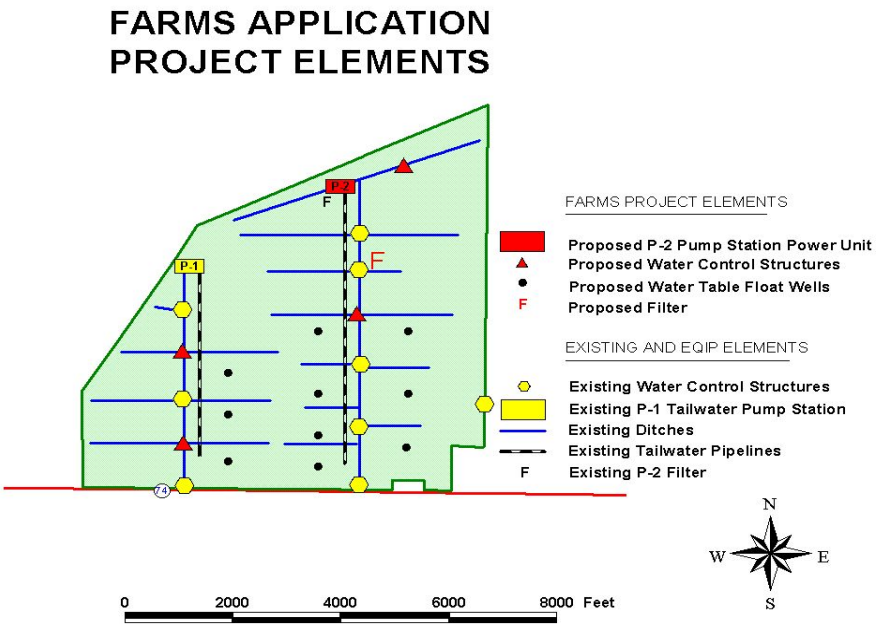
Watershed and WBID:	Shell Creek Watershed - WBID No. 2041
Type of Management Action Employed:	FARMS Project
Management Action Timeline:	September 2003 to present

Background

In January 2003, the District approved a FARMS project located within the Shell Creek Watershed in Charlotte County, more specifically located within WBID No. 2041. The property has approximately 670 acres of citrus which is irrigated by eleven lower intermediate aquifer wells. The current Water Use Permit authorizes the annual average daily withdrawal of 679,400 gallons per day. Water quality testing of onsite irrigation wells indicated that the TDS concentrations ranged from 475 mg/l to 750 mg/l. Chloride concentrations in the wells ranged from 132 mg/l to 720 mg/l. The owner had previously participated in the NRCS EQIP program and wanted assistance in complimenting the infrastructure already cost-shared under EQIP. The scope of the FARMS project was to improve irrigation water quality by offsetting ground water with surface water and improve the overall irrigation efficiency of the grove. The basic concept of the project is to control and collect irrigation tailwater and onsite surface water and reuse the water for irrigation. Construction started after approval and the project became operational in September 2003.

Results

The success of this project lies in the initial design of the grove's drainage. Surface water flow is to the north, towards Shell Creek. Two large ditches run north-south, parallel to the slope, and are intersected by several east-west ditches. By installing water control structures or "flashboard risers" at the ditch intersections, water can be held back during the dry season and stair-stepped at each ditch intersection as it falls to the north. The manipulation of the water table during the dry season helps to keep irrigation tailwater onsite and provide a source of soil hydration through up-flux, which helps to reduce the need for irrigation. Several water table float-wells were installed to monitor the water table within the stair-stepped ditch sections created by the water control structures. Despite the control structures, water eventually seeps to the north and is repumped by two surface water pump stations, P-1 and P-2. These pump stations are plumbed into the irrigation system and directly offset ground water use, or have the option of sending surface water back to the top of the grove near the southern property boundary, where it reenters the stair-stepped ditch system. The ability to recirculate tailwater within the ditch network effectively increases the storage volume capacity of the system. Overall, the FARMS project facilitates improved water quality through the offset of groundwater and an overall decrease in irrigation. A schematic plan view of the project is provided below.



Benefits

After the project was approved by the District's Peace River Basin and Governing Boards, the District entered into a 5-year long contractual agreement with the grove owner commencing in August, 2003. The FARMS contract specifically identifies six irrigation wells, based on water quality, whose use must be reduced and/or eliminated. To date, the property owner has complied with this requirement and as of July 2004 has offset approximately 61,400,000 gallons of ground water with surface water. Due to the project's proximity to the City of Punta Gorda's reservoir and the overall design of the project, it is expected that this project, and others like it, will improve the quality and reduce the quantity of irrigation tailwater entering the Shell Creek watershed.

Case Study No. 5

Watershed and WBID:	Shell Creek Watershed - WBID No. 2040
Type of Management Action Employed:	FARMS Project
Management Action Timeline:	October 2003 to present

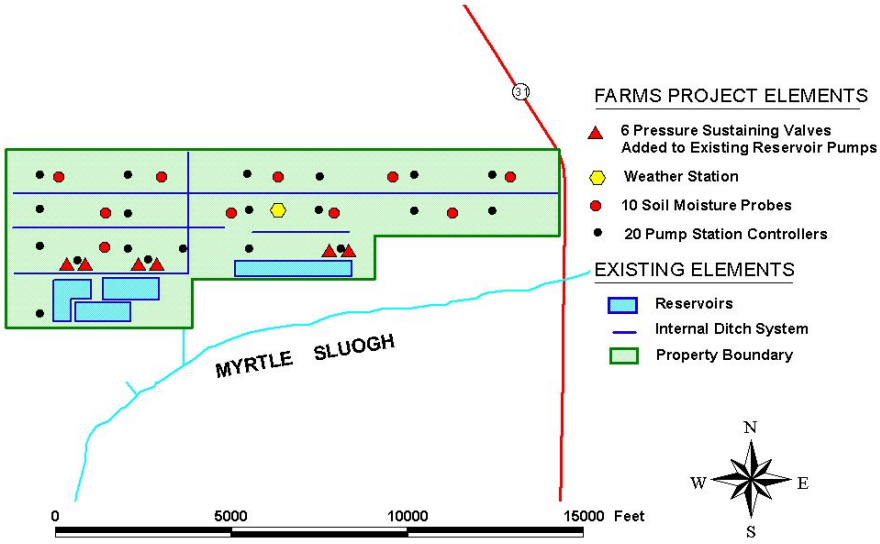
Background

In February 2003, the District approved a FARMS project located within the Shell Creek Watershed in Charlotte County, more specifically located within WBID No. 2040. The property has approximately 1,113 acres of citrus, which is irrigated by ten upper Floridan and nine lower intermediate aquifer wells. The current Water Use Permit authorizes the annual average daily withdrawal of 1,207,000 gallons per day. Water quality testing of onsite irrigation wells indicated that the TDS concentrations ranged from 450 mg/l to 1,900 mg/l. Chloride concentrations in the wells ranged from 120 mg/l to 774 mg/l. The site has approximately 100 acres of existing surface water reservoirs used for irrigation. The basic concept of the FARMS project is to reduce overall irrigation quantities through precise management of irrigation event initiation and termination, while operating the surface water and irrigation tailwater recovery reservoir system in a manner that minimizes the use of ground water to the greatest extent practicable. FARMS project construction started after District approval and the project became operational in October 2003.

Results

The success of this project lies in the design of the grove's irrigation system, which is unique in that it was designed to be computer operated through radio controlled pump controllers. This type system, when working properly, allows for the precise management of irrigation events. In addition, as stated above, the grove was designed to have the option to use surface water for irrigation and has six surface water pump stations with 100 acres of reservoirs. However, the use of surface water was problematic due to irrigation system emitter clogging from algae and plant detritus. In order to address this issue, the FARMS program cost-shared pressure sustaining valves to maintain constant pressure and allow the existing filtration system to work more effectively. The results of adding the pressure sustaining valves have been very favorable with a dramatic increase in surface water use for irrigation. Additional infrastructure cost-shared under the FARMS program included an automated weather station, ten soil moisture sensing stations, and improved remote control pump controllers. These management tools were integrated into the existing computer operated pump irrigation control system and have been used extensively by the property owner. A schematic plan view of the projects components is provided below.

FARMS APPLICATION PROJECT ELEMENTS



Benefits

After the project was approved by the District's Peace River Basin and Governing Boards, the District entered into a 5-year long contractual agreement with the grove owner commencing on July 2003. The FARMS contract specifically identifies fourteen irrigation wells, based on water quality, whose use must be reduced and/or eliminated. To date, the grove owner has complied with this requirement and as of July 2004 has offset approximately 199,811,000 gallons of ground water with surface water. Due to the poor water quality of the irrigation wells, the projects substantial offset of ground water is expected to improve the quality and reduce the quantity of irrigation tailwater entering the Shell Creek watershed.

In June 2004, the grove owner approached the FARMS team with a Phase II project to add additional infrastructure to the existing FARMS project. The Phase II project was approved in September 2004, and their continued participation serves as a milestone in the effort to offset additional ground water quantities in the watershed.

Case Study No. 6

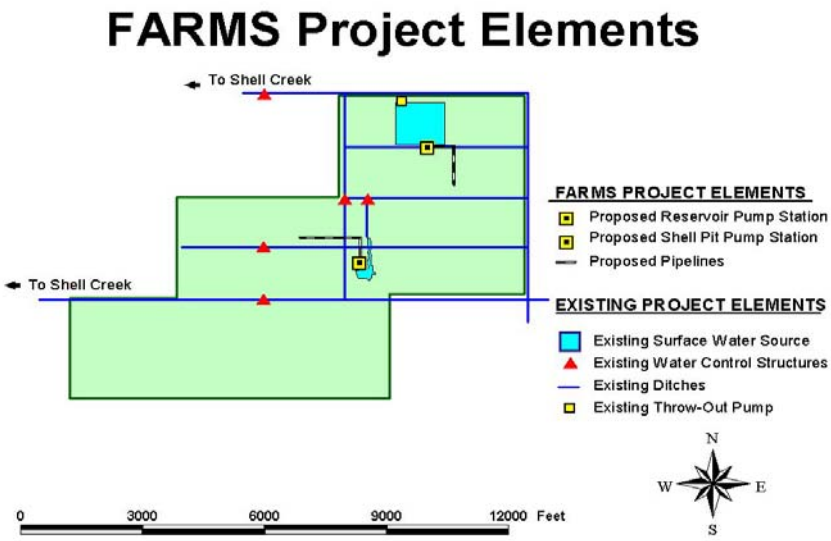
Watershed and WBID:	Shell Creek Watershed - WBID No. 2040
Type of Management Action Employed:	FARMS Project
Management Action Timeline:	December 2003 to present

Background

In June 2003, the District approved a FARMS project on a site that is located within the Shell Creek Watershed in Charlotte County, more specifically located within WBID No. 2040. The property has approximately 962 acres of citrus, which is irrigated by two upper Floridan and five lower intermediate aquifer wells. The current Water Use Permit authorizes the annual average daily withdrawal of 916,700 gallons per day. Water quality testing of onsite irrigation wells indicated that the TDS concentrations ranged from 855 mg/l to 1,788 mg/l. Chloride concentrations in the wells ranged from 315 mg/l to 778 mg/l. The site has two surface water sources, a recently constructed 40-acre reservoir and a 4-acre shell pit. The basic concept of the FARMS project is to offset of ground water used for irrigation with surface water. FARMS project construction started after District approval and the project became operational in December 2003.

Results

The success of this project lies in the owners overall desire to improve irrigation water quality. In this effort, they constructed a 40-acre irrigation reservoir in the northern section of the property prior to entering into the FARMS program. After completion of the reservoir, they attended an outreach meeting held by the District and Peace River Valley Citrus Growers Association and inquired into possible cost-share assistance for a reservoir pump station. In the initial review of the proposed project, District staff suggested that they also consider installing a surface water pump station in an existing 4-acre shell pit. This additional source of surface water would be used to offset additional ground water quantities. Due to the limited storage volume in the 4-acre pit, several existing water control structures would have to operate in a manner that maximized the recycling of irrigation tailwater. A schematic plan view of the projects components is provided below.



Benefits

After the project was approved by the District's Peace River Basin and Governing Boards, the District entered into a 5-year long contractual agreement commencing on November 2003. The FARMS contract specifically identifies six irrigation wells, based on water quality, whose use must be reduced and/or eliminated. To date, the grove owner has complied with this requirement and as of July 2004 has offset approximately 102,217,000 gallons of ground water with surface water. Due to the poor water quality of the irrigation wells, the projects substantial offset of ground water is expected to improve the quality and reduce the quantity of irrigation tailwater entering the Shell Creek watershed. The grove owner has also approached the FARMS team with another project proposal in this same WBID.

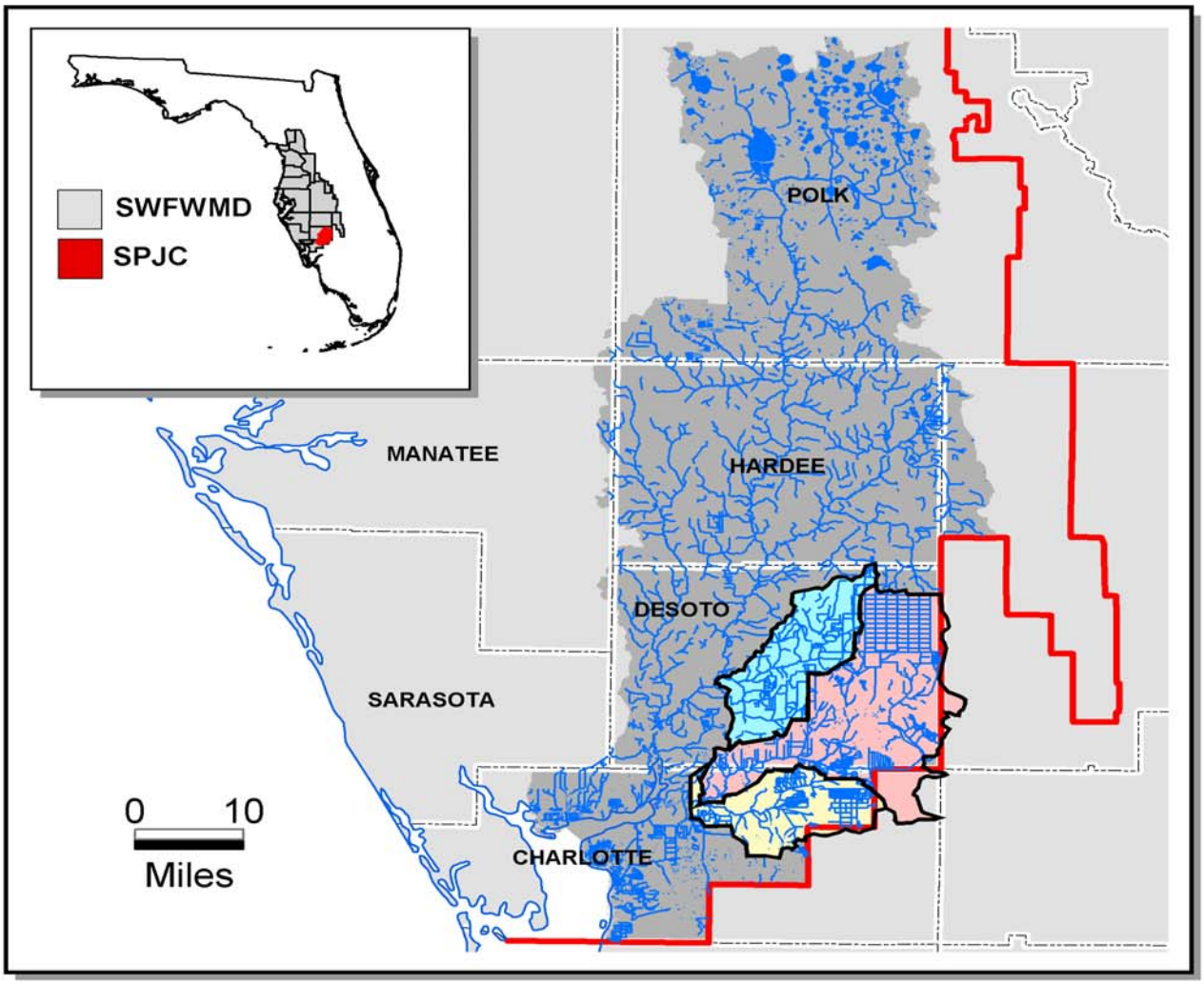


Figure 1.1 Location of the Shell, Prairie, and Joshua Creek Watersheds

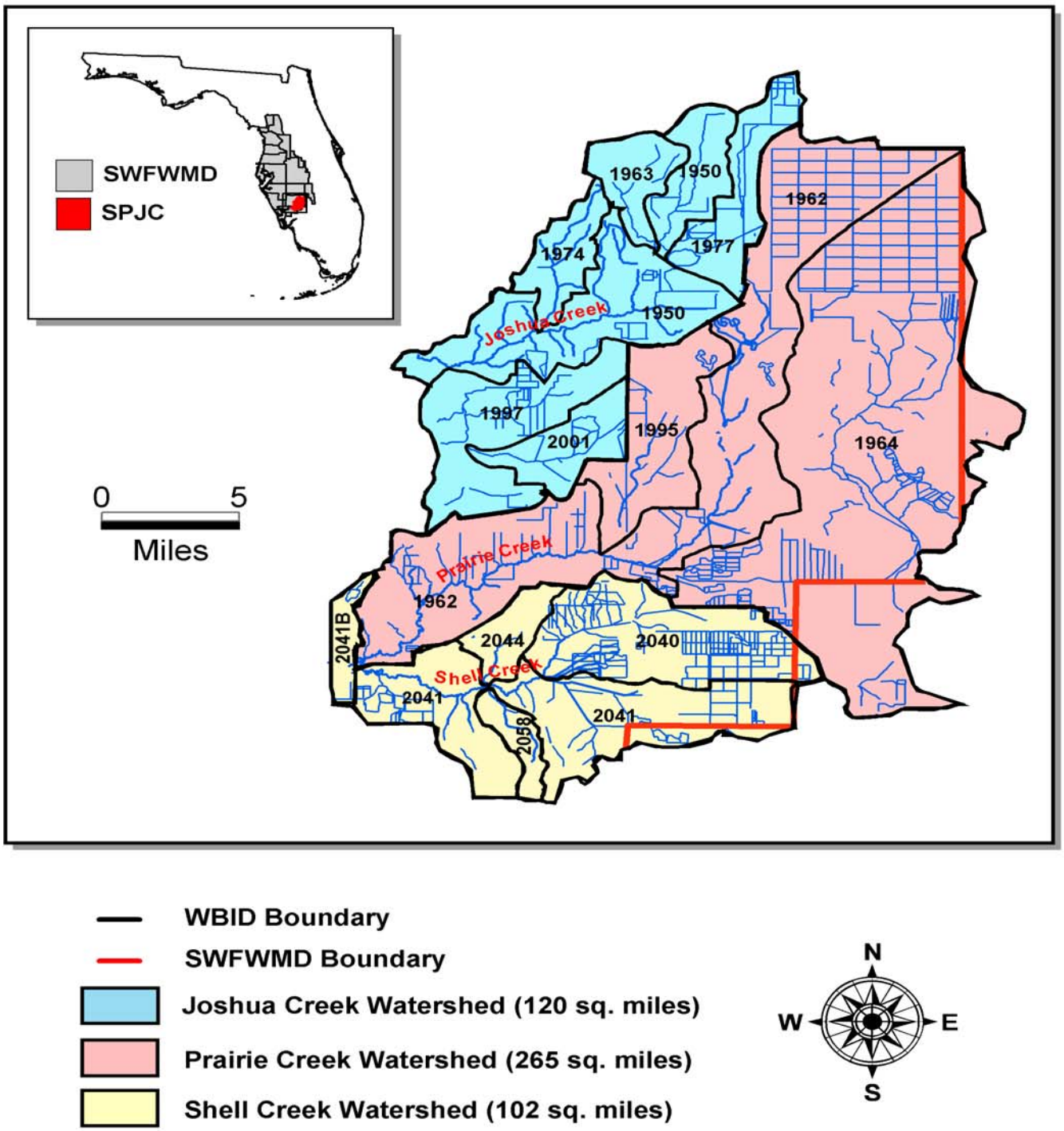


Figure 1.2 Location of Significant Water Bodies in the Shell, Prairie, and Joshua Creek Watersheds

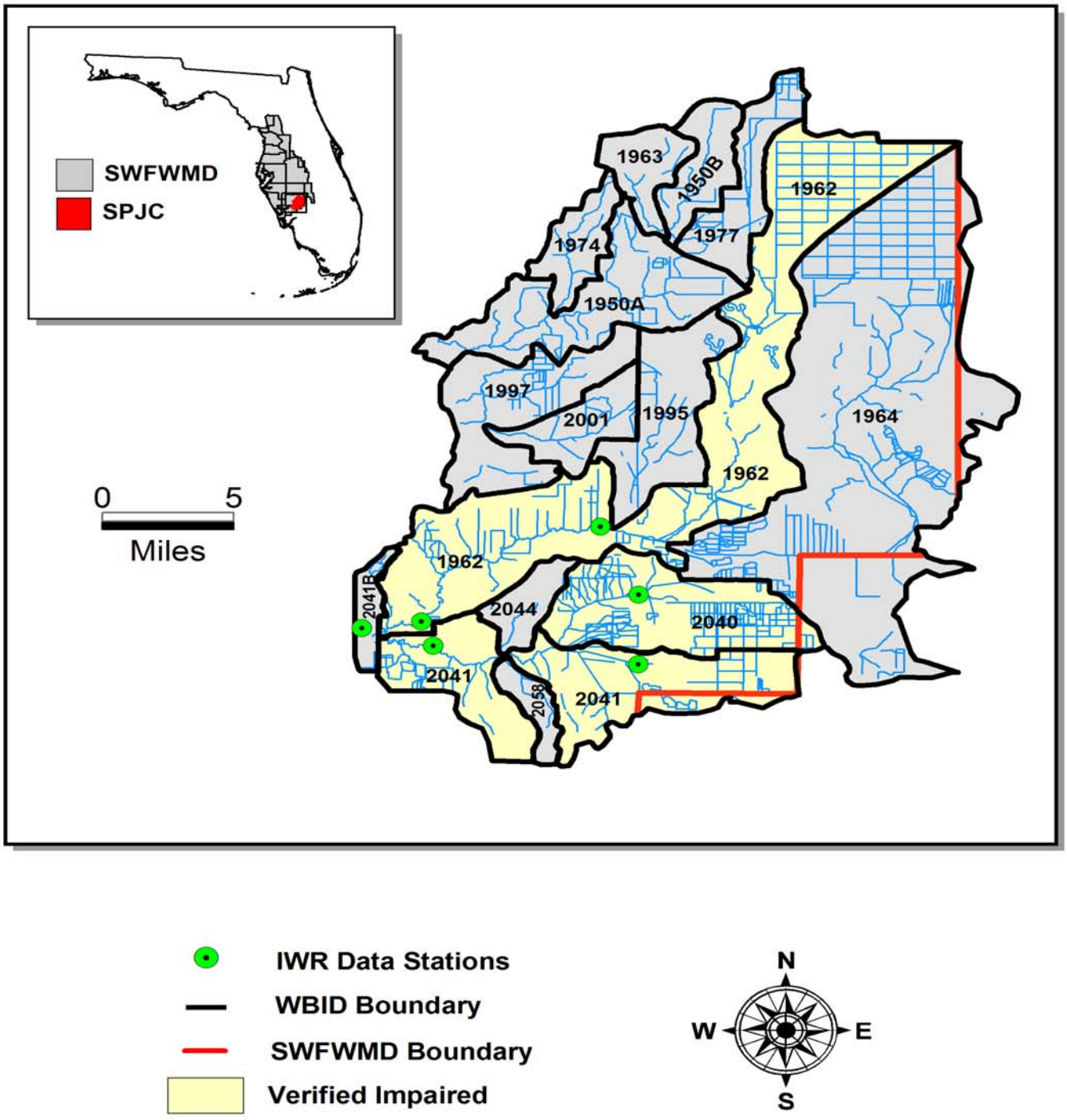


Figure 1.3 Location of the Verified Impaired WBID's in the Shell, Prairie, and Joshua Creek Watersheds Showing Stations where Long-Term Monitoring has Occurred.

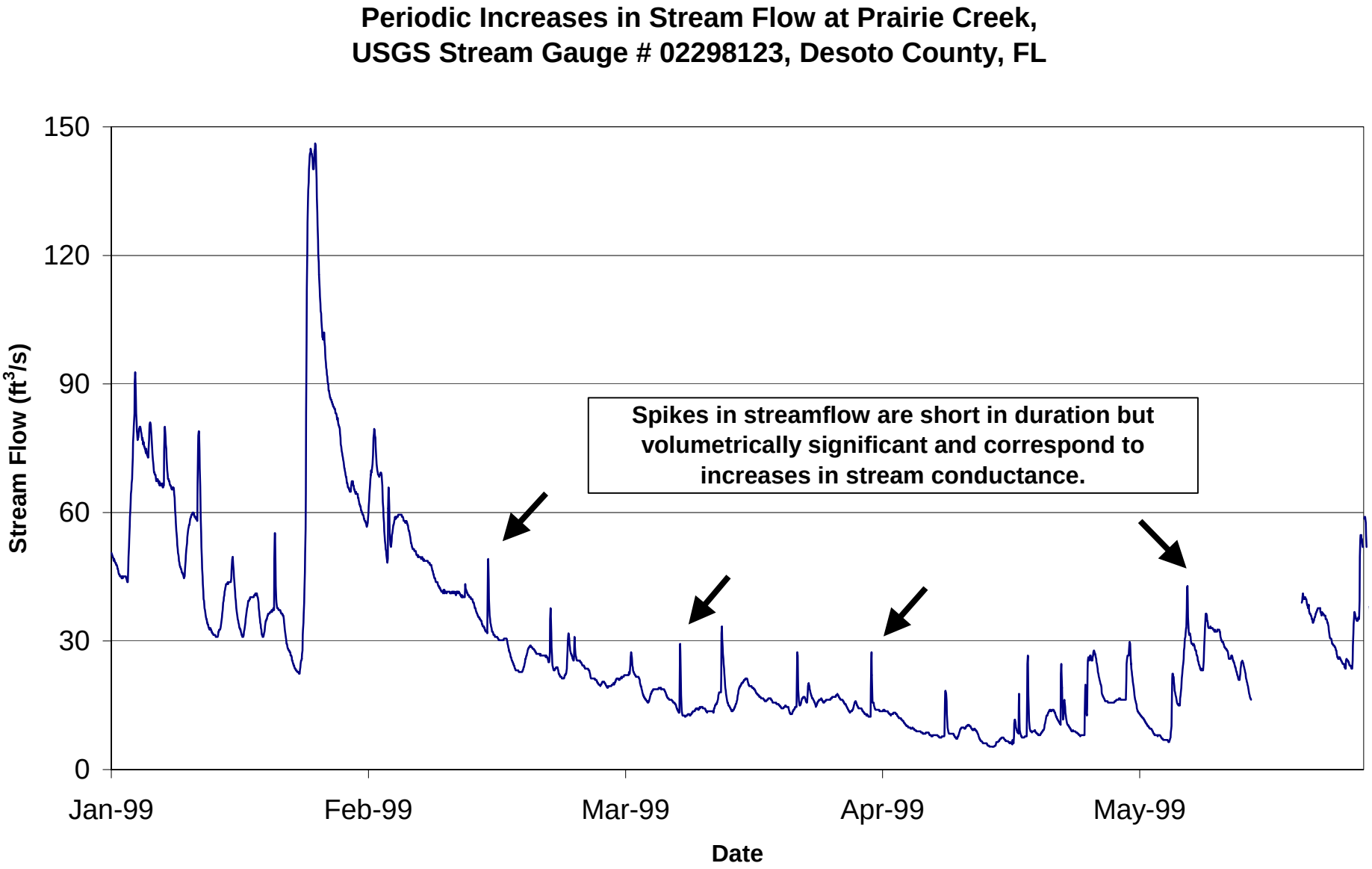


Figure 1.4 Prairie Creek Stream Flow Data Collected at the Highway 31 Bridge

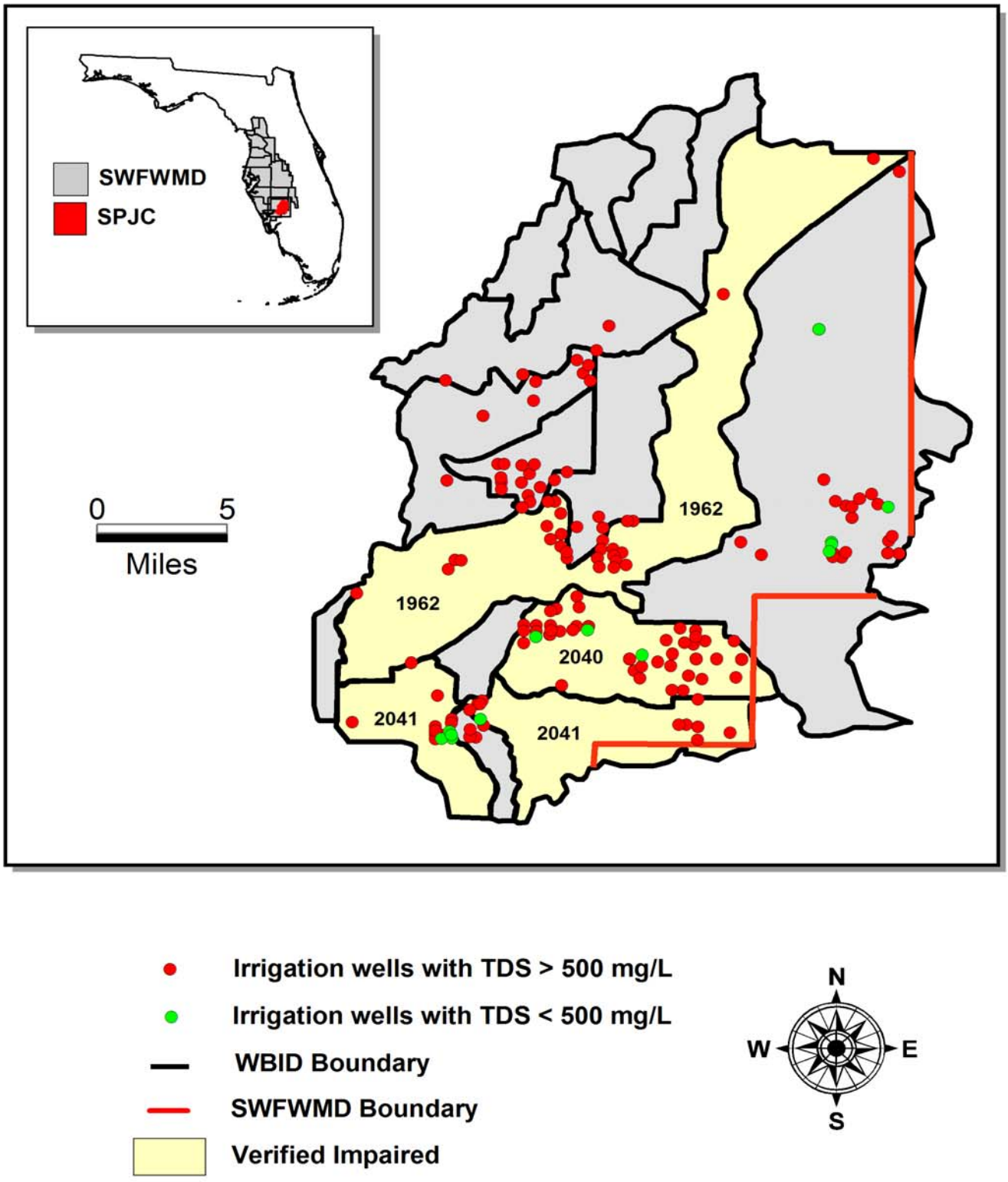


Figure 1.5. Ground-Water Quality Data Collected from Wells that Exceed Depth Criteria within the Shell, Prairie, and Joshua Creek Watersheds.

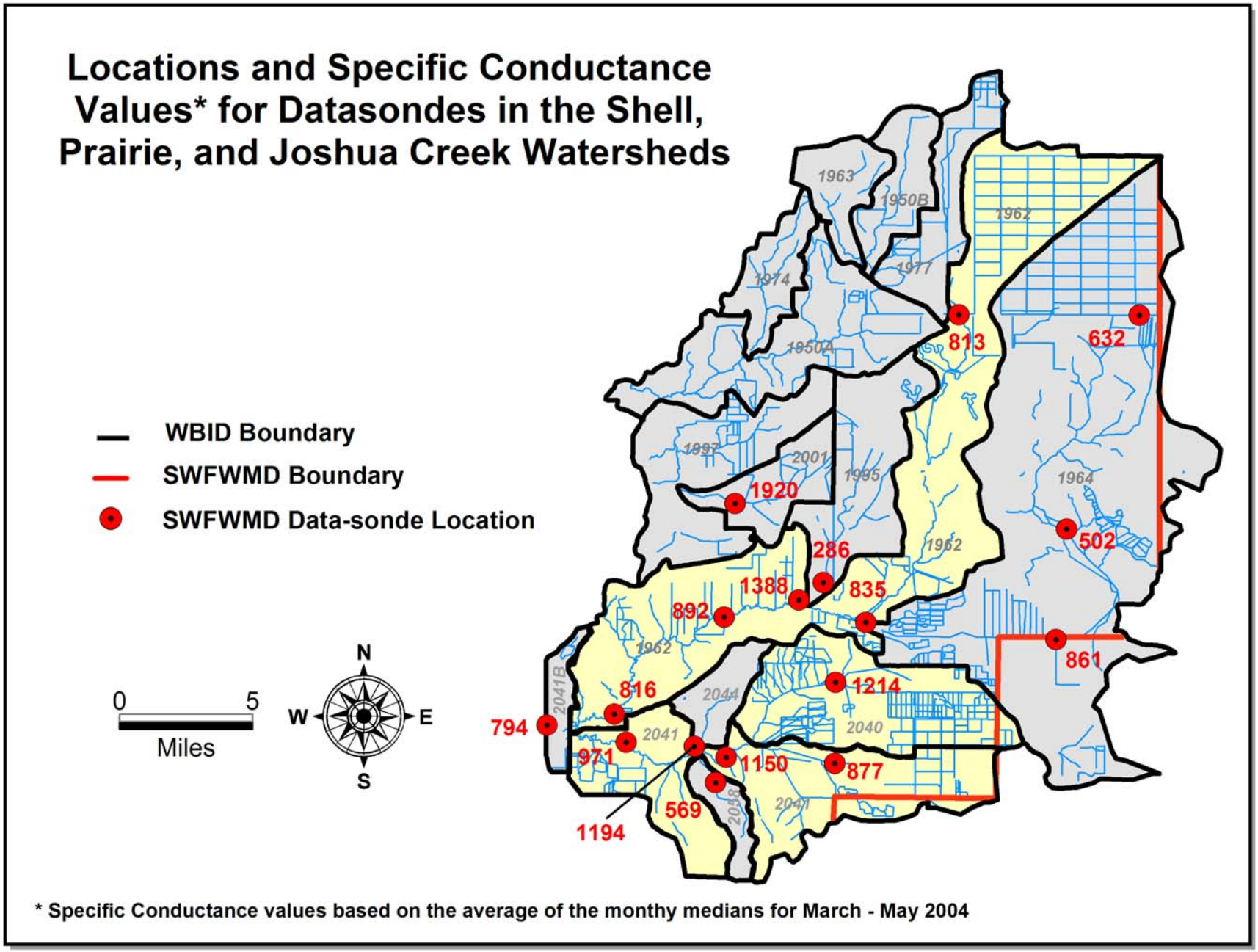
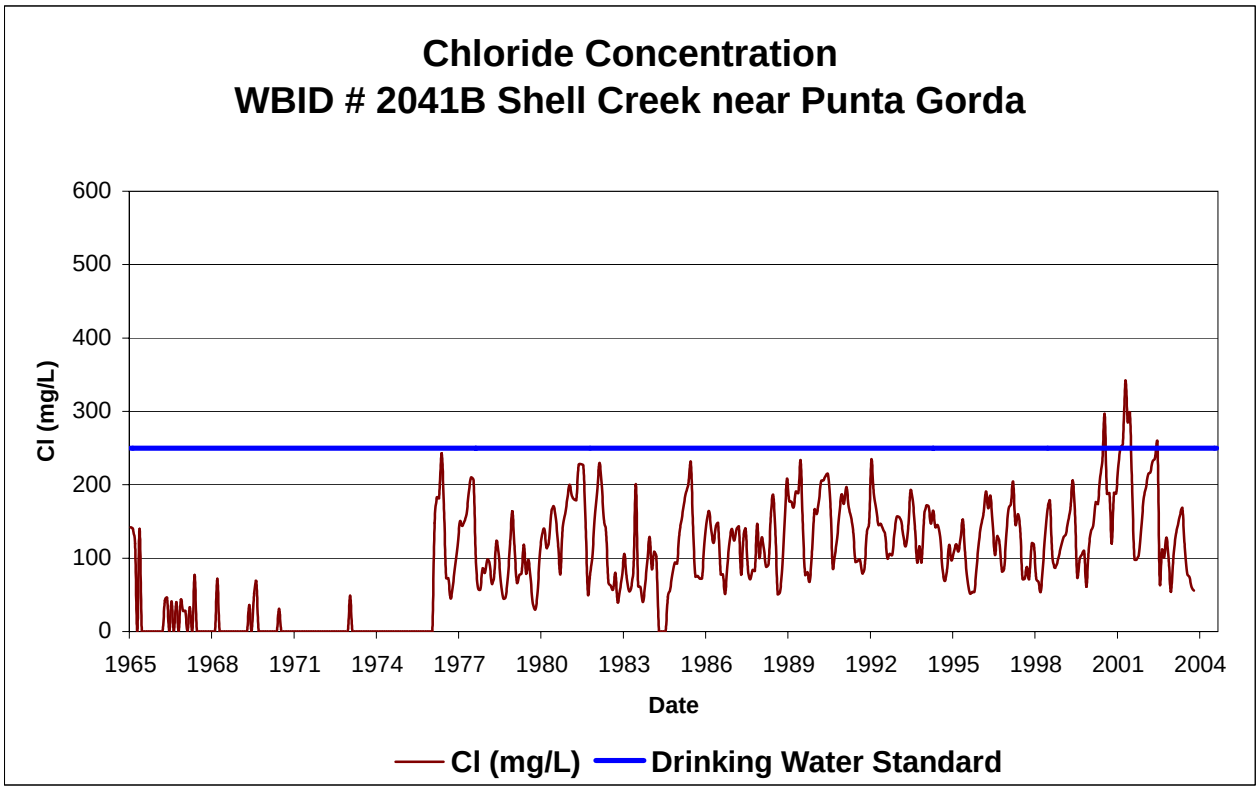


Figure 1.6. Dry Season Average Specific Conductivity Values from Surface Water Systems within the Shell, Prairie, and Joshua Creek Watersheds.



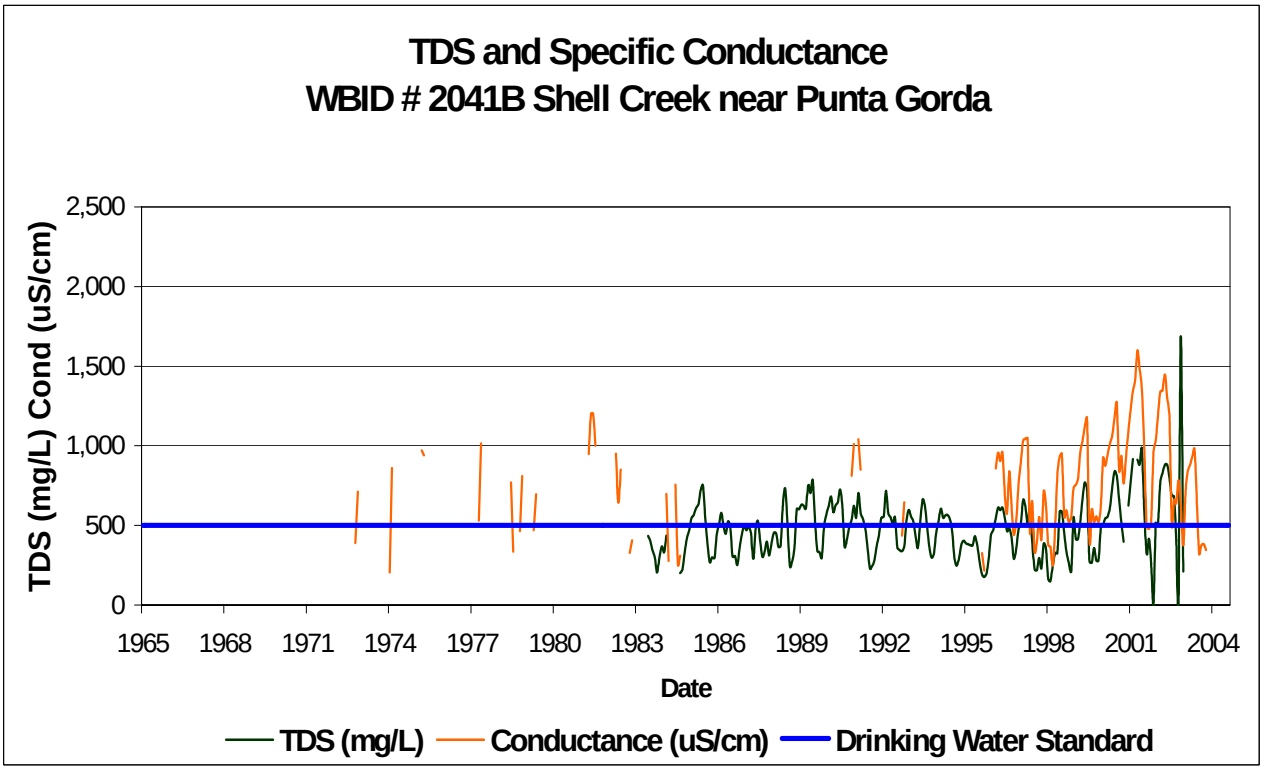
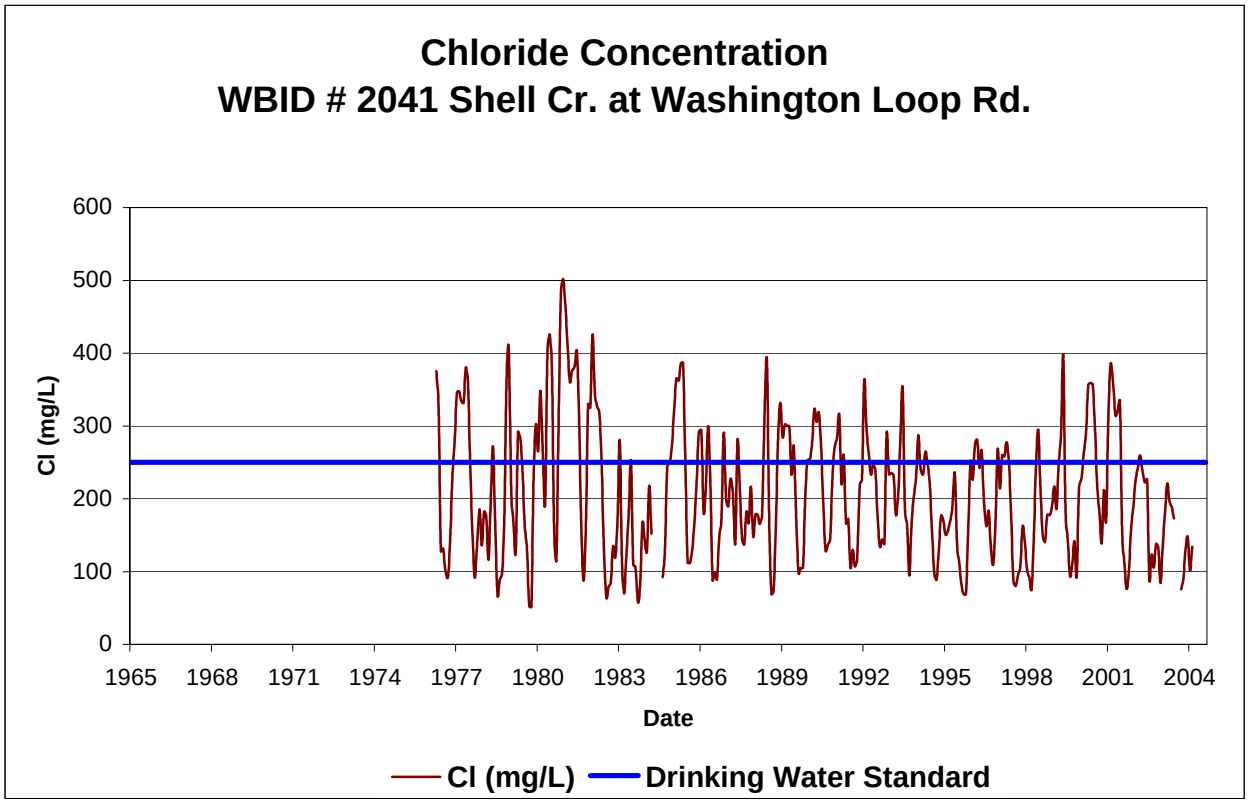


Figure 1.7A. Historical Water Quality from Shell Creek near Punta Gorda (Reservoir)(WBID# 2041B)



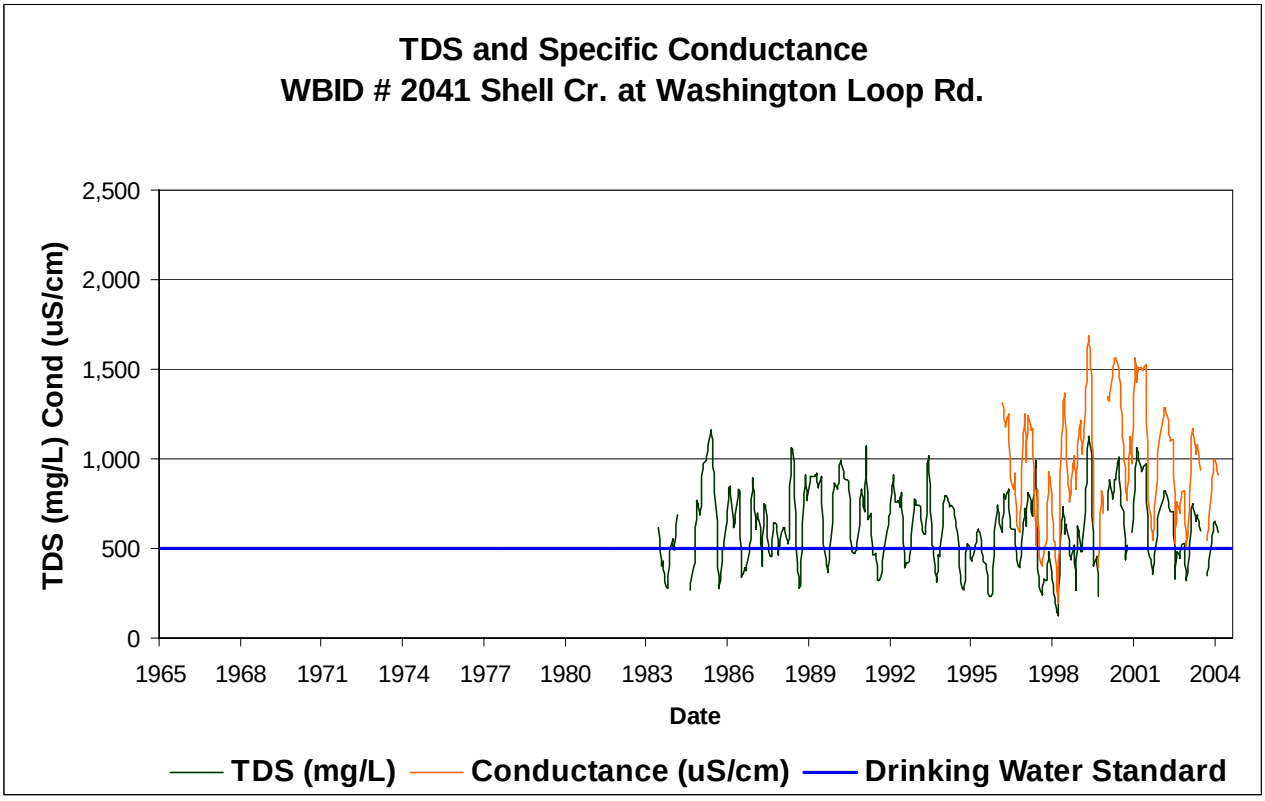
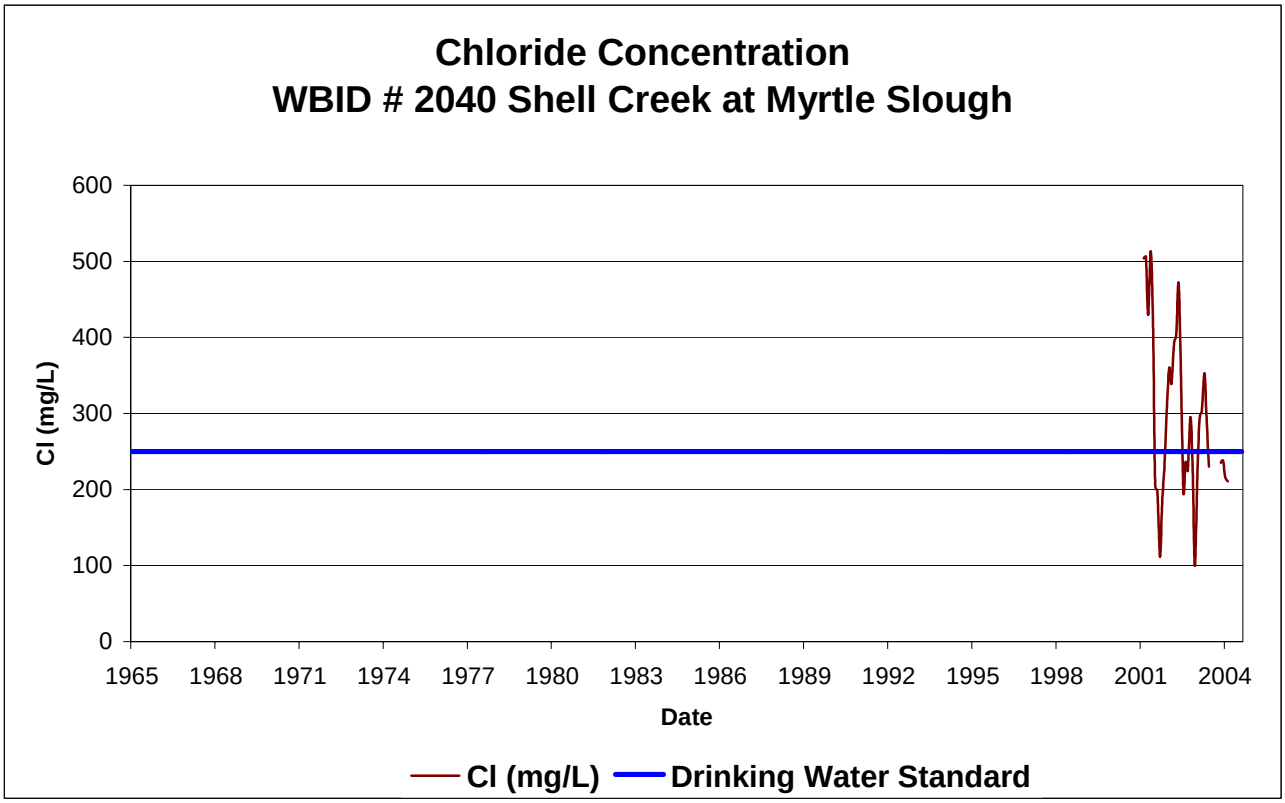


Figure 1.7B. Historical Water Quality from Shell Creek at Washington Loop Road (WBID# 2041)



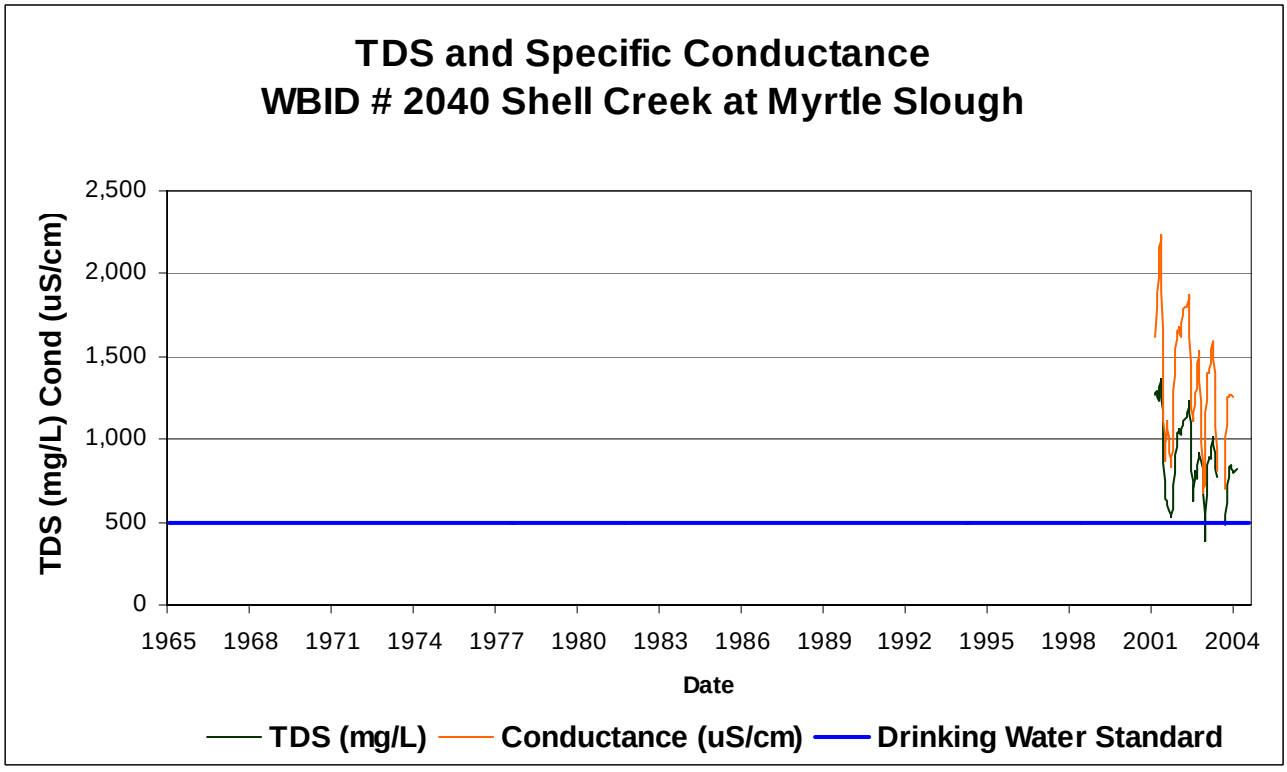
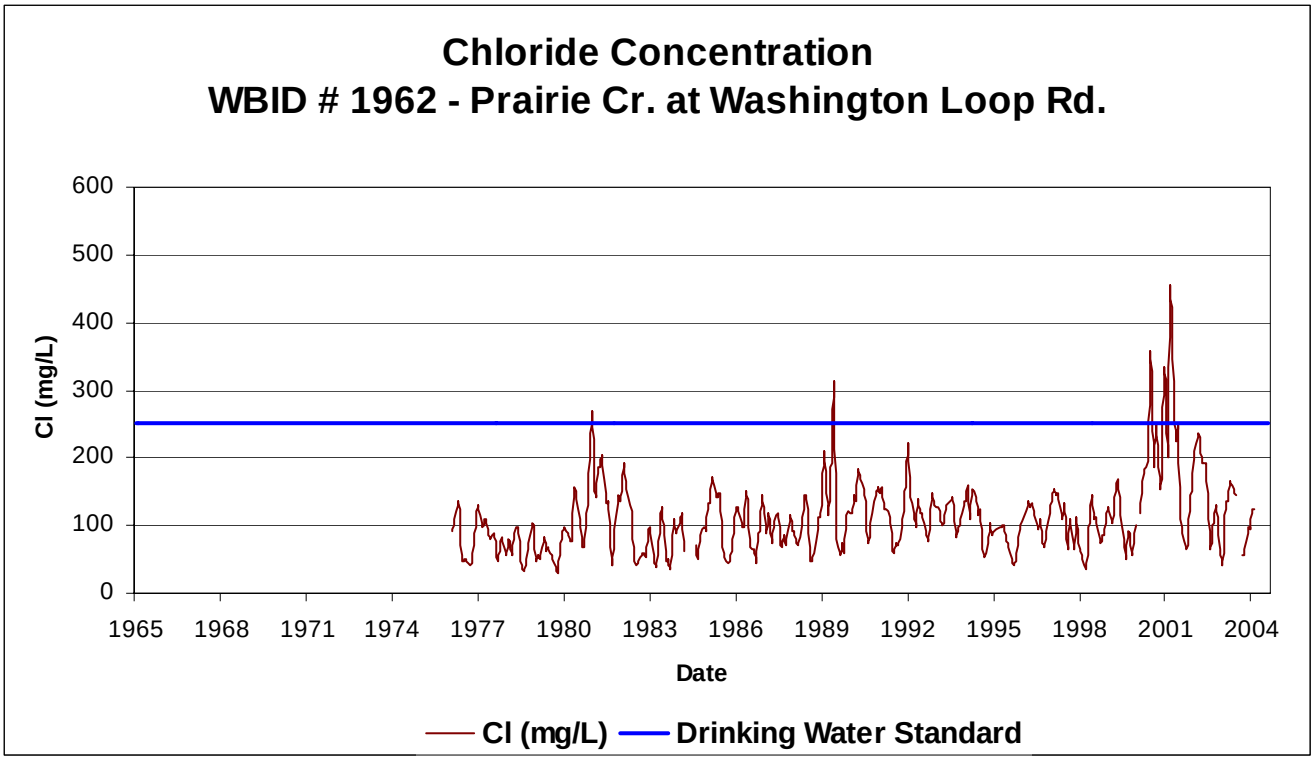


Figure 1.7C. Historical Water Quality from Shell Creek Myrtle Slough (WBID# 2040)



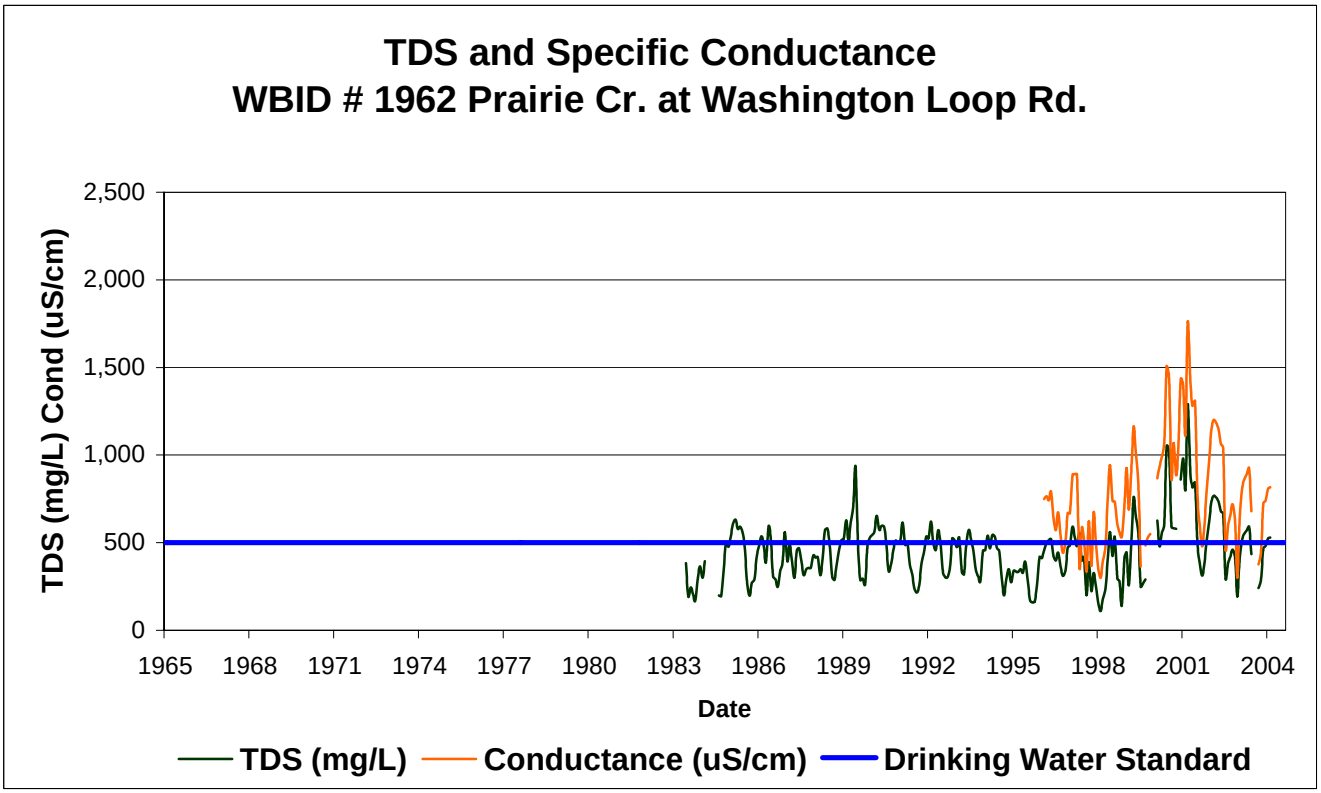
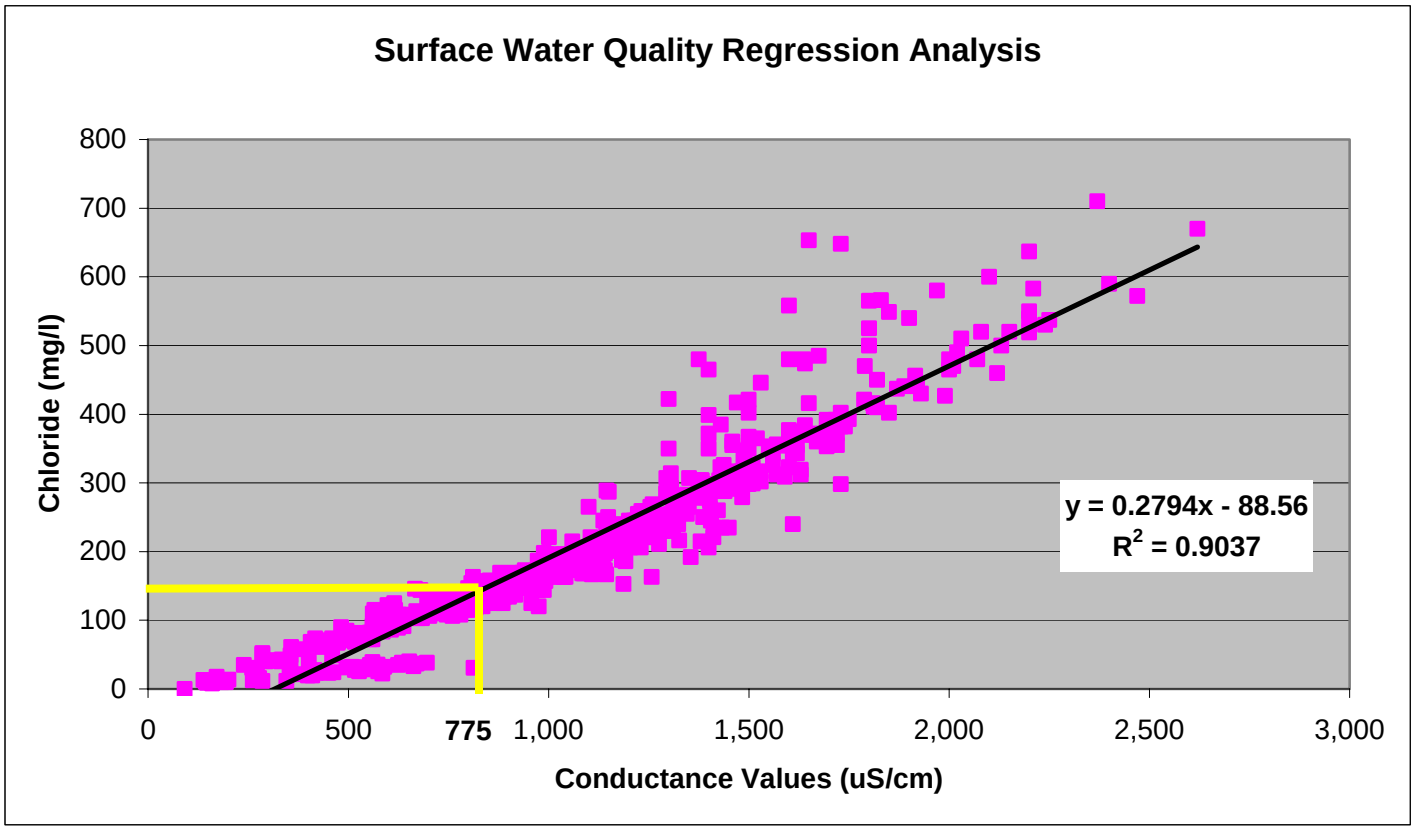


Figure 1.7D. Historical Water Quality from Prairie Creek (WBID# 1962)



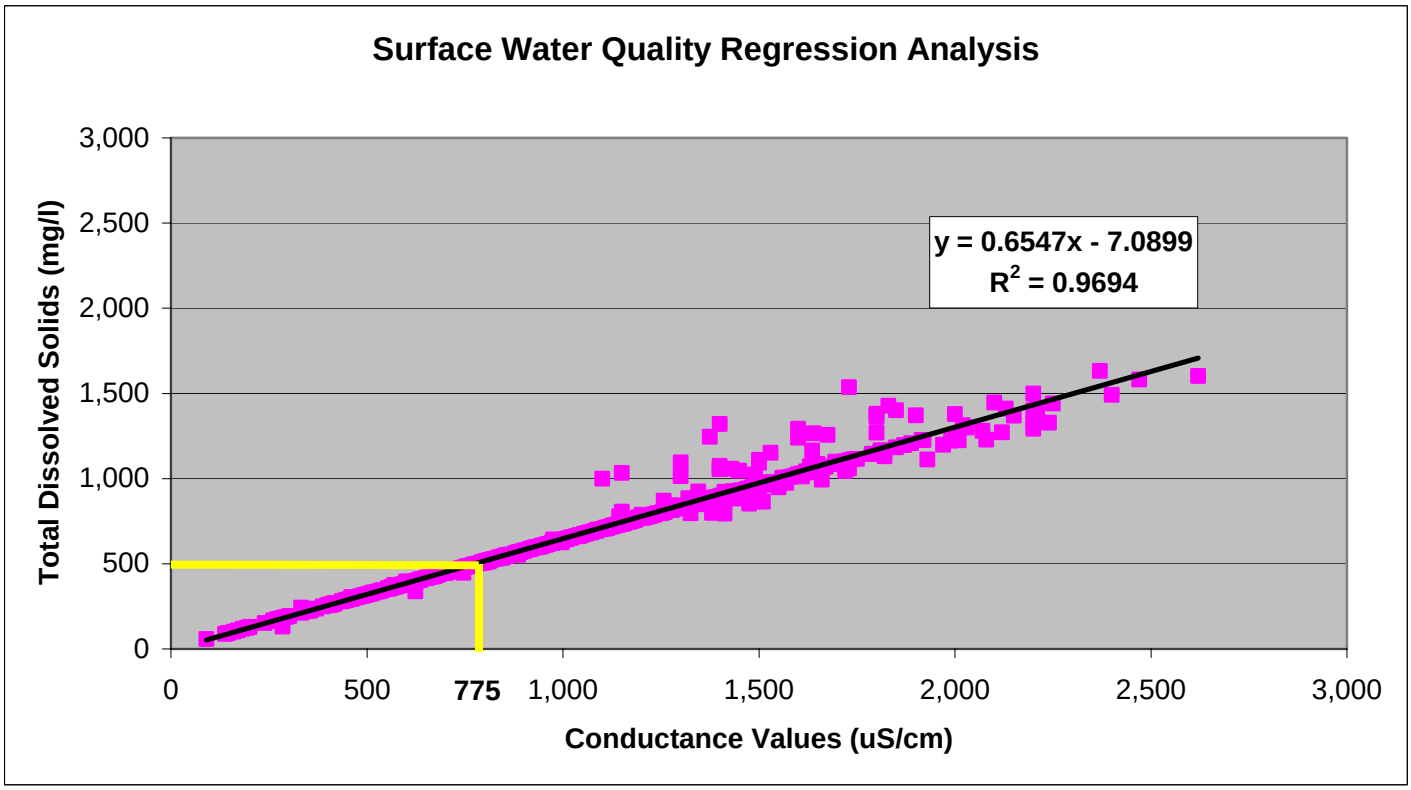


Figure 2.1 Historical Specific Conductivity Trends Versus TDS and Chloride Including Ratio Line at Washington Loop Road Sites

Shell Creek near Punta Gorda (Reservoir); 1965-2003 Monthly Average Chloride Loads

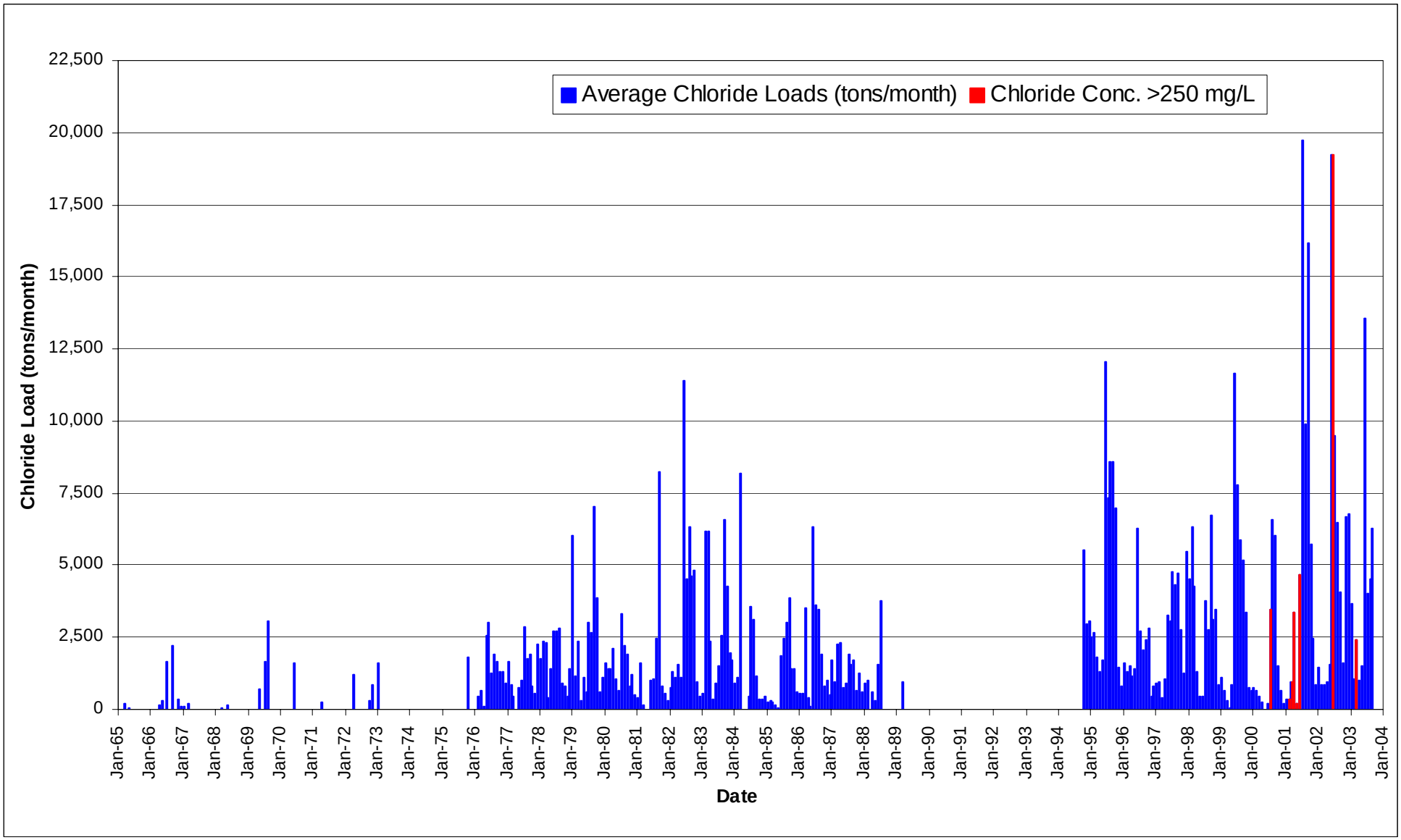


Figure 2.2A. Average Chloride Load Estimates at Shell Creek near Punta Gorda Reservoir

Shell Creek near Punta Gorda (Reservoir); 1965-2003 Monthly Average TDS Loads

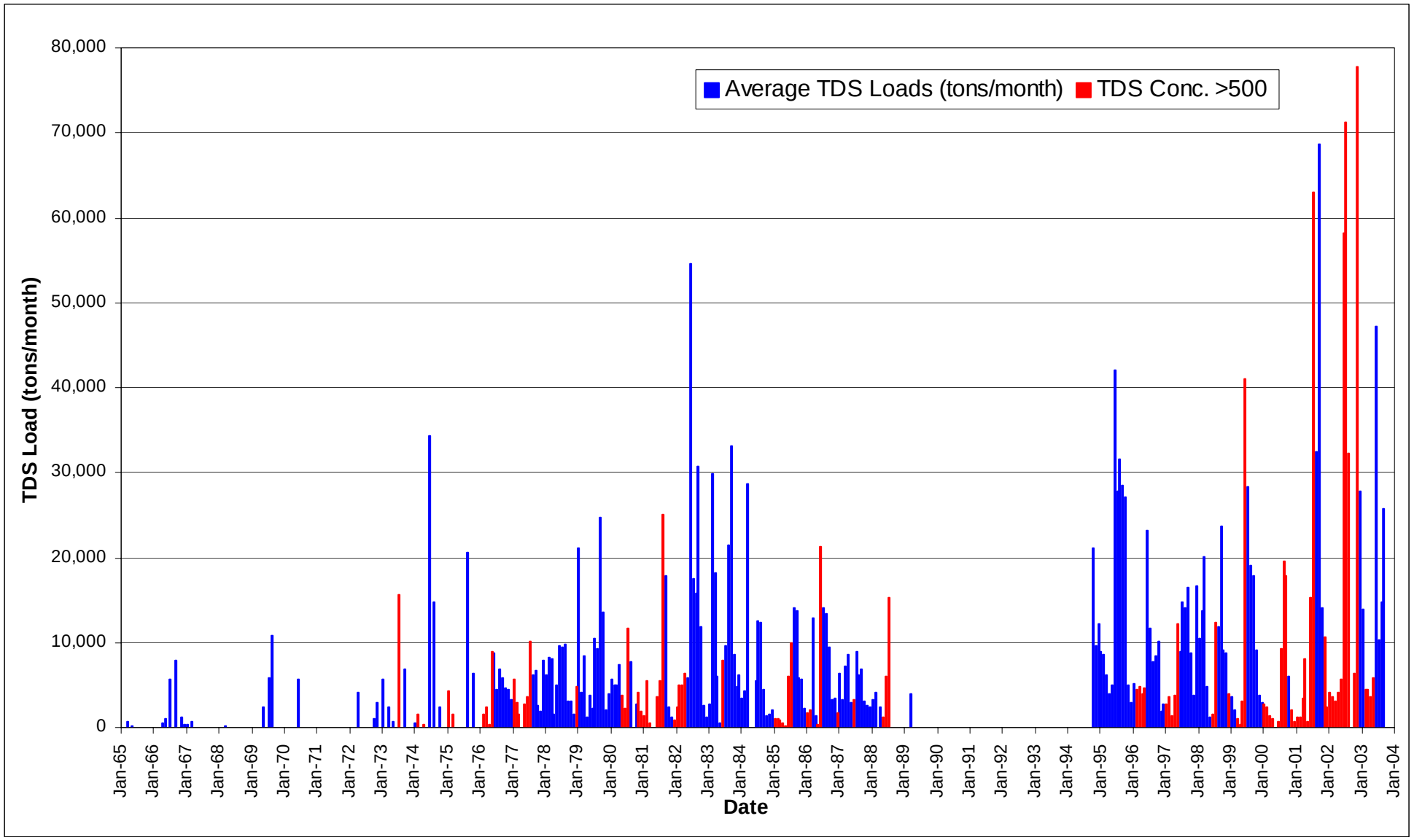


Figure 2.2B. Average TDS Load Estimates at Shell Creek near Punta Gorda Reservoir.

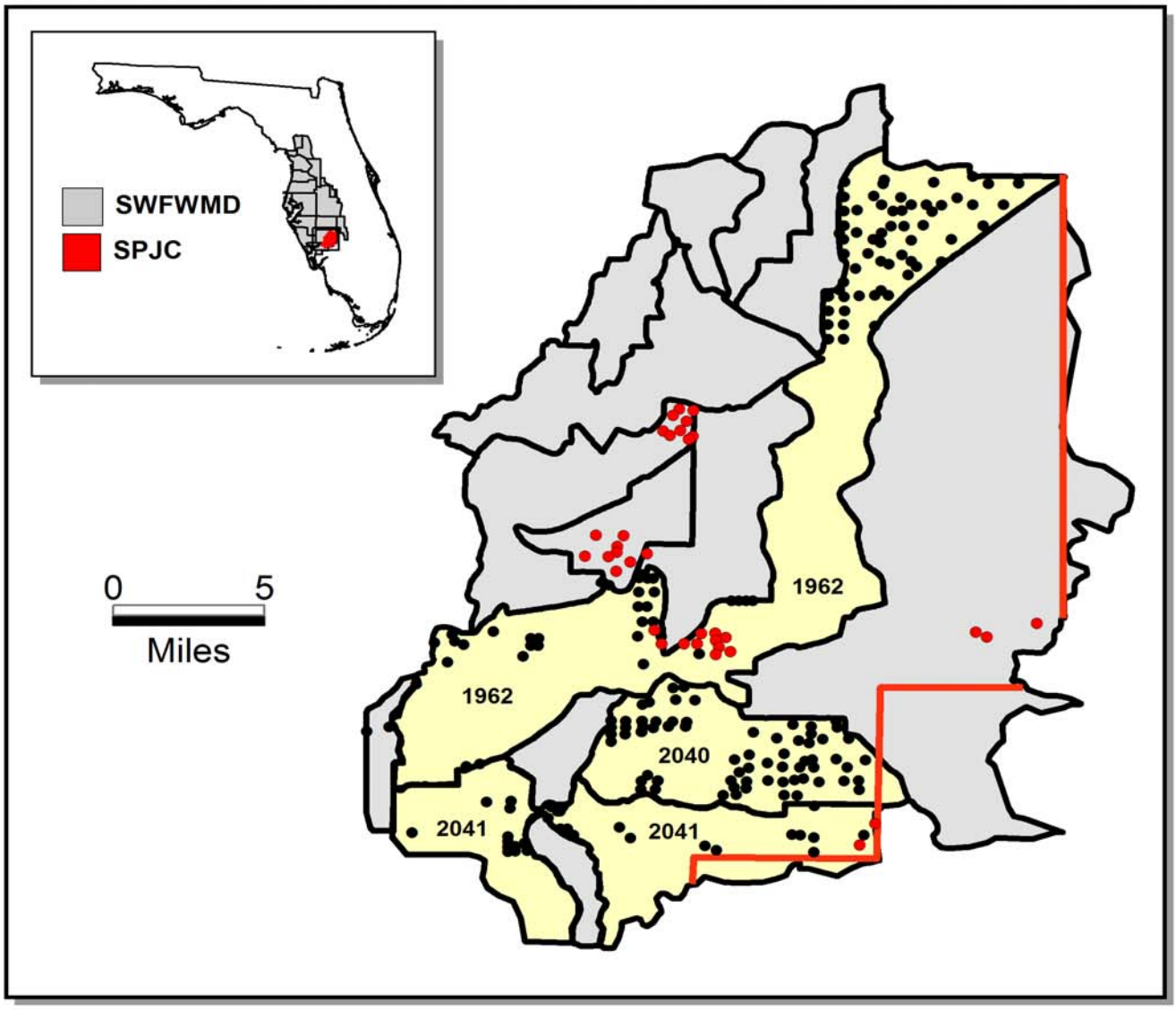


Figure 3.1 Location of Wells Back-Plugged within the Shell, Prairie, and Joshua Creek Watersheds

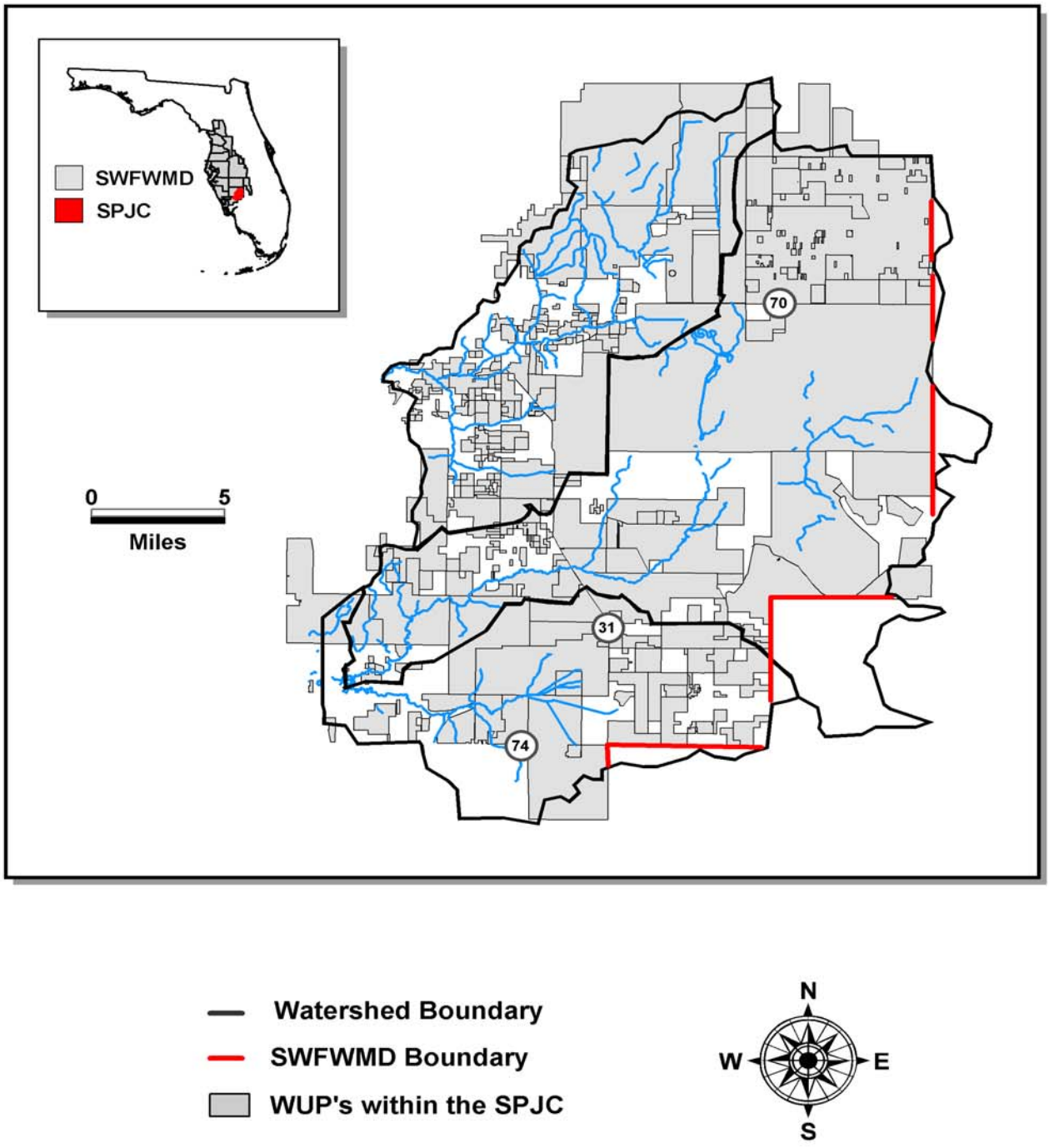


Figure 3.2 Locations of Water Use Permits in the Shell, Prairie, and Joshua Creek Watersheds

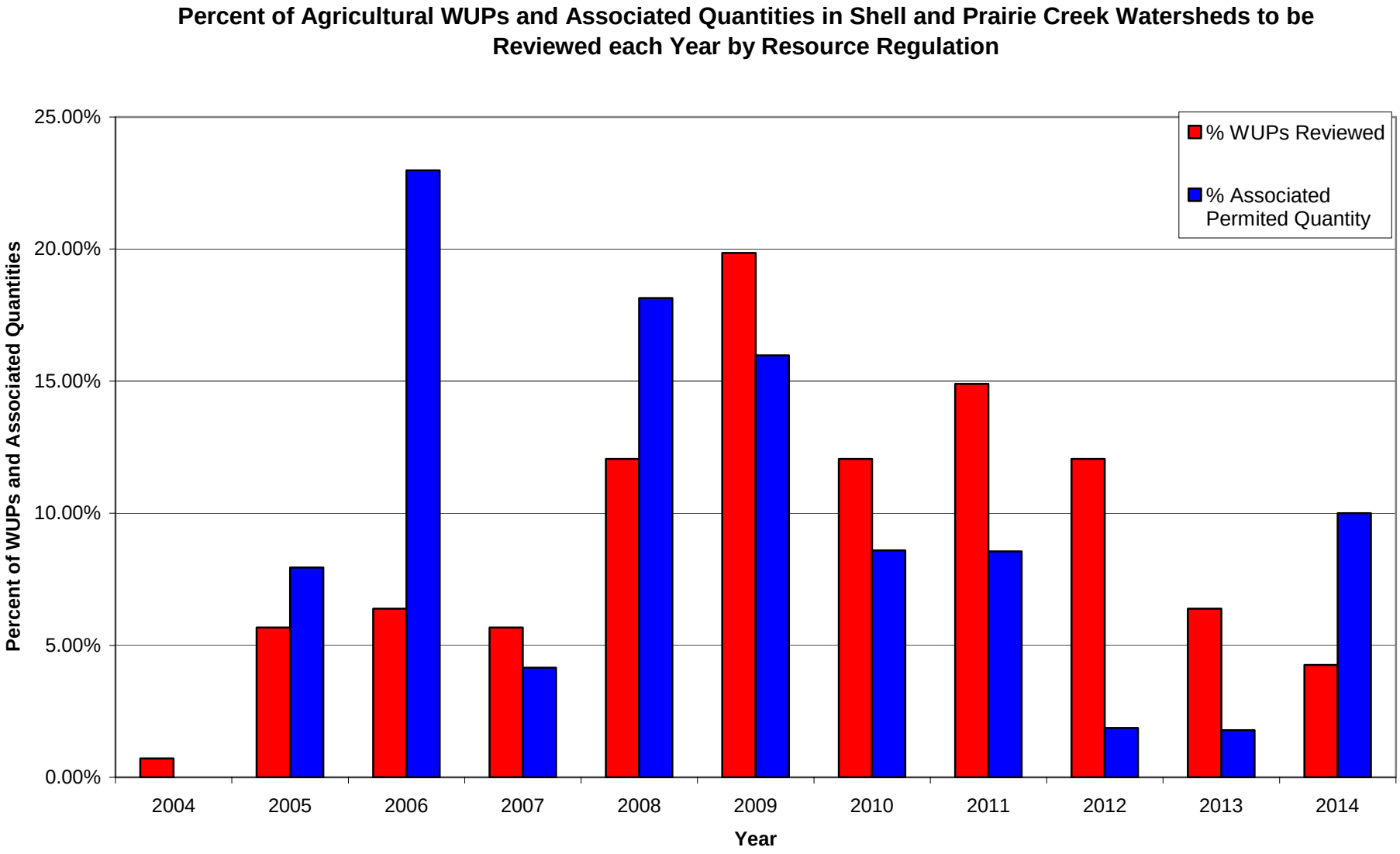


Figure 3.3. Percent of Permits and Associated Quantities to be Renewed each Year Over the Ten-Year Period of the Shell and Prairie Creek Watershed Management Plan.

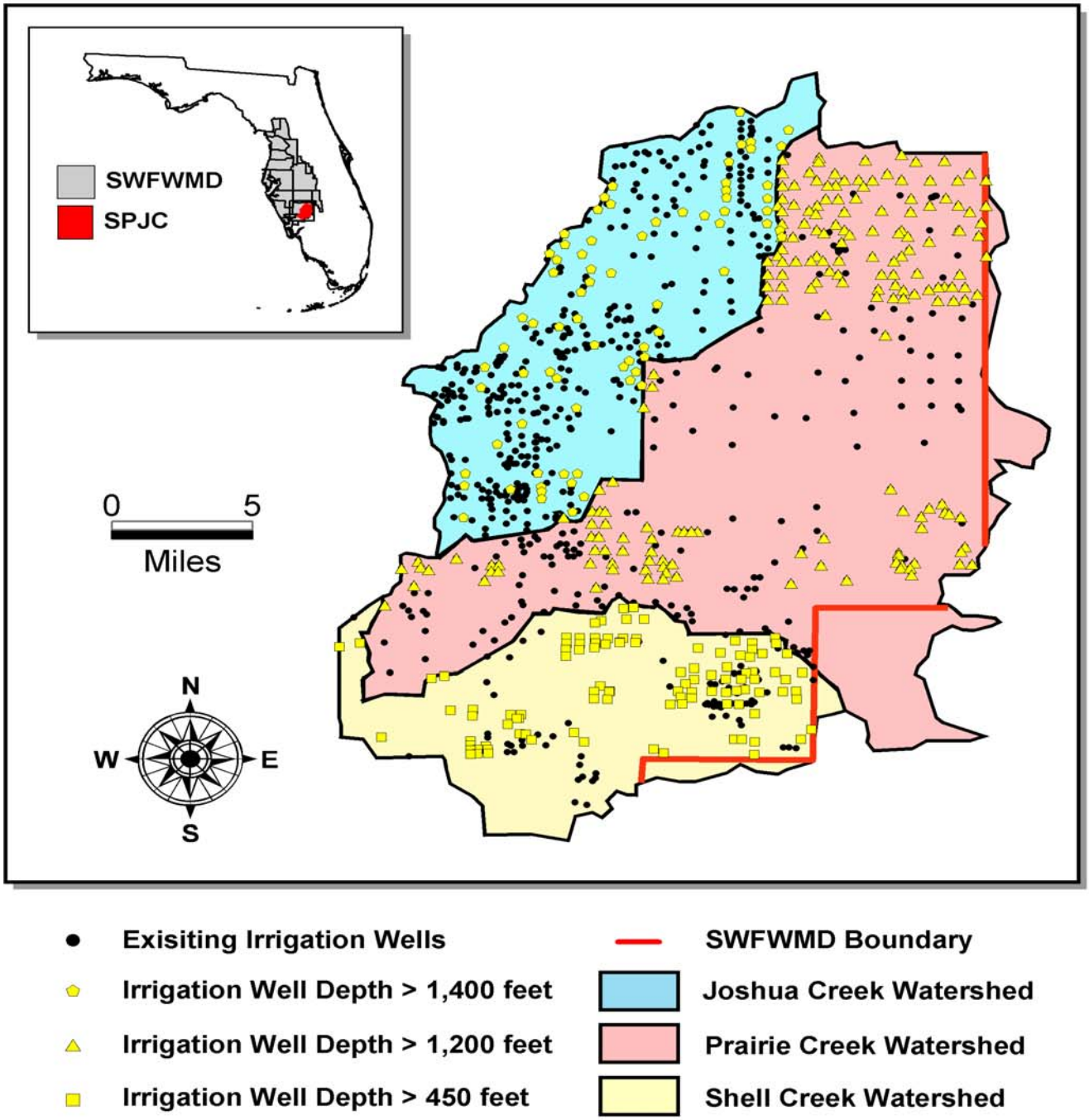


Figure 3.4 Location of Existing Water Use Permit Irrigation Wells in the Shell, Prairie, and Joshua Creek Watersheds.

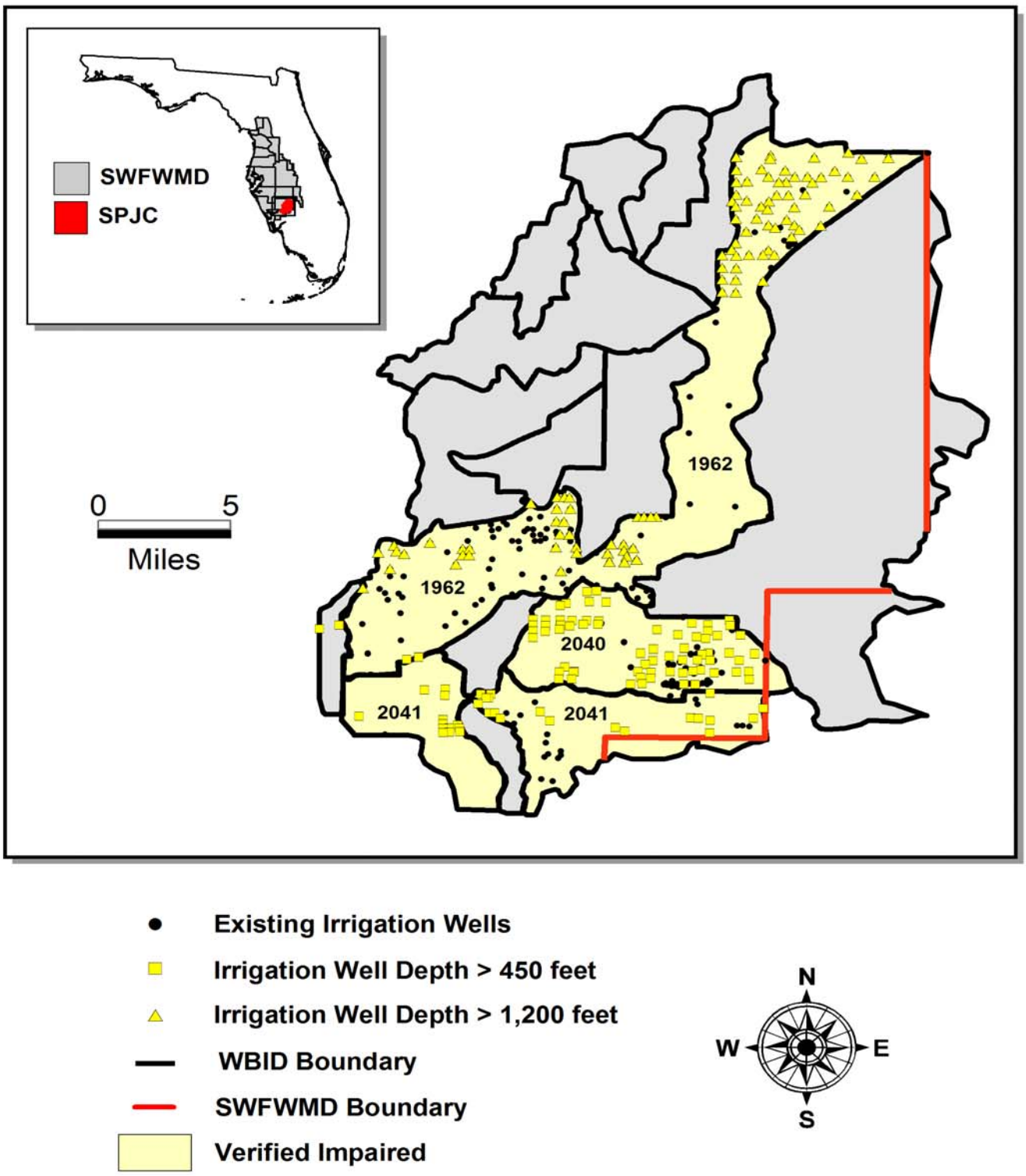


Figure 3.5 Location of Existing Water Use Permit Irrigation Wells in the Impaired WBID's Within the Shell, Prairie, and Joshua Creek Watersheds.

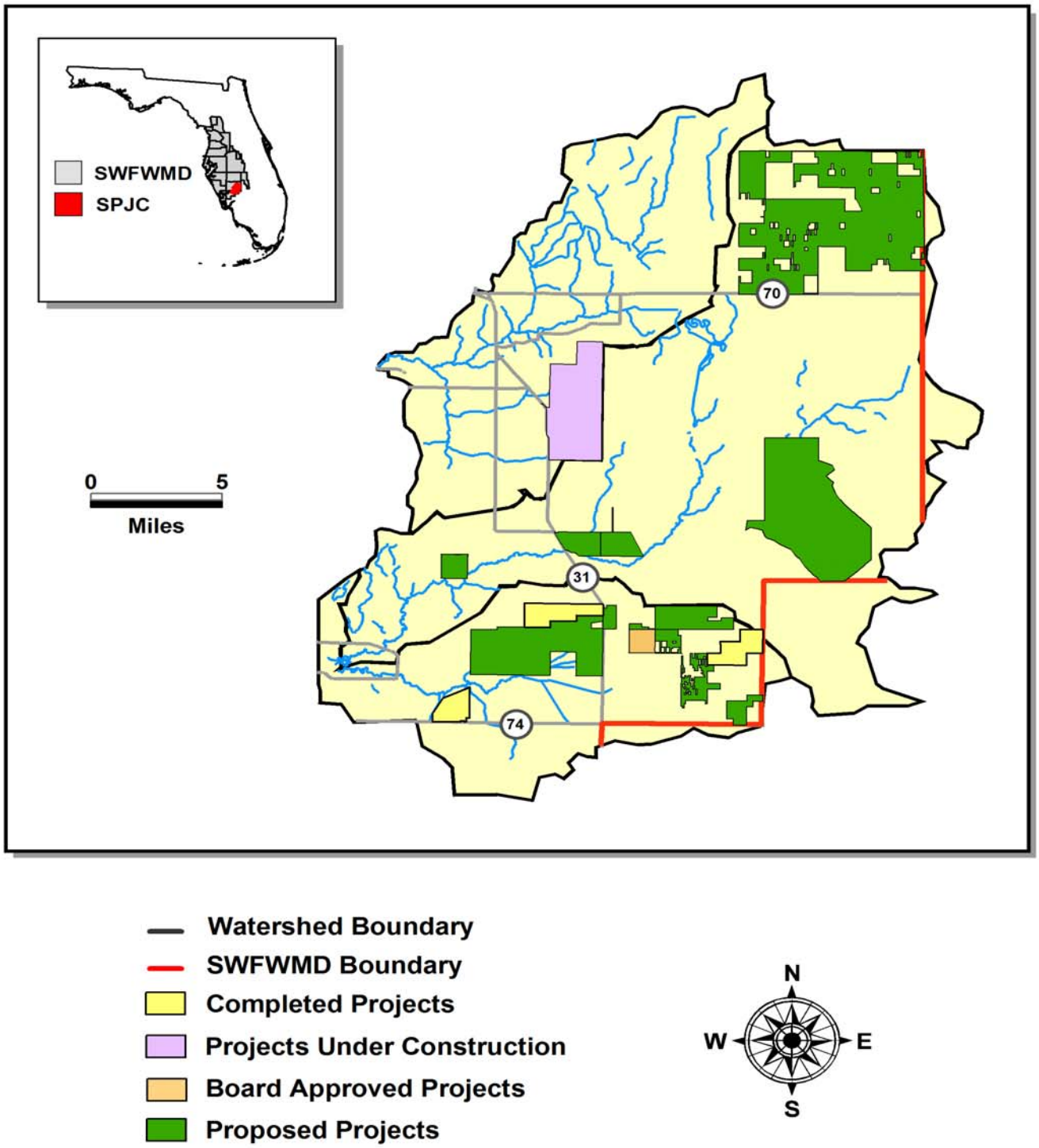


Figure 3.6 Locations of Existing and Proposed FARMS Projects within the Shell, Prairie, and Joshua Creek Watersheds

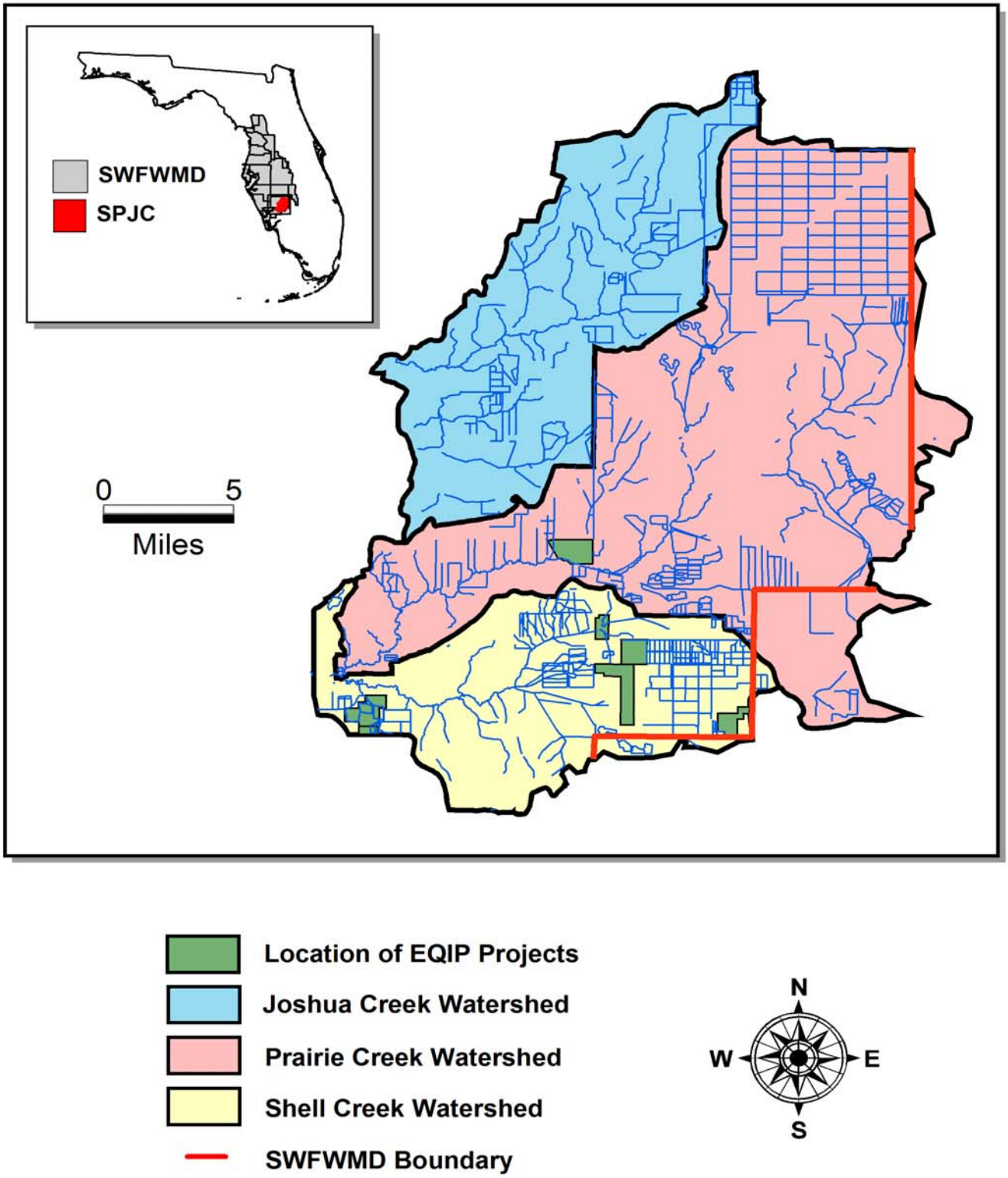


Figure 3.7 Approximate Locations of EQIP Projects Completed within Charlotte County

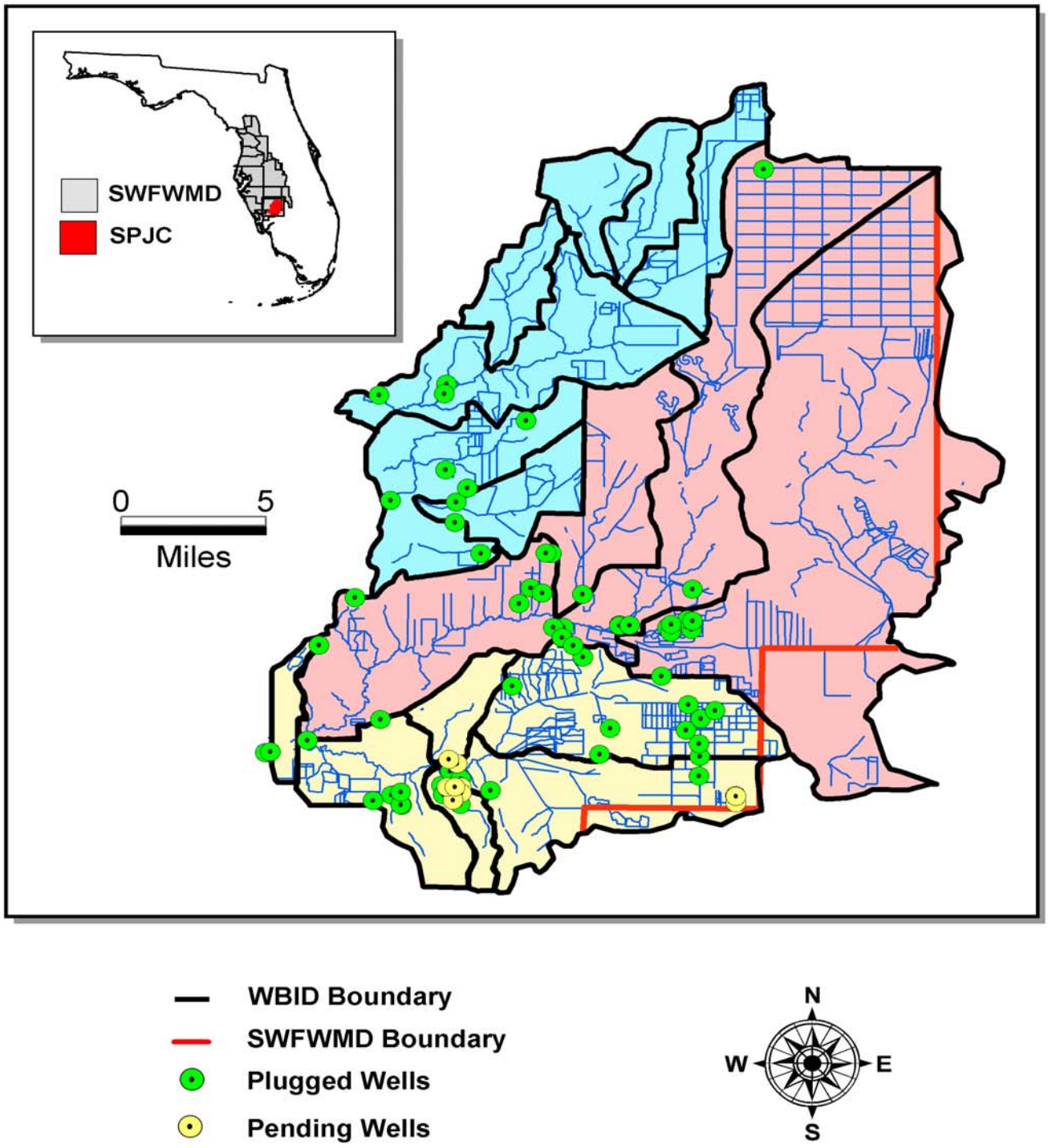


Figure 3.8 Location of Wells Plugged through the Quality of Water Improvement Program (QWIP) in the Shell, Prairie, and Joshua Creek Watersheds

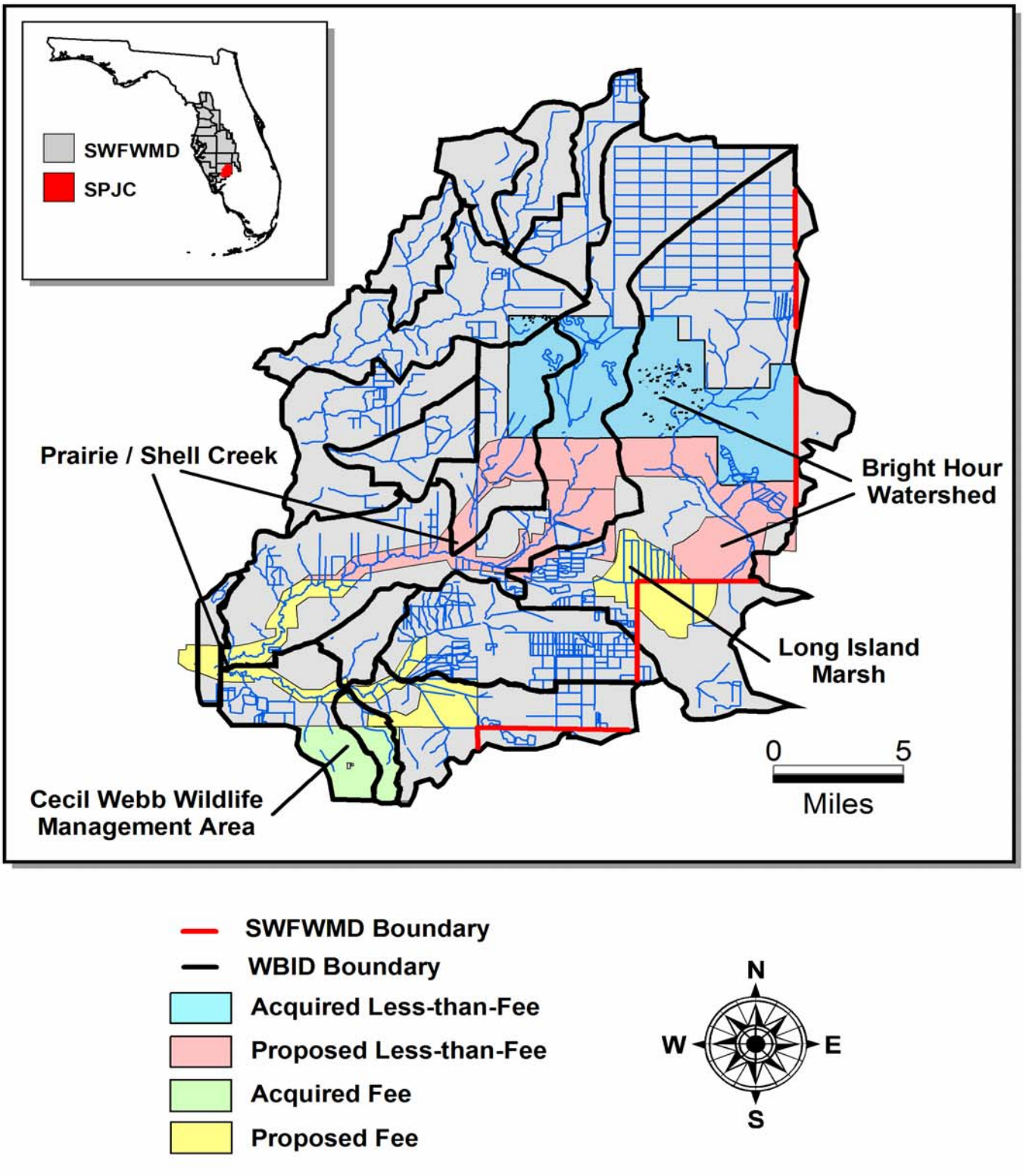


Figure 3.9 Proposed Land Acquisition Targets in the Shell, Prairie, and Joshua Creek Watersheds

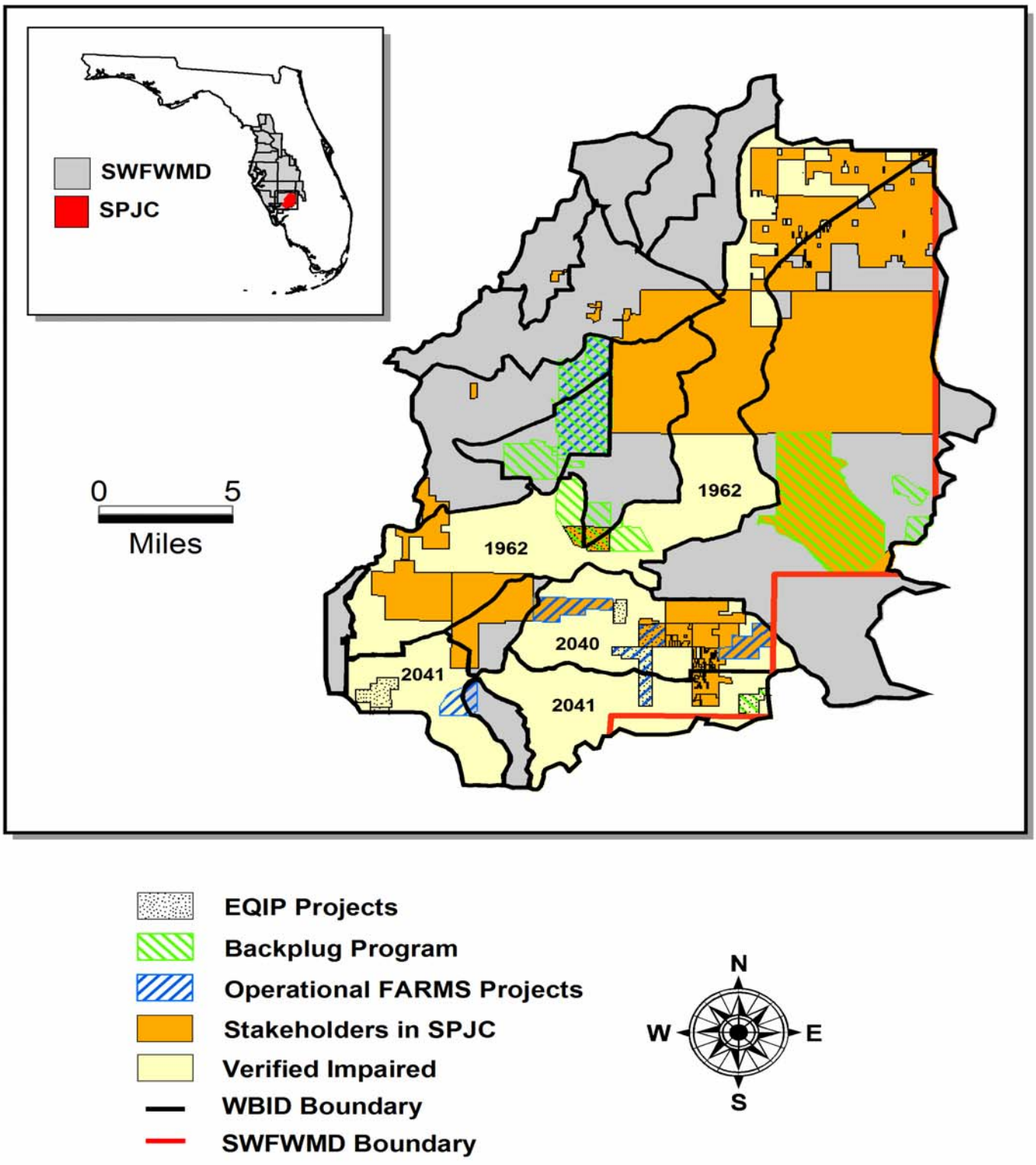


Figure 3.10. Areas where Completed Management Actions have Occurred, as well as the Area Represented by Stakeholder Involvement, within the Shell, Prairie, and Joshua Creek Watersheds.

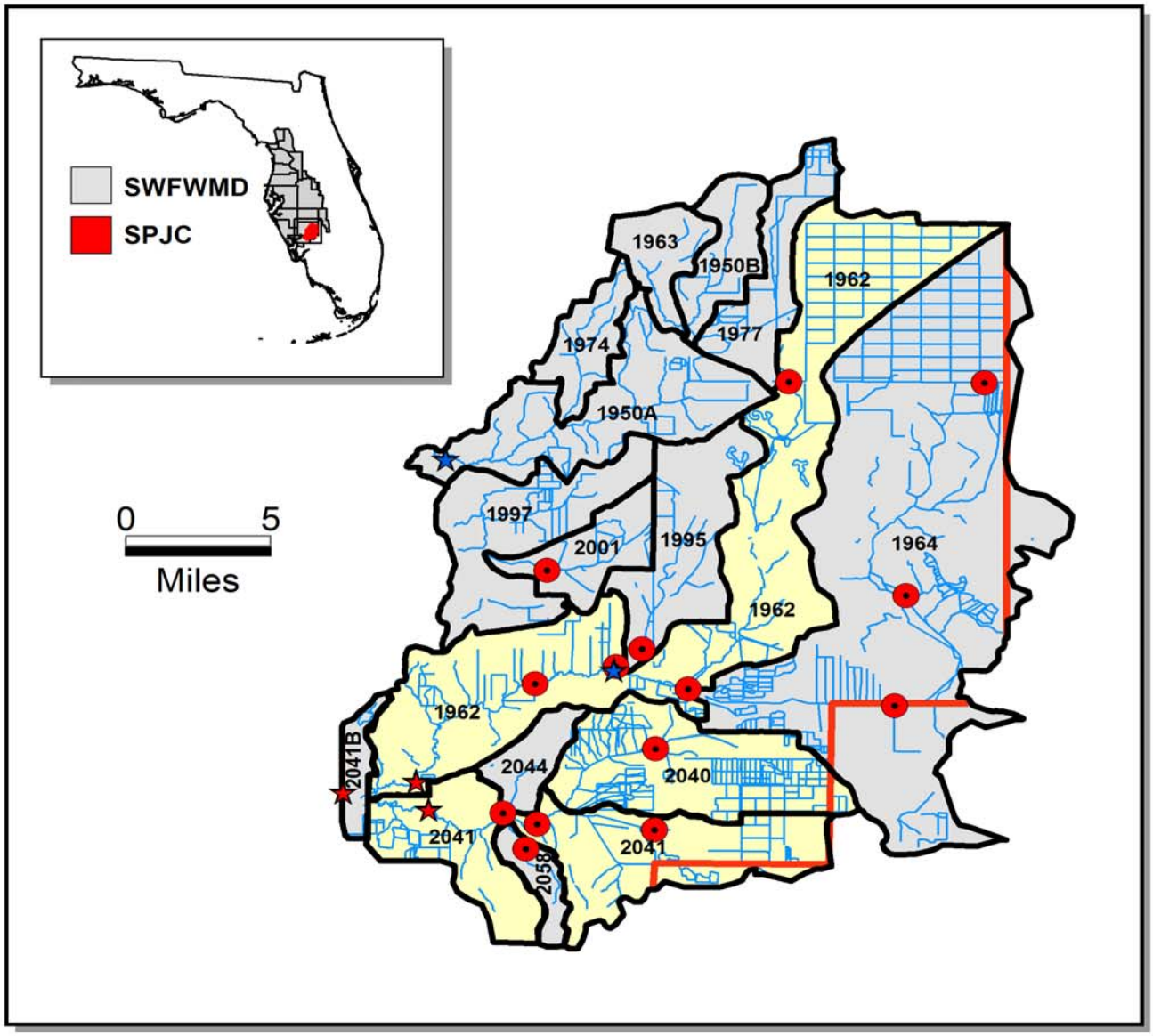


Figure 4.1 SPJC Data-Sonde Conductance Logging Network; Station Locations (SWFMWD)

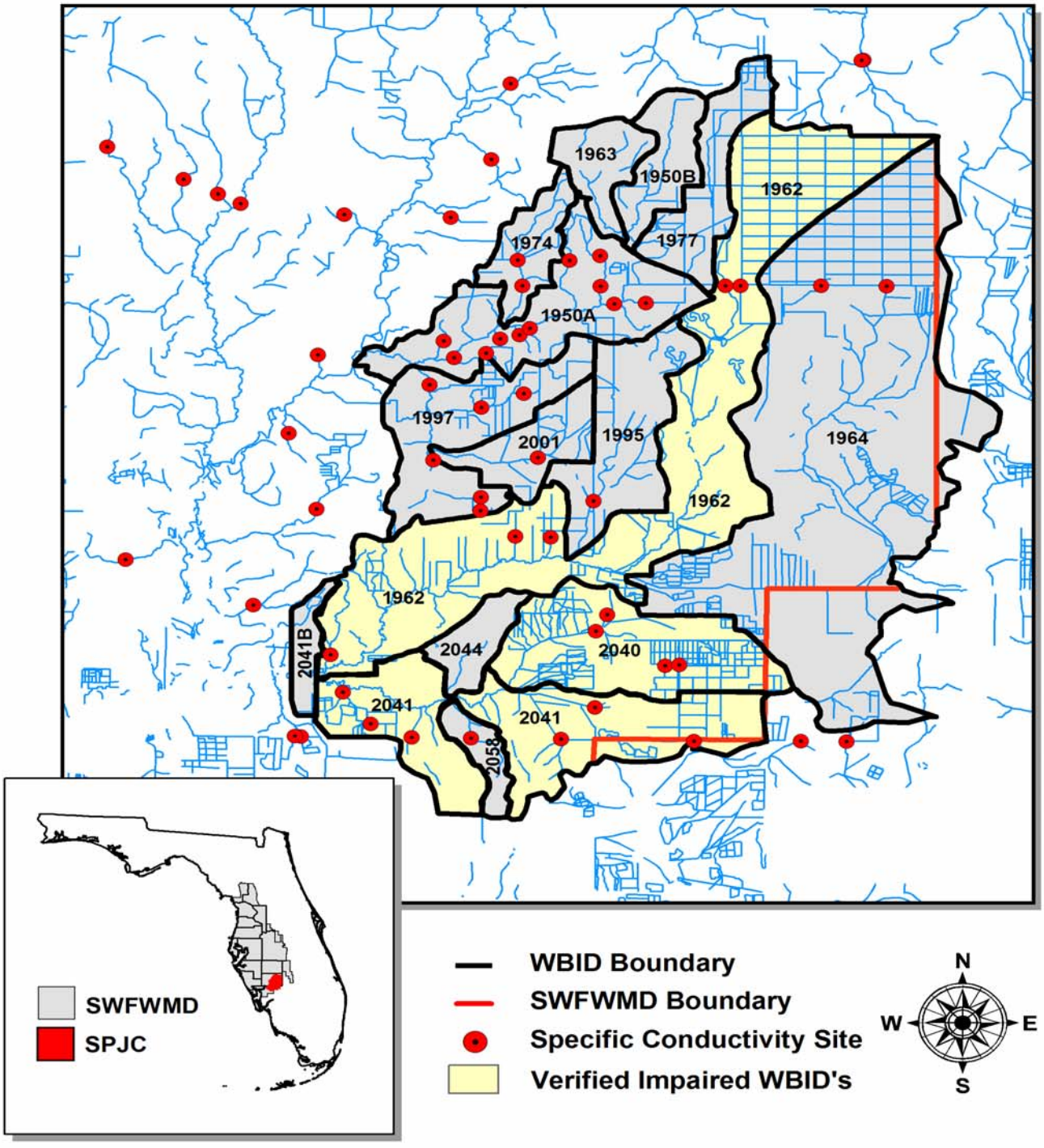


Figure 4.2 SPJC Specific Conductance Reconnaissance Network; Station Locations (SWFWMD)

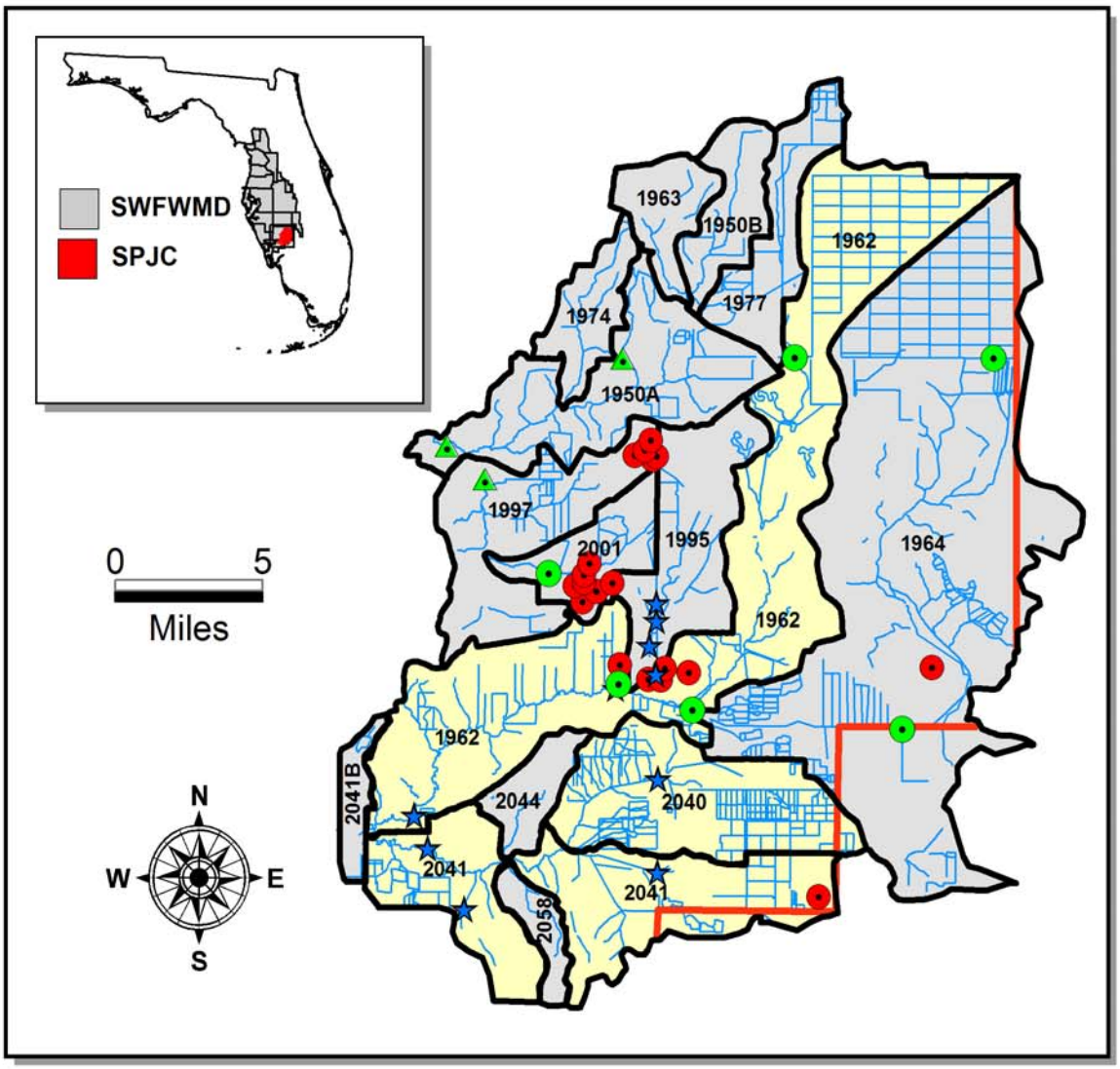


Figure 4.3 SPJC Surface and Ground Water Quality Monitoring Networks; Station Locations (SWFWMD)

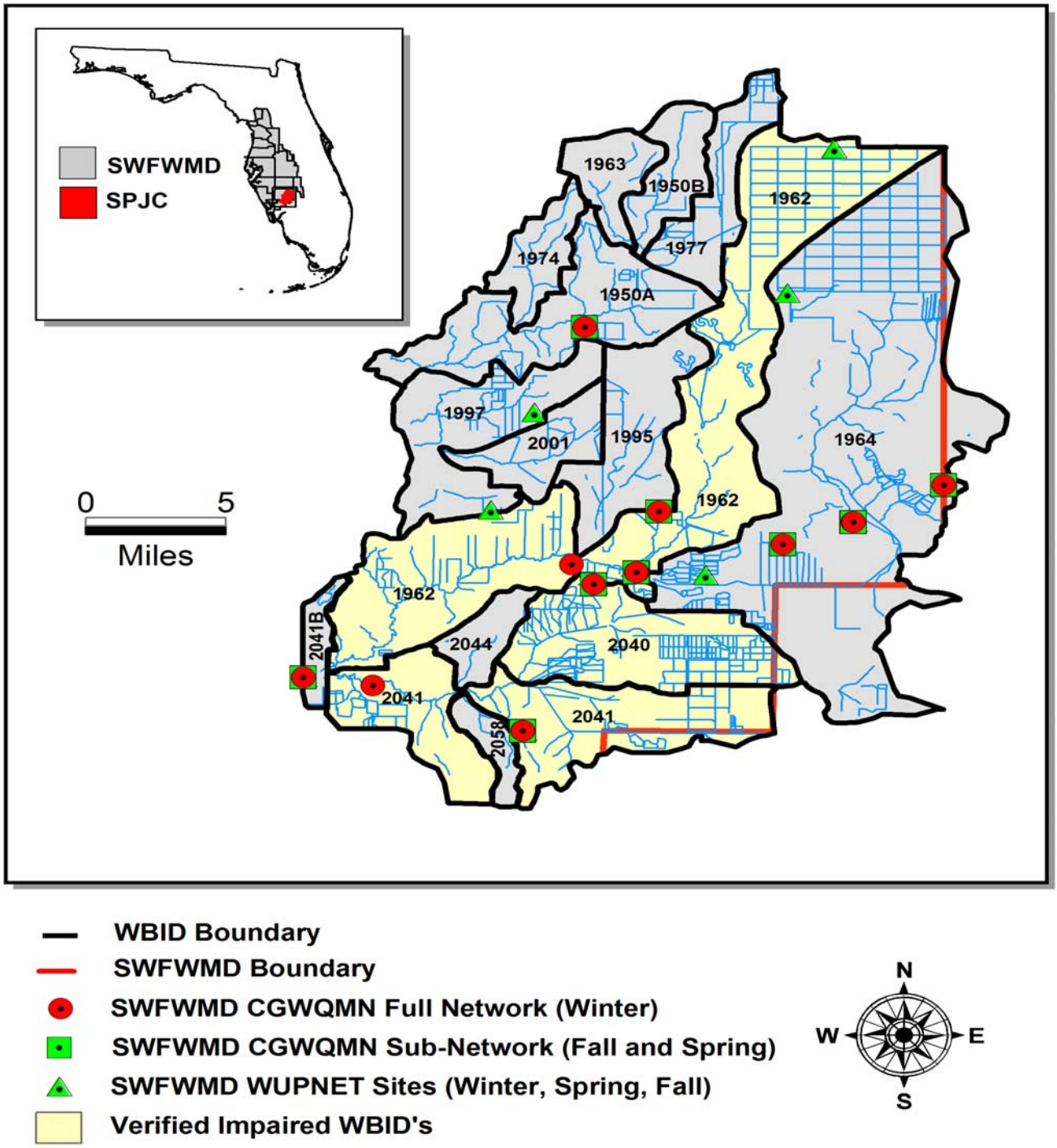


Figure 4.4 CGWQMN / WUPNET Ground Water Quality Monitoring Network; Station Locations (SWFWMD)

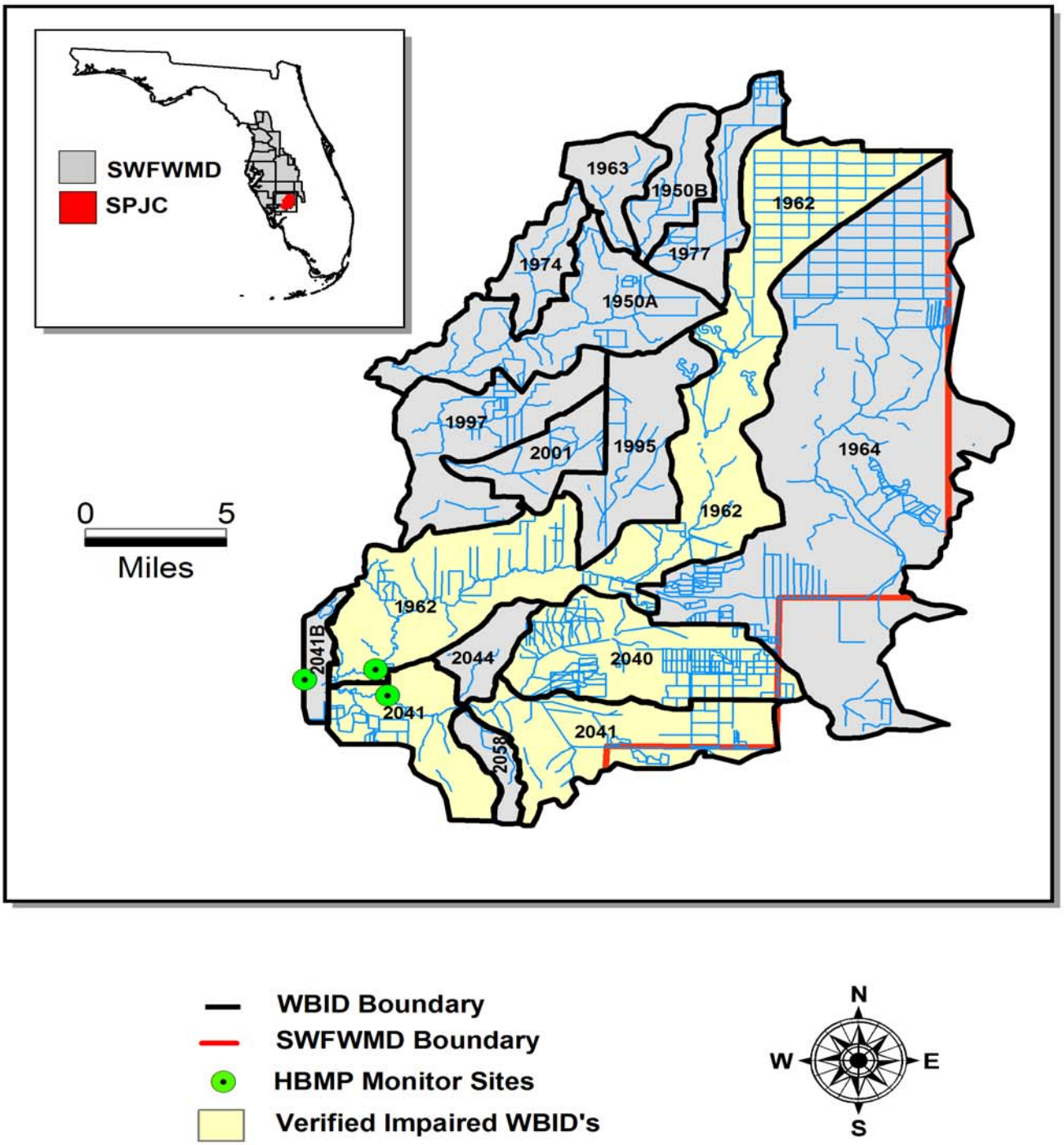


Figure 4.5 Hydrobiological Program (HBMP); Station Locations (City of Punta Gorda)

Table 1.1. DESCRIPTION OF IMPAIRED AND NOT IMPAIRED WATER BODIES IN THE SPJC WATERSHEDS

WATER SEGMENT NAME	FDEP WBID	WATER BODY TYPE	RIVER BASIN/ WATERSHED NAME	HUC CODE	COUNTY	WATER USE CLASS	DESIGNATED USE NOT BEING OBTAINED	IMPAIRED AREA	POLLUTANTS OF CONCERN	SUSPECTED OR DOCUMENTED SOURCES OF THE POLLUTANTS OF CONCERN
SHELL CREEK WATERSHED										
MYRTLE SLOUGH	2040	STREAM	PEACE RIVER/ SHELL CREEK	03100101	CHARLOTTE	1	POTABLE WATER SUPPLY	6 mi.	CHLORIDE, CONDUCTANCE, DISSOLVED SOLIDS	MINERALIZED FLORIDAN AQUIFER GROUNDWATER
SHELL CREEK	2041	STREAM	PEACE RIVER/ SHELL CREEK	03100101	CHARLOTTE	1	POTABLE WATER SUPPLY	10.5 mi.	CHLORIDE, CONDUCTANCE, DISSOLVED SOLIDS	MINERALIZED FLORIDAN AQUIFER GROUNDWATER
SHELL CREEK RESERVOIR	2041B	RESERVOIR	PEACE RIVER/ SHELL CREEK	03100101	CHARLOTTE	1	POTABLE WATER SUPPLY	275 ac.	NONE	N/A
CYPRESS SLOUGH	2044	STREAM	PEACE RIVER/ SHELL CREEK	03100101	CHARLOTTE	1	N/A	N/A	NONE	N/A
UNNAMED DITCH	2058	STREAM	PEACE RIVER/ SHELL CREEK	03100101	CHARLOTTE	3F	N/A	N/A	NONE	N/A
PRAIRIE CREEK WATERSHED										
PRAIRIE CREEK	1962	STREAM	PEACE RIVER/ SHELL CREEK	03100101	CHARLOTTE/ DESOTO	1	POTABLE WATER SUPPLY	29 mi.	CONDUCTANCE, DISSOLVED SOLIDS	MINERALIZED FLORIDAN AQUIFER GROUNDWATER
COW SLOUGH	1964	STREAM	PEACE RIVER/ SHELL CREEK	03100101	CHARLOTTE/ DESOTO	3F	N/A	N/A	NONE	N/A
MYRTLE SLOUGH	1995	STREAM	PEACE RIVER/ SHELL CREEK	03100101	DESOTO	1	N/A	N/A	NONE	N/A
JOSHUA CREEK WATERSHED										
JOSHUA CR. ab. PEACE RV.	1950A	STREAM	PEACE RIVER/ JOSHUA CREEK	03100101	DESOTO	3F	N/A	N/A	NONE	N/A
JOSHUA CR. ab. HONEY RUN	1950B	STREAM	PEACE RIVER/ JOSHUA CREEK	03100101	DESOTO	3F	N/A	N/A	NONE	N/A
LAKE SLOUGH	1963	STREAM	PEACE RIVER/ JOSHUA CREEK	03100101	DESOTO	3F	N/A	N/A	NONE	N/A
UNNAMED BRANCH	1974	STREAM	PEACE RIVER/ JOSHUA CREEK	03100101	DESOTO	3F	N/A	N/A	NONE	N/A
HONEY RUN	1977	STREAM	PEACE RIVER/ JOSHUA CREEK	03100101	DESOTO	3F	N/A	N/A	NONE	N/A
HAWTHORNE CREEK	1997	STREAM	PEACE RIVER/ JOSHUA CREEK	03100101	DESOTO	3F	N/A	N/A	NONE	N/A
HOG BAY	2001	STREAM	PEACE RIVER/ JOSHUA CREEK	03100101	DESOTO	3F	N/A	N/A	NONE	N/A

Table 1.2. Shell, Prairie, and Joshua Creek Watersheds Water Quality Assessment Master List (Based on IWR Run 17)

WBID	Water Segment Name	Waterbody Type	Waterbody Class	1998 303(d) Parameters of Concern	Parameters Assessed Using the Impaired Waters Rule (IWR)	Assessment Status [Planning list (PL), Verified list (VL), Not impaired (NI), No data (ND), Insufficient data (ID)]	Integrated Report Category[1]	Priority for TMDL Development[2]	Projected Year For TMDL Development[2]	Comment PP=Planning Period VP=Verified Period[(3)] (# Exceedances/# Samples)
1962	PRAIRIE CREEK	STREAM	1		Conductance	Impaired	4b			PP = 41 / 245; VP = 45 / 278. Impairment will be addressed by the Shell and Prairie Creek Watershed Management Plan Reasonable Assurance (RA) documentation submitted by the Shell and Prairie Creek Water Management Plan Stakeholders Group. Final assessment category dependent on DEP decision on RA submittal.
1962	PRAIRIE CREEK	STREAM	1		Dissolved Solids	Impaired	4b			PP = 51 / 75; VP = 117 / 183. Impairment will be addressed by the Shell and Prairie Creek Watershed Management Plan Reasonable Assurance (RA) documentation submitted by the Shell and Prairie Creek Water Management Plan Stakeholders Group. Final assessment category dependent on DEP decision on RA submittal.
2040	MYRTLE SLOUGH	STREAM	1		Chloride	Impaired	4b			PP = 27 / 42; VP = 57 / 90. Impairment will be addressed by the Shell and Prairie Creek Watershed Management Plan Reasonable Assurance (RA) documentation submitted by the Shell and Prairie Creek Water Management Plan Stakeholders Group. Final assessment category dependent on DEP decision on RA submittal.
2040	MYRTLE SLOUGH	STREAM	1		Conductance	Impaired	4b			PP = 27 / 42; VP = 63 / 90. Impairment will be addressed by the Shell and Prairie Creek Watershed Management Plan Reasonable Assurance (RA) documentation submitted by the Shell and Prairie Creek Water Management Plan Stakeholders Group. Final assessment dependent on DEP decision on RA submittal.
2040	MYRTLE SLOUGH	STREAM	1		Dissolved Solids	Impaired	4b			PP = 33 / 36; VP = 84 / 90. Impairment will be addressed by the Shell and Prairie Creek Watershed Management Plan Reasonable Assurance (RA) documentation submitted by the Shell and Prairie Creek Water Management Plan Stakeholders Group. Final assessment category dependent on DEP decision on RA submittal.
2041	SHELL CREEK	STREAM	1		Chloride	Impaired	4b			PP = 65 / 196; VP = 79 / 244. Impairment will be addressed by the Shell and Prairie Creek Watershed Management Plan Reasonable Assurance (RA) documentation submitted by the Shell and Prairie Creek Water Management Plan Stakeholders Group. Final assessment category dependent on DEP decision on RA submittal.
2041	SHELL CREEK	STREAM	1		Conductance	Impaired	4b			PP = 70 / 210; VP = 81 / 241 Impairment will be addressed by the Shell and Prairie Creek Watershed Management Plan Reasonable Assurance (RA) documentation submitted by the Shell and Prairie Creek Water Management Plan Stakeholders Group. Final assessment category dependent on DEP decision on RA submittal.
2041	SHELL CREEK	STREAM	1		Dissolved Solids	Impaired	4b			PP = 53 / 68; VP = 135 / 179. Impairment will be addressed by the Shell and Prairie Creek Watershed Management Plan Reasonable Assurance (RA) documentation submitted by the Shell and Prairie Creek Water Management Plan Stakeholders Group. Final assessment category dependent on DEP decision on RA submittal.
2041B	SHELL CREEK RESERVOIR	LAKE	1		Dissolved Oxygen	Impaired	4c			PP - 57/173 Potentially impaired; VP - 57/141 Verified impaired. Unable to link DO to a causative pollutant.
2041B	SHELL CREEK RESERVOIR	LAKE	1		Dissolved Solids	Planning List	3c			VP = 44 / 80. There are a suffcient number of exceedances to identify impairment, however, these data are considered provisional. If these data are validated the assessment may be changed to impaired.
1950A	JOSHUA CK AB PEACE R	STREAM	3F		Biology	Planning List	3c			PP = Potentially Impaired ; VP = No Data
1950A	JOSHUA CK AB PEACE R	STREAM	3F		Coliform (Fecal Coliform)	Planning List	3c			PP = 6 / 35; VP = 2 / 14
1950A	JOSHUA CK AB PEACE R	STREAM	3F		Coliform (Total Coliform)	Not Impaired	2			PP = 1 / 10; VP = 1 / 9
1950A	JOSHUA CK AB PEACE R	STREAM	3F		Conductance	Not Impaired	2			PP = 3 / 81; VP = 3 / 37
1950A	JOSHUA CK AB PEACE R	STREAM	3F		Dissolved Oxygen	Not Impaired	2			PP = 4 / 73; VP = 1 / 37
1950A	JOSHUA CK AB PEACE R	STREAM	3F		Fluoride	Not Impaired	2			PP = 0 / 31; VP = 0 / 11
1950A	JOSHUA CK AB PEACE R	STREAM	3F		Iron	Insufficient Data	3b			PP = 0 / 3; VP = 0 / 3
1950A	JOSHUA CK AB PEACE R	STREAM	3F		Nutrients (chla)	Not Impaired	2			PP = 0 / 4; VP = 0 / 5
1950A	JOSHUA CK AB PEACE R	STREAM	3F		pH	Not Impaired	2			PP = 2 / 80; VP = 2 / 37
1950A	JOSHUA CK AB PEACE R	STREAM	3F		Turbidity	Not Impaired	2			PP = 0 / 42; VP = 0 / 20
1950A	JOSHUA CK AB PEACE R	STREAM	3F		Unionized Ammonia	Not Impaired	2			PP = 0 / 25; VP = 0 / 17

Table 1.2. Shell, Prairie, and Joshua Creek Watersheds Water Quality Assessment Master List (Based on IWR Run 17)

WBID	Water Segment Name	Waterbody Type	Waterbody Class	1998 303(d) Parameters of Concern	Parameters Assessed Using the Impaired Waters Rule (IWR)	Assessment Status [Planning list (PL), Verified list (VL), Not impaired (NI), No data (ND), Insufficient data (ID)]	Integrated Report Category[1]	Priority for TMDL Development[2]	Projected Year For TMDL Development[2]	Comment PP=Planning Period VP=Verified Period[(3)] (# Exceedances/# Samples)
1950B	JOSHUA CK AB HONEY CK	STREAM	3F			No Data	3a			
1962	PRAIRIE CREEK	STREAM	1		Arsenic	Insufficient Data	3b			PP = 0 / 1; VP = 0 / 2
1962	PRAIRIE CREEK	STREAM	1		Biology	Not Impaired	2			PP = Not Impaired ; VP = No Data
1962	PRAIRIE CREEK	STREAM	1		Chloride	Not Impaired	2			PP = 24 / 184; VP = 25 / 245
1962	PRAIRIE CREEK	STREAM	1		Chromium3	Insufficient Data	3b			PP = 0 / 1; VP = 0 / 2
1962	PRAIRIE CREEK	STREAM	1		Coliform (Fecal Coliform)	Insufficient Data	3b			PP = 0 / 1; VP = 0 / 2
1962	PRAIRIE CREEK	STREAM	1		Coliform (Total Coliform)	Insufficient Data	3b			PP = 0 / 1; VP = 0 / 1
1962	PRAIRIE CREEK	STREAM	1		Copper	Insufficient Data	3b			PP = 0 / 1; VP = 0 / 2
1962	PRAIRIE CREEK	STREAM	1	Dissolved Oxygen	Dissolved Oxygen	Planning List	3c	Medium	2008	PP = 51 / 173 Potentially impaired; VP - 24 / 100 Verified impaired. There are a sufficient number of DO violations to place DO on the verified list. However, unable to link low DO to a causative pollutant (BOD or nutrients).
1962	PRAIRIE CREEK	STREAM	1		Lead	Insufficient Data	3b			PP = 1 / 1; VP = 2 / 2
1962	PRAIRIE CREEK	STREAM	1	Nutrients	Nutrients (chla)	Not Impaired	2			Delist. PP - 56 Samples, Range = 1.0 - 12.1 ug/l. VP - 58 Samples, Range = 1.0 - 41.0 ug/l, Verified Period Annual Mean Minimum = 1.62 ug/l, Maximum = 6.21 ug/l.
1962	PRAIRIE CREEK	STREAM	1		pH	Not Impaired	2			PP = 1 / 176; VP = 1 / 111
1962	PRAIRIE CREEK	STREAM	1	Turbidity	Turbidity	Not Impaired	2			Delist PP = 0 / 110; VP = 0 / 63
1962	PRAIRIE CREEK	STREAM	1		Unionized Ammonia	Insufficient Data	3b			PP = 0 / 1; VP = 0 / 1
1962	PRAIRIE CREEK	STREAM	1		Zinc	Insufficient Data	3b			PP = 0 / 1; VP = 0 / 2
1963	LAKE SLOUGH	STREAM	3F			No Data	3a			
1964	COW SLOUGH	STREAM	3F		1122Tetrachloroethane	Insufficient Data	3b			PP = 0 / 1; VP = No Data
1964	COW SLOUGH	STREAM	3F		Aldrin	Insufficient Data	3b			PP = 0 / 1; VP = No Data
1964	COW SLOUGH	STREAM	3F		Arsenic	Insufficient Data	3b			PP = 0 / 1; VP = 0 / 8
1964	COW SLOUGH	STREAM	3F		Benzene	Insufficient Data	3b			PP = 0 / 1; VP = No Data
1964	COW SLOUGH	STREAM	3F		Bromoform	Insufficient Data	3b			PP = 0 / 1; VP = No Data
1964	COW SLOUGH	STREAM	3F		Carbon Tetrachloride	Insufficient Data	3b			PP = 0 / 1; VP = No Data
1964	COW SLOUGH	STREAM	3F		Chloroform	Insufficient Data	3b			PP = 0 / 1; VP = No Data
1964	COW SLOUGH	STREAM	3F		Chromium3	Insufficient Data	3b			PP = 0 / 1; VP = 0 / 8
1964	COW SLOUGH	STREAM	3F		Coliform (Fecal Coliform)	Insufficient Data	3b			PP = No Data; VP = 0 / 8
1964	COW SLOUGH	STREAM	3F		Conductance	Insufficient Data	3b			PP = No Data; VP = 1 / 4
1964	COW SLOUGH	STREAM	3F		Copper	Insufficient Data	3b			PP = No Data; VP = 3 / 8
1964	COW SLOUGH	STREAM	3F		Dichloroethylene	Insufficient Data	3b			PP = 0 / 1; VP = No Data
1964	COW SLOUGH	STREAM	3F		Dissolved Oxygen	Insufficient Data	3b			PP = No Data; VP = 2 / 8
1964	COW SLOUGH	STREAM	3F		Endosulfan	Insufficient Data	3b			PP = 0 / 1; VP = No Data
1964	COW SLOUGH	STREAM	3F		Hexachlorobutadiene	Insufficient Data	3b			PP = 0 / 1; VP = No Data
1964	COW SLOUGH	STREAM	3F		Iron	Insufficient Data	3b			PP = 0 / 1; VP = No Data
1964	COW SLOUGH	STREAM	3F		Lead	Insufficient Data	3b			PP = No Data; VP = 8 / 8
1964	COW SLOUGH	STREAM	3F		Lindane	Insufficient Data	3b			PP = 0 / 1; VP = No Data
1964	COW SLOUGH	STREAM	3F		Malathion	Insufficient Data	3b			PP = 0 / 1; VP = 4 / 4
1964	COW SLOUGH	STREAM	3F		Methoxychlor	Insufficient Data	3b			PP = 0 / 1; VP = No Data
1964	COW SLOUGH	STREAM	3F		Methyl Chloride	Insufficient Data	3b			PP = 0 / 1; VP = No Data
1964	COW SLOUGH	STREAM	3F		Methylene Chloride	Insufficient Data	3b			PP = 0 / 1; VP = No Data
1964	COW SLOUGH	STREAM	3F		Nickel	Insufficient Data	3b			PP = 0 / 1; VP = No Data
1964	COW SLOUGH	STREAM	3F		Nutrients (chla)	Insufficient Data	3b			PP = No Data; VP = No Data
1964	COW SLOUGH	STREAM	3F		Parathion	Insufficient Data	3b			PP = 0 / 1; VP = No Data
1964	COW SLOUGH	STREAM	3F		pH	Insufficient Data	3b			PP = 0 / 1; VP = 0 / 8
1964	COW SLOUGH	STREAM	3F		Selenium	Insufficient Data	3b			PP = 0 / 1; VP = No Data
1964	COW SLOUGH	STREAM	3F		Tetrachloroethylene	Insufficient Data	3b			PP = 0 / 1; VP = No Data
1964	COW SLOUGH	STREAM	3F		Trichlorethylene	Insufficient Data	3b			PP = 0 / 1; VP = No Data
1964	COW SLOUGH	STREAM	3F		Turbidity	Insufficient Data	3b			PP = No Data; VP = 0 / 8
1964	COW SLOUGH	STREAM	3F		Zinc	Insufficient Data	3b			PP = 0 / 1; VP = 0 / 8
1974	UNNAMED BRANCH	STREAM	3F			No Data	3a			
1977	HONEY RUN	STREAM	3F			No Data	3a			
1995	MYRTLE SLOUGH	STREAM	1	Biochemical Oxygen Demand	Biochemical Oxygen Demand	Planning List	3c	Medium	2008	Some water quality data available, but they are insufficient for assessment under the IWR. BOD median above screening level (6 BOD values, median 2.0, range 1.3 - 2.7 mg/L) DO is on planning list.

Table 1.2. Shell, Prairie, and Joshua Creek Watersheds Water Quality Assessment Master List (Based on IWR Run 17)

WBID	Water Segment Name	Waterbody Type	Waterbody Class	1998 303(d) Parameters of Concern	Parameters Assessed Using the Impaired Waters Rule (IWR)	Assessment Status [Planning list (PL), Verified list (VL), Not impaired (NI), No data (ND), Insufficient data (ID)]	Integrated Report Category[1]	Priority for TMDL Development[2]	Projected Year For TMDL Development[2]	Comment PP=Planning Period VP=Verified Period[3] (# Exceedances/# Samples)
1995	MYRTLE SLOUGH	STREAM	1		Biology	Not Impaired	2			PP = Not Impaired ; VP = No Data
1995	MYRTLE SLOUGH	STREAM	1	Coliforms	Coliform (Fecal Coliform)	Planning List	3c	Medium	2008	PP = 4 / 5; VP = No Data
1995	MYRTLE SLOUGH	STREAM	1		Coliform (Total Coliform)	Planning List	3b			PP = 0 / 3; VP = No Data
1995	MYRTLE SLOUGH	STREAM	1		Conductance	Insufficient Data	3b			PP = 0 / 6; VP = 0 / 1
1995	MYRTLE SLOUGH	STREAM	1	Dissolved Oxygen	Dissolved Oxygen	Planning List	3c	Medium	2008	PP = 3 / 6; VP = 1 / 1 Insufficient Data in Verified Period
1995	MYRTLE SLOUGH	STREAM	1		Fluoride	Insufficient Data	3b			PP = 0 / 2; VP = No Data
1995	MYRTLE SLOUGH	STREAM	1	Nutrients	Nutrients (chla)	Planning List	3c	Medium	2008	PP = No Data; VP = No Data. Placed on Planning List pursuant to Rule 62-303.300(2).
1995	MYRTLE SLOUGH	STREAM	1		pH	Insufficient Data	3b			PP = 0 / 6; VP = 0 / 1
1995	MYRTLE SLOUGH	STREAM	1		Turbidity	Insufficient Data	3b			PP = 0 / 6; VP = 0 / 1
1995	MYRTLE SLOUGH	STREAM	1		Unionized Ammonia	Insufficient Data	3b			PP = 0 / 3; VP = No Data
1997	HAWTHORNE CREEK	STREAM	3F		Biology	Planning List	3c			PP = Potentially Impaired; VP = No Data
1997	HAWTHORNE CREEK	STREAM	3F	Coliforms	Coliform (Fecal Coliform)	Planning List	3c	Medium	2008	PP = 4 / 5; VP = 1 / 1
1997	HAWTHORNE CREEK	STREAM	3F		Coliform (Total Coliform)	Planning List	3b			PP = 1 / 1; VP = 1 / 1
1997	HAWTHORNE CREEK	STREAM	3F		Conductance	Not Impaired	2			PP = 2 / 10; VP = 2 / 3
1997	HAWTHORNE CREEK	STREAM	3F		Dissolved Oxygen	Not Impaired	2			PP = 1 / 10; VP = 0 / 3
1997	HAWTHORNE CREEK	STREAM	3F		Fluoride	Insufficient Data	3b			PP = 0 / 6; VP = 0 / 2
1997	HAWTHORNE CREEK	STREAM	3F		Iron	Insufficient Data	3b			PP = 0 / 2; VP = 0 / 2
1997	HAWTHORNE CREEK	STREAM	3F	Nutrients	Nutrients (chla)	Planning List	3c	Medium	2008	PP = No Data; VP = No Data. Placed on Planning List pursuant to Rule 62-303.300(2).
1997	HAWTHORNE CREEK	STREAM	3F		pH	Not Impaired	2			PP = 0 / 10; VP = 0 / 3
1997	HAWTHORNE CREEK	STREAM	3F		Turbidity	Insufficient Data	3b			PP = 0 / 8; VP = 0 / 1
1997	HAWTHORNE CREEK	STREAM	3F		Unionized Ammonia	Insufficient Data	3b			PP = 0 / 3; VP = No Data
2001	HOG BAY	STREAM	3F		Biology	Not Impaired	2			PP = Not Impaired ; VP = No Data
2001	HOG BAY	STREAM	3F		Conductance	Insufficient Data	3b			PP = 2 / 2; VP = 2 / 2
2001	HOG BAY	STREAM	3F		Dissolved Oxygen	Insufficient Data	3b			PP = 0 / 2; VP = 0 / 2
2001	HOG BAY	STREAM	3F		Fluoride	Insufficient Data	3b			PP = 0 / 1; VP = 0 / 1
2001	HOG BAY	STREAM	3F		Iron	Insufficient Data	3b			PP = 1 / 1; VP = 1 / 1
2001	HOG BAY	STREAM	3F		pH	Insufficient Data	3b			PP = 0 / 2; VP = 0 / 2
2001	HOG BAY	STREAM	3F		Turbidity	Insufficient Data	3b			PP = 0 / 2; VP = 0 / 2
2001	HOG BAY	STREAM	3F		Unionized Ammonia	Insufficient Data	3b			PP = 0 / 2; VP = 0 / 2
2020	GANNET SLOUGH	STREAM	3F			No Data	3a			
2040	MYRTLE SLOUGH	STREAM	1		Coliform (Fecal Coliform)	Planning List	3c			PP = 3 / 6; VP = No Data
2040	MYRTLE SLOUGH	STREAM	1		Coliform (Total Coliform)	Insufficient Data	3b			PP = 0 / 4; VP = No Data
2040	MYRTLE SLOUGH	STREAM	1		Dissolved Oxygen	Insufficient Data	3b			PP = 2 / 7; VP = 1 / 1
2040	MYRTLE SLOUGH	STREAM	1		Fluoride	Insufficient Data	3b			PP = 0 / 2; VP = No Data
2040	MYRTLE SLOUGH	STREAM	1		Nutrients (chla)	Insufficient Data	3b			PP = No Data; VP = No Data
2040	MYRTLE SLOUGH	STREAM	1		pH	Insufficient Data	3b			PP = 0 / 7; VP = 0 / 3
2040	MYRTLE SLOUGH	STREAM	1		Turbidity	Insufficient Data	3b			PP = 0 / 6; VP = No Data
2040	MYRTLE SLOUGH	STREAM	1		Unionized Ammonia	Insufficient Data	3b			PP = 0 / 4; VP = No Data
2041	SHELL CREEK	STREAM	1		Arsenic	Insufficient Data	3b			PP = 0 / 2; VP = 0 / 3
2041	SHELL CREEK	STREAM	1		Chromium3	Insufficient Data	3b			PP = 0 / 2; VP = 0 / 3
2041	SHELL CREEK	STREAM	1		Coliform (Fecal Coliform)	Not Impaired	2			PP = 2 / 25; VP = 1 / 6
2041	SHELL CREEK	STREAM	1		Coliform (Total Coliform)	Not Impaired	2			PP = 1 / 15; VP = 1 / 4
2041	SHELL CREEK	STREAM	1		Copper	Insufficient Data	3b			PP = 0 / 2; VP = 1 / 3
2041	SHELL CREEK	STREAM	1		Dissolved Oxygen	Planning List	3c			PP - 49 / 146 Potentially impaired VP - 23 / 68 Verified impaired. There are a sufficient number of DO violations to place DO on the verified list. However, unable to link low DO to a causative pollutant (BOD or nutrients).
2041	SHELL CREEK	STREAM	1		Fluoride	Insufficient Data	3b			PP = 0 / 2; VP = 0 / 2
2041	SHELL CREEK	STREAM	1		Lead	Insufficient Data	3b			PP = 2 / 2; VP = 2 / 3
2041	SHELL CREEK	STREAM	1		Nutrients (chla)	Not Impaired	2			PP = 0 / 9; VP = 0 / 5

Table 1.2. Shell, Prairie, and Joshua Creek Watersheds Water Quality Assessment Master List (Based on IWR Run 17)

WBID	Water Segment Name	Waterbody Type	Waterbody Class	1998 303(d) Parameters of Concern	Parameters Assessed Using the Impaired Waters Rule (IWR)	Assessment Status [Planning list (PL), Verified list (VL), Not impaired (NI), No data (ND), Insufficient data (ID)]	Integrated Report Category[1]	Priority for TMDL Development[2]	Projected Year For TMDL Development[2]	Comment PP=Planning Period VP=Verified Period[(3)] (# Exceedances/# Samples)
2041	SHELL CREEK	STREAM	1		Nutrients (Historic chla)	Planning List	3c			PP = Potentially Impaired; VP = Potentially Impaired
2041	SHELL CREEK	STREAM	1		pH	Not Impaired	2			PP = 0 / 143; VP = 0 / 68
2041	SHELL CREEK	STREAM	1		Turbidity	Not Impaired	2			PP = 0 / 134; VP = 0 / 67
2041	SHELL CREEK	STREAM	1		Unionized Ammonia	Not Impaired	2			PP = 0 / 19; VP = 0 / 4
2041	SHELL CREEK	STREAM	1		Zinc	Insufficient Data	3b			PP = 0 / 2; VP = 0 / 3
2041A	SHELL CREEK BELOW HENDRICKSON DAM	ESTUARY	3M		Chloride	Not Impaired	2			PP = 0 / 65; VP = 0 / 72
2041A	SHELL CREEK BELOW HENDRICKSON DAM	ESTUARY	3M		Conductance	Not Impaired	2			PP = 0 / 2021; VP = 0 / 1062
2041A	SHELL CREEK BELOW HENDRICKSON DAM	ESTUARY	3M		Dissolved Oxygen	Not Impaired	2			PP = 149 / 2019; VP = 79 / 1060
2041A	SHELL CREEK BELOW HENDRICKSON DAM	ESTUARY	3M		Iron	Impaired	5	Medium	2009	PP = 9 / 18; VP = 17 / 30
2041A	SHELL CREEK BELOW HENDRICKSON DAM	ESTUARY	3M		Nutrients (chla)	Impaired	5	Medium	2009	PP - Potentially impaired; VP - Verified Impaired. VP - Annual average chl(a) values exceeded 20 ug/L in 1998 - 2002. Colimited by Nitrogen and Phosphorus. 430 TN values, median 1.2825 mg/L. 430 TP values, median 0.32 mg/L.
2041A	SHELL CREEK BELOW HENDRICKSON DAM	ESTUARY	3M		Nutrients (Historic chla)	Not Impaired	2			PP = Not Impaired; VP = Not Impaired
2041A	SHELL CREEK BELOW HENDRICKSON DAM	ESTUARY	3M		pH	Not Impaired	2			PP = 133 / 2021; VP = 16 / 1062
2041A	SHELL CREEK BELOW HENDRICKSON DAM	ESTUARY	3M		Turbidity	Not Impaired	2			PP = 1 / 713; VP = 0 / 431
2041B	SHELL CREEK RESERVOIR	LAKE	1		Chloride	Not Impaired	2			PP = 8 / 131; VP = 8 / 78
2041B	SHELL CREEK RESERVOIR	LAKE	1		Conductance	Not Impaired	2			PP = 14 / 223; VP = 13 / 142
2041B	SHELL CREEK RESERVOIR	LAKE	1		Nutrients (Historic TSI)	Not Impaired	2			PP = Not Impaired; VP = Not Impaired
2041B	SHELL CREEK RESERVOIR	LAKE	1		Nutrients (TSI)	Not Impaired	2			PP = 0 / 9; VP = 0 / 5
2041B	SHELL CREEK RESERVOIR	LAKE	1		pH	Not Impaired	2			PP = 1 / 171; VP = 0 / 90
2041B	SHELL CREEK RESERVOIR	LAKE	1		Turbidity	Not Impaired	2			PP = 0 / 125; VP = 0 / 77
2041B	SHELL CREEK RESERVOIR	LAKE	1		Unionized Ammonia	Not Impaired	2			PP = 0 / 15; VP = 0 / 15
2044	CYPRESS SLOUGH	STREAM	1			No Data	3a			
2054	MYRTLE SLOUGH	ESTUARY	3M	Biochemical Oxygen Demand	Biochemical Oxygen Demand	Planning List	3c	Medium	2008	No BOD data available.
2054	MYRTLE SLOUGH	ESTUARY	3M		Biology	Not Impaired	2			PP = Not Impaired; VP = No Data
2054	MYRTLE SLOUGH	ESTUARY	3M	Coliforms	Coliform (Fecal Coliform)	Planning List	3c	Medium	2008	PP = No Data; VP = No Data
2054	MYRTLE SLOUGH	ESTUARY	3M	Coliforms	Coliform (Total Coliform)	Planning List	3c	Medium	2008	PP = No Data; VP = No Data
2054	MYRTLE SLOUGH	ESTUARY	3M	Dissolved Oxygen	Dissolved Oxygen	Planning List	3c	Medium	2008	PP = No Data; VP = 1 / 7; Insufficient Data in Verified Period
2054	MYRTLE SLOUGH	ESTUARY	3M	Nutrients	Nutrients (chla)	Planning List	3c	Medium	2008	PP = No Data; VP = No Data. Placed on Planning List pursuant to Rule 62-303.300(2).
2058	UNNAMED DITCH	STREAM	3F			No Data	3a			

(1) 2 - Attains some designated uses, 3a - No data and information available to determine if any designated use is attained, 3b - Some data and information available but they are insufficient for determining if any designated use is attained, 3c - Meets planning list criteria and is potentially impaired for one or more designated uses, 4a - Impaired for one or more designated uses and the TMDL is complete, 4b - Impaired for one or more designated uses, but no TMDL is required because a proposed pollution control measure provides reasonable assurance that the water will attain standards in the future, 4c - Impaired for one or more designated uses but no TMDL will be developed because the impairment is not caused by a pollutant, 5 - Water standards are not attained and a TMDL is required.

(2) Priorities and schedule for TMDL development are only provided for waters in Category 5. Priorities were retained from the 1998 303(d) list (i.e., High or Low), but High, Medium, and Low are used for newly listed waters identified under the IWR.

(3) Planning Period (PP) - 1/1/1992 to 12/31/2001; Verified Period (VP) - 1/1/1997 to 6/30/2004.

Table 2.1. Resource Management Strategies to Address Impaired Parameters and Interim Water Quality Targets.

Resource Management Actions	Proposed Interim Water Quality Target
Shell, Prairie, and Joshua Creek (SPJC) Well Back-Plugging Program	Specific conductance from individual pumped, back-plugged well is targeted at or less than 1000 uS/cm. The 1000 uS/cm goal is recognized as above the 775 uS/cm goal for surface water systems in the region. However, 1000 uS/cm is the lowest concentration that can likely be achieved based upon well hydraulic characteristics of this area, landowners pumping requirements, and the natural aquifer water quality signature. An actual reduction of specific conductance to the 775 uS/cm level is expected to occur through natural dilution with rainfall and surface water, as well as attenuation with the Surficial Aquifer System.
District Resource Regulation Well Construction and WUP Permitting	Any new wells constructed must be drilled above specified depths and also must demonstrate specific conductance is < 1000 uS/cm. New and renewed WUPS must demonstrate use of water that meets Class I standards. Approximately 89% of Water Use Permits in Shell and Prairie Creek Basins will be reviewed over next ten years (2014).
Facilitating Agricultural Resource Management Systems (FARMS) (FDACS/District)	Water quality goals dependent on and established for individual FARMS projects with an overall goal of water quality used on a property at a specific conductance < 775 uS/cm.
Environmental Quality Incentives Program (EQIP) (USDA/NRCS)	Water quality goals dependent on and established for individual projects with an overall goal of improving water quality used on a property.
BMPs for Peace River Valley / Manasota Basin (PRVMSB) Area Citrus Groves Manual (FDACS)	No numeric interim water quality target for specific conductance, TDS, or chloride is available
SWUCA Plans/Recovery Strategy (District)	No specific interim water quality targets set
Quality of Water Improvement Program (QWIP) (District)	Final specific conductance from plugged well is 0.0 uS/cm (complete abandonment). QWIP will also insure legal wells with uncontrolled flow are corrected so flow is now controlled (in cooperation with SWFWMD Resource Regulation)
Land Acquisition (District)	No specific interim water quality targets set. The intent of land acquisition will include retiring water use quantities associated with poor quality water and potentially add off-stream reservoir capabilities to insure a water supply that meets Class I standards.
NRCS Mobile Irrigation Lab (USDA-NRCS/District)	Identification of wells with specific conductance > 1000 uS/cm will occur and, with landowner permission, this information will be referred for potential well back-plugging or EQIP/FARMS project. A maximum of 15% water use savings can result from MIL use which will also improve water quality conditions
Education/Outreach	No specific interim water quality targets set
Research Efforts	No specific interim water quality targets set

Table 2.2. Historical Loading Estimates from Dates when Chloride Values Exceeded 250mg/L Standard – Shell Creek Reservoir

Date	Discharge (USGS) Monthly Avg. (ft^3/sec)	Chloride Monthly Avg. (mg/L)	Chloride Load lbs/gal	Chloride Load gal/day	Chloride Load lbs/day	Chloride Load lbs/month	Chloride Load tons/month
Jul-00	145	296	0.002467752	93709440	231251.66	6937549.74	3468.77
Feb-01	18.1	251	0.002092587	11697523.2	24478.08	734342.55	367.17
Mar-01	46.9	255.5	0.002130104	30310156.8	64563.77	1936913.13	968.46
Apr-01	121	342	0.002851254	78198912	222964.96	6688948.82	3344.47
May-01	9.62	284.5	0.002371877	6217136.64	14746.28	442388.41	221.19
Jun-01	193	298	0.002484426	124730496	309883.69	9296510.62	4648.26
Jun-02	923	258	0.002150946	596509056	1283058.77	38491763.04	19245.88
Mar-03	95.5	310	0.00258447	61718976	159510.84	4785325.26	2392.66
PERIOD OF RECORD AVG. VALUE	**194.02**	**286.88**					**4332.11**
LOAD GOAL AVG. VALUE	**194.02**	**249.00**	**0.002075913**	**125389693.4**	**260298.09**	**7808942.84**	**3904.47**
						% LOAD REDUCTION NEEDED	**9.90**

Table 2.3 Historical Loading Estimates from Dates when TDS Values Exceeded 500 mg/L Standard – Shell Creek Reservoir

Date	Discharge (USGS) Monthly Avg. (ft^3/sec)	TDS	TDS Load lbs/gal	TDS Load gal/day	TDS Load lbs/day	TDS Load lbs/month	TDS Load tons/month
Jul-73	321	604.50	0.005039717	207453312	1045505.88	31365176.38	15682.59
Feb-74	33	559.00	0.004660383	21326976	99391.88	2981756.29	1490.88
Apr-74	7.48	676.00	0.005635812	4834114.56	27244.16	817324.83	408.66
Jan-75	85.9	616.85	0.005142678	55514764.8	285494.58	8564837.54	4282.42
Mar-75	31.1	630.50	0.005256479	20099059.2	105650.27	3169508.18	1584.75
Apr-75	0.2	611.00	0.005093907	129254.4	658.41	19752.30	9.88
Feb-76	36.1	519.12	0.004327917	23330419.2	100972.12	3029163.51	1514.58
Mar-76	43.9	664.05	0.005536219	28371340.8	157069.95	4712098.38	2356.05
Apr-76	8.43	565.47	0.004714329	5448072.96	25684.01	770520.32	385.26
May-76	130	852.91	0.007110672	84015360	597405.70	17922170.96	8961.09
Jan-77	135	527.03	0.004393824	87246720	383346.76	11500402.82	5750.20
Feb-77	71.5	508.16	0.004236525	46208448	195763.26	5872897.93	2936.45
Mar-77	37.5	527.03	0.004393824	24235200	106485.21	3194556.34	1597.28
Apr-77	0.6	506.87	0.004225761	387763.2	1638.59	49157.83	24.58
May-77	50.6	663.79	0.005534022	32701363.2	180970.05	5429101.64	2714.55
Jun-77	60.5	737.84	0.006151354	39099456	240514.60	7215437.92	3607.72
Jul-77	183	683.33	0.005696959	118267776	673766.72	20213001.51	10106.50
Dec-78	105	573.58	0.004781945	67858560	324495.93	9734878.01	4867.44
May-80	81.6	570.95	0.004759976	52735795.2	251021.14	7530634.14	3765.32
Jun-80	45.8	599.93	0.005001637	29599257.6	148044.73	4441341.98	2220.67
Jul-80	267	539.68	0.004499276	172554624	776370.90	23291126.91	11645.56
Nov-80	91.7	562.16	0.004686746	59263142.4	277751.29	8332538.77	4166.27
Dec-80	36.8	608.98	0.005077064	23782809.6	120746.85	3622405.40	1811.20
Jan-81	23.6	702.70	0.005858432	15252019.2	89352.92	2680587.72	1340.29
Feb-81	106	649.84	0.005417695	68504832	371138.30	11134149.06	5567.07
Mar-81	9.08	632.43	0.005272589	5868149.76	30940.34	928210.29	464.11
Apr-81	0.85	625.74	0.005216788	549331.2	2865.74	85972.33	42.99
Jun-81	56	790.54	0.006590736	36191232	238526.87	7155806.20	3577.90
Jul-81	87.4	768.87	0.006410101	56484172.8	362069.28	10862078.40	5431.04
Aug-81	594	520.88	0.004342563	383885568	1667047.28	50011418.38	25005.71

Table 2.3 (cont.) Historical Loading Estimates from Dates when TDS Values Exceeded 500 mg/L Standard – Shell Creek Reservoir

Date	Discharge (USGS) Monthly Avg. (ft^3/sec)	TDS Monthly Avg. (mg/L)	TDS Load lbs/gal	TDS Load gal/day	TDS Load lbs/day	TDS Load lbs/month	TDS Load tons/month
Dec-81	20.6	537.26	0.004479138	13313203.2	59631.67	1788950.13	894.48
Jan-82	43.6	667.57	0.005565511	28177459.2	156821.95	4704658.61	2352.33
Feb-82	80.4	758.57	0.006324178	51960268.8	328605.98	9858179.37	4929.09
Mar-82	87.3	710.43	0.005922875	56419545.6	334165.93	10024977.80	5012.49
Apr-82	141	553.55	0.00461498	91124352	420537.08	12616112.27	6308.06
Jun-83	178	553	0.004611248	115036416	530461.47	15913844.04	7956.92
Jan-85	24.9	543.80	0.004533661	16092172.8	72956.45	2188693.49	1094.35
Feb-85	23.1	575.54	0.004798252	14928883.2	71632.55	2148976.40	1074.49
Mar-85	17.3	611.00	0.005093907	11180505.6	56952.46	1708573.67	854.29
Apr-85	8.49	642.50	0.005356523	5486849.28	29390.43	881712.95	440.86
May-85	4.27	723.00	0.006027651	2759581.44	16633.79	499013.81	249.51
Jun-85	100	750.75	0.006259003	64627200	404501.82	12135054.68	6067.53
Jul-85	224	546.75	0.004558255	144764928	659875.42	19796262.62	9898.13
Jan-86	42.9	506.00	0.004218522	27725068.8	116958.81	3508764.38	1754.38
Feb-86	42.6	582.41	0.004855552	27531187.2	133679.12	4010373.47	2005.19
May-86	9.27	526.00	0.004385262	5990941.44	26271.85	788155.44	394.08
Jun-86	515	510.75	0.004258123	332830080	1417231.34	42516940.07	21258.47
Jun-87	77	527.54	0.004398115	49762944	218863.14	6565894.33	3282.95
May-88	23.4	642.20	0.005354021	15122764.8	80967.61	2429028.19	1214.51
Jun-88	102	731.50	0.006098516	65919744	402012.58	12060377.42	6030.19
Jul-88	367	514.75	0.004291471	237181824	1017858.86	30535765.80	15267.88
Feb-96	102	544.75	0.004541581	65919744	299379.84	8981395.21	4490.70
Mar-96	98.2	610.50	0.005089739	63463910.4	323014.71	9690441.24	4845.22
Apr-96	83.7	590.98	0.004926959	54092966.4	266513.80	7995414.14	3997.71
May-96	94.6	610.00	0.00508557	61137331.2	310918.18	9327545.32	4663.77
Jan-97	67.4	511.00	0.004260207	43558732.8	185569.22	5567076.55	2783.54
Feb-97	68.2	659.00	0.005494083	44075750.4	242155.83	7264674.93	3632.34
Mar-97	25	641.50	0.005348186	16156800	86409.56	2592286.90	1296.14
Apr-97	79.5	586.50	0.004889651	51378624	251223.51	7536705.44	3768.35
May-97	251	605.00	0.005043885	162214272	818190.13	24545704.00	12272.85
Jun-98	33.4	592.27	0.004937727	21585484.8	106583.24	3197497.06	1598.75
Jul-98	261	586.00	0.004885482	168676992	824068.41	24722052.25	12361.03

Table 2.3 (cont.) Historical Loading Estimates from Dates when TDS Values Exceeded 500 mg/L Standard – Shell Creek Reservoir

Date	Discharge (USGS) Monthly Avg. (ft^3/sec)	TDS Monthly Avg. (mg/L)	TDS Load lbs/gal	TDS Load gal/day	TDS Load lbs/day	TDS Load lbs/month	TDS Load tons/month
Dec-98	89.9	548.67	0.004574234	58099852.8	265762.32	7972869.66	3986.43
Mar-99	24.3	521.00	0.004343577	15704409.6	68213.31	2046399.37	1023.20
Apr-99	4.86	664.00	0.005535768	3140881.92	17387.19	521615.81	260.81
May-99	52.5	731.50	0.006098516	33929280	206918.24	6207547.20	3103.77
Jun-99	760	667.39	0.005564009	491166720	2732855.88	81985676.34	40992.84
Jan-00	69.3	504.33	0.004204627	44786649.6	188311.16	5649334.68	2824.67
Feb-00	56.3	544.00	0.004535328	36385113.6	165018.42	4950552.73	2475.28
Mar-00	31.6	555.00	0.004627035	20422195.2	94494.21	2834826.36	1417.41
Apr-00	19.2	615.50	0.005131424	12408422.4	63672.87	1910186.11	955.09
May-00	0.082	743.50	0.00619856	52994.304	328.49	9854.65	4.93
Jun-00	11.1	765.00	0.006377805	7173619.2	45751.94	1372558.33	686.28
Jul-00	145	795.80	0.006634585	93709440	621723.21	18651696.22	9325.85
Aug-00	434	555.73	0.004633079	280482048	1299495.58	38984867.33	19492.43
Sep-00	394	558.33	0.004654756	254631168	1185245.84	35557375.08	17778.69
Nov-00	42.2	594.43	0.004955721	27272678.4	135155.79	4054673.74	2027.34
Dec-00	12	624.00	0.005202288	7755264	40345.12	1210353.51	605.18
Jan-01	20.1	747.58	0.006232533	12990067.2	80961.02	2428830.59	1214.42
Feb-01	18.1	862.63	0.007191705	11697523.2	84125.13	2523753.95	1261.88
Mar-01	46.9	916.83	0.00764357	30310156.8	231677.81	6950334.18	3475.17
Apr-01	121	833.00	0.006944721	78198912	543069.63	16292088.79	8146.04
May-01	9.62	917.45	0.007648781	6217136.64	47553.51	1426605.43	713.30
Jun-01	193	978.00	0.008153586	124730496	1017000.83	30510024.78	15255.01
Jul-01	1271	613.00	0.005110581	821411712	4197891.09	125936732.66	62968.37
Nov-01	210	624.33	0.005204998	135717120	706407.27	21192218.21	10596.11
Dec-01	58.2	515.00	0.004293555	37613030.4	161493.61	4844808.44	2422.40
Jan-02	91.8	558.19	0.004653623	59327769.6	276089.09	8282672.68	4141.34
Feb-02	50.6	868.00	0.007236516	32701363.2	236643.94	7099318.14	3549.66
Mar-02	42.4	897.40	0.007481624	27401932.8	205010.95	6150328.58	3075.16
Apr-02	52	975.48	0.008132535	33606144	273303.14	8199094.34	4099.55
May-02	82	861.38	0.007181283	52994304	380567.11	11417013.43	5708.51
Jun-02	923	779.38	0.006497649	596509056	3875906.69	116277200.85	58138.60

Table 2.3 (cont.) Historical Loading Estimates from Dates when TDS Values Exceeded 500 mg/L Standard – Shell Creek Reservoir

Date	Discharge (USGS) Monthly Avg. (ft^3/sec)	TDS Monthly Avg. (mg/L)	TDS Load lbs/gal	TDS Load gal/day	TDS Load lbs/day	TDS Load lbs/month	TDS Load tons/month
Jul-02	1744	505.65	0.004215604	1127098368	4751400.44	142542013.35	71271.01
Aug-02	720	555.65	0.004632454	465315840	2155554.25	64666627.43	32333.31
Oct-02	153	507.65	0.004232278	98879616	418486.03	12554580.85	6277.29
Nov-02	842	1142.65	0.009526273	544161024	5183826.50	155514794.93	77757.40
Feb-03	99	547.63	0.00456555	63980928	292108.10	8763243.06	4381.62
Mar-03	95.5	571.94	0.00476824	61718976	294290.86	8828725.92	4414.36
Apr-03	74.7	605.52	0.005048206	48276518.4	243709.83	7311294.80	3655.65
May-03	113	635.99	0.005302278	73028736	387218.68	11616560.27	5808.28
PERIOD OF RECORD AVG. VALUE	**150.63**	**642.18**					**7772.22**
LOAD GOAL AVG. VALUE	**150.63**	**499.00**	**0.004160163**	**97347951.36**	**404983.35**	**12149500.36**	**6074.75**
						% LOAD REDUCTION NEEDED	**21.84**

Table 3.1. Resource Management Actions Organized by Effectiveness and Anticipated Benefit

	Percent Effectiveness	Project Type	Comments
Shell Prairie, and Joshua Creek (SPJC) Well Back-Plugging Program	30%	Point Source – Immediate Remediation	Improves water quality at source of mineralized water. Highly effective with documented program success. Provides economic incentive to growers to improve crop production.
District Resource Regulation Well Construction and WUP Permitting	14%	Point Source – Immediate Remediation Non Point Source – Longer Term Remediation Prevention	Highly effective compliment to incentive programs such as FARMS and Well Back-Plugging. Regulates compliance on permit renewals and new applications.
Facilitating Agricultural Resource Management Systems (FARMS)	12%	Point Source – Immediate Remediation Non Point Source – Longer Term Remediation	Very effective dual role of improving water quality and reducing water use. High grower participation due to improved water supply for crops and economic incentive.
Environmental Quality Incentives Program (EQIP)	12%	Point Source – Immediate Remediation Non Point Source – Longer Term Remediation	Focuses on key agricultural management activities to improve environmental conditions
Peace River Valley/Manasota Area Citrus Best Management Practices Plan	12%	Non Point Source – Longer Term Remediation Prevention	Highly effective as applied to nutrient management issues.
Regional Water Supply Plan and SWUCA Recovery Strategy	5%	Non Point Source – Longer Term Remediation Prevention	Significant over long-term (20 years) due to anticipated reduction in overall water use (with corresponding reduction in poor water quality use). Significant funding committed over long-term.
Quality of Water Improvement Program (QWIP)	5%	Point Source – Immediate Remediation	Very effective as wells are available for complete abandonment.
Land Acquisition	3%	Point Source – Immediate Remediation Non Point Source – Longer Term Remediation Prevention	Has the potential for a much greater percent effectiveness. Time frame for land acquisition is undetermined.
Mobile Irrigation Lab	3%	Non Point Source – Longer Term Remediation Prevention	Effective due to its ability to improve water management. Can result in decreased water use (with corresponding reduction in poor water quality use)
Education/Outreach	2%	Point Source – Immediate Remediation Non Non Point Source – Longer Term Remediation Prevention	Effective in promoting awareness of issue and advertising incentive programs available to obtain new projects. Important element to maintain funding levels.
Research Efforts	2%	Point Source – Immediate Remediation Non Non Point Source – Longer Term Remediation Prevention	Effective in continual assessment of water quality problems to focus management actions for greatest effectiveness

Table 3.2. Management Actions With the Approximate Load-Based and Concentration-Based Improvements that are Expected.

Management Action	Percent Effectiveness	TDS Load Reduction (tons/month)	Chloride Load Reduction (tons/month)	TDS Concentration Reduction (mg/l)	Chloride Concentration Reduction (mg/l)
Shell Prairie, and Joshua Creek (SPJC) Well Back-Plugging Program	30%	509.24	128.29	42.95	11.36
District Resource Regulation Well Construction and WUP Permitting	14%	237.65	59.87	20.05	5.30
Facilitating Agricultural Resource Management Systems (FARMS)	12%	203.70	51.32	17.18	4.55
Environmental Quality Incentives Program (EQIP)	12%	203.70	51.32	17.18	4.55
Peace River Valley/Manasota Area Citrus Best Management Practices Plan	12%	203.70	51.32	17.18	4.55
Regional Water Supply Plan and SWUCA Recovery Strategy	5%	84.87	21.38	7.16	1.89
Quality of Water Improvement Program (QWIP)	5%	84.87	21.38	7.16	1.89
Land Acquisition	3%	50.92	12.83	4.30	1.14
Mobile Irrigation Lab	3%	50.92	12.83	4.30	1.14
Education/Outreach	2%	33.95	8.55	2.86	0.76
Research Efforts	2%	33.95	8.55	2.86	0.76
Total	**100%**	**1697.47**	**427.64**	**143.18**	**37.88**

Table 3.3. Summary of Water Quality Results from Wells Back-Plugged Within the Shell, Prairie, and Joshua Creek Watersheds.

Watershed	WUP No.	DID No.	Pre Back-Plugging			Post Back-Plugging Results		
			Conductance (uS/cm)	TDS (mg/L)	Chloride (mg/L)	Conductance % Reduction	TDS % Reduction	Chloride % Reduction
Shell Creek	20009648	1	1,940	1,241	380	48%	47%	67%
Shell Creek	20009648	2	2,540	1,625	606	N/A	N/A	N/A
Prairie Creek	20003069	2	1,988	1,120	448	44%	44%	59%
Prairie Creek	20003069	6	2,430	1,387	584	68%	68%	83%
Prairie Creek	20003069	7	2,720	1,565	691	66%	64%	80%
Prairie Creek	20006275	5	4,500	2,544	1,150			
Prairie Creek	20006872	66	3,400	1,940	836	67%	67%	76%
Prairie Creek	20006872	76	8,800	5,200	2,490	84%	85%	89%
Prairie Creek	20009782	1	1,727	993	372	34%	27%	48%
Prairie Creek	20009782	2	908	536	131	0%	0%	0%
Prairie Creek	20009782	3	1,557	887	321	36%	30%	46%
Prairie Creek	20009782	4	1,346	788	261	4%	1%	13%
Prairie Creek	20009782	5	934	545	155	0%	0%	1%
Prairie Creek	20009782	6	1,470	839	304	8%	11%	21%
Prairie Creek	20009782	7	1,216	676	236	0%	0%	2%
Prairie Creek	20009782	9	2,120	1,234	511			
Joshua	20005060	2	2,190	1,256	429	39%	33%	65%
Joshua	20005060	3	No Pump					
Joshua	20005060	4	2,030	1,188	383	13%	11%	28%
Joshua	20005060	5	2,050	1,190	380	49%	37%	87%
Joshua	20005060	7	2,670	1,528	576	60%	49%	88%
Joshua	20005060	9	3,050	1,806	720	66%	58%	93%
Joshua	20005060	10	3,420	2,029	818	71%	64%	94%
Joshua	20005060	12	2,440	1,423	520	59%	47%	89%
Joshua	20005060	13	3,450	2,080	846	60%	62%	69%
Joshua	20006669	15	1,762	1,040	508	51%	48%	84%
Joshua	20006669	4	995	657	127	0%	0%	0%
Joshua	20006669	8	14,760	9,384	4,880	94%	94%	99%
Joshua	20006669	9	1,913	1,122	395			
Joshua	20006669	10	4,260	2,524	1,170	79%	77%	90%
Joshua	20006669	11	14,940	9,450	4,850	95%	94%	99%
Joshua	20006669	12	15,080	9,336	4,940	94%	94%	98%
Joshua	20006669	13	6,400	3,826	1,505	83%	83%	91%
Joshua	20010971	1	2,290	1,330	507	62%	57%	86%
Horse	20002703	4	2,290	2,070	20	7%	6%	3%
Peace	20007434	5	3,070	1,830	732	58%	54%	78%
Peace	20009565	1	6,530	3,970	1,800	77%	77%	87%
Peace	20009565	4	2,870	1,700	777			
Peace	20012453	4	3,550	2,068	857	58%	55%	71%

Table 3.4a. EQIP Conservation Practices Designed to Protect Water Quality in Charlotte County.

Code	Practice
342	Critical Area Planting
351	Well Decommissioning
449	Irrigation Water Management
528A	Prescribed Grazing
533	Pumping Plant for Water Control
552	Irrigation Pit or Regulating Reservoir
587	Structure for Water Control
590	Nutrient Management
595	Pest Management

Table 3.4b. Additional Water Quality Practices Available for EQIP Assistance

Code	Practice
313	Waste Storage Facility
348	Conservation Crop Rotation
329	Residue Management
340	Cover and Green Manure Crop
342	Critical Area Planting
350	Sediment Basin
359	Waste Treatment Lagoon
391	Riparian Forest Buffer
393	Filter Strip
410	Grade Stabilization Structure
412	Grassed Waterway
436	Irrigation Storage Reservoir
447	Irrigation System, Tail Water Recovery
484	Mulching
558	Roof Runoff Management
561	Heavy Use Area Protection
580	Stream Bank & Shoreline Protection
584	Stream Channel Stabilization
638	Water and Sediment Control Basin
642	Well
702/703	Agrichemical Mixing Center
755	Well Plugging

Table 3.5. Commodity-Specific BMP Manuals have been Developed in Accordance with Florida Law.

BMP Manuals	Description	Areas of Application
Silviculture BMP Manual	Produced in **mid-70's, revised in 2000**; covers all silviculture activities (wetlands, roads, pesticides, fertilizer, wet weather operations, etc.)	Used **statewide** in conjunction with WMD Noticed General Permits
Guide for Producing Container Grown Plants	Through a cooperative effort between the University of Florida, Auburn University, Tennessee Tech University, and Virginia Tech, a BMP manual for nursery cultivation was produced in **1995** and published by the Southern Nurserymen's Association. The manual includes irrigation and fertilization BMPs for the container cultivation of nursery plants. Although this manual is not Florida-specific, a current effort is underway to use this document in the development of a Florida-specific manual.	Generally applicable to container-grown ornamental plants throughout **Southeastern U.S. region**
BMPs for Blended Fertilizer Plants in Florida	This manual was cooperatively produced by the Florida Fertilizer and Agrichemical Association, FDACS, and FDEP. The manual was published in October of **1997.**	**Fertilizer plants statewide**; blending fertilizer products
BMPs for Agrichemical Handling & Farm Equipment Maintenance	FDACS, FDEP and several industry associations cooperatively produced this manual in **1998**. The manual has recently been revised / reprinted and gives producers guidance on hazardous materials, proper pesticide handling, and the proper disposal of waste products.	All agricultural production areas **statewide**
Water Quality BMPs for Cow/Calf Operations	The Florida Cattlemen's Association worked cooperatively with several state, federal, and local agencies in the development of this BMP Manual which was published in June **1999;** printing and distribution of 6000 manuals was done in April 2000 with EPA grant assistance, and many cattle operators have been trained in the use of this manual statewide.	**Statewide** applicability with regional focus underway in the Lake Okeechobee priority basins
Water Quality/Quantity BMPs for Indian River Area Citrus Groves	The Indian River Citrus League led a cooperative effort involving 15 agencies and industry associations in the development of this manual; printing and distribution of 1600 manuals was done in June **2000** with EPA grant assistance. Although this is a regionally specific manual, other Florida flatwoods citrus operations can benefit through the use of this BMP manual.	Applicable to all or parts of seven east coast counties (**Volusia to Martin**)
Aquaculture BMPs	As directed by the 1998 Florida Legislature, FDACS worked cooperatively with industry, state agencies, and the environmental community to develop a comprehensive BMP manual for aquaculture. Florida law required that the FDACS adopt the manual by rule in order to provide specific regulatory exemptions under Chapters 373 and 403, F.S., for growers who implement BMPs and are certified by the FDACS Division of Aquaculture. The manual was printed and distributed in July **2000**, subsequently adopted by rule, and **updated in October 2002**.	**Statewide**, with focus on land-based facilities
Rule-Based Initiatives	Pursuant to Chapters 403, 373 and 576, F.S., the FDACS has adopted BMPs via the administrative process for Ridge Citrus, Leatherleaf Ferns, Lake Okeechobee Priority Basins, Indian River Lagoon and interim measures for Containerized Nursery Operations, Forage Grasses and the Tri-County Ag Area.	**Ridge Citrus BMPs** – Lake Wales Citrus Ridge region **Leatherleaf Fern BMPs** – Production areas in and around Volusia Co. **LO Priority Basins** – Okeechobee Co. **Indian River Lagoon** – Volusia to Martin, including Okeechobee Counties **Containerized Nurseries** – Statewide **TCAA** – St. Johns, Flagler, Putnam Co. **Forage Grasses –** SRWMD boundaries
Ongoing BMP Initiatives	FDACS, Office of Agricultural Water Policy, is working cooperatively on four (4) new initiatives and expects draft manuals in place within the next year or two on: Row Crops, Equine or Horse Farms, Nurseries and Peace River Valley Citrus. Additionally, FDACS has begun discussions with FDEP to propose adopting NRCS Conservation Plans by Rule.	**Row Crops** – Generally statewide **Equine/Horse Farms** – Applicable to small landowner operations and concentrated facilities **Nurseries –** Working through SFWMD **Peace River Citrus** – Regional Effort in Charlotte, Desoto, Hardee, Manatee and Sarasota Counties

Many of these manuals have been printed in bulk and have been distributed to the agricultural community. A summary of these manuals is arranged chronologically below. **The manuals can be downloaded at** www.floridaagwaterpolicy.com **.**

Table 3.6. Summary of the Acreage Totals Associated with Land Acquisition Projects in the Shell, Prairie, and Joshua Creek Watersheds.

Project	***Watershed / County***	***Acres Acquired***		***Acres Proposed***	
		Fee	***Less-Than-Fee***	***Fee***	***Less-Than-Fee***
Prairie / Shell Creek	Prairie & Shell Creek / Charlotte			11,700	10,624
Bright Hour Watershed	Prairie Creek / DeSoto		31,989		19,261
Long Island Marsh	Prairie Creek / DeSoto			7,023	
Cecil Webb Wildlife Management Area	Shell Creek/Charlotte	6,320			

Table 3.7. List of Investigative Studies on Water Use and Water Quality that will Contribute to Improved Water Quality Conditions in the Shell, Prairie, and Joshua Creek Watersheds.

Grower Resource Management Investigations		
Project Name	**Focus**	**Lead Agency**
Increased Irrigation Efficiency through prevention of Micro-Irrigation Plugging	Crop Irrigation	IFAS
Evaluation of Low Cost Irr Mgmt Devices to Reduce Wtr Use	Crop Irrigation	IFAS
Water Use For Citrus Groves Using Low Volume Irrigation.	Citrus Management	IFAS
Comparison of Drip, Low Volume, Undertree and Overhead Citrus Irrigation	Citrus Management	IFAS
Use of Water and Micro-Irrigation For Citrus Freeze Protection	Citrus Management	IFAS
Citrus Irrigation For Young Trees	Citrus Management	IFAS
Economic Aspects Of Citrus Irrigation Management	Citrus Management	IFAS
Citrus Production and Nitrogen Impacts	Citrus Management	IFAS
Field Demonstration of Micro-Irrigation For Citrus Cold Protection	Citrus Management	IFAS
Effective Rainfall in Flatwood Citrus (P530)	Citrus Management	IFAS
Water Req. and Crop Coefficient For Flatwood Citrus	Citrus Management	IFAS
Effects of Water Table Upflux on Citrus Production (P531)	Citrus Management	IFAS
Citrus Micro Irrigation Workshops	Citrus Management	IFAS
Reduce Winter and Fall Citrus Irrigation	Citrus Management	IFAS
Citrus Water Management Training	Citrus Management	IFAS
Implementation of BMP's for Flatwood Citrus	Citrus Management	IFAS
Agricultural Irrigation Efficiency Initiative – Automated Weather Sites	Citrus Management	FDACS/SWFWMD
Effect of Water Table Fluctuation on Pasture Grass	Pasture Management	IFAS
Forage Crop Water Efficiency Study	Pasture Management	IFAS
Water Use Efficiency of Vegetables with Mulch	Vegetable Management	IFAS
Conservation Water Management in Integrated Crop Production	Vegetable Management	IFAS
Subsurface Tile Drainage and Irrigation	Vegetable Management	IFAS
Improvement of Trickle Irrigation For Vegetable Production	Vegetable Management	IFAS
Water Budget & Crop Factors For Seepage Irrigated Vegetables	Vegetable Management	IFAS
Reduction of Irrigation Runoff Using Alt. Management for Seepage Irrigation	Vegetable Management	IFAS
Crop Coeff & Wtr Use For Water Melons	Vegetable Management	IFAS
Enhancing Irr. & Nutrient BMPs for Seepage Irrigation	Vegetable Management	IFAS

Diagnostic/Conditions Investigations		
Project Name	**Focus**	**Lead Agency**
Coastal Ground-Water Quality Monitoring Investigation	Ground Water Conditions	SWFWMD
SWIM/CWM Peace River Water Quality Conditions	Surface Water Conditions	SWFWMD/DEP
Regional Observation Monitor Well Program (ROMP 5, 12, 16.5 and 13)	Ground Water Conditions	SWFWMD
Peace and Myakka River Water Quality Summary	Surface Water Conditions	CHEC
Shell Creek HBMP Summary Report - 2001	Surface Water Conditions	Punta Gorda
Water Quality Status Report - Sarasota Bay and Peace and Myakka Rivers	Surface Water Conditions	DEP
Peace River Comprehensive Watershed Management Plan	Surface Water Conditions	SWFWMD
Florida's Ground Water Quality Monitoring Program	Ground Water Conditions	FGS
Geochemistry of the Intermediate Aquifer System	Ground Water Conditions	USGS
Storage/Transport of Mineralized Irrigation Water	Ground Water Conditions	USF/SWFWMD

Table 3.8. Documentation of the Estimated Pollutant Load Reduction for Individual Management Actions.

Resource Management Actions	Documented Pollutant Load Reduction
Well Back-Plugging Program (District)	Well back plugging activities have resulted in an overall 62% improvement in chloride, 46% in specific conductivity, and 44% in TDS in 39 back-plugged wells. These improvements can be applied to a total pumpage amount of approximately 5.1 mgd, which represents 10% of total pumpage (51.8 mgd) in the Shell and Prairie Creek watersheds.
District Resource Regulation Well Construction Permitting and Water Use Permitting	Approximately 10 new wells have been permitted with the SPJC WCP stipulations attached. Approximately 20 WUPs have been renewed with the SPJC special conditions attached. Estimated load reductions due to these efforts are significant and will continue to be significant but have not been quantified.
Facilitating Agricultural Resource Management Systems (FARMS) (FDACS and District)	Three projects are complete and two projects are under construction as of 08/01/2004. Documented pollution reduction has not occurred but will be available for the first annual report of the SPCWMP. The estimated improvement for each FARMS project is specific conductance < 775 uS/cm.
Environmental Quality Incentives Program (EQIP) (USDA/NRCS)	No documented improvement in water quality has been noted as of 03/01/2004 but will be included as a part of future EQIP activities, especially when teamed with FARMS projects
BMPs for Peace River Valley / Manasota Basin (PRVMSB) Area Citrus Groves Manual (FDACS)	No documented improvement has occurred (BMPs to be implemented in 2004).
SWUCA Plans/Recovery Strategy (District)	No documented pollutant load reduction has occurred. Estimated to correspond to goal associated with ground water withdrawal reductions.
Quality of Water Improvement Program (QWIP) (District)	Increased emphasis has been placed on plugging wells within the Peace Basin due to water quality concerns. In FY 2003, the QWIP Program plugged more wells in the Peace Basin then in any previous year (42 wells) back to 1994. The QWIP program results in a 100% reduction in pollutant loads on an individual well basis due to the complete plugging of the well. A total of 28 wells have been plugged in the Shell Creek Watershed (13 in WBID # 2040 and 15 in 2041), 19 in the Prairie Creek watershed (13 in WBID # 1962), and 10 in the Joshua Creek
Land Acquisition (District)	No documented pollutant load reduction has occurred at this time. Estimated to result in retiring specific quantities of water with corresponding water quality improvement that can be directly quantified.
NRCS Mobile Irrigation Lab (USDA-NRCS/District)	No documented pollutant goal reduction has occurred.
Education/Outreach	Documented pollutant reduction is not possible but is considered to be significant.
Research Efforts	Documented pollutant reduction is not possible but is considered to be significant.

Table 3.9. Documentation of Confirmed Sources of Funding

Resource Management Actions	Funding Sources and Amounts
Well Back-Plugging Program (District)	District General Fund (FY2004) – $229,342 Peace Basin Fund (FY2004) - $274,954
District Resource Regulation Well Construction Permitting and Water Use Permitting	No specific funding allocation has been directed to Shell, Prairie, and Joshua Creek. However, Resource Regulation has recognized this area/issue as a priority.
Facilitating Agricultural Resource Management Systems (FARMS) (FDACS/District)	District General Fund (FY2004/2005) - $900,000 Peace Basin Fund (FY2004/2005) - $900,000 DACS (FY2004/2005) - $200,000 State Appropriation (FY2003) - $1,250,000 State Appropriation (FY2005) - $1,000,000
Environmental Quality Incentives Program (EQIP) (USDA/NRCS)	Since 1997, eleven farms have been funded in Charlotte County for EQIP projects for a total of $346,847. In 2003, $184,806 was dedicated to EQIP in Charlotte County. Future funding is need–based and is dependent upon state and county allocations
BMPs for Peace River Valley / Manasota Basin (PRVMSB) Area Citrus Groves Manual (FDACS)	Funding is provided as needed for implementation of BMPs
Regional Water Supply Plan / SWUCA Recovery Strategy (District)	Refer to Appendix 9 for the RWSP and Recovery Strategy funding sources. No breakout is available for funding associated exclusively with the Shell and Prairie Creek Basins.
Quality of Water Improvement Program (QWIP) – in Peace Basin (District)	District General Fund (FY2004) – $100,829 Peace Basin Fund (FY2004) - $100,829
Land Acquisition (District)	Funding is available through the Florida Forever Program based upon needs (projected at $26 million per year over area of SWFWMD)
NRCS Mobile Irrigation Lab (USDA-NRCS/District)	The NRCS and District operate under a rolling, multi-year (1998 – 2005) contract totaling $118,000 ($25,000 FDACS and $93,000 SWFWMD). The latest 12-month period expended about $10,000 (2003-04).
Education/Outreach	Funding is available as needed.
Research Efforts	BMP Plan Implementation (FY2005 proposed) - $970,000 SWFWMD RA Plan Performance Monitoring and Reporting (FY2004) - $150,000 SWFWMD Other Research (FY2003) - $250,000

Table 4.1. Water Quality Monitoring Network Stations in the SPJC Watersheds

CGWQMN & CGWQMN SUB NETWORKS - FREQUENCY: YEARLY AND/OR 2X PER YEAR
PARAMETERS: SP. CONDUCTANCE, TEMP., pH, MAJOR IONS, ALKALINITY, DISSOLVED SOLIDS, TRACE METALS

STATION	*COUNTY NAME*	*AQUIFER*	*WATERBODY TYPE*	*LATITUDE*	*LONGITUDE*	*DISTRICT ID*
BABCOCK 2126	CHARLOTTE	FA	AQUIFER	265316.59	814426.67	WEL 1868 1320 0
CROMWELL WELL #1	DESOTO	FA	AQUIFER	270440.424	814345.780	WEL 1329 868 0
EMERALD ISLAND FARMS (DID #5)	DESOTO	FA	AQUIFER	270330.571	813925.184	WEL 1332 871 0
GDU WELL T-2	DESOTO	IA	AQUIFER	270542.185	820011.840	WEL 1153 11671 0
PRAIRIE CR UP INT-AG	DESOTO	IA	AQUIFER	270244.840	814649.018	WEL 1165 11611 0
ROB LANE (G.V. RUSSELL)	DESOTO	IA	AQUIFER	270429.488	815752.125	WEL 1338 877 0
ROMP 10 HAWTHORN	CHARLOTTE	IA	AQUIFER	270152.874	820000.658	WEL 536 288 0
ROMP 12 DP UP FLORIDAN	DESOTO	FA	AQUIFER	270228.018	814432.718	WEL 2075 13331 0
ROMP 12 LOWER SURFICIAL	DESOTO	SF	AQUIFER	270228.28	814431.75	WEL 2075 13335 0
ROMP 12 SH UP FLORIDAN	DESOTO	FA	AQUIFER	270227.982	814432.580	WEL 2075 13333 0
ROMP 12 UP INTERMEDIATE	DESOTO	IA	AQUIFER	270228.055	814432.071	WEL 2075 13337 0
ROMP 13 LOW INT	DESOTO	IA	AQUIFER	270419.111	813658.415	WEL 1037 12870 0
ROMP 13 SURFICIAL	DESOTO	SF	AQUIFER	270418.868	813658.749	WEL 1037 11508 0
ROMP 16.5 AVON PARK	DESOTO	FA	AQUIFER	270340.560	815302.361	WEL 2336 34900 0
ROMP 16.5 LOWER INTERMEDIATE	DESOTO	IA	AQUIFER	270339.906	815302.391	WEL 2336 34898 0
ROMP 16.5 SURFICIAL	DESOTO	SF	AQUIFER	270340.388	815302.382	WEL 2336 35458 0
ROMP 16.5 SUWANNEE	DESOTO	FA	AQUIFER	270340.258	815302.378	WEL 2336 34899 0
ROMP 16.5 UPPER INTERMEDIATE	DESOTO	IA	AQUIFER	270340.016	815302.389	WEL 2336 34901 0
ROMP 5 SURF	CHARLOTTE	SF	AQUIFER	265644.929	814827.727	WEL 1069 12623 0
ROMP 5 UPPER INT	CHARLOTTE	IA	AQUIFER	265644.947	814828.098	WEL 1069 12882 0
SHELL CREEK RV PARK INT	CHARLOTTE	IA	AQUIFER	265821.36	815343.38	WEL 2333 17744 0

WUPNET SENTINEL NETWORK- FREQUENCY: YEARLY AND/OR 2X PER YEAR
PARAMETERS: SP. CONDUCTANCE, TEMP., pH, MAJOR IONS, ALKALINITY, DISSOLVED SOLIDS, TRACE METALS

STATION	*COUNTY NAME*	*AQUIFER*	*WATERBODY TYPE*	*LATITUDE*	*LONGITUDE*	*DISTRICT ID*
DT BROWN #6	CHARLOTTE	IA	AQUIFER	270202.151	814559.949	WEL 1872 1324 0
DT BROWN G-36	DESOTO	FA	AQUIFER	270223	814211	WEL 1148 11672 0
GP WOOD PROD WELL #5	DESOTO	FA	AQUIFER	270812.626	814811.014	WEL 1344 883 0
NAFCO GROVES INT	DESOTO	IA	AQUIFER	270539.742	813348.948	WEL 1351 890 0
ROMP 11 DEEP	CHARLOTTE	IA	AQUIFER	265837.667	815609.299	WEL 586 320 0
ROMP 12 LO INTERMEDIATE	DESOTO	IA	AQUIFER	270228.112	814432.454	WEL 2075 13336 0
ROMP 12 MID UP FLORIDAN	DESOTO	FA	AQUIFER	270228.042	814432.227	WEL 2075 13332 0
ROMP 13 AVON PARK	DESOTO	FA	AQUIFER	270418.869	813658.549	WEL 1037 12916 0
ROMP 13 MID INT	DESOTO	IA	AQUIFER	270419.143	813658.26	WEL 1037 12871 0
ROMP 13 SWNN	DESOTO	FA	AQUIFER	270419.226	813658.143	WEL 1037 12872 0
ROMP 15 DEEP	DESOTO	FA	AQUIFER	271232.829	813921.723	WEL 219 10933 1
ROMP 16 HAWTHORNE	DESOTO	IA	AQUIFER	271117.019	814624.788	WEL 221 414 0
ROMP 35 CH-1 FLORIDAN	DESOTO	FA	AQUIFER	271705.28	820221.75	WEL 2257 17516 0
ROMP 5 AVON PARK	CHARLOTTE	FA	AQUIFER	265644.869	814828.613	WEL 1069 12885 0
ROMP 5 LOWER INT	CHARLOTTE	IA	AQUIFER	265644.962	814827.868	WEL 1069 12883 0
ROMP 5 SWNN	CHARLOTTE	FA	AQUIFER	265644.962	814827.47	WEL 1069 12884 0
ROPER GROVES WELL	DESOTO	FA	AQUIFER	270441.752	814940.938	WEL 1327 866 0
ROWELL DEEP	HARDEE	IA	AQUIFER	273156.220	814516.812	WEL 302 36 0
TROPICAL RIVER GROVE	DESOTO	FA	AQUIFER	271744.837	813745.327	WEL 777 511 0

Table 4.1. (cont.) Water Quality Monitoring Network Stations in the SPJC Watersheds

PEACE RIVER WATER QUALITY NETWORK - FREQUENCY: MONTHLY
PARAMETERS: SP. CONDUCTANCE, TEMP., pH, SALINITY, MAJOR IONS, NUTRIENTS, CHLOROPHYLL

STATION	*COUNTY NAME*	*AQUIFER*	*WATERBODY TYPE*	*LATITUDE*	*LONGITUDE*	*DISTRICT ID*
JOSHUA CREEK @ NOCATEE	DESOTO	---	STREAM	270959.626	815245.543	FLO 32 67 0

CWM WATER QUALITY NETWORK - FREQUENCY: MONTHLY
PARAMETERS: SP. CONDUCTANCE, TEMP., pH, SALINITY, MAJOR IONS, NUTRIENTS, CHLOROPHYLL

STATION	*COUNTY NAME*	*AQUIFER*	*WATERBODY TYPE*	*LATITUDE*	*LONGITUDE*	*DISTRICT ID*
HAWTHORNE CREEK @ 760A	DESOTO	---	STREAM	270903.361	815129.639	FLO 66 2568 0
TRIBUTARY TO JOSHUA CREEK @ SR 70	DESOTO	---	STREAM	271231.733	814656.771	FLO 32 2567 0

SPJC QUARTERLY BACK-PLUG WELLS - FREQUENCY: QUARTERLY
SPJC QUARTERLY SURFACE WATER SITES - FREQUENCY: QUARTERLY
PARAMETERS: SP. CONDUCTANCE, TEMP., pH, MAJOR IONS, ALKALINITY, DISSOLVED SOLIDS, TRACE METALS

STATION	*COUNTY NAME*	*AQUIFER*	*WATERBODY TYPE*	*LATITUDE*	*LONGITUDE*	*DISTRICT ID*
2 x 4 GROVES #10 - BP (DID #10)	DESOTO	FA	AQUIFER	270955.27	814609.02	WEL 2900 12289 0
2 x 4 GROVES #12 - BP (DID #12)	DESOTO	FA	AQUIFER	270946.28	814629.25	WEL 2900 18101 0
2 x 4 GROVES #13 - BP (DID #13)	DESOTO	FA	AQUIFER	270939.06	814552.74	WEL 2900 18102 0
2 x 4 GROVES #3 - BP (DID #3)	DESOTO	FA	AQUIFER	270944.39	814544.91	WEL 2900 25694 0
2 x 4 GROVES #9 - BP (DID #9)	DESOTO	FA	AQUIFER	271012.38	814557.29	WEL 2900 10043 0
COW SLOUGH NEAR ARCADIA	DESOTO	---	STREAM	271235.538	813436.063	FLO 408 2562 0
DOEHILL CITRUS DH-58 - BP (DID #66)	DESOTO	FA	AQUIFER	270345.11	813635.67	WEL 2862 11145 0
EMERALD ISLE CANAL #5	CHARLOTTE	---	CANAL	270158.158	813734.746	FLO 339 1096 0
LADY MOON FARMS G-1 - BP (DID #1)	CHARLOTTE	IA	AQUIFER	265711.07	814018.57	WEL 2863 30898 0
MARSH CITRUS GROVES (OLD EMERALD GROVE) -BP DID #1	DESOTO	FA	AQUIFER	270606.91	814712.02	WEL 2706 1892 0
MONTGOMERY CANAL @ ROMP 12	DESOTO	---	CANAL	270229.1	814431.9	FLO 172 1083 0
MOSSY GULLY @ SR 70	DESOTO	---	STREAM	271234.875	814112.021	FLO 403 2520 0
PEACE VALLEY GROVES W1 - BP (DID #1)	DESOTO	FA	AQUIFER	270340.57	814526.40	WEL 2731 31049 0
PEACE VALLEY GROVES W3 - BP (DID #3)	DESOTO	FA	AQUIFER	270333.19	814438.67	WEL 2729 31051 0
PEACE VALLEY GROVES W4 - BP (DID #4)	DESOTO	FA	AQUIFER	270321.13	814534.24	WEL 2728 31052 0
PRAIRIE RIVER GROVE - HOG BAY SLOUGH	DESOTO	---	STREAM	270621.507	814919.503	FLO 397 2504 0
PRAIRIE RIVER GROVE R-10 - BP (DID #10)	DESOTO	FA	AQUIFER	270534.19	814810.95	WEL 2702 27327 0
PRAIRIE RIVER GROVE R-11 - BP (DID #11)	DESOTO	FA	AQUIFER	270552.25	814743.69	WEL 2702 27328 0
PRAIRIE RIVER GROVE R-12 - BP (DID #12)	DESOTO	FA	AQUIFER	270620.13	814808.92	WEL 2702 27329 0
PRAIRIE RIVER GROVE R-13 - BP (DID #13)	DESOTO	FA	AQUIFER	270608.16	814808.92	WEL 2702 27330 0
PRAIRIE RIVER GROVE R-8 - BP (DID #8)	DESOTO	FA	AQUIFER	270640.07	814757.45	WEL 2702 27325 0
PRAIRIE RIVER GROVE R-9 - BP (DID #9)	DESOTO	FA	AQUIFER	270601.83	814826.84	WEL 2702 27326 0
SYMONS CANAL @ KICK-OUT PUMPS	DESOTO	---	CANAL	270312.537	814658.634	FLO 36 2493 0
SYMONS GROVES #2 - BP (DID #2)	DESOTO	FA	AQUIFER	270346.18	814656.61	WEL 2692 22708 0
SYMONS GROVES #6 - BP (DID #6)	DESOTO	FA	AQUIFER	270321.41	814559.12	WEL 2692 22711 0

SPJC CONDUNCTANCE RECONNAISSANCE - FREQUENCY: 2X PER YEAR - WET & DRY SEASON
PARAMETERS: SP. CONDUCTANCE, TEMP., pH, SALINITY, STATION DEPTH

STATION	*COUNTY NAME*	*AQUIFER*	*WATERBODY TYPE*	*LATITUDE*	*LONGITUDE*	*DISTRICT ID*
BEE GUM @ CR 760 - DES 15	DESOTO	---	STREAM	271004.815	815521.039	FLO 41 2743 0
BRANDY BRANCH @ SR 70 - DES 23	DESOTO	---	STREAM	271539.367	815852.645	FLO 27 2721 0

Table 4.1. (cont.) Water Quality Monitoring Network Stations in the SPJC Watersheds

SPJC CONDUNCTANCE RECONNAISSANCE - FREQUENCY: 2X PER YEAR - WET & DRY SEASON
PARAMETERS: SP. CONDUCTANCE, TEMP., pH, SALINITY, STATION DEPTH

STATION	*COUNTY NAME*	*AQUIFER*	*WATERBODY TYPE*	*LATITUDE*	*LONGITUDE*	*DISTRICT ID*
BUZZARD ROOST BRANCH @ SR 70 - DES 18	DESOTO	---	STREAM	271609.192	820004.418	FLO 27 2722 0
DRAINAGE ON WEST SIDE OF SYMONS GROVE #13	DESOTO	---	CANAL	270347.08	814712.84	FLO 36 2704 0
HAWTHORNE CREEK @ CR 760A - DES 13	DESOTO	---	STREAM	270903.936	815127.527	FLO 32 2690 0
HOG BAY @ SR 31#9	DESOTO	---	STREAM	270633.039	814740.741	FLO 32 2693 0
HORSE CREEK @ SR 70 - DES 22	DESOTO	---	STREAM	271519.637	815805.228	FLO 27 2720 0
JOSHUA CREEK @ SR 70 - DES 6	DESOTO	---	STREAM	271231.456	814531.782	FLO 41 2742 0
LEE BRANCH @ US 17 - CHAR 1	CHARLOTTE	---	STREAM	270121.457	815731.333	FLO 41 2746 0
MAPLE BRANCH @ ROAN ST - DES 8	DESOTO	---	STREAM	271324.907	814825.981	FLO 32 2695 0
MAPLE BRANCH @ SR 70 - DES 7	DESOTO	---	STREAM	271231.904	814815.813	FLO 32 2696 0
MARE BRANCH @ MCINTYRE RD - DES 10	DESOTO	---	STREAM	271655.312	814922.179	FLO 41 2739 0
MCBRIDE BRANCH @ US 17 - DES 12	DESOTO	---	STREAM	271453.054	815046.373	FLO 41 2741 0
MOSSY GULLY @ SR 70 - DES 3	DESOTO	---	STREAM	271234.276	814111.915	FLO 36 2707 0
MYRTLE SLOUGH @ CR 74 - CHAR 3	CHARLOTTE	---	STREAM	265648.178	815602.856	FLO 60 2709 0
MYRTLE SLOUGH @ PINE ISLAND RD. #30	DESOTO	---	STREAM	270503.285	814543.864	FLO 36 2702 0
OAK CREEK MARSH @ COUNTYLINE RD - DES 1	DESOTO	---	STREAM	272026.082	813630.218	FLO 33 2718 0
SHELL CREEK ON HWY 31 NORTH PRONG	CHARLOTTE	---	STREAM	270031.573	814537.143	FLO 60 2478 0
SHELL CREEK ON HWY 31 SOUTH PRONG	CHARLOTTE	---	STREAM	265752.279	814538.077	FLO 60 2479 0
THORTON BRANCH @ SENATE AVE - DES 17	DESOTO	---	STREAM	270443.116	815521.291	FLO 41 2745 0
TRIBUTARY FROM CECIL WEBB LAKE ON SR 74	CHARLOTTE	---	STREAM	265646.288	814955.661	FLO 381 2477 0
UNNAMED CREEK #22	CHARLOTTE	---	STREAM	265643.48	813653.35	FLO 418 2677 0
UNNAMED CREEK @ AIRPORT AVE. # 34	DESOTO	---	STREAM	271000.461	815037.359	FLO 32 2687 0
UNNAMED CREEK @ COUNTYLINE RD - DES 1A	DESOTO	---	STREAM	272026.302	813625.824	FLO 33 2717 0
UNNAMED CREEK @ CR 661A - DES 14	DESOTO	---	STREAM	271457.940	815428.545	FLO 41 2740 0
UNNAMED CREEK @ CR 74 - CHAR 4	CHARLOTTE	---	STREAM	265647.950	815550.093	FLO 60 2708 0
UNNAMED CREEK @ CR 74 #20	CHARLOTTE	---	STREAM	265642.59	814211.84	FLO 418 2676 0
UNNAMED CREEK @ CR 74 #21	CHARLOTTE	---	STREAM	265644.24	813828.31	FLO 418 2678 0
UNNAMED CREEK @ CR 74 #25	CHARLOTTE	---	STREAM	265646.011	814648.77	FLO 60 2711 0
UNNAMED CREEK @ CR 74 #26	CHARLOTTE	---	STREAM	265647.538	815159.928	FLO 60 2712 0
UNNAMED CREEK @ CR 760 #5	DESOTO	---	STREAM	271048.693	814820.304	FLO 32 2685 0
UNNAMED CREEK @ CR 760 (HANSEL AVE. INTERSECT.) #4	DESOTO	---	STREAM	271103.247	814759.31	FLO 32 2686 0
UNNAMED CREEK @ CR 760 (NEAR CREEKWOOD DR.) #6	DESOTO	---	STREAM	271040.835	814901.207	FLO 32 2684 0
UNNAMED CREEK @ CR 763 #10	DESOTO	---	STREAM	270509.296	814939.225	FLO 36 2703 0
UNNAMED CREEK @ CR 763 #8	DESOTO	---	STREAM	270816.843	814939.34	FLO 32 2692 0
UNNAMED CREEK @ FARABEE RD. #17	CHARLOTTE	---	STREAM	270105.81	814514.27	FLO 60 2716 0
UNNAMED CREEK @ HULL AVE - DES 16	DESOTO	---	STREAM	270720.440	815620.873	FLO 41 2744 0
UNNAMED CREEK @ KINGS HWY - DES 20	DESOTO	---	STREAM	270254.207	820158.134	FLO 41 2737 0
UNNAMED CREEK @ ROAN STREET #2	DESOTO	---	STREAM	271334.787	814533.642	FLO 32 2682 0
UNNAMED CREEK @ ROAN STREET #3	DESOTO	---	STREAM	271325.128	814637.328	FLO 32 2681 0
UNNAMED CREEK @ SE KING STREET #16	DESOTO	---	STREAM	271035.503	815059.222	FLO 32 2689 0
UNNAMED CREEK @ SR 31 #7	DESOTO	---	STREAM	271010.075	814930.57	FLO 32 2688 0
UNNAMED CREEK @ SR 31 NEAR 760A #31	DESOTO	---	STREAM	270846.195	814810.959	FLO 32 2691 0
UNNAMED CREEK @ SR 70 - DES 19	DESOTO	---	STREAM	271716.144	820244.554	FLO 27 2719 0
UNNAMED CREEK @ SR 70 - DES 2	DESOTO	---	STREAM	271234.594	813751.750	FLO 36 2705 0
UNNAMED CREEK @ SR 70 - DES 3A	DESOTO	---	STREAM	271234.298	814040.287	FLO 36 2706 0

Table 4.1. (cont.) Water Quality Monitoring Network Stations in the SPJC Watersheds

SPJC CONDUNCTANCE RECONNAISSANCE - FREQUENCY: 2X PER YEAR - WET & DRY SEASON
PARAMETERS: SP. CONDUCTANCE, TEMP., pH, SALINITY, STATION DEPTH

STATION	COUNTY NAME	AQUIFER	WATERBODY TYPE	LATITUDE	LONGITUDE	DISTRICT ID
UNNAMED CREEK @ SR 70 #33	DESOTO	---	STREAM	271234.137	813534.75	FLO 36 2699 0
UNNAMED CREEK @ US 17 - DES 9A	DESOTO	---	STREAM	271933.491	814842.957	FLO 41 2738 0
UNNAMED CREEK @ WASHINGTON LOOP RD. # 28	CHARLOTTE	---	STREAM	265820.625	815423.512	FLO 60 2714 0
UNNAMED CREEK @ WASHINGTON LOOP RD. #29	CHARLOTTE	---	STREAM	265938.89	815450.089	FLO 60 2715 0
UNNAMED DITCH @ BRONCO RD. #27	CHARLOTTE	---	CANAL	265714.83	815325.34	FLO 60 2713 0
UNNAMED DITCH @ CR 760 - DES 5	DESOTO	---	CANAL	271155.114	814503.939	FLO 32 2697 0
UNNAMED DITCH @ CR 763 #11	DESOTO	---	CANAL	270441.621	814939.215	FLO 36 2701 0
UNNAMED DITCH @ FARMS RD. #12	DESOTO	---	CANAL	270348.132	814826.505	FLO 36 2700 0
UNNAMED DITCH ON NEAL RD #18	CHARLOTTE	---	CANAL	265921.4	814243.17	FLO 418 2680 0
UNNAMED DITCH ON NEAL RD. #19	CHARLOTTE	---	CANAL	265920.07	814312.18	FLO 418 2679 0
UPPER HAWTHORNE CREEK @ PIGGY BACK RD. #14	DESOTO	---	STREAM	270626.007	815119.009	FLO 32 2694 0
UPPER JOSHUA CREEK #32	DESOTO	---	STREAM	271157.414	814357.771	FLO 32 2683 0

SPJC DATA SONDE LOGGING NETWORK - FREQUENCY: MONTHLY DOWNLOADS
PARAMETERS: SP. CONDUCTANCE, TEMP.

STATION	COUNTY NAME	AQUIFER	WATERBODY TYPE	LATITUDE	LONGITUDE	DISTRICT ID
TRIBUTARY FROM CECIL WEBB LAKE @ CIRCLE K PROPERTY	CHARLOTTE	---	CANAL	265712.8	814958.6	FLO 60 2670 0
SHELL CREEK ON HWY 31 SOUTH PRONG	CHARLOTTE	---	STREAM	265752.279	814538.077	FLO 60 2479 0
SHELL CREEK @ CIRCLE K GROVE	CHARLOTTE	---	STREAM	265802.441	814935.892	FLO 60 2519 0
CYPRESS SLOUGH ABOVE SHELL CREEK	CHARLOTTE	---	STREAM	265823.6	815045.3	FLO 60 2669 0
SHELL CREEK @ WASHINGTON LOOP ROAD	CHARLOTTE	---	STREAM	265830.98	815315.082	FLO 60 2498 0
SHELL CREEK NEAR PUNTA GORDA	CHARLOTTE	---	STREAM	265903.505	815608.168	FLO 60 167 0
PRAIRIE CREEK @ WASHINGTON LOOP ROAD	CHARLOTTE	---	STREAM	265926.225	815340.979	FLO 36 2499 0
SHELL CREEK ON HWY 31 NORTH PRONG	CHARLOTTE	---	STREAM	270031.573	814537.143	FLO 60 2478 0
EMERALD ISLE CANAL #5	CHARLOTTE	---	CANAL	270158.158	813734.746	FLO 339 1096 0
MONTGOMERY CANAL @ ROMP 12	DESOTO	---	CANAL	270229.1	814431.9	FLO 172 1083 0
PRAIRIE CREEK @ NEWHOFFER PROPERTY	DESOTO	---	STREAM	270237.832	814942.014	FLO 36 2521 0
PRAIRIE CREEK NEAR FORT OGDEN	DESOTO	---	STREAM	270306.886	814702.972	FLO 36 71 0
SYMONS CANAL @ KICK-OUT PUMPS	DESOTO	---	CANAL	270312.537	814658.634	FLO 36 2493 0
MYRTLE SLOUGH @ SYMONS GROVE	DESOTO	---	STREAM	270347.3	814605.9	FLO 337 2672 0
DOEHILL PROPERTY CANAL MAIN	DESOTO	---	CANAL	270535.02	813712.875	FLO 172 2528 0
PRAIRIE RIVER GROVE - HOG BAY SLOUGH	DESOTO	---	STREAM	270621.507	814919.503	FLO 397 2504 0
JOSHUA CREEK @ NOCATEE	DESOTO	---	STREAM	270959.626	815245.543	FLO 32 67 0
MOSSY GULLY @ SR 70	DESOTO	---	STREAM	271234.875	814112.021	FLO 403 2520 0
COW SLOUGH NEAR ARCADIA	DESOTO	---	STREAM	271235.538	813436.063	FLO 408 2562 0

FDEP WATER QUALITY SITES - FREQUENCY: WEEKLY, BI-WEEKLY, OR BI-MONTHLY
PARAMETERS: SP. CONDUCTANCE, TEMP., pH, MAJOR IONS, NUTRIENTS, CHLOROPHYLL, BACTERIA AT SELECT SITES

STATION	COUNTY NAME	AQUIFER	WATERBODY TYPE	LATITUDE	LONGITUDE	DEP ID
SHELL CR. @ SR 764 (WASH LOOP RD)	CHARLOTTE	---	STREAM	26 58 31	81 53 16	25020120
PRAIRIE CR. @ SR 764 (WASH LOOP RD)	CHARLOTTE	---	STREAM	26 59 27	81 53 43	25020433
MYRTLE SLOUGH @ SR 31	CHARLOTTE	---	STREAM	27 00 31	81 45 39	25020434
PRAIRIE CR. @ SR 31 (NEAR FT OGDEN)	DESOTO	---	STREAM	27 03 06	81 47 05	25020435
SHELL CR. @ SR 31	CHARLOTTE	---	STREAM	26 57 52	81 45 39	25020555
MYRTLE SLOUGH SITE 2 @ NICHOLS RD.	DESOTO	---	STREAM	27 04 20.6	81 45 58.2	25020639
MYRTLE SLOUGH SITE 4 @ CR 74	DESOTO	---	STREAM	26 56 47	81 52 03	25020640

Table 4.1. (cont.) Water Quality Monitoring Network Stations in the SPJC Watersheds

FDEP WATER QUALITY SITES - FREQUENCY: WEEKLY, BI-WEEKLY, OR BI-MONTHLY
PARAMETERS: SP. CONDUCTANCE, TEMP., pH, MAJOR IONS, NUTRIENTS, CHLOROPHYLL, BACTERIA AT SELECT SITES

STATION	*COUNTY NAME*	*AQUIFER*	*WATERBODY TYPE*	*LATITUDE*	*LONGITUDE*	*DEP ID*
MYRTLE SLOUGH SITE 1 @ CULVERT UNDER PINE ISLAND RD.	DESOTO	---	STREAM	27 05 03	81 45 44.3	25020641
MYRTLE SLOUGH SITE 3 @ SOUTH END OF EAST FARMS RD.	DESOTO	---	CANAL	27 03 31.4	81 45 44.4	25020642
MYRTLE SLOUGH SITE 4 @ CANAL CORNER OF PINE ISL. RD.	DESOTO	---	CANAL	27 05 33	81 45 44.4	25020643

CITY OF PUNTA GORDA HBMP WATER QUALITY SITES - FREQUENCY: -MONTHLY
PARAMETERS: SP. CONDUCTANCE, TEMP., pH, SALINITY, NUTRIENTS, CHLOROPHYLL, TSS, TURBIDITY, COLOR, TOC

STATION	*COUNTY NAME*	*AQUIFER*	*WATERBODY TYPE*	*LATITUDE*	*LONGITUDE*	*CITY ID*
PRAIRIE CREEK @ CR 764 BRIDGE (WASH LOOP RD)	CHARLOTTE	---	STREAM	26 59 27	81 53 43	1
SHELL CREEK @ CR 764 BRIDGE (WASH LOOP RD)	CHARLOTTE	---	STREAM	26 58 31	81 53 16	2
RESERVOIR PROPER (200 FT UPSTREAM OF DAM)	CHARLOTTE	---	RESERVOIR	27 05 33	81 45 44.4	3