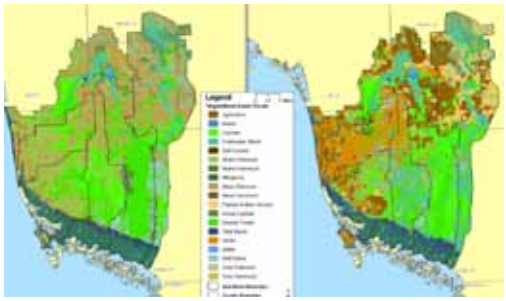

Collier County watershed management plan

Final Report Volume 1:

Executive Summary

Assessment of Existing Conditions and Performance Measures

01022-12

Collier County

Prepared by: ATKINS

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FINAL REPORT

COLLIER COUNTY WATERSHED MANAGEMENT PLAN COLLIER COUNTY, FLORIDA

VOLUME 1: EXECUTIVE SUMMARY, SUMMARY ASSESSMENT OF EXISTING CONDITIONS, AND DEVELOPMENT OF PERFORMANCE MEASURES

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Acronyms and Abbreviations

ACSC	Area of Critical State Concern
ACSC-ST	Area of Critical State Concern – Special Treatment
BCB	Big Cypress Basin
BCC	Board of County Commissioners
BCE	Black, Crow, and Eidsness
BCNP	Big Cypress National Preserve
BMAP	Basin Management Action Plan
BMP	Best Management Practices
BOD-5	5-Day Biochemical Oxygen Demand
CC	Cocohatchee-Corkscrew Watershed
CCME	Conservation Coastal Management Element
CCPC	Collier County Planning Commission
CCWMP	Collier County Watershed Management Plan
CDU	Community Development Unit
CERP	Comprehensive Everglades Restoration Plan
cfs	Cubic feet per second
CN	Curve Number
Cu	Copper
DCIA	Directly Connected Impervious Area
DEM	Digital Elevation Model
DO	Dissolved Oxygen
EAC	Environmental Advisory Council
ECM	Existing Conditions Model
EDDMapS	Early Detection and Distribution Mapping System
EMC	Event Mean Concentration
ENP	Everglades National Park
EPA	Environmental Protection Agency
ERD	Environmental Research and Design
ERP	Environmental Resource Permit
ERU	Equivalent Residential Unit
ET	Evapotranspiration
F.A.C.	Florida Administrative Code
FAS	Floridan Aquifer System
FCM	Future Conditions Model
FDEP	Florida Department of Environmental Protection

FDoH	Florida Department of Health
Fe	Iron
FLInv	Florida Invasive Plants Geodatabase
FLUCCS	Florida Land Use, Land Cover Classification System
FLUE	Future Land Use Element
FLUM	Future Land Use Map
FNAI	Florida Natural Areas Inventory
FPLOS	Flood Protection Level of Service
FRESP	Florida Ranchlands Environmental Services Project
FUFHOK	Faka Union, Fakahatchee, and Okaloacoochee-SR29 Watersheds
FWRI	Fish and Wildlife Research Institute
GGAMP	Golden Gate Area Master Plan
GGNB	Golden Gate-Naples Bay Watershed
GIS	Geographic Information Systems
GMP	Growth Management Plan
H&H	Hydraulic and Hydrologic
HOA	Homeowners Association
IAS	Intermediate Aquifer System
IWR	Impaired Waters Rule
JEI	Janicki Environmental Inc.
LASIP	Lely Area Stormwater Improvement Plan
LDC	Land Development Code
LID	Low Impact Development
LSI	Landscape Suitability Index
MAL	Minimum Aquifer Level
mg/l	milligrams/liter
MPN	Most Probable Number
MSL	Mean Sea Level
MSTU	Municipal Services Taxing Unit
NAVD	North American Vertical Datum
NEXRAD	High Resolution Radar
NGGE	Northern Golden Gates Estates
NGGEFRA	North Golden Gate Estates Flowway Restoration Area
NGGEFRP	North Golden Gate Estates Flowway Restoration Program
NGVD	National Geodetic Vertical Datum
NOx	Nitrate + Nitrite
NSG	Natural Systems Group

NSM	Natural Systems Model
OFW	Outstanding Florida Water
OL	Overland
Pb	Lead
PBS&J	Post Buckley Schuh and Jernigan
PCU	Platinum Cobalt Units
PDVM	Pre-Development Vegetation Map
PIR	Project Implementation Report
PSRP	Picayune Strand Restoration Project
PUD	Planned Unit Development
RB	Rookery Bay Watershed
RFMU	Rural Fringe Mixed Use
RIDS	Regional Irrigation Distribution System
RLSA	Rural Lands Stewardship Area
ROMA	Regional Offsite Mitigation Area
RSF	Residential Single Family
RWCA	Recyclable Water Containment Areas
SAS	Surficial Aquifer System
SCS	Soil Conservation Service
SFWMD	South Florida Water Management District
SGGE	Southern Golden Gate Estates
SOW	Scope of Work
S.R.	State Road
ST	Special Treatment
SWFFS	Southwest Florida Feasibility Study
SWIM	Surface Water Improvement and Management
SZ	Saturated Zone
TDR	Transfer of Development Rights
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TKN	Total Kjeldahl Nitrogen
TM	Technical Memorandum
TP	Total Phosphorus
TSS	Total Suspended Solids
TTI	Ten Thousand Islands
ug/l	micrograms/liter
UMAM	Uniform Mitigation Assessment Method

URF	Urban Residential Fringe
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USGS	United States Geologic Survey
UZ	Unsaturated Zone
WBID	Water body Identification Number
WMD	Water Management District
WMPs	Watershed Management Plans
Zn	Zinc

Executive Summary

The Collier County Watershed Management Plan (CCWMP) has been developed using an integrated water resources approach to balance water needs of both the human and natural system environments in the County's watersheds and estuaries. One of the key features of this approach is that it takes advantage of opportunities for restoring the natural ability of the landscape to benefit the human environment and protect the water quality, water quantity, and natural systems in the County.

Directive

The CCWMP was prepared to address protection of the County's estuarine and wetland systems, consistent with Florida Statute (Subsection 163.3177(5)(d)). Applicable Elements of the Collier County's Growth Management Plan (GMP) addressed by the CCWMP include Conservation and Coastal Management and Drainage. The development of WMPs is specifically called out under Goal 2 of the Conservation and Coastal Management Element, Protection of Surface and Estuarine Water Resources. In addition, goals of the CCWMP are to help meet levels of service for flood protection, as well as sustainability of future water supplies for the citizens of Collier County.

Background and Purpose

Under pre-development conditions, surface waters flowed through wetlands in Collier County and into the receiving estuaries Rookery Bay, Ten Thousand Island, Naples Bay and Wiggins Pass. Originally most of the land drained towards Ten Thousand Island and Rookery Bay. However, intense development that has occurred in Collier County over the past 70 years, including the extensive canal construction that began in south Florida in the 1940s, has substantially changed the drainage patterns. For example, the Golden Gate Canal network that was constructed in the 1960s more than doubled the size of the Naples Bay watershed and reduced by that same amount the drainage area to Rookery Bay.

Growth in Collier County has continued in recent years. According to the 2010 Census data, population increased by about 27 percent between 2000 and 2009. As development continues, the risk of impacting the natural system will increase. In addition, external factors such as sea level rise will result in further environmental pressures.

Drainage canals and urbanization have altered regional surface and groundwater flow patterns, lowered groundwater levels, increased freshwater discharges to estuaries, and drained wetlands. Associated urbanization and coastal development displaced native habitats, increased surface water discharges, reduced aquifer recharge, and increased pollutant loads to estuaries. As a result, what was historically a regional watershed has become multiple, artificially created watersheds. Therefore, restoring regional function via a County-wide watershed management approach is critical to restoring historical functions that allow the County to manage the resources for both human and natural environmental needs.

Development of the CCWMP started with an evaluation of the current conditions in the study area in terms of surface and groundwater quantity and quality, as well as the natural system. These conditions were then compared to pre-development by way of performance measures. The performance measures were also used to later evaluate proposed recommendations for management actions that will improve the volume and timing of flows to the estuaries, reduce pollutant loads, increase groundwater recharge, and restore natural systems, to the extent possible, in the County. Recommendations were developed to:

- Restore historical water quantity and estuarine discharges
- Improve water quality within the watersheds and estuaries
- Address flood control and water supply issues

Study Area

Collier County encompasses an area of approximately 2,000 square miles. The CCWMP was developed to address watershed and estuarine conditions in the approximately 1,400 square mile area that has been subject to historical impacts due to human activity. That area is located west of the Big Cypress Preserve (Figure ES-1) and includes: three high priority watersheds: Cocohatchee-Corkscrew, Golden Gate, and Rookery Bay. The eastern watersheds, Faka Union, Okaloacoochee / State Road (SR) 29, and Fakahatchee watersheds were evaluated as a single unit due to their less intensive land development and restoration activities currently underway in those watersheds. The estuaries in the study area are Wiggins Pass, Naples Bay, Rookery Bay, and the Ten Thousand Islands estuaries.

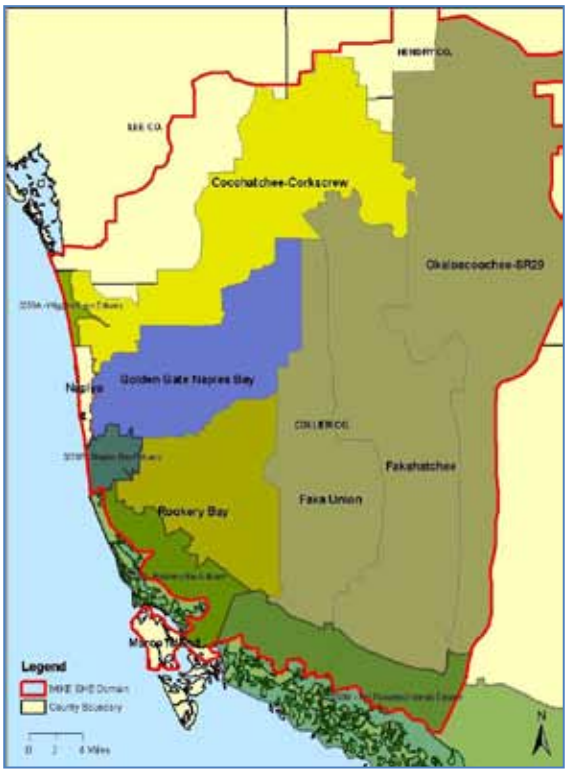

Figure ES-1. Collier County Watersheds and Estuaries

Approach

Relevant data were compiled from numerous sources, including State and local agencies, the Florida STORET data base, and the extensive literature available on relevant topics. Two primary hydrologic/hydraulic computer modeling tools were used to compare pre-development with current conditions in the study area: a) a MIKE-SHE natural systems, or pre-development, model (NSM) developed for the Southwest Florida Feasibility Study (SWFFS) area (SDI, 2007), and b) a MIKE-SHE existing conditions model (ECM) developed as part of this project.

The NSM model domain includes the BCB as well as the Caloosahatchee and Estero River Basins. The ECM is an integrated surface and groundwater model based on the previous SFWMD Big Cypress basin (BCB) model. The model was setup to analyze the watershed processes using a grid approach. Each cell in the grid is 1,500 x 1,500 ft long. This indicates the extensive level of detail applied in the analysis.

Existing conditions were assessed for surface and groundwater quantity and quality, as well as the characteristics of the natural system. A major conclusion of the analysis was that the study area is an integrated system where water moves between watershed boundaries depending on local and regional hydrologic characteristics. Therefore, the CCWMP does not focus on individual watersheds that were artificially created by land development activities, particularly construction of roads and drainage canals, but on the system as a whole.

Differences between pre- and post- development conditions were used as the basis to develop performance measures. In this manner it was possible to quantify existing watershed and estuary conditions and also quantify the improvement anticipated as a result of implementing proposed management actions.

Performance measures were developed to quantify conditions in terms of seasonal water levels in natural systems, freshwater discharges to estuaries, surface water pollutant loads, and groundwater aquifer conditions.

A number of potential capital improvement projects were identified, screened, and ranked to

develop a list of recommended projects for addressing water resource issues in the County. Rankings are based on the anticipated improvements in the system due to proposed projects. A benefit/cost analysis was also completed, for which benefit=improvement and cost=construction cost. Priority project are recommended and described for each watershed.

A major finding of the analysis was that the proposed structural projects will provide improvements from existing conditions, but will not be enough to reach restoration goals. They must be complemented by non-structural/ policy actions. A total of thirteen non-structural initiatives are recommended for implementation. They are primarily incentive-based and cost neutral. They range from suggested changes to the land development code to establishment of a watershed-specific mitigation bank. These actions are summarized later in this document and described in detail as part of the WMP recommendations.

Element 1: Existing Conditions – Watersheds

The canals have increased the freshwater discharges to the Naples Bay estuary by as much as 10 times compared with pre-development conditions and altered the timing and volume of flows to the other estuaries. Development and altered surface water flows have led to a dramatic decline in natural wetland systems in the County, including nearly 70 percent of the wetlands in the Golden Gate – Naples Bay watershed.

Watershed surface water quantity

A detailed water budget analysis (Figure ES-2) showed that stormwater runoff volumes are strongly influenced by precipitation; therefore, small changes in rainfall can result in large runoff changes. Increases in baseflow are a major impact to the natural conditions because they represent groundwater contributions to surface water flows due to the drainage canals cutting into the Water Table aquifer. In this sense, the Collier County drainage canals act as an extensive source or sink of groundwater to and from the Water Table aquifer system.

The Big Cypress Basin and Collier County, respectively, maintain the primary and secondary canal system through a rigorous water control operation schedule, with virtually no surface water discharges to the estuaries for at least five months of an average year. In spite of such rigid operation, the canals derive baseflow from the Water Table aquifer system and incur losses to evaporation. It is recommended that the County and the District further evaluate the operation of the canal structures in response to groundwater levels to help manage freshwater discharges to estuaries. Maintenance of minimum flows and levels is necessary to protect in-stream fish and wildlife.

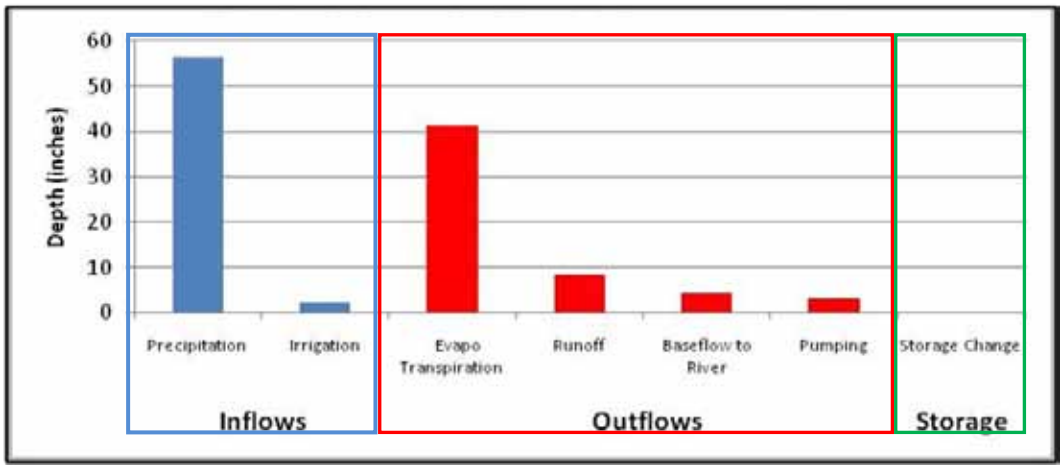

Figure ES-2. Surface Water Budget

The surface water quantity analysis also showed that the drainage system capacity is limited. In some cases, the drainage canals are unable to accommodate the flow associated with large storm events (return periods of 10 years or more). Lowering the water surface in the canal network prior to large storm events can provide storage and mitigate some of the flood risks.

In-stream water quality

Water quality in Collier County watersheds was evaluated with respect to Total Maximum Daily Load (TMDL) conditions per the Florida Department of Environmental Protection's FDEP verified list of impaired waters. Multiple impairments were documented. Each of the six watersheds have identified dissolved oxygen impairments, The Golden Gate watershed is also impaired for iron. Two watersheds had fecal coliform impairments and one was impaired for nutrients. The dissolved oxygen and iron impairments may be caused by pollution from human activities as organic material and nutrients discharged from urban areas affect dissolved oxygen concentrations. Sources of high iron concentrations may include mine drainage, sewage treatment plan outfalls and landfill leachate from industrial scarp yards. It is also possible that the impaired dissolved oxygen and iron conditions may be the result of baseflow (groundwater) in the canals. Groundwater concentrations of dissolved oxygen and iron do not meet surface water quality standards (Collier County Groundwater Database, 2010) and the water budget conducted for each watershed as part of this project showed that baseflow represents up to 70 percent of the surface water in the canals during the dry season and 55 percent during the wet season.

Watershed pollutant loads

Watershed pollutant loads reflect man-made pollution. Areas with larger pollutant loads, particularly nutrients, corresponded to older urban areas without stormwater runoff treatment facilities. Nutrient loads are also higher in agricultural areas, although further verification and definition of discharge characteristics from these areas is recommended. Higher 5-day biological oxygen demand (BOD-5) and heavy metals loads corresponded with low/medium residential land uses and commercial areas, respectively.

Watershed hydrogeology and water uses

Hydrogeology. The groundwater system in Collier County is a regional reservoir and varies in response to seasonal precipitation. Current wet season recharge in each aquifer corresponds to the current dry season withdrawals in the 4 aquifers examined, Water Table, Lower Tamiami, Sandstone, and Mid-Hawthorn aquifers. The combined Water Table and Lower Tamiami aquifer system is often referred to as the Surficial aquifer system.

The pattern of drawdown was similar among the Water Table, Lower Tamiami, and Sandstone aquifers (Figure ES-3). The Mid-Hawthorn aquifer is relatively isolated from these three and exhibits a somewhat different pattern due to limited withdrawals. Aquifer conditions are generally acceptable, except in the areas of influence of the existing wellfields, which produce significant groundwater drawdowns.

Changes in the operation of the existing surface water control structures in the Golden Gate Canal may provide opportunities to reduce groundwater losses and increase water availability. Reducing groundwater withdrawals for agricultural irrigation would also increase the water available for potable supply and habitat protection.

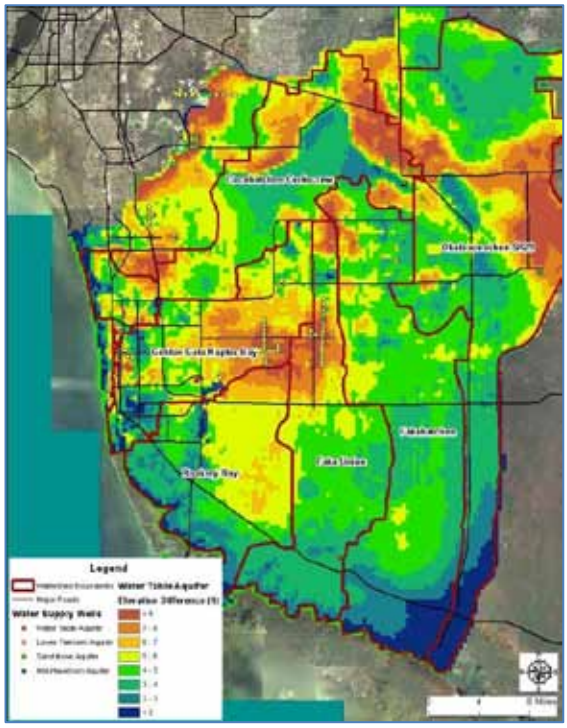

Figure ES-3. Water Table Aquifer Average Annual Groundwater Fluctuation

Water uses. Changes in groundwater levels due to withdrawals were examined with respect to minimum aquifer levels established by the SFWMD. Predicted additional declines in aquifer levels exceeded 5 feet in many areas of the County and in all 4 of the aquifers under a scenario of a 10 percent increase in groundwater withdrawals from the existing wellfields (Figure ES-4). Predicted impacts are greater under prolonged dry season conditions. That is an indication that new water supply sources must be identified to meet expected future demands.

Groundwater quality and pollutant loads

Dissolved oxygen concentrations in groundwater are less than 1.5 mg/L in most of the County, compared to the State of Florida surface water standard of 5 mg/L. Because the Collier County Existing Conditions model results indicated that for the study area, baseflow (groundwater) represents 36 percent of the total annual flow in the canals and as much as 56 percent during the dry season, groundwater is a potential cause of the dissolved oxygen impairments in the canals However, it should be noted that the discharge of organic material and nutrients into surface waters resulting from human activities may also be the cause of the lower dissolved oxygen levels.

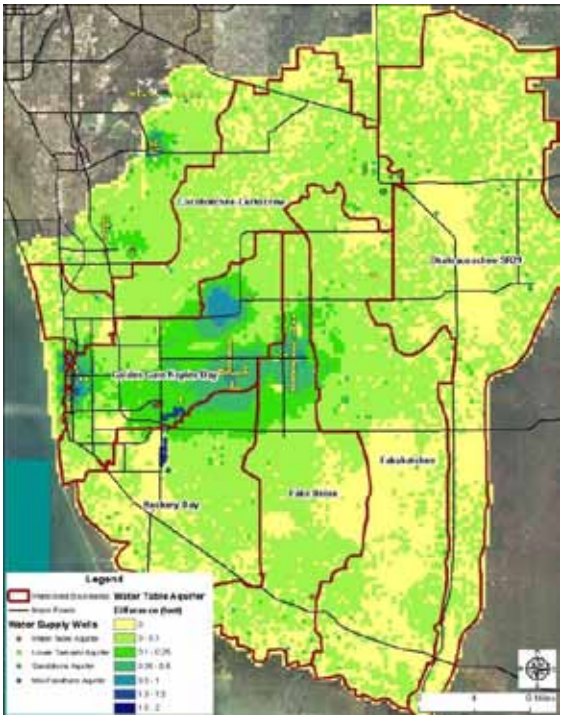

Figure ES-4. Water Table Aquifer (Prolonged Dry Season) Drawdown with 10 percent Increase in Withdrawals

Similarly, groundwater concentrations of total nitrogen in most of the County and phosphorus concentrations in the North County and coastal areas also exceed corresponding Florida surface water criteria and because baseflow represents a large percent of the total annual flow in the canals, it is possible that groundwater is a source of the reported Rookery Bay nutrient impairment. No correlation was found between septic tank density and nutrient concentrations in the watersheds, but further study is required.

Iron concentrations may also be affected by baseflow. Groundwater concentrations are often five times larger than the State's surface water standard. Given the amount of baseflow in the surface water system, it is possible that the reported surface water iron impairment is affected by groundwater, although, as described previously, sources of high iron concentrations may include mine drainage, sewage treatment plan outfalls and landfill leachate from industrial scarp yards.

High copper concentrations in surface waters, on the other hand, are likely the result of human activities. No groundwater impacts were identified in close proximity to surface water copper exceedances.

Natural systems

A landscape-level functional assessment method (modified from Florida's Unified Mitigation Assessment Method) was used to assess, and assign value to, existing natural systems conditions in the watersheds in Collier County. Measures used in the assessment included landscape suitability index (LSI), vegetation, and hydrology. Figure ES-5 shows the results of the hydrology assessment. In general, the combined Faka Union, Okaloacoochee/ SR29, and Fakahatchee watersheds exhibited the highest functional values (the least change from pre-development) when compared with the other watersheds. Measured functional values were lower in the Rookery Bay and Cocohatchee-Corkscrew watersheds, and least in the Golden Gate-Naples watershed. These scores were also used as performance measures for evaluating potential improvement projects.

The functional assessment analysis also provided a means of identifying resource protective lands that are not currently included in the County's or the SFWMD's preserved lands and supportive agricultural lands programs. Those resource protective lands were identified via consideration of LSI and vegetation scores.

Element 2, Existing Conditions – Estuaries

Volume and timing of freshwater flows

Figures ES-6 and ES-7 (red bars) show the fresh water surplus /deficit entering the estuaries during the wet and dry seasons compared to the natural system based on ECM and NSM comparisons. Excess wet season runoff under existing conditions (ECM), compared with pre-development (NSM) conditions is the primary issue in the Wiggins Pass, Naples Bay, and Ten Thousand Islands estuaries. For the Rookery Bay Estuary, the primary issue appears to be the timing of flow to the estuary and is due to fresh water surplus during the wet season and deficit during the dry season. The ECM and NSM comparisons were further verified by developing a model based on measured salinity at the estuaries. Salinity model results (green bars) are consistent with differences measured by comparing pre- and post- development conditions.

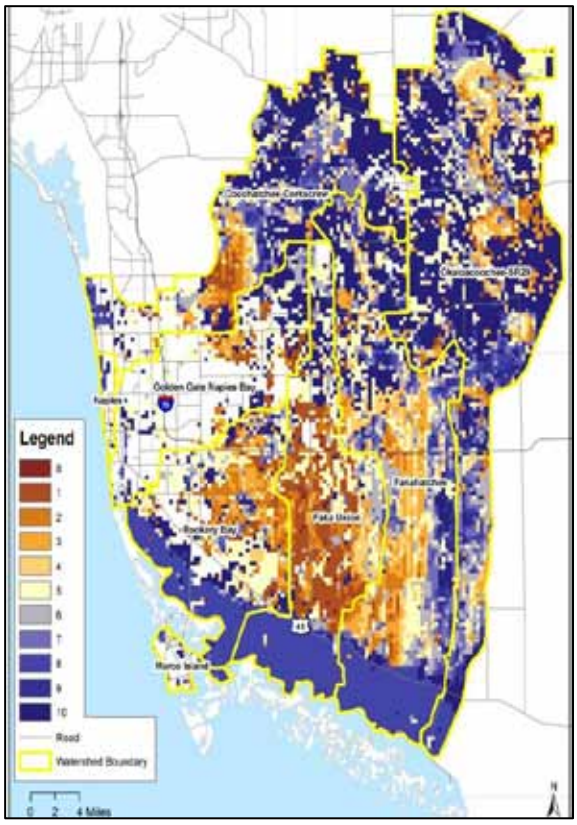

Figure ES-5. Hydrology Assessment (pre-development vs. existing conditions)

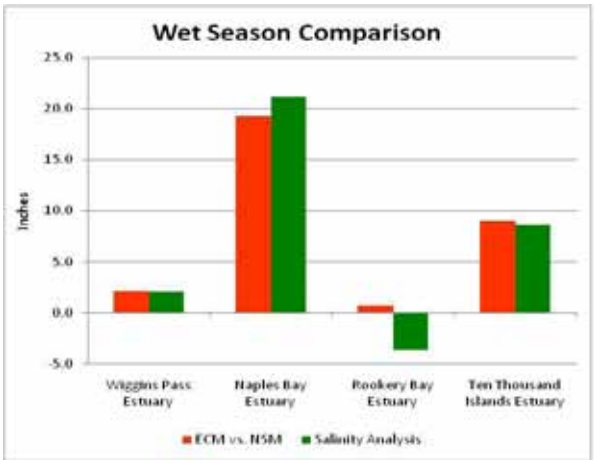

Figure ES-6. Wet season fresh water surplus/deficit (inches) in Collier County estuaries

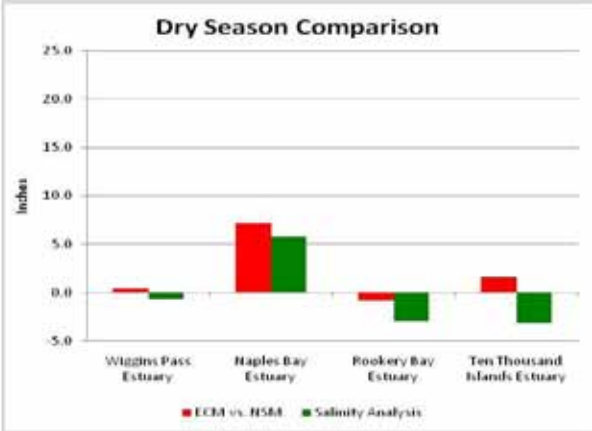

Figure ES-7. Dry season fresh water surplus/deficit (inches) in Collier County estuaries

Water quality of fresh water discharges

Collier County estuaries are typically impaired (with respect to state water quality criteria) for dissolved oxygen and fecal coliform bacteria. Rookery Bay is also impaired for nutrients. The causes of the impairments are not yet clearly defined and require further analyses. It could be attributed to nutrient discharges due to human activity, groundwater influence, or impacts of discharges from wetland systems. However, it is noted that concentrations of dissolved oxygen and fecal coliform bacteria in the discharges to the estuaries do not meet water quality criteria. Therefore, it can be concluded that watershed conditions are likely impacting the receiving estuaries.

Other parameters of impairment concern are iron and copper. The water budget analysis conducted based on the results of the existing conditions computer model developed for this project indicated that in the individual watersheds, up to 70 percent of the average dry season surface water flow in the canals is baseflow. Therefore, iron concentrations appear to be affected by the groundwater discharges to the canal network, although other sources related to human activity are possible. High copper concentrations may be the result of impacts of human activities such as the use of copper sulfate as an algaecide to prevent algae growth in ponds or leaching from boardwalks and pilings that are constructed from pressure-treated lumber.

Quality of receiving waters

Water quality impairments identified as part of the FDEP TMDL program were confirmed with a single exception: the Rookery Bay impairment for chlorophyll-*a.* This impairment was not confirmed and should be addressed through further analyses that include determination of actual causes.

The Wiggins Bay, Naples Bay, and Rookery Bay estuaries were found to be impaired for dissolved oxygen and fecal coliform. Wiggins Bay was also found to be impaired for iron, and Naples Bay was found to be impaired for iron and copper. The Ten Thousand Islands estuary is not listed as, and was not found to be, impaired for any water quality parameter. Collier County should consider working with the Florida Department of Environmental Protection (FDEP) to determine the sources for the identified impairments in Wiggins, Naples, and Rookery Bay estuaries.

Coastal habitats

The reduction in areal extents of oyster bars, seagrass beds, mangrove forests and salt marshes in the estuaries is attributable to direct physical loss associated with coastal development and the associated changes in the hydrologic pattern of fresh water discharges. Habitat loss in Wiggins Pass and Naples Bay estuaries (Figures ES-8 and ES-9) is substantially greater when compared with the Ten Thousand Islands and Rookery Bay estuaries (Figures ES-10 and ES-11), due to greater urbanization in Wiggins Pass and Naples Bay estuaries. In the Wiggins Pass estuary, the combined acreage of salt marsh and mangroves has declined by 29 percent over pre-development conditions. Acres of salt marsh and mangrove have declined by approximately 76 percent in Naples Bay. In contrast, the less-impacted estuaries of Rookery Bay and the Ten Thousand Islands have experienced salt marsh and mangrove declines of 12 and 5 percent, respectively.

Element 3, Performance Measures

Performance measures were developed as a baseline against which to measure the improvement due to implementation of proposed improvement projects. Performance measures

considered the natural system functional assessment results, freshwater discharges to estuaries, surface water pollutant loads, and aquifer conditions. Functional assessment values included vegetation, hydrology, and LSI. Water quality was not explicitly considered as a performance measure because it is a consequence of pollutant loading. Conditions were scored on a scale from 0 to 10, where ten represents the pre-development condition. Details of the methodology applied for establishing the Performance Measures are provided in Volume 4 of this report.

The expected benefits of proposed projects considered the increase in the performance measure score compared to existing conditions. More detailed descriptions of the evaluation of recommended projects are provided later in this Section.

Natural System Functional Assessment.

Functional assessment scores, or performance measures, are presented in Table ES-1. Higher scores indicate greater similarity to pre-development conditions. Average scores are lower in the Golden Gate-Naples Bay watershed due to extensive canals systems and development and indicate that hydrologic restoration may provide the greatest opportunity for measurable improvement in functional value in Collier County. Hydrologic restoration is defined as the attempt to replicate pre-development conditions.

Table ES-1. Average Functional Values (Performance Scores) for Non-Urban Lands, by Watershed

Watershed	Non-Urban Area (acres)	Vegetation Score	Hydrology Score	LSI Score
Cocohatchee-Corkscrew	111,250	7	7	8
Golden Gate-Naples	36,630	5	6	6
Rookery Bay	83,100	8	6	9
Faka Union/ Okaloacoochee SR 29/ Fakahatchee	431,410	9	6	9

Freshwater discharges to estuaries

Performance measures (scores) are based on comparisons of timing and volume of discharges to estuaries for modeled pre- (NSM) and post- (ECM) development conditions. Average monthly discharge volumes from the NSM and ECM models were used to define the baseline distribution and total volume of flow from each watershed. Average annual and seasonal scores for existing conditions are shown in Table ES-2.

Table ES-2. Discharge to Estuary Performance Scores

Watershed	Annual Score	Dry Season Score	Wet Season Score
Golden Gate-Naples Bay	1.6	1.9	1.0
Cocohatchee-Corkscrew	5.4	6.9	2.5
Rookery Bay	4.3	3.1	6.8
Faka Union, Okaloacoochee / SR 29, and Fakahatchee	5.6	7.4	2.0

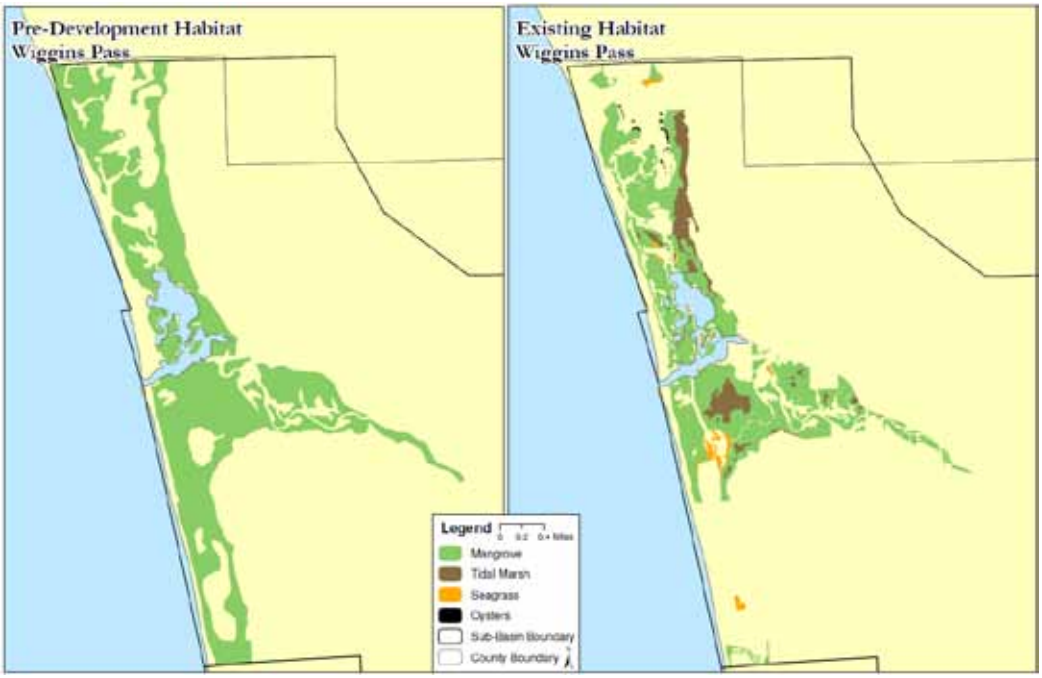

Figure ES-8. Wiggins Pass Habitat

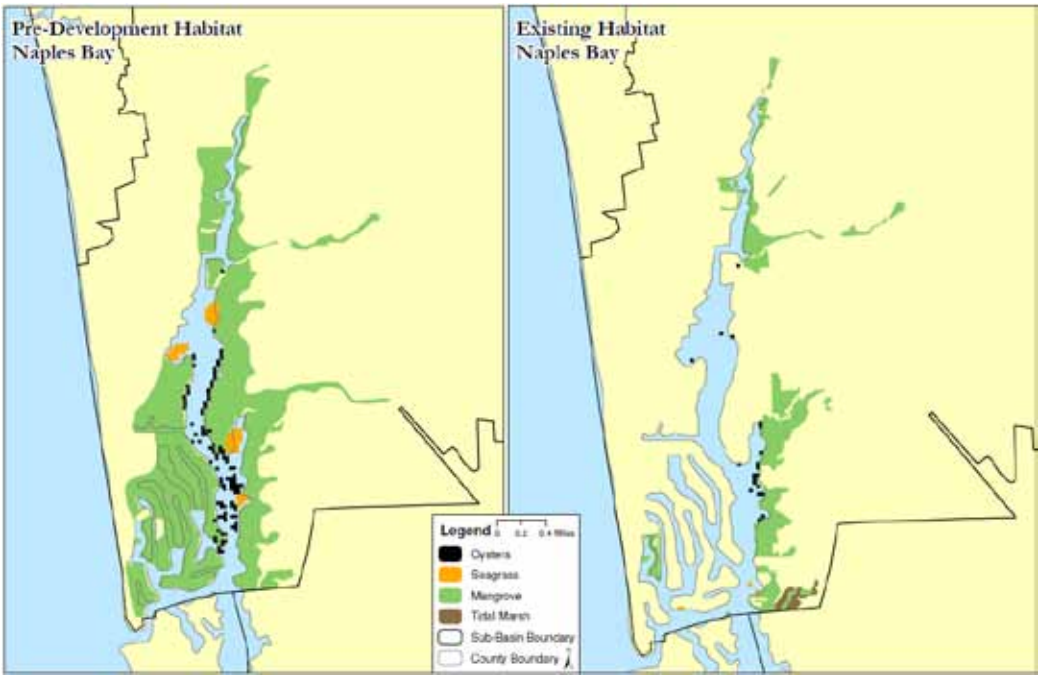

Figure ES-9. Naples Bay Habitat

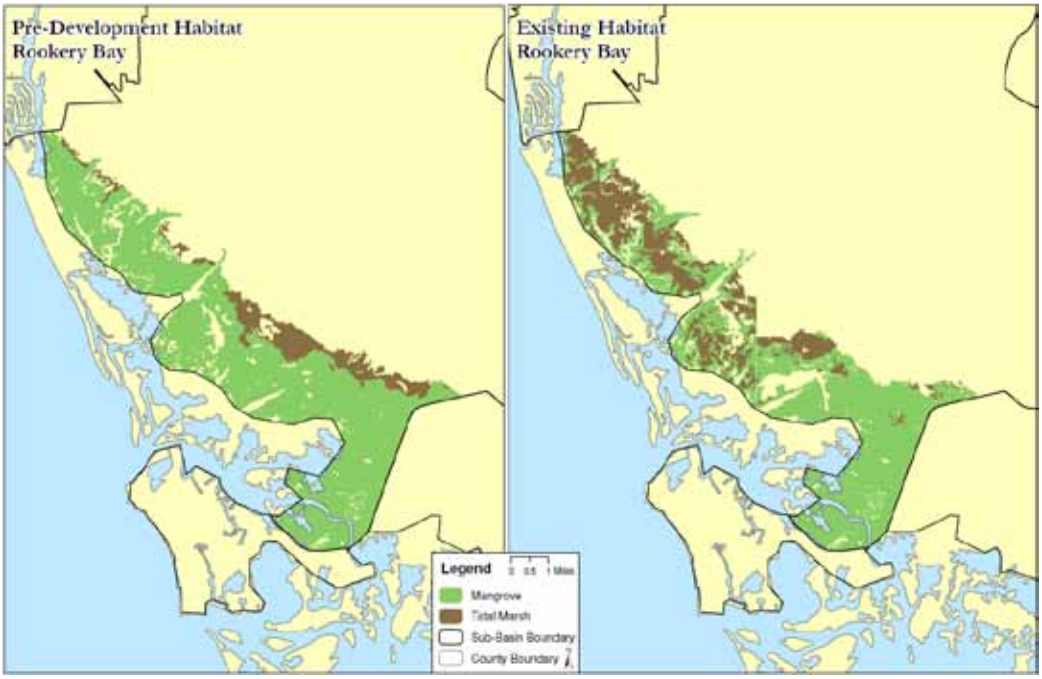

Figure ES-10. Rookery Bay Habitat

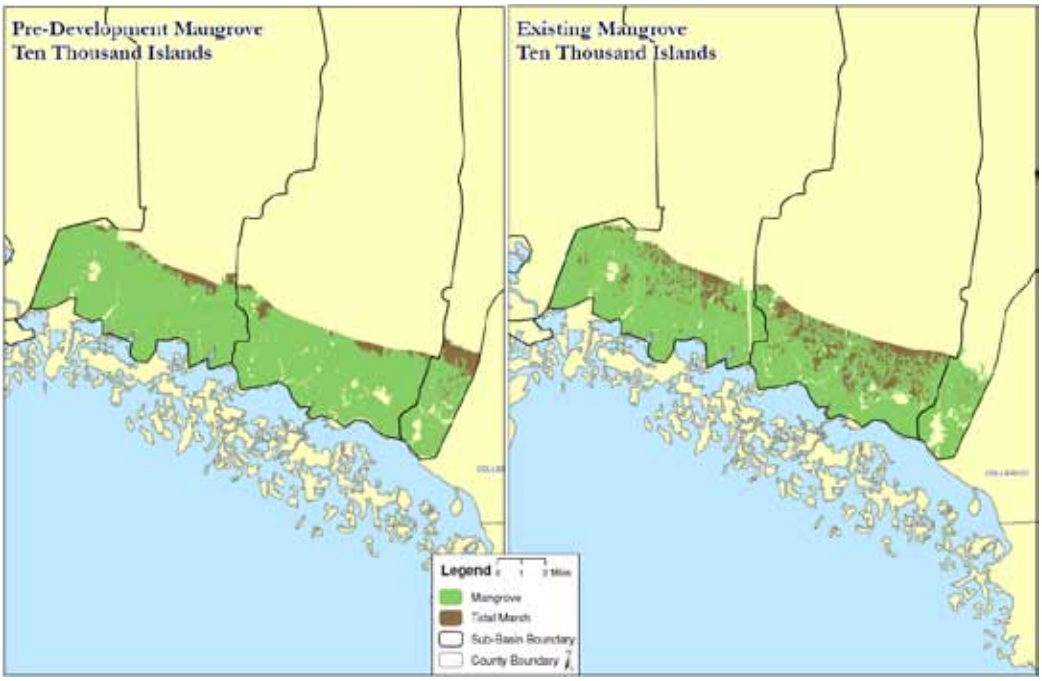

Figure ES-11. Ten Thousand Islands Mangrove

Higher scores indicate greater similarity to pre-development conditions. The Golden Gate – Naples Bay watershed has the lowest annual score of 1.6; this is due to the year round flow surplus into Naples Bay. The scores for the Rookery Bay indicate dry season freshwater deficits, likely due to the reduced watershed caused by construction of the Golden Gate Canal. During the wet season the problem is a freshwater surplus likely due to stormwater runoff from the Lely area and from the agricultural lands in the southeastern watershed.

Scores for the Cocohatchee-Corkscrew, and eastern watersheds suggest that the operational controls used to manage dry season flows are reasonably effective at reducing baseflow and therefore provide some control over potential impacts. This contributes to the higher scores during the dry season. Low wet season scores in all watersheds point to the effect of development on the natural drainage system.

Surface water pollutant loads

Pollutant load performance measures (scores) for watersheds were based on data for each individual cell in the ECM grid. The loads were then aggregated by FDEP water body identification numbers (WBIDs) and for each watershed. Scores (Table ES-3) were calculated as a function of pollutant loads relative to the land use and the extent of runoff treatment existing with each cell. Natural areas received a score of 10, whereas areas of high pollution potential received scores lower than 3. Current scores indicate that the WBIDs of most concern in terms of nutrient loads are in the Cocohatchee – Corkscrew and the Golden Gate – Naples Bay watersheds, particularly the coastal segment of Naples Bay and the Gordon River Extension. The Golden Gate – Naples Bay watershed received the lowest average pollutant loading scores for total suspended solids, biochemical oxygen demand and heavy metals because of the presence of areas of urban development with no treatment. The Lake Trafford WBID includes only the lake itself and received a score of zero for nutrient loads (area of high nutrient load) due to the high measured concentrations of nitrogen and phosphorus. The scores do not reflect conditions after the recent large-scale restoration projects.

Table ES-3. Nutrient Pollution Load Performance Scores

Watershed	Total Nitrogen	Total Phosphorus
Golden Gate-Naples Bay	1.0	3.0
Cocohatchee-Corkscrew	6.0	9.0
Rookery Bay	8.0	7.0
Faka Union, Okaloacoochee / SR 29, and Fakahatchee	5.0	4.0

Groundwater aquifer conditions

Weighted average performance scores were determined for each cell in the study area by comparing average existing conditions dry season water levels with respect to pre-development (NSM) conditions. Those scores were then aggregated to reflect average watershed conditions. Low performance scores within each watershed were typically associated with locations of public water supply wellfields and areas of heavy agricultural irrigation. Figure ES-12 shows mapped scores for the water table aquifer.

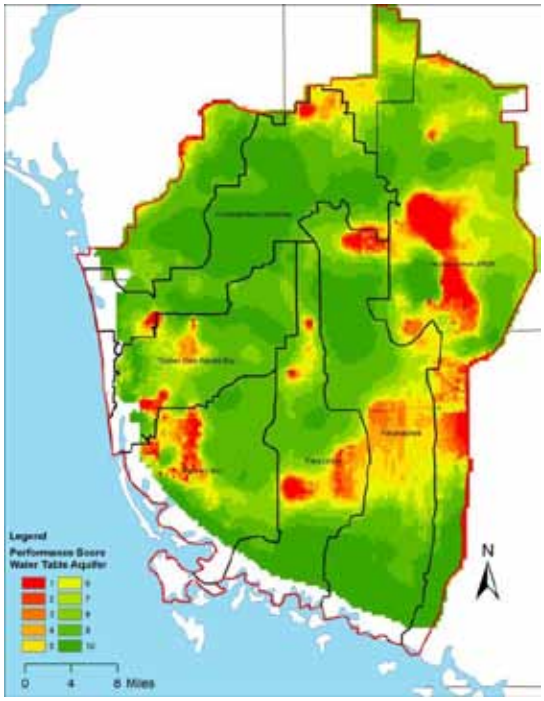

Figure ES-12: Mapped scores for the water table aquifer

High scores (10) indicate relatively a small change in dry season aquifer level condition when compared with the NSM. Low scores (1) indicate areas where aquifer levels are lower relative to historic conditions because of the presence of facilities that help meet agricultural and potable water supply needs. Areas that score poorly correspond generally to the locations of the public water supply wellfields.

Table ES-4 shows average scores by watershed. Those average scores do not adequately represent problem areas at specific locations within each watershed.

Table ES-4. Aquifer Conditions Performance Scores

Watershed	Water Table	Lower Tamiami	Sandstone
Golden Gate-Naples Bay	9.4	9.5	9.6
Cocohatchee-Corkscrew	8.9	9.3	9.8
Rookery Bay	8.7	9.3	9.9
Faka Union, Okaloacoochee / SR 29, and Fakahatchee	8.2	8.5	9.3

Element 4, Analysis of Alternatives and Recommendations

Structural and non-structural projects were identified as potential solutions to existing and anticipated water resource and natural systems issues in Collier County based on analyses completed as part of this study, as well as previously completed studies.

Recommended Structural Improvements

The methodology to identify structural recommendations included: a) an initial identification of potential projects from the review of previous studies including the Southwest Florida Feasibility Study (SWFFS), or projects identified as part of this study, b) a preliminary screening of those projects based on permitting and constructability issues, c) a more detailed evaluation of the projects that passed the initial screening based on a further assessment of potential benefits, and d) final selection of recommended projects.

A total of 105 projects were initially identified and were subject to initial permitting and constructability screening. A total of 27 were selected for the more detailed evaluation that included environmental benefits and preliminary implementation costs. This final evaluation reduced the number of feasible projects to 18. Of those 18 projects, 10 were found feasible for implementation through capital improvements by the County or other agencies such as SFWMD. The other eight (8) projects are located on private property within Stewardship Sending Areas or Flowway Stewardship Areas in the Fakahatchee and Okaloacoochee- SR29 watersheds and should be implemented through existing incentive programs.

The 10 recommended capital projects were evaluated against the four performance criteria (seasonal water levels for natural systems, freshwater discharges to estuaries, surface water pollutant loads, and groundwater aquifer conditions). Project benefits were measured by the "lift," or the improvement in performance criteria anticipated as a result of the proposed project. Weighting factors were integrated into the calculation process to address both individual watershed characteristics (e.g. watershed size) and the relative importance of the watershed issues (e.g. extent of development). The performance "lifts" were then normalized to a 0 to 10 scale and summed for each of the criteria to represent the expected project benefit.

The evaluation process also allowed for the calculation of a benefit/cost (B/C) ratio associated with each project by dividing the benefit score by the estimated project construction cost. The B/C ratio was used to prioritize project implementation. Table ES-5 shows normalized project benefit scores for each performance criteria, estimated project construction costs, and B/C ratios.

The final 10 projects, in order of B/C ratio, range in cost from $96,000 to approximately $7 million

(Table ES-6). Priority projects, in order of preferred implementation, are briefly outlined below.

1. **Northern Golden Gate Estates Flow-way Restoration**. The project ranks second in B/C, but first in benefits. It has the most lift anticipated for each of the 4 performance criteria, but only minimal lift for the discharge to estuary criteria.
2. **North Belle Meade Spreader Swale project** provides lift with respect to each of the 4 performance criteria. The primary benefit is lift in discharge to estuary in the Golden Gate and Rookery Bay watersheds, based on an anticipated 10 percent reduction in flows to Naples Bay and increased flows to Rookery Bay. Moderate lift is expected for the other 3 performance measures.
3. **The Henderson Creek Diversion project** is considered the third most important project to implement. It ranks fourth in the B/C ratio and, similar to the North Belle Meade project, it provides lift to estuary discharge for the Golden Gate and Rookery Bay watersheds. It does not provide lift to the 3 other performance criteria.
4. **The Corkscrew Regional Ecosystem Watershed Restoration** has the greatest B/C ratio among the 10 projects. However, the anticipated improvement in wetland hydrology is local and does not address some of the more important issues facing the county. Consequently, the project was assigned a lower priority for implementation despite the higher B/C ratio.

Table ES-5. Normalized Performance Scores and B/C Ratios for the Four Performance Criteria

Project Name	Discharge to Estuary	Water Quality	Wetland Hydrology/ Habitat	Ground-water	Total Score	Estimated Cost ($ millions)	Benefit-to-Cost Ratio
Corkscrew Regional Ecosystem Watershed	0.00	0.00	2.01	0.00	2.01	0.10	20.95
North Golden Gate Estates Flowway Restoration	0.05	10.00	10.00	10.00	30.09	2.37	12.71
North Belle Meade Spreader Swale	8.60	2.58	2.70	2.76	25.24	7.03	3.59
Henderson Creek Diversion	10.00	0.00	0.00	0.00	20.00	5.71	3.50
South I-75 Canal Spreader Swale	0.13	1.04	7.81	1.38	10.49	3.13	3.35
Wolfe Road Wetland Treatment System	0.00	0.11	0.00	3.34	3.45	1.42	2.44
Upper Golden Gate Estates Canal Weir Construction	0.00	0.00	0.00	0.67	0.67	0.55	1.21
Orange Tree Canal Control Structure Installation	0.00	0.00	0.00	0.67	0.67	0.55	1.21
Henderson Creek Off-Line Storage Reservoir	1.06	0.14	0.00	0.07	2.33	2.93	0.79
US HWY 41 Stormwater Treatment Area	0.00	0.03	0.12	0.00	0.15	0.54	0.28

Table ES-6. Cumulative Benefit (Performance Scores) and Cost of Project

Project Name	Cocohatchee-Corkscrew Cumulative Lift				Golden Gate - Naples Bay Cumulative Lift				Rookery Bay Cumulative Lift				Cumulative Cost (Millions of Dollars)
	Discharge to Estuary	Water Quality	Hydrology	Groundwater	Discharge to Estuary	Water Quality	Hydrology	Groundwater	Discharge to Estuary	Water Quality	Hydrology	Groundwater	
Corkscrew Regional Ecosystem Watershed	0.000	0.000	0.031	0.000									$0.096
North Golden Gate Estates Flowway Restoration Project					0.010	0.682	0.118	0.002					$2.464
North Belle Meade Spreader Swale[(1)]					0.900	0.682	0.118	0.002	1.250	0.435	0.036	0.200	$9.490
South I-75 Canal Spreader Swale									1.289	0.523	0.088	0.250	$12.621
Henderson Creek Diversion [(1)]					1.345	0.682	0.118	0.002	2.124				$18.329
Wolfe Road Wetland Treatment System					1.345	0.690	0.118	0.007					$19.745
Henderson Creek Off-Line Storage Reservior									2.282	0.547	0.088	0.255	$22.674
Upper Golden Gate Estates Canal Weir Constuction					1.345	0.690	0.118	0.008					$23.226
Orange Tree Canal Control Structure Installation					1.345	0.690	0.118	0.009					$23.778
US HWY 41 Stormwater Treatment Area									2.282	0.553	0.089	0.255	$24.322
Total Benefit or Cost	0.000	0.000	0.031	0.000	1.345	0.690	0.118	0.009	2.282	0.553	0.089	0.255	$24.322

Recommended non-structural (policy) initiatives

An important finding of the existing conditions analysis was that the recommended structural watershed projects will provide only partial restoration of the currently affected environment. Fourteen non-structural initiatives or Best Management Practices (BMPs) are recommended to complement the structural improvements. The non-structural initiatives focus on preserving and protecting natural features of the landscape and attempt to manage stormwater at its source. The purpose was to formulate recommendations that allow for the implementation of an environmentally sustainable management program that includes modifications to the applicable regulatory framework such that they can be used to guide land development into the future. The recommended initiatives are listed in Table ES-7 and briefly described below.

Low Impact Development Program (LID). This initiative encompasses implementation of an LID program that would apply to all new development in Collier. LID aims at reducing pollutant loads using micro-controls that either reduce the volume of runoff or treat the runoff at the source (i.e. pervious pavement, rain gardens, or created wetlands). It is proposed that new development include LID techniques to remove **the nutrient load associated with 50 percent of the basic ERP State requirement**. Based on input from local stakeholders, LID treatment would be in addition to the current County 150% treatment requirement. It should be noted that the local requirement is the same as the current SFWMD requirement for impaired water bodies.

Table ES-7. Recommended Non-Structural Initiatives

Low Impact Development (LID) Program
Stormwater Retrofit Program
Fee-Based Stormwater Utility Incentive Program
Allowable Maximum Site Discharges
Stormwater Runoff Volume Control
Verification of No Floodplain Impact
Flood Protection Levels of Service Criteria
Golden Gate Estates Transfer of Development Rights Program
Golden Gate Estates Watershed Mitigation Program
Modified Operations of Water Control Structures
Expanded Water Quality Monitoring Program
Additional Watershed Protection Programs
Stormwater Facilities Maintenance and Certification Program
Establish a Fertilizer Ordinance

The implementation of the proposed LID program is expected to be cost neutral for the development community. However, to promote program

implementation, various incentives are proposed through changes in the Land Development Code (LDC).

Stormwater Retrofit Program. Protection of the existing natural system will require establishment of a retrofit program for existing developments. The proposed initiative will focus on: a) retrofit of public facilities, including parking lots in public buildings such as the Government Center and public schools, b) installation of local treatment facilities in areas that lack runoff treatment and where land acquisition makes traditional approaches cost prohibited, and c) retrofit private facilities by working with Municipal Services Taxing Units (MSTUs). It is recommended that the County establish a program dedicated to funding of stormwater retrofits. The program would be funded using current stormwater utility revenues and complemented by funds from available state and federal grants. The projects to be funded would be selected from a prioritized list to be developed by County staff.

Fee-Based Stormwater Utility Incentive Program. The existing stormwater utility funds the stormwater program based on ad-valorem property tax revenues. It is recommended that the financing of the utility be changed to a fee-based system that in turn is based on the volume of runoff discharged from each property. All properties within the County would be assessed. However, the estimates of runoff discharges would concentrate on large parcels that could substantially benefit from a reduced fee. The goal would be to maintain the same County revenue, but using a different fee structure. The advantage of the proposed fee structure is that it can be used to provide incentives for both more environmentally-friendly new development design and retrofit of private property. An economic feasibility study must be conducted to establish a cost neutral fee schedule. To minimize any initial economic impact on existing properties that discharge large amounts of stormwater runoff, a credit system that incentivizes retrofitting should be considered.

Allowable Maximum Site Discharges. Specific maximum allowable discharges have been established in the GMP for five of the identified 28 stormwater basins in the County. The rest are subject to a default value of 0.15 cfs/acre. Computer model results indicated that many of the drainage canal segments lack the conveyance capacity to accommodate large storm events. To reduce the risk of flooding, basin-specific maximum discharges less than the default value are recommended for 14 additional basins. The recommended maximum allowable discharges by basin are listed in Table 3-3 in the WMP Volume 3 report. The proposed maximum discharges should apply to new development as part of the development permit. This initiative is simply a re-visiting of current requirements using the available computer modeling tools.

Stormwater Runoff Volume Control. Changes in discharge timing due to new development may impact flood elevations downstream for large storm events. In addition to the established maximum allowable discharges, it is recommended that the land development regulations be updated to require post-development volume mitigation not to exceed pre-development conditions for the 25-year/24-hour design storm event conditions. Analyses conducted as part of the watershed management plan development process have shown that this recommendation would have basically no impact on new development because the limiting condition in terms of required site storage capacity is the allowable maximum discharge limit. The volume control requirement will be a

double check on potential impacts in the areas downstream from a proposed development.

Verification of No Floodplain Impact. It is critical that future development discharges do not impact the extent of the FEMA regulatory floodplain at any point along the canal network. It is recommended that the County implement the requirement that impacts resulting from large development permits (e.g. 160 acres or larger) be verified by using one of the currently available regional computer models, such as the Tomasello model developed by the County for floodplain management purposes, or a version of the MIKE-SHE model developed using a smaller grid size, i.e. 500 ft. Application of this initiative will require changes to LDC Section 3.07.02 referencing affected properties

Flood Protection Levels of Service (FPLOS) Criteria. The existing FPLOS criteria are based on the results of a single design storm event (return period = 25-years and duration = 72-hours) and do not allow county staff to prioritize drainage improvement projects based on the type of road. It is recommended that new criteria be establish that consider both the type of road and the return period of the storm. Some flooding would be acceptable on minor roads during large events as long as health and safety are not compromised. Evacuation Routes would have the highest priority and no flooding would be acceptable even for the 100-year return period event.

Golden Gate Estates Transfer of Development Rights (TDR) Program It is recommended that the County evaluates the feasibility of establishing a TDR program in the North Golden Gate Estates Flowway Restoration Area (NGGEFRA) located between the Faka Union and Golden Gate Canals. The program would be designed to provide sufficient market attraction to not only accomplish resource protection goals, but also to provide enhanced incentives to promote development of the Rural Villages in all or some of the established Rural Fringe Mixed Use (RFMU) Receiving lands. The TDR program would provide for the voluntary severing of residential development rights from the identified Sending lands and allow the transfer of such rights to targeted Receiving lands, which may be those currently identified in the existing RFMU program. It is recommended that programs be implemented to encourage aggregation of smaller parcels into a larger development tract. An oversight committee should be established to develop the specifics of the program. The purpose of the oversight committee will be to define the relationship between the various County programs and to ensure that the proposed TDR program in the NGGE complements and enhances the existing programs. The oversight committee may elect to modify those existing programs to address known deficiencies.

Golden Gate Estates Watershed Mitigation Program. Regulations allow wetland impacts to be mitigated either on-site, at a permitted mitigation bank or at an authorized "regional offsite mitigation area" (ROMA). There is no ROMA within the Golden Gate – Naples Bay watershed. However, ROMAs do exist within the Cocohatchee – Corkscrew, Rookery Bay, and Okaloacoochee – SR29 watersheds. It is recommended that the County develop a mitigation area within the Golden Gate – Naples Bay and Faka Union watersheds to offset wetland losses within the watershed. The lands required for the establishment of the mitigation bank would be located within the area considered for the Golden Gate Estates TDR program to provide another mechanism to finance the proposed North Golden Gate Estates Flowway Restoration Plan.

Improved Operations of Water Control Structures. The Big Cypress Basin and Collier County respectively maintain the primary and secondary canal system through a rigorous water control operation schedule that limits the amount of baseflow entering the canals. In spite of such rigid operation, the canals will continue to derive baseflow from the Water Table aquifers and incur losses to evaporation.

Results of the existing conditions model (ECM) developed as part of this study indicate that baseflow (groundwater) discharges entering the drainage canal system contribute approximately 58 percent of the annual flow from the Golden Gate Main Canal to Naples Bay. During the dry season, as much as 70 percent of the discharge to

the estuary is predicted to come from groundwater. It is recommended that Collier County and the South Florida Water Management District (SFWMD) work together to fully evaluate opportunities to improve structure operations within the physical limitations of the existing structures to maintain the water surface in the canals at an elevation that more closely matches the water table elevation such that baseflow is reduced.

Water Quality Monitoring Program. Multiple agencies collect water quality data from surface water and groundwater sampling locations. The various agencies should coordinate their activities so that the collected data are consistent for all stations and can be applied for multiple purposes. It would be beneficial if one agency were responsible for collecting all data and sharing the analytical results with the other agencies. Implementation of a one-time wet weather sampling program is also recommended to better define pollutant loading contributions from specific land uses, particularly agriculture.

Additional Watershed Protection Programs. Several watershed protection programs are recommended for implementation in various areas identified as being valuable for resource protection: a) land acquisition along the State Road 29 corridor from I-75 to US 41, b) expansion of the incentive-based Recyclable Water Containment Area Programs by partnering with the SFWMD to include agricultural lands in the Rookery Bay watershed and those areas in Lee and Hendry counties that flow into Collier County watersheds, c) evaluation of the rural fringe neutral lands programs to reclassify some areas as Rural Fringe Sending Lands based on the vegetative communities and preservation standards required for Red Cockaded Woodpecker protection, d) coordination with property owners to ensure that resource protective lands within the Rural Lands Stewardship Area (RLSA) are added to the existing Stewardship Sending, or Flowway Stewardship Areas.

Stormwater Facilities Maintenance and Certification Program. Proper operation of existing stormwater system, including the runoff treatment facilities, is critical to safeguard water quality. It is recommended that a certification program be implemented to make sure that the stormwater facilities continue to operate as originally permitted. The objective is to be able to implement remedial actions before water quality in the receiving water bodies is impacted.

Conclusions

Canal construction and urban development in Collier County have altered what were historically regional surface and groundwater patterns, resulting in multiple, artificially created watersheds that have reduced water quality, altered freshwater flows to estuaries, reduced groundwater recharge, and altered natural ecosystems.

The CCWMP provides an analysis of existing conditions in the County with respect to changes from pre-development conditions and provides County-wide recommendations to:

- Restore historical water quantity and estuarine discharges
- Improve water quality within the watersheds and estuaries
- Address flood control and water supply issues

Simulation results of the existing conditions model (ECM) developed as part of this management plan and the SWFFS natural systems model (NSM) were used to evaluate historical changes and develop performance measures that were, in turn, used to quantify relative benefits anticipated from implementing proposed structural projects.

Several structural projects are recommended for implementation. Projects were ranked based on various criteria, including a detailed cost versus benefit analysis. The top four structural projects recommended, in order of preferred implementation are:

- Northern Golden Gate Estates Flow-way Restoration
- North Belle Meade Spreader Swale
- Henderson Creek Diversion
- Corkscrew Regional Ecosystem Watershed Restoration

Thirteen nonstructural policy initiatives that will provide long term, sustainable ecosystem benefits are also recommended for implementation. These non-structural measures promote an integrated approach to managing water resources in Collier County and include programs such as low impact development (LID), transferrable development rights, better management and/or improvements of existing control structures, and water quality monitoring. The implementation of these initiatives will require significant input from stakeholders, including the land development community, environmental groups, and the general public.

INTRODUCTION

Collier County is developing Watershed Management Plans (WMPs) to protect the County's estuarine and wetland systems, consistent with Florida Statute (Subsection 163.3177 (5)(d)). Under the statute, "a Conservation Element that addresses the conservation, use, and protection of natural resources in the area . . . is required as part of Local Government Comprehensive Plans." This WMP specifically addresses the Conservation and Coastal Management Elements of the County Comprehensive Growth Management Plan.

The Collier County Watershed Management Plan (CCWMP) has been developed using an integrated water resources approach to balance water needs of both the human and natural system environments in the County's watersheds and estuaries. One of the key features of this approach is that it takes advantage of opportunities for restoring the natural ability of the landscape to benefit the human environment and protect the water quality, water quantity, and natural systems in the County. This chapter discusses the County's directive for the CCWMP, the general process by which it was developed, and the organization of this document.

Historically, south Florida, including Collier County, was characterized by overland water flow through interconnected sloughs and wetlands. Most water flowed south into the Rookery Bay and Ten Thousand Island estuaries. Intense development has occurred in Collier County over the past 50 years. In 1947, Congress formed the Central and Southern Florida (CS&F) Flood Control Project under which 1,400 miles of canals, levees, and water control devices were constructed to provide a means of growth in south Florida. More than six million people subsequently moved to South Florida between 1940 and 1965 alone (Grunwald 2006). Growth has continued to recent years. According to the 2010 Census data, population increased by about 27 percent between 2000 and 2009.

Water control projects, particularly canal systems, have severely impacted small- and large- scale processes throughout the County. Canals drain surface waters and groundwater and subsequently alter freshwater discharges to estuaries. Construction of the Golden Gate Canal network in the 1960s and subsequent development along the west coast changed regional flow patterns to the estuaries, lowering groundwater elevations, draining wetlands, and increasing pollutant loads to Naples Bay.

The drainage system in the study area has been statutorily administered through the SFWMD Big Cypress Basin Board since 1977. The Big Cypress Basin and Collier County maintain the primary and secondary canal system in the study area, respectively, and through a rigorous water control operation schedule work to reduce the impacts of the existing infrastructure. In spite of such rigid operation, the canals continue to have significant impacts on the area's natural resources.

In terms of the natural system, urbanization and coastal development physically replaced native habitats, increased surface water runoff, and reduced water infiltration to the aquifers (aquifer recharge).

Consequences of these early water control actions include altered salinity regimes in the estuaries, degraded water quality, reduced water supply availability, and fish and wildlife habitat losses in many areas throughout the County. Altered salinity regimes may in turn impact the ecology and productivity of an estuary. Reduced flows and subsequently increased salinities can shift seagrass species composition and location, reduce oyster populations due to increased parasitism and species competition, reduce primary productivity, and alter the life cycles of fish. The ecological effects of increased flows due to increased groundwater discharges include algal bloom initiation and eutrophication as a result of nutrient inputs, as well as contamination due to metals.

Specific impacts of altered flows include increased freshwater discharges to the Naples Bay estuary by as much as 10 times compared with pre-development conditions and altered the timing and volume of flows to the other estuaries. Variation in freshwater flow can result in increased loading and transport of materials and organisms, dilution or mobilization of contaminants, a shift or compression of the salinity gradient, increase in stratification, and decreased water residence time. Freshwater flow accounts for the primary physical variability in estuaries and can be an issue where a substantial fraction of the fresh water has been diverted (Kimmerer 2002).

The decline in groundwater elevations has led to a dramatic decline in natural wetland systems in the County, including nearly 70 percent of the wetlands in the Golden Gate – Naples Bay watershed. Intense development has occurred in Collier County in recent years. According to the 2010 Census data, population increased by about 27 percent between 2000 and 2009. As development continues, the risk of impacting the natural system will increase. In addition, external factors such as sea level rise will result in further environmental pressures.

The CCWMP is intended to evaluate these issues with respect to pre-development conditions and develop recommendations for water management actions that will help restore surface water quality and freshwater flows, groundwater quality and recharge, and the condition of natural systems in the County.

Collier County encompasses an area of approximately 2,000 square miles. The CCWMP was developed to address conditions in the approximately 1,400-square-mile area of historical anthropogenic impacts located west of the Big Cypress Preserve. The study area includes three highest priority watersheds: Cocohatchee-Corkscrew, Golden Gate, and Rookery Bay (Figure 1.1). In addition, the plan included an assessment of the Faka Union, Fakahatchee, and Okaloacoochee / State Road (SR) 29 watersheds as a single unit due to the lower existing level of land development coupled with the on-going implementation of significant restoration projects. The plan includes the assessment of all estuary systems in Collier County — Wiggins Pass, Naples Bay, Rookery Bay, and the Ten Thousand Islands.

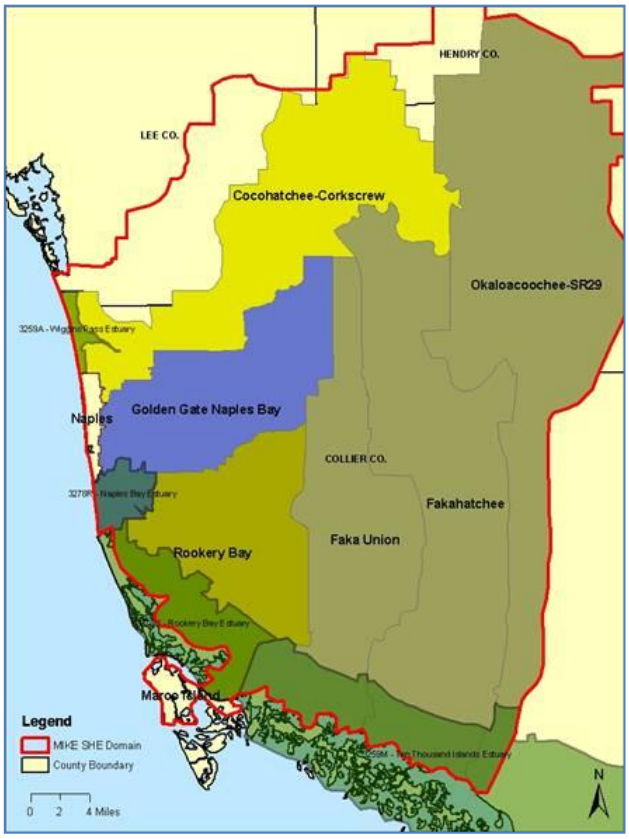

Figure 1-1. Collier County Watersheds and Estuaries

Watershed Management Plan Directive

Collier County is developing the watershed management plans with the purpose of protecting the County's estuarine and wetland systems, consistent with Florida Statute (Subsection 163.3177 (5)(d)). The goal is to develop a mechanism for *the conservation, use, and protection of natural resources in the area, including air, water, water recharge areas, wetlands, water wells, estuarine marshes, soils, beaches, shores, flood plains, rivers, bays, lakes, harbors, forests, fisheries and wildlife, marine habitat, minerals, and other natural and environmental resources*. Applicable Elements of the Collier County's Growth Management Plan (GMP) addressed by the plan include Conservation and Coastal Management and Drainage.

The development of WMPs is specifically called out under Goal 2 of the Conservation and Coastal Management Element, Protection of Surface and Estuarine Water Resources, by which the County committed to complete the prioritization and begin the process of preparing Watershed Management Plans, which contain appropriate mechanisms to protect the

County's estuarine and wetland systems. All but four (denoted with an asterisk) of the 13 goals identified (and listed below) in the Conservation and Coastal Management Elements are addressed in the CCWMP:

1. Protection of natural resources
2. Protection of surface and estuarine water resources
3. Protection of groundwater resources
4. Protection of freshwater resources
5. Protection of mineral and soil resources*
6. Protection of native vegetation and wildlife habitat
7. Protection of fisheries and wildlife
8. Maintenance of existing air quality*
9. Management of hazardous materials and hazardous wastes*
10. Protection of coastal resources
11. Protection of historic resources*
12. Hurricane evacuation and sheltering
13. Avoiding duplication of regulations

In addition to the goals stated in the GMP, the CCWMP also addressed issues of flood protection levels of service.

Watershed Management Plan Development

This CCWMP was developed following completion of the Southwest Florida Feasibility Study (SWFFS). The SWFFS was developed by the U.S. Army Corps of Engineers in cooperation with the South Florida Water Management District (SFWMD) and is a continuation of the earlier Southwest Florida Study that provided a framework to address aquatic ecosystems health; water flows; water supply; wildlife, biological diversity and natural habitat; the region's economic viability; and property rights in southwest Florida. The SWFFS includes a preliminary feasibility analysis of alternative solutions to issues identified in the SWFFS so that a viable plan can be authorized and funded.

The CCWMP development consisted of an assessment of existing and pre-development conditions, development of performance measures to evaluate anticipated success of proposed projects, analysis of alternatives, and a list of recommendations for implementation of specific watershed management projects and initiatives for both the watersheds and estuaries. More specifically, CCWMP is intended to:

- Restore historical water quantity and estuarine discharges
- Improve water quality within the watersheds and estuaries
- Address flood control and water supply issues

Watershed Management Plan Document Organization

This WMP describes the link between water quality, water quantity, and natural systems issues in Collier County watersheds and estuaries and provides recommendations for projects intended to address these issues and comply with Federal, State, and local regulations. Proposed improvements anticipated as a result of the proposed projects, as well as planning-level cost estimates for the recommended projects, are included in this CCWMP. The document is organized by Elements for consistency with the work elements outlined in the County's Scope of Work and then grouped into four volumes. The first three volumes provide a description of the analysis, conclusions, and recommendations of the CCWMP. Volume 4 provides technical details of the assessments that support the plan's conclusions and recommendations. Further details of the report contents are provided below.

Volume 1

Volume 1 presents a summary of existing conditions in the watersheds and estuaries and the performance measures developed for evaluating potential projects. Volume 1 addresses Elements 1 through 3 of the CCWMP scope of services. Because of the extent of the analyses completed for the CCWMP, the detailed analyses are presented in technical memos in Volume 4 of this report.

Introduction. This introduction presents an overview of the purpose and development of the CCWMP, as well as the organization.

Element 1, Assessment of Existing Conditions – Watersheds. Existing and pre-development conditions are characterized for the Cocohatchee-Corkscrew, Golden Gate – Naples Bay, Rookery Bay, and the combined Faka Union, Okaloacoochee / State Road 29 (SR 29), and Fakahatchee watersheds to assess changes in the systems and the potential for restoration via

management actions. This element addresses surface and groundwater quantity and quality, as well as natural systems conditions in the watersheds.

Element 2, Assessment of Existing Conditions – Estuaries. Similarly, existing conditions in Wiggins Pass, Naples Bay, Rookery Bay, and Ten Thousand Islands estuaries were characterized and evaluated in terms of potential management actions. This section addresses volume, timing, and quality of freshwater inflows to the estuary; quality of receiving waters in the estuary; and coastal habitats.

Element 3, Development of Performance Measures. Performance measures were developed for quantitatively assessing watershed and estuary conditions and providing a measure of improvement anticipated as a result of implementing proposed management actions. Performance measures were developed for surface water quantity, surface water pollutant loads associated with human activity, aquifer/hydrogeology conditions, and conditions of the natural system.

Volume 2

Volume 2 is a stand-alone report that describes the structural best management practices (BMPs) recommended for implementation. Volume 2 describes the identification, screening, evaluation, and ranking of recommendations for addressing water resource issues in the County. Project implementation rankings are based on the anticipated improvements in the system due to proposed projects. Priority improvements are recommended and described for each watershed.

Volume 3

Volume 3 was prepared as a stand-alone document to describe the non-structural (policy) initiatives recommended for implementation as part of the watershed management plan. The non-structural, initiatives are designed to help bridge the gap between the benefits expected from structural projects and the long-term approaches needed to address water quantity, water quality, and resource protection in Collier County as land development continues.

Volume 4

Volume 4 is a compilation as separate sections, of the individual technical memoranda completed to address existing conditions in the County's watersheds and estuaries. Volume 4 presents detailed descriptions of the analyses conducted, with supplemental appendices as appropriate, of the applied methodologies and corresponding results of the work conducted as part of the development of the CCWMP. Volume 4 also includes a complete list of project references. Volumes 1 through 3 include separate sections on the cited literature.

SUMMARY ASSESSMENT OF EXISTING CONDITIONS – WATERSHED

1.1: Surface Water Quantity

Stormwater runoff and base flow account for about 15 and 8 percent, respectively, of the annual rainfall in Collier County watersheds. Groundwater that enters the canal network as base flow makes up approximately 36 percent of the total fresh water discharged into the canals.

Introduction

Surface water budgets, based on results from the Collier County MIKE SHE/MIKE11 Existing Conditions Model (ECM) are summarized here. Potential issues identified during the water budgeting process are presented. Water budget components, surface and groundwater budgets, base flow and structure operations, and canal capacity are also presented.

The water budget schematic presented in Figure 1-2 illustrates that the primary inflows to the watershed are precipitation and applied irrigation. Water accumulates on the land surface as basin storage, runs off as overland flow, or seeps into the ground (infiltration/percolation). Overland flow can evaporate, discharge into the canal, or be conveyed across watershed boundaries. Water that seeps into the soils can be assimilated by plants or percolate into the Water Table aquifer. Water can subsequently be assimilated by plants, flow across the watershed boundary, be pumped for potable water supply (PWS) and irrigation, or percolate into underlying aquifers. Residual water is stored in the aquifer. Similar processes occur in each of the deeper aquifers.

Methods

Data from the MIKE SHE/MIKE11 model results were extracted and processed to create water budgets for the entire study area and each of the watersheds. Water budgets were prepared for a wet and a dry year relative to average annual conditions and for the simulation period of January 1, 2002, through October 31, 2007. Budgets were developed for different time periods based on data availability. Finally, seasonal water budgets were developed for each watershed.

Results for Study Area

Average water year and seasonal water budgets were generated for each of the watersheds in Collier County. The average water year budget for the entire study area is shown in Figure 1-3 and indicates that rainfall during the 4-month wet season represents about 54 percent of the total annual amount and that most is lost through evapotranspiration (ET), which ranges between 50 and 60 percent in the wet season for all watersheds. During the dry season, ET losses equal precipitation in all watersheds except Golden Gate – Naples Bay. In this watershed, ET is about 80 percent of precipitation due to the high level of urban development, as water is quickly routed to the drainage network.

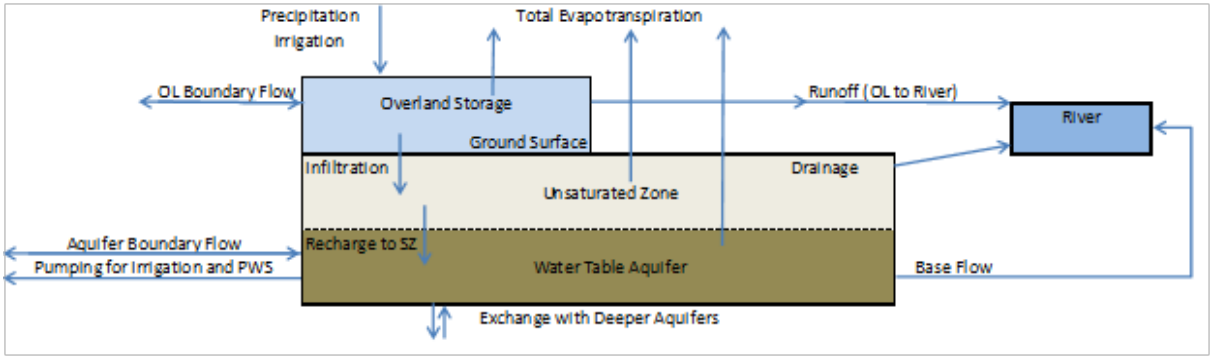

Figure 1-2. Surface Water Flow Schematic

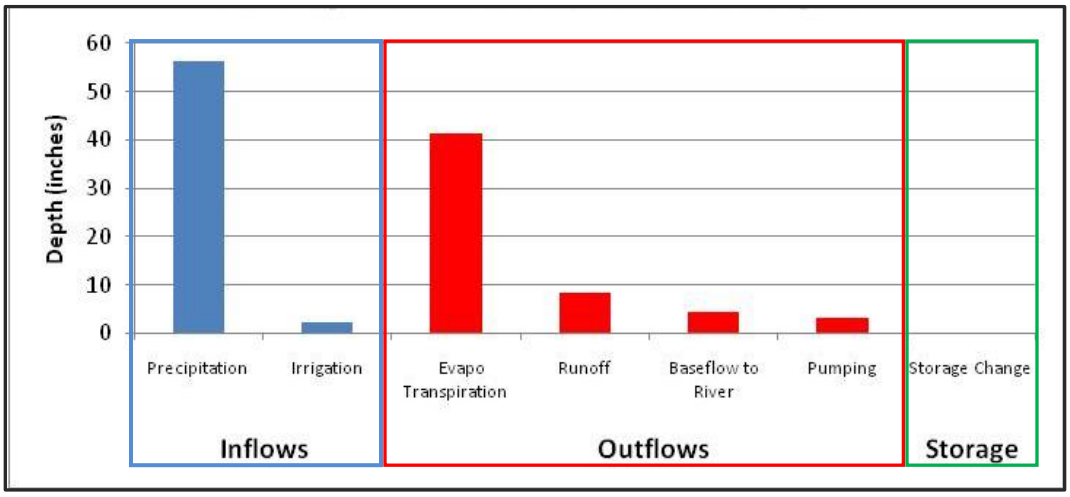

Figure 1-3. Average Water Year (2003–2007) Water Budget

Runoff and base flow are important components of the water budget and represent about 15 and 8 percent of annual rainfall (8.3 and 4.7 inches, respectively): the volume of groundwater that enters the canal network as base flow makes up approximately 36 percent of the total fresh water discharged into the canals. During the wet period, runoff is about 70 percent of the total water contributions to the canal network. In the dry season, the runoff volume declines to about 44 percent of the total contribution to the canals. Therefore, most of the canal flow is base flow, and is explained by the response of runoff to varying meteorological conditions, while base flow is relatively stable. The ratio of average runoff to average rainfall ranges from 20 percent in the wet season to 6 percent in the dry season. On the other hand, baseflow (wet season = 2.62 inches and dry season = 1.93 inches) remains at about 8 percent of rainfall. Dry season irrigation accounts for 85 percent of the annual irrigation demand.

Finally, the water budget also includes watershed storage. Change in storage as an annual average is negligible: about 2.5 inches of storage is lost in the dry season, but that volume is recovered in the wet season.

To assess system characteristics under critical conditions, water budgets were developed for both the driest dry season and the wettest wet season in the simulation period. Total precipitation during this totaled about 17 inches, or about 33 percent less than the average dry season rainfall for the entire simulation period.

Results confirm that the change in runoff volume is much larger than the change in precipitation. Results of the annual and seasonal water budgets indicate that management of both runoff and baseflow are critical to reducing the volume of water discharged to the estuaries. During the dry season, reduced baseflow to the canal network appears to be of primary importance.

During extreme dry weather, irrigation and pumping for PWS increase substantially and watershed storage decreases substantially. Similar to the annual average analysis, irrigation and pumping are drastically reduced during extreme wet weather conditions and the watershed storage is quickly recovered.

Results for Watershed

Cocohatchee-Corkscrew Watershed. Model results indicate that the annual average runoff volume is approximately 14 percent of rainfall, mostly from urban and agricultural development. For example, the 2003 wet season results indicate that runoff was more than 9 inches, of which 8.5 inches came from urban and agricultural development. The average water year budget for the watershed is shown in Figure 1-4.

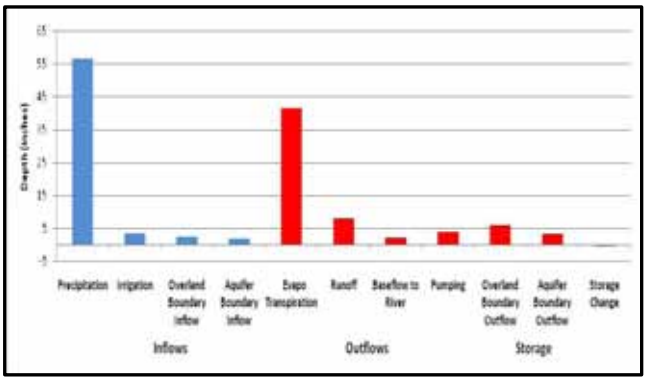

Figure 1-4. Average Water Year Budget – Cocohatchee-Corkscrew Watershed

Water runoff contributions from natural areas are small because most water is stored in Corkscrew Swamp. In addition, there is a large component of overland runoff flow that leaves the Cocohatchee-Corkscrew watershed and enters the Golden Gate–Naples Bay, Faka Union, Okaloacoochee/SR 29, and Fakahatchee watersheds during large rainfall events due to the little difference in elevation at the watershed ridges. In terms of baseflow, the amount relative to runoff is only half of that computed for the entire study area. This can be attributed to the low density of canals in the watershed.

Golden Gate-Naples Bay Watershed. The most conspicuous feature of this watershed is that baseflow is the primary source of water to the canals and often makes up more than 70 percent of the dry season flows. This can be attributed to the high density of canals in the watershed. Reducing base flows to the canals may substantially reduce the volume of water discharging to the Naples Bay estuary. The average water year budget for the watershed is in Figure 1-5.

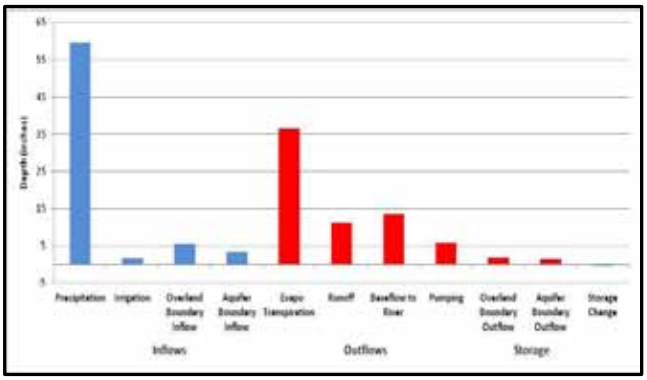

Figure 1-5. Average Water Year Budget – Golden Gate-Naples Bay Watershed

Runoff exceeds 19 percent of rainfall and occurs primarily during the rainy season. As in the Cocohatchee – Corkscrew watershed, most of the runoff is from coastal urban development. The volume of water leaving the watershed via overland and aquifer flow is low and is directly influenced by the canal network that drains the Water Table aquifer and directs water to the estuary.

Rookery Bay Watershed. The Rookery Bay watershed has urban development west of the Henderson Creek Canal, while the central portion of the watershed is mostly undeveloped and includes Henderson Strand and portions of the Picayune Strand State Forest. The southeast portion of the watershed is agricultural. In general, the proportion of runoff relative to precipitation (11 percent) is low compared to the other watersheds and is most likely due to the lack of development in large parts of the watershed. Water budget results are in Figure 1-6.

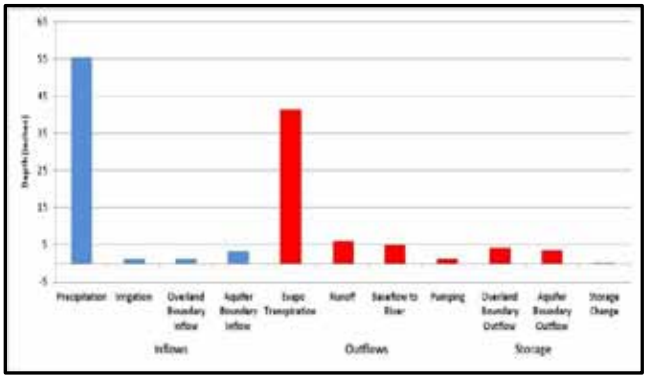

Figure 1-6. Average Annual Water Budget – Rookery Bay Watershed

Seasonally, surface water runoff makes up 60 percent of canal flow during the wet season and base flow contributes more than 70 percent of canal flow during the dry season. Wet season runoff is due primarily to urban and agricultural areas; while dry season base flow contributions are primarily in the Henderson Creek Canal.

Faka Union, Okaloacoochee/SR 29, and Fakahatchee watersheds. The northern portion of the Okaloacoochee/SR 29 and Fakahatchee watersheds include large areas of agriculture, while the northern part of the Faka Union watershed includes more rural residential areas. The remainder of the watershed consists of wetlands or other natural areas. However, portions of the Golden Gate canal network drain large portions of the natural areas in the southern Faka Union watershed. The average water year budget for the watershed is shown in Figure 1-7.

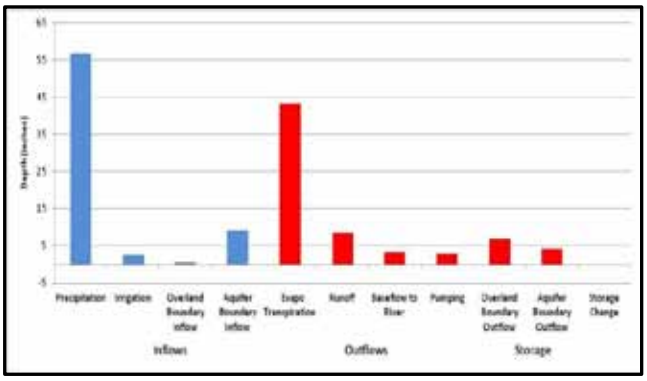

Figure 1-7. Average Water Year Budget – Faka Union, Okaloacoochee/SR 29, and Fakahatchee Watersheds

In the wet season, base flow in these watersheds is equal to approximately 120 percent of runoff, but during the dry season, the volume of base flow is more than 7.5 times that of runoff. Model results indicate that base flow is primarily in the Faka Union watershed, although there are base flow contributions to the State Road 29 Canal in the Okaloacoochee/SR 29 watershed. The Picayune Strand Restoration Project is expected to greatly reduce the volume of base flow in these combined watersheds.

Water budget results indicate a small loss in stored water over the simulation period. This is possibly the result of high base flow contributions to the canal network in the Faka Union watershed or groundwater pumping for potable water supply and agricultural irrigation in the northern parts of the study area. Further site specific analyses would be required to quantity actual causes of the storage loss.

Conclusions

Stormwater runoff and groundwater discharges to the canal network via base flow are critical water budget processes in the watershed as a whole. Management actions that alleviate impacts of increased development are necessary to reduce the adverse effects of the existing, limited conveyance capacity of the canal system.

- Annual and seasonal average stormwater runoff volumes are greatly influenced by precipitation and, consequently, relatively small variations in precipitation result in large changes in the volume of runoff.
- Base flow contributions increase with canal density. Reducing base flow would alter the volume and timing of water delivered to the estuaries.
- Based on the relationship of base flows and difference in ground and surface water elevations (Figure 1-8), managing canal stage to groundwater elevations is important to reducing base flows to the canals.
- Existing control structures limit the ability to stage water at higher elevations in canals and new and replacement structures that can be changed with seasonal groundwater head elevations are recommended. Greater flexibility in managing water levels in the canals to reduce base flow contributions to estuaries should be part of the design for new or replacement control structures.

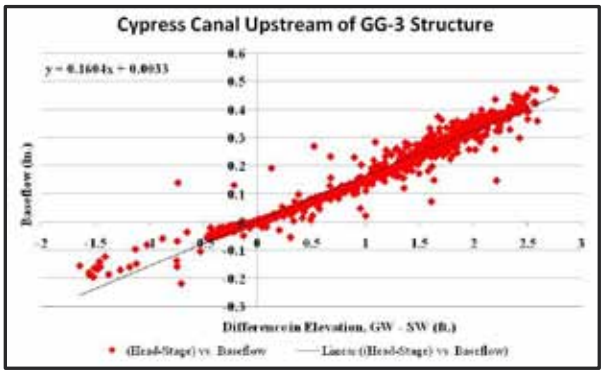

Figure 1-8. Relationship of Baseflow and (Head – Stage) Elevation Difference

- No net loss or gain in watershed storage was documented for the simulation period. Annual storage losses in the dry season corresponded with high base flow contributions and pumping from the Water Table and Lower Tamiami aquifers for potable and irrigation water supply needs.
- Lowering the water surface in the canal network prior to large storm events is an important management tool to provide storage within the canal network and to mitigate flooding risks.
- Water inflow and outflow patterns among watersheds are similar. The notable exception is the large base flow and runoff component in the Naples-Golden Gate basin when compared with the other watershed.

1.2: In-Stream Surface Water Quality

In-stream water quality was evaluated in the context of the Total Maximum Daily Load (TMDL) impairment process. Results are consistent with FDEP's findings. Detailed site specific analyses are necessary to establish cause-effect relationships for the potential impairments.

Introduction

In-stream water quality in the study area was characterized based on comparisons to the State's water quality standards per FDEP's TMDL impairment analysis. Screening criteria were used for parameters that do not have a numerical standard. Analyses included: 1) review of relevant reports from local, state, and regional agencies, 2) review of relevant water quality data, 3) identification of water quality concerns that may require source verification or restoration measures., 4) identification of factor(s) that may affect conclusions related to TMDL impairment, and 5) an overview of factor(s) that strongly influence water quality in Collier County's watersheds.

Methods

In-stream water quality was evaluated for potential impairments by first characterizing long term water quality in each of the six watersheds and then evaluating water quality with respect to FDEP thresholds for water quality impairments. Water parameters examined included color, dissolved oxygen, chlorophyll-*a*, total nitrogen, total phosphorus, iron, fecal coliform bacteria, and un-ionized ammonia.

Results

Per the data analysis, the fourteen FDEP identified water body identification (WBID) basins previously verified as impaired by FDEP were confirmed to be impaired. An additional 16 WBIDs were identified as potentially impaired, or "basins of concern" by FDEP standards. Impairments relate primarily to low dissolved oxygen concentrations (Figure 1-9). The potential new impairments, which will have to be verified by FDEP, may be due to the use of additional data available for this study, compared to the FDEP databases, as well as differences in the timeframe used in the analysis. The data analysis indicated also that with the exception of Lake Trafford (Figure 1-10), watersheds are not characterized by high levels of total nitrogen or total phosphorus. Chlorophyll-*total* phosphorus, and total suspended solids concentrations were within the range of the regulatory standards and screening levels for all six watersheds. Therefore, further study to be conducted as part of the TMDL program is necessary prior to the County committing to implement water quality improvement projects.

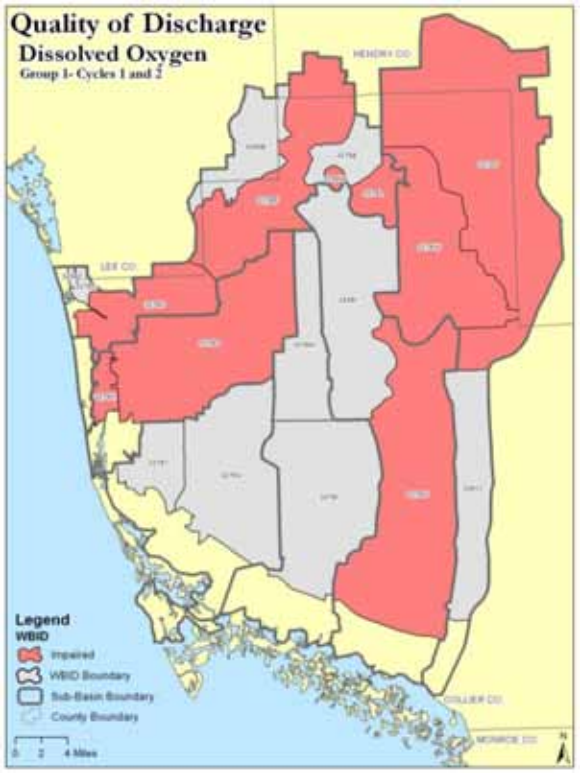

Figure 1-9. WBIDs Impaired for Dissolved Oxygen

Another impairment parameter is fecal coliforms. Before any action is taken to address this issue, the County should wait for further guidance by FDEP. The agency is looking into this issue on a statewide basis.

Cocohatchee-Corkscrew Watershed

Water quality assessments conducted as part of this project indicated three potential parameters of concern: color, dissolved oxygen, and fecal coliform bacteria. Statistical data analyses were conducted to identify the most likely cause of the low dissolved oxygen levels in the watershed. Those analyses indicated that color resulting from discharges from wetland systems may be the primary causative factor. This finding applies primarily to the Corkscrew marsh and potentially the area downstream from the marsh. Nutrient loading from urban runoff may also contribute to low dissolved oxygen levels in the western portion of the watershed. The area around Immokalee is likely impacted by urban and agricultural runoff.

Figure 1-10. Collier County Nutrient Impairment

Groundwater is also a potential contributor to low dissolved oxygen levels as baseflow represents about 23 percent of the average annual flow and 36 percent of the dry season flow. Baseflow occurs primarily in the areas near the coast and into the Cocohatchee Canal adjacent to Immokalee Road.

A review of water quality data completed during this project indicated that concentrations of chlorophyll-*a* and nutrients have been below FDEP's screening criteria, including those in the Lake Trafford basin. The results for Lake Trafford are most likely due to the sediment removal projects being conducted in the lake. Continued coordination with FDEP is necessary to confirm this finding and define the next courses of action in the TMDL process.

Golden Gate-Naples Bay Watershed

Based upon the evaluation of the long term stations within the watershed, 3 parameters of "potential concern" were identified: dissolved oxygen, color, and iron. The extensive development (61 percent) of the watershed, significant baseflow contributions, and runoff from forested areas may all influence dissolved oxygen concentrations in the watershed. Groundwater, which is low in dissolved oxygen concentration, represents 58 percent of the annual flow and 70 percent of the dry season flow from the Golden Gate – Naples Bay watershed However, as potential man-made impacts cannot be disregarded, further site-specific analyses in coordination with FDEP are required to verify the dissolved oxygen impairments and to identify the causes of the impairment. In terms of the iron impairment, results from a computerized water quality model of the watershed, discussed in Volume 4, have indicated that it may be the result of groundwater contributions to the canal network, although human activities may also be sources of high iron concentrations. Iron concerns and recommended courses of action will need to be defined during the next FDEP TMDL assessment cycle.

Rookery Bay Watershed

None of the WBIDs that comprise the Rookery Bay watershed were identified by FDEP as impaired for dissolved oxygen. However, based on the evaluation of the long term water quality data, dissolved oxygen was identified as being of "potential concern". Statistical relationships conducted as part of this project, which are described in Volume 4, suggest that total phosphorus may be indirectly responsible for the low dissolved oxygen by stimulating algae growth that in turn may deplete waters of oxygen. However, the statistical relationship is weak. In addition, chlorophyll-*a* and nutrient values were found to be consistently below FDEP's screening criteria. Pollutant loads from developed land uses, significant baseflow contributions, and runoff from forested areas may all influence dissolved oxygen concentrations in the watershed. Further analyses are needed to identify the actual cause of the low dissolved oxygen concentrations.

Faka Union, Fakahatchee, and Okaloacoochee/SR 29 Watersheds

Some of the WBIDs in these watersheds have been found impaired for dissolved oxygen, fecal coliform, and iron. The evaluation of the long term water quality data from this watershed confirmed the impairments.

Regression analyses conducted as part of this project (see Volume 4) suggest that low dissolved oxygen concentrations in discharge waters in the watershed may be due to color. That is consistent with the characteristics of these watersheds, as 86 percent of the area is comprised of natural areas. High color is typical of water discharged from forested areas.

Other factors that can affect dissolved oxygen concentrations are baseflow contributions and the discharge of pollutants from areas impacted by human activity. More detailed studies are necessary to define the actual cause of the impairment.

In terms of iron concentrations, similar to the conditions in the Golden Gate- Naples Bay watershed, baseflow is a likely source of the elevated concentrations, although human activity sources should also be considered and evaluated. The presence of areas where hydrologic processes have been altered (i.e., the Southern Golden Gate Estates drainage canals) suggests that further analysis is necessary to determine the actual cause of the observed impairment.

Conclusions

The FDEP has identified multiple impairments of individual WBIDs for several water quality parameters in Collier County. The data analyses for individual WBIDS conducted as part of this project, which use all the FDEP data plus new data collected specifically for this project, are consistent with the FDEP findings. Additional potential water quality impairments were also identified. Impairments for parameters such as dissolved oxygen and iron could be attributed to several causes including pollutant loading from developed areas, water color from natural landscape discharges, and groundwater contributions (baseflow) to the surface water flows.

The data analyses conducted by either FDEP as part of the TMDL implementation process or as part of this study are not sufficient to determine impairment. Establishment of a cause versus effect relationship through more detailed analysis is necessary. Those efforts should be coordinated with FDEP. Ideally conclusions are reached as part of the work necessary prior to the TMDL development stage of the TMDL program.

1.3: Surface Water Pollutant Loading

Net surface water pollutant loads were quantified for priority watersheds in Collier County. Nutrient loads were higher in older urban areas, golf courses, and agriculture due to fertilizers. Higher biological oxygen demand and metals loads corresponded with low/medium residential areas and urban areas, respectively, and no treatment facilities.

Introduction

Net pollutant loads, i.e., pollutants that are discharged into the primary and secondary drainage network, were calculated for the entire study area. The pollutant loads provide a means of examining the relative contribution o f land use types to total pollutant loads as well as a baseline against which to measure the effects of improvement projects. The calculation of pollution loads addressed strictly those resulting from human activities in the watershed given the CCWMP focus on mitigation of those impacts.

Methods

Pollutant loads to the receiving waters were estimated using a Pollutant Loading and Removal Model based on the U.S. Environmental Protection Agency Method. By this method, average annual pollutant loads are calculated by the product of average annual stormwater runoff volume times an event mean concentration (EMC). The EMC represents the estimated concentration of a pollutant in the discharge from a particular land use.

Pollutant loads were estimated for the parameters of concern identified in the Southwest Florida Feasibility Study (SWFFS): total suspended solids, total nitrogen, total phosphorus, biological oxygen demand, copper, zinc, and lead. The MIKE SHE / MIKE 11 hydrologic and hydraulic (H&H) existing conditions model (ECM) was used to estimate runoff volumes. For consistency with the SWFFS, the EMCs were also assumed to be the same as those used in that study. However, they were checked with other data available from the literature. No significant differences were noted. A recommendation from the analysis is that additional data be collected through wet weather sampling monitoring to better define the EMCs associated with agricultural discharges given the variations in runoff pollution control practices.

Gross pollutant loads, defined as loads generated in a watershed, were calculated for each cell in the model domain. These loads were then modified to reflect the pollutant removal effect of Best Management Practices (BMPs) for stormwater treatment, such as detention ponds, which are typical treatment systems. The net loads are those that enter the drainage network, and therefore discharge into the estuary systems.

Results

Table 1-1 provides a summary of predicted nutrient pollutant loads by watershed, which are critical for TMDL impairments analysis. The areas predicted to contribute the largest pollutant load are older developments, golf courses, and agriculture. Further details on areas of concern are provided later in this report and in Volume 4. The nutrient source may be related to excessive use of fertilizers. It must be noted that the largest EMC value for nutrients in the SWFFS analysis is for agricultural land uses. As indicated previously, further wet weather sampling is recommended to better define areas of agricultural nutrient concern.

Table 1-1. Predicted Surface Water Pollutant Loads

Watershed	Total Nitrogen		Total Phosphorus	
	Tons/year	lbs/acre/yr	Tons/year	lbs/acre/yr
Cocohatchee - Corkscrew	160	2.50	30	0.46
Golden Gate - Naples Bay	120	2.75	19	0.42
Rookery Bay	70	1.47	13	0.26
Faka Union, Fakahatchee, Okaloacoochee SR29	452	2.01	90	0.40

The magnitude of the tabulated loads can be assessed by comparing them to the loads from a single land use category. For example, using the same calculation methodology, the average loads per acre from a medium density residential area with no runoff treatment are 4.39 and 0.73 lbs/acre/year for TN and TP, respectively. Given that the loads represent only those from human activities but distributed over the entire watershed area, results indicate the presence of areas of critical concern.

1.4: Hydrogeology

Understanding the interaction of the surface water and the groundwater systems and the highly dynamic transfer of water between one system and the other is a critical aspect of the watershed management planning process

The groundwater resource in Collier County is essential to meet agricultural and urban needs, as well as to maintain the characteristics of the natural system. Therefore, understanding the interaction of the surface water and the groundwater systems and the highly dynamic transfer of water between one system and the other is a critical aspect of the watershed management planning process.

In the MIKE SHE Existing Conditions Model (ECM) developed as part of this project, the subsurface model includes the unsaturated and saturated zones. The unsaturated zone in South Florida is shallow and the soils are sandy and highly permeable, except in wetlands where a surface deposit of fine-grained sediment may be present. Soil porosities are typically high even compared to those for regular sandy soils. The ECM was based on the soil types and properties from the Southwest Florida Feasibility Study (SWFFS). In the SWFFS, soil types were classified into six different hydrologic response groups. Hydraulic parameters were defined for each soil profile.

The saturated zone has a complex stratigraphy. The primary aquifers that underlie Collier County in order of increasing depth: Water Table, Lower Tamiami, Sandstone unit of the Upper Hawthorn (Sandstone), and the Mid-Hawthorn. These hydrogeologic units are generally comprised of stratified layers of porous media having high transmissivities with relatively thin layers of silt and clay rich units that comprise the confining units.

In the ECM, each aquifer is represented as individual computational layers. Each computational layer is made up of an aquifer and overlying confining unit. Generally the upper aquifers exhibit significant interaction. Potentiometric elevation data from existing monitoring wells indicate variable amounts of communication between the Mid-Hawthorn and the overlying Sandstone Aquifer. In the northern parts of the study area, the potentiometric surface of the Mid-Hawthorn is similar to the overlying layers, indicating less confinement. However, the heads in the few wells screened in the Mid-Hawthorn in the southern part of Collier County indicate greater confinement. In the southern part of the County, the Mid Hawthorn is very thick and in the north it is relatively thin. The confinement is the result of reduced transmissivity, a function of the vertical conductivity and thickness of the unit. Since the vertical conductivity is uniform throughout the computational layer, the confinement is the result of the increased thickness of the aquifer layer.

The primary hydrogeologic parameters used in the ECM, horizontal and vertical hydraulic conductivities, leakance, and storage parameters were derived from the SWFFS and included revisions made during the calibration of subsequent modeling efforts, such as the Lee County DR/GR model. The hydrogeologic parameters are associated with each computational layer, which is made up of an aquifer and overlying confining unit. Therefore the hydrogeologic parameters are composites of parameters representing the combined parameter estimates of the geologic units that make up each computational layer. Groundwater budgets and annual and seasonal groundwater levels for current conditions in Collier County watersheds were developed using the ECM. This groundwater assessment provides a means of identifying potential locations for future water supply withdrawals that also minimize impacts to natural systems such as wetlands.

1.5: Groundwater Quantity

A water supply analysis was completed for Collier County to assess the change from pre-development to existing conditions and the effects of increased urban and agricultural water supply demands with respect to minimum aquifer levels. Results indicate groundwater level declines of more than 5 feet in some parts of the County and additional declines are anticipated if withdrawals are increased.

Introduction

The Collier County Existing Conditions Model (CC ECM) was used to simulate the hydrodynamics of the Collier County aquifer systems. Groundwater budgets were developed to assess aquifer conditions including the lateral flow of water across and within model basin boundaries, and the flow of water between aquifers. Annual and seasonal aquifer specific water budgets were generated for the model simulation period of January 1, 2002, through October 31, 2007. Atkins believes that the model is adequate to assess the conditions in Collier County; however, it is recognized that the groundwater calibration, primarily in the deeper aquifers, may be improved with additional effort. A detailed discussion of model limitations is presented in the Model Calibration Report

A conceptual groundwater budget (Figure 1-11) illustrates inflows (primarily percolation to underlying layers), outflows (discharge to canals, pumping, etc.), and storage. Water that infiltrates into the soils may be assimilated by vegetation or percolate into the upper portion of the Water Table aquifer. The water can be removed from the Water Table aquifer by vegetation, lateral flows, water supply withdrawals, or percolation to adjacent aquifers. Any residual water is stored in the aquifer(s).

Average annual and seasonal (wet and dry) groundwater budgets were developed for each aquifer system. The budget included both the natural processes and groundwater demands. Average annual groundwater elevations, as well as annual fluctuations were also calculated and mapped. The analysis considered differences in seasonal elevations to identify areas of extreme drawdown.

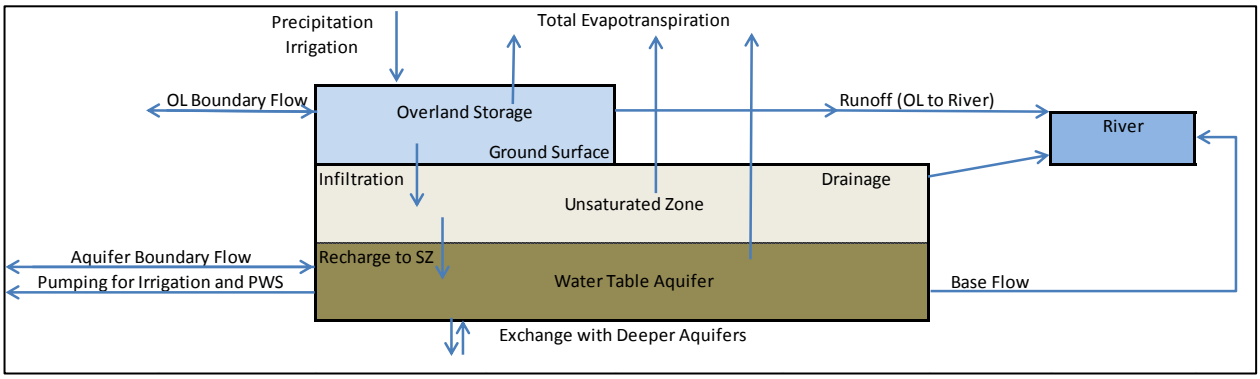

Figure 1-11. Conceptual Groundwater Budget

Groundwater Demands

An important component of the groundwater budget is water demands, which include public supply, private domestic consumption, and irrigation for agriculture and golf courses. The average annual public water demand over the ECM simulation period was about 46 mgd. In the CC ECM, pumping rates were defined by time series of reported monthly pumping for each well. The majority of potable water supply wells are located in the Golden Gate-Naples Bay, Rookery Bay, and Faka Union watersheds (Figure 1-12), but most water supply withdrawals are from the Lower Tamiami aquifer from wells located in the Golden Gate watershed.

The domestic groundwater demand from private wells (Figure 1-13) amounts to about 7.5 mgd and represents approximately 16 percent of the public supply demand.

Agricultural and golf course irrigation (Figure 1-14) use substantial amounts of water throughout Collier County. In the CC ECM, irrigated agricultural areas were defined from water use permits issued by the SFWMD. Model results indicated that irrigation for agriculture is on the same order of magnitude as public supply. The majority of the irrigated agricultural and pasture lands are in the northeastern part of the County in the Cocohatchee-Corkscrew, Faka Union, Fakahatchee, and Okaloacoochee/SR 29 watersheds. The golf course irrigation demand is about 2.5 mgd. Golf courses are located in the urbanized coastal areas in the Golden Gate – Naples Bay watershed.

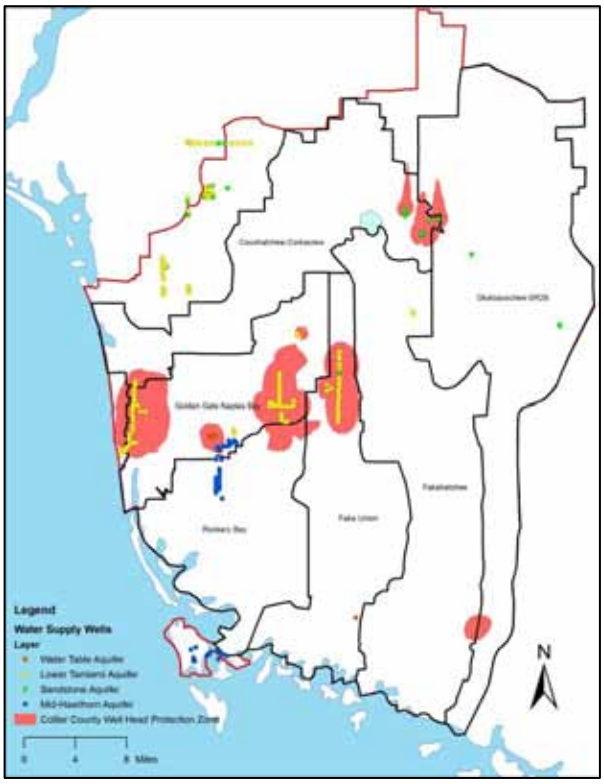

Figure 1-12. Well Head Protection Zones and Public Supply Wells

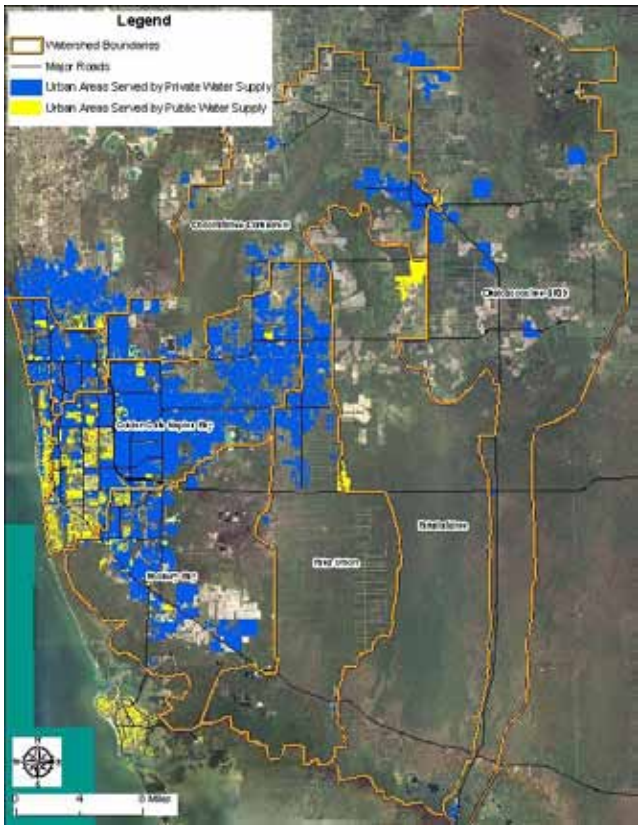

Figure 1-13. Urban Water Supply Distribution

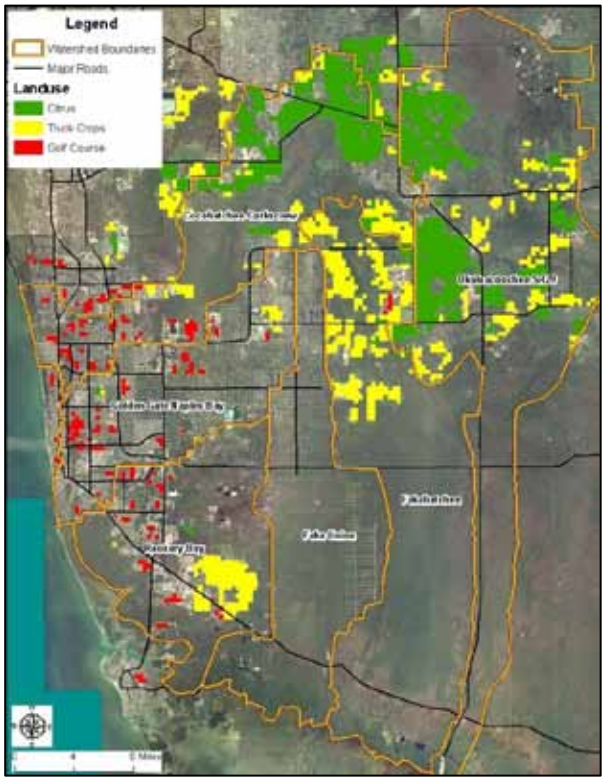

Figure 1-14. Agricultural and Golf Course Irrigated Areas

Groundwater Budget Results

Budgets were developed for each aquifer system and included recharge, transfer of water to adjacent aquifers, losses to baseflow, and pumping. As indicated previously, groundwater flows in the Water Table aquifer are influenced by the operations of the control structures. The Big Cypress Basin and Collier County, respectively, maintain the primary and secondary canal system through a rigorous water control operation schedule to limit groundwater inflows into the surface water system. Table 1-2 provides a summary of the groundwater budget results. Following are descriptions of conditions by aquifer.

Water Table aquifer

It is estimated that about 15 inches of water infiltrates from the unsaturated zone into the Water Table aquifer. An important result of the assessment is that approximately 26 percent is lost as baseflow to the drainage canal system. The average annual water transfer to the Lower Tamiami aquifer is approximately 8.5 inches, but almost the same amount (7.65 inches) flows back to the water table, depending on pumping conditions. During the dry season, the amount of water percolating down into the Lower Tamiami aquifer exceeds the amount entering the Water Table aquifer from the overlying soils and, together with increased water withdrawals, results in an average net loss (2.19 inches) of aquifer storage. Most of that is recovered during the wet season. Annually, an average 0.44 inch of water is pumped from the Water Table aquifer. Close to 90 percent of the pumping occurs during the dry season when demand is higher.

The Cocohatchee-Corkscrew watershed had the greatest proportion of annual average recharge to the Lower Tamiami aquifer: more than 25 percent of the water entering the Water Table aquifer reached the Lower Tamiami aquifer. Infiltration was lower in the Golden Gate Naples Bay (19 percent) and Rookery Bay watersheds (10 percent). In the eastern watersheds, there is net upward movement of water from the Lower Tamiami aquifer into the Water Table aquifer due to the difference in head elevation resulting from evapotranspiration from the extensive wetlands in the watersheds. The canal network also influences groundwater elevations and contributes to long term changes in the water table elevation.

The seasonal average groundwater surface elevation maps for the Water Table Aquifer and Lower Tamiami aquifers indicate a shift in the isohyetal lines. This is most evident is near the coast in Naples and in the Rookery Bay and Faka Union watersheds where the 5- and 10-foot elevation contours shift as much as 3 miles further inland during the dry season. This shift is influence by increased groundwater pumping and may also be indicative of potential risks to water supply due to salt water intrusion.

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Lower Tamiami aquifer

As indicated above, the average annual inflow to the Lower Tamiami aquifer from the water table aquifer is 0.85 inches. In addition, there is a net annual inflow from the underlying Sandstone Aquifer of 1.5 inches. The net inflow appears to be driven by water withdrawals for potable water and irrigation that create a hydraulic gradient. There is a net loss of water (1.9 inches) from the Lower Tamiami to the Sandstone aquifer in the Cocohatchee-Corkscrew watershed, suggesting that this watershed is a primary source of recharge to the Sandstone aquifer system. There are net water inflows to the Lower Tamiami from the Sandstone aquifer in the Golden Gate- Naples Bay (0.14 inch), Rookery Bay (0.78 inch) and the eastern (3.43 inches) watersheds. In the Golden Gate-Naples Bay and Rookery Bay watersheds, the net gain is likely the result of withdrawals for water supply. The net loss in the eastern watersheds is probably due to agricultural pumping to meet irrigation needs. Although not as drastic as in the Water Table aquifer, the Lower Tamiami also loses about six (6) percent of the inflow as drainage canal baseflow.

Sandstone aquifer

No annual change in water storage was identified for the Sandstone aquifer, indicating equal seasonal inflows and outflows. There is a net loss of 1.5 inches of water from the Sandstone aquifer to the overlying Lower Tamiami aquifer, and a net gain of 0.3 inches from the underlying Mid-Hawthorn. The estimated net annual loss of water is 0.76 inch and is due primarily due to dry season withdrawals for water supply. Boundary inflows account make up for the losses and results in no net change in storage.

In this aquifer system, the Cocohatchee-Corkscrew watershed has a net inflow of water from the Lower Tamiami aquifer of 1.93 inches annually, and a net loss to the Mid-Hawthorn Aquifer of 0.05 inch annually. The other watersheds showed a net loss to the overlying Lower Tamiami aquifer and a net gain from the underlying Mid-Hawthorn Aquifer. The inflows from the Mid-Hawthorn are less than 1 inch annually and indicate little interaction between the Sandstone and Mid-Hawthorn aquifer systems

Table 1-2. Annual Water Year and Seasonal Budgets

Water Table Aquifer	Inflows (inches)				Outflows (inches)					Change in Storage
	Infiltration from Unsaturated Zone	Recharge from Canal Network	From Lower Tamiami	Boundary Inflow	Evapo-transpiration	Baseflow	Percolation to Lower Tamiami	Pumping	Boundary Outflow	
Average Water Year	14.93	0.35	7.65	0.31	9.92	3.90	8.50	0.44	0.68	-0.16
Average Wet Season	8.72	0.05	3.02	0.10	4.07	2.26	3.35	0.05	0.26	1.92
Average Dry Season	5.86	0.30	4.53	0.20	5.76	1.52	4.99	0.39	0.41	-2.19
Lower Tamiami Aquifer	**Inflows (inches)**				**Outflows (inches)**					**Change in Storage**
	Percolation from Surficial	Recharge from Canal Network	From Sandstone	Boundary Inflow	Baseflow	To Surficial	Percolation To Sandstone	Pumping	Boundary Outflow	
Average Water Year	8.50	0.08	2.81	2.65	0.80	7.65	1.31	2.13	2.13	-0.01
Average Wet Season	3.35	0.02	0.98	0.83	0.37	3.02	0.30	0.38	0.92	0.18
Average Dry Season	4.99	0.05	1.82	1.80	0.41	4.53	1.00	1.77	1.15	-0.19
Sandstone Aquifer	**Inflows (inches)**				**Outflow (inches)**					**Change in Storage**
	Percolation from Lower Tamiami		From Mid-Hawthorne	Boundary Inflow		To Lower Tamiami	Percolation to Mid-Hawthorne	Pumping	Boundary Outflow	
Average Water Year	1.31		0.39	2.20		2.81	0.09	0.76	0.24	0.00
Wet Season Average	0.30		0.10	0.74		0.98	0.04	0.07	0.05	0.00
Dry Season Average	1.00		0.27	1.47		1.82	0.06	0.69	0.17	0.00
Mid-Hawthorne Aquifer	**Inflows (inches)**				**Outflows (inches)**					**Change in Storage**
	Percolation From Sandstone			Boundary Inflow		To Sandstone		Pumping	Boundary Outflow	
Average Water Year	0.09			0.43		0.39		0.09	0.03	0.00
Wet Season Average	0.04			0.12		0.10		0.02	0.00	0.00
Dry Season Average	0.06			0.29		0.27		0.07	0.00	0.00

Mid-Hawthorn aquifer

The Mid-Hawthorn has little interaction with the overlying aquifer systems. Less than 0.3 inch of water moves between the Sandstone in Mid-Hawthorn Aquifers across the study area. Withdrawals from this aquifer are limited, but occur during the dry season. Most of the pumping is in the Golden Gate – Naples Bay watershed at the Collier County wellfield. Smaller volumes are pumped from the Rookery Bay and Cocohatchee-Corkscrew watersheds. There is no net storage change in the Mid-Hawthorn aquifer as a result of inflows and withdrawals.

Groundwater Aquifer Levels

Average annual and seasonal fluctuations in groundwater surface levels (elevations) were predicted and mapped for each of the aquifer systems.

Water Table aquifer

The gradient of the average annual groundwater surface (Figure 1-15) is approximately 0.8 foot/mile (0.016 percent) from the northeastern part of the county, north of Immokalee, to the southwest. The water surface gradient generally follows the topographic slope of approximately 1.0 foot per mile (0.020 percent). At a location north of Immokalee, the Water Table aquifer exceeds 30 feet in elevation, while groundwater elevations in the underlying Lower Tamiami aquifer only reaches these levels during the wet season, suggesting a perched water table. Predicted annual fluctuation in the Water Table aquifer (Figure 1-16) illustrates the difference between the average annual maximum groundwater elevation and the average annual minimum groundwater elevation. Red areas indicate greater fluctuation in the groundwater surface. These large fluctuations are attributed to groundwater pumping to meet potable water supply and irrigation demand during the dry season. The extents of the areas of high demand are related to the horizontal conductivity of the aquifers and connectivity to other aquifers.

Lower Tamiami aquifer

The average annual groundwater surface elevations and annual fluctuation in groundwater head elevations are mapped in Figures 1-17 and 1-18. Results indicate a high demand on this aquifer during the dry season in the Okaloacoochee/SR 29 and Fakahatchee watersheds, consistent with the agricultural and golf course withdrawals exceed 9 and 12 inches, respectively, from the Lower Tamiami aquifer during the dry season.

Sandstone aquifer

Average annual groundwater surface elevations are mapped in Figure 1-19. Similar to the Lower Tamiami aquifer, an area of higher groundwater elevations occurs north of Immokalee. Annual fluctuations in head elevations for the Sandstone aquifer (Figure 1-20) indicate a high demand on this aquifer during the dry season. The Lee County wellfield draws from the Sandstone aquifer and is the likely cause of the drawdown in the northern portion of the Cocohatchee-Corkscrew watershed. However, there is little pumping directly from the Sandstone aquifer in the Faka Union and Okaloacoochee/SR 29 watersheds, indicating water is migrating from the Sandstone aquifer into the Lower Tamiami aquifer in response to withdrawals. In fact, more than 3 inches of groundwater migrates from the Sandstone to the Lower Tamiami aquifer during the average dry season.

Mid-Hawthorn aquifer

The depression in the Mid Hawthorn Aquifer at the boundary between the Golden Gate – Naples Bay and Rookery Bay (Figures 1-21 and 1-22) is likely associated with operations of the Mid-Hawthorn wellfield. This pattern of drawdown was not observed in the Sandstone aquifer; indicating that there is little interaction between the Mid-Hawthorn Aquifer and the overlying Sandstone aquifer.

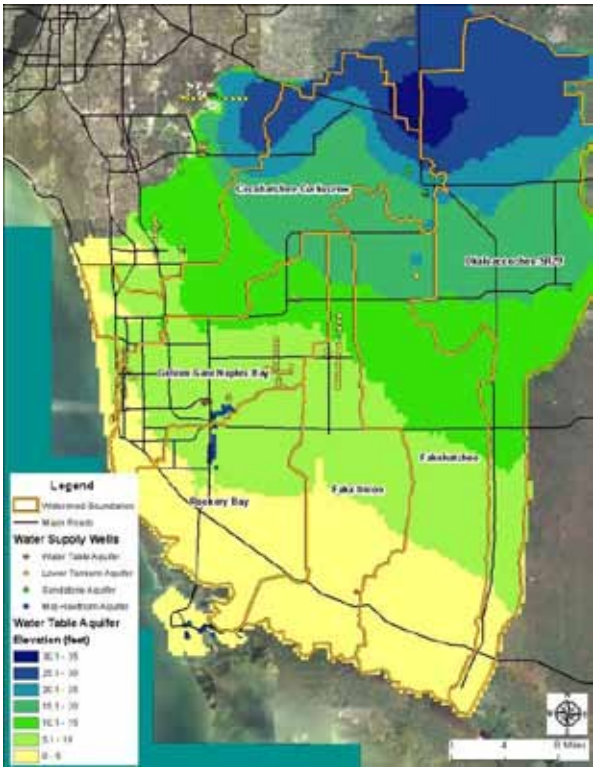

Figure 1-15. Water Table Aquifer Average Annual Groundwater Head Elevation

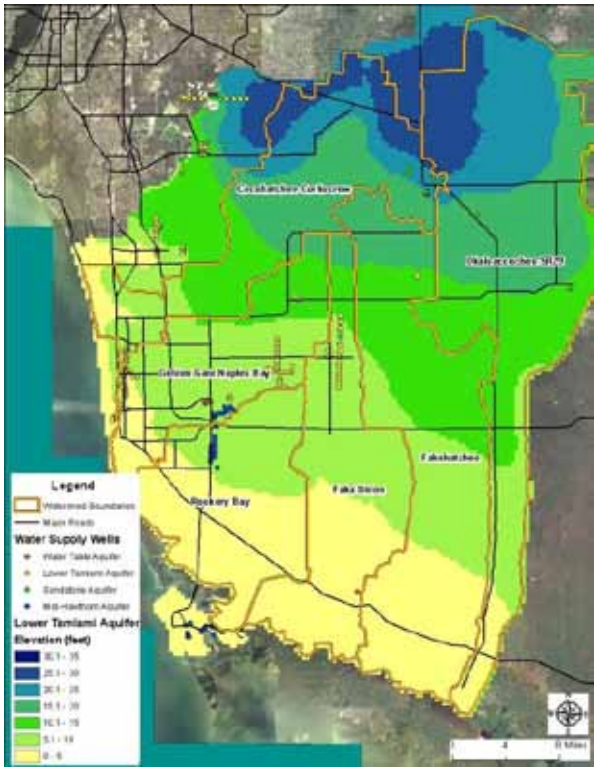

Figure 1-17. Lower Tamiami Aquifer Average Annual Groundwater Head Elevation

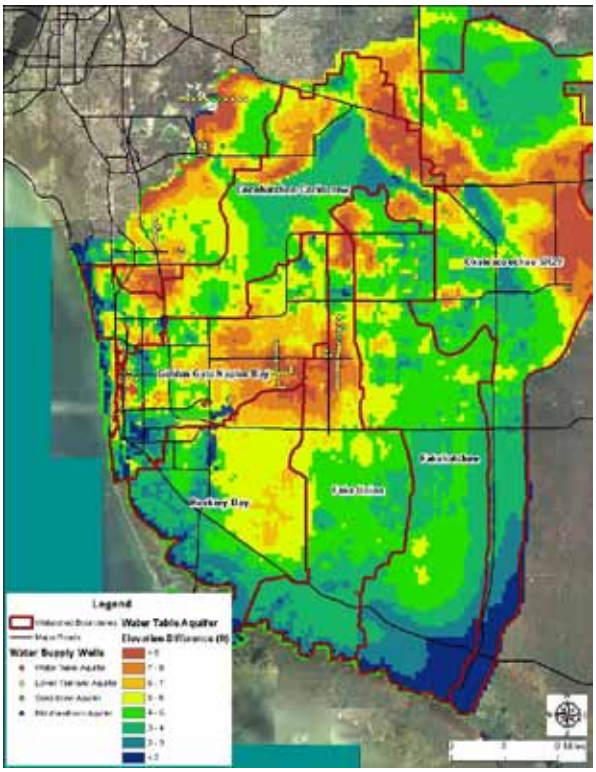

Figure 1-16. Water Table Aquifer Average Annual Groundwater Fluctuation

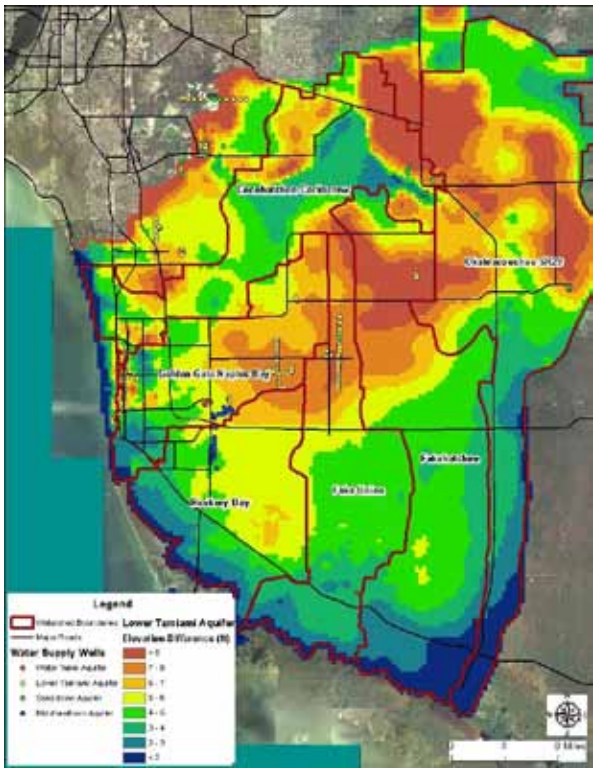

Figure 1-18. Lower Tamiami Aquifer Average Annual Groundwater Fluctuation

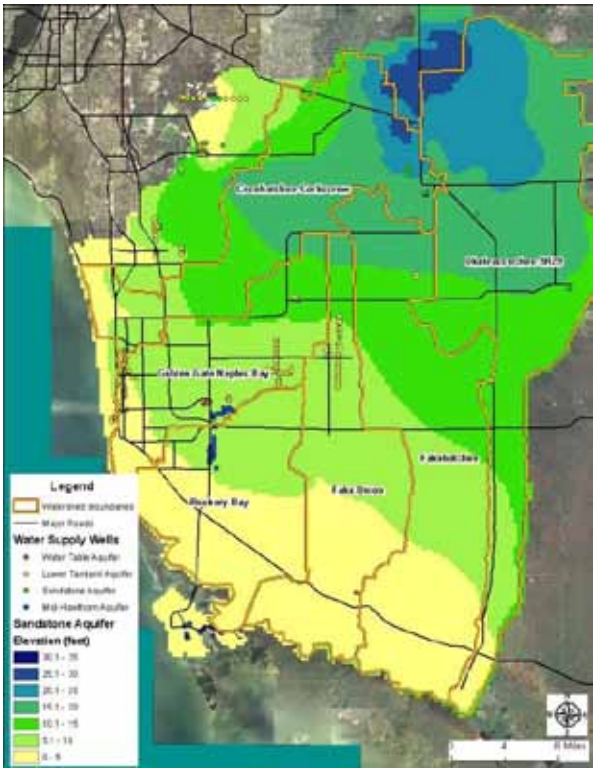

Figure 1-19. Sandstone Aquifer Average Annual Groundwater Head Elevation

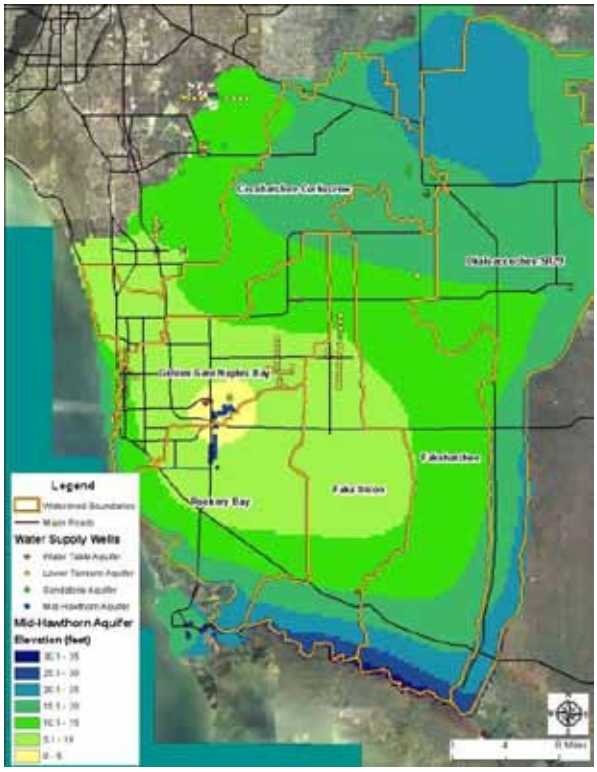

Figure 1-21. Mid-Hawthorn Aquifer Average Annual Groundwater Head Elevation

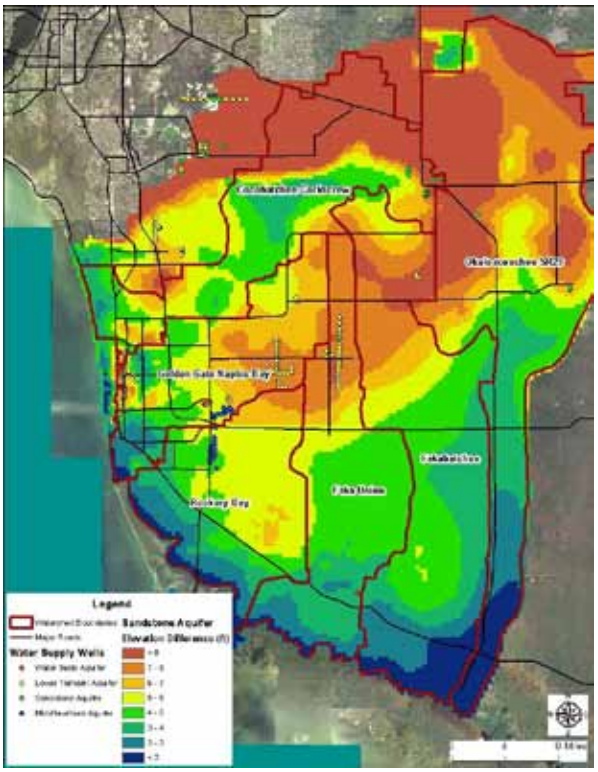

Figure 1-20. Sandstone Aquifer Average Annual Groundwater Fluctuation

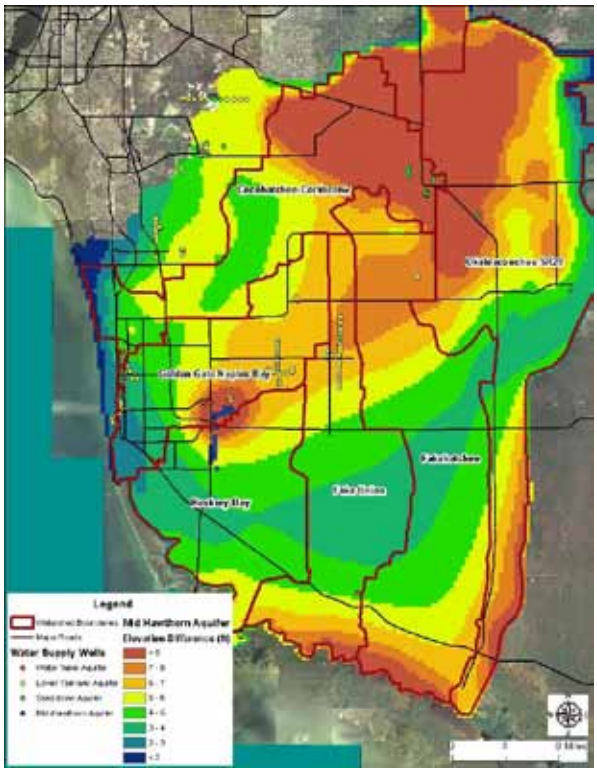

Figure 1-22. Mid-Hawthorn Aquifer Average Annual Groundwater Fluctuation

Comparison to Pre-Development Conditions

The overall effect of groundwater withdrawals was assessed by comparing groundwater head elevations for existing and pre-development conditions. The process consisted of comparing the average groundwater elevation water surface elevation or potentiometric head) simulated in the NSM (pre-development conditions) and the ECM (existing conditions). Results were mapped for the Water Table, Lower Tamiami, and Sandstone aquifers. The NSM did not include the Mid Hawthorn Aquifer and so no direct comparison was possible to assess drawdown impacts in the Mid Hawthorn Aquifer. In the Mid Hawthorn Aquifer, head elevations during periods of pumping were compared to head elevations during periods with no pumping.

Results indicated that groundwater levels have declined in the Water Table, Lower Tamiami, and Sandstone aquifers by more than 4 feet in portions of all six watersheds (Figure 1-23). For example, the "head difference", or change in groundwater elevation of the Water Table aquifer in the wellhead protection zone in the Golden Gate-Naples Bay watershed experienced a decline of 4 to 4.9 feet. Watershed most impacted by the declining groundwater levels are the Golden Gate-Naples Bay, Faka Union, and Okaloacoochee/SR 29. Impacts are less severe in the Rookery Bay and Fakahatchee watersheds because of the location of the existing wellfields.

Patterns of decline were similar among the aquifers and coincide with the location of the public supply wellfields and well head protection zones. Modeled drawdowns are somewhat greater in the Lower Tamiami and Sandstone aquifers (Figures 1-24 and 1-25). As with the other aquifers, the greatest drawdown in the Mid Hawthorn Aquifer was observed in the Mid Hawthorn well field in the southern portion of the Golden Gate-Naples Bay watershed.

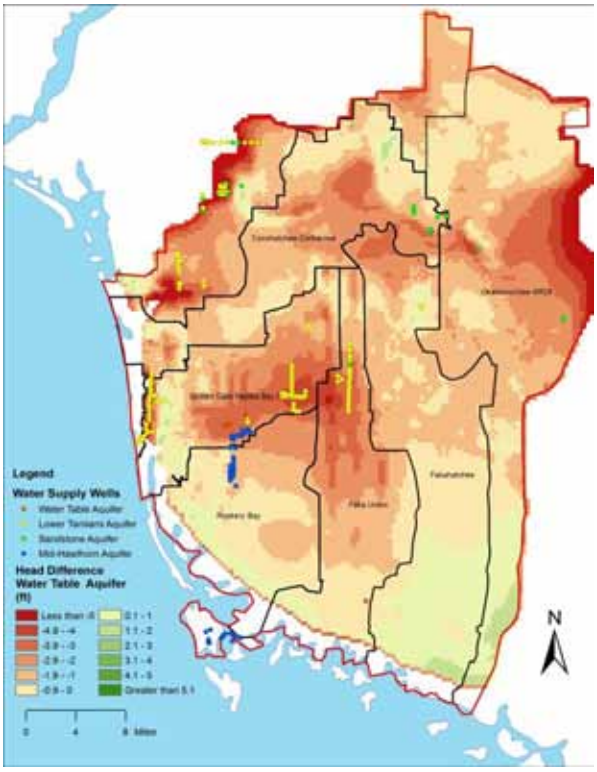

Figure 1-23. Water Table Aquifer Average Annual Groundwater Head Elevation Difference (ECM-NSM)

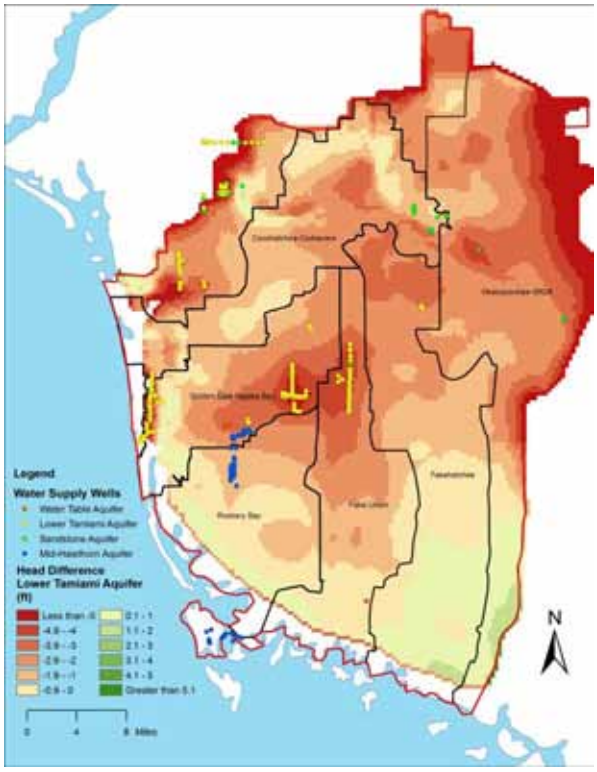

Figure 1-24. Lower Tamiami Aquifer Average Annual Groundwater Head Elevation Difference (ECM-NSM)

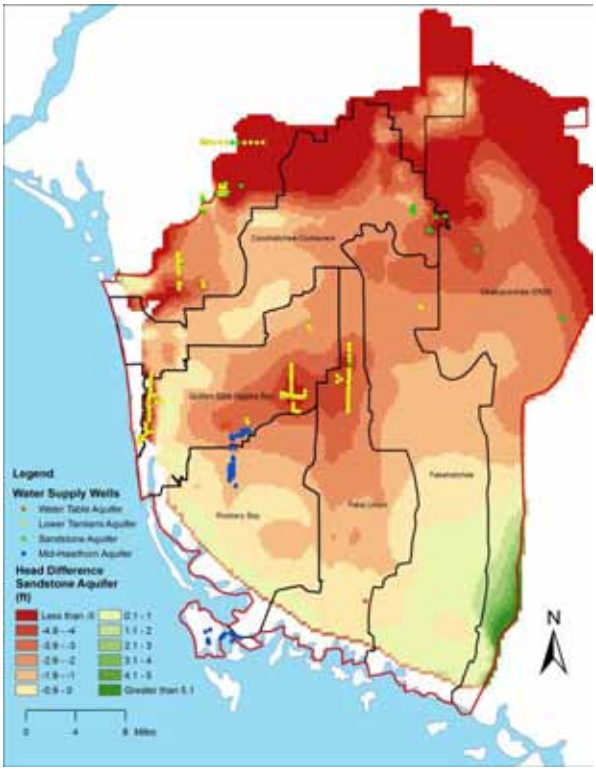

Figure 1-25. Sandstone Aquifer Average Annual Groundwater Head Elevation Difference (ECM-NSM)

Effects of Increased Wellfield Pumping Rates

A computer model sensitivity run was conducted to evaluate the effects of increasing pumping rates from the existing wellfields. Although water demands in Collier County are expected to increase by 50 percent in the next 20 years, it was considered that an assumed 10 percent increase from the existing wellfields would provide meaningful results to assess potential impacts. For this sensitivity analysis, it was also assumed no changes on irrigation or domestic self supply demands.

The initial sensitivity test consisted of comparing the average annual minimum head elevation in each aquifer predicted by the ECM against the average annual head elevation in each aquifer as predicted by the model with increased pumping. The results are shown in maps that define the change in drawdown resulting from the increased pumping in each aquifer. Figures 1-26 – 1-29 show the increased drawdown in each aquifer.

A second sensitivity test considered the effect of increased pumping during a prolonged dry season. The dry season of 2007 which began on November 1, 2006 and continued through June 2007 followed a wet season with little rainfall. This average groundwater elevation calculated for the dry season 2007 was used to evaluate the effect of increased pumping during prolonged drought conditions. Figures 1-30 – 1-33 show the extent of the increased drawdown during the extended dry period.

In each of the aquifer systems, the extent of the predicted areas influenced by pumping increases as a result of increased pumping. The results show that during periods of extended drought, the area of influence extends from the City of Naples wellfield into the northern portions of the Fakahatchee watershed and that individual areas of influence have merged into a single area of influence that encompasses almost the entire area of the Golden Gate – Naples Bay watershed.

The results indicate that the availability of groundwater is limited to meet long-term water supply needs for Collier County. Increased pumping is predicted to increase the risk of salt water intrusion and potentially affect availability of water for domestic self supply from the Water Table and Lower Tamiami aquifer systems.

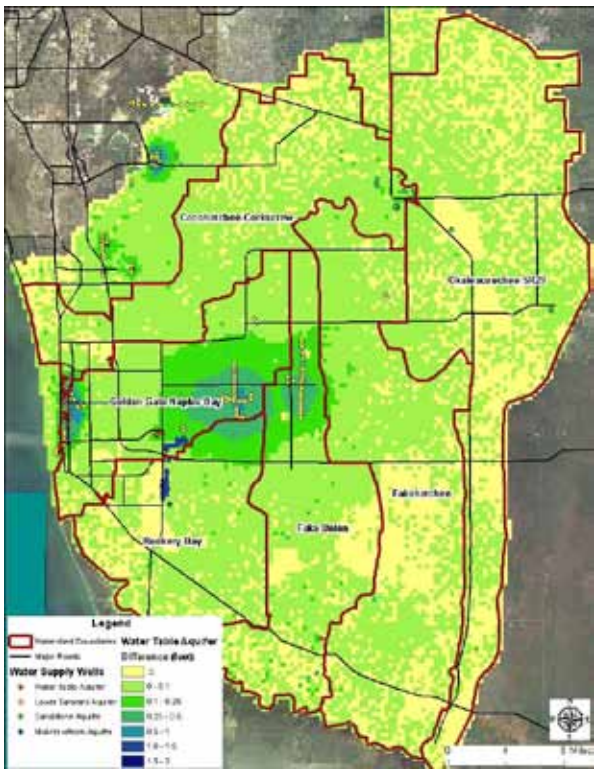

Figure 1-26. Water Table Aquifer Average Increase in Drawdown with 10% Increase in Groundwater Withdrawal

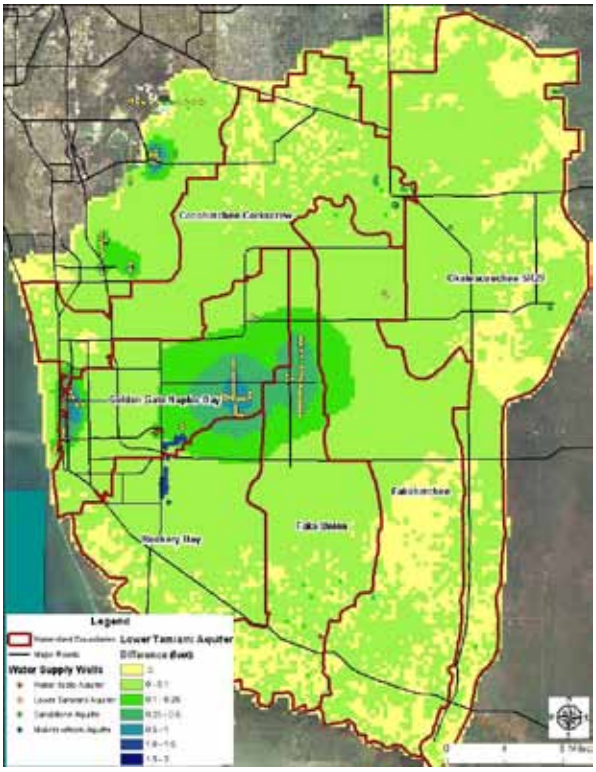

Figure 1-27. Lower Tamiami Aquifer Average Increase in Drawdown with 10% Increase in Groundwater Withdrawal

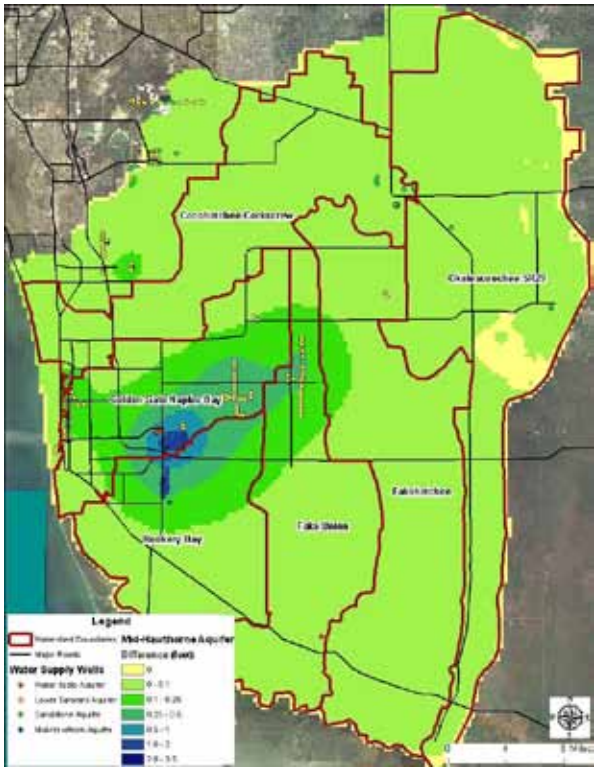

Figure 1-29. Mid-Hawthorn Aquifer Average Increase in Drawdown with 10% Increase in Groundwater Withdrawal

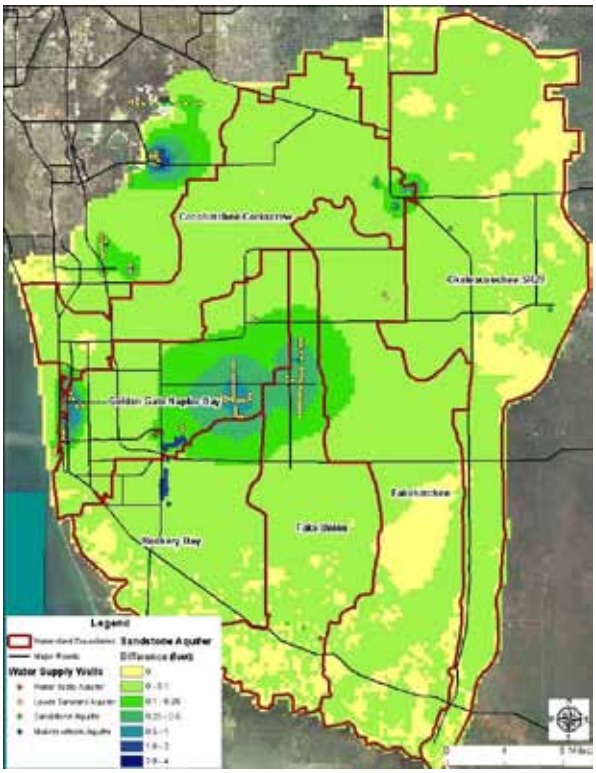

Figure 1-28. Sandstone Aquifer Average Increase in Drawdown with 10% Increase in Groundwater Withdrawal

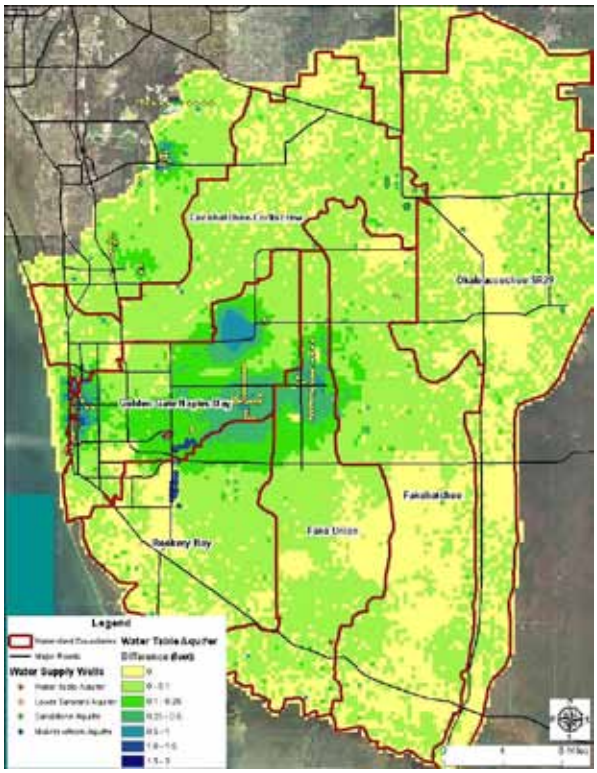

Figure 1-30. Water Table Aquifer Average Driest Dry Season Increase in Drawdown with 10% Increase in Groundwater Withdrawal

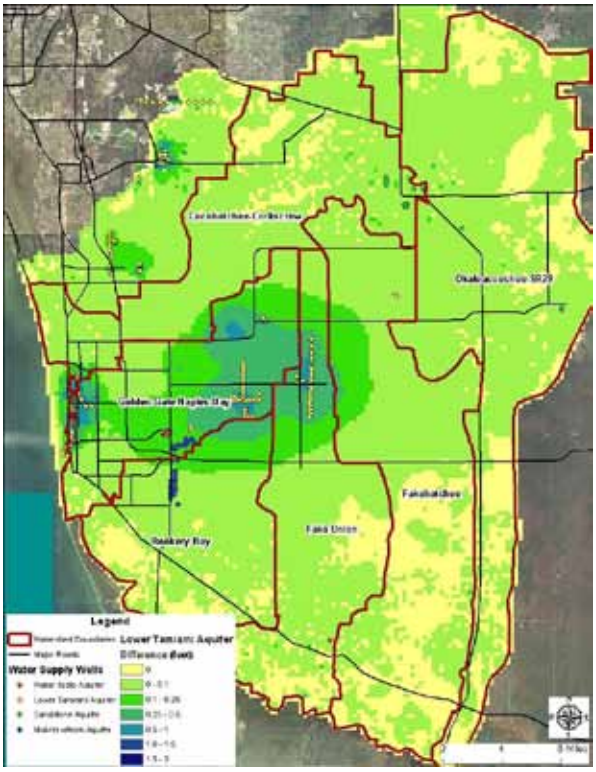

Figure 1-31. Lower Tamiami Aquifer Average Driest Dry Season Increase in Drawdown with 10% Increase in Groundwater Withdrawal

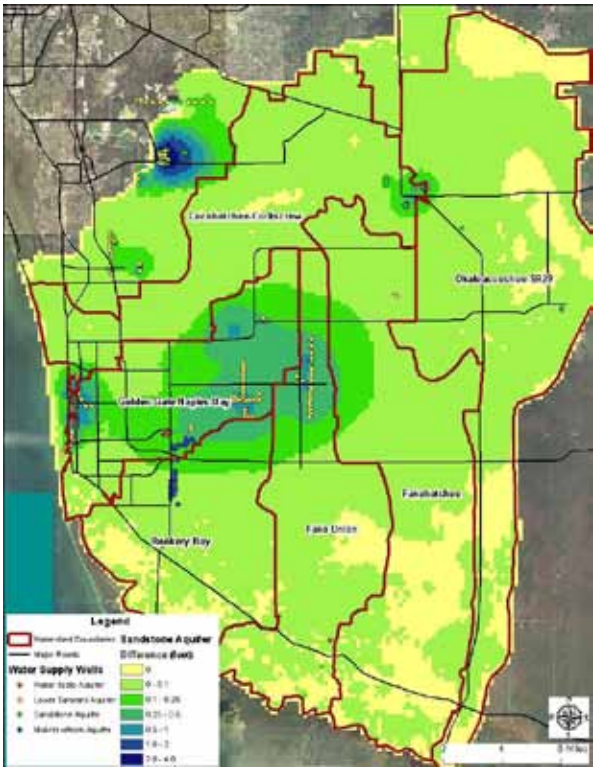

Figure 1-32. Sandstone Aquifer Average Driest Dry Season Increase in Drawdown with 10% Increase in Groundwater Withdrawal

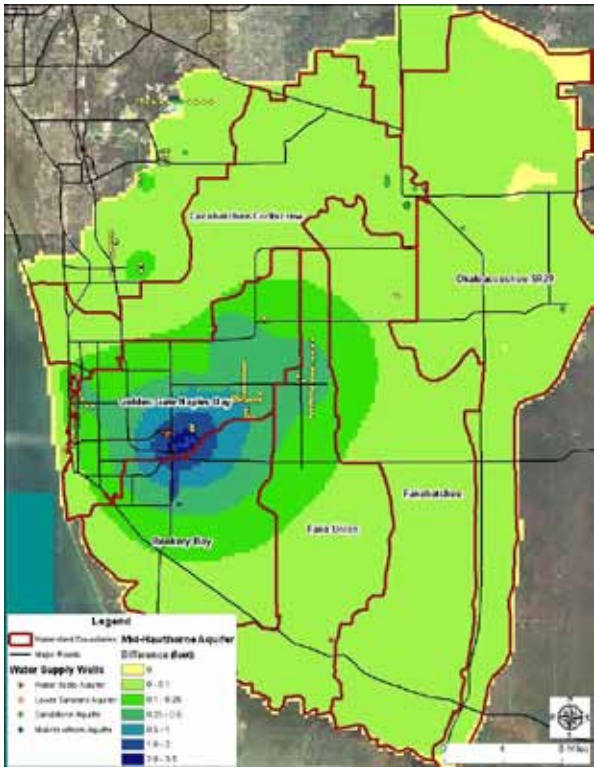

Figure 1-33. Mid Hawthorn Aquifer Average Driest Dry Season Increase in Drawdown with 10% Increase in Groundwater Withdrawal

1.6: Groundwater Quality and Groundwater Pollutant Loads

Groundwater quality was characterized and pollutant loads to canals were estimated for Collier County watersheds. Data indicated that dissolved oxygen concentration in groundwater is significantly lower than the surface water standard, whereas total nitrogen and phosphorus concentrations exceed corresponding surface water criteria. Iron concentrations also exceed the surface water standard.

Introduction

Groundwater quality in the Cocohatchee-Corkscrew, Golden Gate-Naples Bay, Rookery Bay, and the combined Faka Union, Okaloacoochee/SR 29, Fakahatchee watersheds was characterized and the groundwater pollutant loads to the canals in the watersheds were estimated. Pollutants identified for analyses were dissolved oxygen, total nitrogen and phosphorus, copper, and iron, based on the National Pollutant Discharge Elimination System (NPDES) pollutant list. In addition, the analyses included a preliminary regional assessment of the potential impacts of septic tanks on groundwater quality in the watersheds. This effort focused on the groundwater quality in the Water Table and Lower Tamiami aquifer systems. The other aquifers are confined and are not known to interact with the surface water drainage system.

Methods

Concentrations of the water quality parameters in the groundwater in Collier County and estimates of pollutant loads from the local aquifers into the surface water hydrologic network that eventually reaches the receiving estuaries were calculated.

Because groundwater systems are more regional in nature when compared with surface water systems, a Kriging interpolation method was applied to create regional groundwater concentration maps for each water quality constituent. For each well with available data, median concentrations were calculated for each water quality parameter of interest and groundwater concentrations were predicted for each cell in the hydrologic/hydraulic model domain. Consequently, the groundwater quality analysis was consistent with the surface water modeling approach.

Pollutant loads associated with groundwater discharges from the Water Table and Lower Tamiami aquifers to the surface water system were determined based on the calculated baseflow to the drainage network and the predicted average concentrations of each parameter in groundwater.

Results

Dissolved Oxygen

Dissolved oxygen concentrations are not typically monitored in groundwater. Therefore the data available for analysis are limited and most are from wells associated with the Gordon River and the Picayune Strand. No groundwater quality data are available for the Cocohatchee-Corkscrew, Fakahatchee, and Okaloacoochee/SR 29 watersheds, or the eastern portion of the Golden Gate watershed (Figure 1-34).

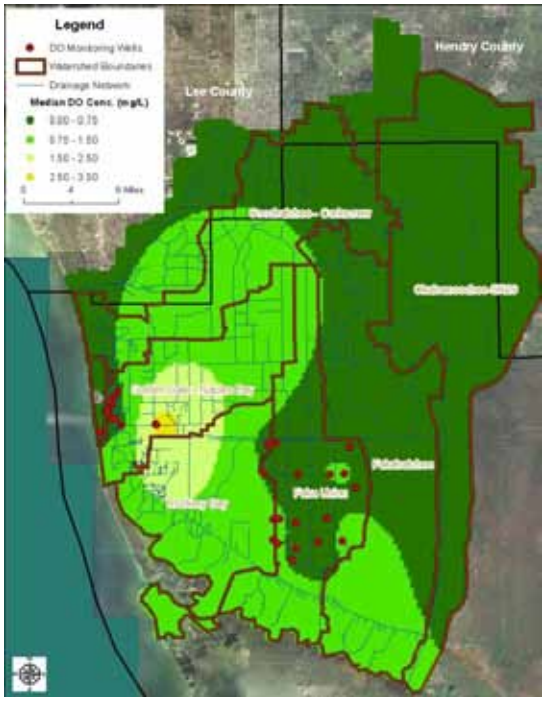

Figure 1-34. Dissolved Oxygen Concentration Interpolation

The data evaluation predicts that dissolved oxygen concentrations do not vary significantly across the study area and are less than 3.5 mg/L. Adamski (2001) states that dissolved-oxygen concentrations in ground

water generally decrease over time as the oxygen in the water reacts with minerals and organic material; therefore, it is assumed that the predicted results are appropriate to provide a preliminary assessment of groundwater quality in the watersheds. It is recommended that additional groundwater monitoring for dissolved oxygen be completed to verify this assumption.

Total Nitrogen

Total nitrogen data were available at 94 wells in the study area. Because 38 of 47 wells along the coast from the Cocohatchee canal to Henderson Creek are associated with the County's reuse monitoring program, a comparison of total nitrogen concentrations at the reuse wells with other wells was made. Results from the water quality analyses completed during this project indicated no significant difference in total nitrogen among the wells, except for a few identified areas. Other than at those locations, it was considered that the analysis provided adequate results. Wells for which water exceeded the screening criteria for nitrogen are located primarily in the western portion of the County. While none of the basins in which the wells were located were identified as impaired for nutrients, they may be considered at risk due to groundwater discharges (Table 1-3).

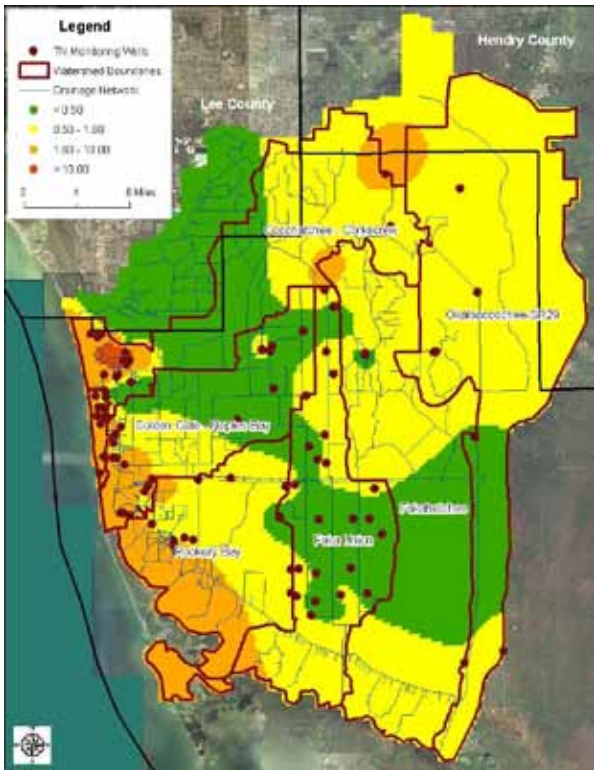

Figure 1-35. Groundwater Total Nitrogen Concentration

Groundwater total nitrogen concentrations (Figure 1-35) exceeded FDEP screening criteria for streams (1.6 mg/L) in the Golden Gate-Naples Bay and Rookery Bay watersheds as well. The average predicted concentration of total nitrogen in the Faka Union, Okaloacoochee/SR 29, and Fakahatchee watershed is less than the in stream water quality screening level in most of the watershed.

Table 1-3. Predicted Groundwater Pollutant Loads

Watershed	Groundwater Pollutant Load			
	TN	TP	Cu	Fe
	tons/yr	tons/yr	tons/yr	tons/yr
Cocohatchee - Corkscrew	53	4	0.06	53
Golden Gate - Naples Bay	76	4	0.17	212
Rookery Bay	74	8	0.05	104
Faka Union/ Fakahatchee/ Okaloacoochee -SR29	89	5	0.27	124
	Groundwater Pollutant Load			
	TN	TP	Cu	Fe
	lbs/ac/yr	lbs/ac/yr	lbs/ac/yr	lbs/ac/yr
Cocohatchee - Corkscrew	0.831	0.067	0.001	0.82
Golden Gate - Naples Bay	1.729	0.094	0.004	4.83
Rookery Bay	1.518	0.167	0.001	2.14
Faka Union/ Fakahatchee/ Okaloacoochee -SR29	0.4	0.023	0.001	0.56

The largest total predicted TN groundwater load in lbs acre/ year was found in the Golden Gate – Naples Bay watershed. Naples Bay is listed as impaired for DO with the likely cause identified as nutrients. The water budget analysis indicated that baseflow makes up more than 50 percent of discharge from the watershed annually and more than 70 percent of discharge during the dry season. It is likely that baseflow contributes to the low DO concentrations in the estuary; however nutrients entering the groundwater system and discharging to the canal network may also contribute to the impairment.

Total Phosphorus

Total phosphorus concentration data are available at 117 wells located throughout the study area. Similar to

the total nitrogen analysis, the interpolated values for total phosphorus were compared to the FDEP screening criteria for streams (0.22 mg/L). Results indicated that areas in which predicted concentrations exceed the in stream water quality criteria are located along the coast and along the northeastern portion of the study area.

Given that only one WBID (3278U – Rookery Bay Coastal Segment) in the study area has been identified as impaired for nutrients, it appears that high groundwater total nitrogen and total phosphorus (Figures 1-35 and 1-36) concentrations are not currently determining surface water quality conditions. However, the relatively high groundwater concentrations in the groundwater at some of the reuse monitoring wells may indicate a risk of groundwater pollution loads (Table 1-3).

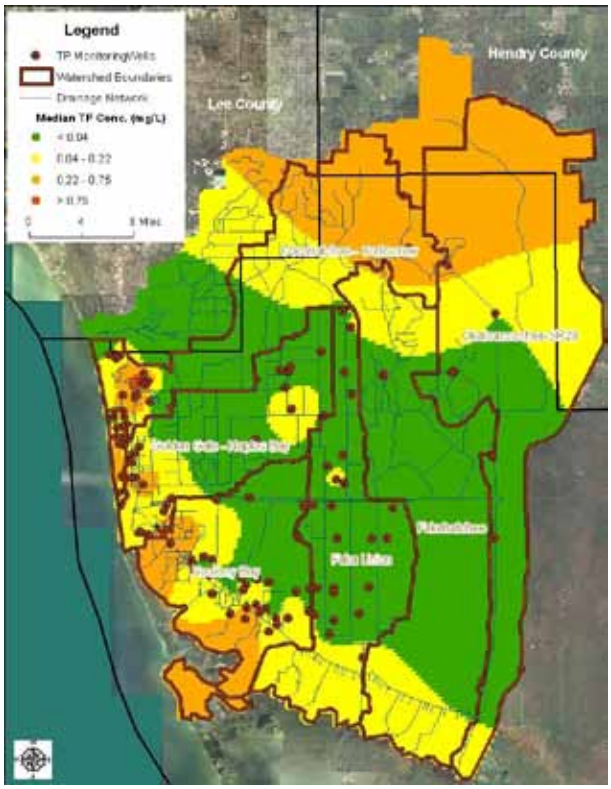

Figure 1-36. Groundwater Total Phosphorus Concentration

Also similar to nitrogen, a potential identified problem with the analysis was that many of the wells along the coast are associated with the County's reuse monitoring program. Unfortunately, as opposed to the TN analysis, the reuse wells showing higher TP concentrations do not define specific problem areas, but are present at various locations along the coast. Therefore some of the phosphorus hot spots, particularly along the coast in the Cocohatchee-Corkscrew and Golden Gate – Naples Bay watersheds may be associated with having information only from reuse wells. Better data is needed to better define the groundwater concentration of total phosphorus in the study area. In any case it was considered that the analysis provided meaningful results.

Copper

Well C-00495 is used to monitor the Lower Tamiami aquifer system in the watershed and is located near the SR 29 canal. Median copper concentration in the well exceeds 90 µg/L. For comparison, the in stream standard for copper in WBID 3261C is 22.69 µg/L. Collier County is investigating potential sources of metals in the area around this well. There is no known activity in the area that would contribute to elevated copper concentrations.

Iron

The results of the Kriging interpolation for iron concentrations in groundwater indicate that the groundwater concentration of iron in most of the study area exceeds the in stream water quality standard of 1,000 µg/L. These results suggest that groundwater entering the surface water system as baseflow (Table 1-3) is a potential cause of the identified iron surface water impairment. As indicated previously, more detailed source identification efforts are necessary to define the cause of the reported iron impairments. A special case is with the Rookery Bay watershed where no iron impairments have been identified, although groundwater concentrations are predicted to be elevated in a portion of the watershed. A close examination of the data revealed that the highest rates of baseflow occur in areas where the predicted iron concentration in groundwater is below the state standard. As human activities may also be sources of iron, Collier County should collaborate with FDEP to complete further source evaluation studies.

Groundwater Pollutant Loading to the Surface Water Network

Pollutant loads associated with groundwater discharges from the Water Table and Lower Tamiami aquifers to the surface water system were estimated based on flows obtained for each model cell in the hydrologic/hydraulic model domain and the corresponding pollutant concentrations from the Kriging analysis. Pollutant loads were calculated for total nitrogen, total phosphorus and copper.

Results of the analysis conducted as part of this project indicated that the majority of the area-wide pollution load originates in the surface water system. About 26 and 12 percent of the total nitrogen and total phosphorus load into the estuaries, respectively, are from groundwater sources, whereas the groundwater load of copper represents about 25 percent of the total. It is to be noted, however, that Rookery Bay is the only watershed for which the predicted total nitrogen load from groundwater is approximately the same as the surface water load. That can be attributed to the estimated higher groundwater nitrogen concentrations along the coast.

Assessment of Pollution Loads from Septic Tanks

Septic tanks are common in parts of Collier County that are not served by sewer. They are also potential sources of nutrient discharges into the receiving water bodies by way of percolation into the Water Table aquifer. The objective of this analysis was to provide a preliminary and region-wide assessment of the potential effect of septic tanks on the groundwater concentrations of total nitrogen and total phosphorus. This was done by first estimating the number of septic tanks in each cell within the model domain and subsequently conducting a correlation analysis between septic tank density and constituent concentration in the groundwater. Results of the analysis indicated that, on a region-wide basis, there is little correlation between total and nitrogen and total phosphorus and septic tank density. It should be kept in mind that this is a regional analysis that does not reflect localized problems.

Conclusions

- Kriging interpolation indicated that dissolved oxygen concentrations in groundwater are less than 1.5 mg/L throughout most of Collier County, compared to the surface water standard of 5 mg/L. Given the significant amount of baseflow entering the system, it is likely that baseflow contributes to the low dissolved oxygen levels in the canal network, However, human activities are also factors that can contribute to reduced dissolved oxygen concentrations.
- Total nitrogen concentrations in groundwater exceed the corresponding screening criteria for surface water in a large portion of the study area. Total phosphorus concentrations exceed the criteria along the coast and in the northern portion of the study area.
- Pollution load estimates indicate that groundwater is a potential contributor to the nutrient impairment in the Rookery Bay watershed.
- Copper concentrations in groundwater are typically low throughout the County, suggesting that copper impairments in the canal network can be attributed to surface runoff.
- Iron concentrations in groundwater were elevated relative to the Class 3 surface water standard in several areas that correspond with identified impairment locations in the canal network. Groundwater appears to be a potential source of iron to the surface water system.
- A preliminary assessment indicated little correlation between total nitrogen and total phosphorus and septic tank density, suggesting that septic tanks are not a water quality issue in Collier County. However, as this is a regional analysis, site specific studies in problem areas may be appropriate to fully define the nutrient contributions from septic tanks.
- It was suspected that the use of data from wells in the County's reuse program may have introduced bias in the analysis. A data review completed as part of this project indicated that the results are adequate.

1.7: Natural Systems: Reference Period Comparison

The conversion of natural wetlands and uplands represent a loss of nearly 273,000 acres (426 square miles) of wildlife habitat, natural water storage, filtration, and open recreational space in these 6 watersheds.

Pre-development and current conditions were compared to estimate the loss of native vegetation over the past 50–60 years in the Cocohatchee-Corkscrew, Golden Gate-Naples Bay, Rookery Bay, and combined Faka Union, Okaloacoochee/SR 29, Fakahatchee watersheds. Losses of native vegetation total nearly 273,000 acres. Losses were due to primarily urban development and were most conspicuous in the Golden Gate-Naples watershed.

Introduction

Vegetation changes were quantified as the change in the number of acres for each vegetation community in each watershed, and further analyzed to determine losses as a result of conversion to specific types of development. The pre-development data served as the reference period or an index against which to evaluate current vegetation conditions in evaluating the natural system function. Changes in areal extent of natural vegetation communities and the causes of those changes are reported here.

Methods

Vegetation changes were quantified as the change in number of acres in each vegetation community for each watershed, and further examined to determine losses due to conversion to specific types of development (i.e., change analysis). Changes were quantified from a simple comparison of pre-development and current vegetation data. Land use conversions were quantified using a GIS digital overlay process that generates a matrix of "from/to" changes in land use and cover (e.g. cypress swamp to urban). Vegetation classes from MIKE SHE, Florida Land Use and Cover and Forms Classification System (FLUCCS), and the Southwest Florida Feasibility Study (SWFFS) were developed as part of a "crosswalk" so that comparisons between pre-development and 2007 vegetation maps could be made. Figure 1-37 shows a comparison of pre-development and 2007 vegetation maps.

Results

Cocohatchee-Corkscrew Watershed

The Cocohatchee-Corkscrew Watershed had a nearly 85 percent reduction in acres of pre-development uplands and a loss of more than 30 percent of pre-development freshwater wetlands. Native uplands were replaced by primarily agricultural land uses, while urban development accounted for the greatest loss of wetlands. In 2007, the watershed included 8,300 acres of undeveloped uplands (16 percent of the pre-development acres) and 51,000 acres of freshwater wetlands (71 percent of the pre-development acres).

Golden Gate-Naples Bay Watershed

The Golden Gate-Naples Bay watershed had the greatest loss of pre-development vegetation communities when compared with the other watersheds, with a loss of almost 70 percent of wetland acres and over 80 percent loss of native uplands. Unlike the Cocohatchee-Corkscrew watershed, the largest conversion of lands in the Golden Gate-Naples Bay watershed occurred due to urban development. In 2007, there were just over 17,000 acres of wetlands (31 percent of the pre-development amount) and 25,000 acres of undeveloped uplands (17 percent of the pre-development amount) in the watershed.

Rookery Bay Watershed

The Rookery Bay Watershed had the smallest loss of pre-development vegetation communities of the three primary watersheds, with a loss of approximately 30 percent of wetland acreage and less than 50 percent of native uplands. The Rookery Bay watershed still included approximately 42,000 acres of wetlands (70 percent of the pre-development amount), 8,500 acres of undeveloped uplands (52 percent of the pre-development amount), and 16,000 acres of tidal systems (87 percent of the pre-development amount).

Faka Union, Okaloacoochee/SR 29, and Fakahatchee Watersheds

These three watersheds were combined for analysis because they were assigned lower priority relative to the previously described three watersheds. As an example, existing acres of wetlands make up 85 percent of the pre-development acres freshwater wetlands and 87 percent of the former tidal wetlands. However, only 30 percent of the pre-development native uplands remain. The largest conversion of lands in this set of watersheds occurred due to agriculture.

Conclusions

The conversion of natural wetlands and uplands represent a loss of nearly 273,000 acres (426 square miles) of wildlife habitat, natural water storage, filtration, and open recreational space in these 6 watersheds. Of the three primary watersheds, the greatest percentage loss occurred due to urban development in the Golden Gate-Naples Bay watershed, with almost 60 percent of the watershed now categorized as urban. In contrast, just 23 percent of the lands within Rookery Bay watershed are categorized as any type of development. Of the 273,000 acres of natural lands converted to other land uses throughout these six basins, agriculture accounts for approximately 97,000 acres (12 percent of the combined watershed area).

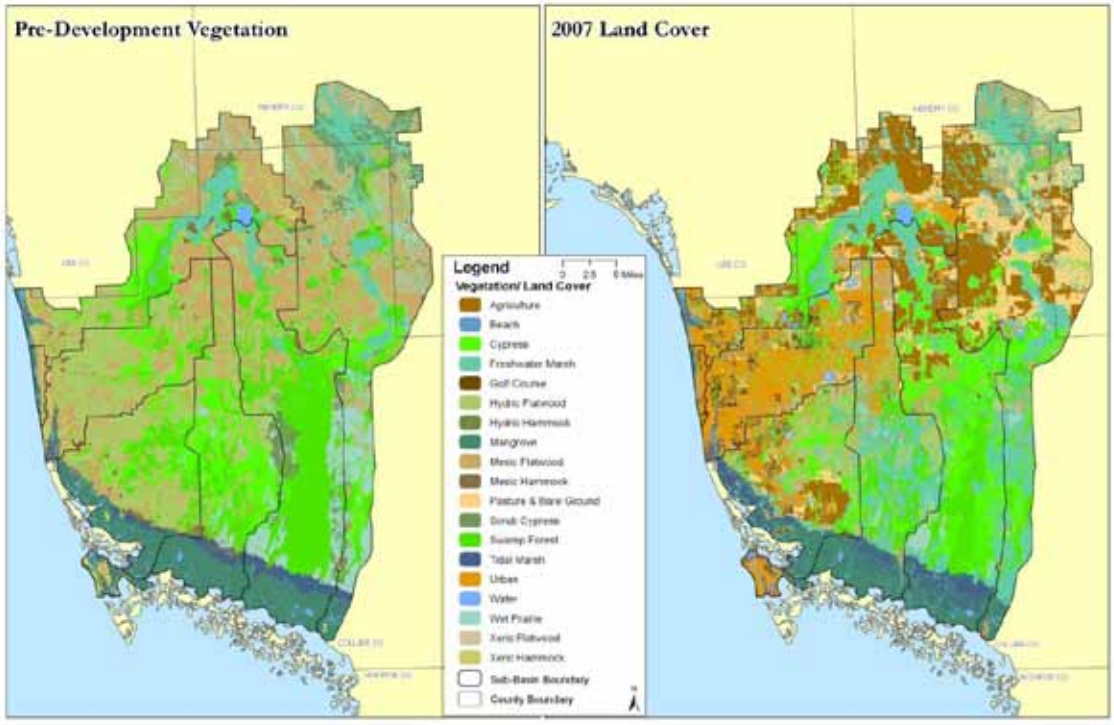

Figure 1-37. Model-Wide Overview, Land Use and Land Cover Changes from Pre-Development to 2007

1.8: Natural Systems: Functional Assessment

A method was developed to assess and compare systems functions of existing and pre-development conditions in the Collier County watershed and to quantify the loss of natural system functions. The assessment will be used to develop performance measures against which restoration project success can be measured under a later task (performance measures are addressed in Chapter 2).

Introduction

A landscape-level functional assessment method was developed and used to assess, and assign value to, existing natural systems conditions in the Cocohatchee-Corkscrew, Golden Gate-Naples Bay, Rookery Bay, and the combined Faka Union, Okaloacoochee/SR 29, Fakahatchee watersheds in Collier County. The same method was developed for use as resource protection-based performance measures for the evaluation of proposed restoration projects (described in Chapter 2).

Methods

The Uniform Mitigation Assessment Method (UMAM, Chapter 62-345 Florida Administrative Code) provided the template from which to design the functional assessment method for this project. Modifications from UMAM were made to implement the functional assessment at the watershed level, rather than the site-specific level for which UMAM was designed

Similar to UMAM, the condition of a natural system for the functional assessment addresses landscape position, vegetation, and hydrology. Scores are assigned on a scale of 1 to 10, based on the degree of change compared to a reference (in this case pre-development). A score of 10 is appropriate where a site has retained optimal value (100 percent of the value compared to the reference condition), 7 for moderate value (70 percent of the value compared to the reference condition), 4 for minimal value (40 percent of the value compared to the reference condition), 0 for no value. Whole-number scores between 1 and 9 are used as appropriate to represent interpolated conditions.

The functional assessment method applied herein relied exclusively on available GIS data due to the watershed-scale analysis required here and the resolution available for the analyses and mapping is a grid cell size of 1500 X 1500 feet. As indicated previously, three independent scores, or indices, were developed to evaluate the current condition with respect to the appropriate referenced condition:

- Vegetation Score
- Hydrology Score
- Landscape Suitability Index (LSI)

Vegetation scores (Figure 1-38) represent the value of the landscape (cells) based on the degree to which the pre-development vegetation persists under existing conditions. For example, dramatic conversions from pre-development wet prairie vegetation to a developed urban land use, for example, would be assigned low scores, while little or no change in vegetation cover (i.e., no change from pre-development, or shift to another natural vegetation classification) would be scored higher. The scores for agriculture and other developed areas reflect the degree of support for wetland resources. Scores are assigned to each community based on the information listed below and are based on conversion between FLUCCS designations and the previously developed Pre-Development Vegetation Map (PDVM). No other values were assigned during this evaluation.

- Score=10. Natural water systems that are present in both existing and pre-development conditions and areas that retained the same dominant stratum and ecosystem type (freshwater forested wetland to freshwater forested wetland).
- Score=8. Areas where the vegetation has shifted, but has retained the same ecosystem type (forested freshwater wetland to herbaceous freshwater wetland).
- Score=6. Natural systems that have been converted to an artificial water body.

- Score=4. Natural systems that have been converted to agriculture.
- Score=0. Natural systems that have been converted to a developed land use such as high density urban or bare ground.

The hydrology score (Figure 1-39) is a measure of the effects of depth and duration (hydroperiod) of inundation and represents the functional value of a cell based on the degree to which the cell retains the hydrological characteristics of the pre-development conditions. Pre-development hydrological conditions are estimated based on the typical range of depth and duration (hydroperiod) of inundation of the vegetation community present on the PDVM. Like the vegetation scores, no change from pre-development is scored 10, while total loss of hydrology (e.g., a cell dominated by a pre-development wetland or open water body but now experiences no inundation) would result in a score of 0.

The LSI is an index of the effects of adjacent lands on the target site and represents the degree to which adjacent lands provide or inhibit connectivity, buffers, and corridors. Higher scores (Figure 1-40) indicate adjacent natural lands or lands conducive to wildlife passage, while lower LSI scores are surrounded by land uses that act as barriers. Even a natural preserve area would score low if surrounded by commercial land uses, while a parcel with otherwise poor conditions would score high if surrounded by pasture or natural areas. Cells were first assigned LSIs by FLUCCS codes, e.g., natural systems and open water = 10, pine plantation=9.4, crops=6.07, industrial=1.87, etc. An LSI score for a cell was then calculated as the average of the 8 surrounding cells.

Results

In general, the combined Faka Union, Okaloacoochee/SR 29, and Fakahatchee watersheds exhibited the highest functional values (the least change from pre-development), when compared with the other watersheds. The measured functional values were less in the Rookery Bay and Cocohatchee-Corkscrew watersheds, and least in the Golden Gate-Naples Bay watershed (see Table 1-4).

Table 1-4. Average Functional Values of Non-Urban Lands, by Watershed

Watershed	Non-Urban Acres	Average Vegetation Score	Average Hydrologic Score	Average LSI Score
Cocohatchee-Corkscrew	111,250	7	7	8
Golden Gate-Naples	36,627	5	6	6
Rookery Bay	83,105	8	6	9
Faka Union/ Okaloacoochee SR 29/ Fakahatchee	431,414	9	6	9

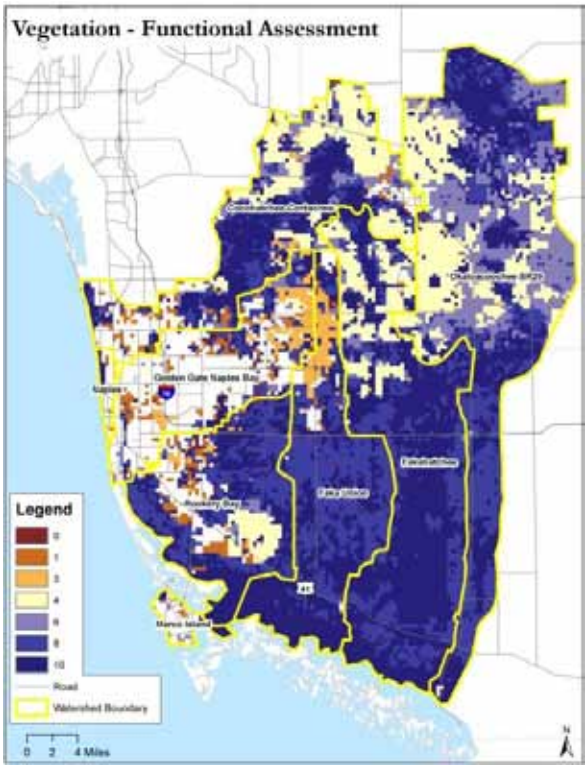

Figure 1-38. Vegetation, Functional Assessment

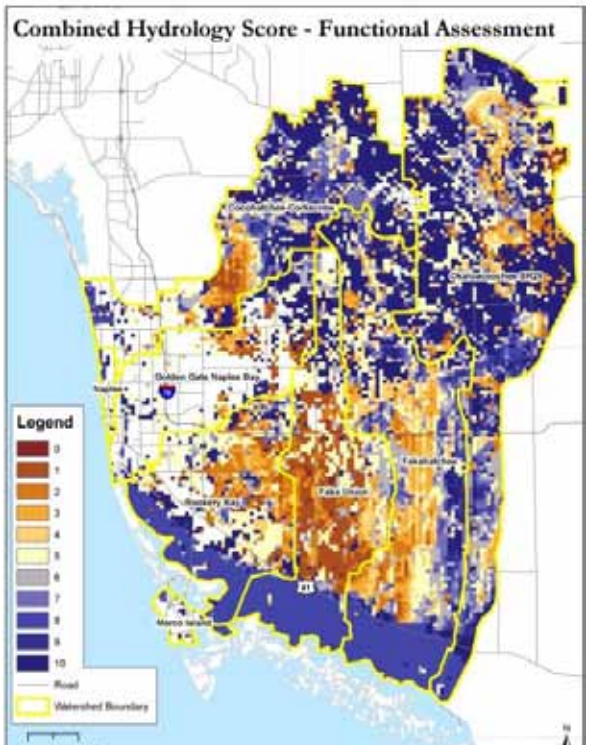

Figure 1-39. Combined Hydrology Score, Functional Assessment

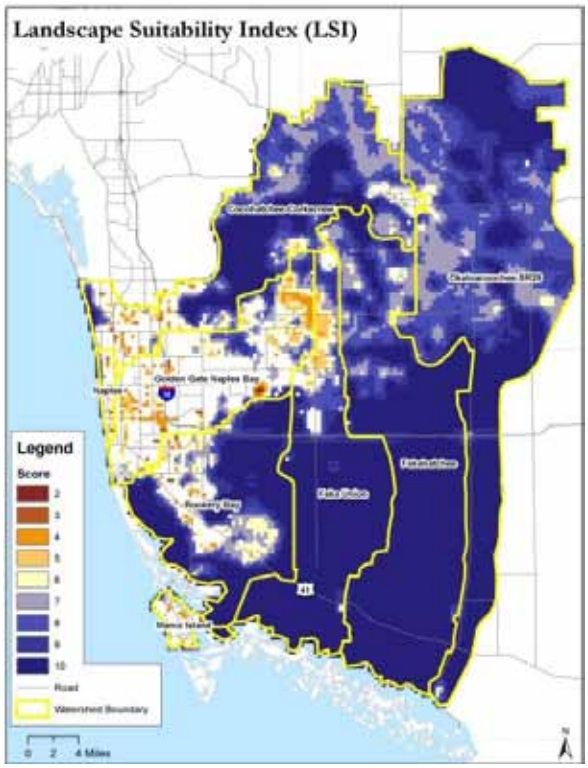

Figure 1-40. Landscape Suitability Index (LSI)

Cocohatchee-Corkscrew Watershed

The functional assessment of the non-urban portions of the Cocohatchee-Corkscrew indicates that the central part of the watershed just east of Corkscrew Swamp system maintains a high functional value, as measured by all 3 parameters, while the northern and eastern portions have relatively high hydrology and LSI scores and moderate vegetation scores due to non-pasture agricultural lands. The LSI is high (7 or greater) throughout the non-urban portion of the watershed due to natural and agricultural land uses. Vegetation and hydrology scores are somewhat lower due to conversion to agricultural uses.

Golden Gate-Naples Bay Watershed

Nearly 60 percent (over 50,000 acres) of the Golden Gate-Naples Bay watershed is urban land not suitable for large ecological restoration projects. Even the non-urban areas have relatively low ecological value, with an average vegetation score of 5 and hydrology and LSI scores of 6. However, this present opportunities for both restoration of natural areas, and improved urban landscape through policy changes regarding new development.

Rookery Bay Watershed

The functional assessment in this watershed reflects the low proportion (30 percent) of the watershed that has been converted to urban or agricultural uses. Scores are low in the vicinity of Belle Meade and Tamiami Trail, but relatively higher in the remainder of the watershed. Overall, functional values are higher than in Golden Gate-Naples and Cocohatchee-Corkscrew watersheds, with a watershed-wide average LSI score of 9 and average vegetation score of 8.

The large extent of undeveloped and agricultural lands in this watershed provides opportunities for restoration, while the functional values indicate opportunities for improvements via hydrological restoration throughout these lands.

Faka Union, Okaloacoochee/SR 29, and Fakahatchee Watersheds

These watersheds, individually and as a whole, retain relatively high functional value, with average

vegetation and LSI scores of 9, and hydrological score average of 6. The mapped scores indicate higher vegetation and LSI scores south of I-75 than north, and higher hydrology scores in the north than in the south.

Resource Protective Areas

The natural system functional assessment methodology is described in detail in Volume 4, Section 2.8. Results of the analysis were also used to identify resource protective lands that are not included in any of the existing land conservation or land protection programs such that recommendations about protection measures can be assessed as part of the CCWMP. The procedure consisted of comparing the total extent of resource protective lands identified in this study with the extent of the areas included in the existing land conservation and protection programs. Results shown in Figure 1-41indicate that much of the identified resource-protective lands are currently included in the existing protection programs. Recommendations regarding protection for the areas not currently protected are described in Volume 3 of the WMP.

Conclusions

Vegetation, hydrology, and landscape scores were developed to assess functional values of the natural system. These scores can be used as indicators of hydrologic restoration and will provide opportunities for quantifying the impact of future natural resources restoration programs in Collier County. As expected, the areas most impacted by human activities, particularly in the Golden Gate – Naples Bay and Rookery Bay watersheds, received the lowest scores, whereas the Faka Union, Okaloacoochee/SR 29, and Fakahatchee watersheds, individually and as a whole, have retained relatively high functional values,

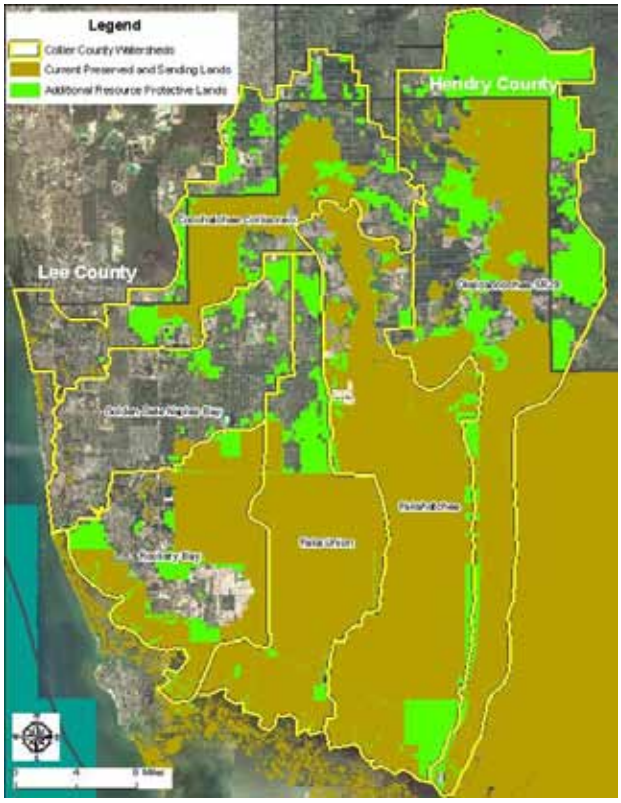

Figure 1-41. Resource Protective Lands not Currently Protected

1.9: Volume and Timing of Freshwater Inflows

The volume and timing of freshwater inflows to the Wiggins Pass, Naples Bay, Rookery Bay, and Ten Thousand Islands estuaries were compared for existing and pre-development conditions as a means to define water surplus and deficit targets for potential restoration projects in Collier County.

Introduction

Historical fresh water flow patterns in Collier County have changed over the years due to increased development. The consequences have been increased freshwater flows into the estuaries and changes to the estuarine systems resulting from reduced salinity and increased deliveries of organic sediments. Quantifying these changes is important to developing any restoration projects.

Methods

The changes in freshwater flows (surplus and deficits) into the estuaries were assessed by comparing existing conditions with natural (or pre-development) conditions through the use of hydrology/hydraulic models. The results provide a means with which to determine the monthly water surplus or deficit targets for restoration.

Existing freshwater discharges from the watershed into the estuaries were characterized based on results of the MIKE SHE/ MIKE 11 Existing Conditions model (ECM), which represents 2007 land use conditions in Collier County and was calibrated against surface water stage and flow and groundwater elevation data.

Predevelopment conditions were characterized using the results of the Natural Systems Model (NSM), which was developed for the Southwest Florida Feasibility Study (SWFFS) area. The NSM represents land use and conveyance systems under pre-development conditions. Also, it assumes the absence of the existing water control structures. A full description of the model can be found in the report titled "Final Report, Natural Systems Model (NSM) Scenario Southwest Florida Feasibility Study" (SDI, 2007). The model domain includes the BCB as well as the Caloosahatchee and Estero River Basins.

The results of the ECM and NSM comparisons were validated against salinity:flow analysis conducted using available salinity and flow data to create salinity:flow relationships. Flow deficits or surpluses required to reach historical salinity targets were calculated at each of the monitoring stations shown in Figure 1-42. These results were then compared with those from the ECM and NSM analysis.

Results

The analysis included average annual, seasonal, and monthly assessments of flow comparisons. Figures 1-43 and 1-44 (red bars) depict the average surplus and/or deficit of fresh water inflows to each of the estuaries during the wet and dry seasons, respectively, based on the ECM to NSM comparison. More detailed discussions are included in Volume 4 of this report. Following are summaries of finding for each estuary.

Wiggins Pass Estuary

Analyses results indicate that Wiggins Pass is experiencing a surplus of approximately two inches of freshwater inflows compared to pre-development conditions during the wet season. This is likely due to new development in the western portion of the watershed, particularly along the Cocohatchee canal. The monthly flow analysis indicates that flow increases begin earlier in the year and continue longer than in the pre-development period.

Naples Bay Estuary

The magnitude of development experienced by this watershed, coupled with the extensive network of drainage canals and the substantial disruption of drainage patterns (the Golden Gate Main Canal effectively increased the extent of the watershed drainage area from approximately 50 to approximately 135 square miles), has created an average freshwater

surplus of close to 20 inches during the wet season. A surplus of close to seven inches has also been estimated for the dry season. The dry season surplus occurred in June, November, and December. The excess flows during November and December shown by the monthly analysis are likely due to delayed runoff resulting from above-average rainfall during 2003 and 2005. The results do not indicate a significant change in the timing of discharges. These results are consistent with previous studies (Black, Crow, and Eidsness, 1974; SFWMD, 2007).

Figure 1-42. Flow and Salinity Monitoring Stations in Collier County

Rookery Bay Estuary

The main impact of human activities in terms of freshwater discharges from the watershed have related to timing. The ECM vs. NSM results indicate a small flow deficit during the dry season (October through May) and a flow surplus during the wet season (June through September). Results of the ECM and the NSM indicate that the total average annual volume discharged to the estuary is similar. During the dry season, the flow surplus can be attributed to the flow contributions from the secondary and uncontrolled releases to the estuary systems.

Ten Thousand Islands Estuary

The Ten Thousand Islands Estuary receives freshwater discharges from the Faka Union, Okaloacoochee / SR 29, and Fakahatchee watersheds. Control structures manage the discharge from the Faka Union and SR 29 canals into the estuary. Model results indicate that a freshwater surplus is discharged to the estuary primarily during the wet season. The excess wet season flow is dominated by discharges from the largely impacted Faka Union watershed and not from the Okaloacoochee/SR 29 and Fakahatchee watersheds, which have been impacted by development to a much smaller degree.

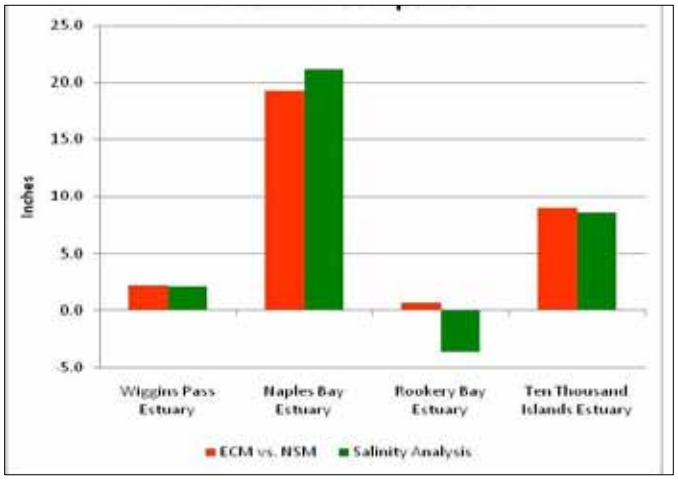

Figure 1-43. Average Wet Season Freshwater Surplus/Deficit in Collier County Estuaries

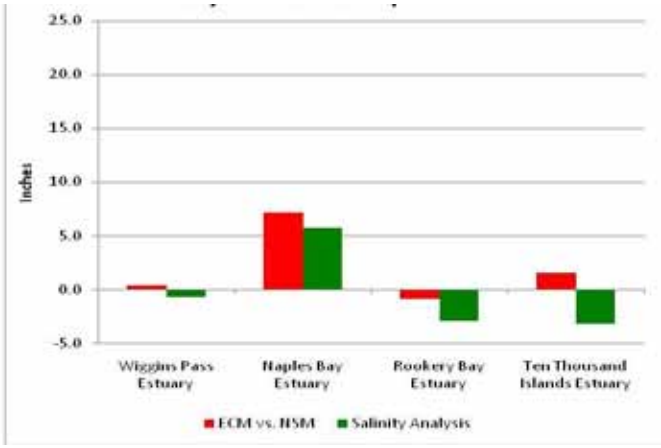

Figure 1-44. Average Dry Season Freshwater Surplus/Deficit in Collier County Estuaries

Salinity Analysis

The ECM and NSM results were further verified by conducting a salinity analysis that consisted of analyzing measured salinities at the discharge points and comparing them to a location that has been subject to minimum historical development impacts. The estuarine surplus or deficit of freshwater discharges was then estimated based on calculated salinity vs. flow

relationships. Results are also shown in Figures 1-43 and 1-44 (green bars).

The similarity of the ECM vs. NSM results to those from the salinity analysis (for wet and dry seasons) provides confidence in the results of the overall analysis.

For the Rookery Bay estuary, the salinity analysis indicates a wet season deficit and a wet season surplus. The difference between the results of the salinity and model analyses is that the salinity analysis includes flows from the Henderson Creek Canal, which drains approximately 40 percent of the watershed. In contrast, the ECM vs. NSM analysis considers flows from the entire watershed and includes the urbanized Lely Area in the western portion of the watershed and the agricultural areas in the southeastern portion of the watershed.

The salinity analysis also shows that during the dry season there is a flow deficit from the primary canals to the Wiggins Pass, Rookery Bay, and Ten Thousand Islands estuaries. This is not unexpected, given the most downstream control structures in the Cocohatchee, Henderson Creek, and Faka Union Canals often prevent flows during the dry season.

Conclusions

Results of the ECM and NSM models were used to characterize the freshwater discharges into Collier County estuaries. Model results are comparable and validate the use of the ECM to evaluate potential restoration projects. Compared with pre-development conditions, discharges to Wiggins Pass, Naples Bay, and Ten Thousand Islands estuaries are excessive during the wet season.

In the Rookery Bay estuary, the difference in timing flows to the estuary appears more important: the system receives too much water during the wet season and too little water during the dry season.

The pre-development flow estimates generated from the NSM offer a baseline against which surplus or deficit flow targets for restoration projects can be measured (performance measures are discussed in Chapter 2).

1.10: Quality of Freshwater Inflows

Water quality of freshwater flows entering the Wiggins Pass, Naples Bay, Rookery Bay, and Ten Thousand Islands estuaries is characterized here. Annual pollutant loads were calculated for each watershed and for basins (designated with water body identification numbers, "WBIDs") in the watersheds.

Introduction

Water quality was characterized for 6 watersheds that discharge fresh water to these 4 estuaries. The Wiggins Pass estuary receives runoff from the Cocohatchee-Corkscrew watershed. The Golden Gate-Naples Bay and Rookery Bay watersheds discharge into Naples Bay and Rookery Bay estuaries, respectively. Three watersheds comprise the drainage area to the Ten Thousand Islands estuary: Faka Union, Okaloacoochee/SR 29, and Fakahatchee.

Methods

Water quality data used in this analysis were acquired from the Impaired Waters Rule (IWR) Run 39 data (provided by FDEP), Florida STORET data warehouse, Collier County, City of Naples, and the Rookery Bay National Estuarine Research Reserve. No TMDL-related data were available from the Collier County Health Department. Data were screened through a quality assurance and control procedure and data from the most downstream monitoring stations were included for the analysis. Percent exceedances were calculated for dissolved oxygen, total phosphorus, total nitrogen, and fecal coliform bacteria concentrations with respect to the state water quality standards. As no numeric State standards exist for nutrients, data were compared to FDEP's screening criteria for streams. In addition, at the direction of the County, data were compared to FDEP's Hendry Creek TMDL concentrations because of the potential of those standards being used in the future for assessing fresh water outfalls in Collier County.

Results

Wiggins Pass

Wiggins Pass is the receiving water for the Cocohatchee-Corkscrew watershed. The estuary is presently listed as impaired for three water quality parameters; dissolved oxygen, fecal coliform and iron. Available data indicate that the dissolved oxygen concentration in the watershed discharge may be affecting the estuary because it generally falls below the 4 mg/L estuarine standard. Low oxygen levels may be attributed to high nutrient concentrations from runoff or other sources that subsequently stimulate plant growth, which in turn may deplete oxygen from the water. However, measured total nitrogen and total phosphorus concentrations do not exceed FDEP's screening criteria for streams, although they exceed the Hendry Creek TMDL target. Low dissolved oxygen concentrations may be caused by human activities, but it is also possible that the low measured values are the result of baseflow (groundwater) discharges from the watershed. Groundwater is low in dissolved oxygen concentration and baseflow represents up to 35 percent of the canal flow in the dry season, and over 23 percent as an annual average.

In terms of fecal coliform bacteria, because the data available show some exceedences of the estuarine standard, there is the possibility that the estuary is affected by watershed discharges. However, bacteria source evaluations are necessary to confirm the condition.

No data for iron is available at the sampling stations considered for data analysis. However, there is data from groundwater samples that indicates groundwater iron concentrations are high enough to account for the surface water concentrations. The water quality model developed for the Golden Gate watershed also suggested groundwater discharges may be a potential source of iron. Other activities such as mine drainage, sewage treatment plant outfalls, or landfill leachate from industrial scrap yards (e.g., junkyards for cars) are also potential sources that should be investigated.

Naples Bay Estuary

Naples Bay is presently listed as impaired for four parameters: dissolved oxygen, fecal coliform bacteria,

copper, and iron. Naples Bay receives water from the Golden Gate- Naples Bay watershed and Gordon River Extension. Analyses of data available from two stations and analyzed for the TMDL planning period and the four stations with data available for the verified period indicate that dissolved oxygen concentrations in the discharges do not meet the estuary water quality standard. Low dissolved oxygen concentration may be attributable to excessive nutrient concentrations but neither total nitrogen nor total phosphorus concentrations in the discharges exceed the Florida stream criteria standards. Therefore, it is unclear if total nitrogen and total phosphorus in discharges from the watershed are causing the lower dissolved oxygen levels. Like Wiggins Pass, low dissolved oxygen concentrations in the estuary may be impacted by baseflow discharges from the drainage canals. Groundwater is predicted to be low in dissolved oxygen concentration and baseflow in the watershed represents as much as 70 percent of the canal flow in the dry season and about 58 percent as an annual average. Additional monitoring should be conducted to evaluate the effect of any nutrient loading that may occur as a result of human activities.

Fecal coliform bacteria concentrations exceeded the state standard at most discharge locations. Therefore, there is a possibility that the estuary is affected by watershed discharges of fecal coliform bacteria. Bacteria source evaluations are necessary to confirm this condition.

Similar to the discussion for Wiggins Pass, it is possible that groundwater discharges through the canal system are a source of elevated iron concentrations. In fact, the water quality model developed for the Golden Gate watershed (discussed in Volume 4) predicts high concentration of iron in canal discharge during dry periods.

The source of copper in the estuary could be due to human activity, such as algaecide applications used to prevent algae growth. Sources of high copper concentrations could also include leachate from boardwalks and pilings that are constructed from pressure-treated lumber.

Rookery Bay Estuary

Rookery Bay is the receiving water for the Rookery Bay watershed and is presently listed as impaired for dissolved oxygen and fecal coliform. This estuary is also listed impaired for nutrients, which are potential causes of low dissolved oxygen concentrations.

Data available at the two stations analyzed for planning period conditions and the four stations with data available for the verified period analysis indicate that the dissolved oxygen concentration in the discharges do not meet the estuary water quality standard. Low dissolved oxygen concentrations in the drainage canals could be attributed to excessive nutrient concentrations, as well as groundwater inflows.

The estuarine water quality criterion for fecal coliform bacteria is exceeded between approximately 60 and 75 percent of the time at the watershed discharge point. It is therefore likely that the estuary is affected by watershed discharges. Additional bacteria source evaluations are necessary to verify the sources of fecal coliform in the estuary.

Ten Thousand Islands Estuary

The Ten Thousand Islands is the receiving water for the Faka-Union, Okaloacoochee/SR 29, and Fakahatchee watersheds and is presently not listed as impaired for any parameter. The watersheds remain relatively undeveloped in comparison with the three priority watersheds. Therefore, the estuary has not been subject to significant impacts from human activity.

Conclusions

Wiggins Pass, Naples Bay, and Rookery Bay have been found impaired for dissolved oxygen and fecal coliform bacteria. Rookery Bay is also impaired for nutrients. The discharges to the estuaries have concentrations of dissolved oxygen and fecal coliform bacteria that may affect the estuarine water quality. The causes of low dissolved oxygen concentration may include high nutrients concentrations, baseflow (groundwater) discharges, and potentially water color. Additional monitoring is needed to determine if low dissolved oxygen concentrations are due to natural processes or due to human activity.

Other parameters of impairment concern are iron and copper. Iron appears to result from the groundwater discharges throughout the canal network, although other man-made sources are possible. High copper concentrations may be the result of human activity such as the use of copper sulfate as an algaecide to prevent algae growth in ponds or leaching from boardwalks and pilings.

1.11: Quality of Receiving Waters

Water quality in Wiggins Pass, Naples Bay, Rookery Bay, and Ten Thousand Island estuaries was characterized with respect to TMDL criteria per the Florida Department of Environmental Protection's (FDEP) verified list of impaired waters. The primary water quality concerns were dissolved oxygen, fecal coliform bacteria, and iron. Further studies are necessary to identify the causes of the impairments.

Introduction

The estuaries in Collier County are designated as Class II – Shellfish Propagation or Harvesting, and FDEP established water quality criteria to protect recreation and the propagation of a healthy, well-balanced population of fish and wildlife. The water quality assessment completed in Wiggins Pass, Naples Bay, Rookery Bay, and Ten Thousand Islands estuaries (Figure 1-45) was characterized in the context of the TMDL impairment conditions per the Florida Department of Environmental Protection's (FDEP) verified list of impaired waters. The full evaluation criteria and results of the analysis are described in Volume 4. The Wiggins Pass estuary is the receiving water of the Cocohatchee-Corkscrew watershed. The Naples Bay estuary is the receiving water of the Golden Gate-Naples Bay watershed and Gordon River extension. The Rookery Bay estuary is the receiving water of the Rookery Bay watershed. The Ten Thousand Islands estuary is the receiving water of the Faka Union, Okaloacoochee / SR 29, and Fakahatchee watersheds combined.

Methods

The estuaries were evaluated for potential impairments by analyzing data collected during the 10-year period of 2000 – 2009. FDEP data was supplemented with data from Florida STORET, Collier County, the City of Naples, and the Rookery Bay National Estuarine Research Reserve (RBNERR) to create a comprehensive water quality database. Water quality parameters reviewed included dissolved oxygen, fecal coliform bacteria, chlorophyll-*a*, iron, copper, color, transparency, total suspended solids, total nitrogen, and total phosphorus.

Results

The data analysis confirmed most of the water quality impairments previously identified by FDEP for Wiggins Pass, Naples Bay and Rookery Bay. The results of the analysis completed for this project indicated that the Rookery Bay chlorophyll-*a* impairment is not supported by the available data. Rookery Bay may be re-assessed in the next FDEP listing cycle. FDEP has no listed impairments for the Ten Thousand Islands estuary. Following is a more detailed description of the findings by estuary system.

Figure 1-45. Collier County Estuaries and Major Features

Wiggins Pass Estuary

The estuary is presently listed as impaired for dissolved oxygen, fecal coliform and iron. Based on analysis of available water quality data, impairments for dissolved oxygen, fecal coliform, and iron in Wiggins Bay estuary previously identified by FDEP were confirmed. Per the State's Impaired Waters Rule 62-303.710 FAC, the cause of the dissolved oxygen impairment must be identified. The data analysis completed for this project indicated that one potential cause is the decomposition of organic material from the adjacent mangroves and upstream landscapes. Low dissolved oxygen concentrations due to high levels of color (aka. tannins) occurring in wetland systems is a factor of importance in the watershed that is mostly comprised of natural areas. Another potential cause is baseflow (groundwater) discharged into the estuary as it represents between 20 and 40 percent of the total annual surface water flow. Nutrient runoff from agricultural and urban areas in the watershed may also

be a contributing factor; however, measured concentrations of total nitrogen and total phosphorus are below FDPE's screening criteria. Source identification studies are recommended to further determine the cause of the impairment.

Atkins confirmed the listed impairment for fecal coliforms. Source identification studies are recommended to determine whether anthropogenic factors are the source of the elevated bacteria concentrations. Currently, the FDEP is evaluating the application of the State standard (Bartlett, 2010) and the County should continue to work with the agency to address the issue.

In terms of iron concentrations, the sources may be the result of human activity or the sources may be due to groundwater contributions. As indicated above, baseflow represents between 20 and 40 percent of the total annual surface water flow in the Cocohatchee watershed. In addition, the results of a water quality computer model developed for the Golden Gate watershed have shown that iron concentrations remain high in the drainage canals during dry periods when the flow consists primarily or baseflow. Source identification assessments are necessary to identify the source of impairment.

Naples Bay Estuary

An analysis of available water quality data completed as part of this project confirmed the dissolved oxygen, fecal coliform, iron, and copper impairments identified previously by FDEP for the Naples Bay estuary. The dissolved oxygen impairment may be attributed to nutrient inputs, however measured nutrient concentrations are less than 15 percent of FDEP's screening criteria. Low dissolved oxygen concentrations may also be the result of baseflow discharges, since it represents 58 percent of the average annual flow into the estuary, and is as high at 73 percent during the dry season. Other potential causes of the dissolved oxygen impairment include elevated total suspended solids loads if sufficient organic material is available for decomposition, and the stratification caused by stormwater discharges. Further study is needed to identify the actual causes of the dissolved oxygen impairment.

In addition to dissolved oxygen, the Naples Bay Estuary was found to be impaired for fecal coliform. Elevated fecal coliform bacteria concentrations in Naples Bay may be caused by discharges from the watershed; however, none of the water bodies in the watershed have been declared impaired for this parameter. As in Wiggins Pass, source identification studies are recommended to determine whether anthropogenic factors are the source of the elevated bacteria concentrations.

Similar to the Wiggins Pass Estuary, the iron impairment may be a result of human activity or may be due to groundwater influence. The Golden Gate watershed computer model (discussed in Volume 4) has shown that iron concentrations remain high in the drainage canals during dry periods because the flow is primarily baseflow. Source identification assessments are necessary to further verify the cause of the impairment.

Sources of copper appear to be due to human activity. The source of copper in the estuary could be due to human activity, such as algaecide applications used to prevent algae growth. Sources of high copper concentrations could also include leachate from boardwalks and pilings that are constructed from pressure-treated lumber. It is possible that the siting of the sampling stations near boardwalks and pilings contributed to the overall determination of copper impairment. The City of Naples and FDEP are completing additional copper sampling to try and identify the sources of this impairment.

Rookery Bay Estuary

Based on analysis of available water quality data, Atkins confirmed FDEP's Rookery Bay impairments for dissolved oxygen and fecal coliform. However, FDEP's assessment that the estuary is impaired for chlorophyll-*a* was not confirmed. The designated impairment for chlorophyll-*a* may be re-assessed by FDEP as part of the next impairment cycle.

Similar to the other estuaries, the dissolved oxygen impairment may be attributed to nutrient loading from runoff; however, the measured concentrations of total nitrogen and total phosphorus are approximately 10 percent of the FDEP's screening criteria. The dissolved oxygen impairment may also be attributed to the decomposition of organic material from the adjacent wetlands and upstream landscapes (McCormick, 1997), or from baseflow discharges that represent 63 percent of the total annual flow and 71 percent of the dry season flow in the drainage canals. Source identification studies are recommended to further determine the cause of the impairment.

The Rookery Bay Estuary was also found to be impaired for fecal coliform. Elevated fecal coliform bacteria concentrations may be caused by discharges from the watershed; however, as in the Naples Bay Estuary, none of the water bodies in the watershed have been declared impaired for this parameter. Source identification studies are also recommended for this estuary system.

Ten Thousand Islands Estuary

Based on analysis of available water quality data, FDEP has determined that the Ten Thousand Islands estuary is not impaired for any water quality parameter.

Conclusions

The Wiggins Bay, Naples Bay, and Rookery Bay estuaries were found to be impaired for dissolved oxygen and fecal coliforms. Wiggins Bay was also found to be impaired for iron, and Naples Bay was found to be impaired for iron and copper. The Ten Thousand Islands estuary was not found to be impaired for any water quality parameter. It is recommended that Collier County work with the FDEP to determine the sources for the identified impairments in Wiggins, Naples, and Rookery Bay estuaries.

1.12: Coastal Habitats

The reduction in areal extents of oyster bars, sea grass beds, mangrove forests and salt marshes for the estuaries of Wiggins Pass, Naples Bay, Rookery Bay, and the Ten Thousand Islands is attributable to direct physical loss associated with coastal development. Habitat loss in Wiggins Pass and Naples Bay estuaries has been substantially greater when compared with the Ten Thousand Islands and Rookery Bay estuaries, due to greater urbanization in Wiggins Pass and Naples Bay estuaries.

Introduction

Estuaries provide many ecosystem functions, including shoreline stabilization, nutrient recycling, and habitat for a diverse assemblage of plants and animals. Within Collier County, dredge-and-fill became the established method to meet the post-World War II demand for housing. Canals served to create waterfront property, increase access for boating, and provide fill material needed for the creation of buildable lots. Coastal development has also led to increased extent of impermeable surfaces and a subsequent increase in freshwater inputs from the watershed. The timing and volume of freshwater discharges to the estuaries have been dramatically altered when compared with historical conditions as a result of too much fresh water delivered to the estuaries during the wet season and too little during the dry season. As a result, the historical areal extents of oyster bars and sea grass beds have been reduced by salinity changes in response to altered freshwater inputs, shading due to increased water turbidity, and smothering due to increased sedimentation. The tidal mangrove habitat has also been affected by coastal development and the altered salinity regime.

Methods

To quantify changes, if any, in the spatial extent of oyster bars, sea grass beds, mangrove forests, and salt marshes, a variety of GIS databases were queried, and results compared and contrasted.

Results

Wiggins Pass

Wiggins Pass was first officially dredged in 1952, and dredging has continued in the inlet and along the inland waterway south of Bonita Beach and north of Naples Park. Development of the coastal area surrounding Wiggins Pass began in the early 1950s resulting in the creation of residential canals which have altered natural sheet flow of water. The area adjacent to Wiggins pass (Figure 1-46) has shifted from a mangrove dominated system to a one of both tidal marsh and mangroves. In addition, there has been an overall decrease in the extent of the mangrove community associated with direct physical alterations of the shoreline due to coastal development.

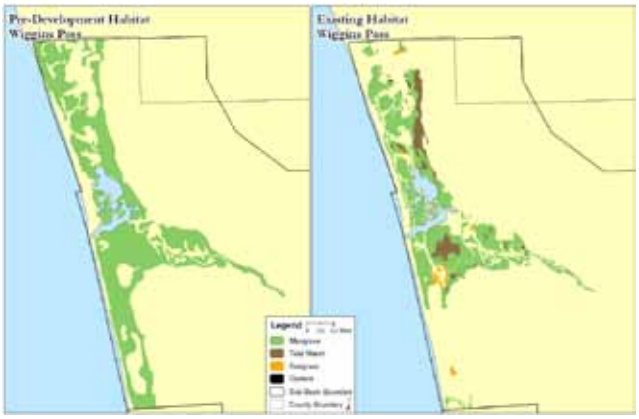

Figure 1-46. Wiggins Pass Habitat

Naples Bay

Historical maps and records indicate that Naples Bay was a shallow estuarine system with mangrove islands surrounded by oyster and sea grass beds. Dredging to create the residential development along artificially created canals altered the tidal flushing patterns and the overall function of the bay as a shallow estuarine system. The length of shoreline along Naples Bay (Figure 1-47) increased by nearly 50 percent between 1927 and 1965, followed by an additional increase of 11 percent between 1965 and 1978. The increase in shoreline length is due to the construction of residential canals. In addition, a 91 percent loss in sea grass habitat and 82 percent loss in oyster habitat since the 1950s were documented.

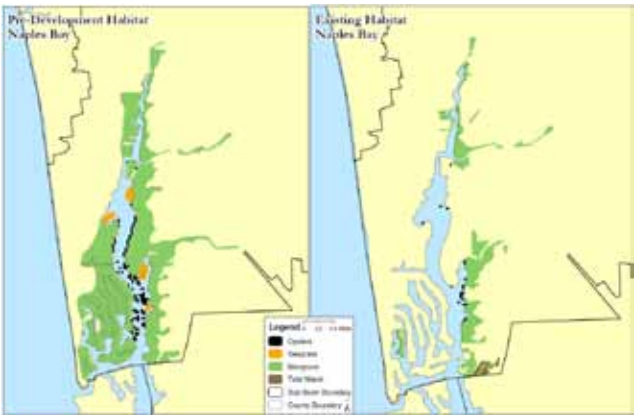

Figure 1-47. Naples Bay Habitat

Rookery Bay

The Rookery Bay watershed has been dramatically altered by channel construction and current estuarine salinity regimes are more strongly influenced by canal management than by tides or rainfall.

Based on assessments of the rates of vertical accretion in the mangrove forests within Rookery Bay (Figure 1-48), elevations of the mangrove forest have kept pace with sea level rise over approximately the past 70 years. This finding supports the importance of mangroves as a stabilizing influence on shorelines and preventing erosion in coastal regions. Rookery Bay has experienced an overall decrease in the combined mangrove and salt marsh habitat within its estuary boundaries.

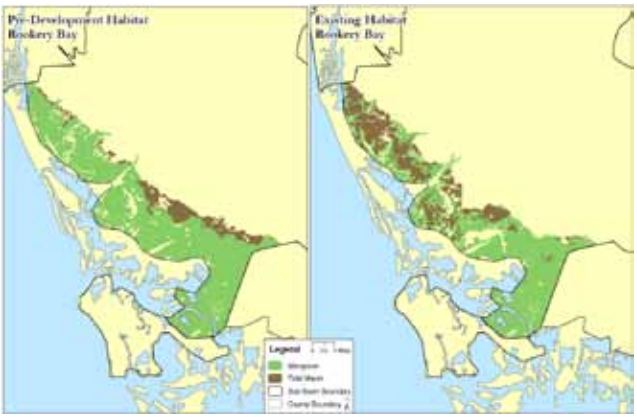

Figure 1-48. Rookery Bay Habitat

Ten Thousand Islands

Within the Ten Thousand Islands estuary, the natural spatial and temporal variation in salinities has been substantially and adversely affected by upstream water management. The Ten Thousand Islands estuary is a complex community of mangrove islands, oyster beds and shallow lagoons. The Ten Thousand Islands mangrove system (Figure 1-49) appears to have declined slightly in areal extent, but has also apparently transitioned into tidal marsh.

Figure 1-49. Ten Thousand Islands Mangrove

Conclusions

The loss of coastal habitats in Collier County's estuaries is due primarily to direct physical loss associated with coastal development. However, habitat loss in the Wiggins Pass and Naples Bay estuaries has been substantially greater when compared with the Ten Thousand Islands and Rookery Bay estuaries. In the Wiggins Pass estuary, the combined acreage of salt marsh and mangroves has declined by 29 percent over pre-development conditions. Acres of salt marsh and mangrove have declined by approximately 76 percent over time in Naples Bay. In contrast, the less-impacted estuaries of Rookery Bay and the Ten Thousand Islands have experienced salt marsh and mangrove declines of 12 and 5 percent, respectively.

For Wiggins Pass and Naples Bay, the amount of loss of salt marsh and mangrove reflects the greater degree of development pressures. Less development in the coastal reaches of the Rookery Bay estuary reflects the protection this area has received through various land acquisition activities (e.g. the 110,000-acre Rookery Bay National Estuarine Research Reserve). Direct loss of salt marsh and mangrove habitat is even less in the Ten Thousand Islands; however the remaining estuarine habitats have been adversely affected by alterations in the timing and quantity of freshwater inflows.

In addition to the reduced ecosystem functioning of estuarine ecosystems due to alterations in the timing and quantity of freshwater inflow, Collier County's

more urbanized estuaries (e.g., Wiggins Pass and Naples Bay) have also experienced large-scale habitat losses due to direct physical alterations of the shoreline. For Wiggins Pass and Naples Bay, re-creating a more natural hydrologic inflow pattern might not be sufficient for restoring past estuarine functions, since many of the physical features formed by oyster reefs and sea grass meadows have been lost over time. In contrast, the majority of tidal marsh and mangrove systems are still intact in Rookery Bay and the Ten Thousand Islands. What remains to be accomplished in Rookery Bay and Ten Thousand Islands appears to be restoration of a more natural pattern of freshwater inflow for these less-developed estuaries, a feasible option that will be fully developed as part of this project.

SUMMARY DEVELOPMENT OF PERFORMANCE MEASURES

Performance measures were developed for freshwater discharge to estuaries, pollutant loads, aquifer recharge, and natural systems using the same approach of comparing pre-development with existing conditions to establish a performance score against which to evaluate the success of proposed projects.

Performance measures are tools based on a set of indicators used in project planning to predict (or evaluate) the degree to which proposed alternative plans are likely to meet restoration objectives and to assess the success of implemented plans in meeting restoration objectives (CERP 2007). For example, most performance measures for the Everglades restoration projects were developed through conceptual models that identified key stressors and attributes of the natural system. Attributes are biological and ecological indicators in the natural system that respond to effects of stressors. Performance measures for other watershed processes are based on estimates of potential impacts to the natural system.

The intent of the performance measures developed for the CCWMP was to maintain consistency with this concept, as developed by the CERP program. Therefore, performance measures for natural systems, freshwater discharge to the estuaries, pollutant loads, and aquifer characteristics were developed based on the concepts outlined below.

- The performance measure must address indicators that represent attributes or stressors of natural or human systems that the proposed project or management action is expected to affect.
- The performance targets, e.g., reduced pollutant loads, must reflect the desired restoration condition, which is the maximum level of restoration possible given the existing development conditions.
- The performance measure must provide an understanding of system-wide responses relative to how project implementation will meet improvement and/or restoration goals

The approach to developing the performance measures was based on "restoring" the system as close as possible to the original condition, while being cognizant of the limitations imposed by existing land use conditions and economic constraints.

The maximum level of restoration, then, would be pre-development conditions. The NSM was used to provide the pre-development, or baseline condition. The County's ECM was used to characterize existing conditions. The difference between the two gives the total restoration possible, without restraints of existing development and cost and provides a means of evaluating the improvement, or "lift" anticipated as a result of implementing a project. The process applied to the development of individual performance measures is described in the following sections.

2.1: Natural Systems

Functional assessment scores, or performance measures, were calculated for the watersheds in Collier County. Average scores are lower for the Golden Gate-Naples Bay watershed due to extensive canals systems and development and suggest that hydrologic restoration may provide the greatest opportunity for measurable improvement in functional value in the County.

Introduction

Performance measure development for the natural systems component of the CCWMP was accomplished as part of the *Functional Assessment*. Under this task, pre-development and current conditions were compared and losses and conversions of native plant communities in Collier County watersheds over the past 50–60 years were estimated via a change analysis of land use cover data. The 1942 Collier County soils map provided additional data to characterize pre-development characteristics in the watersheds. The vegetation and soils data are reported and analyzed for the first three watersheds individually and the other three watersheds collectively.

Methods

Results of an analysis of changes in areal extent of natural communities and the causes of those changes (described in Volume 4) were used to evaluate current watershed functions (Functional Assessment). The pre-development data serve as the reference period, or baseline index against which to evaluate current land cover data. The modified UMAM scoring provided a landscape scale functional assessment adequate to identify resource protection areas. Performance measures were established prior to the development of proposed project alternatives and were used to:

- Evaluate how well proposed alternatives meet specific project objectives.
- Examine the applicability and feasibility of specific alternative analyses.
- Address the issues identified in the assessment of existing conditions, including surface water, groundwater, and natural systems.

Similar to performance measures developed for freshwater discharges and groundwater, performance scores were calculated that provide a baseline conditions against which the success of proposed projects can be measured.

Resource protection scores represent the function, or value, of the landscape based on the degree to which the existing conditions are the same as pre-development. The difference in scores between pre-development and existing conditions provides the baseline against which to evaluate the result of a project, such as removing a control structure or filling a canal. If the anticipated improvement, or "lift" score from the proposed project is greater than the performance score, one can conclude that the project will have a net benefit on the system. Hydrology and landscape (LSI) scores are developed similarly.

Dramatic conversions from pre-development wet prairie vegetation to a developed urban land use, for example, would be assigned low scores, while little or no change in vegetation cover (i.e., no change from pre-development, or shift to another natural vegetation classification) would be scored higher.

Results

Performance measures developed for this CCWMP are simply the hydrology and LSI scores developed for the functional assessment. The LSI and hydrology scores were developed as a means of characterizing existing baseline data (in numerical form) for natural conditions and, therefore, provide the conditions against which proposed projects can be measured. The vegetation score is not as applicable for evaluating the results of hydrological restoration projects because proposed projects will not focus on active vegetation management (although shifts in vegetation are expected to occur over time, commensurate with changes in hydrology).

The performance measures developed, i.e., the LSI and hydrology scores (refer to Volume 4 for further detail on development of scores), are suitable for small-scale site-level assessments (i.e., for projects that have little or no affect on the score of a 1500-X-1500-foot cell) or as modeled performance measures for larger-scale projects. The functional value of proposed projects will

be assessed using the UMAM functional value calculation below:

Resource Protection Value = [(Anticipated Score-Existing Score)/Maximum Score] x Number of Acres

where:

Performance Measure = Resource Protection Value

Anticipated Score = anticipated hydrology index or LSI

Existing Score = Hydrology score OR LSI based on existing conditions

Maximum Score = 10

Number of Acres = Acres of site being evaluated

As an example, consider a 500-acre proposed project area with a current hydrology score of 6. Rehydration of the site by filling a drainage ditch to the elevation of the surrounding area is reasonably expected to increase the hydrology score to 8. The hydrologic functional value of this proposed project would be 100 ((8-6)/10) X 500 acres). Likewise, LSI functional values would improve within, and adjacent to, projects that include restoration to more-natural conditions, conservation easements, transfers of development rights, or other similar means of improving the degree of resource protection to adjacent areas.

Conclusions

Resource protection scores, or performance measures, are presented in Table 2-1 for the watersheds in Collier County. Average scores are lower in the Golden Gate-Naples Bay watershed due to extensive canals systems and development and indicate that hydrologic restoration may provide the greatest opportunity for measurable improvement in functional value in Collier County.

Table 2-1. Existing Conditions Average Resource Protection Scores of Non-Urban Lands, by Watershed

Watershed	Non-Urban Acres	Average Vegetation Score	Average Hydro Score	Average LSI Score
Cocohatchee-Corkscrew	111,250	7	7	8
Golden Gate-Naples	36,627	5	6	6
Rookery Bay	83,105	8	6	9
Faka Union/ Fakahatchee/ Okaloacoochee - SR 29	431,414	9	6	9

2.2: Freshwater Discharge to Estuaries

A performance measure was developed for freshwater discharges from Collier County watersheds and provides a baseline against which to measure the improvement, or "lift" due to implementation of a proposed project. The Golden Gate – Naples Bay watershed had the lowest performance score among the watersheds. The low score represents the year round flow surplus discharging into Naples Bay.

Introduction

A "Discharge to Estuary" performance score was developed for the Cocohatchee-Corkscrew, Golden Gate-Naples Bay, Rookery Bay, and Faka Union, Okaloacoochee/SR 29, and Fakahatchee watersheds. The score was based on a comparison of existing and pre-development discharge conditions and provides a baseline against which to measure the improvement, or "lift" due to implementation of a proposed project. As indicated previously, the method is defined as the Performance Measure and is used to assign a score to the characteristics of the system under existing conditions against which the success of proposed projects can be measured. It will also be used to identify benefits of alternative improvement projects that are being proposed for each watershed.

Methods

Scoring is based on results of the timing and volume of discharges to estuaries from the NSM and ECM for the watersheds. As described previously, average monthly discharge volumes from the NSM and ECM models were used to define the baseline distribution and total volume of flow from each watershed. The methods are outlined below.

- The monthly discharge from each watershed in the NSM model is considered the baseline condition and assigned a performance score = 10.
- Monthly discharge from the ECM is assigned a score from one (1) to 10.
- The monthly score is (NSM volume/ECM volume) X 10. If the NSM volume is larger than the ECM volume, score = (ECM volume/NSM volume) X 10.
- The average of the monthly scores determines the watershed score relative to the NSM.

Results

The scoring matrix shown in Table 2-2 lists wet and dry season and annual scores for each of the other watersheds. Of the four watersheds, the Golden Gate – Naples Bay watershed received the lowest annual score of 1.6. The score is indicative of the year round flow surplus discharging into Naples Bay. The scores for the Rookery Bay watershed reflect the freshwater deficits occurring during the dry season and the surplus occurring during the wet season. The deficit is caused by the current reduced size of the watershed that resulted from construction of the Golden Gate Main Canal. The wet season surplus is likely due to stormwater runoff from the Lely area and from the agricultural lands in the southeast portion of the watershed.

In the Cocohatchee-Corkscrew, and Eastern (Faka Union, Fakahatchee, and Okaloacoochee/SR 29) watersheds, the dry season scoring results indicate that the operational controls that are used to manage dry season flows are reasonably effective at matching pre-development flow conditions. However, wet season scores are low for all watersheds, which is an indication of the effect of development on the existing canal drainage system.

Table 2-2. Discharge to Estuary Performance Scores

Watershed	Annual Score	Dry Season Score	Wet Season Score
Golden Gate-Naples Bay	1.6	1.9	1.0
Cocohatchee-Corkscrew	5.4	6.9	2.5
Rookery Bay	4.3	3.1	6.8
Faka Union/ Fakahatchee/ Okaloacoochee- SR 29	5.6	7.4	2.0

Conclusions

To evaluate the alternative scenarios, a similar scoring methodology will be used. The calculated monthly flows for each scenario will be compared to the NSM calculated monthly flows. For instance, for a project implemented in the Golden Gate Naples Bay watershed that leads to a reduction in flow to the estuary, the calculated monthly flow for September might be 5.0 inches. In the ECM, the score for September is one (1), but for the alterative, the score would be two (2):

$$(0.78/5.0) \times 10 = 2, \text{ where:}$$

0.78 = the NSM monthly flow for September, and

5.0 = the Alternative monthly flow for September

2.3: Surface Water Pollutant Loads

Performance measures for pollutant loads were calculated as a function of pollutant loads. Current scores indicate that the WBIDs of most concern in terms of nutrient pollution loads are in the Cocohatchee – Corkscrew and the Golden Gate – Naples Bay watersheds, particularly the coastal segment of Naples Bay and the Gordon River Extension.

Introduction

Pollutant loads were characterized for existing conditions as part of Element 1: Assessment of Existing Conditions- Watersheds. The pollution load calculations are based strictly on pollution resulting from human activities. Performance scores were developed as part of that characterization to provide a measurable means to assess pollutant loading conditions compared to the natural system. In addition, the scores were used as performance measures to assess the benefit of proposed watershed improvement projects. Post project conditions considered the improvement, or "lift" in water quality conditions due to reduced pollutant loads anticipated as a result of implementing proposed projects.

Pollution loads and pollution load scores were calculated for each cell in the computer model domain and then aggregated by watershed and water body identification number (FDEP basins for TMDL purposes). Further details on pollution loads calculations and scoring are provided in Volume 4.

Methods

The pollution load score is a function of the pollutant loads for each model cell based on land use and drainage characteristics. The first step in the calculation of pollutant load scores was to normalize the pollutant load estimate to allow for comparisons between cells, WBIDs, and watersheds on a common scale. A data normalization factor was used for that purpose. The normalization factor in this case was assumed to be the average pollutant load from a medium density residential development not including treatment facilities. That normalization factor has no other significance but to provide a way to compare loads from multiple land uses and flow characteristics. The natural system load cannot be used as the normalization factor because the associated load is zero.

Once the data were normalized, the pollution load scores were calculated based on the ratio of total load from a model cell to the normalization factor, as shown is Table 2-3.

Table 2-3. Pollutant Load Scores and Ratios

Score	Ratio of Net Load to the Normalization Factor
10	< 10% of Normalization Factor
9	10% < Normalization Factor < 20%
8	20% < Normalization Factor < 30%
7	30% < Normalization Factor < 40%
6	40% < Normalization Factor < 50%
5	50% < Normalization Factor < 60%
4	60% < Normalization Factor < 70%
3	70% < Normalization Factor < 80%
2	80% < Normalization Factor < 90%
1	90% < Normalization Factor < 100
0	> 100% of Normalization Factor

Results and Conclusions

The distribution of pollutant load scores in Collier County is shown in the maps below (Figures 2-1 through 2-7). A score of 10 indicates no pollution loading associated with human activity, while a score of less than 2 indicates areas (e.g., urban or agriculture) that exhibit pollutant loads equal to or greater than urban areas with no stormwater runoff treatment. The minimum value is consistent with the 90 percent removal rate identified by FDEP to meet State Water policy.

Areas with higher pollutant loads are generally those without BMPs. For example, areas with low scores (high loadings) for total suspended solids correspond to the older urban developments located along the coast where total suspended solids are a consequence of the re-suspension of sediments accumulated on roads and drainage facilities. Nutrient loading scores (nitrogen and phosphorus) are lower in older developments, golf courses, and agriculture, most likely

a consequence of fertilizer application. Areas of concern for nutrient discharges are the Gordon River Extension, the Naples Bay and Wiggins Pass coastal area, and the agricultural areas along the eastern portion of the Cocohatchee-Corkscrew and Golden Gate-Naples Bay watersheds.

Lower heavy metal loading scores are associated with urban areas that have few or no stormwater treatment facilities. Notably, the largest EMC pollutant value used in the SWFFS analysis is for agricultural land uses. Further wet weather sampling is necessary to better define areas of agricultural nutrient concern.

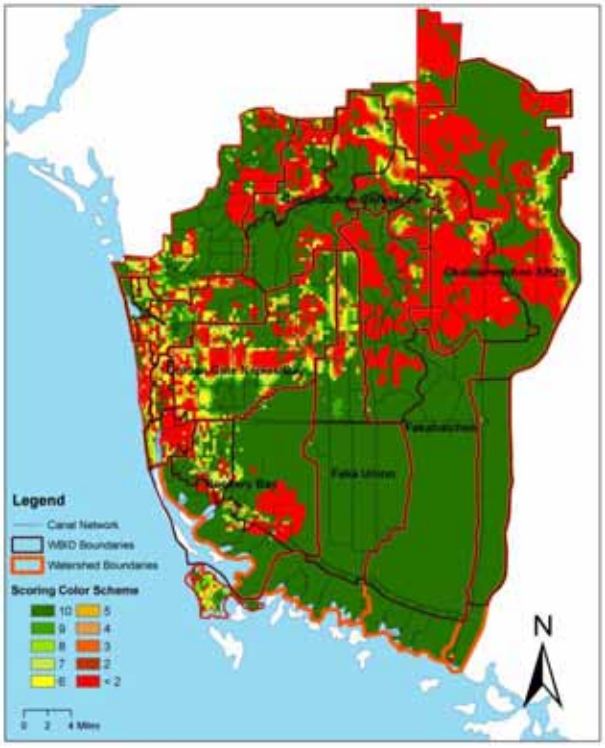

Figure 2-1. Total Nitrogen Pollutant Load Scores

Average performance scores for each pollutant constituent examined by watershed and by WBID are presented in the Table 2-4. Scores indicate that the WBIDs of most concern in terms of nutrient pollution loads are in the Cocohatchee – Corkscrew and the Golden Gate – Naples Bay watersheds, particularly the coastal segment of Naples Bay and the Gordon River Extension. The Golden Gate – Naples Bay watershed received the lowest average scores for the other pollutants because of the presence of areas of urban development with no treatment. It should be noted that the Lake Trafford WBID shows a pollution load of zero (0). That is because the WBID includes only the lake itself. The drainage area contributing to Lake Trafford includes WBIDs 3278E, Cow Slough, and 3278L, the Immokalee Basin.

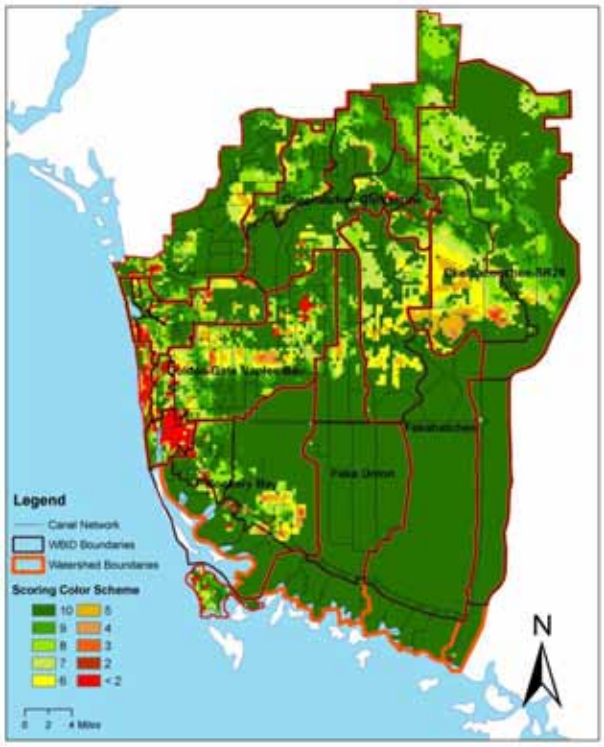

Figure 2-2. Total Suspended Solids Pollutant Load Scores

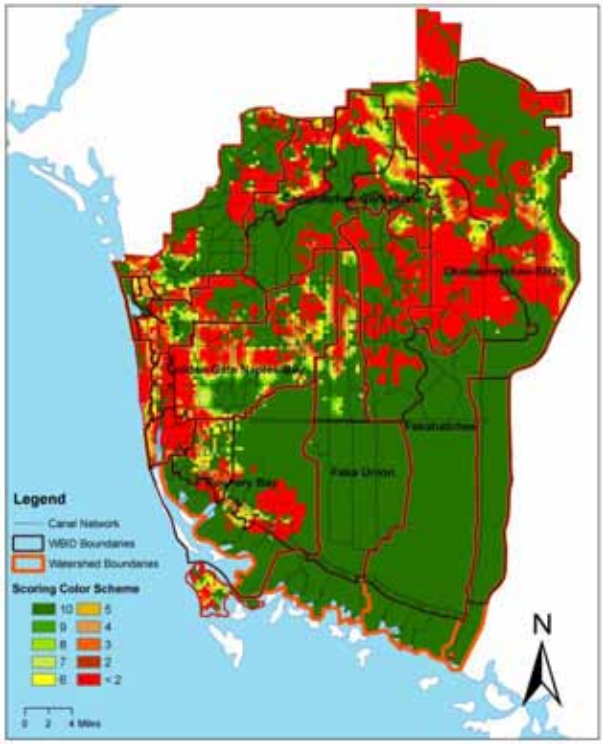

Figure 2-3. Total Phosphorus Pollutant Load Scores

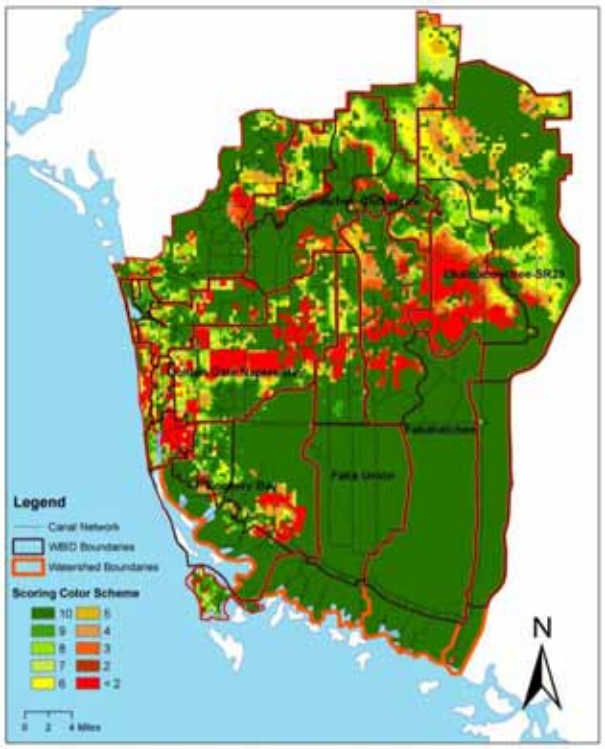

Figure 2-4. BOD-5 Pollutant Load Scores

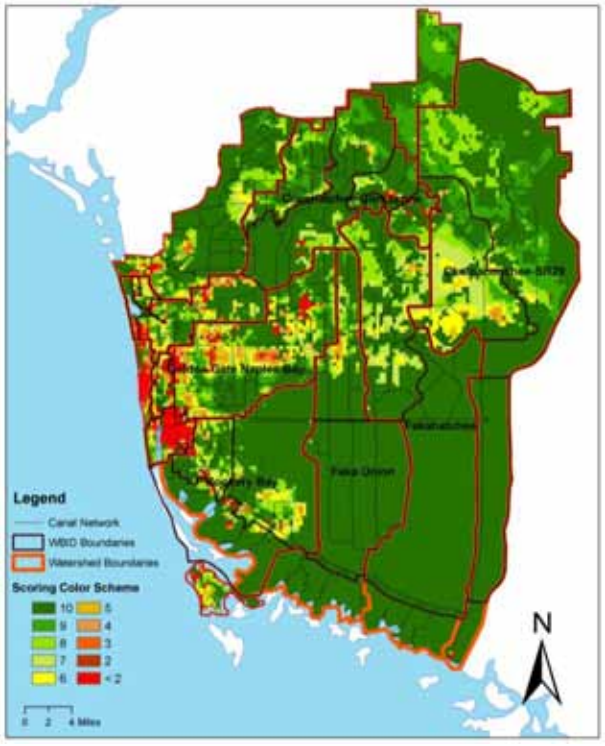

Figure 2-5. Copper (Cu) Pollutant Load Scores

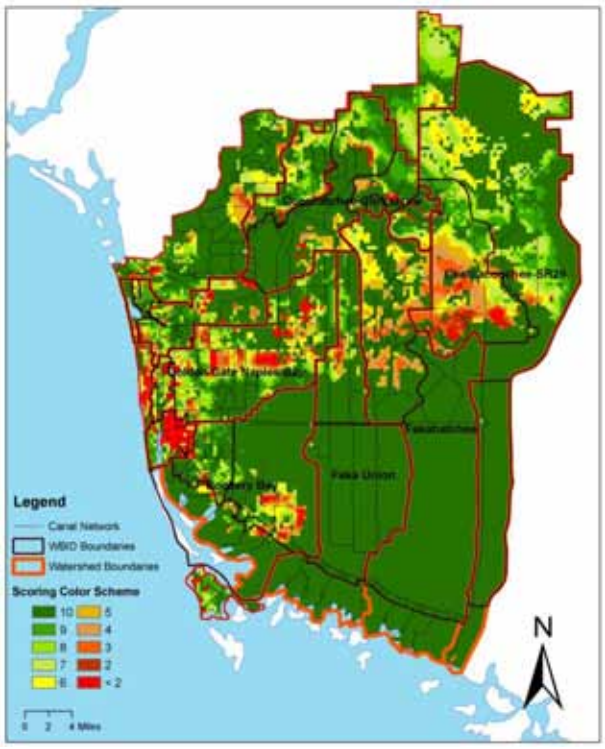

Figure 2-6. Lead (Pb) Pollutant Load Scores

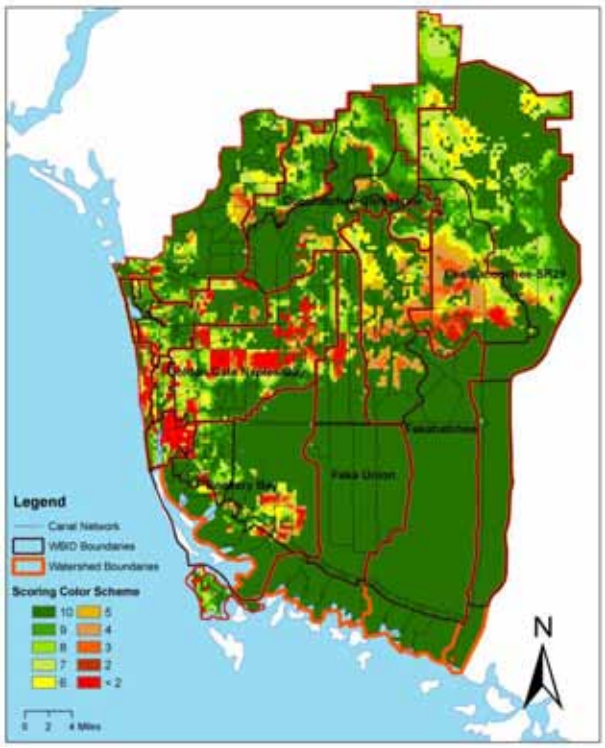

Figure 2-7. Zinc (Zn) Pollutant Load Scores

Table 2-4. Pollutant Load Performance Measures, by WBID and Watershed

Watershed	WBID	WBID Name	BOD-5	TP	TN	TSS	Zinc	Copper	Lead
Cocohatchee-Corkscrew	3259A	COCOHATCHEE RIVER	8	8	7	8	8	8	8
	3259B	DRAINAGE TO CORKSCREW	7	0	2	9	8	9	8
	3259W	LAKE TRAFFORD	10	10	10	10	10	10	10
	3259Z	LITTLE HICKORY BAY	6	5	5	7	7	7	7
	3278C	COCOHATCHEE GOLF COURSE DISCHARGE	8	7	5	7	8	6	8
	3278D	COCOHATCHEE (INLAND SEGMENT)	8	4	4	9	8	8	8
	3278E	COW SLOUGH	8	4	4	9	9	9	9
	3278F	CORKSCREW MARSH	9	5	6	10	9	10	9
	3278L	IMMOKALEE BASIN	7	1	2	8	8	8	8
Average			8.2	3.8	4.5	9.3	8.5	9.1	8.5
Golden Gate - Naples Bay	3278K	GORDON RIVER EXTENSION	5	2	1	6	6	5	6
	3278R	NAPLES BAY (COASTAL SEGMENT)	0	0	0	0	1	0	0
	3278S	NORTH GOLDEN GATE	6	6	5	8	8	8	7
Average			5.3	5.1	4.2	7.0	7.1	7.0	6.2
Rookery Bay	3278U	ROOKERY BAY (COASTAL SEGMENT)	10	8	9	10	10	10	10
	3278V	ROOKERY BAY (INLAND EAST SEGMENT)	9	6	7	10	10	10	9
	3278Y	ROOKERY BAY (INLAND WEST SEGMENT)	9	7	6	9	9	8	9
Average			9.3	6.7	7.4	9.8	9.8	9.7	9.3
Faka Union/ Fakahatchee/ Okaloacoochee/ SR29	3278H	FAKA UNION (NORTH SEGMENT)	8	8	8	10	9	10	9
	3278I	FAKA UNION (SOUTH SEGMENT)	10	10	10	10	10	10	10
	3259I	CAMP KEAIS	7	0	1	9	8	9	8
	3278G	FAKAHATCHEE STRAND	10	10	10	10	10	10	10
	3261C	BARRON RIVER CANAL	10	10	10	10	10	10	10
	3278T	OKALOACOOCHEE SLOUGH	9	4	5	10	9	10	9
	3278W	SILVER STRAND	5	0	0	8	7	8	7
Average			8.6	5.8	6.2	9.6	9.0	9.6	9.0

2.4: Aquifer Recharge/Yield

Areas in the Water Table aquifer that score poorly tend to correspond to wellfield locations such as the Rookery Bay and Golden Gate watersheds and the northern portion of the Faka Union watershed.

Introduction

Groundwater levels in Collier County fluctuate seasonally in response to withdrawals. The critical period for groundwater conditions is the dry season that coincides with the advent of seasonal population and when agricultural irrigation needs increase.

The impacts experienced by the Water Table, Lower Tamiami, and Sandstone aquifers systems in Collier County was assessed by comparing results of the NSM, which represents pre-development conditions, to those from the Existing Conditions Model ECM. A performance measure was developed to calculating the difference in potentiometric surface elevations for the confined aquifers, or the water level for the Water Table aquifer.

Methods

The NSM is considered to represent pre-development aquifer levels, which in turn represents the highest potential aquifer yield. A performance score of 10 was assigned to those pre-development aquifer levels. A performance score of zero was assigned to the lowest acceptable aquifer level. The SFWMD has defined the minimum aquifer level for confined aquifers to be the structural top of each aquifer. The lower limit of the performance measure was therefore designated as the physical upper limit of the aquifer unit. The lower limit of the Water Table aquifer was the bottom of the system, as defined by the location of the confining unit.

A performance score (0 to 10) for existing conditions was defined for each aquifer as the ratio of the ECM water level to the NSM water level using the following equation:

$$\text{Performance Score} = 10 - (10 \times [\text{NSM-ECM}] / [\text{NSM-TOA}])$$

Where: ECM= current potentiometric surface elevation

TOA= elevation of structural top of aquifer

NSM= elevation of potentiometric surface under pre-development conditions

Figure 2-8 is a conceptual diagram representing an aquifer with a performance score of approximately 4.5. As the NSM does not include the Mid Hawthorn, no performance score has been calculated for that aquifer.

Results and Conclusions

Weighted average performance scores for each WBID in each watershed are shown in Table 2-5. These scores are based on the average dry season water level for the ECM and the NSM. Relatively high performance levels are the result of averaging scores over the WBID or watershed area. Mapped performance scores based on each cell in the ECM illustrate a clearer pattern (Figures 2-9 through 2-11). For example, high (i.e., 10) scores (green) indicate high performance or relatively little change in dry season condition when compared with the NSM. Red areas represent low scores (i.e., 1) and are indicative of areas where water demand to meet agricultural and potable water supply needs reduces the performance scores relative to the historic groundwater levels against which they are measured.

Areas in the Water Table aquifer that score poorly tend to correspond to wellfield locations such as the Rookery Bay and Golden Gate watersheds and the northern portion of the Faka Union watershed. The results for the Lower Tamiami aquifer indicate the same pattern of performance scores exhibited by the Water Table aquifer. These similarities can be attributed to water movement between the aquifers.

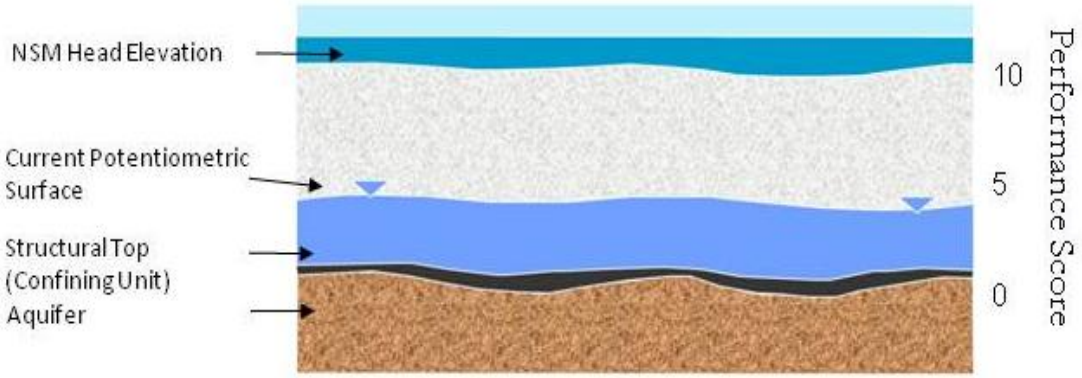

Figure 2-8. Conceptual Aquifer with Performance Score = 4.5

Table 2-5. Performance Scores for each Aquifer by WBID

Watershed	WBID	WBID Name	Water Table Aquifer	Lower Tamiami Aquifer	Sandstone Aquifer
Cocohatchee-Corkscrew	3278D	COCOHATCHEE (INLAND SEGMENT)	9.3	9.6	9.9
	3278C	COCOHATCHEE GOLF COURSE DISCHARGE	9.1	9.6	9.7
	3278F	CORKSCREW MARSH	9.4	9.4	9.6
	3278E	COW SLOUGH	9.5	9.4	9.5
	3259B	DRAINAGE TO CORKSCREW	9.5	9.6	9.5
	3278L	IMMOKALEE BASIN	9.1	9.2	9.5
	3259W	LAKE TRAFFORD	9.4	9.4	9.7
	3259Z	LITTLE HICKORY BAY	8.9	9.6	9.7
	Weighted Average		9.4	9.5	9.6
Golden Gate - Naples Bay	3278K	GORDON RIVER EXTENSION	9.3	9.5	9.8
	3278R	NAPLES BAY (COASTAL SEGMENT)	9.6	9.6	10.0
	3278S	NORTH GOLDEN GATE	8.9	9.3	9.8
	Weighted Average		9.0	9.3	9.8
Rookery Bay	3278U	ROOKERY BAY (COASTAL SEGMENT)	9.6	9.8	10.0
	3278V	ROOKERY BAY (INLAND EAST SEGMENT)	9.0	9.2	9.9
	3278Y	ROOKERY BAY (INLAND WEST SEGMENT)	7.2	9.1	9.9
	Weighted Average		8.7	9.3	9.9
Fakaunion	3278H	FAKA UNION (NORTH SEGMENT)	8.5	8.8	9.7
	3278I	FAKA UNION (SOUTH SEGMENT)	8.4	8.9	9.8
	Weighted Average		8.5	8.9	9.8
Fakahatchee	3259I	CAMP KEAIS	9.3	9.2	9.8
	3278G	FAKAHATCHEE STRAND	8.7	9.0	9.9
	Weighted Average		8.9	9.1	9.8
Okaloacochee-SR29	3261C	BARRON RIVER CANAL	8.4	8.8	10.0
	3278T	OKALOACOOCHEE SLOUGH	8.5	8.9	9.3
	3278W	SILVER STRAND	8.4	8.6	9.5
	Weighted Average		8.4	8.8	9.5

A low scoring area in the Okaloacoochee / SR 29 watershed corresponds with agricultural areas with significant irrigation demands. The southern Faka Union watershed was also scored poorly. This result is likely due to the presence of the canal network that has effectively drained the historical wetlands. Results are similar in a portion of the Golden Gate – Naples Bay watershed. These canals also influence the groundwater elevations and contribute to lower head elevations in the Water Table aquifer. Changes in structure operations could have a positive influence on groundwater elevation and availability in the watershed.

Differences in defined boundary conditions between the ECM and NSM are the likely cause of the low scores along the watershed boundaries for the Water Table and Lower Tamiami aquifers.

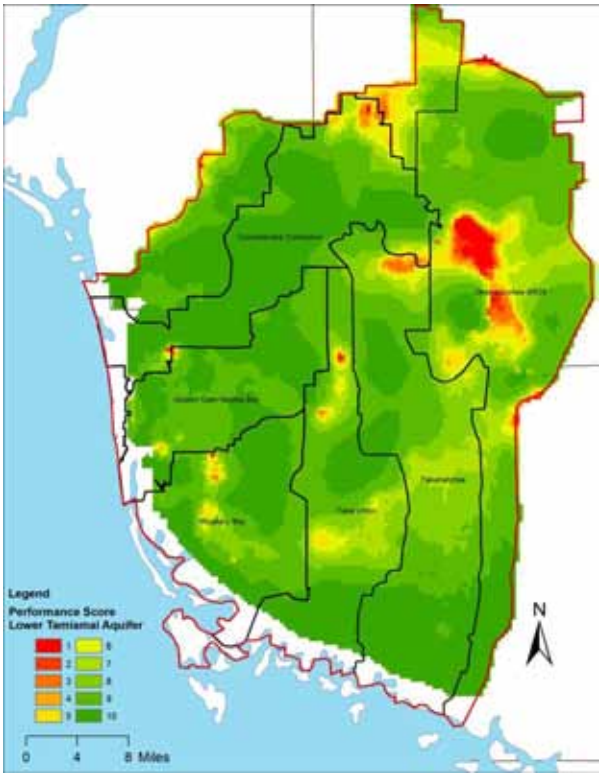

Figure 2-10. Lower Tamiami Aquifer Average Dry Season Performance Score

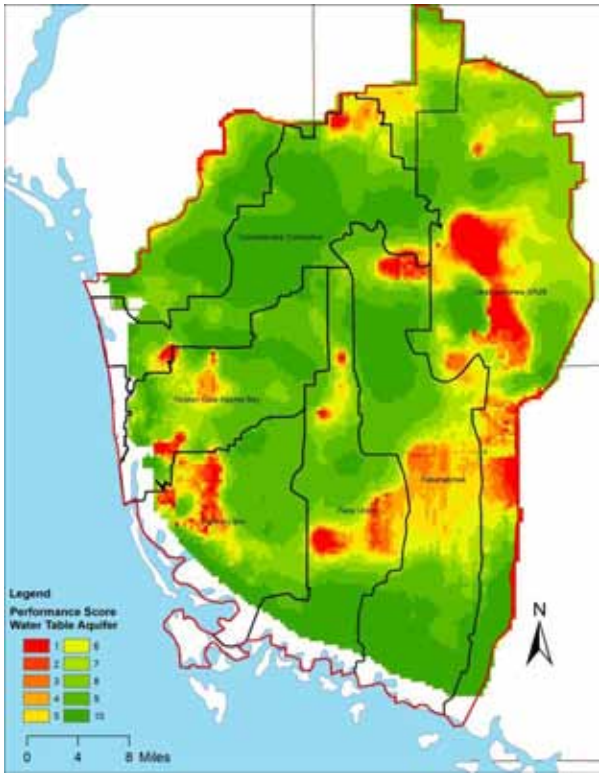

Figure 2-9. Water Table Aquifer Average Dry Season Performance Score

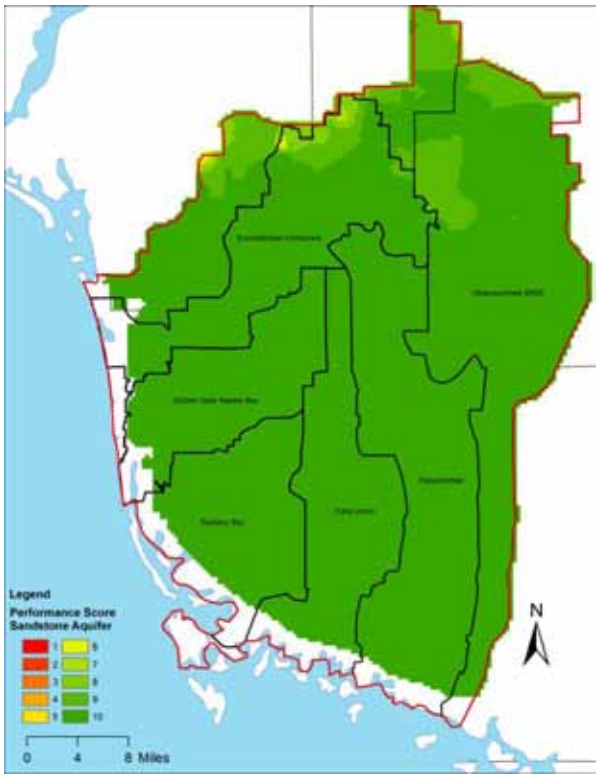

Figure 2-11. Sandstone Aquifer Average Dry Season Performance Score

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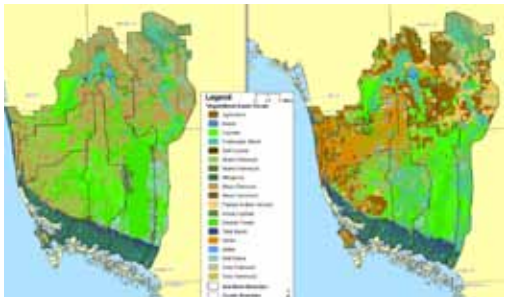

Collier County watershed management plan

Final Report Volume 2:

Analysis of Alternatives and Structural Recommendations

01022-12

Collier County

Prepared by: ATKINS

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FINAL REPORT

COLLIER COUNTY WATERSHED MANAGEMENT PLAN COLLIER COUNTY, FLORIDA

VOLUME 2: ANALYSIS OF ALTERNATIVES AND STRUCTURAL RECOMMENDATIONS

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Acronyms and Abbreviations

ECM	Existing Conditions Model
EMC	Event Mean Concentration
ET	Evapotranspiration
FDEP	Florida Department of Environmental Protection
FLUCCS	Florida Land Use, Land Cover Classification System
FLUE	Future Land Use Element
IWR	Impaired Waters Rule
LID	Low Impact Development Techniques
NEXRAD	High Resolution Radar
NGGEFRA	North Golden Gate Estates Flowway Restoration Area
NGGEFRP	North Golden Gate Estates Flowway Restoration Program
NSM	Natural Systems Model
RFMU	Rural Fringe Mixed Use
RWCA	Recyclable Water Containment Areas
SFWMD	South Florida Water Management District
SWFFS	Southwest Florida Feasibility Study
TDR	Transfer of Development Rights
TMDL	Total Maximum Daily Load
TTI	Ten Thousand Islands
URF	Urban Residential Fringe
USACE	United States Army Corps of Engineers
WBID	Water body Identification Number

1.0 Introduction

Watershed Management recommendations provide the means by which to protect natural resources, restore critical ecosystem functions, and implement stormwater solutions that integrate the developed and natural environments in Collier County.

Watershed Stressors

Watershed stressors are driven by population growth and the needs of urban development. The Collier Interactive Growth Model (CIGM) (Van Buskirk, 2008) predicts that the population of Collier County at full build-out will be approximately 950,000. The additional development will occur primarily east of Collier Boulevard and north of I-75. The Van Buskirk model suggests that the Golden Gate Estates area will be the first area to be more densely developed. Properties that are currently designated as Rural Lands Stewardship Areas are also predicted to convert to highly urbanized areas in the next 50–60 years.

The Lower West Coast Water Supply Plan (LWCWSP) (SFWMD, 2005-2006) evaluated issues related to water supply and environmental issues based on projections out to the year 2025. According to the LWCWSP, there are three primary issues to be considered when planning for the future in Collier County:

- Saltwater intrusion, wetland protection, and interference with existing land uses will significantly limit increased usage of existing groundwater and surface water supplies.
- Freshwater high-flow discharges from altered surface water systems in the planning area are impacting coastal resources and estuaries. Capturing some of the excess surface and storm water for water supply purposes would improve water supply availability and benefit the environment.
- Additional water storage is needed to create opportunities to fully use reclaimed water and seasonal surface water resources to meet urban irrigation needs.

In addition, further stress to Collier County's environmental system will result from sea level rise. At this time, scientists have only developed potential future scenarios of the magnitude of that impact. They range from minimum to significant. Actual impacts will have to be tracked in the coming years.

Recommended Structural Recommendations

Recommendations for structural and non-structural means of watershed management and improvement are the core of the CCWMP and provide the means by which to protect natural resources, restore critical ecosystem functions, and implement stormwater solutions that integrate the developed and natural environments in Collier County. Volume 2 is a stand-alone report that describes the structural best management

practices (BMPs) recommended for implementation. This document, along with three other project reports, comprises the final documents for the Collier County Watershed Management Plan (CCWMP). Volume 1 presents a summary of existing conditions in the watersheds and estuaries and the performance measures developed for evaluating potential projects. Volume 3 describes the non-structural initiatives recommended for implementation as part of the watershed management plan. Volume 4 is a compilation of the individual technical memoranda completed to address existing conditions in the watershed and estuaries and presents the details of the analyses conducted as part of this project.

The proposed structural projects will help address the impacts of the watershed stressors. Volume 2 was prepared as a stand-alone document. This volume presents a list of recommendations for implementation of specific watershed management projects and initiatives for both the watersheds and estuaries. Recommendations were developed based on differences in historical and existing conditions in the watersheds and estuaries and then examining the changes necessary to help restore the natural function of a system to the extent practical. The differences in historical and existing conditions and the development of performance measures against which to evaluate the success of projects were described in Volume 1.

The proposed structural improvement projects have been prioritized for implementation based on cost and benefits, but the final implementation strategy will depend on several other factors such as availability of resources and public support. It is noted that the structural improvements provide only partial solutions to the water resource issues facing the county. They are complemented by non-structural, policy based, initiatives that are described in Volume 3.

2.0 Identification of Potential Structural Projects

The approach for analyzing previously identified projects was to provide definition to define their implementation feasibility.

This section addresses the method used to identify potential projects in Collier County. The process is divided into the steps described in detail below. These steps include the following:

1. Review completed studies to identify previously proposed projects.
2. Identify new improvement projects
3. Initial Screening

Review Completed Studies to Identify Previously Proposed Projects

Many studies have been completed to identify potential projects within specific areas of Collier County. Because the descriptions of the projects vary widely from specific details to general concepts, our approach was to provide definition to the projects that so require so as to be able to define their implementation feasibility. Following is a description of the identified projects.

Picayune Strand Restoration Project

The Picayune Strand Restoration Project (PSRP) was designed by the USACE and the SFWMD to restore the wetlands of the Picayune Strand located in Collier County south of I-75. The projects calls for the installation of ditch blocks in four (4) canals and the construction of three (3) pump stations to move water into the overland flow plain. Figure 2-1 shows the components of the PSRP. This project is under construction and will be included in the "with project" evaluation as part of the alternative scenarios.

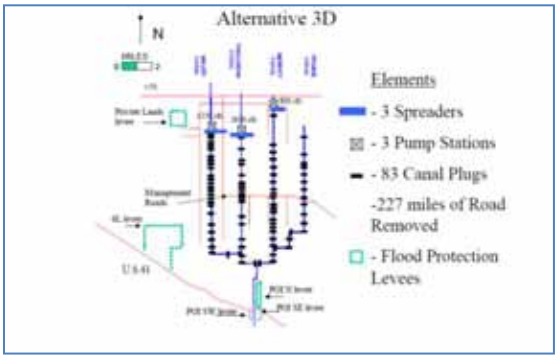

Figure 2-1. Components of the Picayune Strand Restoration Project

Southwest Florida Feasibility Study

The SWFFS is an ongoing project funded by the USACE and the SFWMD. This project considers projects that will improve water quality, restore wetland habitat, improve estuary systems, and remove exotic species in the Cocohatchee, Estero, and Big Cypress Basins. Several projects were recommended in Collier County. These are described below:

- Okaloacoochee Flowway Restoration – This project provides little detail in the SWFFS documentation. The concept is to improve the wetland system by improving the flowway by removing man-made impediments. Specific projects to support this concept have been proposed.
- Camp Keais Strand Flowway Restoration – This project provides little detail in the SWFFS documentation. The concept is to improve the

wetland system by improving the flowway by removing man-made impediments. The Rural Lands Stewardship Area program provides incentives to restore the Camp Keais Flowway Stewardship Area. The designation of most of the flowway as Stewardship Sending Areas has already been accomplished.

- Corkscrew Swamp Flowway Restoration – This project provides little detail in the SWFFS documentation. The concept is to improve the wetland system by improving the flowway by removing man-made impediments. PBS&J has proposed specific projects to support this concept.
- Off-Line Storage Reservoirs – The SWFFS identified several potential off-line storage reservoir locations in the Golden Gate-Naples Bay, and Faka Union watersheds. These proposed projects are described in more detail in the watershed specific projects section.
- SR-29 Flowway Restoration – This project calls for the SR-29 Canal to be plugged with ditch blocks at regular intervals. Culverts underneath SR-29 will be used to divert water to the west into Fakahatchee Strand. Other components include the construction of spreader canal and pump stations to divert water into wetland systems north of I-75.

Belle Meade Stormwater Management Master Plan

The Belle Meade Stormwater Management Plan was completed in 2006 and describes a number of projects to rehydrate wetlands and restore historical flow patterns to Rookery Bay. These projects are shown in Figure 2-2. Conditions have changed since this report was published; however, most proposed projects are still relevant. Updates and details have been added as needed. For example, a series of flow way restoration projects were identified through the agricultural area in the southeast portion of the Rookery Bay watershed. These lands are now part of the "Receiving Areas" for development credits, which limits current restoration opportunities. Recommendations are made to facilitate restoration of the flowways when urban development occurs in the future.

Figure 2-2. Components of the Belle Meade Stormwater Management Master Plan

North Golden Gate Estates Flowway Restoration Project

This project is sponsored by the Collier Soil and Water Conservation District. The concept is to link the wetland systems in the Northern Golden Gates Estates that were fragmented by construction of the Golden Gate Canal network and the residential

road network. PBS&J will coordinate with the Collier Soil and Water Conservation District and will include projects defined as part of the project in the alternative scenario simulations.

Lely Area Stormwater Improvement Project

This project focused primarily on stormwater management issues in the Lely area of the Rookery Bay watershed. Projects include, but are not limited to, culvert and structure upgrades, spreader swales, removal of exotic species, and expansion of stormwater ponds. Many of the projects have been built and are included in the ECM. Other components are scheduled for construction over the next 3–5 years and all will be included in the alternative scenarios simulations.

Immokalee Stormwater Master Plan

This project focused primarily on stormwater management issues in the Immokalee area of the Okaloacoochee–SR 29 watershed. Projects include, but are not limited to, culvert and structure upgrades, rapid infiltration trenches, and spreader swales. It is assumed that all of the projects will be constructed and they will be included in the alternative scenario simulations.

Gordon River Improvements

This project focused on stormwater and wetland restoration projects in the Gordon River Extension. Projects included culvert upgrades along the Gordon River corridor and the development of water quality parks. The parks have been built and it is assumed that the upgraded culverts will be installed in the near future. All will be included in the alternative scenario simulations.

Other South Florida Water Management District (SFWMD) Projects

The SFWMD has several projects in process. Most of the projects include redesign of existing structures to improve management capability. The redesigned GG-3 structure is now operational in a new location. In addition, the SFWMD plans to replace the GG-6, GG-7, and Miller3 structures in the near future. The SFWMD is also considering a project to divert water from the Golden Gate Main Canal to the Henderson Creek Canal. Specific conceptual characteristics of this project have been identified and were used to assess its potential benefits and disadvantages.

New Projects

Atkins conducted desktop and field level investigations to refine potential projects identified by others and to identify potential new improvements. To complete this task, Atkins considered several key factors when identifying potential project locations:

Estuary Freshwater Surplus/Deficit

The status of the receiving estuary is important in determining the types of projects to be identified. If the estuary receives a surplus, it is necessary to identify projects that will store or divert, or otherwise reduce the volume of flow released to the estuary. Similarly, if the estuary has a flow deficit, projects must be identified that will increase flow to the estuary at the appropriate time.

Changes in Hydrology

If the hydrologic analysis indicates that the hydrology of a wetland area has changed, then the projects' objective will be to restore the hydroperiod or depth of water to a more desirable condition.

Future roadway improvements

This issue will help determine the location of future projects or how a project will be configured to accommodate the footprint of future roadways.

Property Ownership

Projects can be implemented on publicly owned lands more readily and at less cost that on privately owned lands. Publicly owned lands include properties that have existing conservation easements or are within the Rural Fringe Sending Areas. Properties that fall within the "Receiving Areas" are assumed to be unavailable for implementation of specific projects.

Initial Project Screening

During the initial screening process, more than 100 potential projects were identified. Many of those projects were eliminated from further consideration because they did not support the water quantity and water quality goals of the Watershed Management Plans. The types of projects that were eliminated from further consider include:

- Wildlife road crossing
- Exotic species removal
- Local flood control projects
- Projects that fall within designated Rural Fringe Receiving Areas. It is expected that wetland protection activities in these areas would be managed through changes in the Land Development Code.
- Berm removal projects that cannot be adequately represented at the regional scale.
- Urban *BMPs designed to provide water quality treatment.*
- *Project*s that have been recommended for implementation or are scheduled for construction. This includes projects located at sites with active permits.

Table 2-1 lists each of the projects identified during this task and offers comment about the potential application of each to the regional watershed assessment process.

A total of 27 individual projects were identified for further evaluation. These include

- One project in the Cocohatchee-Corkscrew watershed
- Ten projects in the Golden Gate – Naples Bay watershed
- Six projects in the Rookery Bay watershed, and
- Ten projects in the Faka Union, Fakahatchee, and Okaloacoochee-SR29 watersheds.

Watershed	Project Name	Comment
Cocohatchee-Corkscrew	Bird Rookery Swamp Hydrologic Improvement	Permitted
	Candlewood Lane Culvert Improvements	Local Flood Control
	Cocohatchee Slough	Project defined
	Corkscrew Watershed Agricultural Containment Area	Incentive Based Program
	CREW Acquisition and Management	CREW managed lands
	East Bird Rookery Swamp Upland Habitat Restoration	Replanting with xeric pine
	LivingstonE/W Drainage Outfall	Local Flood Control
	Madison Creek	Local Flood Control
	Northern Golden Gate Estates Unit 53 Restoration and Acquisition	Project defined
	Slough Cross Drains	Local Flood Control

Table 2-1. Projects Identified during the Initial Screening by Watershed

Table 2-1. Projects Identified during the Initial Screening by Watershed (Cont'd)

Watershed	Project Name	Comment
Golden Gate - Naples Bay	4th Street NE Ditch Blocks	Project defined
	Channel Excavation along Goodlette Rd.	Local Flood Control
	Channel Excavation under Royal Poinciana Bridge	Local Flood Control
	Cypress Canal Storage Reservoir	Project defined
	Golden Gate Canal Storage Reservoir	Project defined
	Golden Gate City Master Plan - Northeast Quadrant	Local Flood Control
	Golden Gate City Master Plan - Northwest Quadrant	Local Flood Control
	Golden Gate City Master Plan - Southwest Quadrant	Local Flood Control
	Golden Gate City Master Plan - Southeast Quadrant	Local Flood Control
	Henderson Creek Diversion	Project defined
	Horsepen Strand	Projects defined
	Northern Golden Gate Estates Canal/Weir Improvements	Project defined
	Orange Tree Canal	Project defined
	Outfall for Royal Palm Estates	Local Flood Control
	Pine Ridge Outfall	Local Flood Control
	Pine Ridge Rd (North Side)	Local Flood Control
	Replace existing pipe along GG Pkwy	Local Flood Control
	Replace existing pipe along Goodlette Rd	Local Flood Control
	Replace existing pipe along Goodlette Rd	Local Flood Control
	Replace existing pipe under 26th Ave.	Local Flood Control
	Replace existing pipe under Creech Rd	Local Flood Control
	Replace existing pipe under Ohio Dr.	Local Flood Control
	Replace existing pipe under Pompei Ln.	Local Flood Control
	Replace existing pipe under Ridge Rd	Local Flood Control
	Replace existing pipe under Solana Rd.	Local Flood Control
	Weir Replacement Pine Ridge # 1	Local Flood Control
	Widen existing cross-sections along Reach 3	Local Flood Control
	Wolfe Rd Water Quality Treatment	Project defined

Table 2-1. Projects Identified during the Initial Screening by Watershed (Cont'd)

Watershed	Project Name	Comment
Rookery Bay	Belle Meade	Check individual components
	Belle Meade Flow-way South of I-75	Project defined
	Belle Meade Flow-way south of Tamiami Trail	Agricultural land within Rural Fringe Neutral area. LDC will define restoration activities
	Belle Meade Flow-way south of Tamiami Trail	Agricultural land within Rural Fringe Neutral area. LDC will define restoration activities
	Belle Meade Stormwater Master Plan	Check individual components
	Belle Meade Stormwater Master Plan/Central Flow-way Restoration	Within Rural Fringe Receiving Lands. LDC will define restoration activities
	Belle Meade WQ Treatment Area	Within Rural Fringe Receiving Lands. LDC will define restoration activities
	Bone Fish Springs Acquisition	Land Acquisition
	CR 92 Culverting	Local Flood Control
	CR 951 Culverting	Local Flood Control
	Fiddlers Creek Spreader System	Conflicts with Marco Island Facility
	Griffin road	Design is on-going
	Henderson Creek MAPS	Algal Scrubber for WQ
	Henderson Creek Storage Reservoir	Project defined
	Lely Area Stormwater Improvement Project	Construction program underway
	Manatee Road Area Improvements	Local Flood Control
	North Belle Meade Rehydration	Project defined
	North Belle Meade WQ Treatment Area	Permit pending for mining activity
	Road regrading	Projects defined
	Sabal Palm Spreader System	Cannot be represented at regional scale
	Shell Island Rd. Culvert Installation	Flowway Restoration (project completed)
	South Belle Meade Flow-way	Evaluate individual components
	Stormwater Treatment Area - Tamiami Canal and Manatee Rd.	Project defined
	Tomato Road Diversions	Cannot be represented at regional scale

Table 2-1. Projects Identified during the Initial Screening by Watershed (Cont'd)

Watershed	Project Name	Comment
Faka Union	Faka Union Hydrologic Restoration	Berm Removal
	Picayune Strand at I-75 WQ Treatment Area	Part of Northern Golden Gate Estates Flowway
Fakahatchee	Camp Keais Extensions (Multiple)	Projects defined
	Camp Keais Strand Agricultural Containment Area (multiple)	Incentive Based Program
	Camp Keais Water Quality Treatment Area (multiple)	Incentive Based Program
	CREW/Camp Keais Marsh Restoration	Projects defined
	CREW/Camp Keais Marsh Restoration	Projects defined
	CREW/Pepper Ranch Acquistion	Water Containment Areas/exotic species
	Fakahatchee Strand/Ten Thousand Islands Connector	Berm Removal ; Airboat trail restoration
	Florida Panther NWR Okaloacoochee Slough Hydrologic Restoration	Recommended in SWFFS
	Florida Panther NWR Wetland	Recommended in SWFFS
	Florida Panther NWR Wetland	Recommended in SWFFS
	I-75 Panther NWR Canal Plugs	Evaluated in SWFFS
	Janes Scenic Drive Culverts	Local Flood Control
	Lake Trafford	Dredging is complete; urban BMPs
	Mud Lake Strand	WQ treatment is flowway
	Route 41 Culvert Emplacement West of the Tamiami Trail Culverts Project	Local Flood Control
	Rural Lands R2 Other listed species	In Rural Lands Stewardship
	Rural Lands R2 Wading Bird	In Rural Lands Stewardship
	Shaggy Cypress addition to Camp Keais Strand (multiple)	Land purchase; project considered
	Wildlife Crossing/Oil Well Road East	Wildlife Crossing
	Wildlife Crossing/Oil Well Road West	Wildlife Crossing

Table 2-1. Projects Identified during the Initial Screening by Watershed (Cont'd)

Watershed	Project Name	Comment
Okaloacoochee Slough/SR29	Bear Island Road Network	Outside Model Domain
	Downtown Immokalee	Local Flood Control
	Half Circle L Ranch	Biological conservation
	Immokalee Drive	Local Flood Control
	Immokalee Stormwater Master Plan	Local Flood Control
	Immokalee Connector	Exotics Removal and Local Flood Control
	Okaloacoochee Slough Agricultural Containment Area	Incentive Based Program
	Okaloacoochee Slough Agricultural Containment Area (Multiple)	Incentive Based Program
	Okaloacoochee Slough Flowway from the Caloosahatchee to the Big Cypress Swamp	Projects defined
	Okaloacoochee Slough Wildlife Management Area Hydrologic Restoration	Projects defined
	Palm Tree Farm Restoration	Restore natural vegetation
	Rural Lands R1 Wading Bird	In Rural Lands Stewardship
	SR 29/Barron River Flow-way Restoration	Recommended in SWFFS
	SR 29/Barron River Flow-way Restoration	Recommended in SWFFS
	SR29/Barron River Flow-way Restoration	Recommended in SWFFS
	SR29/Barron River Water Control	Recommended in SWFFS
	SR29/Barron River Water Control	Recommended in SWFFS
	Wildlife Crossing/SR29 South	Wildlife Crossing
	Wildlife Crossing/Immokalee Road East	Wildlife Crossing
	Wildlife Crossing/Immokalee Road West	Wildlife Crossing
	Wildlife Crossing/SR 29 North	Wildlife Crossing

3.0 Alternative Analysis

The purpose of the non-structural initiatives is to formulate recommendations that would allow for the implementation of an environmentally sustainable management program to will guide future land development activities in Collier County.

This section describes the methodology used to evaluate each of the 27 projects that were found to be potentially feasible during the initial screening process. The objective was to evaluate the identified projects in more detail, select those that are recommended for implementation, and rank the projects based on expected benefits and costs.

General Methodology

The process included three evaluation steps:

a) Assessment of the project's feasibility based on permittability and constructability

b) Evaluation of project benefits based on the application of performance measures.

c) Cost estimating

d) Calculation of the benefit versus cost (B/C) ratio

Permittability and Constructability

The permittability review considered potential environmental impacts that would make a project difficult to obtain the necessary permits from the regulatory agencies, namely the South Florida Water Management District (SFWMD), Florida Department of Environmental Protection (FDEP), and the Corps of Engineers (USACOE). The constructability evaluation considered project location, property ownership and land acquisition needs, site characteristics, technical limitations such as infiltration capacity or tidal influences, difficulty of installing project components, public acceptance, and operation and management issues. A total of 7 of the original 27 projects were eliminated from further consideration based on these criteria. Two or the projects were merged with other projects. The projects are listed in Table 2-2, along with related comments.

Types of Feasible Structural Projects

The projects that passed the permittability and constructability assessment were grouped in two categories; publicly funded projects that could be implemented by Collier County, the SFWMD, or other public entity; and privately funded projects that could be implemented by private property owners through existing incentive programs.

Recommended Public Structural Projects

A total of 10 projects have been identified that may be implemented through public funding. Following are brief descriptions of those projects. Full project descriptions are included in **Appendix 2-A**.

Table 2-2. Comments on Permittability and Constructability

Watershed	Project ID	Project Name	Comments
Cocohatchee-Corkscrew	CC-3	Corkscrew Regional Ecosystem Watershed	Alternative Analysis
Golden Gate - Naples Bay	GG-1	Upper Golden Gate Operable Weir	Alternative Analysis
	GG-2	NGGE Flowway Restoration	Alternative Analysis
	GG-3	Corkscrew Regional Ecosystem Watershed - Area 4	Merged with CC-3
	GG-4	4th Street NE - Ditch Block	Provides no benefit; area is part to roadside stormwater management area
	GG-5	Wolfe Road Wetland Treatment System	Alternative Analysis
	GG-6	Cypress Canal Off-line Reservoir	The location conflicts will Collier County wellfield. Reservoir would drain quickly back to adjacent canal.
	GG-7	Orange Tree Canal Operable Weir	Alternative Analysis
	GG-8	Golden Gate Canal Off-line Reservoir	Reservoir would drain quickly back to Golden Gate Canal via baseflow and provides no benefit as a stand-alone project.
	GG-9	Golden Gate Canal Water Supply Reservoir	Insufficient storage volume for water supply source
	GG-10	Henderson Creek Diversion	Alternative Analysis
Rookery Bay	RB-1	North Belle Meade Spreader Swale	Alternative Analysis
	RB-2	South I-75 Canal Spreader Swale	Alternative Analysis
	RB-3	Henderson Creek Off-line Reservoir	Alternative Analysis
	RB-4	Picayune Strand Natural Grade Restoration - Area 1	Provides no benefit
	RB-5	Picayune Strand Natural Grade Restoration - Area 2	Provides no benefit
	RB-6	Henderson Creek Spreader Swale	Location conflicts with Marco Island facility
	RB-7	US Highway 41 Stormwater Treatment Area	Alternative Analysis
Faka Union	FA-1	Winchester Head Rehydration	Merged with GG-2
Fakahatchee	FH-1	Fakahatchee Wetland Restoration - Area 1	Alternative Analysis
	FH-3	Fakahatchee Wetland Restoration - Area 3	Alternative Analysis
Okaloacoochee/SR29	OK-1	Upper Okaloacoochee SloughWetland Restoration	Alternative Analysis
	OK-2	Middle Okaloacoochee SloughWetland Restoration	Alternative Analysis
	OK-3	Lower Okaloacoochee Slough Wetland Restoration	Alternative Analysis
	OK-4	Okaloacoochee Wetland Restoration - Area 1	Alternative Analysis
	OK-5	Okaloacoochee Wetland Restoration - Area 2	Alternative Analysis
	OK-6	Okaloacoochee Wetland Restoration - Area 3	Alternative Analysis

Project 1: North Belle Meade Rehydration

This project includes a constructed spreader swale to rehydrate wetland areas north of I-75, south of the Golden Gate Main Canal, and west of the Miller Canal. A pump station would be constructed to divert water from the Golden Gate Main Canal into the spreader swale and thus increase the volume of fresh water delivered to Rookery Bay, which experiences a water deficit. The project is predicted to reduce the volume of discharge to Naples Bay by 10 percent and will provide treatment of the diverted water in the wetland systems. Full design would need to consider the conveyance capability of the culverts under I-75.

Project 2: Northern Golden Gate Estates Northern Golden Gate Estates Flowway Restoration

The purpose of this project is to restore wetland flow paths and reconnect isolated wetlands in the Northern Golden Gate Estates between the Golden Gate and Faka Union Canals. Implementation of this project would reduce the volume of water entering the canals and provide water quality treatment of runoff. The project would also provide groundwater recharge to benefit the

potable water supply wellfield in the area. One of the recommended non-structural initiatives to incentivize project implementation is to a) designate this area as a mitigation bank and b) implement a Transferrable Development Rights (TDR) program to help acquire residential property rights.

Project 3: Henderson Creek Diversion

This project would utilize a 100 cfs pump station constructed near the new GG-3 structure to divert water from the Golden Gate Main Canal to the Henderson Creek Canal. The project is predicted to reduce the volume of discharge to Naples Bay by about 10 percent. The project will also increase the volume of water entering Rookery Bay. This project's benefits are strictly about water quantity. Pollution removal potential is limited.

Project 4: South I-75 Spreader Swale

This conceptual project focuses on rehydration of wetland areas in the Rookery Bay portion of the Picayune Strand State Forest. A spreader swale would be constructed to facilitate movement of water out of the canals that parallel I-75 and direct the water south via overland flow. This would provide water quality and wetland hydrology benefits. The project is also predicted to affect the timing of flows to Rookery Bay, although it is unlikely to have a significant effect on the volume of water reaching the estuary.

Project 5: Corkscrew Regional Watershed Improvements

This proposed project consists of constructing ditch blocks to restore wetland hydrology in lands located adjacent to the Corkscrew Regional Ecosystem Watershed. The project is predicted to affect the timing of flows to the Wiggins Pass Estuary and to provide improvements in wetland habitat and water quality treatment in the area.

Project 6: Henderson Creek Off-line Storage Reservoir

This is a future project that relies upon acquisition of an active mining operation after the mine reaches the end of its economic life. The mine pit would be used to store water pumped from Henderson Creek during the wet season. Recharge from the mine pit to the Water Table aquifer is predicted to have no effect on the nearby wellfield that draws from the Mid-Hawthorne aquifer; however, it may augment the available groundwater flow at the Marco Island water intake near US-41. The operation of this off-line reservoir is expected to reduce wet season discharge from Henderson Creek and be used to supplement dry season flows to the Rookery Bay estuary.

Project 7: US 41 Stormwater Treatment Area

This conceptual project involves construction of a Stormwater Treatment Area adjacent to the US-41 canal in the Rookery Bay watershed. The project will provide water quality treatment and off-line storage of runoff from the highway.

Project 8: Wolfe Road Wetland Treatment Area

This proposed project would utilize existing pond features at the western end of Wolfe Road to treat runoff that is currently directed into the Island Walk Subdivision. The project is predicted to reduce the volume of water entering the Island Walk stormwater management system, reduce the

incoming nutrient load, and provide additional groundwater recharge in the area.

Project 9: Upper Golden Gate Canal Weir Construction

The canal on the north side of the Collier County Fairgrounds currently discharges to the Golden Gate Canal without restraint. It is recommended that an operable weir structure be constructed near the outlet of the canal. The weir structure will allow more runoff to be stored in the canal network and can also be used to reduce baseflow between storm events. The project is predicted to contribute to the reduction of flow to Naples Bay.

Project 10: Orange Tree Canal Weir Construction

The Orange Tree Canal currently discharges to the Golden Gate Canal. No water control features exists along this system. This project involves construction of an operable weir structure near the Orange Tree canal outlet. The operable weir could be operated to store more runoff in the canal during storm events and also to reduce baseflow between storm events. The project is predicted to contribute to reduced flows to Naples Bay.

Incentive Based Projects

Several feasible projects may be constructed within Stewardship Sending Areas (SSAs) or within Flowway Stewardship Areas. Implementation of these, and other similar types of projects, should be encouraged through existing incentive programs. Full descriptions of these conceptual projects are included in Appendix 2-B

Five of the conceptual projects identified in the SSAs involve restoration of isolated wetland areas that have been drained for agricultural or logging purposes. The concept is to utilize existing dredge spoil to backfill or to create blocks within the ditches that were dug to drain the wetlands. Two (2) of these projects are located in the Fakahatchee watershed and three (3) in the Okaloacoochee watershed. These projects would provide significant local scale benefits to wetland hydrology and water quality treatment, but are unlikely to have a significant effect on discharges to the Ten Thousand Islands estuary.

Other, more significant feasible wetland restoration projects are located within the Okaloacoochee Slough Flowway Protection Area. Ditches exist that provide preferential flow paths through the slough area and speed delivery of runoff to the estuary. It is recommended that ditch blocks or other similar methods be used to restore the historic overland flow pattern. These conceptual projects may require public –private partnerships to implement.

4.0 Estimated Project Benefits

The purpose of the non-structural initiatives is to formulate recommendations that would allow for the implementation of an environmentally sustainable management program to will guide future land development activities in Collier County.

Methods

The method used to estimate project benefits evaluated each project individually. Benefits were defined as the increase in watershed score resulting from each of the previously-defined performance measures: water quantity, pollution load, wetland hydrology, and groundwater recharge. The process consisted of first conducting an assessment of project benefits, as described below and subsequently applying weighting factors that considered both the special characteristics of each watershed and the relative importance of the watershed issues for watershed management purposes. It is noted that flood protection was also initially considered as a performance measure, but it was determined that none of the proposed projects would have a negative impact on flood elevations because project operation would be such that water diversion structures, including pump stations, that may have the potential of affecting the conveyance capacity of the drainage network would cease operations during periods when large storm events are anticipated.

Water Quantity Benefits

The benefit of a project was measured based on the effect it would have on the volume of fresh water discharged to the estuarine systems.

The post-project score was determined by comparing the monthly fresh water discharges to the natural system condition. Changes in monthly discharge patterns were estimated for each project based on water pumping rates and corresponding water diversion volumes. Subsequently the post project scores were compared to those for the existing condition. The project benefit was defined as the "lift" in watershed score due to project implementation.

Pollutant Load Reduction Benefits

The water quality benefits were measured in terms of the anticipated anthropogenic pollutant load reduction. This evaluation focused on total nitrogen and total phosphorus because those are the pollutants of primary concern in Collier County and Florida in general. The predicted post-project pollutant load removed was calculated based on typical removal rates associated with runoff treatment processes associated with a project. For the most part proposed projects would remove pollutants through created/restored wetland systems. Based on available literature values, it was assumed that removal efficiencies would be 30 and 65 percent for total nitrogen and total phosphorus, respectively. Once the pollutant load reduction benefits were quantified for each specific project, the overall watershed impact was determined by calculating the post-project pollutant loading score. As with the water quantity benefits, the

project benefit was defined as the "lift" in watershed score compared to existing conditions.

Wetland Hydrology Benefits

Each project was evaluated to consider the potential change in hydroperiod and average wet season water depth. The predicted hydroperiod and water depth were then used to generate post project performance measure scores in the area affected by the project. These new scores were then averaged with the scores in the remainder of the watershed to determine the average post-project hydrologic performance measure score for the watershed. As with the other evaluation criteria, the project benefit was defined as the "lift" in watershed score compared to existing conditions.

Groundwater Recharge Benefits

Each project was evaluated to consider the potential change in aquifer water level. The predicted groundwater levels in the Water Table and Lower Tamiami aquifers were used to generate post project watershed scores, which were then compared to the existing conditions scores. As with the other evaluation criteria, the project benefit was defined as the "lift" in watershed score compared to existing conditions.

General Description of Project Costs

The cost item in the calculation of the B/C ratio was cost of construction. It is recognized that project implementation also includes operation and management (O&M) costs. However, for project evaluation purposes, it was considered that O&M costs are generally proportional to the size of the project and weigh equally for all projects. Therefore, it is not necessary to include them for project prioritization purposes.

Detailed Evaluation of Project Benefits

As described previously, the identified feasible projects were evaluated to determine expected benefits based on each performance measure. Project benefits were defined as the "lift" in watershed performance measure score associated with discharge to estuaries, pollutant load removal, wetland hydrology, and groundwater recharge. **Table 2-3** shows the calculated score "lift" for each project. This first assessment of benefits was then modified by the application of weighting factors, as described later in this section, to prioritize project implementation.

It is noted that the scoring for all categories was based on a scale of 0 to 10 for all performance items. For example, if the existing conditions score for a given performance measure is 5 and the anticipated lift is 1.25, it means that the project is expected to raise the score to 6.25. As expected, large projects have a larger impact on watershed conditions, as opposed to local projects that may improve the characteristics of the immediate project area, but are not significant at the watershed level.

Project Benefit Weighting Factors

Two types of weighting factors were applied to further assess project benefits, a) watershed-based factor, and b) issue-based factor. The methodology is described below.

Table 2-3. Calculated Performance Measure Lift

Project Name	Discharge to Estuary Benefit	Water Quality Benefit	Wetland Hydrology/Habitat	Groundwater Benefit
	Performance Lift	Performance Lift	Performance Lift	Performance Lift
Corkscrew Regional Ecosystem Watershed	0.0000	0.0000	0.0314	0.000
North Golden Gate Estates Flowway Restoration Project	0.0095	0.6822	0.1177	0.1/0.1
North Belle Meade Spreader Swale[1]	0.89/1.25	0.4354	0.0358	0.200
South I-75 Canal Spreader Swale	0.0385	0.1759	0.1035	0.100
Henderson Creek Diversion [1]	0.89/1.67	0.0000	0.0000	0.000
Wolfe Road Wetland Treatment System	0.0000	0.0076	0.0000	0.050
Middle Okaloacoochee Slough Wetland Restoration	0.0000	0.2779	0.0154	0.000
Henderson Creek Off-Line Storage Reservior	0.3169	0.0237	0.0000	0.005
Lower Okaloacoochee Slough Wetland Restoration	0.0000	0.0588	0.0024	0.000
Upper Golden Gate Estates Canal Weir Constuction	0.0001	0.0000	0.0000	0.010
Orange Tree Canal Control Structure Installation	0.0001	0.0000	0.0000	0.010
Fakahatchee Wetland Restoration - Area 1	0.0000	0.0415	0.0001	0.000
US HWY 41 Stormwater Treatment Area	0.0000	0.0058	0.0015	0.000
Fakahatchee Wetland Restoration - Area 2	0.0000	0.0309	0.0001	0.000
Upper Okaloacoochee Slough Wetland Restoration	0.0000	0.0023	0.0004	0.000
Okaloacoochee Wetland Restoration - Area 2	0.0000	0.0000	0.0002	0.000
Okaloacoochee Wetland Restoration - Area 3	0.0000	0.0000	0.0002	0.000
Okaloacoochee Wetland Restoration - Area 1	0.0000	0.0000	0.0002	0.000

(1) Includes change in benefit score for multiple watersheds

Watershed-Based Weighting Factors

The calculated project benefit (lift of performance measure score) was modified by applying a watershed-based weighting factor that considers the differences in the extent of each watershed and the corresponding a) discharge to the receiving estuary, b) anthropogenic load, c) natural wetland systems and d) water demand for public supply and irrigation. This approach allowed project comparisons across watersheds and helped better represented the risk associated with each watershed. The weighting factors are described below.

Discharge to Estuary Weighting Factor

This factor is based on the assumption that runoff from a watershed will have more effect on the receiving estuary if the estuary is small in comparison to the drainage area. The equation used to define this weighting factor is as follows:

Discharge to Estuary WF = 10 - (10 x (Receiving Estuary Area / Watershed Area))

Pollution Load Weighting Factor

This factor considers the percentage of urban and agricultural lands in a watershed. The higher the percentage of these land use types, the greater the anthropogenic load, and the larger the weighting factor. The equation used to define this weighting factor is as follows:

Pollution Load WF = 10 x (Urban + Agricultural Area / Watershed Area)

Wetland Hydrology/Habitat Weighting Factor

This factor is based on the premise that it is more important to preserve and restore wetland habitat in watersheds with few wetland systems relative to the total watershed area. Therefore, the watersheds with the lowest percentage of wetland

habitat will have the highest weighting factor. In addition, it was considered that the natural system in the County has been impacted in a way that wetlands with short hydroperiods currently provide the most valuable and must receive an additional level of protection and restoration effort. The general equation used to determine this weighting factor is shown below. The final weighting factor for this parameter was derived as a weighted average of the factor value calculated for short hydroperiod wetlands and the factor value for long hydroperiod wetlands.

Wetland Hydrology/Habitat WF = 10 - (10 x (Short HP Wetland Area/Watershed Area))

Groundwater Demand Weighting Factor

This factor is based on the premise that it is more important to promote recharge in watersheds where water demand is higher. Therefore, watersheds with the highest demand for groundwater would have the highest weighting factor. This was calculated as the model predicted total volume of water pumped from the aquifer systems averaged over the watershed area.

Table 2-4 shows the calculated weighting factors for each watershed and performance measure.

Table 2-4. Evaluation Criteria Weighting Factors

Watershed	Weighting Factor			
	Discharge to Estuary	Water Quality	Wetland Hydrology/Habitat	Groundwater
Golden Gate/Naples Bay	9.75	6.06	7.85	5.86
Rookery Bay	6.55	2.45	6.98	1.21
FU-FA-OK/Ten Thousand Islands	7.27	1.81	3.82	2.91
Cocohatchee-Corkscrew/Wiggins Pass	9.75	4.01	5.92	3.88

Once the lift in performance measure score was modified by the weighting factors, they were normalized using a 0 to 10 scale. In this manner all scores were measured using the same scale. The normalized project scores by project are listed in **Tables 2-5** and 2**-6.**

Detailed Description of Project Costs

Conservative cost estimates were prepared for each of the publically funded projects such that a Benefit to Cost (B/C) ratio can be used as the basis for project prioritization. These estimates assumed no land acquisition costs if projects are located on publically owned lands, within Rural Fringe Sending Lands, within Stewardship Sending Areas, or within designated flowway protection areas. Table 2-7 lists the estimated construction cost by recommended capital project. Cost estimates, including estimates for engineering and construction, are also shown on the individual project sheets found in Appendix 1-A. Detailed cost estimates are included in Appendix 1-C. As shown, the total estimated construction cost for all Capital Improvement Projects included in the management plan amount to $24,322,000.

Table 2-5. Normalized Project Scores

Project Name	Discharge to Estuary Benefit				Water Quality Benefit			
	Performance Lift	Watershed Weighting	Weighted Score	Normalized Score	Performance Lift	Watershed Weighting	Weighted Score	Normalized Score
Corkscrew Regional Ecosystem Watershed	0.0000	9.75	0.0000	0.0000	0.0000	4.0062	0.0000	0.000
North Golden Gate Estates Flowway Restoration Project	0.0095	9.75	0.0927	0.0472	0.6822	6.0585	4.1330	10.000
North Belle Meade Spreader Swale[(1)]	0.89/1.25	9.75/6.55	16.865	8.5976	0.4354	2.4475	1.0658	2.579
South I-75 Canal Spreader Swale	0.0385	6.55	0.2525	0.1287	0.1759	2.4475	0.4304	1.041
Henderson Creek Diversion [(1)]	0.89/1.67	9.75/6.55	19.616	10.000	0.0000	6.0585	0.0000	0.000
Wolfe Road Wetland Treatment System	0.0000	9.75	0.0000	0.0000	0.0076	6.0585	0.0462	0.112
Henderson Creek Off-Line Storage Reservior	0.3169	6.55	2.0768	1.0587	0.0237	2.4475	0.0581	0.141
Upper Golden Gate Estates Canal Weir Constuction	0.0001	9.75	0.0006	0.0003	0.0000	6.0585	0.0000	0.000
Orange Tree Canal Control Structure Installation	0.0001	9.75	0.0005	0.0003	0.0000	6.0585	0.0000	0.000
US HWY 41 Stormwater Treatment Area	0.0000	6.55	0.0000	0.0000	0.0058	2.4475	0.0143	0.035

(1) Weighting considers benefits to two (2) watersheds.

Table 2-6. Normalized Project Scores

Project Name	Wetland Hydrology/Habitat Benefit				Groundwater Benefit			
	Performance Lift	Watershed Weighting	Weighted Score	Normalized Score	Performance Lift	Watershed Weighting	Weighted Score	Normalized Score
Corkscrew Regional Ecosystem Watershed	0.0314	5.9200	0.186	2.011	0.000	3.88	0.000	0.000
North Golden Gate Estates Flowway Restoration Project	0.1177	7.8500	0.924	10.000	0.1/0.1	5.86/2.91	0.877	10.000
North Belle Meade Spreader Swale[(1)]	0.0358	6.9800	0.250	2.703	0.200	1.21	0.242	2.759
South I-75 Canal Spreader Swale	0.1035	6.9800	0.722	7.814	0.100	1.21	0.121	1.380
Henderson Creek Diversion [(1)]	0.0000	6.9800	0.000	0.000	0.000	1.21	0.000	0.000
Wolfe Road Wetland Treatment System	0.0000	7.8500	0.000	0.000	0.050	5.86	0.293	3.341
Henderson Creek Off-Line Storage Reservior	0.0000	6.9800	0.000	0.000	0.005	1.21	0.006	0.069
Upper Golden Gate Estates Canal Weir Constuction	0.0000	7.8500	0.000	0.000	0.010	5.86	0.059	0.668
Orange Tree Canal Control Structure Installation	0.0000	7.8500	0.000	0.000	0.010	5.86	0.059	0.668
US HWY 41 Stormwater Treatment Area	0.0015	6.9800	0.011	0.117	0.000	1.21	0.000	0.000

(1) Weighting considers benefits to two (2) watersheds.

Table 2-7. Total Normalized Project Scores

Project Name	Discharge to Estuary Benefit	Water Quality Benefit	Wetland Hydrology/Habit	Groundwater Benefit	Total Normalized Project Score	ESTIMATED PROJECT COST	Benefit-to-Cost Ratio
	Normalized Score	Normalized Score	Normalized Score	Normalized Score		Cost (In Millions of Dollars)	
North Golden Gate Estates Flowway Restoration Project	0.0472	10.000	10.000	10.000	30.094	$2.368	**12.71**
North Belle Meade Spreader Swale[1]	8.5976	2.579	2.703	2.759	25.236	$7.026	**3.59**
Henderson Creek Diversion [1]	10.000	0.000	0.000	0.000	20.000	$5.708	**3.50**
South I-75 Canal Spreader Swale	0.1287	1.041	7.814	1.380	10.493	$3.131	**3.35**
Wolfe Road Wetland Treatment System	0.0000	0.112	0.000	3.341	3.453	$1.416	**2.44**
Corkscrew Regional Ecosystem Watershed	0.0000	0.000	2.011	0.000	2.011	$0.096	**20.95**
Upper Golden Gate Estates Canal Weir Constuction	0.0003	0.000	0.000	0.668	0.669	$0.552	**1.21**
Orange Tree Canal Control Structure Installation	0.0003	0.000	0.000	0.668	0.669	$0.552	**1.21**
Henderson Creek Off-Line Storage Reservior	1.0587	0.141	0.000	0.069	2.327	$2.929	**0.79**
US HWY 41 Stormwater Treatment Area	0.0000	0.035	0.117	0.000	0.152	$0.544	**0.28**

(1) Weighting considers benefits to two (2) watersheds.

Project Priorities Results

The B/C ratios calculated for all 10 publicly-funded projects found to be feasible for implementation are also shown in Table 2-7. The table lists the projects in the order that Atkins recommends for implementation. The wetland restoration project in the Corkscrew Regional Ecosystem Watershed area is predicted to provide the most benefit for the dollars spent. This is attributed to the low cost to implement this project. However, the project is expected to only provide a lift in wetland hydrology for a localized wetland area and does not address the more important issues facing the county. Therefore this project was moved to a lower priority for implementation.

Atkins recommends that the Northern Golden Gate Estates Flowway Restoration Project be implemented first although it places second on the benefit to cost scale. It does place first on the benefits based scale. This project provides a lift for each of the four performance criteria used to evaluate the projects. The project provides minimal lift in the Discharge to Estuary criteria, but provides the most lift for each of the other evaluation criteria.

The second project recommended for implementation (the North Belle Meade Spreader Swale) also provides a lift in each of the four performance criteria. For this project, the primary benefit is a significant lift in the Discharge to Estuary performance measure in the Golden Gate and Rookery Bay watersheds. This project has the potential to reduce flows to Naples Bay by 10 percent annually while increasing the volume of flow reaching Rookery Bay. This project also provides a moderate lift for each of the other performance measures.

The Henderson Creek Diversion project is considered the third most important project to implement and ranks fourth in the benefit to cost ratio. Similar to the North Belle Meade Spreader Swale, this project provides a significant lift in the Discharge to Estuary performance measure for the Golden Gate and Rookery Bay watersheds. However, it provides no benefit for the other evaluation criteria.

Conclusions

The implementation of all proposed projects will require a very significant commitment by the County, SFWMD, and possibly the federal government. It is recognized that project implementation will also result in lost efficiencies because of the overlapping of project functions.

As an example, two projects are recommended that divert water from the Golden Gate Main Canal into the Rookery Bay watershed. Individually, each of these projects has the potential to divert as much as 10 percent of the excess water discharging to Naples Bay. However, both projects would potentially draw from the same segment of the Golden Gate Main Canal which would limit the total volume of water that could be transferred. If both were implemented, it may only be possible to divert 15 percent of the excess water discharging to Naples Bay. **Table 2-8** shows the combined benefits of the recommended publically funded projects in terms of a cumulative score lift achieved as projects are implemented.

Results also show that, although the recommended projects are valuable steps towards protecting the ecological conditions in Collier

County, watershed conditions cannot consider solely construction of capital projects. Watershed management plans must also include a substantial non-structural component based primarily on regulatory controls and incentive programs to encourage better land management practices for new development and for the retrofit and modification of management practices on lands that are currently developed or used for agricultural purposes.

Table 2-8. Cumulative Benefit and Cost of Projects

Project Name	Cocohatchee-Corkscrew Cumulative Lift				Golden Gate - Naples Bay Cumulative Lift				Rookery Bay Cumulative Lift				Cumulative Cost (Millions of Dollars)
	Discharge to Estuary	Water Quality	Hydrology	Groundwater	Discharge to Estuary	Water Quality	Hydrology	Groundwater	Discharge to Estuary	Water Quality	Hydrology	Groundwater	
Corkscrew Regional Ecosystem Watershed	0.000	0.000	0.031	0.000									$0.096
North Golden Gate Estates Flowway Restoration Project					0.010	0.682	0.118	0.002					$2.464
North Belle Meade Spreader Swale[(1)]					0.900	0.682	0.118	0.002	1.250	0.435	0.036	0.200	$9.490
South I-75 Canal Spreader Swale									1.289	0.523	0.088	0.250	$12.621
Henderson Creek Diversion [(1)]					1.345	0.682	0.118	0.002	2.124				$18.329
Wolfe Road Wetland Treatment System					1.345	0.690	0.118	0.007					$19.745
Henderson Creek Off-Line Storage Reservior									2.282	0.547	0.088	0.255	$22.674
Upper Golden Gate Estates Canal Weir Constuction					1.345	0.690	0.118	0.008					$23.226
Orange Tree Canal Control Structure Installation					1.345	0.690	0.118	0.009					$23.778
US HWY 41 Stormwater Treatment Area									2.282	0.553	0.089	0.255	$24.322
Total Benefit or Cost	0.000	0.000	0.031	0.000	1.345	0.690	0.118	0.009	2.282	0.553	0.089	0.255	$24.322

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Appendix 2-A

Capital Improvement Program
Recommended Projects

Corkscrew Regional Ecosystem Watershed

ATKINS

Collier County Watershed Management Plan

Collier County

Cocohatchee Watershed

STATEMENT OF PROBLEM

These lands are partially located within the Corkscrew Regional Ecosystem Watershed. Development of residential areas included construction of drainage ditches and swales. These ditches and swales interconnect with stormwater management systems in downstream sub-divisions before discharging into the Cocohatchee Canal.

The man-made ditches and swales contribute to a modified wetland system with shorter hydroperiod.

PROJECT BENEFITS

(1) The project provides local benefits in restoring wetland hydrologic characteristics. The improvement is predicted to provide an average annual watershed wetland hydrology performance measure lift of 0.03.

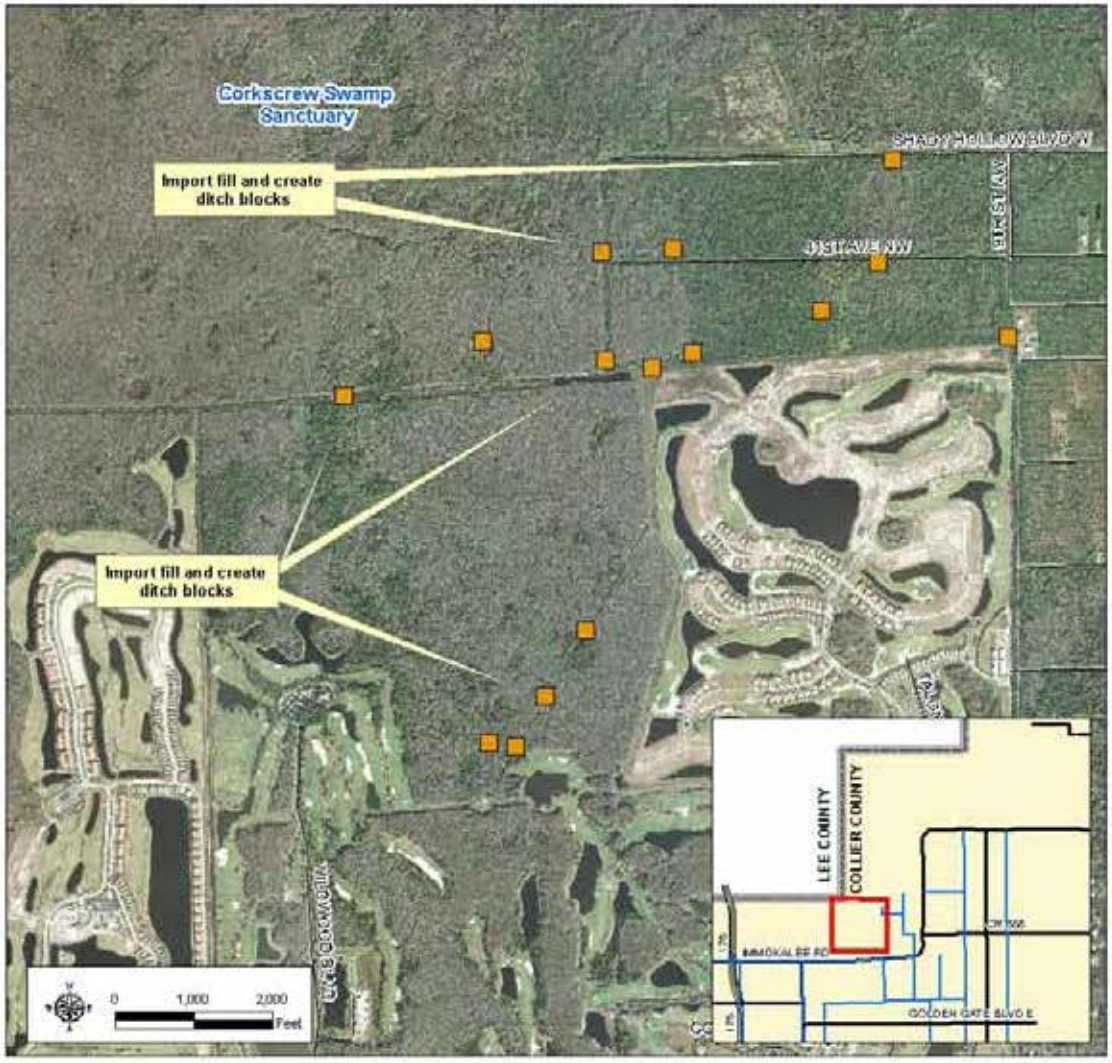
(3) Increased groundwater recharge.

PROJECT DISADVANTAGES

(1) Local improvements provide little benefit to the watershed as a whole.

(2) Changed depth of overland water could affect golf courses and residential communities.

(3) Portions of project area along 41st Ave NW are privately held and outside Rural Fringe Sending Area.



SOLUTION

- Southern portion of project is located within existing Rural Fringe Sending Area. Use incentive programs to encourage property owner to implement local wetland restoration activities.

- Import material and backfill man-made drainage ditches at wetland outfall locations.

DESIGN CONSIDERATIONS

- Coordination with CREW.

- Potential impacts to golf courses and surrounding residential communities.

- Potential presence of exotic species.

- Equipment access.

- Investigate availability of potential onsite material.

North Golden Gate Estates Flowway Restoration Project

ATKINS

Collier County Watershed Management Plan

Collier County

Golden Gate and Faka Union Watersheds

STATEMENT OF PROBLEM

Construction of the Golden Gate Main Canal network and construction of residential roads fractured the connectivity of wetland systems in the north Golden Gate Estates areas. Roadside drainage swales, coupled with a lack of culverts underneath the roads now divert runoff directly into the canal system.

The result is a loss of wetland hydrology and an increased volume of discharge to Naples Bay. The effect also includes less recharge to the surficial aquifer system that is a primary source of drinking water in the northern Golden Gate Estates.

PROJECT BENEFITS

(1) Improves wetland hydrology in the proposed flowway. Predicted to provide an average annual watershed performance measure lift of 0.12.

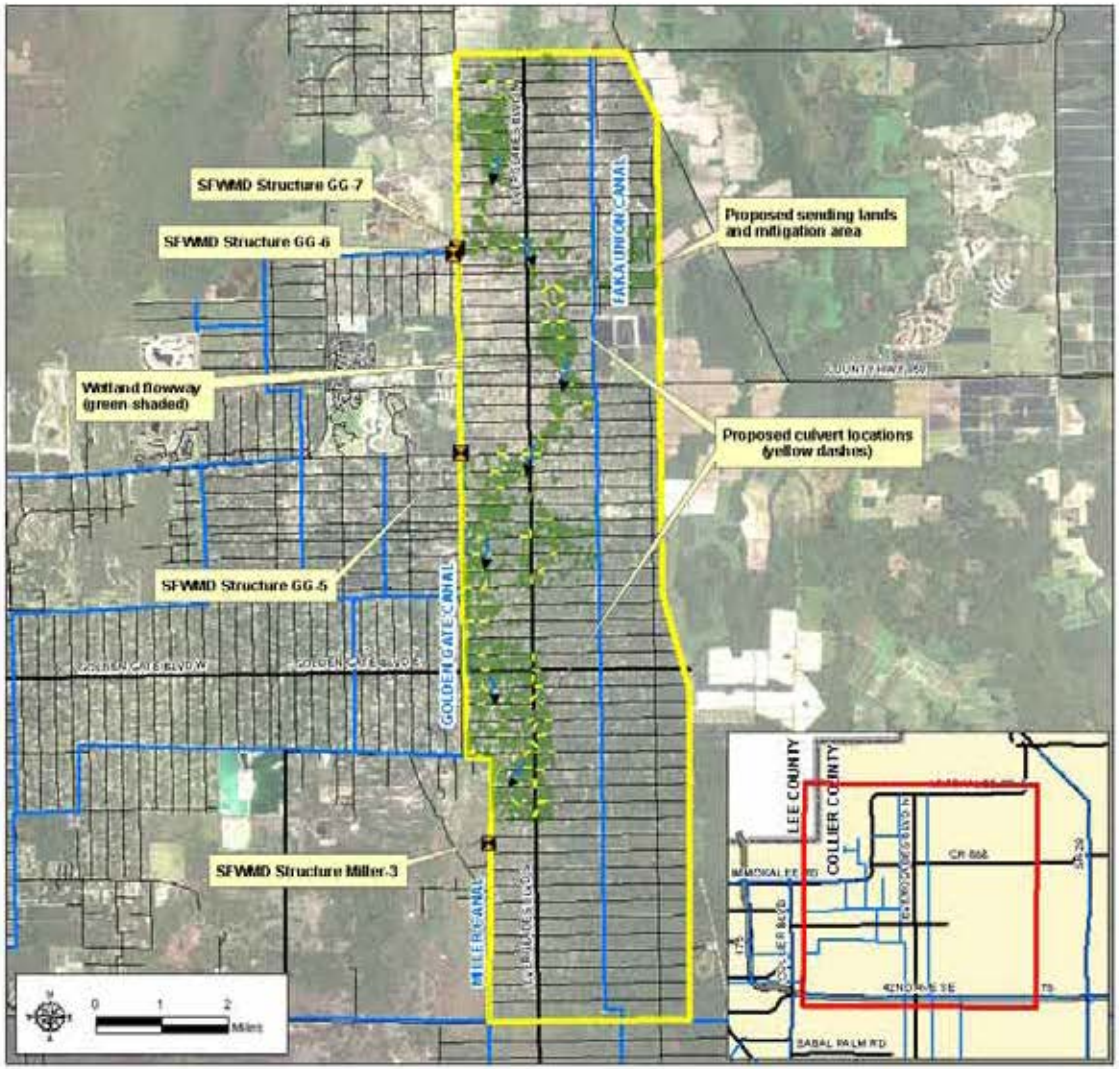
(2) Provides additional water quality treatment resulting in a annual average performance measure lift of 0.68 across the watershed.

(3) The project also increases groundwater recharge and helps maintain groundwater elevations in the Collier County well field.

PROJECT DISADVANTAGES

(1) Elevated groundwater level may affect septic leach fields or increase flood risk for residential properties near the project.

(2) May require purchase of private properties within the primary flowway.



SOLUTION

- The Northern Golden Gates Estates Flowway Restoration Project would utilize ditch blocks and equilization culverts to provide connectivity within the wetland system and help re-establish historical flow patterns.

- Recommend designation of area as a mitigation area and use TDR incentive programs to obtain properties and to generate funds to implement the project.

DESIGN CONSIDERATIONS

- Evaluate the presence of roadside berms that restrict sheet flow.

- Determine the maximum groundwater elevation that is allowed for proper function of septic systems in the immediate vicinity.

- Consider the affects of increased sheetflow on downstream properties.

- Evaluate flow rates and storage capacities within the system and size culverts accordingly.

COST ESTIMATE

Construction:	$1,691,000
Land Acquisition:	$0
Engineering and Contingency:	$677,000
TOTAL:	$2,368,000

North Belle Meade Spreader Swale

ATKINS

Collier County Watershed Management Plan

Collier County

Rookery Bay Watershed

STATEMENT OF PROBLEM

Construction of the Golden Gate Main Canal significantly increased the size of the watershed draining to Naples Bay and reduced the size of the watershed flowing to Rookery Bay. As a result, Naples Bay receives significantly too much water and Rookery Bay receives too little water, negatively affecting both receiving estuary systems.

Additionally, the reduction of stormwater runoff to the south has decreased wetland hydroperiods in areas where sheetflow used to occur.

PROJECT BENEFITS

(1) Predicted to reduce freshwater discharges to Naples Bay by 10 percent resulting in an annual performance measure lift of 0.69.

(2) Predicted to increase freshwater discharge to Rookery Bay by 19 percent, resulting in an annual performance measure lift of 1.25.

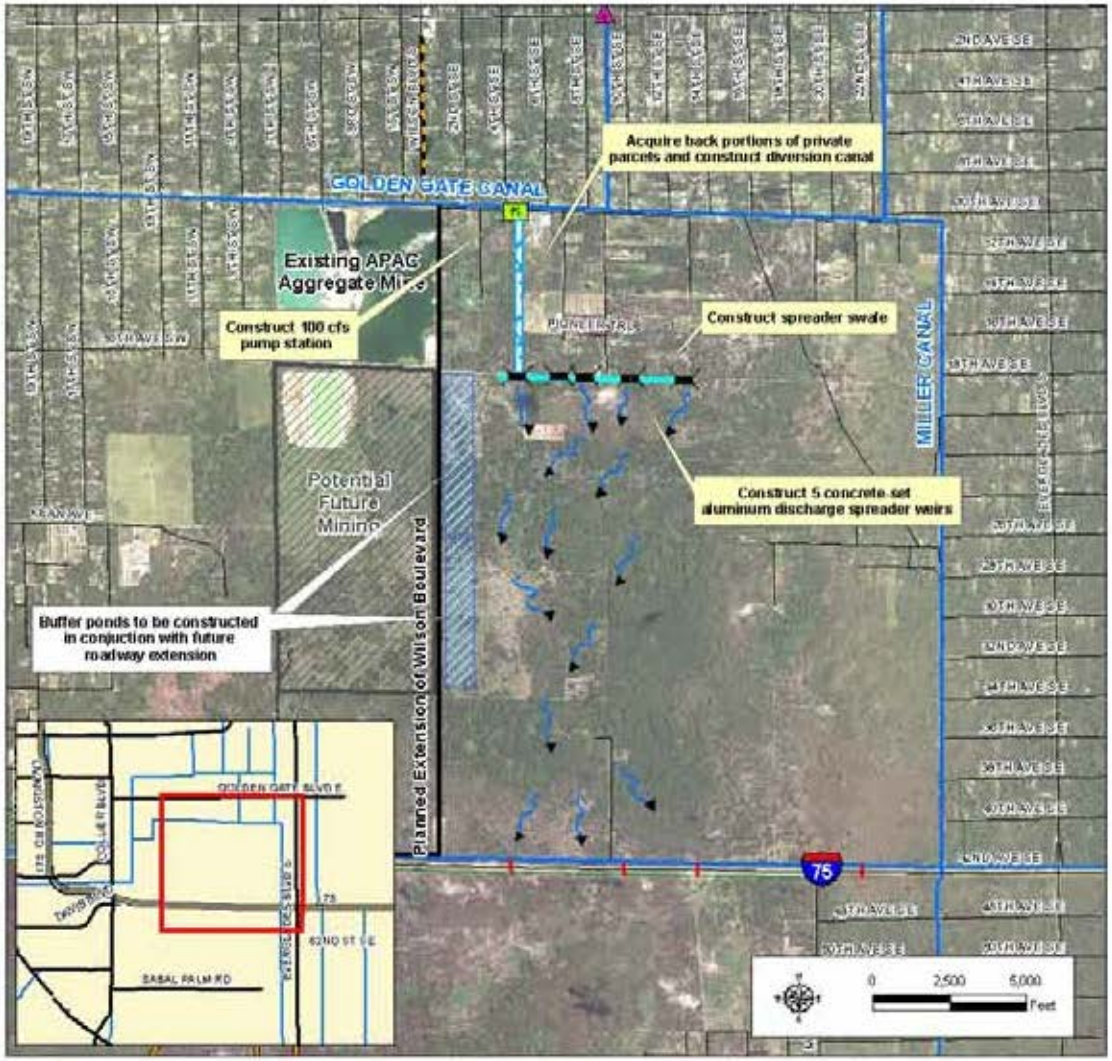
(3) Increases wetland hydrology in North Belle Meade with predicted performance measure lift of 0.04.

(4) Project reduces nutrient load to Naples Bay but does not significantly increase load to Rookery Bay.

PROJECT DISADVANTAGES

(1) Primary concept is dependant on acquisition of privately-owned property for the diversion canal construction.

(2) Project implementation may be tied to construction of Wilson Boulevard Extension or to proposed mining permits in the area.



SOLUTION

- Construct a 100 cfs pump station to divert water south from the Golden Gate Main Canal.

- Construct a spreader swale with weir structure to promote overland flow into wetland areas in North Belle Meade.

DESIGN CONSIDERATIONS

- An alternative design would be to build the diversion canal in conjunction with and adjacent to the Wilson Blvd extension. Water would be pumped from the diversion canal to the spreader swale.

- Flows north of the constructed spreader swale may need to be graded slightly east to the constructed finger canal.

- Project discharge area lies with a Rural Fringe Sending area, the development rights for this area would need to be obtained prior to construction. This could be tied to the proposed mining permits in the area.

COST ESTIMATE

Construction:	$4,788,000
Land Acquisition:	$322,000
Engineering and Contingency:	$1,916,000
TOTAL:	$7,026,000

South I-75 Canal Spreader Swale

ATKINS

Collier County Watershed Management Plan

Collier County

Rookery Bay Watershed

STATEMENT OF PROBLEM

Construction of the Golden Gate Main Canal interrupted the historical sheet flow pattern to the south toward Rookery Bay. The water is now diverted west toward the Naples Bay estuary. Due to the redirection of flow and the impedence to overland flow caused by I-75, the wetland area south of I-75 in the Rookery Bay watershed has a decreased hydroperiod and a change in wetland habitat.

PROJECT BENEFITS

(1) Increases hydrology of the wetland areas in the Rookery Bay portion of the Picayune Strand State Forest. Predicted to provide an annual average watershed performance measure lift of 0.10.

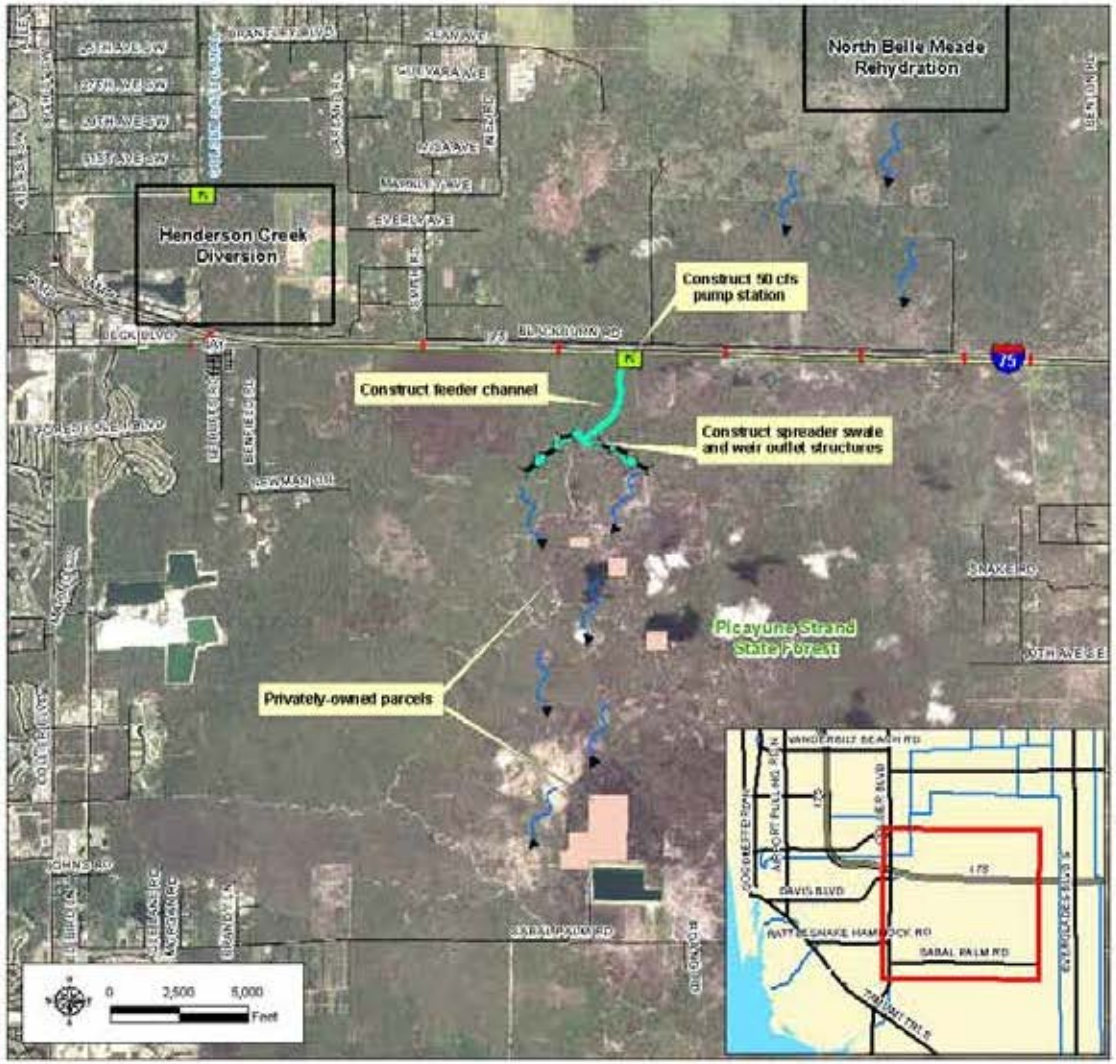
(2) Provides water quality treatment to diverted flows. The average annual watershed performance measure lift is predicted to be 0.10.

PROJECT DISADVANTAGES

(1) Project implementation would depend on agreement with the managers of the Picayune Strand State Forest.

(2) Additional culverts or other crossing would likely be required under Sabal Palm Rd.

(3) Privately owned out-parcels exist in the Picayune Strand State Forest. Conservation easements may be required, or the properties may have to be purchased.



SOLUTION

- Construct a 50 cfs Pump Station to pump water from the interconnected I-75 Canal Network into the to feeder channel.

- Construct spreader swale with outfall weirs that discharge at topographic lows.

DESIGN CONSIDERATIONS

- Consider the effect of increased sheet flow on out-parcels in the Picayune Strand State Forest.

- Availability of water to divert to the spreader system may be dependent upon contributions from other recommended projects.

- Culverts under I-75 will require regular maintenance to convey water from areas north of I-75.

- Culverts and crossings under Sabal Palm Rd may not have capacity to manage additional flow.

COST ESTIMATE

Construction:	$2,328,000
Land Acquisition:	$0
Engineering and Contingency:	$932,000
TOTAL	$3,131,000

Henderson Creek Diversion Pump Station

ATKINS

Collier County Watershed Management Plan

Collier County

Golden Gate Watershed

STATEMENT OF PROBLEM

Construction of the Golden Gate Main Canal significantly increased the size of the watershed draining to Naples Bay and reduced the size of the watershed draining to Rookery Bay. As a result, Naples Bay receives significantly too much water and Rookery Bay receives too little water, negatively affecting both receiving water estuary systems.

PROJECT BENEFITS

(1) Predicted to reduce freshwater discharges to Naples Bay by 10 percent resulting in an annual performance measure lift of 0.89.

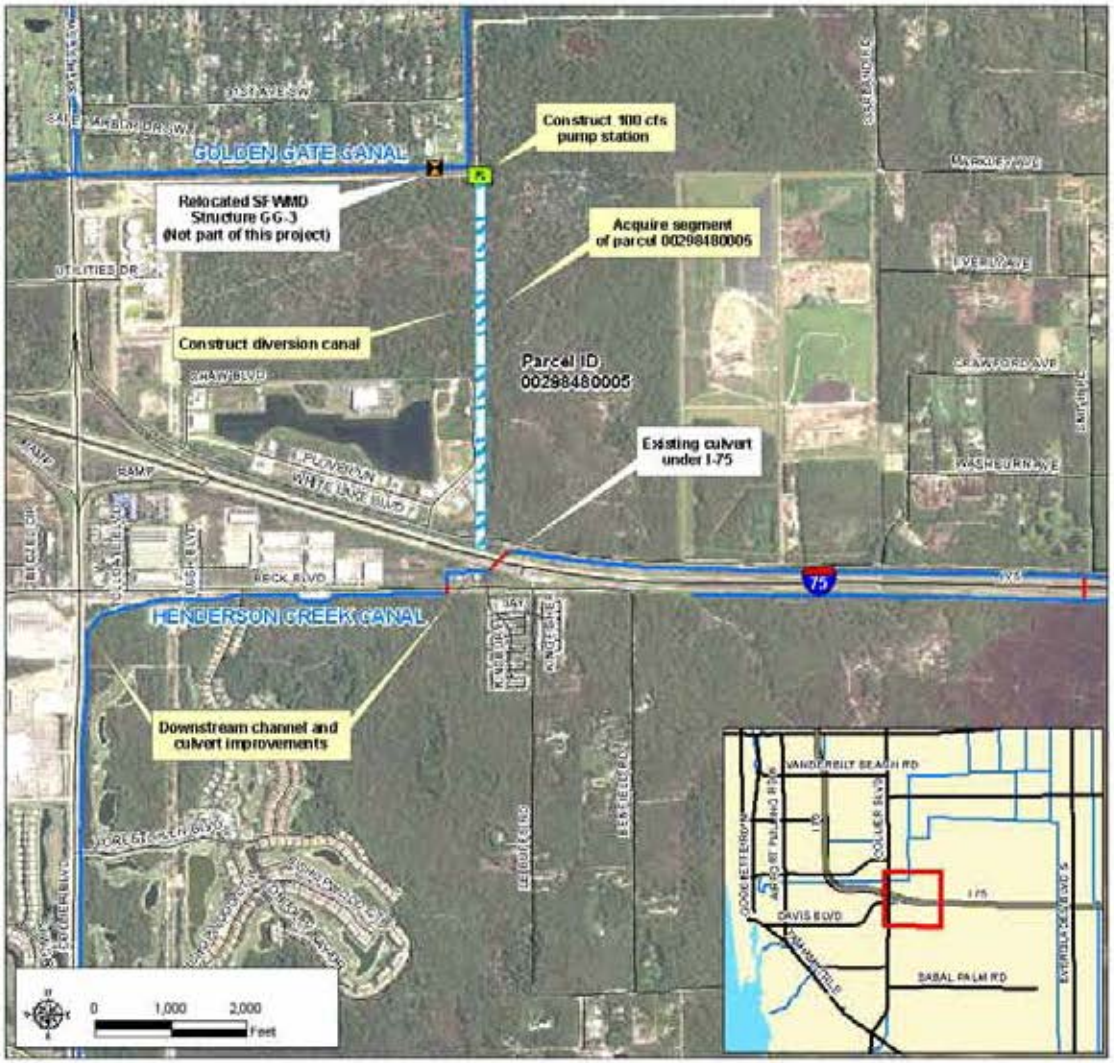
(2) Predicted to increase freshwater discharge to Rookery Bay by 33 percent, resulting in an annual performance measure lift of 1.67.

(3) Provides additional water to Henderson Creek that may be available to augment future supply needs for the Marco Island Water Treatment Plant.

PROJECT DISADVANTAGES

(1) The project would be dependant on the purchase of a portion of private property required to construct diversion canal.

(2) Project reduces total nutrient load to Naples Bay, but potentially increases total load to Rookery Bay.



SOLUTION

This project has been conceptualized by the South Florida Water Management District and seeks to divert water from the Golden Gate Main Canal into Henderson Creek.

- Plans call for construction of a 100 cfs pump station to divert flows from the Golden Gate Canal to the Henderson Creek Canal.

- Diverted water will move south through a new 5200 LF dredged canal, 30' wide and 10' deep and water will flow into Henderson Creek through an existing box culvert under I-75.

- Channel and Culvert improvements will be required in Henderson Creek downstream I-75 to convey the additional flows.

DESIGN CONSIDERATIONS

- Evaluate alternative pumping strategies to determine optimal operation.

- Inclusion of a water quality treatment system would reduce the potential increase in total pollutant load to Rookery Bay.

COST ESTIMATE

Construction:	$4,065,000
Land Acquisition:	$423,000
Engineering and Contingency:	$1,220,000
TOTAL:	$5,708,000

Atkins Light Blue Horizontal Logo.png

Wolfe Road Wetland Treatment System

ATKINS

Collier County Watershed Management Plan

Collier County

Golden Gate Watershed

STATEMENT OF PROBLEM

Urban runoff and pollutant loading to stormwater ponds. In this area, runoff from upstream areas is routed through the Island Walk subdivision and contributes to elevated nutrient concentrations in the stormwater ponds.

PROJECT BENEFITS

(1) The project utilizes existing features.

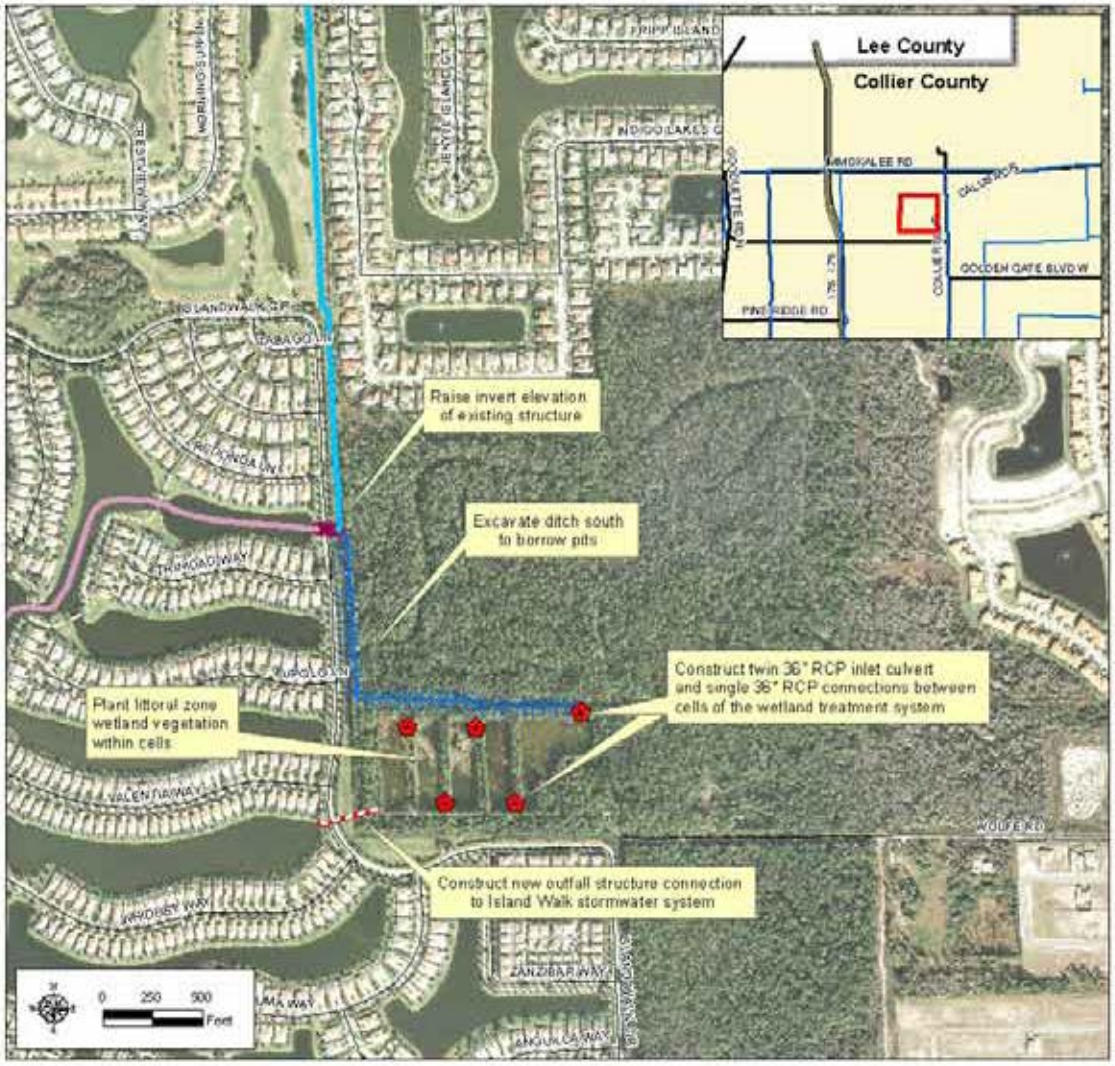
(2) The project will reduce the volume of outside flow entering the Island Walk stormwater management system.

(3) The project will provide water quality treatment of runoff before it enters the Island Walk system. The average annual watershed performance measure lift is predicted to be 0.008

PROJECT DISADVANTAGES

(1) The required property (approximately 20 acres) is privately owned and permits have been requested for urban development.

(2) The existing permit for the Island Walk Subdivision would have to be modified to change the inflow characteristics



SOLUTION

- Raise the invert of the existing structure that controls discharge from the drainage ditch into the Island Walk stormwater system.

- Extend the drainage ditch south and to the east into the series of existing borrow pits.

- Install culverts to convert the borrow pits into interconnected wetlands with sediment sumps and littoral shelf planting.

- Construct new control structure to release treated stormwater back into the Island Walk stormwater system.

DESIGN CONSIDERATIONS

- Evaluate stage and volume of stormwater flowing through the existing structure into Island Walk.

- Determine maximum volume that can be treated in the proposed wetland treatment system.

- Consider requirements to change the Island Walk permit.

COST ESTIMATE

Construction	$353,000
Land Acquisition	$921,000
Engineering and Contingency	$142,000
TOTAL	$1,416,000

Henderson Creek Off-Line Storage Reservior

ATKINS

Collier County Watershed Management Plan

Collier County

Rookery Bay Watershed

STATEMENT OF PROBLEM

The Henderson Creek Canal discharges to the south, directly to Rookery Bay. Rookery Bay experiences a freshwater inflow surplus during the wet season (June -September) and freshwater deficit during the dry season. These flow deficits/surpluses have a negative impact on the salinity levels within the receiving water estuary.

PROJECT BENEFITS

(1) Project is used to modify the timing of flow to Rookery Bay. The reservoir would capture excess wet season flow that may be released water during the dry season.

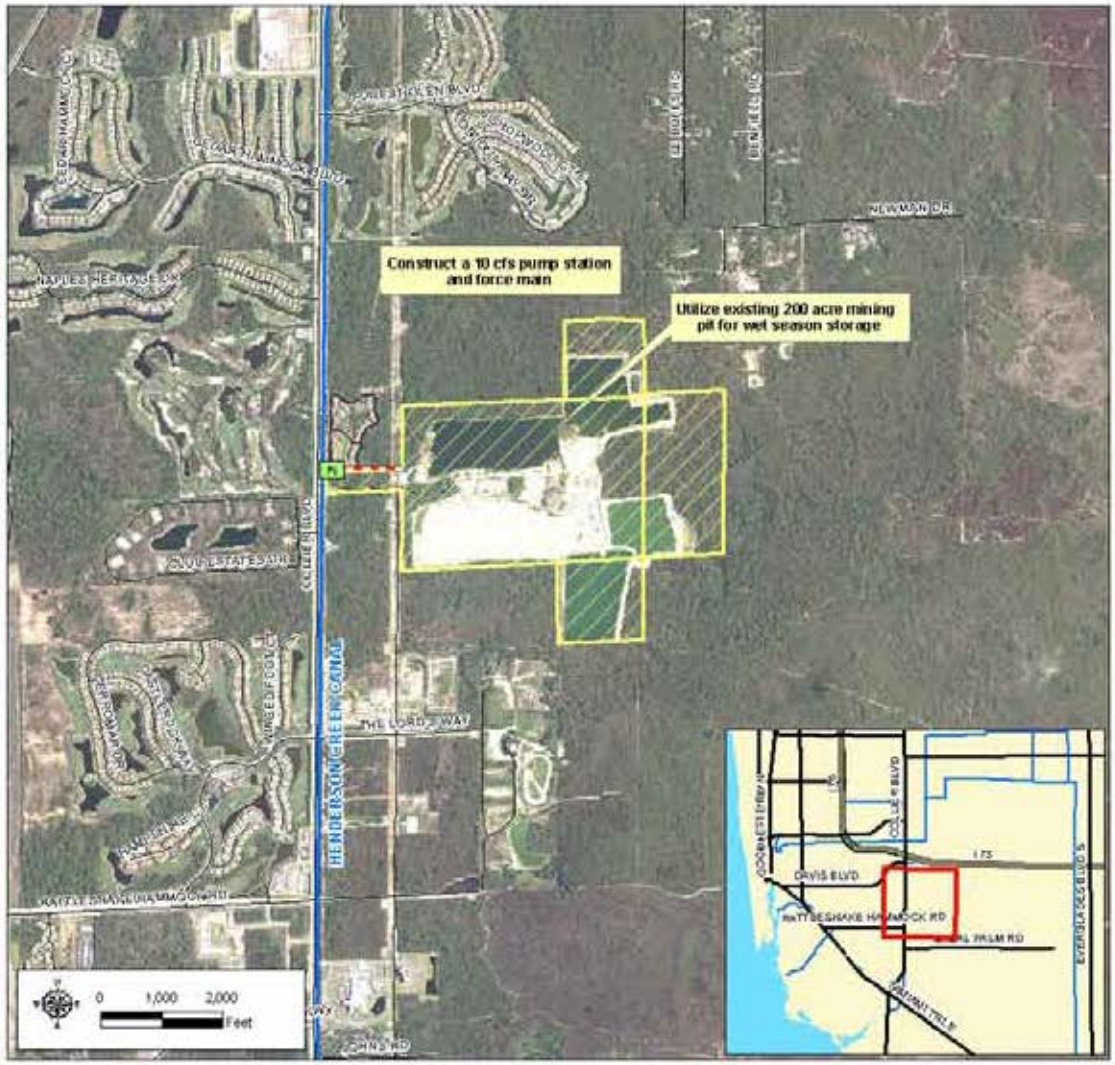
(2) Would increase groundwater recharge from the mining pit which would affect the timing of flows from the watershed.

(3) Predicted to provide average annual performance measure lift of 0.32 in the discharge to estuary scores.

PROJECT DISADVANTAGES

(1) Property is currently private-owned and is actively mined. Project may not be viable for many years.

(2) A large portion of diverted water would likely be lost to groundwater recharge. If the rock is fractured, groundwater may rapidly migrate back into the canal as baseflow.



SOLUTION

- Obtain the rights to the mining property after the mine is closed.

- Utilize storage volume in the abandoned mine by constructing a 10 cfs pump station to divert excess wet season flows (August-September) into the reservoir.

DESIGN CONSIDERATIONS

- Pumping operation will be based on stage and flow in the Henderson Creek Canal.

- Determine the leakage rate through the bed of the mining pit to the canal.

- Re-evaluate storage/pump capacity when mining operations are completed.

- Consider potential affects on private or public potable water supply wells in the vicinity of the project site.

COST ESTIMATE

Construction:	$671,000
Land Acquisition:	$1,989,000
Engineering and Contingency:	$269,000
TOTAL	$2,929,000

Upper Golden Gate Estates Canal Operable Weir Installation

ATKINS

Collier County Watershed Management Plan

Collier County

Golden Gate Watershed

STATEMENT OF PROBLEM

Construction of the Golden Gate Main Canal significantly increased the size of the watershed draining to Naples Bay. The result is that the discharge to Naples Bay is more than five times the historic volume. This has negatively affected the Naples Bay estuary system.

In additional, the canal network and use of shallow groundwater sources for potable water supply has contributed to lower groundwater elevations in the Golden Gate Estates.

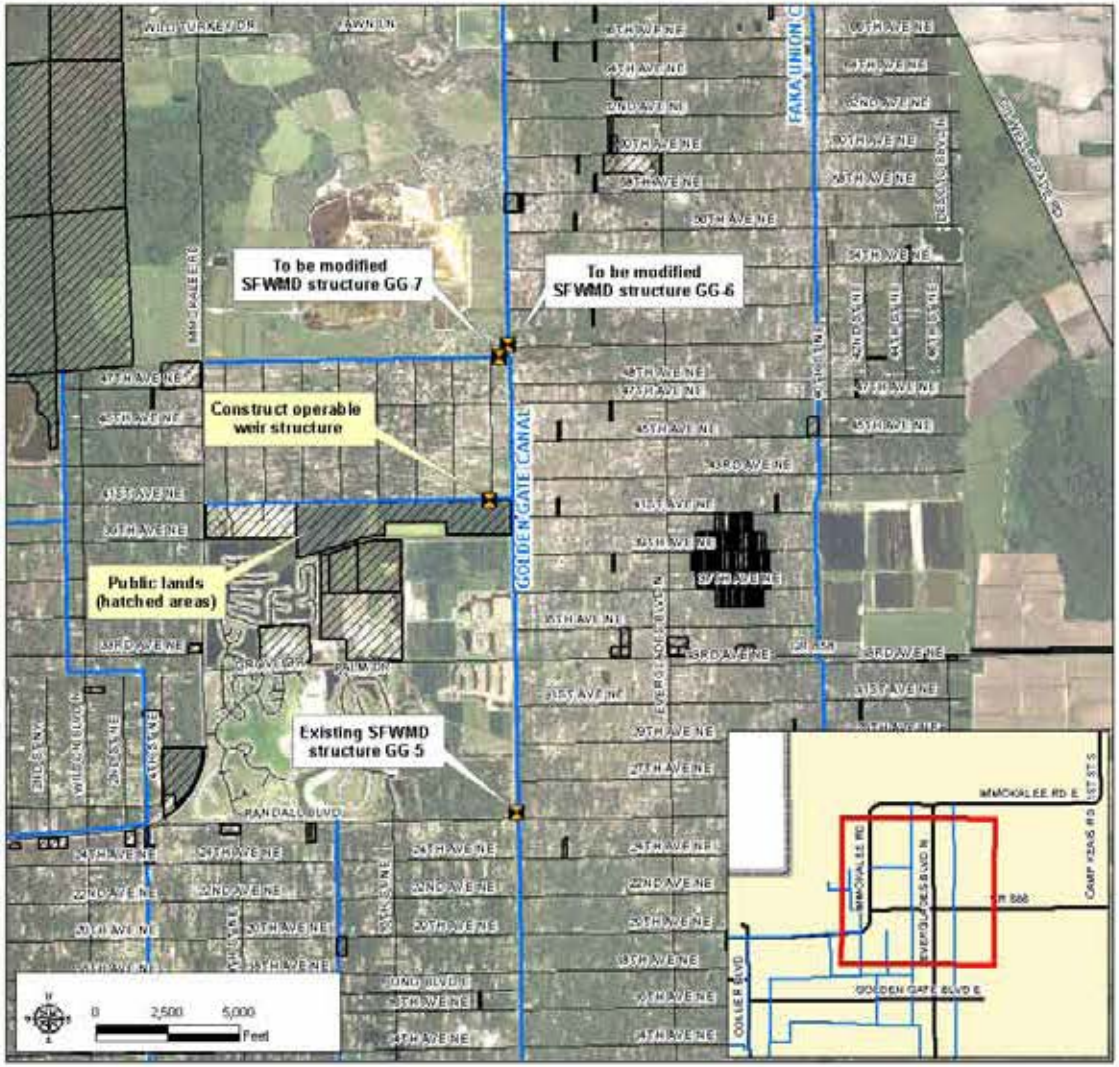
PROJECT BENEFITS

(1) Provides more flexibility to increase the volume of runoff stored, and decrease the volume of water released during storm events. The direct benefit is a lift in the Discharge to Estuary performance measure score of 0.0001.

(2) The proposed operable weir provides flexibility to manage groundwater and surface water elevations effectively. Indirect benefits includee reduced baseflow and an increase in available groundwater.

PROJECT DISADVANTAGES

(1) Increased groundwater elevations may affect septic leach fields or increase flood risk for residential areas near the canal.



SOLUTION

- In conjuction with SFWMD projects to replace GG-6 and GG-7 with operable structures, construct an additional operable structure on the finger canal south of the GG-7 canal. The structure will allow the canal to be used as water storage feature and to reduce baseflow in the Golden Gate Canal network.

DESIGN CONSIDERATIONS

- Design and operational protocol would be coordinated with SFWMD projects to replace the GG-6 and GG-7 structures.

- Construction and operational access may require construction easement on the north side of the canal.

- Permits for upstream water detention facilty may have to be modified.

COST ESTIMATE

Construction	$394,000
Land Acquisition	$0
Engineering and Contingency	$158,000
TOTAL	$552,000

Orange Tree Canal Control Structure Installation

ATKINS

Collier County Watershed Management Plan

Collier County

Project GG-7 Golden Gate Watershed

STATEMENT OF PROBLEM

Construction of the Golden Gate Main Canal significantly increased the size of the watershed draining to Naples Bay. The result is that the discharge to Naples Bay is now more than five times the historic volume. This has negatively affected the Naples bay estuary system.

In addition, the canal network and use of shallow groundwater sources for potable water supply has contributed to lower groundwater elevations in the Golden Gate Estates.

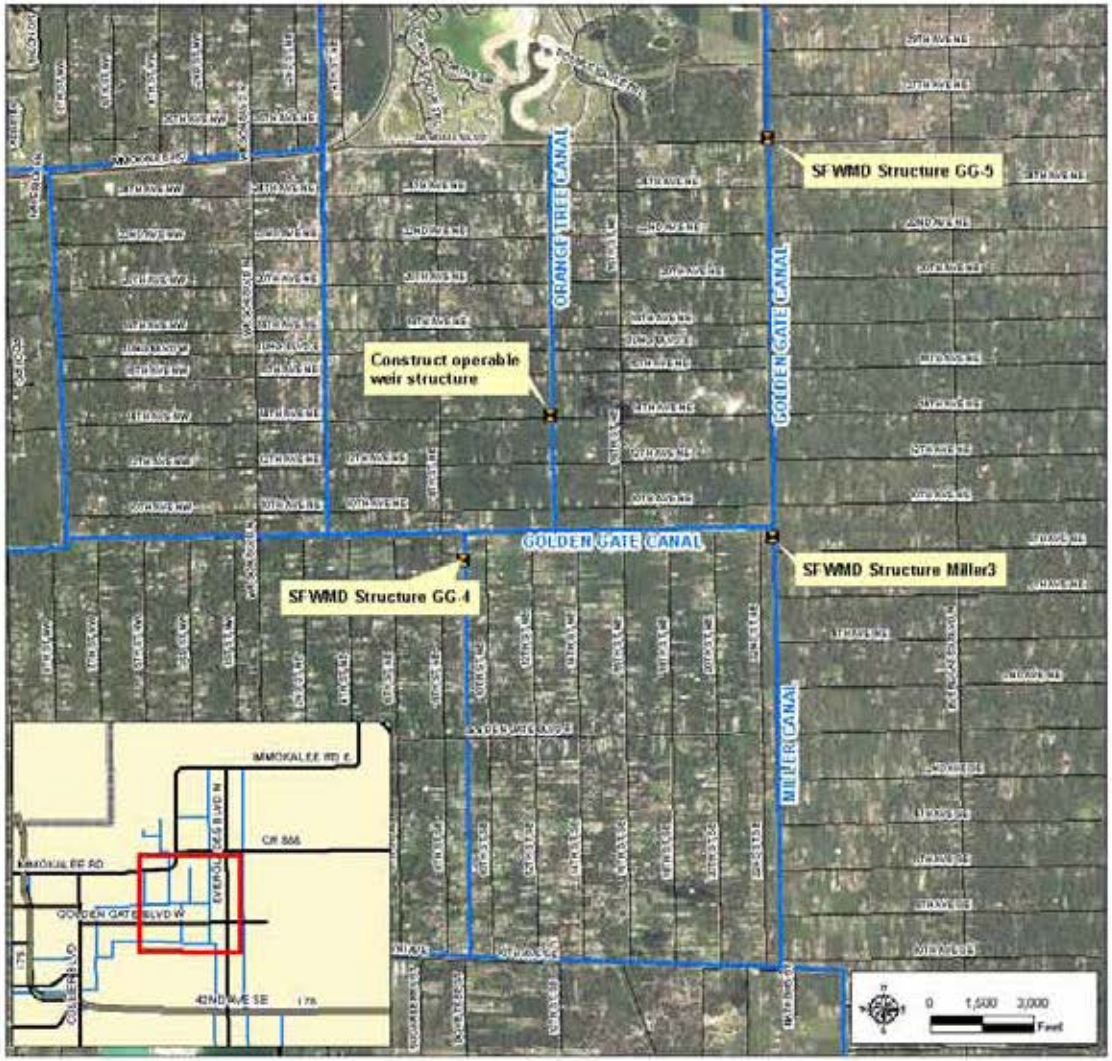
PROJECT BENEFITS

(1) Provides more flexibility to increase the volume of runoff stored, and decreases the volume of water released during storm events. The direct benefit is a lift of 0.0001 in the Discharge to Estuary annual average performance measure score.

(2) The proposed operable weir provides flexibility to manage groundwater and surface water elevations effectively. Indirect benefits include reduced baseflow and an increase in available groundwater.

PROJECT DISADVANTAGES

(1) Elevated groundwater level may affect septic leach fields or increase flood risk in developed areas near the canal.



SOLUTION

- Construct an operable weir structure near the intersection of the Orange Tree Canal and 14th Avenue NE to increase storage capacity and better manage baseflow.

- Properties on either side of the canal near the structure location may be required to provide construction and maintenance access.

DESIGN CONSIDERATIONS

- Coordinate operational protocols with SFWMD Structure GG-4.

- Evaluate the effect of increased stage in the canal upstream of the structure. Evaluation should include changes in groundwater elevation and potential changes in flood risk.

COST ESTIMATE

Construction	$384,000
Land Acquisition	$0
Engineering and Contingency	$158,000
TOTAL	$552,000

US Highway 41 Stormwater Treatment Area

ATKINS

Collier County Watershed Management Plan

Collier County

Rookery Bay Watershed

STATEMENT OF PROBLEM

The Rookery Bay watershed is identified as impaired for nutrients and dissolved oxygen. In addition, this wetland area was identified as having a reduced hydroperiod relative its pre-development condition.

PROJECT BENEFITS

(1) The project will provide water quality treatment to remove nutrients from the US Highway 41 canal system. Watershed average performance measure list is predicted to be 0.035

(2) The project will rehydrate this wetland area during the wet season by extending the depth and length of the hydroperiod. Watershed average performance measure list is predicted to be 0.11

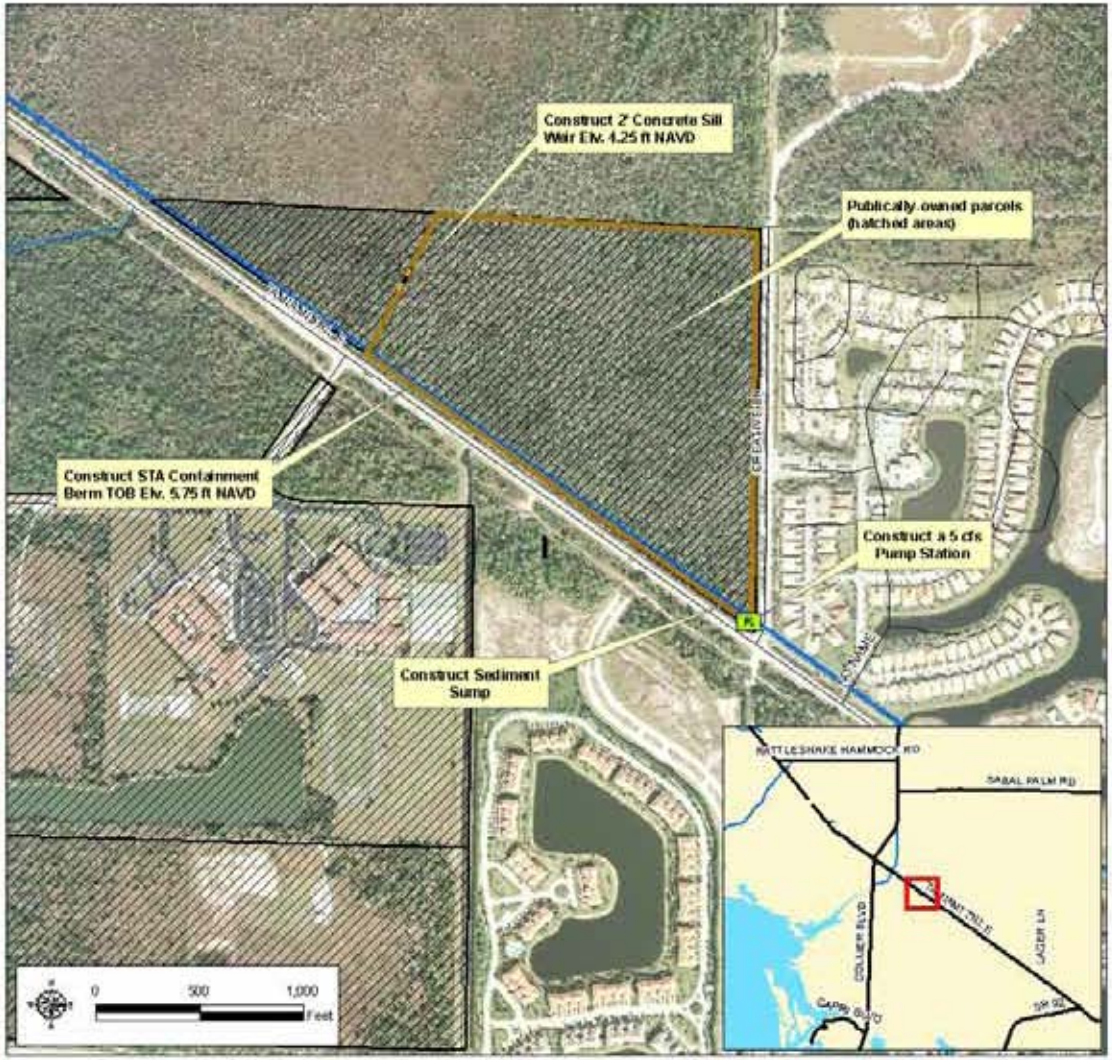
(3) The lands are publically-owned

PROJECT DISADVANTAGES

(1) The project is relatively small and may not provide a large water quality benefit.

(2) Flow analysis in the US41 Canal suggests that the operational period for the system would likely be limited to a three month period during the wet season.

(3) The increased groundwater elevations could affect adjacent residential areas.



SOLUTION

- Construct a 52-acre wetland stormwater treatment area (STA) on publicly owned land on the north side of US Highway 41. A pump station will divert water from the US 41 canal into the STA for treatment during the wet season.

- The STA will include a sediment sump.

- Treated water would be released into the wetland downstream via gravity flow over a concrete spillway to optimize detention time.

DESIGN CONSIDERATIONS

- Determine wetland characteristics to determine final wetland inundation depth.

- The location of the outfall from the STA must be carefully selected to ensure that treated water is drawn back into the wetland system.

- Consider installing a manual stop-log structure on the concrete sill to retain the last pumped cycle and further extend the STA wetland hydroperiod.

COST ESTIMATE

Construction	$388,000
Land Acquisition	$0
Engineering and Contingency	$156,000
TOTAL	$544,000

Appendix 2-B

Incentive Based Program
Recommended Projects

Fakahatchee Wetland Restoration - Area 1

ATKINS

Collier County Watershed Management Plan

Collier County

Fakahatchee Watershed

STATEMENT OF PROBLEM

During agricultural development, many isolated wetlands were drained for logging or planting. Historically, this wetland stored more water and maintained a longer hydroperiod.

This canal dredging also negatively impacted the ecology of the wetlands by decreasing natural marsh and wetland vegetation. Native species habitat was likely impacted as well.

PROJECT BENEFITS

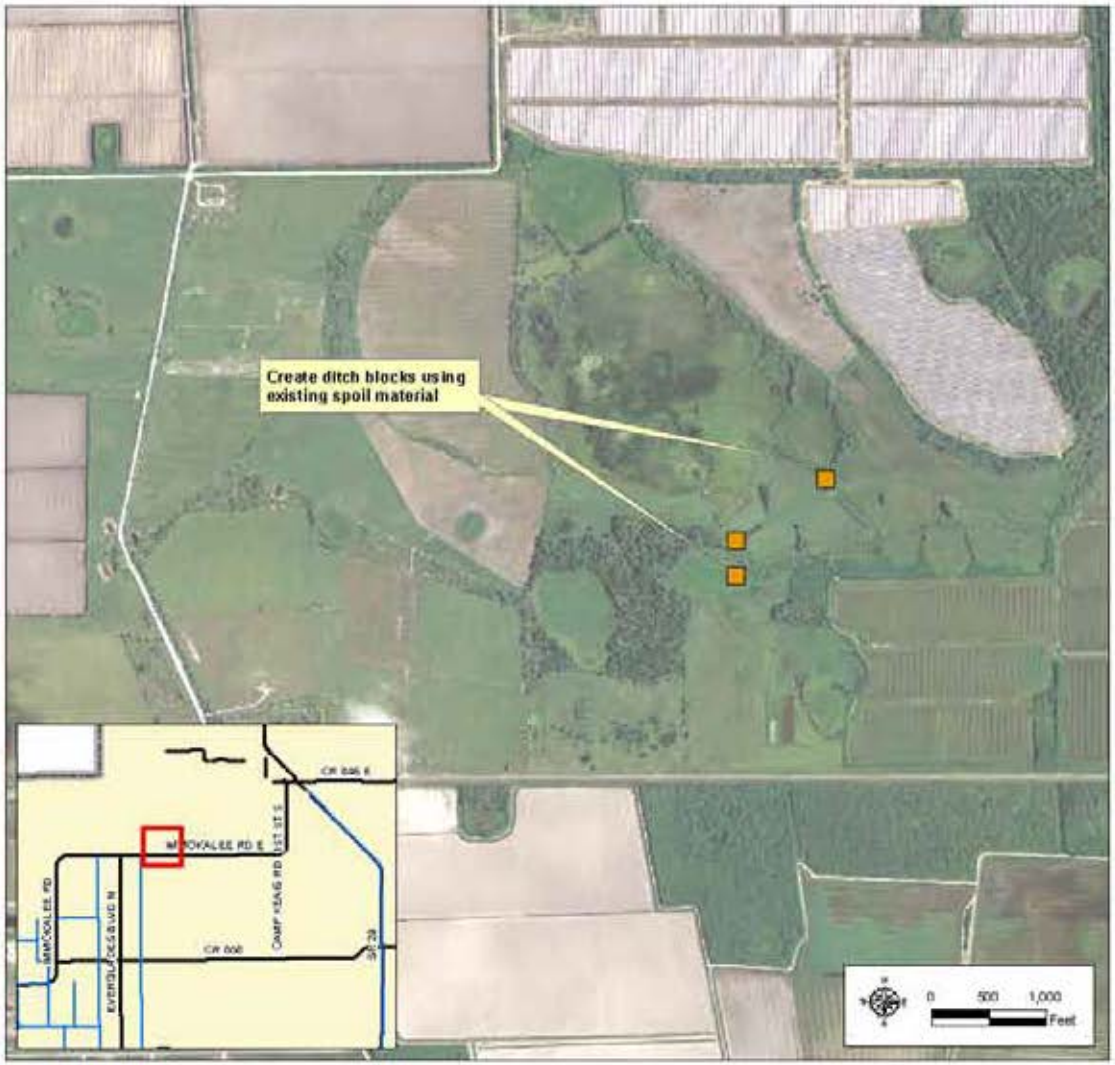
(1) The projects is predicted to improved the hydrology of these isolated wetland systems by blocking ditches and reducing artificial drainage.

(2) The project serves a local area (120 acres) and provides a lift in average wetland hydrology score for the combined watersheds of 0.0001.

(3) Provides storage and water quality treatment.

PROJECT DISADVANTAGES

(1) Changes in groundwater and surface water elevations may affect adjacent farming activities.



SOLUTION

- Project is located within existing Stewardship Sending Area. Use incentive programs to encourage property owner to implement local wetland restoration activities.

- Use existing dredge spoil material on the canal banks to backfill drainage ditches and create ditch blocks at the wetland outfall locations to allow wetlands to discharge via overland flow.

DESIGN CONSIDERATIONS

- Determine if volume of on-site dredge spoil material is adequate to meet backfill requirements.

- Potential presence of exotic species

- Equipment access

Fakahatchee Wetland Restoration - Area 2

ATKINS

Collier County Watershed Management Plan

Collier County

Fakahatchee Watershed

STATEMENT OF PROBLEM

During agricultural development, many isolated wetlands were drained for logging or planting. Historically, these wetlands stored more water and had a longer hydroperiod.

The canal dredging also negatively impacted the ecology of the wetlands by decreasing natural marsh and wetland vegetation. Native species habitat was likely impacted as well.

PROJECT BENEFITS

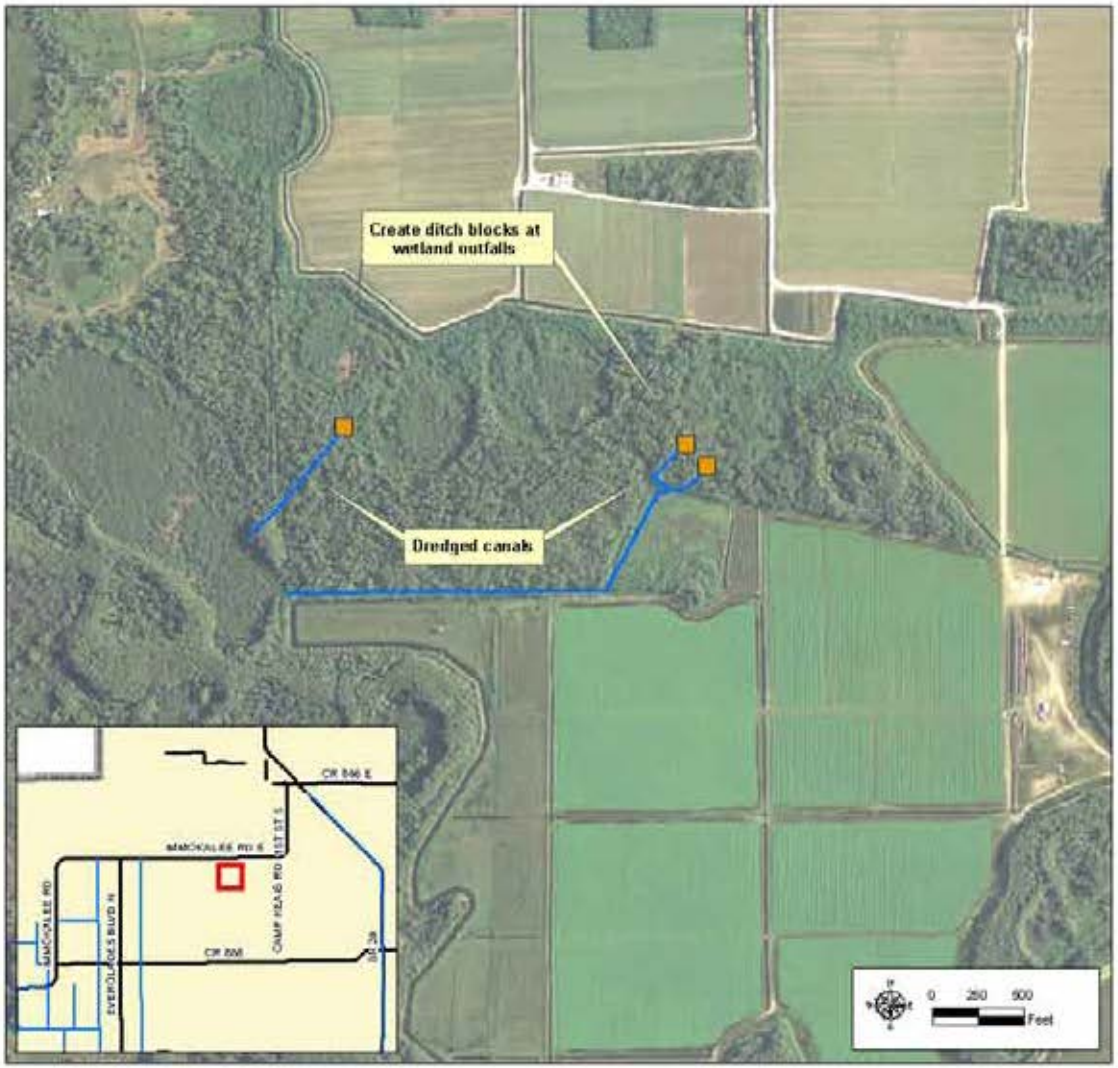
(1) The project is predicted to improve the wetland hydrology of these isolated wetland systems by blocking ditches.

(2) The project serves a local area (37 acres) and provides a lift in average wetland hydrology for the combined watersheds of 0.0001.

(3) Provides on-site storage and water quality treatment.

PROJECT DISADVANTAGES

(1) Changes in groundwater and surface water elevations may affect adjacent farming activities.



SOLUTION

- Project is located within existing Habitat Stewardship Area. Use incentive programs to encourage property owner to implement local wetland restoration activities.

- Use existing dredge spoil material or import material to backfill drainage ditches and create ditch blocks at the wetland outfall locations and allow wetlands to discharge via overland flow.

DESIGN CONSIDERATIONS

- Determine if volume of on-site dredge spoil material is adequate to meet backfill requirements.

Upper Okaloacoochee Slough Wetland Restoration

ATKINS

Collier County Watershed Management Plan

Collier County

Okaloacoochee Watershed

STATEMENT OF PROBLEM

This portion of the Okaloacoochee Slough was dredged to drain the upstream wetland areas for farming activities. This resulted in shorter wetland hydroperiods and less groundwater recharge. The dredged canal also negatively impacted the ecology of the surrounding wetlands by decreasing natural marsh and wetland vegetation. Native species habitat was likely impacted as well.

PROJECT BENEFITS

(1) Re-establishes wetland hydroperiods by reducing drainage. Lift in annual watershed performance measure is predicted to be 0.0004.

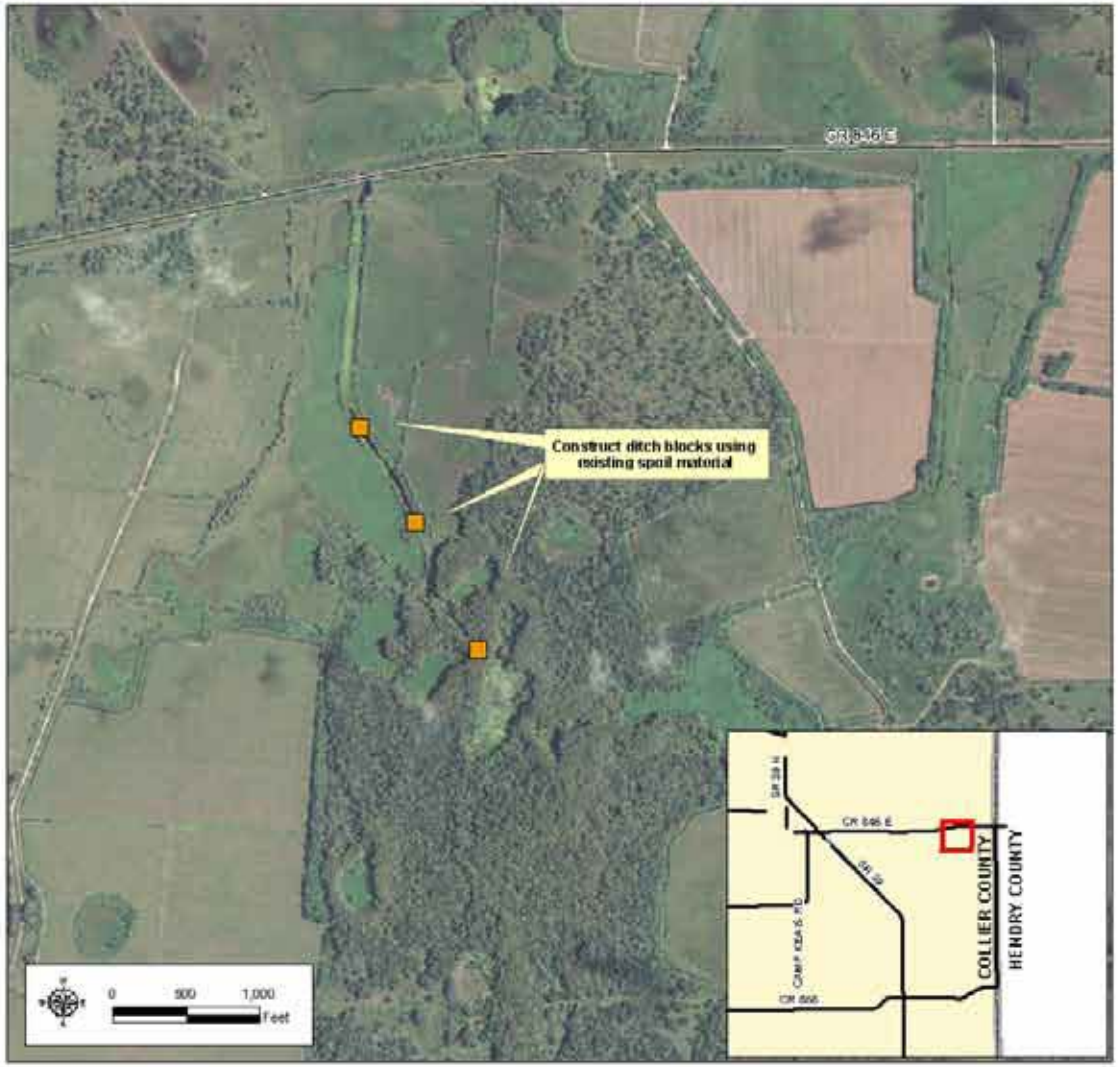
(2) Provides additional water quality treatment in the wetland area. Lift in annual watershed performance measure is predicted to be 0.002.

(3) Increases groundwater recharge.

PROJECT DISADVANTAGES

(1) Reduced drainage capacity could increase flood risk of SR 848 and upstream lands.

(2) Changes in depth of surface water could affect surrounding agricultural areas.



SOLUTION

- Project is located within an approved Stewardship Sending Area and within the Okaloacoochee Flowway Stewardship Area. Use incentive programs to encourage property owner to implement local wetland restoration activities.

- Use existing dredge spoil material on the canal banks to backfill ditches and create ditch blocks at the wetland outfall locations. The ditch blocks created within the slough will re-hydrate wetlands and provide natural sedimentation in the dredged canal to raise the slough profile and promote the natural restoration of the waterway.

DESIGN CONSIDERATIONS

- Determine if volume of on-site dredge spoil material is adequate to meet backfill requirements.

- Verify no flooding impacts are generated at SR 848 and the lands to the north of SR 848.

Middle Okaloacoochee Slough Wetland Restoration

ATKINS

Collier County Watershed Management Plan

Collier County

Okaloacoochee Watershed

STATEMENT OF PROBLEM

This portion of the Okaloacoochee Sough was dredged to drain the upstream wetland area for farming activities. This resulted in shorter wetland hydroperiods and less groundwater recharge. The dredged canal also negatively impacted the ecology of the upstream wetlands by decreasing natural marsh and wetland vegetation. Native species habitat was likely impacted as well.

PROJECT BENEFITS

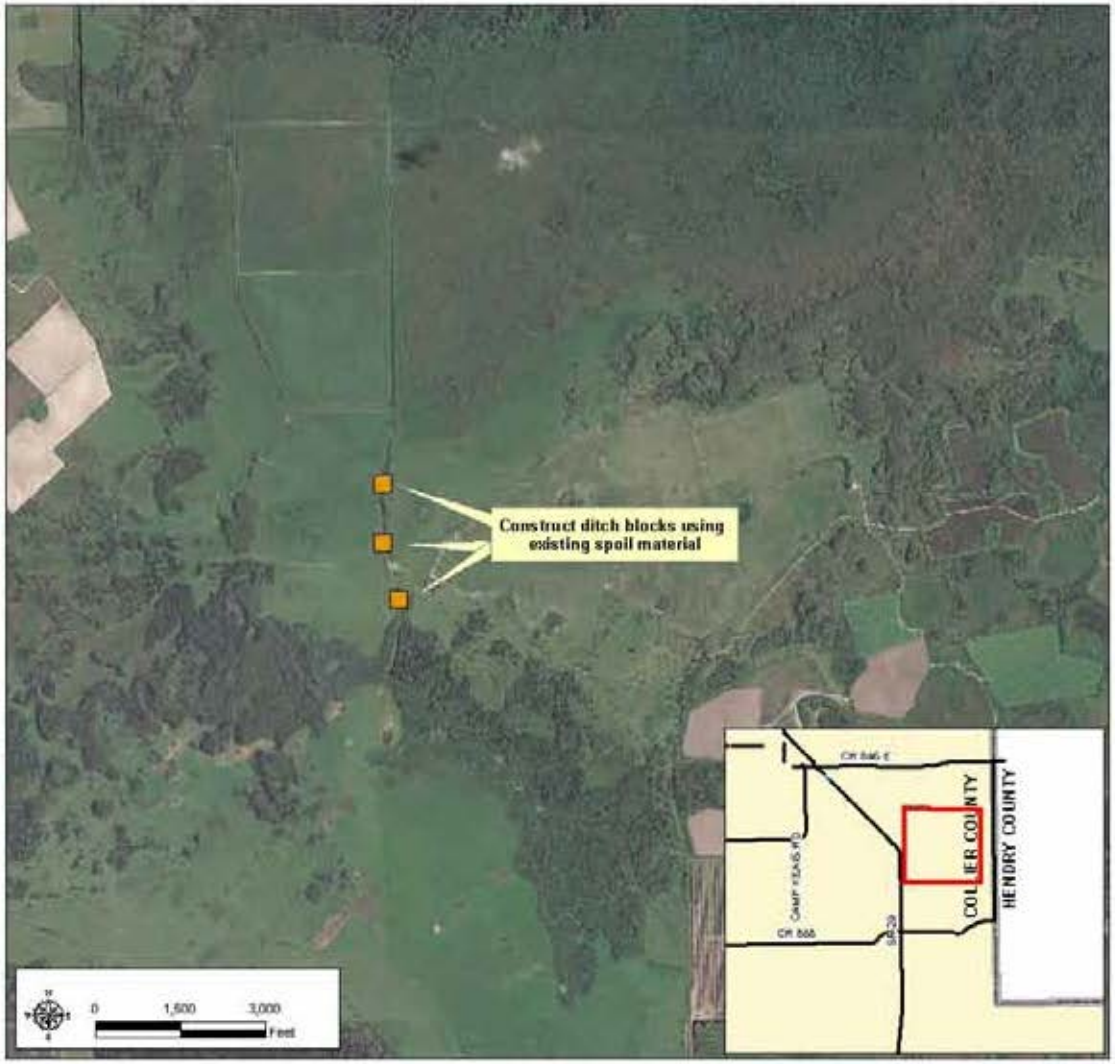
(1) Re-establishes historic wetland hydroperiod by containing inflows which are artificially drained. Predicted to provide an average annual watershed performance measure lift of 0.015.

(2) Predicted to increase water quality treatment in the wetland area. An annual average watershed performance measure lift of 0.20 is predicted.

(3) Increases groundwater recharge.

PROJECT DISADVANTAGES

(1) Change in depth of water could negatively impact surrounding agricultural activities.



SOLUTION

- Project is located within the Okaloacoochee Floweay Stewardship Area. Use incentive programs to encourage property owner to implement local wetland restoration activities.

- Use existing dredge spoil material on the canal banks to backfill man-made ditches and create ditch blocks at the wetland outfall locations. The ditch blocks created within the slough will provide natural sedimentation in the canal to raise the slough profile and promote the natural restoration of the waterway.

DESIGN CONSIDERATIONS

- Determine if volume of on-site dredge spoil material is adequate to meet backfill requirements.

Lower Okaloacoochee Slough Wetland Restoration

ATKINS

Collier County Watershed Management Plan

Collier County

Okaloacoochee Watershed

STATEMENT OF PROBLEM

This portion of the Okaloacoochee Sough was dredged to drain the upstream wetland areas for farming activities. This resulted in shorter wetland hydroperiods and less groundwater recharge. The dredged canal also negatively impacted the ecology of the surrounding wetlands by decreasing natural marsh and wetland vegetation. Native species habitat was likely impacted as well.

PROJECT BENEFITS

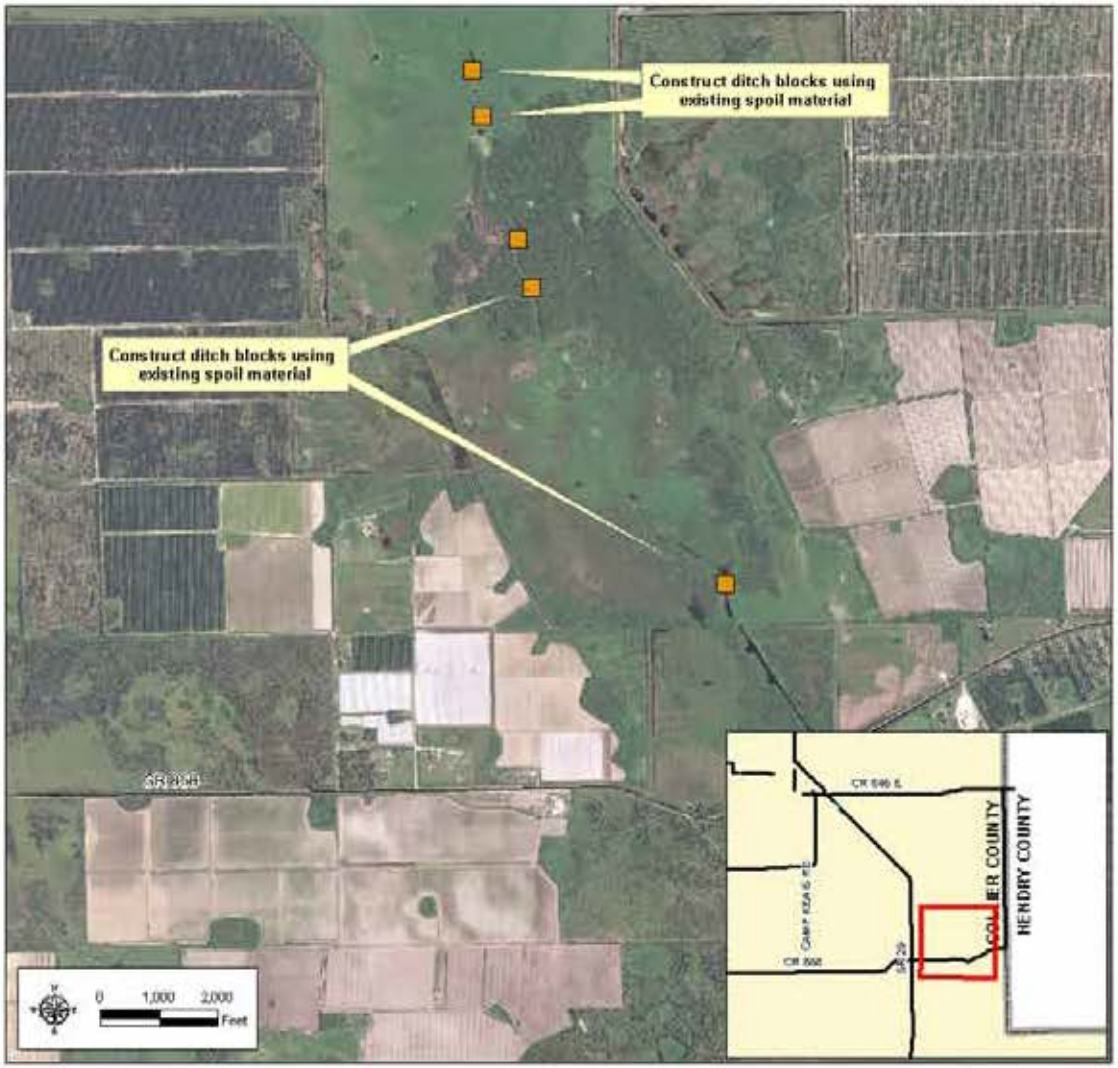
(1) Improves wetland hydrology and habitat by reducing drainage. Predicted to provide an average annual watershed performance measure lift of 0.002.

(2) Provides improved water quality treatment in wetland areas. An average annual performance measure lift of 0.059 is predicted.

(3) Increases groundwater recharge.

PROJECT DISADVANTAGES

(1) Changes in depth of surface water could increase flood risk of surrounding agricultural areas.



SOLUTION

- Project is located within existing Okaloacoochee Flowway Stewardship Area. Use incentive programs to encourage property owner to implement local wetland restoration activities.

- Use existing dredge spoil material on the canal banks to backfill man-made ditches and create ditch blocks. The ditch blocks created within the slough will rehydrate wetlands and provide natural sedimentation to raise the ditch profile and promote the natural restoration of the waterway.

DESIGN CONSIDERATIONS

- Determine if volume of on-site dredge spoil material is adequate to meet backfill requirements.

Okaloacoochee Wetland Restoration - Area 1

ATKINS

Collier County Watershed Management Plan

Collier County

Okaloacoochee Watershed

STATEMENT OF PROBLEM

During agricultural development, many isolated wetlands were drained for logging or planting. Historically, these wetlands discharged at higher stages via a natural slough or overland flow.

These drained wetlands currently have a shorter hydroperiod and provide less groundwater recharge than previously. The wetland dredging also negatively affected the ecology of the wetlands by decreasing natural marsh and wetland vegetation. Native species habitat was likely impacted as well.

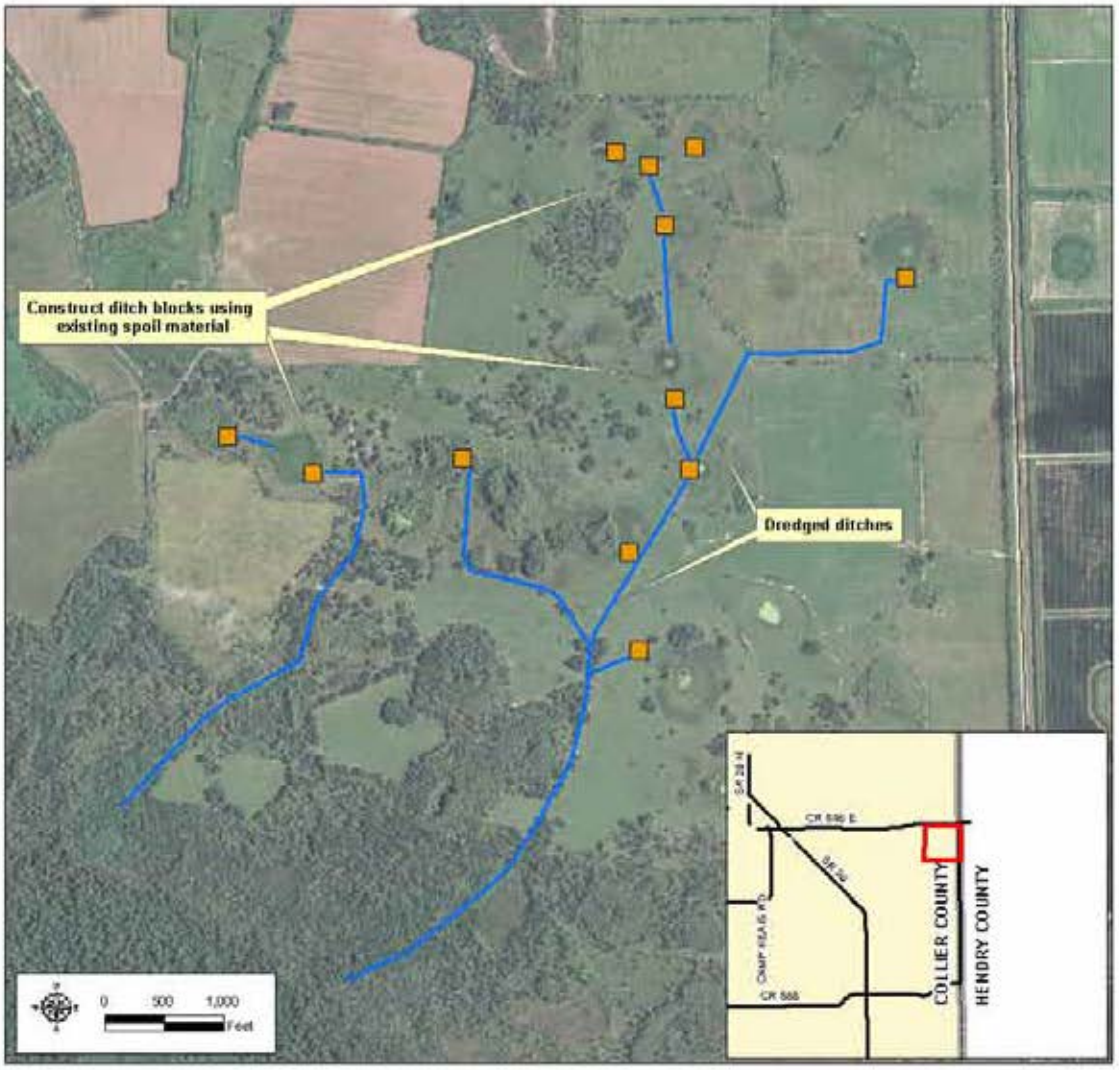
PROJECT BENEFITS

(1) Improves wetland hydrology/habitat in isolated wetland areas. The average annual lift in performance measure for the watershed is predicted to be 0.0002.

(2) Increases groundwater recharge.

PROJECT DISADVANTAGES

(1) Changes in groundwater and surface water elevation may affect adjacent agricultural lands.



SOLUTION

- Project is located within approved Stewardship Sending Area and existing Habitat Stewardship Area. Use incentive programs to encourage property owner to implement local wetland restoratiin activities.

- Use existing dredge spoil material on the canal banks to backfill man-made ditches and create ditch blocks at the wetland outfall locations. The ditch blocks created within the canals will contain the wetland inflows which will increase the hydroperiods and groundwater recharge in the area.

DESIGN CONSIDERATIONS

- Determine if volume of on-site dredge spoil material is adequate to meet backfill requirements.

Okaloacoochee Wetland Restoration - Area 2

ATKINS

Collier County Watershed Management Plan

Collier County

Okaloacoochee Watershed

STATEMENT OF PROBLEM

During agricultural development, many isolated wetlands were drained for logging or planting. Historically, these wetlands discharged at higher stages via a natural slough or overland flow.

These drained wetlands currently have a shorter hydroperiod and provide less groundwater recharge than previously. The wetland dredging also negatively affected the ecology of the wetlands by decreasing natural marsh and wetland vegetation. Native species habitat was likely impacted as well.

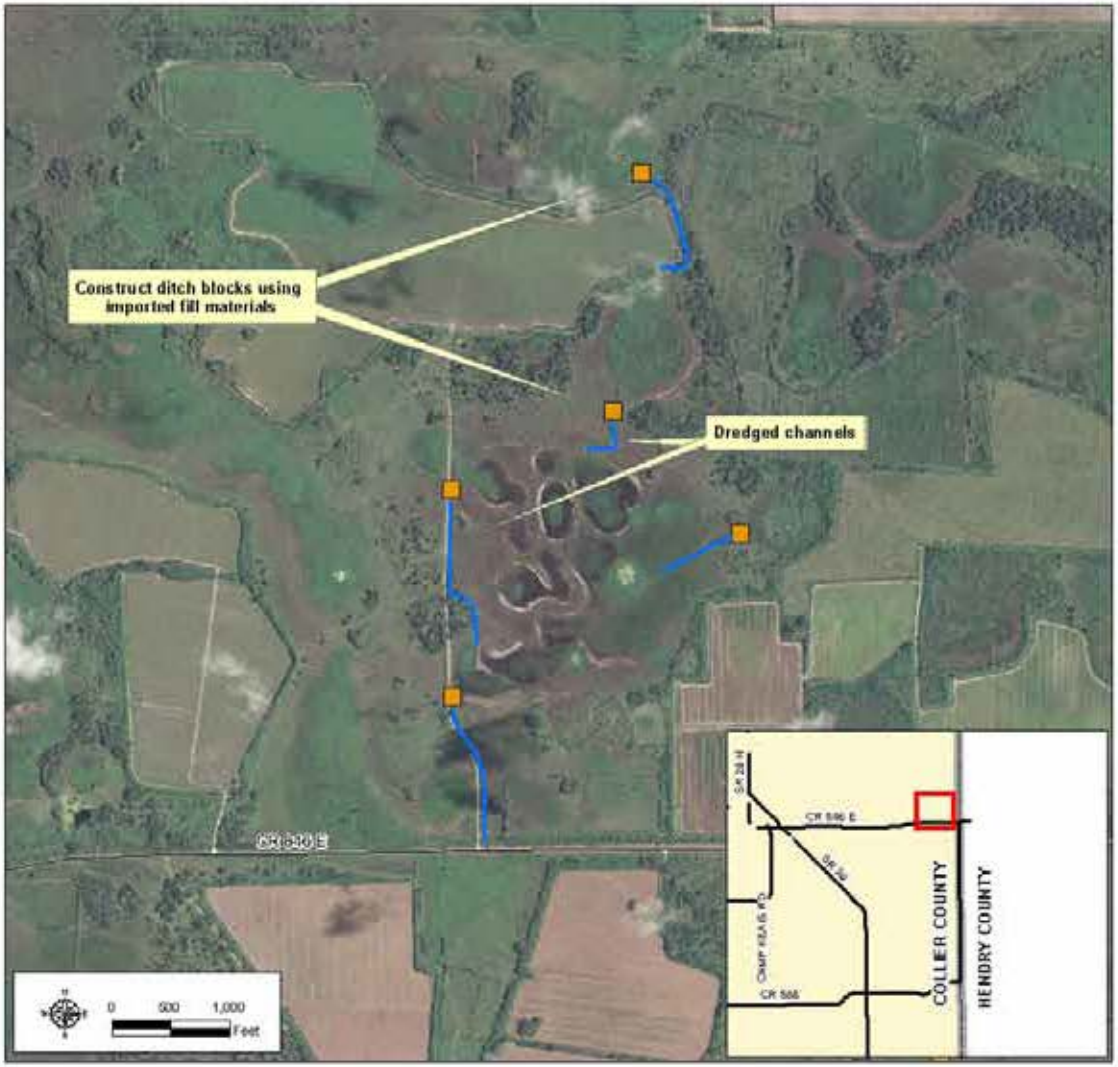
PROJECT BENEFITS

(1) Improves wetland hydrology and habitat by blocking ditches that artificially drain these isolated wetlands. Predicted to provide an average annual watershed performance measure lift of 0.0002.

(2) Increases groundwater recharge.

PROJECT DISADVANTAGES

(1) Changes in groundwater and surface water elevations may affect adjacent agricultural lands.



SOLUTION

- Project is located within approved Stewardship Sending Area. Use incentive programs to encourage property owner to implement local wetland restoration activities.

- Use existing dredge spoil material or import material to backfill drainage ditches and create ditch blocks at the wetland outfall locations to allow wetlands to discharge via overland flow. The ditch blocks created within the canals will contribute to an increase in hydroperiod and groundwater recharge in the area.

DESIGN CONSIDERATIONS

- Determine if any on-site dredge spoil material is available for backfill requirements.

Okaloacoochee Wetland Restoration - Area 3

ATKINS

Collier County Watershed Management Plan

Collier County

Okaloacoochee Watershed

STATEMENT OF PROBLEM

During agricultural development, many isolated wetlands were drained for logging or planting. Historically, these wetlands discharged at higher stages via a natural slough or overland flow.

These drained wetlands currently have a shorter hydroperiod and provide less groundwater recharge. The wetland dredging also negatively affected the ecology of the wetlands by decreasing natural marsh and wetland vegetation. Native species habitat was likely impacted as well.

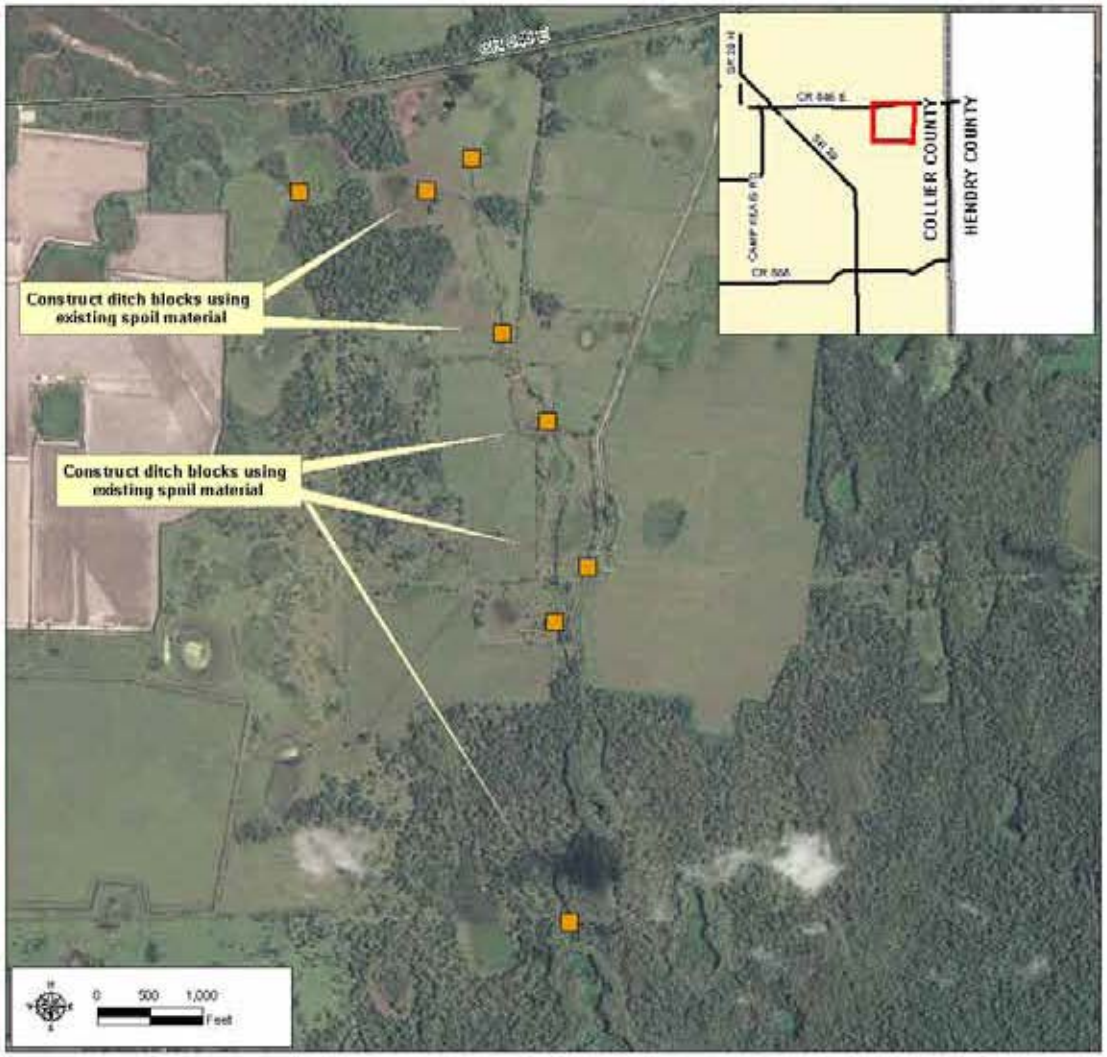
PROJECT BENEFITS

(1) Improves wetland hydrology and habitat by blocking ditches that artificially drain these isolated wetlands. Predicted to provide an annual average watershed performance measure lift of 0.0002.

(2) Increases groundwater recharge.

PROJECT DISADVANTAGES

(1) Changes in groundwater and surface water elevation may affect adjacent agricultural lands.



SOLUTION

- Project is located within approved Stewardship Sending Area and existing Habitat Stewardship Area. Use incentive programs to encourage property owner to implement local wetland restoration activities.

- Use existing dredge spoil material on the canal banks to backfill man-made ditches and create ditch blocks at the wetland outfall locations. The ditch blocks created within the isolated wetlands and slough will provide natural sedimentation in the canal to raise the slough profile and promote the natural restoration of the waterway.

DESIGN CONSIDERATIONS

- Determine if volume of on-site dredge spoil material is adequate to meet backfill requirements.

Appendix 2-C

Capital Improvement Program
Recommended Project Cost Estimates

Cost Estimate
Collier County Watershed Management Plan

CC-3
Cocohatchee Watershed
CORKSCREW REGIONAL ECOSYSTEM WATERSHED

Item	Unit	Quantity	Unit Price	Total Price*
Site Demolition/Removal				
Clearing & Grubbing	AC	0.25	$15,000	$3,800
Erosion Control (coir logs)	LF	900	$5	$4,500
				$8,300
Grading & Earthwork				
Ditch Bottom excavation	CY	500	$10	$5,000
Ditch Backfill Placement and Compaction	CY	2,438	$20	$48,800
				$53,800
Subtotal				**$63,000**
Mobilization & Demobilization (5%, minimum $5,000)				**$5,000**
		Estimated Construction Cost		**$68,000**
Land Acquisition				
Partial Property Acquisition	N/A	-	N/A	**$0**
Engineering & Contingency (40% of Construction, minimum $15,000)				**$28,000**
	ESTIMATED TOTAL COST =			**$96,000**

Cost Estimate
Collier County Watershed Management Plan

GG-2
Golden Gate Watershed
NORTH GOLDEN GATE ESTATES FLOWWAY RESTORATION PROJECT

Item	Unit	Quantity	Unit Price	Total Price*
Site Demolition/Removal				
Land Clearing & Grubbing	AC	1	$15,000	$15,000
				$15,000
Storm Structure & Pipes				
MES 24" RCP	EA	212	$1,800	$381,600
24" RCP	LF	8,240	$100	$824,000
				$1,205,600
Grading & Earthwork				
Sodding	SY	3,533	$1.75	$6,200
Miscellaneous Onsite Grading	CY	1,060	$10.00	$10,600
				$16,800
Paving and Roadway				
Pavement Restoration	SY	4,240	$70	$296,800
				$296,800
Miscellaneous				
Septic Tank Upgrades	EA	100	$750	$75,000
				$75,000
Subtotal				**$1,610,000**
Mobilization & Demobilization (5%)				**$81,000**
		Estimated Construction Cost		**$1,691,000**
Engineering and Contingency (40% of Construction)				**$677,000**
	ESTIMATED TOTAL COST =			**$2,368,000**

*Rounded to the nearest $1000

Cost Estimate
Collier County Watershed Management Plan

RB-1
Rookery Bay Watershed
NORTH BELLE MEADE SPREADER SWALE

Item	Unit	Quantity	Unit Price	Total Price*
Site Demolition/Removal				
Clearing & Grubbing (Spreader swale only)	AC	25	$15,000	$372,000
				$372,000
Storm Structures & Pipes				
5 - 75' Concrete-Set Aluminum Spreader Weirs	LF	375	$500	$188,000
4' x 8' RCBC	LF	40	$850	$34,000
4' x 8' RCBC Headwall	EA	2	$18,000	$36,000
				$258,000
Grading & Earthwork				
1 Mile Diversion Canal (30' wide, 10' Deep & 2:1 SS)	LS	1	$1,000,205	$1,000,000
Spreader Swale Excavation and Construction	CY	47,111	$10	$471,100
Sodding	SY	66,667	$1.75	$116,700
				$1,587,800
Miscellaneous				
100 cfs Pump Station	LS	1	$2,342,068	$2,342,000
				$2,342,000
Subtotal				**$4,560,000**
Mobilization & Demobilization (5%)				**$228,000**
			Estimated Construction Cost	**$4,788,000**
Land Acquisition				
100, Wide Segment of 5 Parcels (5300 LF total)	AC	12	$10,000	$122,000
150' Wide Segement of Parcels for Spreader (6000 LF)	AC	20	$10,000	$200,000
			Land Cost Total	**$322,000**
Engineering and Contingency (40% of Construction)				**$1,916,000**
			ESTIMATED TOTAL COST =	**$7,026,000**

*Rounded to the nearest $100

Cost Estimate
Collier County Watershed Management Plan

RB-2
Rookery Bay Watershed
SOUTH I-75 CANAL SPREADER SWALE

Item	Unit	Quantity	Unit Price	Total Price*
Site Demolition/Removal				
Clearing & Grubbing (Spreader swale only)	AC	16	$15,000	$234,000
				$234,000
Storm Structures & Pipes				
Concrete-Set Aluminum Spreader Weirs	LF	190	$500	$95,000
				$95,000
Grading & Earthwork				
Channel & Swale Excavation and Construction	CY	27,111	$10	$271,100
Sodding	SY	16,000	$1.75	$28,000
				$299,100
Miscellaneous				
50 cfs Pump Station	LS	1	$1,500,000	$1,500,000
				$1,500,000
Subtotal				**$2,129,000**
Mobilization & Demobilization (5%)				**$107,000**
			Estimated Construction Cost	**$2,236,000**
Land Acquisition				
	AC	0	$0	$0
			Land Cost Total	**$0**
Engineering and Contingency (40% of Construction)				**$895,000**
			ESTIMATED TOTAL COST =	**$3,131,000**

*Rounded to the nearest $100

Cost Estimate
Collier County Watershed Management Plan

GG-10
Golden Gate Watershed
HENDERSON CREEK DIVERSION

Item	Unit	Quantity	Unit Price	Total Price*
Site Demolition/Removal				
	AC	0	$15,000	$0
				$0
Storm Structure & Pipes				
	LF	0	$80	$0
				$0
Grading & Earthwork				
	LF	0	$1,200	$0
				$0
Paving and Roadway				
	SY	0	$70	$0
				$0
Miscellaneous				
100 cfs Pump Station	LS	1	$2,144,704	$2,144,800
Diversion Canal	LS	1	$919,826	$919,900
Diversion Canal DS Connection Improvements	LS	1	$1,000,000	$1,000,000
Subtotal				**$4,065,000**
		Estimated Construction Cost		**$4,065,000**
Land Acquisition		Porportional Value	MARKET	
100' Wide Section of PARCEL #00298120608	LS		$422,170	$423,000
		Estimated land Acquisition		**$423,000**
Engineering and Contingency (30% of Construction)				**$1,220,000**
			ESTIMATED TOTAL COST =	**$5,708,000**

*Rounded to the nearest $100

Cost Estimate
Collier County Watershed Management Plan

GG-5
Golden Gate Watershed
WOLFE ROAD WETLAND TREATMENT SYSTEM

Item	Unit	Quantity	Unit Price	Total Price*
Site Demolition/Removal				
Land Clearing & Grubbing	AC	2	$15,000	$22,500
				$23,000
Storm Structure & Pipes				
Modify Existing Control Structure	LS	1	$2,500	$2,500
FDOT Type E Inlet Modified	EA	2	$3,500	$7,000
Double 36" RCP Headwall	EA	3	$3,600	$10,800
36" RCP Headwall	EA	8	$3,000	$24,000
36" RCP	LF	930	$150	$139,500
				$184,000
Grading & Earthwork				
Channel Excavation and Grading	CY	3,684	$10	$36,900
Riprap	TN	110	$100	$11,000
Sodding	SY	8,933	$1.75	$15,700
				$64,000
Paving and Roadway				
Sidewalk Restoration	LS	1	$500	$500
Pavement Restoration	SY	60	$70	$4,200
				$5,000
Miscellaneous				
Littoral Shelf Planting	AC	4.00	$15,000	$60,000
Subtotal				**$336,000**
Mobilization & Demobilization (5%)				**$17,000**
		Estimated Construction Cost		**$353,000**
Land Acquisition			MARKET	MARKET
PARCEL #00204360009	N/A		$910,660	$910,660
Easement purchace PARCEL #00203720006	LS		$10,000	$10,000
		Estimated land Acquisition		**$921,000**
Engineering and Contingency (40% of Construction)				**$142,000**
	ESTIMATED TOTAL COST =			**$1,416,000**

*Rounded to the nearest $100

Cost Estimate
Collier County Watershed Management Plan

RB-3
Rookery Bay Watershed
HENDERSON CREEK OFF-LINE STORAGE RESERVIOR

Item	Unit	Quantity	Unit Price	Total Price*
Site Demolition/Removal				
Land Clearing & Grubbing (force main only)	AC	0	$15,000	$1,500
				$1,500
Storm Structure & Pipes				
24" Force Main	LF	1,700	$144	$244,800
				$244,800
Paving and Roadway				
Pavement Restoration	SY	55	$70	$3,900
				$3,900
Miscellaneous				
10 cfs Pump Station	LS	1	$400,000	$400,000
				$400,000
Subtotal				**$405,400**
Mobilization & Demobilization (10%)				**$20,300**
		Estimated Construction Cost		**$671,000**
Land Acquisition			MARKET	MARKET
PARCEL #00411800006	LS		$1,740,506	$1,740,506
PARCEL #00417040006	LS		$45,844	$45,844
PARCEL#00412240005	LS		$155,648	$155,648
PARCEL #00411160005	LS		$46,182	$46,182
		Estimated land Acquisition		**$1,989,000**
Engineering and Contingency (40% of Construction)				**$269,000**
	ESTIMATED TOTAL COST =			**$2,929,000**

*Rounded to the nearest $100

Cost Estimate
Collier County Watershed Management Plan

GG-7
Golden Gate Watershed
UPPER GOLDEN GATE ESTATES CANAL WEIR CONSTRUCTION

Item	Unit	Quantity	Unit Price	Total Price*
Description				
Land Clearing & Grubbing	AC	0.1	$15,000	$1,500
Turbidity Barrier	LF	160	$18	$2,900
Backfill and Reshape Canal slope	CY	444	$5	$2,300
Sheetpile with concrete Cap	SF	3,200	$44	$140,800
Install self-contained slide gate/weirs	EA	4	$24,000	$96,000
Rip Rap	CY	296	$90	$26,700
H Beam to support walkway	LF	400	$102	$40,800
Floor grating steel, panels, handrails and cross bars	SF	180	$48	$8,700
Security fence	LF	120	$38	$4,600
Swing Gate	EA	2	$1,200	$2,400
Fine clearing and grading	LS	1	$1,200	$1,200
Subtotal				**$327,900**
Markup (15%)				**$49,200**
Mobilization & Demobilization (5%)				**$16,400**
		Estimated Construction Cost		**$394,000**
Land Acquisition			MARKET	MARKET
	LS		$0	$0
		Estimated land Acquisition		**$0**
Engineering and Contingency (40% of Construction)				**$158,000**
	ESTIMATED TOTAL COST =			**$552,000**

*Rounded to the nearest $1000

Cost Estimate
Collier County Watershed Management Plan

GG-7
Golden Gate Watershed
ORANGE TREE CANAL CONTROL STRUCTURE INSTALLATION

Item	Unit	Quantity	Unit Price	Total Price*
Description				
Land Clearing & Grubbing	AC	0.1	$15,000	$1,500
Turbidity Barrier	LF	160	$18	$2,900
Backfill and Reshape Canal slope	CY	444	$5	$2,300
Sheetpile with concrete Cap	SF	3,200	$44	$140,800
Install self-contained slide gate/weirs	EA	4	$24,000	$96,000
Rip Rap	CY	296	$90	$26,700
H Beam to support walkway	LF	400	$102	$40,800
Floor grating steel, panels, handrails and cross bars	SF	180	$48	$8,700
Security fence	LF	120	$38	$4,600
Swing Gate	EA	2	$1,200	$2,400
Fine clearing and grading	LS	1	$1,200	$1,200
Subtotal				**$327,900**
Markup (15%)				**$49,200**
Mobilization & Demobilization (5%)				**$16,400**
		Estimated Construction Cost		**$394,000**
Land Acquisition			MARKET	MARKET
	LS		$0	$0
		Estimated land Acquisition		**$0**
Engineering and Contingency (40% of Construction)				**$158,000**
	ESTIMATED TOTAL COST =			**$552,000**

*Rounded to the nearest $1000

Cost Estimate
Collier County Watershed Management Plan

RB-1
Rookery Bay Watershed
US Highway 41 Stormwater Treatment Area

Item	Unit	Quantity	Unit Price	Total Price*
Site Demolition/Removal				
Clearing & Grubbing	AC	3	$15,000	$45,000
				$45,000
Storm Structures & Pipes				
2' Concrete Sill Weir	EA	1	$8,000	$8,000
				$8,000
Grading & Earthwork				
STA Bank Construction	CY	4,815	$10	$48,100
Sodding	SY	10,111	$1.75	$17,700
				$65,800
Miscellaneous				
5 cfs Pump Station	LS	1	$250,000	$250,000
				$250,000
Subtotal				**$369,000**
Mobilization & Demobilization (5%)				**$18,500**
		Estimated Construction Cost		**$388,000**
Land Acquisition			MARKET	
			Land Cost Total	**$0**
Engineering and Contingency (40% of Construction)				**$156,000**
	ESTIMATED TOTAL COST =			**$544,000**

*Rounded to the nearest $100

Collier County
Watershed Management Plan

Collier County

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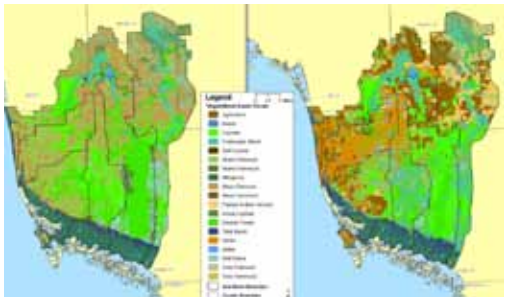

Collier County watershed management plan

Final Report Volume 3:

Recommended Non-Structural Initiatives

01022-12

Collier County

Prepared by: ATKINS

NOVEMBER 2011

Document No. 110082
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FINAL REPORT

COLLIER COUNTY WATERSHED MANAGEMENT PLAN COLLIER COUNTY, FLORIDA

VOLUME 3: RECOMMENDED NON-STRUCTURAL INITIATIVES

Prepared for:

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November 2011

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3-A Low Impact Development Approach

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Acronyms and Abbreviations

ACSC	Area of Critical State Concern
ACSC-ST	Area of Critical State Concern – Special Treatment
AASHTO	American Association of State Highway and Transportation Officials
BCC	Board of County Commissioners
BMP	Best Management Plan
CCME	Conservation Coastal Management Element
CCPC	Collier County Planning Commission
CCWMP	Collier County Watershed Management Plan
CDU	Community Development Unit
cfs	Cubic feet per second
CN	Curve Number
DCIA	Directly Connected Impervious Area
DEM	Digital Elevation Model
DO	Dissolved Oxygen
EAC	Environmental Advisory Council
ECM	Existing Conditions Model
EMC	Event Mean Concentration
ERP	Environmental Resource Permit
ERU	Equivalent Residential Unit
ET	Evapotranspiration
FDEP	Florida Department of Environmental Protection
FLUCCS	Florida Land Use, Land Cover Classification System
FLUE	Future Land Use Element
FLUM	Future Land Use Map
FPLOS	Flood Protection Level of Service
FRESP	Florida Ranchlands Environmental Services Project
GGAMP	Golden Gate Area Master Plan
GMP	Growth Management Plan
HOA	Homeowners Association
IWR	Impaired Waters Rule
LDC	Land Development Code
LID	Low Impact Development
MSTU	Municipal Services Taxing Unit
NEXRAD	High Resolution Radar

NGGE	Northern Golden Gates Estates
NGGEFRA	North Golden Gate Estates Flowway Restoration Area
NGGEFRP	North Golden Gate Estates Flowway Restoration Program
NSM	Natural Systems Model
OFW	Outstanding Florida Water
O&M	Operations and Maintenance
PUD	Planned Unit Development
RFMU	Rural Fringe Mixed Use
RLSA	Rural Lands Stewardship Area
ROMA	Regional Offsite Mitigation Area
RSF	Residential Single Family
RWCA	Recyclable Water Containment Areas
SCS	Soil Conservation Service
SFWMD	South Florida Water Management District
ST	Special Treatment
SWFFS	Southwest Florida Feasibility Study
TDR	Transfer of Development Rights
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
TTI	Ten Thousand Islands
UMAM	Uniform Mitigation Assessment Method
URF	Urban Residential Fringe
USACE	United States Army Corps of Engineers
WBID	Water Body Identification Number
WMD	Water Management District
WMP	Watershed Management Plan

1.0 Description of Recommended Non-Structural Initiatives

The purpose of the non-structural initiatives is to formulate recommendations that would allow for the implementation of an environmentally sustainable management program to will guide future land development activities in Collier County.

General

Recommendations for structural and non-structural means of watershed management and improvement are the core of the Collier County Watershed Management Plan (CCWMP). Non-structural Best Management Practices (BMPs) focus on preserving and protecting natural features of the landscape and attempt to manage stormwater at its source. Their evaluation includes an analysis of the applicable regulatory framework. In this document, the recommended non-structural initiatives address issues that range from land development guidelines to water quality monitoring.

Volume 3 was prepared as a stand-alone document to describe the non-structural initiatives recommended for implementation as part of the watershed management plan. These non-structural, policy based initiatives are designed to bridge the gap between the improvements expected from structural projects and the long-term approaches needed to address water quantity, water quality, and resource protection in Collier County as land development continues. The other 3 volumes prepared as part of this project are: a) Volume 1 presents a summary of existing conditions in the watersheds and estuaries and the performance measures developed for evaluating potential projects; b) Volume 2 is a stand-alone report that describes the structural recommended projects for implementation; and Volume 4 is a compilation of the individual technical memoranda completed to address existing conditions in the watershed and estuaries and presents the details of the analyses conducted as part of this project.

The purpose of the analyses presented herein is to formulate recommendations that will allow for the implementation of an environmentally sustainable management program. The implementation of that program will guide future land development activities in Collier County and it is of critical importance to control impacts in terms of water quantity, water quality, and resource protection.

The program objectives are to:

- Promote more effective site planning and minimize water quantity and quality impacts due to human activities.
- Promote preservation of the natural systems
- Help meet the County's regulatory requirements

Regulatory Background

In Florida, "Waters of the State" are protected per the Water Resources Act, Chapter 373 FS. The Act provides for the establishment of permit programs, including those related to surface water management systems and the Environmental Resource Permit (ERP) process. The ERP addresses issues of water quantity, water quality, and wetland protection. In Collier County the ERP process is implemented by the South Florida Water Management District (SFWMD) per the regulations codified in Title 40-E of the Florida Administrative Code (FAC). Regulations relate to water quantity, water quality, and wetland protection/mitigation.

In terms of water quality, minimum standards for Florida streams have been established depending on a stream designated use. Chapter 62-303 FAC defines the State water quality standards. The condition of a water body not meeting standards is referred to as "impairment".

The issues of Florida impaired water bodies came to light as part of the recent implementation of the Total

Maximum Daily Load (TMDL) program by the Florida Department of Environmental Protection (FDEP). The TMDL program requires identification of water bodies that do not meet applicable State water quality standards. The process for identifying impaired water bodies is described in the State's Impaired Waters Rule Chapter (IWR) 62-303 FAC. As part of that process, FDEP determined that a large number of water bodies in the State are impaired or potentially impaired. Impairments are particularly prevalent for nutrients, which have been found to be the most common impairment parameter throughout Florida. FDEP has found several impaired water bodies in Collier County. A detailed evaluation of the TMDL issues was conducted as part of this project. Results are described in the in-stream water quality analysis section of Volume 4, Watershed Management Plan Technical Report.

Surface water management, also referred to as stormwater management, is also the responsibility of local governments, in this case Collier County. The County's Growth Management Plan (GMP), Public Facilities Element, Drainage Sub-Element, indicates that "stormwater management refers to a set of comprehensive strategies for dealing with stormwater quantity and stormwater quality issues." Goal 2 of the GMP Conservation and Coastal Management Element states that the County "shall complete the prioritization and begin the process of preparing Watershed Management Plans, which contain appropriate mechanisms to protect the County's estuarine and wetland systems." Regulations pertaining to stormwater management are included in various ordinances and the Land Development Code (LDC).

Recommended Non-Structural Initiatives

The existing conditions analysis conducted as part of the watershed management planning process helped assess the magnitude of the anthropogenic impacts in Collier County in terms of a) water quantity management including fresh water discharge patterns to the estuaries; b) water quality in the existing streams, canals, and estuaries, and c) natural system hydrology and habitat. It was concluded that, in spite of current regulations, the local environment has been subject to significant impact. That is consistent with evaluations conducted by the State of Florida, by which the State has determined that current permitting requirements have been unable to meet the goals of the State Water Policy (62-40.416) in terms of pollution reduction goals.

An important finding of the analysis of alternatives conducted as part of the watershed management plan was that the recommended structural watershed projects that were analyzed and proposed as part of the watershed management plan will not be enough to have a significant effect on the restoration of the currently affected environment. Therefore, implementation of non-structural initiatives is also necessary to complement the structural watershed improvement measures. The proposed 13 non-structural initiatives are listed in **Table 3-1**. The following sections provide specific descriptions of the proposed initiatives.

Table 3-1
Recommended Non-Structural Initiatives

Description
Low Impact Development (LID) Program
Stormwater Retrofit Program
Fee-Based Stormwater Utility Incentive Program
Allowable Maximum Site Discharges
Stormwater Runoff Volume Control
Verification of No Floodplain Impact
Flood Protection Levels of Service Criteria
Golden Gate Estates Transfer of Development Rights Program
Golden Gate Estates Watershed Mitigation Program
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Expanded Water Quality Monitoring Program
Additional Watershed Protection Programs
Stormwater Facilities Maintenance and Certification
Issue of Fertilizer Ordinance

Initiative 1: Low Impact Development (LID) Program

Low Impact Development aims at minimizing the volume of runoff reaching the receiving water bodies and managing it as close as possible to where it is generated. Techniques defined as micro-controls are implemented in a dispersed fashion throughout a site.

General

This initiative proposes implementation of a Low Impact Development (LID) program that would apply to all new development in Collier County. LID is a well established approach to stormwater management that relies on hydrology-based site planning and design. LID aims at minimizing the volume of runoff and associated pollutant loads reaching the receiving water bodies and managing it as close as possible to where it is generated. Techniques defined as micro-controls are implemented in a dispersed fashion throughout a site. Following is a description of the program's background and recommended implementation strategy.

Current Collier County Runoff Treatment Requirement

The Collier County Growth Management Plan, Conservation and Coastal Management Element, Ordinance 2008-10, and the Land Development Code (LDC) Section 3.07.00, require that until the Watershed Management Plans are completed all new development and re-development projects meet 150 percent of the ERP water quality volumetric requirements. This interim requirement basically considers that all waters in the County should be held to the same standards as those applicable to Outstanding Florida Waters. This requirement also reflects the County's intention to provide additional protection to water quality beyond that provided by the State. The effectiveness of the County's stormwater treatment requirement was evaluated as part of this project. The results of the evaluation are described below.

Concurrently with the implementation of the TMDL program, FDEP conducted an in-depth study (FDEP 2007) to determine whether the existing technology-based design criteria for stormwater systems are helping meet State Water Policy (62-40.416), by which such systems should be designed to achieve at least 80 percent reduction of the average annual pollutant loads that would cause or contribute to violations of State water quality standards. FDEP's studies demonstrated that current design criteria for wet detention, which is the most common stormwater runoff treatment method in Collier County, generally meet the State Water Policy requirements for removal of total suspended solids (TSS). However, nutrient removal efficiencies amount to less than 70 and 45 percent for total phosphorus and total nitrogen, respectively (FDEP, 2007). In addition, nutrient removal efficiency (nitrogen and phosphorus) decreases substantially after an initial detention time of about 14 to 20 days, which is a feature of the standard design (FDEP, 2007). **Figure 3-1** shows schematically the components of a traditional wet detention pond. **Figures 3-2 and 3-3** show the relationship of detention time to removal efficiency of phosphorus and nitrogen, respectively.

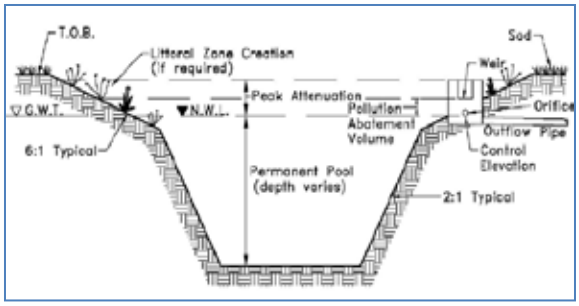

Figure 3-1. Schematic of Wet Detention Pond Components (from FDEP 2007)

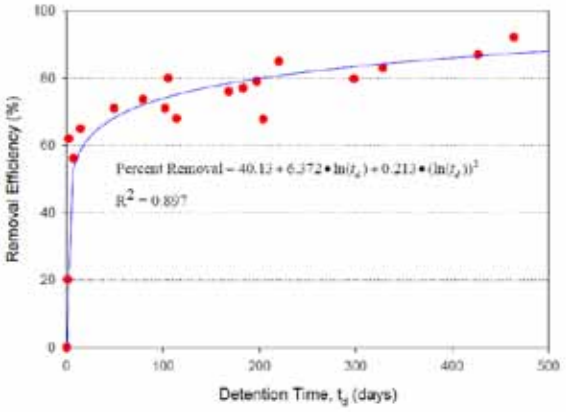

Figure 3-2. Removal Efficiency of TP in
Wet Detention Ponds as a Function of Detention Time

Based on the removal characteristics of stormwater runoff detention treatment facilities, it is likely that the County's additional treatment volumetric requirement has contributed to a further reduction in the discharge of total suspended solids (TSS) to the County's waters. However, it is also likely that small gains in nutrient removal are being achieved. In addition, the current practice of meeting the treatment requirement by simply increasing the volume of the treatment pool (pollution abatement volume), as opposed to increasing the size of the permanent pool further reduces the effectiveness of the treatment requirement (for definitions see Figure 3-1, Wet Detention Pond Components). Research (FDEP, 2007) has shown that treatment for nutrients occurs in the permanent pool.

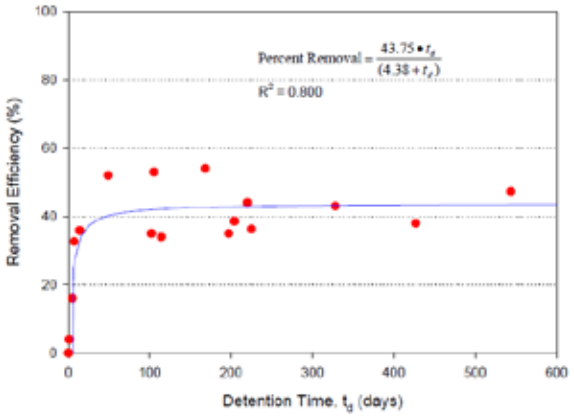

Figure 3-3. Removal Efficiency of TN in
Wet Detention Ponds as a Function of Detention Time

Description of the Recommended LID Program

As described above, FDEP's studies (FDEP 2007 and FDEP 2010) have concluded that the current design requirements for stormwater Best Management Practices (BMPs) are not adequate to meet State law. The agency also concluded that an update of the Florida Statewide Stormwater Treatment Rule was necessary and a draft new rule was developed. A main requirement of the drafted new rule is that post-development pollution loads should not exceed the pre-development loads. Pre-development is defined as the natural native landscape. This would make necessary the implementation of new approaches to remove the additional anthropogenic pollution load, including the implementation of treatment trains.

The application of the proposed FDEP stormwater rule would provide an effective approach to control water quality impacts of new development. However, it is unlikely it will be adopted in the near future. Therefore, it is safe to assume that the State's current regulatory requirements would remain in place over the foreseeable future and that mitigation of growth impacts at the local level will be critical to achieving environmental protection goals.

It is recommended that a new approach based on the preservation of a site's natural features be implemented to minimize pollution loads from new development and help preserve the natural system. Such an approach should be consistent with the concept of Low Impact Development (LID). An approach to promote implementation of LID for existing development is presented herein as Initiative 2, which is described later in this document.

As indicated previously, LID aims at minimizing the volume of runoff reaching the receiving water bodies and managing it as closely as possible to where it is generated. This is accomplished through the application of techniques defined as micro-controls. These techniques are implemented in a dispersed fashion throughout a site. The basic principle is to attempt to mimic pre-development hydrology by retaining or treating stormwater runoff close to the source thereby replicating the natural pathways. Examples of LID techniques include a) use of

pervious pavement to minimize runoff volume, b) construction of rain gardens, localized infiltration areas, or created systems of filter marshes to treat stormwater runoff, c) storage and re-use of stormwater for irrigation purposes, and d) minimizing the extent of the directly connected impervious area (DCIA). The DCIA is the impervious area hydraulically connected to the stormwater conveyance system, and thence to the basins outlet point, without flowing over previous areas. Further descriptions of the LID concept are provided in Appendix A.

The three options listed below were considered for implementation of the proposed new approach. They are all based on treating 50 percent of the basic ERP requirement. SFWMD regulations for water quality establish that the basic runoff treatment requirement for new development is one inch of runoff over the developed area or 2.5 inches times the percentage of imperviousness, whichever is greater. The basic runoff treatment requirement described above applies to discharges to all water bodies considered to be Waters of the State, except for discharges into Outstanding Florida Waters (OFWs) or currently impaired water bodies.

a) Require that the runoff volume equivalent to 50 percent of the basic ERP requirement be disposed of by retention and percolation

b) Require that a runoff volume equivalent to 50 percent of the basic ERP requirement be treated by LID techniques.

c) Require that the nutrient load associated with 50 percent of the basic ERP requirement be treated by LID.

The first option was considered impractical for application in areas of high groundwater table elevations. The second option was also considered not adequate because of the wide range in LID treatment techniques and corresponding treatment efficiencies. The third option was considered practical because it basically establishes pollutant removal goals based on post development conditions, while letting the designers choose the techniques that best suit local site conditions. The proposed LID treatment should be for the nutrient load generated by 0.5 inch of runoff over the developed area or 1.25 inches times the percentage of imperviousness, whichever is greater.

Based on input from local stakeholders, it is proposed that the current 150% treatment be maintained and the LID approach be set as an additional land development requirement.

Application of the Recommended LID Program

In practice, the LID techniques applied to a particular development should be left at the discretion of the designer as conditions may vary substantially between sites. The techniques could be applied at the lot level or at the subdivision level. Because runoff reduction is the most efficient method to reduce pollution loads, infiltration techniques should be considered when possible. From that standpoint it was estimated that for residential areas, based on typical lot designs for single-family homes under zoning categories RSF-3 through RSF-6, and assuming an average DCIA of 25 percent and an SCS curve number (CN) of 74 for the non-DCIA areas (a CN of 74 represents soils type C), the design storm event for LID design should be 1.5 inches, which represents approximately the 93rd percentile event. A storm is defined as a period of continuous rainfall separated from other events by at least a 24-hours dry period. This means that the nutrient pollutant load associated with 93 percent of the storms would be eliminated by LID if infiltration methods are used at a site. For parking facilities, assuming a 90 percent DCIA, the design event is 1.30 inches. This rainfall event represents approximately the 90th percentile.

It is recognized that the construction of infiltration systems is not always possible in areas of high water table elevations. Design of appropriate LID techniques must consider this condition. Significant amount of information regarding LID design criteria is available from the literature. Documents that could be used as reference to facilitate the setting of design criteria include the "Stormwater Quality Applicant's Handbook" developed by FDEP as part of the draft stormwater rule and the Sarasota County, Florida, LID manual. The FDEP handbook defines design criteria for numerous types of BMPs from retention basins and exfiltration trenches to swales, pervious pavement, and underground storage facilities. The Sarasota County manual focuses on detention with biofiltration and pervious pavement. The establishment and adoption of design criteria for various types of

facilities should be part of the LDC amendment process.

LID Cost Effectiveness

Although the concept and application of LID has been promoted and studied for over 20 years, it is still considered a new and emerging technology and there is some apprehension in the development community as to installation costs. This is particularly true at the initial stages of an LID implementation program because construction costs for LID technologies are often site-specific and developers may see some increases in site assessment and design. Also, the development community may be concerned with long-term maintenance costs associated with LID techniques including on-site management of stormwater facilities. However, numerous studies (Foss 2005; Conservation Research Institute 2005; U.S. EPA 2005; Zickler 2004) have demonstrated that LID can compare favorably with conventional controls in a side-by-side analysis of installation and maintenance costs. LID costs may be higher in terms of installation of site specific technologies, but savings are accrued because of the reduced stormwater conveyance systems capacity needs and the reduced load of sediments to existing ponds, which eliminates the need of dredging to restore the facilities' treatment efficiency and aesthetic characteristics.

In summary, consistent with current research, the implementation of the proposed LID program is expected to be at worst cost neutral for the development community. The main benefit of implementing the proposed program is the achievement of countywide water quality improvements of the County's water bodies due to pollution load reductions.

Program Assessment within the State's Regulatory Framework

The proposed initiative was presented to, and discussed with, SFWMD staff to determine how it fits within the permitting process. It was determined that the program complements and enhances the ERP permitting process. For example, one of the limitations of the State permitting process occurs when pre-development pollutant loads exceed those anticipated for post-development. In that case, the State is unable to require post-development treatment beyond those allowed by current rules. The proposed County requirement is based totally on post-development conditions, which would eliminate the State's limitation.

LID Implementation Incentives

Although the implementation of the proposed LID program is likely not to increase development costs, we believe incentives to land developers are necessary to help offset the perception that traditional designs are less expensive and perhaps more attractive to potential buyers than the proposed approach. Various incentives are proposed through changes in the Land Development Code (LDC). They are listed in **Table 3-2** by LDC chapter and refer mainly to modifications to road and parking design criteria.

An important recommendation is for the County to revisit the road width criteria to consider the average daily traffic (ADT) needs. A minimum road width for local streets is recommended to be set at 18 ft based on an ADT of less than 400.

That results in roads serving either 36 single family homes or 60 multi-family units. The proposed design is consistent with the American Association of State Highway and Transportation Officials (AASHTO) standards.

The off-site parking recommendations refer to modified requirements for minimum parking spaces, parking aisle widths, and general design features. The new design features would not diminish the safety or aesthetic characteristics of the parking facilities.

It should be considered that many of the current design standards for parking lots were established years ago when cars were generally larger and more difficult to maneuver.

Table 3-2. Low Impact Development Incentives

4.02.01 Dimensional standards for principle uses Allow 18-ft width on local roads having an ADT of 400 trips (36 single family homes). The recommended width is consistent with (AASHTO) standards. Allow reducing the front yard setback to 18 ft if the driveway is designed with permeable pavement
4.04.00 Transportation System Standards 1. Promote design of shallow swales on local roads, as long as maintenance procedures are clearly defined. 2. Allow road medians to be designed as depressed surfaces that can collected and treat road runoff
4.05.02 Parking design standards 1. Promote parking lots design using surfaces with pervious materials that promote water infiltration 2. Allow aisle width design to be reduced by 2 feet except for parallel parking 3. Allow grassed swale dividers along opposing parking spaces. Parking space depth reduced from 18 feet to 16.5 feet if wheel stop is located 0.5 foot from edge of swale
4.05.04 Parking space requirements 1. Modify the LDC to only address minimum counts for typical use/demand. Allow the developer or facility owner to provide what is believed necessary for peak use. 2. Reduce the minimum retail shop and store and department store parking requirement from 1 per 250 square feet to 1 per 500 square feet of indoor/outdoor retail area. 3. Allow for up to 25% grass spaces (or other suitable permeable pavement) for developments regardless of parking count. There should be at least 3 paved spaces (excluding handicap parking). Allow use of identified grassed areas for locating dry detention facilities.
4.06.03 Landscaping requirements for vehicular use areas and rights-of-way 1. Allow use of depressed landscape islands 2. Allow rows of parking spaces to contain 20 spaces, instead of 10, between islands if drainage is directed to grassed swale dividers 3. Allow swale divider area and grass parking areas to count as part of the off-parking interior vegetated areas. 4. Allow parking stalls to be up to 100 feet away from a tree. Allow one tree for every 500 square feet on interior landscaped area
6.05.01 Stormwater management system requirements 1. Allow in-ground percolation type retention systems to achieve water quality retention if designed per LID manual requirements

Initiative 2: Stormwater Retrofit Program

The Stormwater Retrofit Program would be funded using current stormwater utility revenues and will be complemented with funds available from State and Federal grants.

The implementation of the LID program will help control impacts of new development. However, restoration and protection of the existing natural system will require establishment of retrofit LID programs for existing development. It is recommended that the County establish a program dedicated to funding stormwater retrofits. The program would be funded using current stormwater utility revenues and may be complemented with funds available from State and Federal grants such as those from the Clean Water Act Section 319(h). The projects would be selected from a prioritized list to be developed by County staff. The project list would be flexible to accommodate changes due to funding sources, public preferences, and/or water quality improvement needs. It will be important for the County to keep track of any funded projects to receive the corresponding TMDL credit. The proposed initiative would aim to:

- Retrofit public facilities,
- Install local runoff treatment facilities in areas that lack treatment systems
- Retrofit private facilities by working with Municipal Services Taxing Units (MSTUs)

Retrofit Public Facilities

The County operates a number of public facilities that can be retrofitted with LID features, including parking lots in public buildings such as the Government Center and public schools. Parking lots, in particular, would be re-designed to route the drainage flows to depressed islands or grassed areas. It is also possible to install pre-manufactured treatment systems in some locations (i.e. baffle boxes) as long as the systems are capable of removing target pollutants. This program not only will benefit the natural systems in the County, but would also provide opportunities for educating the community on stormwater issues and would be an example of the County's commitment to environmental protection

Install Local Runoff Treatment Facilities

A retrofit program that may be considered by the County involves the acquisition of small parcels in areas where stormwater treatment is limited. The program would consist of converting those parcels to local runoff treatment facilities such as retention ponds or created wetlands. Stormwater runoff would be routed to these facilities prior to discharging into a canal. An area that would significantly benefit from this approach is Golden Gate Estates where more than 400 streets dead end at a drainage canal. It is estimated, for example, that a 5-acre lot can accommodate a 3 to 4-acre retention/detention pond or wetland system that would be able to treat a drainage area of approximate 50 to 70 acres. In addition to runoff treatment, these facilities can provide better wetland connectivity and improve the local habitat.

Retrofit private facilities by working with Municipal Service Taxing Units (MSTUs)

MSTUs are another mechanism available to provide incentives for implementing a stormwater retrofit program. MSTUs are established by ordinance to assess benefiting properties typically for capital improvement projects such as paving, drainage, and stormwater projects from which they directly benefit. The MSTU programs encourage residents to financially participate in implementing capital improvement projects. To encourage residents to participate, the County would agree to pay a portion of a project's costs and assess the residents for the remaining amount. The residents' participation would occur in the form of annual assessments that could typically be spread over 5-10 years.

Initiative 3: Fee-Based Stormwater Utility Incentive Program

The financing of the stormwater utility may be changed to a fee-based system that in turn would be based on the volume of runoff discharged from each property. The goal would be to maintain the same revenue, but using a different fee structure.

Collier County Ordinance 2008-80 describes the funding mechanism for stormwater projects through the stormwater utility and states the County's commitment to properly fund the program. Funds are proceeds from 0.15 mills of ad valorem tax revenues, which are deposited into Fund 325. According to the Ordinance, the funding extends through, and includes fiscal year 2025.

Although the stormwater utility funds the stormwater program, it is not setup to allow implementation of an incentive program. It is recommended that the financing of the utility be changed to a fee-based system that in turn would be based on the volume of runoff discharged from each property. The fee would apply to all properties contributing to the ad valorem tax revenues. The goal would be to maintain the same revenue, but use a different fee structure.

Approximately 87 percent of stormwater utilities in Florida are based on a user fee (FSA 2011). For Collier County, an annual user fee could be established based on the concept of Equivalent Residential Units (ERUs), which represents the volume of runoff discharged from a "typical home" in the County. The fee for each user would depend on the number of ERUs. A "typical home" can be defined as a developed parcel with no stormwater controls. Credit should be provided to parcels, or entire developments, that have been designed to provide treatment of stormwater runoff through LID techniques or through recycling of treated stormwater for irrigation. Field verifications would be necessary to establish if a fee reduction is appropriate for a site.

The advantage of the proposed fee structure is that it can be used to provide incentives for both new development and retrofit of private property. For example, new developments that are designed per the LID concepts could use the stormwater fee structure to market sales of homes that pay a lower stormwater utility fee. The fee could also be used to provide credit to private property when retrofitting programs are implemented. Property owners would weigh the retrofitting costs with the benefit of a reduced stormwater fee. Field verifications by County staff may be necessary to verify construction of runoff control projects that may not require a permit.

It is recognized that the ERU fee structure sometimes results in large fees imposed on businesses that include large parking facilities. A credit system could be applied to the business sector to reduce the initial fee impact. However, the credit should be applicable within a defined time frame, i.e. 5 years, to further incentivize implementation of retrofitting programs.

Finally, although the benefit to Collier County may be small, it should be noted that the ERU fee structure allows collection of funds from federal facilities, which do not contribute to the ad valorem tax revenue.

Initiative 4: Allowable Maximum Site Discharges

Computer model results indicated that various segments of the primary and secondary drainage systems do not have the capacity to handle large storm events. In some cases, the canal banks are overtopped even during the 5-year design storm event.

Another water quantity-related recommendation pertains to the policies in the County's Growth Management Plan, Public Facilities Element, Drainage Sub-Element, that state that the drainage system should have adequate stormwater management capacity at the time a development permit is issued. Also, it indicates that the system has to be designed "so as to ensure that the final outlet point has adequate capacity to handle all discharges from the upstream portion of the watershed under conditions present at the time of design".

The County has established maximum allowable off-site discharges for many of the basins served by the drainage canal network. Ordinance 2007-11 establishes an allowable discharge of 0.15 cfs/acre for all areas in the County, except six basins and subbasins that are subject to specific discharge limitations. The ordinance also states that "allowable off-site discharge rates shall be computed using a storm event of 3-day duration and 25-year return frequency."

A hydraulic conveyance analysis was conducted as part of this project to determine the maximum flow that can be conveyed by the various drainage canal segments included in the MIKE SHE / MIKE 11 computer model.

Results indicated that various segments of the primary and secondary drainage systems do not have the capacity to handle large storm events. In some cases, the canal banks are overtopped even during the 5-year design storm event. A detailed description of the analysis is provided in the Surface Water Quantity Assessment section in Volume 4. To check the current allowed maximum discharges, as required by the County ordinance, the maximum flow predicted by the computer model was divided by the extent of the drainage area to obtain the actual maximum allowable discharge rate associated with each canal segment. It was found that maximum discharges for many of the County basins needed updating. That was expected because the original limits were based on preliminary analyses.

Table 3-3 lists the recommended maximum discharges, which should be adopted jointly by Collier County and SFWMD. It is recognized that the proposed new limits may represent a cost to new development in the affected basins. However, the limits should be viewed as simply a way to control for the additional flooding risk caused by new development. It must be noted that the established requirements do not aim at improving conditions by imposing requirements on new development. The new limitations simply maintain the existing status.

Table 3-3. Proposed Maximum Allowable Discharges by Basin

Stormwater Subbasins	Current Maximum Allowable Discharge	Recommended Maximum Allowable Discharge
	cfs/acre	cfs/acre
951 Canal Central Basin	0.15	0.15
951 Canal North Basin	0.15	0.11
Airport Road North Canal Basin	0.04	0.04
Airport Road South Canal Basin	0.06	0.06
Barron River Canal Basin (North)	0.15	0.15
C-4 Basin	0.15	0.11
Cocohatchee River Canal Basin	0.04	0.04
Corkscrew Canal Basin	0.15	0.04
Cypress Canal Basin	0.15	0.06
East Branch Cocohatchee Basin	0.15	0.15
West Branch Cocohatchee Basin	0.15	0.15
Faka Union Canal Basin (North of I-75)	0.15	0.09
Gateway Triangle Basin	0.15	0.15
Gordon River Extension Basin	0.15	0.09
Green Canal Basin	0.15	0.15
Haldeman Creek Basin	0.15	0.15
Harvey Canal Basin	0.15	0.11
Henderson Creek Basin	0.15	0.08
I-75 Canal Basin	0.15	0.06
Imperial Drainage Outlet Basin	0.15	0.12
Island Walk Basin (aka Harvey Basin)	0.055	0.055
Lely Canal Basin	0.06	0.06
Lely Manor Canal Basin	0.15	0.06
Main Golden Gate Canal Basin	0.15	0.04
Miller Canal Basin (North of I-75)	0.15	0.15
Palm River Canal Basin	0.15	0.13
Pine Ridge Canal Basin	0.15	0.13
Upper Immokalee Basin	0.15	0.15

Modified Discharge by Basin

Initiative 5: Stormwater Runoff Volume Control

This recommendation would have no impact on new development because the limiting storage condition is the allowable maximum discharge limit. The volume control requirement will simply represent a double check on potential impacts in the areas downstream from proposed developments.

The current ERP requirement is to mitigate post development peak stages for the 25-year/72-hour design storm event. The permitting process does not require verification of downstream impact in areas beyond those surrounding a proposed new development due to changes in discharge timing from pre-development conditions.

An approach that other Florida municipalities have adopted to control for these impacts is to limit both peak discharges and volumes to pre-development conditions. In addition to the established maximum allowable discharges for the County's canals (Ordinance 2007-11), it is recommended that the GMP Drainage Sub-Element and the LDC be modified to require post-development volume mitigation not to exceed pre-development conditions for the 25-year/24-hour design storm event conditions. Mitigation will be provided as volume detention. Volume recovery would be similar to that for detention facilities per the ERP permitting process.

This approach, combined with the current requirement that flood elevations are not exceeded anywhere in the watershed (Initiative 6), would ensure that the three critical hydrologic/hydraulic factors (water elevations, runoff volume, and timing of discharges) are maintained from pre-development conditions. More stringent requirements for volume control using events with a larger duration or longer return period may be considered at a later date.

Analysis conducted as part of the Watershed Management Plan development process have shown that this recommendation would have basically no impact on new development because the limiting condition in terms of required site storage capacity is the allowable maximum discharge limit. The volume control requirement will simply represent a double check on potential impacts to areas downstream from proposed developments.

Initiative 6: Verification of No Floodplain Impact

It is critical that future development discharges are controlled such that the extent of the regulatory floodplain is not increased at any point along potentially affected canal systems,

It is critical that future development discharges are controlled such that the extent of the regulatory floodplain is not increased at any point along potentially affected canal systems. This is because floodplain impacts would have implications associated with the National Flood Insurance Program.

It is recommended that the County implement the requirement that each development permit include a check of no impact upstream or downstream for the 100-year/72-hour design storm event.

Tools that can be used for this purpose include a) the Tomasello computer model that was developed by the County for floodplain management purposes, or b) a version of the existing conditions model (ECM) but modified using a smaller grid size, i.e. 500 ft to better define local conditions.

It should be noted that the application of this recommendation would also require changing the LDC Section 3.07.02 from referencing "surrounding properties" to "any properties upstream or downstream" of a development. It is also important to adopt this initiative jointly with SFWMD.

Initiative 7: Flood Protection Levels of Service (FPLOS) Criteria

The proposed FPLOS criteria consider the type of road and the return period of the storm. This approach also allows distinguishing between nuisance flooding and hazard flooding.

Another aspect associated with water quantity is the flood protection levels of service (FPLOS). The FPLOS are a measure of the acceptable flooding depth along public roads that are considered not to pose a threat to the health and safety of the community. The more stringent the FPLOS criteria, the more expensive the drainage improvements needed to meet those criteria. In addition, the larger the drainage system, the greater the potential impact to the natural environment. Therefore, a balance must be achieved between risk, cost, and environmental impacts.

Collier County has defined FPLOS criteria (Ordinance 90-10) by which roads and parking lot travel ways must provide drainage and flood protection during the 25-year/72-hour storm event. Currently, there are four (4) defined FPLOS categories. They are listed in **Table 3-4**. County Ordinance Number 2007-11 indicates that 27 of the 37 defined drainage basins in Collier County have been rated as having a FPLOS standard of "D", unacceptable. The other 10 defined basins are rated as FPLOS "C", substandard.

Table 3-4. Level of Service Definitions

FPLOS	General Hydraulic Performance
A	**Excellent**: Flow contained in drainage system with substantial water quality and/or water supply/recharge benefits
B	**Adequate**: Street flooding with significant water quality and/or water supply/recharge benefits
C	**Substandard**: Street and yard flooding with identifiable water quality and/or water supply/recharge benefits
D	**Unacceptable**: Street, yard, and structure flooding with limited or no water quality and/or water supply/recharge benefits

Table 3-5 shows the proposed FPLOS criteria. The proposed criteria were developed considering the type of road and the return period of the storm. Return period is defined as the average interval in years between the occurrence of a flood of specified magnitude and an equal or larger flood. This approach also allows distinguishing between nuisance flooding and hazard flooding.

Table 3-5. Proposed FPLOS Criteria for Collier County

Roadways	Storm Return Period (years)		
	10	25	100
A. Evacuation Routes	None	None	None
B. Arterials	None	None	6 inches
C. Collectors	None	6 inches	9 inches
D. Neighborhood	6 inches	9 inches	12 inches
Open Space (Flooding of open space is acceptable if it does not compromise public health and safety).			

The proposed criteria were evaluated by applying them to the road system in the County. The first step was to classify the roads as evacuation routes, arterials, collectors, and neighborhood roads.

- **Evacuation Routes are** identified by Collier County based on emergency needs
- **Arterials** are high capacity urban roads that connect developed areas to freeways and evacuation routes.
- **Collectors** are low to moderate traffic roads that link local streets to arterial roads. Collectors also provide access the residential areas.
- **Neighborhood roads** are local roads within neighborhoods or other developed areas.

A roads shapefile was obtained from Collier County. Each road in the County was divided into segments broken at each road intersection. For consistency with the model grid size, the maximum road segment length was set at 1500 feet (equal to the size of the model grid). Road surface elevations along each segment were extracted from the topographical Digital Elevation Model (DEM) which is based on a 5-foot grid. **Figure 3-4** shows the Collier County roads by road classification.

The MIKE SHE / MIKE 11 computer model was used to simulate the South Florida Water Management District (SFWMD) design storm events for the 10, 25, and 100-year return periods, all of 72-hour duration.

Initial simulation conditions were made consistent with those used to develop the County's Federal Emergency Management Agency (FEMA) flood maps. The difference between the water elevation as predicted by the model and the road surface elevation was calculated for each road segment. A segment was classified as failing if the difference between the water elevation and the road surface elevation exceeded the proposed FPLOS criteria.

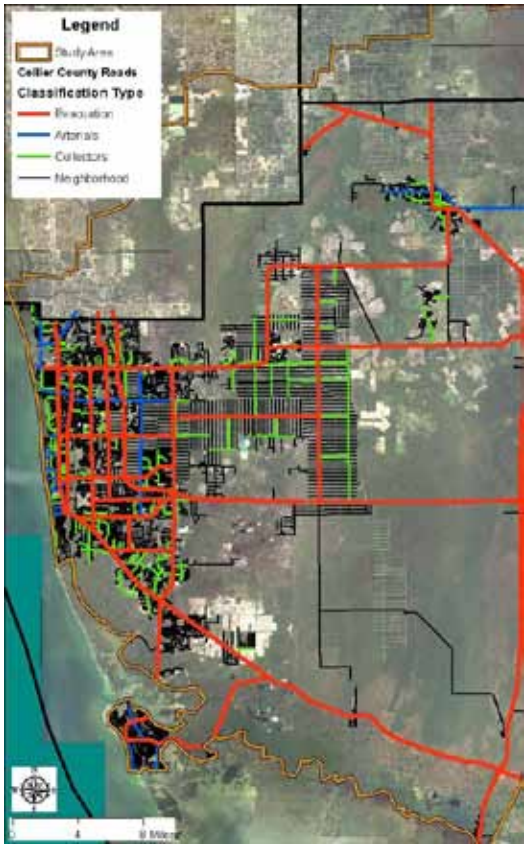

Figure 3-4. Roads by Road Classification

Results of the analysis indicate that the proposed FPLOS for the evacuation routes do not change significantly from the existing FPLOS results for the 25-year/72-hour storm. However, results also indicate that the criteria are not met along the evacuation routes even for the 10-yr/72-hr storm event conditions.

The failures occur along US-41 in the City of Naples and near the intersection of US-41 and Airport Pulling Road. Failures are also predicted on Golden Gate Parkway west of Airport Pulling Road and in the Golden Gate City area, at Golden Gate Parkway east of Santa Barbara Boulevard. In the northern Golden Gates Estates, Everglades Blvd. is predicted to fail the proposed FPLOS during all storm events.

Results for the arterial roads analysis indicated that most road segments that fail 25-year design storm criteria also fail the 10-year storm criteria. However, several road segments, primarily those along Vanderbilt Beach Rd and Logan Blvd, fail the 25-year design storm criteria but pass the 100-year criteria. That is because the proposed 100-yr criteria allow six (6) inches of inundation above the road surface. The results suggest that the 25-year design storm should be used to support drainage design for arterial roads.

For collector and neighborhood roads, results indicated that the 10-year design storm should be used for drainage design purposes.

In addition to flood depth, the FPLOS analysis should also consider flood duration. In some cases, shallow flooding is not acceptable if duration exceeds 24 hours. IN other cases, the flood depth requirement may be exceeded if it is associated with short duration. For regulatory purposes, it is desirable to specify the FPLOS in terms of depth and consider the duration factor on a case by case basis during the design phase of specific projects.

Initiative 8: Golden Gate Estates Transfer of Development Rights Program

It is recommended that Collier County evaluate the feasibility of establishing the North Golden Gate Estates Flowway Restoration Program (NGGEFRP) and the corresponding North Golden Gate Estates Flowway Restoration Area (NGGEFRA) to preserve and thus protect the value of the natural resources, as well as its aquifer recharge functions

Objective

Certain portions of the North Golden Gate Estates basin, along with lands directly east of the Golden Gate Watershed, also within the Golden Gates Estates Subdivision (and falling within Faka Union Watershed) show high restoration potential. Currently these areas have low population density, and land uses follow predominantly a single family low coverage semi-rural development pattern of one dwelling unit per 2.25 acres (or in the case of legal nonconforming lots, one dwelling unit per 1.2 acres). In fact, the North Golden Gate Estates Flowway Restoration Plan is currently under design. The purpose of that project is to restore "strategic areas of drained wetlands within Golden Gate Estates and north Belle Meade to allow storage and conveyance of stormwater runoff. The restoration of these wetlands will enhance flood management, water quality, wildlife habitat; add recreational area and green space; promote aquifer recharge; and provide opportunities as a potential mitigation area for wetland and stormwater impacts within the North Golden Gate Basin."

The factors described above provide the opportunity to set aside or otherwise guide land development to protect environmentally valuable lands with a modification to the current Collier County RMFU and URF Transfer of Development Rights (TDR) program.

The purpose of this chapter is to describe the potential modification of the current TDR program in Collier County as part of the watershed management plan local regulatory recommendations. At the outset, it should be understood that the potential TDR program is intended to be largely incentive based. It is recognized that there are existing property rights and that any regulatory program designed to achieve or further the Watershed Management Plan Project objectives must be designed with full consideration of the impacts such regulations may have on those existing private property rights, including both federal (constitutional) rights, and the potential impacts of Florida's "Bert J. Harris Private Property Rights Protection Act."

General Description of TDR Programs

Often there are valid public policy reasons for limiting property rights on certain land, where the preservation or substantial preservation of such land is deemed to have a valid public purpose. Generally, this is regulated through zoning, and derives from a local government's "police powers."[1] However, local governments must use caution when adopting new policy or zoning regulations that further limit or eliminate existing private property rights. If not, an unjust "Taking" can occur when the government acquires private property and fails to compensate an owner fairly. A taking can occur even without the actual taking of property title, such as when a government regulation substantially devalues a property. For many years TDR programs have been adopted throughout the Country (with varying degrees of success) as a means of compensating landowners who, for a valid public purpose, have had their private property rights either fully or partially "taken" as a result of the local government action.

[1] The right of states to make laws governing public health, safety, welfare, and morals is granted by the Tenth Amendment to the US Constitution, which states, "The powers not delegated to the United States by the Constitution, nor prohibited by it to the states, are reserved to the States respectively, or to the people." State legislatures exercise their police power by enacting statutes to protect the public's health, safety, welfare, and they also delegate much of their police power to local governments.

There are essentially two goals for TDR programs. The primary goal is to preserve some identified asset for public benefit. Examples include resource protective areas, open space, farmland, areas prone to flooding, areas necessary for groundwater recharge, waterfront areas, or historic structures. The areas that are the target of such preservation are generally called "Sending" lands. Lands to which such property rights may be transferred are generally referred to as "Receiving" lands.

The second goal of a TDR program is to compensate landowners in the Sending areas, for the loss of development rights on the Sending lands. This is accomplished through the ability to transfer these rights, or to sell these rights to another person or entity who can then use these rights within designated Receiving areas. The goal of compensating Sending land property owners is no less important than the first goal of preservation for primarily two reasons.

- If the program is purely voluntary, Sending land owners will not sell or transfer such rights unless the value they will receive for severing these rights provides sufficient incentive when compared to the rights they retain on the Sending lands and the goals of preserving the Sending lands and compensating the landowners will not be accomplished.
- If the TDR program includes a significant loss of the existing property rights on Sending lands, and such program is not viable and thus Sending land owners are not compensated for the loss of property rights, such landowners may then have a course of legal action for "Taking" claims against the agency, thereby jeopardizing the implementation of the entire program.

The Collier County Existing TDR Programs

In Collier County there are already several types of TDR programs in effect. Most follow the format of the traditional TDR program, but one of them, the County's Rural Lands Stewardship (RLSA) program is significantly different and is specifically excluded from the County's general TDR provisions (Land Development Code (LDC) Section 2.03.07. D.4.a.iii.).

This analysis assumes that any TDR policies developed to advance the goals of the Watershed Management Plan will be in the form of a traditional TDR program. However, such policies would be distinct from policies that are presently applicable in various areas of Collier County. It should be noted that the LDC TDR provisions presently provide for transfers in three ways: a) from urban areas to urban areas; b) from Rural Fringe Mixed Use (RFMU) Sending lands to RFMU Receiving lands; and c) from Rural Fringe Mixed Use (RFMU) Sending lands to urban areas (limited to the Urban Residential Fringe (URF) subdistrict and to qualified urban infill areas. The applicable TDR provisions are as described below.

LDC Section 2.03.07. D.

4. Transfer of Development Rights (TDR).

a. Purpose, Intent and Applicability.

i. Purpose. *The primary purpose of the TDR process is to establish an equitable method of protecting and conserving lands determined to have significant environmental value, including large connected wetland systems and significant areas of habitat for listed species; and to provide a viable mechanism for property owners of such environmentally valuable lands to recoup lost value and development potential which may be associated with the application of environmental preservations standards to such lands.*

ii. Intent. *These TDR provisions are intended to accomplish the above stated purpose through an economically viable process of transferring development rights from less suitable non-RFMU sending areas and RFMU sending lands to more suitable non-RFMU receiving areas and RFMU receiving lands.*

iii. Applicability. *These TDR provisions shall be applicable to those areas specifically identified in (b), (c) and (d) below. These TDR provisions shall not be applicable to the any transfer of development rights within the RLSA District.*

The existing Collier County TDR programs have not been utilized for a number of reasons. The urban to urban transfer has been rarely used as typically it is not necessary for a landowner to

purchase a transferable urban TDR to accomplish the desired gross density on a project. In simple terms, there is no market for the urban to urban TDR program. As to the potential transfer from RFMU Sending to qualified urban infill areas, there has also been little use of this opportunity. The County's Future Land Use Element (FLUE) provides the following conditions related to Residential Infill (and the ability to transfer a TDR from the RFMU Sending Lands into the Urban Area):

Density Bonuses

d. Residential In-fill

To encourage residential in-fill in urban areas of existing development outside of the Coastal High Hazard Area, a maximum of 3 residential dwelling units per gross acre may be added if the following criteria are met:

(a) The project is 20 acres or less in size;

(b) At time of development, the project will be served by central public water and sewer;

(c) The project is compatible with surrounding land uses;

(d) The property in question has no common site development plan with adjacent property;

(e) There is no common ownership with any adjacent parcels;

(f) The parcel in question was not created to take advantage of the in-fill residential density bonus and was created prior to the adoption of this provision in the Growth Management Plan on January 10, 1989;

(g) Of the maximum 3 additional units, one (1) dwelling unit per acre shall be transferred from Sending Lands; and

(h) Projects qualifying under this provision may increase the density administratively by a maximum of one dwelling unit per acre by transferring that additional density from Sending Lands.

Again, based upon the fact that the Residential Infill provision has been rarely used, the additional requirement that at least one of the three additional bonus units must come from RFMU Sending lands (added in 2002), even though a project could realize an increased density of up to one dwelling unit per gross acre administratively (without being required to rezone the property), creates a condition for which there is insufficient market demand for the urban infill provisions.

Collier County also provides for TDR to be transferred from RFMU Sending lands to RFMU Receiving lands. That program provides for a base TDR at a ratio of one TDR per 5 acres of Sending land, and also provides that for each base TDR a property owner also has the ability to secure an early entry TDR Bonus (still in effect) and a bonus for environmental restoration for the Sending lands and a bonus for deeding the Sending lands to a public land management/conservation agency. Although there have been several properties which have secured the base and early entry TDR bonuses, to date there has been no actual utilization of these TDRs in receiving lands.

Within the RFMU Subdistrict there are four distinct Receiving areas. The RFMU Receiving areas were chosen because they contained lower resource protection value than other lands within the RFMU subdistrict and are situated such that they had or could relatively easily develop adequate access to the arterial transportation network and to other necessary public services such as public utilities. The Receiving area can be developed in two ways, either as a Rural Village, or as receiving lands located outside of a Rural Village. The maximum allowable density within a Rural Village is 3.0 units per gross acre and for Receiving lands located outside of a Rural Village the maximum density is 1.0 unit per gross acre. For a number of reasons, all generally related to the economic viability (that is potential return when compared to cost and potential risk), development of RFMU Receiving lands has not happened since the inception of the RFMU TDR program.

Since there has been no utilization of the TDR in designated RFMU Receiving areas, either in a Village or outside of a Village, again one must look to the market viability of the program.

Clearly any new or expanded TDR program must be designed so as to have a tangible market value, both to the Sending landowners, and to the owners or potential owners of Receiving lands.

Recommendation to Develop a TDR Program for the Northern Golden Gate Estates

It is recommended that Collier County evaluates the feasibility of establishing the North Golden Gate Estates Flowway Restoration Program

(NGGEFRP) and the corresponding North Golden Gate Estates Flowway Restoration Area (NGGEFRA) to preserve and thus protect from further degradation the value of the natural system as well as the aquifer recharge functions in the areas primarily within the north eastern portion of the Golden Gate Estates Subdivision. The location of the NGGEFRA is shown in **Figure 3-5**. The methodology applied in this study to identify the resource protective areas shown in the Figure is described in detail in Volume 4, Section 2.8.

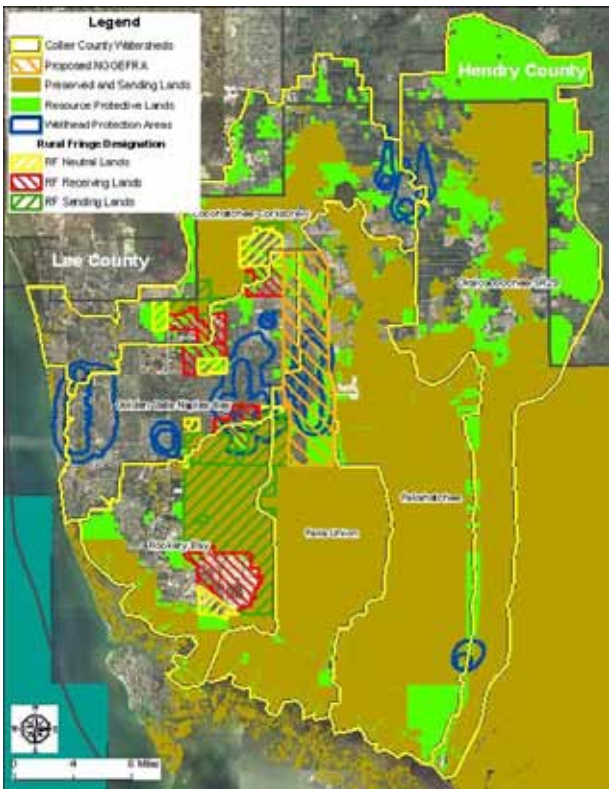

Figure 3-5. Location of the North Golden Gate Flowway Protection Area (NGGFPA)

In addition to this area being used for the Floodway Restoration Plan, it includes significant portions of non-agricultural areas that have been identified in this study as "resource protective areas", as well as areas identified by the County for wellhead protection.

A major component of the NGGEFRP would be a TDR program designed to provide sufficient market attraction to not only accomplish the protection goals of the NGGEFRP (stated below), but also to provide enhanced incentives to promote development of the Rural Villages in all or some of the established RFMU Receiving lands. The TDR program would provide for the voluntary severing of residential development rights from the identified Sending lands in the NGGEFRA and allow the transfer of such rights to targeted Receiving lands.

Program Description and Recommended Elements

It is further recommended that the following elements be considered for inclusion in the program:

- Design the TDR program to be completely voluntary (with appropriate incentives).
- *Use the TDR program to incentivize aggregation of smaller parcels into a larger development tract*. If smaller parcels are aggregated and then clustered development is employed, the remaining undisturbed portions can then be protected while still allowing common passive recreation uses. In such cases, an incentive of some amount of increased density, for example 10 or 20 percent, could be considered. In effect, the "clustered development area" becomes a Receiving area, and is granted a density bonus for protecting the remaining undisturbed land. As an example, if several smaller parcels containing the rights for 10 single family units are combined to create a large 20 acre development tract, and the single-family development is designed to be clustered such that the impact area is limited to a maximum of 10,000 square feet per unit, and a 20

percent bonus is granted bringing the density up to 12 units, then the overall impact area would not exceed 120,000 square feet or 2.75 acres. This would leave 17.25 acres of open space which could be used for passive recreation and at the same time for recharge and storm water management. Ideally the majority of this remainder area would be cleared of exotic vegetation and remain in its natural state with limited clearing permitted.

- Incentivize TDR transfers from the NGGEFRA to RFMU Receiving lands and further incentivize Rural Village development in all or some of the RFMU Receiving Areas. The TDRs generated from the NGGEFRA have the potential to provide additional market attraction for the RFMU Receiving lands. If designed properly, with sufficient bonus and/or multipliers, the TDR program can become more equitable for both owners of NGGEFRA Sending lands and owners or potential owners of RFMU Receiving lands. As stated by Dennis E. Gilkey, an individual with vast experience in Southwest Florida developing high quality large mixed-use master planned communities, "For a TDR program to work, it must first be market driven."[2] Thus the program must achieve a marketable balance in terms of the cost to acquire necessary TDRs for use in Receiving areas and the compensation to Sending land owners for those TDRs.
- As previously stated, the maximum allowable density within a Rural Village is 3.0 units per gross acre and for Receiving lands located outside of a Rural Village the maximum density is 1.0 unit per gross acre. To achieve these densities, one must purchase TDRs and TDR bonuses. Certainly it would be reasonable to allow additional density in these areas (for example an additional 1.0 units per in Receiving lands located outside of a Rural Village (for a total of 2.0 gross units per acre) and up to 5 units per acre in a Rural Village (for up to 5 units per gross acre)) if such increases were tied to TDRs and TDR bonus units derived from the High Recharge Sending lands. At least two of the identified RFMU Receiving lands areas are well suited in terms of existing access to the arterial network and extension of utility lines and service from existing County facilities. It is not enough just to allow additional density, but to ensure a viable market attraction and provide a balance in terms cost. This will require appropriate incentives to direct development to the Receiving areas.
- *Allow the transfer of TDRs and/or TDR bonus units from the* NGGEFRA *into the urban area under limited or general conditions.* For example, any project in the Urban Area qualifying as Urban Infill might then be able to increase its density by 1 or 2 units per gross acre by right (under certain identified conditions) through the acquisition and use of TDRs from the NGGEFRA Sending areas. Other opportunities for transfer to the urban area may also exist.
- Consider whether or not to expand the NGGEFRA to also include other lands in the general vicinity that also contain high value for resource protection and/or aquifer recharge. Of particular note is the fact that the data indicate high scores as resource protective areas on the various "Neutral Lands" within the RFMU subdistrict. **Figure 3-5** also shows the location of adjacent Neutral Lands.

Next Steps

1) Establish an Oversight Committee of 9 members to work with staff to develop the specifics of the TDR program. It is recommended that the committee have representation from the following stakeholder groups:

[2] *Transfer of Development Rights (TRDs) in Florida's Rural Lands (and why they haven't worked).* Report prepared by Dennis E. Gilkey, Gilkey Organization, 2010)

a. Landowners within the affected area (2 or 3 members)
b. Nongovernmental environmental organizations (2 members)
c. Golden Gate Estates Civic groups/organizations (2 members)
d. Land owners within the RFMU Subdistrict (2 members)
e. At least one a representative from the development industry.

2) Prepare a map or series of maps depicting the individual parcel boundaries within the targeted high recharge areas, primarily located in the North Golden Gate Estates Subdivision, to quantify the number of legal nonconforming and conforming parcels. Overlaying these maps on an aerial will allow quantification of the number of developed parcels as well as identification of the Sending lands boundaries.

3) Determine whether there is support to move forward with developing a TDR program for this area by bringing the concept of a TDR program primarily to the local community and subsequently to the Environmental Advisory Council (EAC) and Planning Commission (CCPC) for policy recommendation and then to the Board of County Commissioners (BCC) for policy direction.

Additional Considerations

It should be noted that the creation of a TDR program in the NGGEFRA and the attendant identification of Sending and Receiving areas and potential TDR bonuses, as well as potential changes to the RFMU subdistrict will require amendments to the County's Comprehensive Growth Management Plan (GMP), including amendments to the Golden Gate Area Master Plan (GGAMP), the Future Land Use Element (FLUE), Future Land Use Map (FLUM), and the Conservation and Coastal Management Element (CCME), at a minimum. These Plan amendments would then be followed by implementing LDC amendments. Approval of the WMP by the Collier County Board of County Commissioners will start the evaluation process to determine feasibility of the recommendation. Additional approvals would be necessary to complete the regulatory amendments. In addition, any restoration project that may be implemented on lands obtained through the TDR program would have to be vetted by the community and evaluated thoroughly to make sure that the flood risk is not increased on nearby homes.

Initiative 9: Golden Gate Estates Watershed Mitigation Program

The Northern Golden Gate Estates (NGGE) has been identified as an area of particular interest, in regards to wetland mitigation practices. Golden Gate-Naples Bay is the only watershed that does not currently have a mitigation bank or ROMA within its boundaries.

Objective

Filling or dredging of wetlands requires state and federal permits, which often allow mitigation to occur outside of the functional watershed. Collier County and most other local governments have little direct authority to regulate wetland mitigation decisions. Therefore, non-regulatory incentives will be necessary in order to achieve wetland mitigation that is compatible with Collier County's objective to mitigate wetland impacts within the same functional watershed. This memorandum proposes mechanisms to incentivize mitigation of wetland impacts within the same functional watershed as the impacts.

Currently, regulations allow wetland impacts to be mitigated either on-site, at a permitted mitigation bank or at an authorized "regional offsite mitigation area" (ROMA). Mitigation banks are large (usually at least a square mile), privately-managed tracts of land that are awarded mitigation credits by restoring or enhancing wetlands on the site. ROMAs are generally government-operated mitigation sites, usually to generate mitigation credits needed either by the land-owning agency itself or by single-family homeowners. Mitigation service areas (the geographic limits within which impacts can be offset by purchasing credits at the bank or ROMA) for mitigation banks and ROMAs generally extend well beyond the functional watershed. This process allows permit applicants to select mitigation far away from the impact site. As a collective result of many individual impacts being mitigated far off-site, the wetland functions within a functional watershed, as defined for the Watershed Management Plan, could potentially be significantly diminished.

Wetland Permitting Programs

Two primary regulatory programs govern the issuance of wetland impact permits: the Environmental Resource Permit (ERP) program administered by the water management districts (WMD) and Florida Department of Environmental Protection (FDEP), and the Section 404 "dredge and fill" program of the federal Clean Water Act, administered by the U.S. Army Corps of Engineers (USACE). ERP permits are required for many types of activities beyond wetland impacts, including water quality and quantity for upland developments as well; however, for the purposes of this memorandum, only wetland regulations are covered herein.

ERP responsibility is divided between FDEP and each WMD in accordance with an operating agreement. The FDEP-SFWMD operating agreement gives FDEP the responsibility to review and issue ERP permits for several categories including solid waste, wastewater, hazardous waste, and potable water facilities; marina, seaport and docking facilities (other than those associated with land-based commercial and residential projects regulated by SFWMD); projects constructed, operated or maintained by SFMWD; navigational dredging by governmental entities; mining, and single-owner residential development up to 3 parcels, as long as each parcel contains only one dwelling unit (single-family home through quadruplex). SFWMD has the responsibility to review and issue ERP permits for all other regulated activities, including residential subdivisions, commercial developments, roads, and certain agricultural activities.

ERP rules exclude (by way of specific exemption or a noticed or no-noticed general permit) several types of activities from wetland impact and mitigation requirements, notably impacts to

isolated wetlands smaller than ½ acre; unavoidable filling of up to 4,000 square feet and clearing up to 6,000 square feet of a wetland for the purpose of constructing a single-family home; many agricultural and silvicultural activities; and most maintenance and repair activities, subject to certain BMP's.

On the federal side, USACE permits are required only for projects that deposit dredged or fill materials into non-isolated wetlands (i.e., wetlands not connected to navigable waters by way of other wetlands, ditches, flow-ways, streams, or canals). USACE rules provide similar exclusions from typical impact and mitigation criteria, except that the nationwide permit for single-family homes allows filling of up to ½ acre of non-tidal wetlands without mitigation (rather than the 4,000 square-foot limit in the ERP Noticed General Permit).

The general process and approach to assessing wetland impacts and mitigation is similar for all three regulatory agencies. An applicant, oftentimes with the assistance of a consultant, submits an application identifying the wetland location(s), along with quantification of the area and functional value of wetland impacts and mitigation. The functional value of a proposed wetland impact or mitigation plan is determined through the Uniform Mitigation Assessment Method (UMAM). Per Chapter 62-345 FAC, UMAM is the method that State agencies use to assess the amount of mitigation needed to offset adverse impacts to wetlands and other surface waters based on its location (connectivity to other wetlands and natural resources), hydrology, water quality, vegetative composition, and acreage. Within the original application or subsequent submittals, the applicant must demonstrate that the proposed wetland impacts are permittable (i.e., low-quality, or unavoidable if higher-quality) and that the proposed mitigation offsets the proposed impact. The regulatory agency reviews proposed mitigation to determine whether it is the appropriate amount (i.e., UMAM value of the mitigation is equal to or greater than the UMAM value of the impact), type (e.g., a freshwater herbaceous impact generally must be offset by freshwater herbaceous mitigation), location, and has long-term assurance of success.

Agency rules and practices, particularly federal mitigation criteria, provide a general preference for mitigation via the purchase of mitigation credits at a permitted mitigation bank or use of a ROMA whose mitigation service area includes the area of impact. In some circumstances, on-site wetland mitigation is permitted, due primarily to financial circumstances for single-family home owners and/or the high resource protection value of an on-site wetland.

Wetland Mitigation Criteria and Practice in Collier County

Four mitigation areas are commonly used to offset impacts in Collier County: the Big Cypress Mitigation Bank located in southern Hendry County, Panther Island Mitigation Bank located in northern Collier County (in the Cocohatchee-Corkscrew functional watershed), Corkscrew Regional Mitigation Bank located in Lee County (adjacent to the Cocohatchee-Corkscrew functional watershed), and the Northern Golden Gate Estates ROMA located in the Picayune Strand State Forest (in the Rookery Bay functional watershed). The mitigation service area for a mitigation bank or ROMA generally is comprised of one or more of the regional drainage basins shown in **Figure 3-6**. The mitigation service areas for Big Cypress and Panther Island are identical: the entirety of Estero Bay, West Collier and East Collier regional drainage basins. The mitigation service area for the Corkscrew Regional Mitigation Bank consists of the West Collier, Estero Bay, and West Caloosahatchee regional drainage basins. The service area for the Northern Golden Gate Estates ROMA is single-family residential development within NGGE (note that this service area is defined both geographically and by type of wetland impact project).

Regulatory agencies and local governments have little authority to deny the use of one of these mitigation banks or ROMAs based on location of the impact, so long as the impact is within the same regional drainage basin and service area.

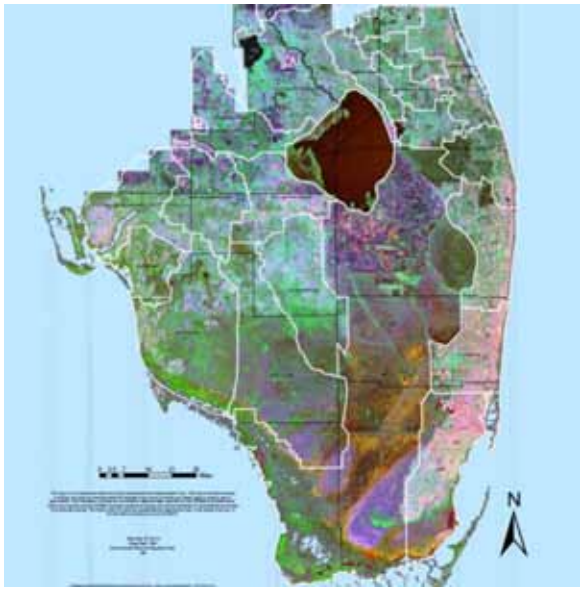

Figure 3-6. SFWMD Regional Drainage Basins

Mitigation can also occur at a mitigation bank in a different regional drainage basin within the mitigation service area, if the impact is to a lower-quality wetland (e.g., an impact to a melaleuca-infested wetland in the Estero Bay basin could be offset via the purchase of credits at the Panther Island Mitigation Bank located in the West Collier basin, since the Panther Island service area includes the Estero Bay basin). Wetland functions in areas with impacts are therefore transferred to other functional watersheds and regional drainage basins where mitigation banks are located. This conflicts with the extent of the functional watersheds as defined in the Watershed Management Plan. For example, impacts in the Rookery Bay functional watershed can be offset at the Panther Island Mitigation Bank located in the Cocohatchee-Corkscrew functional watershed, as both are contained within the larger West Collier regional drainage basin and the Panther Island Mitigation Bank service area defined by SFWMD.

Recommended Mitigation Strategy for the NGGE

The Northern Golden Gate Estates (NGGE) has been identified by several stakeholders as an area of particular interest, in regards to wetland impact and mitigation practices. Of the three primary functional watersheds reviewed in the Collier County Watershed Model Update, the Golden Gate-Naples Bay watershed is the only one that does not currently have a mitigation bank or ROMA within its boundaries. These stakeholders have expressed a desire for mitigation within the functional Golden Gate-Naples Bay watershed, and more specifically within or adjacent to NGGE. Development of the single-family lots that dominate NGGE often requires no wetland mitigation because this type of development generally fills less than 4,000 square feet in wetlands. For those wetland lots that require more than 4,000 square feet of fill, on-site mitigation is generally not available or is insufficient. As a result, off-site mitigation is generally required through the purchase of mitigation bank credits at Big Cypress or Panther Island Mitigation Bank, or through funding or participation in restoration activities at the NGGE ROMA. Consequently, NGGE is losing wetland functions, including opportunities for stormwater retention and treatment.

In-Watershed NGGE Mitigation

No regulatory mechanisms exist that would require mitigation of NGGE impacts within the Golden Gate-Naples Bay Watershed. Further, no ROMA or mitigation bank is currently available within NGGE to offset wetland impacts. Additional incentives and opportunities must therefore be developed, if wetland mitigation is to occur within NGGE. Encouragement of mitigation within NGGE (and more broadly for other areas desiring in-watershed mitigation) requires several key elements: identification of site(s) that are available and can be restored to provide increased the value of the resource; development of restoration plans that meet state and federal criteria for permittable regional mitigation; and analysis of costs to determine how mitigation credits could be sold at a lower cost than currently available via existing mitigation options.

Ecological review, engineering assessment, UMAM analysis and land-ownership review would be necessary to determine the extent to which one or more wetland-restoration projects in this area can provide mitigation value by acquiring land, filling ditches, removing roads, restoring former hydrological connections, and/or managing vegetation. The ROMA would be established by permit and/or interagency agreements, including a detailed plan providing assurance to the regulatory agencies (FDEP and/or SFWMD and/or USACE) that the necessary parcels will be

acquired, projects will be constructed, and the land and projects will be managed in perpetuity. Credits would be released in accordance with a schedule, tied to accomplishment of project goals (acquisition of lands/easements, construction of projects, eradication of exotic vegetation, planting of native vegetation, achievement of hydrological criteria, etc.).

Regulatory approval of a ROMA within NGGE is not a likely impediment, to the extent that the mitigation would be designated for single-family residential development, similar to the current NGGE ROMA at Picayune Strand approved by FDEP. In fact, based on discussion with FDEP staff, it is possible for FDEP to develop a special "Noticed General Permit" specifically for NGGE that would provide for expedited review and approval of single-family wetland impacts mitigated within NGGE. Under this scenario, wetland restoration at the ROMA would ideally be funded by a mitigation fee required by FDEP and collected by the County or Soil and Water Conservation District. Alternative mechanisms to acquire parcels and/or construct projects within this phase could include transfer of development rights or in-kind services provided by permit applicants. If the mitigation would be used only for single-family residential projects, these costs could be subsidized if necessary.

Benefits of a single-family ROMA and Noticed General Permit within NGGE include quick permitting for single-family homeowners, and addressing two issues--loss of wetland functions and flooding-- that are inadequately addressed currently. The greatest impediments include the logistical effort necessary to assemble a thorough plan of acquisition, construction and management that is acceptable to the regulatory agencies and affected landowners; the potential necessity of County or other governmental subsidy to provide a financially viable option to homeowners; and future projects (e.g., large development planned to the east by Barron Collier or Collier Enterprises) that may restrict the ability of a mitigation project within NGGE to achieve hydrological restoration.

If mitigation is desired for other projects regulated by SFWMD and/or USACE (e.g., County roads and other public works projects), there would be a higher level of requested detail, analysis and certainty of outcomes, including long-term protection and funding. Both SFWMD and USACE require a level of analysis and regulatory assurance for ROMA's that is substantially comparable to private mitigation banks. This would likely include establishment of a long-term funding mechanism (e.g., trust fund dedicated to long-term management and operation, funded by mitigation credit sales, separately from initial construction and restoration), dedication of conservation easements to SFWMD, and extensive analysis to demonstrate the project would achieve the projected natural system restoration goals.

Recommendation

Based on stakeholder comments and the results of landscape-level functional assessment, the sites most suited to provide regional mitigation within NGGE are within the Northern Golden Gate Estates Flowway Restoration area and adjacent connecting wetland areas. These sites consist of current and former wetlands that have been degraded due to artificial drainage and/or loss of watershed drainage area. A well-designed project would retain the system's functions as well as re-establish drainage patterns such that runoff would flow into these wetlands rather than be diverted into the Golden Gate canal network. Based on review of stakeholder input and other data, an ideal project would include public acquisition of fee simple or conservation and flowage easements over parcels; complete or partial filling of drainage ditches (constrained by the need to maintain existing levels of flood control); removal of roads; and installation of culverts and/or channels to restore watershed flows to these areas.

Due to the different requirements for single-family mitigation and public works mitigation, permitting would be most easily accomplished by separating the project into two phases: one phase permitted by FDEP for mitigation of single-family residential impacts, and the other phase permitted by SFWMD for mitigation of roads and other public works impacts. Funding and acquisition sources for the FDEP-permitted phase could include mitigation credit sales, TDRs, grants, and/or direct county funding.

The second phase, to be permitted by SFWMD to offset impacts associated with County public works projects, would be paid for via the public works projects. On the cost-analysis side, it should be noted that Lee County has determined that mitigation for public works projects on their

County-owned lands is significantly less expensive than the purchase of private mitigation bank credits (from the same mitigation banks that currently provide mitigation for Collier County projects). Collier County currently pays wetland mitigation fees, generally via the purchase of wetland mitigation credits from private mitigation banks, at a rate of up to $90,000 per credit (each credit offsets approximately 2–3 acres of wetland impacts). As with the FDEP permit, the SFWMD and USACE would require a detailed, supportable plan and measurable restoration in order to award and release mitigation credits.

Factors favoring this second, SFWMD- and ACOE-permitted phase of the ROMA include:

- Internal capture and/or reduction in mitigation costs;
- Dual-purpose regional wetland mitigation and stormwater attenuation;
- Regulatory precedent for wetland mitigation on County lands (the SFWMD has issued several permits to Lee County for this type of project);
- County-owned upland parcels in NGGE that could potentially be "swapped" with privately-owned wetland parcels, in order to acquire lands within the projects' footprint; and
- Upcoming statewide rules affecting water quality criteria and enabling water quality credit-trading.

Potential impediments include (in addition to the impediments listed for the FDEP phase above, which are also pertinent for this phase): the necessity of a reliable funding source within the County to accomplish the project objectives; potential SFWMD requirement for the County to acquire much of the land up-front; and potential negative reaction by environmentalists concerned by the use of public lands to mitigate (i.e., incentivize) impacts.

This initiative is closely linked to the proposed TDR program for the Golden Gate watershed. The implementation of this initiative requires the vetting and active participation of numerous stakeholders including the residents of the Golden Gate watershed.

Other Potential Mitigation Concepts

Other concepts to incentivize and fund in-watershed mitigation were also evaluated. These concepts, and rationale for not proposing them at this time, include:

- Offsite regional water quality mitigation banking. In this scenario, a mitigation project could generate water quality "credits," which would be sold to offset a portion of the water quality impacts for other projects, similar to wetland mitigation. This concept was not deemed feasible due to lack of regulatory guidance at this time. However, upcoming statewide implementation of a pilot water quality trading program by FDEP may provide a market for this type of approach in the future.
- Public-private wetland mitigation bank, located on County lands, with authorization to sell mitigation credits to any entity and a portion of the fees being returned to the County for a long-term management fund. The primary obstacle for this type of project is financial feasibility, due to current market conditions and two existing permitted mitigation banks in this area, which generate a surplus of mitigation credits.
- Adopt local Zoning and/or Comprehensive Plan requirements to retain habitat within the functional watershed. Rules of this nature may encounter significant opposition from developers and mitigation bankers, and would need to be structured in a manner to avoid directly regulating wetland impacts or endangered species' impacts exceeding local government authority.

Initiative 10: Modified Operations of Water Control Structures

It is recommended that Collier County work with the SFWMD to minimize baseflow by modifying water control structure operations where possible to reduce the difference between groundwater levels and the canal surface water elevation.

As discussed in the assessment of existing conditions, baseflow is a major source of excess flow to the estuaries and contributes to losses in groundwater storage. Computer modeling results indicate that the wetland area in the Okaloacoochee Slough, Camp Keais Strand, and the Corkscrew Swamp provides groundwater recharge on a year round basis. The analyses also indicate that large baseflow contributions to the canal network occur in the Golden Gate and Faka Union watersheds. It is expected that completion of the Picayune Strand Restoration Project will greatly reduce the baseflow contributions in the Faka Union watershed; therefore, the primary focus of this initiative is on structure operations in the Golden Gate-Naples Bay Watershed.

It is noted that at completion the Picayune Strand Restoration Project will reduce loss of groundwater through canal baseflow. However, the section of the Faka Union canal downstream from the "T" is expected to have a larger dry season baseflow compared to existing conditions.

A comparison of baseflow during the wet and dry seasons in the Golden Gate-Naples Bay Watershed indicates that, as expected, substantially more baseflow occurs during the wet season than during the dry in terms of total volume. The water budget analysis showed that 8.51 inches of baseflow occurs in the Golden Gate-Naples Bay Watershed during the wet season compared to 4.27 inches during the dry season. However, baseflow contributes more than 70 percent of the dry season fresh water discharges to the canal network, compared to 50 percent during the wet season.

Figure 3-7 and **Figure 3-8** show the average wet season and dry season baseflow contributions in the Golden Gate-Naples Bay Watershed. It is interesting to note that during the dry season, recharge is predicted to occur in several locations immediately upstream of operable gates, or near shallow potable water supply well fields.

The greatest volume of dry season recharge occurs immediately north of the CR951-1 structure which includes a pump to divert water from the Golden Gate Main Canal into the CR951 Canal. Results also indicate that water pumped into the CR951 Canal is returning to the Golden Gate Main Canal via baseflow. Groundwater recharge influenced by pumping for potable water supply is also observed in the dry season near the GG-4 structure.

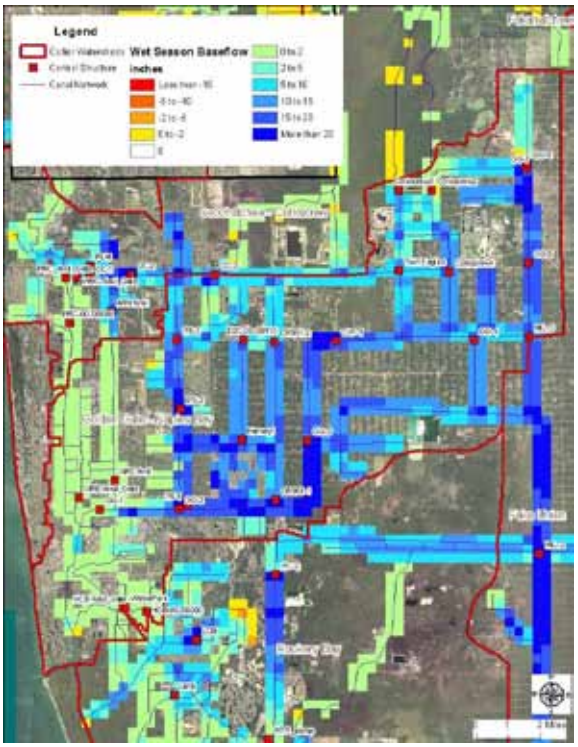

Figure 3-7. Average Wet Season Baseflow Contributions, Golden Gate Watershed

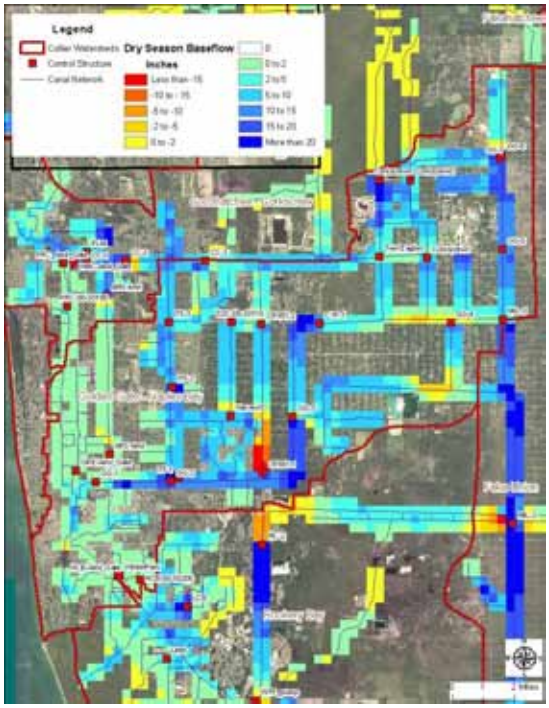

Figure 3-8. Average Dry Season Baseflow Contributions, Golden Gate Watershed

The analyses also show that the highest predicted baseflow values occurs immediately downstream of the operable structures and that baseflow decreases along the canal toward the next downstream structure. This is most evident along the Cypress Canal segment between structures CYP-1 and GG-3. This pattern of baseflow along the length of a canal segment is the result of staging water at different elevations upstream of each structure. Standard operating rules are defined by the SFWMD or by Collier County for each structure in the canal network.

These rules primarily rely upon the water levels upstream and downstream of the individual structures and are designed to stage water at different elevations during the wet and dry seasons. During the wet season, the structures are operated to stage the canals at an elevation that is approximately one foot (1 ft) lower than the dry season.

The lower elevation, paired with higher groundwater elevations due to rainfall, leads to an increase in baseflow. The defined operations may contribute to the seasonal difference in baseflow upstream and downstream of the individual structures. **Figure 3-9** shows the typical relationship between baseflow and the difference in groundwater and canal water surface elevations in the Cypress Canal. The data clearly indicates that managing canal stage to more closely match groundwater elevations is an important tool for reducing the volume of baseflow entering the canal network.

It is recommended that Collier County work with the SFWMD to modify structure operations where possible to reduce the difference between groundwater levels and the canal surface water elevation. The potential range of operations is constrained by the design and physical limitations of the structures and may limit the ability to stage water at a seasonally higher elevation within the canal network.

Therefore, design of new and replacement structures should consider seasonal groundwater head elevation data. The ability to more closely match canal stage and the groundwater head elevation will have long-term benefits to the estuaries by reducing baseflow to the canal network. Changes in structure operations must consider maintenance of minimum flows and levels as necessary to protect in-stream fish and wildlife.

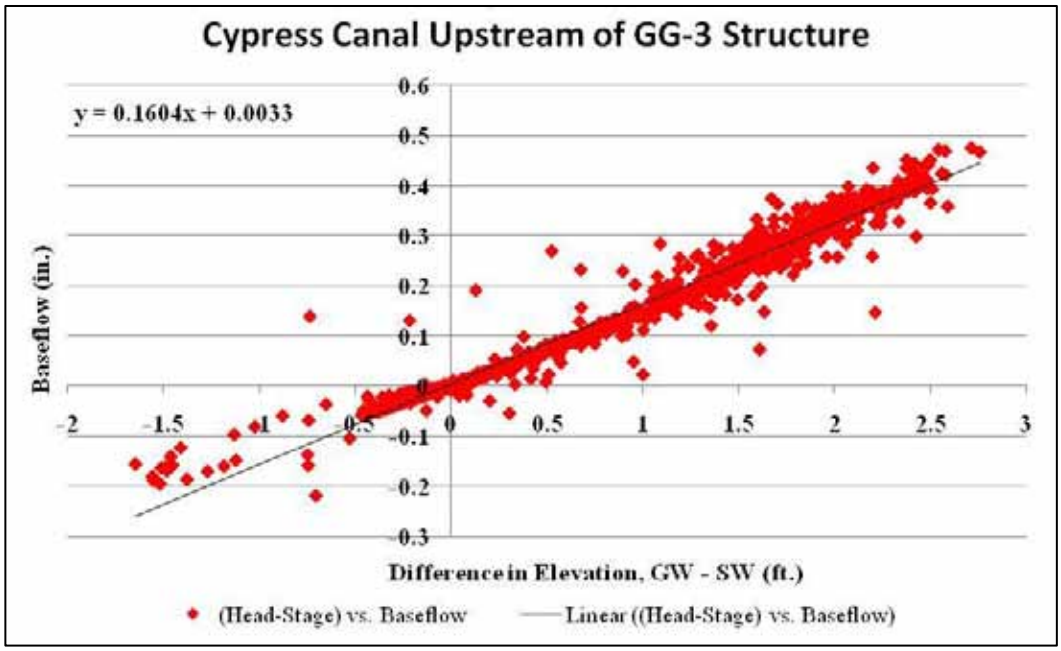

Figure 3-9. Relationship of Baseflow
and (Head–Stage) Elevation Difference

Initiative 11: Water Quality Monitoring Program

The main objective of the recommended improvements to the surface water monitoring program is to better define water quality conditions in the estuaries and along the canal network.

Existing Monitoring Programs

Surface water monitoring stations in Collier County are managed by multiple agencies. Each agency has different objectives and goals. The City of Naples surface water monitoring stations are located in the estuarine systems and track the long-term health of the estuaries. Similarly, Collier County and the FDEP monitor the Wiggins Pass estuarine system, whereas the Rookery Bay National Estuarine Research Reserve monitors the Rookery Bay and Ten Thousand Island estuaries.

The South Florida Water Management District (SFWMD) manages most of the inland surface water monitoring stations. Many of the stations are located near watershed outfalls and track water quality leaving the watershed and entering the estuary system. Other sampling stations are co-located at operational structures within the managed canal network. Some of the stations in the Immokalee area are likely used to identify potential sources of nutrient loading to Lake Trafford, but in general, the surface water monitoring programs do not seek to identify the loading contributions from specific land use or sub-drainage areas

Groundwater monitoring includes the Water Table and Lower Tamiami Aquifers. The monitoring wells are fairly well distributed across the county; however, many of the wells have not been sampled recently and do not provide current information.

As with the existing surface water monitoring programs, the groundwater wells are sampled by different agencies to meet different objectives. As an example, many of the wells located near the coast in the Cocohatchee-Corkscrew, Golden Gate-Naples Bay, and Rookery Bay watersheds are installed at locations where reuse water is used for irrigation. These wells are typically sampled two or three times per year and track groundwater water quality at or adjacent to irrigated lands. These wells do not measure off-site background concentrations or provide opportunities to assess regional groundwater quality trends.

Review of the reported groundwater data also indicated that there was no consistency in frequency of sampling, or in the analytical tests completed for each sample. As an example, the wells in the Picayune Strand State Restoration Project area have only been sampled once for analytical data, although the wells are monitored frequently for head elevation. These wells are also some of the few where DO results have been reported.

Recommended Monitoring Plan

The recommended monitoring plan includes three monitoring areas, surface water, groundwater, and wet weather discharges. They are described below. More detailed descriptions are provided in a technical memorandum prepared as part of this project.

Surface Water Monitoring

The main objective of the recommended improvements to the surface water monitoring program is to better define water quality conditions in the estuaries and along the canal network.

Estuarine Water Quality Monitoring

The number of existing estuarine monitoring stations is generally adequate to track water quality in the estuaries. However, monitoring should focus on the potential TMDL impairment issues, i.e. low dissolved oxygen concentration, high nutrient concentrations, iron, and copper. It is imperative that the County, the SFWMD, and FDEP work together to determine the cause of the low dissolved oxygen conditions. An issue of

importance is the location of the water quality stations. For example, several stations in the Rookery Bay watershed are located in landlocked areas or areas strongly affected by stormwater treatment systems. It is recommended that these locations be moved to locations that better represent actual estuarine conditions.

Canal Network Monitoring

There are adequate surface water sampling stations to measure nutrient contributions at the discharge from the Cocohatchee–Corkscrew, Golden Gate-Naples Bay, and Faka Union, Fakahatchee, and Okaloacoochee–SR29 watersheds into the receiving estuaries. However, it would be beneficial to establish additional permanent monitoring stations at all discharge points into the Rookery Bay Estuary. Stations exist on the Lely Canal and near the agricultural lands located in the southeast portion of the watershed; however, it would be useful to also monitor the Lely Manor Canal.

In addition, it would be beneficial to establish additional monitoring stations upstream in the Golden Gate and Cocohatchee canals to establish trends and potentially identify drainage areas that contribute high concentrations of contaminants. These stations would be located adjacent to existing water control structures.

Recommended additional locations for permanent monitoring stations are listed in **Table 3-6**. These stations should be sampled quarterly and analyzed at least for nutrients and metals. Similar to estuarine monitoring, canal network monitoring should focus on the potential TMDL impairment parameters, i.e. low dissolved oxygen concentration, high nutrient concentrations, and iron to determine the cause of the potential impairments.

Groundwater Monitoring

The overall objective of the expansion of the groundwater monitoring program is to achieve a better distribution in the monitoring well network. Better distribution of the wells will help define background levels of potential contaminants and allow the County to better understand the distribution of contaminants in groundwater. A goal is to improve the understanding of how land management practices affect groundwater quality.

Table 3-7 shows proposed locations of additional permanent monitoring wells. These wells are all located in the Water Table and Lower Tamiami aquifers and will provide better information about the distribution of contaminants in groundwater.

New monitoring well locations were identified based on the results of the groundwater pollutant loading analysis conducted as part of this project. That analysis identified areas with potentially high concentrations of nitrogen, phosphorus, and iron that require better data to confirm predicted results and to fill gaps where available data is outdated or where no data is available. In some case, installation of new monitoring wells is necessary. In other cases, existing wells can be redeveloped. Samples should be collected on a quarterly basin. Also FDEP recommends that monitoring wells be installed near Lake Trafford to assess groundwater contributions to the lake system.

Table 3-6. Proposed Permanent Surface Water Monitoring Stations

Watershed	Branch	Location	Comment
Golden Gate-Naples Bay	County Road 951 Canal	Crystal Lake Drive	Measure of contributions to Cocohatchee Canal from County Road 951 Canal
Golden Gate-Naples Bay	Cocohatchee Canal	Twin Eagles Structure	Measure of contributions to Cocohatchee Canal from upstream of Twin Eagles
Golden Gate-Naples Bay	I-75 Canal	I-75 Canal Structure 1	Measure of contributions from I-75 Canal to Golden Gate Main Canal
Golden Gate-Naples Bay	Gordon River Extension	Pine Ridge Road	Measure of contributions to Gordon River Extension from upstream of Pine Ridge Rd.
Golden Gate-Naples Bay	Cypress Canal	Cypress 1 Structure	Measure of contributions to Golden Gate Main Canal upstream of Cyp-1 Structure
Rookery Bay	Lely Manor Canal	US 41	Measure of contributions from Lely Manor to Rookery Bay
Faka Union	Miller Canal	Upstream–Miller 3 Structure	Sample when gate is open

Table 3-7. Proposed Groundwater Monitoring Stations

Watershed	Location	Comment
Cocohatchee – Corkscrew	North of Lake Trafford	Proposed by FDEP to monitor groundwater around Lake Trafford
Cocohatchee – Corkscrew	East of Lake Trafford	Proposed by FDEP to monitor groundwater around Lake Trafford
Cocohatchee – Corkscrew	West of Lake Trafford	Proposed by FDEP to monitor groundwater around Lake Trafford
Cocohatchee – Corkscrew	East of US 41 near Imperial Golf Course Blvd	Well to verify extent of potential hot spot for TN and TP
Rookery Bay	North side of US 41 near Willough at Naples Hospital	Well to verify extent of potential hot spot for TN and TP
Rookery Bay	North of US 41 along Greenway Rd.	No data since 1980's. Well to monitor effect of agricultural and urban development
Rookery Bay	North of US 41 along 6L Farm Rd.	No data since 1980's. Well to monitor effect of agricultural development
Rookery Bay	Near proposed extension of Wilson Blvd.	Well to verify elevated iron concentrations
Faka Union	Everglades Blvd south of I-75	Use existing well for background data
Okaloacoochee-SR29	Keri Road east of SR 29	Evaluate water quality at County boundary

Wet Weather Event Sampling Program

The pollutant loading analysis conducted as part of the watershed management plan was based on rainfall event mean concentrations (EMCs) used in the Southwest Florida Feasibility Study (SWFFS). Although the SWFFS was the best available information, better site specific data is necessary to assess nutrient loads from specific land uses such as single family residential and agriculture. These land uses vary in design characteristics as well as pollution control features.

It is recommended that a one-time sampling program be established to measure EMCs at specified locations.

The program would rely upon installation of automated sampling devices to collect samples during storm events from the areas listed below:

- One site to monitor runoff from residential development designed with curb and gutter
- One site to monitor runoff from a residential development designed with shallow roadside swales
- One site to monitor runoff from a golf course
- One site to monitor runoff from a commercial parking lot
- Two sites to monitor runoff from agricultural lands
- One site to monitor from an area likely to discharge copper-polluted runoff, i.e. boardwalks and pilings that are constructed from pressure-treated lumber.

Automated samplers should be installed at each location to obtain a minimum of 4 wet season samples and 4 dry season samples.

Monitoring Plan Cost Estimate

Cost estimates were prepared for each of the monitoring strategies. **Table 3-8** describes the assumptions made for each recommended type of monitoring and includes the total estimated cost. The cost assumes that all work would be completed by contractors, not by county staff.

Table 3-8. Estimated Annual Cost of Proposed Monitoring Plan

Monitoring Component	Assumptions	Estimated Annual Cost
Surface Water Monitoring	– Six new permanent stations at existing structures – Quarterly sampling – Analyzed for nutrients and metals	$32,000
Storm Event Monitoring (wet and dry seasons)	– Six temporary monitoring stations – Eight samples per site – Automated samplers are rented – Analyzed for nutrients and metals	$150,000 (Includes equipment rental of $55,000)
Groundwater Monitoring	– Wells in Water Table and Lower Tamiami – FDEP constructs 3 new monitoring wells – County constructs 4 new monitoring wells – County redevelops 4 existing wells – Quarterly sampling – Analyzed for nutrients and metals	$55,000 (Includes installation and redevelopment cost of $15,000)

Initiative 12: Additional Watershed Protection Programs

It is recommended that Collier County partner with the SFWMD as well as Lee and Hendry counties to provide incentives to agricultural land owners to install and manage Recyclable Water Containment Areas (RWCAs).

Various approaches are recommended for implementation to protect land that is considered of important environmental value. Those approaches are described below.

Recyclable Water Containment Areas

Description of the Program. Many of the agricultural lands in the northeastern parts of the county are predicted to contribute significant amounts of nutrients to surrounding wetlands and canals.

RWCAs are a relatively new concept proposed by the University of Florida, Southwest Florida Research and Education Center as a means of incorporating the agricultural community into regional environmental restoration efforts for mutual benefit (Hanlon 2005). RWCAs have been proposed as a method of inland water storage and treatment as either an alternative, or a compliment to large scale above ground storage reservoirs for the purpose of water impoundment.

RWCAs are temporary shallow water impoundments constructed on private crop lands that provide the south Florida community selected ecosystem services in exchange for compensation that would be less than that incurred if the state were to provide that service. Water stored in the RWCAs would not be available for municipal water supply or agricultural irrigation. The goal is total loss of the stored water to both evapotranspiration (ET) and infiltration. The RWCAs allow for groundwater recharge and nutrient sequestration. An RWCA would operate as a contractual agreement between government agencies and members of the private sector.

A similar program, the Florida Ranchlands Environmental Services Project (FRESP) (http://www.fresp.org/), is already under development by the South Florida Water Management District (SFWMD) for the Lake Okeechobee basin.

RWCAs would store non-urban runoff and stormwater drainage from cropped fields and, similar to standard agricultural impoundments, would be surrounded by a low perimeter berm and seepage ditch. Land within a participating watershed would be selected for water containment. This selected land would persist as a containment area for an agreed time period, usually five (5) years. Water within the impoundment would be retained at a depth of no greater than two feet and a weir structure feeding into a drainage system would bleed down excess water should the depth exceed two feet (Hanlon 2005). Transplanting or seeding of wetland plants is encouraged to maximize the productivity of the retention area while inundated.

When maintained properly, RWCAs provide a variety of environmental services. In return, the land owner through contractual agreement is provided compensation for the use of land and maintenance of the water containment area. The provided storage helps to slow flows to the coast, recharge groundwater, improve water and soil quality through nutrient sequestration and particulate settling, create temporary wetland habitat, and sequester carbon in the form of senesced plant matter (Hanlon 2009). To participate in an RWCA program, soil properties in the land proposed as a RWCA would have to be tested for elevated nutrient levels and deemed safe for water storage and capable of nutrient sorption (Hurt et al. 2004).

Recommendation. It is recommended that Collier County partner with the SFWMD as well as Lee and Hendry counties to continue providing incentives to

agricultural land owners to install and manage RWCAs. This program is currently being pursued within the areas in the Rural Lands Stewardship program area of Collier County, but outside of the Stewardship Sending Lands program.

It is also recommended that this program be extended to the agricultural areas used for production of row crops in Collier, Lee, and Hendry counties (**Figure 3-10**). One location includes the agricultural lands in the Rookery Bay watershed because runoff from these lands flow quickly to the estuary system. Also, other lands to be considered for this program are those in Lee and Hendry counties that drain into watersheds in Collier County. Potential locations for RWCAs considered for this program are those in Lee and Hendry counties that drain into watersheds in Collier County.

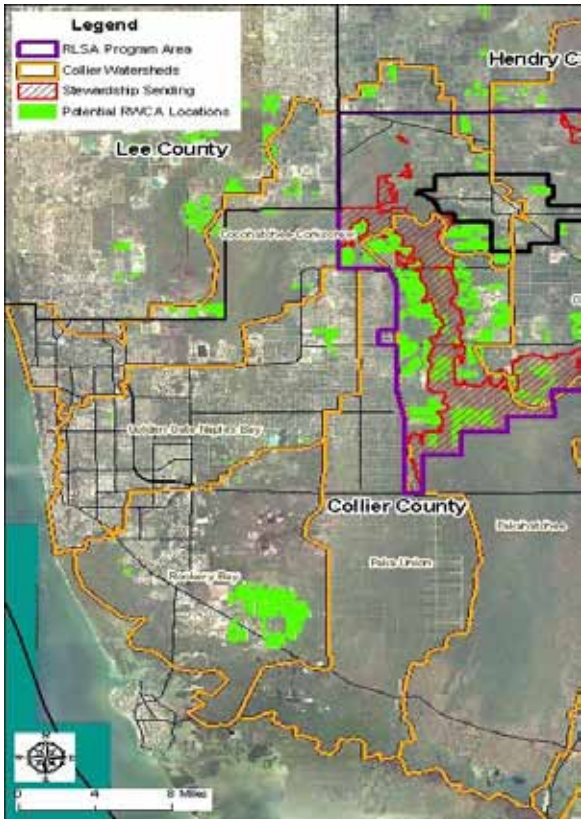

Figure 3-10. Potential Locations for Recyclable Water Containment Areas

Evaluation of Rural Fringe Neutral Lands

The methodology applied to identify resource protective lands is describes in Volume 4, Section 2.8. There are several areas in the Golden Gate – Naples Bay and Rookery Bay watersheds that have high resource protection value. These areas are defined as "Neutral" lands within the Rural Fringe Mixed Use District (RFMU). **Figure 3-11** shows the location of the RFMU Neutral lands. Two of the RFMU Neutral land areas are located within existing planned urban developments (PUDs). However, the other RFMU Neutral lands are located outside of existing PUDs.

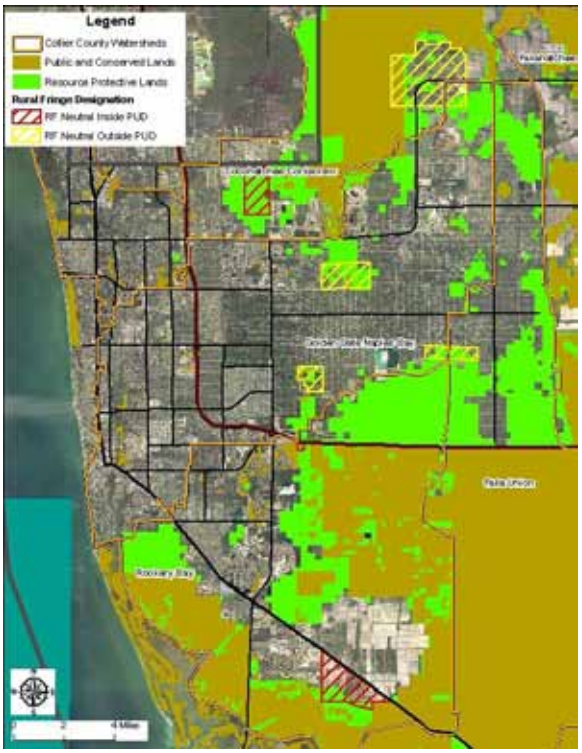

Figure 3-11. Rural Fringe Neutral Lands

Recommendation. Section 3.05.07 of the Land Development Code currently requires that 60 percent of the native vegetation present, not to exceed 45 percent of the total site area shall be preserved in Neutral lands. It is recommended that the designation for the Neutral lands, located outside of the PUDs be reconsidered. It may be appropriate to reclassify the areas as Rural Fringe Sending Lands and increase the required percentage of native vegetation preservation. This would provide a dis-incentive to develop areas of high resource protection value.

One of these areas located in the Cocohatchee – Corkscrew watershed adjacent to the Corkscrew Regional Ecosystem Watersheds. Reclassification of this area would reduce the potential impact of future development on the adjacent wetland systems and help offset the loss of valuable resource protective lands in the RFMU receiving area immediately to the south.

The other RFMU neutral areas outside the PUDs are located in the Golden Gate Estates. The reclassification of these areas would help reduce the density of future development in the Golden Gate Estates and lessen the impact of build-out conditions on the canal network.

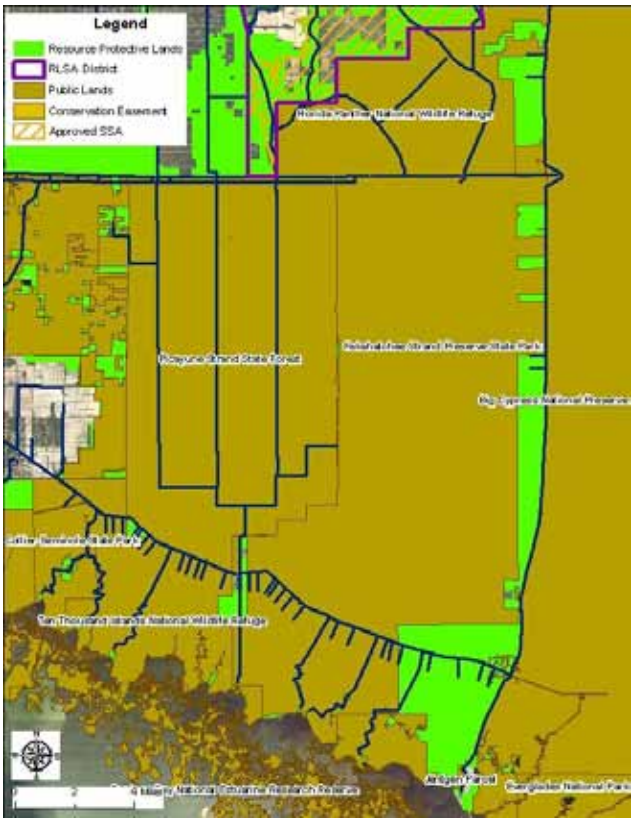

Figure 3-12. Resource Protective Lands along the State Road 29 Corridor

Land Acquisition

The Southwest Florida Feasibility Study evaluated multiple projects along the State Road 29 corridor designed to increase connectivity between the Big Cypress National Preserve and the Fakahatchee Strand Preserve State Park. There are several large tracts of land in this area that remain in private ownership. The location of these tracts is shown in **Figure 3-12**. Most of these private lands are wetlands that have high resource protection value. These lands are located within Areas of Critical State Concern. This designation limits development per the regulations in section 4.02.14 – Design Standards for Developments in the ST and ACSC-ST Districts. However, it is recommended that Collier County support the purchase of these lands by State or Federal agencies in order to ensure long-term protection of these lands and to provide increased connectivity among preserved lands.

Modifications of Preservation Standards

Section 3.05.07 establishes the preservation standards for single family residences and for lands that are outside the RFMU and RLSA districts. These standards require that a specified percentage of native vegetation be preserved and that preservation areas shall be interconnected to maintain wildlife corridors. The Preservation Standards currently exempt single family residences including a large portion of the Golden Gate Estates. This area is characterized by small wetland features and flowways that have been fractured by infrastructure installed in the 1960s.

It is recommended that the Preservation Standards exception for single family residences be lifted in those areas that include local wetland systems and historic flowways. In addition, incentives should be provided to encourage the consolidation of nonconforming lots into lots that meet minimum size requirements. It is also recommended that the required preservation percentage of native vegetation be re-evaluated for all development categories in order to reduce off-site impacts of future development.

Initiative 13: Stormwater System Maintenance and Certification

The purpose of this recommendation is to insure that all stormwater management systems within the jurisdiction of the Collier County Government are regularly inspected so that facilities operate as originally designed.

General

Maintenance is critical to proper operation of stormwater the stormwater system. This is particularly important to maintain the pollution removal efficiency of runoff treatment facilities. Improperly maintained facilities can increase the discharge of pollutants downstream, increase the risk of flooding, increase the instability of downstream channels, and lead to aesthetic and nuisance problems. In addition, poor maintenance of wet detention ponds, the most common treatment system in Collier County, can lead to unpleasant odors, nuisance insects, and algae blooms.

The Growth Management Plan and the Board of County Commissioners of Collier County have directed that every stormwater management system in Collier County must be properly operated, regularly inspected, and constantly maintained such that it functions as originally designed.

Operation, Inspection, and Maintenance Responsibility

In Collier County, many different types of entities are responsible for the varied parts of the stormwater system. Operations and maintenance activities of the primary and secondary drainage systems that serve multiple private entities are the responsibility of governmental agencies. These agencies are responsible for scheduled inspections and scheduled maintenance of those systems and for unexpected (not scheduled) repairs.

In addition to those systems, there are independent quasi-governmental agencies such as Community Development Districts (CDD) and Municipal Servicing Taxing Units (MSTU) that are responsible for maintaining large portions of the stormwater system. These types of entities generally hire private firms to conduct the work. Funds are raised through their taxing authority.

Legally established entities such as Homeowner Associations (HOAs) may also retain the responsibility for the operation and maintenance (O & M) of their stormwater management systems through legal documentation such as plats or surface water management permits granted through the South Florida Water Management District (SFWMD). HOAs and similar entities may also hire private engineers on an as-needed basis. For some of these entities a basis for generating revenues exists, such as a vote of the membership at a noticed meeting.

The owners of Commercial and Industrial zoned sites are responsible for the operation and maintenance of their systems. Since the site owner has his/her own source of O&M revenue, hiring an engineer or contractor is at his/her discretion.

There are locations that fall outside any of the sites mentioned. These locations may not be commercial or industrially zoned areas and may not have an organizational entity to handle their O&M. An example is the older platted residential subdivisions. These types of sites are the most difficult to manage since there is no formal chain of responsibility and no means of generating revenue. However areas that were approved and permitted to earlier standards must still comply with the provisions of this ordinance. These older subdivisions and projects will need to create O&M entities to insure that inspections and necessary repairs are done as required.

Current Inspection and Certification Programs

All permitted systems are initially inspected and approved for operation by Collier County. Also, in some cases portions of the systems are accepted by Collier County for maintenance. The SFWMD also manages a pond certification program by which pond operators are required to submit an annual pond certification prepared by a licensed professional engineer during the first 5 years of operation. Although these programs help maintain the facilities in good operation in the period following construction, a certification program is necessary to track operation of the stormwater systems over their design life.

Types and Scheduling of Inspections

The purpose of this recommendation is to insure that all stormwater management systems within the jurisdiction of the Collier County Government are regularly inspected so that facilities operate as originally designed. It is not the intention of this ordinance to implicate any third party for liability as a result of any action, or lack of such action, by the responsible maintenance entity. The following inspections and subsequent maintenance actions for every stormwater system in Collier County should be performed on the following regular schedule:

1. Within 60-days of June 1st each year a substantially competent pre-designated representative of the Agency, District, HOA, owner, or other entity shall visually review the components of the entire stormwater system. The intent is to notice any malfunctions, abnormalities, or potential problems from an above ground visual inspection. Also, water quality conditions in the outfalls of detention ponds will be inspected to determine if actions such as installation of an aeration system are necessary. Observations shall be noted in a log book that is kept on site in the management office or other commonly known location. Problems and potential problems must be reported to the responsible authority immediately and provisions for repair must be commenced as soon as physical conditions allow. The Agency, District, HOA or other managing entity will retain copies of the reports on site in the log book for a minimum of five years.

2. At each 5-year interval the Agency, District, HOA, owner, or other entity responsible for the O&M of the stormwater system shall submit a standard County Stormwater System Inspection Checklist (to be prepared concurrently with the ordinance) to the Collier County Floodplain Management Office, along with copies of the log book for the past 5 years. The checklist should include items that depict conditions of structural features and littoral zones, water quality characteristics such as presence of algae, and to the extent possible sediment buildup.

3. At each 10-year interval, inspections will include a measurement of the accumulated sediment. A minimum of one measurement per acre will be required.

The Checklist must be completed, signed, and sealed by Professional Engineer licensed in the State of Florida, or other "Stormwater Inspection Professional" approved by Collier County because of their experience or training.

Personnel Authorized to Conduct the Inspections

Annual inspections must be conducted by a competent pre-designated representative, not necessarily a Professional Engineer. The County may establish a training course to provide certification. As part of that program setup, the County will specify the minimum qualifications of individuals that may attend the certification course. Collier County will also accept the judgment of the maintenance entity in designating this person for the yearly walkthrough inspection. Five Year Inspections must be conducted by a licensed Engineer or County approved Stormwater Inspection Professional.

Initiative 14: Establish a Fertilizer Ordinance

The objective is to control nutrients at the source because it is less expensive and more effective than providing treatment after the pollutants have entered the surface waters.

Nutrient loading from urban areas is a very important concern for water quality. To help minimize the contribution of nutrient runoff from urban landscapes, agencies including the FDEP, Florida Department of Agriculture and Consumer Services, and the University of Florida Institute for Food and Agricultural Services (IFAS) developed a model fertilizer ordinance that can be implemented as a non-structural BMP. The objective is to control nutrients at the source because it is less expensive and more effective than providing treatment after the pollutants have entered the surface waters.

Collier County has already initiated the process to establish a fertilizer ordinance that is locally adapted, but based on the model fertilizer ordinance. Items addressed by the fertilizer ordinance include better control of fertilizer application rates, professional training, establishment of wetland buffers, and maintenance practices. Maintenance practices are included to limit the contribution of cut vegetation to surface water pollution. An adequate buffer distance is specified to prevent the direct deposition of fertilizer in water bodies by broadcast spreaders.

Concurrently with the issuing of the fertilizer ordinance to limit nutrient runoff, Collier County will implement a public education program that will be critical to increase compliance with the ordinance and promote recommended landscape maintenance practices that will help limit nutrient runoff loads. The program will focus on information about the fertilizer ordinance requirements, as well as information on fertilizer standards, and recommended irrigation and vegetative maintenance practices. Components of the education program may include development of web pages, mail inserts in the utility bills, and public information meetings.

Professional fertilizer applicators should be notified about the ordinance by sending a summary of the ordinance requirement to the existing license holders. They will also be notified of the requirement to attend and pass BMP training classes as well as information of opportunities to obtain the training through web-based programs or training classes offered locally by private organizations. Completion of the training is a requirement of future business licensing.

2.0 Regulatory Framework Implementation Schedule and Cost

Implementation of the Watershed Management Plan recommendations will require amendments to various Elements and Sub-Elements of the County's Comprehensive Growth Management Plan (GMP).

Implementation of the Watershed Management Plan recommendations, including but not limited to the recommended Water Quality and Low Impact Development (LID) program, water quantity and flood protection policies, monitoring programs, the TDR/Mitigation Area, and any additional protection programs will require amendments to various Elements and Sub-Elements of the County's Comprehensive Growth Management Plan (GMP), including amendments to the Golden Gate Area Master Plan (GGAMP), the Future Land Use Element (FLUE), Future Land Use Map (FLUM), and the Conservation and Coastal Management Element (CCME), the Drainage Sub-Element, and potentially other Elements and Sub-Elements.

These Plan amendments would then be followed by implementing Land Development Code (LDC) amendments to the degree necessary. **Table 3-9** shows the tasks and an estimated schedule necessary to establish the regulatory framework needed to implement the recommended initiatives. It also shows an estimate of the cost associated with County staff time required to participate in the process. It is noted that the regulatory process at the State level is in flux at the time of preparing this estimate. Rule 9-J5 (which implements much of the Comprehensive Planning process) has been repealed. It is likely that whatever new procedures and rules are adopted, they will be more streamlined and less costly. This estimate is based upon current and known procedures, but can be revised when new procedures and established.

Table 3-9. Tasks, Schedule, and Cost Associated with Establishment of the Regulatory Framework

Task	Days to Complete	Projected Hours	Project Cost**
Policy Discussion Regarding Proposed Watershed Plan and related GMP and LDC amendments (before EAC, CCPC, and BCC)	90	60	$7,200
Creation of TDR Oversight Committee and Committee Work Period***	360	720	$86,400
Preparation of final draft GMP amendments for public hearings before EAC, CCPC, BCC (Transmittal Hearings) and Transmittal Hearings	150	400	$48,000
DCA Review and issuance of Objection Recommendation and Comment (ORC) Report (issued 60 days after completion determination)	70	30	$3,600
County review of ORC and Adjustments to address Objections (and Recommendations and Comments). Revisions as necessary and Adoption hearings before EAC, CCPC,BCC); Begin to Draft LDDC Amendments	120	300	$36,000
Final Preparation of LDC Amendments	60	240	$28,800
LDC Amendment final draft and hearings (again, EAC, CCPC,BCC)	100	200	$24,000
Total Estimated Staff Time, Hours, and Cost for Completion (Including TDR Oversight Committee Review Period)	1,000	1,950	$234,000
Total Estimated Staff Time, Hours, and Cost for Completion (Excluding TDR Oversight Committee Review Period)	640	1,230	$147,600

**Cost to a developer and/or homeowner have not been estimated at this time as the details of any proposed regulations are unknown. For example, costs will need to be weighed against any available incentives. Once draft LDC amendment language is developed, detailed estimated fiscal impact associated with a proposed regulation can be estimated (in fact this is required, as a part of the LDC amendment process).*

***Cost is estimates at $80.00 per hour for senior level staff plus%50 cost for benefits and overhead (Total $120.00/hour). Total estimated hours with TDR Oversight support equals 1950 , plus or minus 1.0 FTE over 33 months (or about .35 FTEs per year).*

****Oversight Committee as proposed is limited in Scope (to TDR Program) thus other proposed amendments may not be subject the Committee Review Period (Estimate for Oversight Committee work increased to 360 days based upon DSAC discussion).*

3.0 Watershed Management Plan Conclusions and Recommendations

Implementation of the Watershed Management Plan recommendations must be vetted by the stakeholders and will require development of a public education program

Conclusions

Key conclusions derived from the development of the Collier County Watershed Management Plan (WMP) are:

- The WMP was developed to fulfill the Growth Management Plan commitment to assess and protect the County's water resources and natural systems. Completion of the WMP supports objective 2.1 of the Conservation and Coastal Management Element.

- The County watersheds represent an integrated hydrologic system. The existing watersheds divides are the result of human impacts due to increased impervious areas and construction of roads and drainage canals. Therefore, a comprehensive countywide approach is necessary to provide restoration and better management of the resources.

- Human activities have had the largest impact on the area's hydrology. Natural systems have been drained to facilitate agricultural activities and urbanization.

- Large volumes of additional freshwater are being discharged to the estuaries. A major issue is the large amount of baseflow (groundwater) resulting from the drainage canals cutting into the aquifers. Baseflow represents up to 70 percent of the total flow to the estuaries during the dry season.

- Development activities and the associated hydrologic impacts have also resulted in the discharge of pollutants and the associated degradation of water quality conditions. FDEP has identified numerous cases of water quality impairment, that is, water bodies that do not meet the State's water quality criteria.

- The groundwater system has also been impacted by the reduced recharge caused by the increased impervious surfaces. Also, groundwater uses to meet agricultural and potable water supply demands have resulted in large aquifer drawdowns that have impacted the wetland systems and increased the risk of salt water intrusion.

Recommendations

WMP recommendations include a combination of structural projects and non-structural initiatives. Implementation of all these projects, particularly the non-structural initiatives, must be vetted by the stakeholders and will require development of a public education program.

- Implementation of the WMP is to be accomplished by utilizing existing staff to construct the ranked recommended projects (**Table 3-10**) and non structural initiatives as time and existing budget allow.

- The same methodology used during WMP development to assess existing conditions and benefits of proposed project should be used to track changes over time. Updates to be conducted by County staff are recommended every five years for consistency with the TMDL program cycle.

- Ten structural projects totaling an estimated construction cost of approximately $24 million are recommended for implementation by the County in cooperation with SFWMD and other agencies.

- Implementation of the structural projects is to be accomplished with existing stormwater budget, partnering, and grants as funds become available following Lely Area Stormwater

Improvement Project completion. The projects can be phased into the Capital Project schedule as budget permits.

Table 3-10. Structural Projects Ranked by Estimated Benefit to Cost Ratio.

Project Name	Total Score	Estimated Cost ($ millions)	Benefit-to-Cost Ratio
Corkscrew Regional Ecosystem Watershed	2.01	0.10	20.95
North Golden Gate Estates Flowway Restoration	30.09	2.37	12.71
North Belle Meade Spreader Swale	25.24	7.03	3.59
Henderson Creek Diversion	20.00	5.71	3.50
South I-75 Canal Spreader Swale	10.49	3.13	3.35
Wolfe Road Wetland Treatment System	3.45	1.42	2.44
Upper Golden Gate Estates Canal Weir Construction	0.67	0.55	1.21
Orange Tree Canal Control Structure Installation	0.67	0.55	1.21
Henderson Creek Off-Line Storage Reservoir	2.33	2.93	0.79
US HWY 41 Stormwater Treatment Area	0.15	0.54	0.28
Total Construction Cost ($)		**24.3**	

- Eight restoration projects were identified within Stewardship Sending Areas (SSAs) or within Flowway Stewardship Areas. Implementation of these, and other similar types of projects, should be encouraged through existing incentive programs. The projects involve restoration of isolated wetland areas. Implementation of these projects may require public –private partnerships.

- Non structural initiatives are to be implemented by developing policy, standards, and or criteria in scheduled LDC and Growth Management Plan amendment cycles utilizing existing staff, committees and with only minor consulting technical assistance. A general strategy for implementing the non-structural initiatives is presented in Section 2.0 of this report.

- Develop a Low Impact Development (LID) program as an incentive based program that requires on-site stormwater runoff treatment for new development. The program will be implemented with existing staff by creating Land Development Code (LDC) incentives to encourage and offset any additional startup or operational costs. Focus will be on techniques that maximize water quality and recharge benefits. Based on input from local stakeholders, the current 150% treatment will be maintained and the LID approach will be set as an additional land development requirement.

- Start a Stormwater Treatment System Retrofit program to upgrade public systems with LID and other techniques to maximize water quality and recharge benefits as grants and stormwater budget funds are available. Funds could also be used to fund projects with MSTUs

- Consider switching to a Fee-Based Stormwater Utility that could create incentives to retrofit private property for improved water quality treatment and recharge. Structure of the fees would not increase the total revenues but would reward users with effective treatment systems. This initiative would require an initial fee rate study that would be funded by grant or from existing stormwater funds. Implementation of this initiative, including system setup, may require up to two years.

- Utilize existing staff develop flood protection LDC requirements for stormwater treatment system standards proposed in Initiatives 4, 5, and 6to prevent increased flooding risk to downstream properties.

- Consider changing the Flood Protection Levels of Service (FPLOS) standard by utilizing existing staff to analyze the proposed system to insure it has the intended benefit of expanding the range of grading and identifying critical areas for improvement. IF analysis is positive develop an implementation plan to amend the standards in the Growth Management Plan.

- Evaluate the feasibility to develop a North Golden Gate Estates (NGGE) Transfer of Development Rights program within the North Golden Gates Flowway Restoration Area to encourage restoration of valuable resource protective areas and improve recharge of the Surficial aquifer system. This will be accomplished utilizing existing staff and an oversight committee to determine if there is support for the program. Final acceptance of the program will be through EAC, and Collier County Planning Commission reviews and BCC approval.

- Develop a NGGE mitigation program to ensure stormwater treatment, and floodplain storage capacity within the functional watershed is not lost. This will be a pilot program that can be utilized in other basins if it is effective. Existing staff will work alternatives through the review process during the nest Golden Gate Master Plan revision.

- To maximize ground water recharge, improve water quality, and reduce ground water discharge to the canal network staff will work with South Florida Water Management and Big Cypress Basin staff to improve the operation and or design of the Water Control Structures in future planned basin and structure evaluations.

- Refinement of the existing Water Quality Monitoring program to add additional stations and include focused stormwater runoff sampling will be accomplished through contract negotiation with partners, reevaluation of the existing monitoring program, and or grant opportunities.

- Existing staff will work with state and federal partners to develop the Additional Watershed Protection Program as stormwater funds and or grants are available. This program includes efforts to encourage storage and treatment of stormwater in fallow agriculture areas and undeveloped estates lots to improve water quality, recharge and delivery of fresh water to the estuaries. The other component of the program is to reevaluate the preservation standards in rural fringe neutral areas with identified resource protective areas.

- A Stormwater treatment system certification program will be developed by existing staff utilizing guidance in the draft State Stormwater Quality Applicant's Handbook and Conservation and Coastal Management Element Policy 2.2.5 in the next LDC or as an alternative staff could be directed to modify CCME Policy 2.2.5 through the EAR Based amendments to eliminate this requirement.

- Develop a Florida-Friendly Fertilizer Use on Urban Landscapes ordinance and complimentary public education program utilizing existing staff.

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Appendix 3-A

Low Impact Development Approach

Appendix 3-A
The Low Impact Development (LID) Approach

Research has shown the watershed imperviousness has a direct relationship with stream degradation (MWCG 1995). In addition, as indicated previously, exclusive reliance on conventional BMPs is not allowing streams to meet water quality standards. Therefore, a new approach based on the preservation of a site's natural features has been found to be an effective way to minimize pollution loads and help preserve the natural system.

LID is a well established approach to stormwater management that relies on hydrology-based site planning and design. LID aims at minimizing the volume of runoff reaching the receiving water bodies and managing it as close as possible to where it is generated. Techniques defined as micro-controls are implemented in a dispersed fashion throughout a site. The basic principle is to attempt to mimic pre-development hydrology by detaining and infiltrating rainwater close to the source thereby replicating the natural pathways. LID techniques are often more cost effective than the conventional stormwater management approach that relies primarily on fast drainage through storm drains, ditches and/or canals that take runoff to central detention facilities or to open water bodies.

1.1 Framework

Meeting water quality standards and addressing the water surplus/deficit issues affecting the natural system requires application of a variety of new tools and approaches that need to be grounded on a common framework consisting of the following main elements:

Hydrology Centric Site Planning. Site design should consider maintaining the natural site's hydrology, or helping restore hydrologic conditions if previously impacted. The objective should be the protection of hydrologically beneficial assets such as soils, native vegetation, wetlands, and natural drainage patterns. Hydrology centric site planning typically results in better site layout and reduced development costs.

Water Quality Improvement. The Florida stormwater treatment rule is specifically aimed at reducing the input of nutrients to receiving waters. Nutrient load reduction is most effectively attained by both reducing runoff volume and reducing sources of nitrogen and phosphorus. If stormwater runoff treatment is necessary, controls should be based on appropriate unit processes for pollution removal, particularly nitrogen and phosphorus, that considers the chemical characteristics of the pollutants.

Habitat Protection. Runoff reduction and water quality improvement have a direct beneficial effect on natural habitat. Site development should strive to preserve and/or restore natural resources on site such as wetlands and native vegetation on site.

Effective Land Use. Collier County is not yet as urbanized as other neighboring counties but development pressure is mounting. Comprehensive planning at the county level and judicious site planning at the development level allows effective deployment of new infrastructure,

reduced maintenance needs, enhanced community aesthetics, and access to natural resources for recreation.

Whole-Life Cost-Effectiveness. The implementation of a stormwater management program should consider the costs of development in terms of both construction and operation and maintenance (O&M), as well as the potential gains associated with the environmental and social benefits to the community.

Enhanced Aesthetics: Planning and engineering measures for stormwater control should be blended into streetscapes and landscapes and become assets to the community.

1.2 Implementation Techniques

LID implementation techniques are divided into three categories: planning, stormwater controls, and pollution prevention. Following is a description of these categories, along with the techniques that we believe can be implemented in Collier County.

Planning Techniques. At the site level, planning techniques are aimed at taking advantage of existing assets, especially those that help maintain the hydrology of the site and minimize runoff volume through maximization of the hydrologic performance. These techniques include:

- Promote site design based on natural hydrologic patterns by conserving / restoring such features as drainageways, wetlands, stream corridors, riparian buffers, and forested areas.
- Maximize the extent of pervious areas and areas of absorbent landscape, while minimizing paved areas.
- Disconnect impervious surfaces from conveyance systems so that runoff discharges to on-site pervious areas.
- Manage runoff close to where it is generated by creating micro-controls adjacent to paved areas
- Protect areas of permeable soils.
- Design multiple storage systems throughout the site to maximize the assimilative capacity and create redundancy.
- Minimize site disturbance during construction. Research (Gregory, 2004) has shown that to maintain predevelopment infiltration rates, identified areas within a subdivision, or specific areas within a lot, should be left undisturbed because even a small degree of compaction of imported soils has been found to drastically reduce infiltration capacity.
- Protect native vegetation existing on site. Conserve as much as possible of existing trees and shrubs

- Use native species in landscaping plans and providing sufficient top soil to promote healthy plant development and minimize chemical application needs as well as irrigation needs
- Substitute turf with native species consistent with Florida-Friendly Landscaping guidelines
- Promote cluster development practices with higher densities that reduce road length and utility footprint.
- Apply road width requirements that are consistent with actual average daily traffic needs based on the number of homes served.

Stormwater Controls Techniques. From its inception, the application of LID recognized that, depending on specific site characteristics, a versatile set of controls is needed for effective stormwater management. These techniques belong to a broad array of engineered features aimed at mitigating anthropogenic impacts in terms of both water quantity and quality. Key objectives are to minimize the volume of runoff discharged into the public collection system and design the stormwater controls in a way that is consistent with the chemical unit processes associated with the pollutants of interest. Disperse deployment of micro-controls throughout the site is emphasized, but the stormwater management strategy can also include end-of-pipe devices such as detention basins and constructed wetlands.

The strategy to treat stormwater is summarized below:

a) **Runoff segregation.** Rain that falls on roofs should not be allowed to come in contact with fertilizers and other ground-level pollutants.

b) **Stormwater controls in series.** Stormwater controls should be installed in series to obtain incremental treatment levels. It should be noted that the upstream- most controls provide the largest removal, when properly sized. The removal efficiency of additional controls downstream is much less because the influent concentrations have been reduced. Stormwater controls in series benefits system redundancy.

c) **Bioretention.** Roof runoff should be directed to bioretention areas located in the fill pads devoted to building construction. Pad configuration may have to be slightly modified to locate the bioretention facilities at sufficient distance from the buildings. The bioretention facilities should be designed to exfiltrate the water into the surficial aquifer. Stormwater planters around buildings can also be used to treat roof runoff. The filter media in the bioretention facilities shall be engineered for nutrient removal. Guidelines have been provided in the 2008 publication *Alternative Stormwater Sorption Media for the Control of Nutrients* by Marty Wanielista and Ni-Bing Chang, researchers for the Stormwater Management Academy of the University of Central Florida. From the findings of this publication, it is possible that limestone material from site excavation can be used as a component of the engineered media.

d) **Filter strips.** As implementation of imperviousness disconnection, filter strips should be added to receive runoff from paved areas and discharge it to bioretention facilities, vegetated swales, or other stormwater controls.

e) **Surface depression.** Design absorbent landscape areas as depressions that temporarily store stormwater and allow it to infiltrate. The drainage properties of these areas should be designed so that they infiltrate the water without becoming a nuisance.

f) **Permeable pavement**. Permeable asphalt or concrete should be used in parking lots as much as possible. In combination with conventional pavement for high traffic surfaces, permeable pavement is an effective way to retain runoff. The gravel reservoir below the pavement stores the water and exfiltrates it through the bottom. If drainage through the bottom is limited by the fill material, perforated pipes can be used to drain the reservoir. Several studies of permeable pavement systems are available on the University of Central Florida (UCF) Stormwater Management Academy's website http://stormwater.ucf.edu.

g) **Conveyance in vegetated swales.** Provide vegetated swales between building pads and along streets and driveways. The swales should use the engineered filter media described above. Check dams should be used to enhance infiltration.

h) **Pocket wetlands.** Distribute pocket wetlands through the site, in series with other stormwater controls, to receive up to 10 acres of areas drained by swales. Pocket wetlands can also receive drainage from pervious pavement to restore the storage in the gravel bed.

i) **Central treatment facility. Performance of conventional s**tormwater treatment facilities such as detention ponds can be enhanced with littoral shelves; settling basins or phyto-zones; wetland areas, especially upstream of outfalls; and internal berms to lengthen the flow path. Floating wetlands can also be deployed. These central facilities need to be stocked with fish to control mosquitoes.

j) **Stormwater harvesting.** Runoff stored in a detention facility can be used as a source of irrigation water. In addition to reductions of pollutant loads to surface waters, stormwater harvesting can reduce potable water use.

Other LID stormwater controls can be applied depending on the nature of the site and can lead to innovative solutions. The following are examples of these other alternatives:

- Vegetated roofs absorb rainwater and the excess can be directed to stormwater planters or bioretention facilities as described above. Vegetated roofs provide additional benefits in roof membrane longevity and cooling energy savings. These systems are most commonly deployed in large buildings with flat roofs.
- Rain barrels and cisterns can be used to collect runoff from conventional roofs. The water could be used later for irrigation but if not used, it must be drained from the cisterns to provide storage for the next rain event.

Pollution Prevention Techniques. These techniques are aimed at minimizing pollutant loads and include the following:

- Enforce fertilizer management ordinances

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- Designate elements of landscaping (e.g., vegetated swales, bioretention facilities, and surface depressions planted with absorbent landscape) as stormwater management devices where no chemicals shall be applied
- Educate homeowners about impacts on water quality of excessive chemical applications. A tool available for this purpose is the Florida Yards and Neighborhood handbook.

Appendix 4-A

Comparison of Model Input and Result
Picayune Strand Restoration Project
Natural Systems MIKE SHE – MIKE 11 Model
Existing Conditions (2000) MIKE SHE – MIKE 11 Model

Plate 1. Comparison of ECM and NSM Topographic Elevations

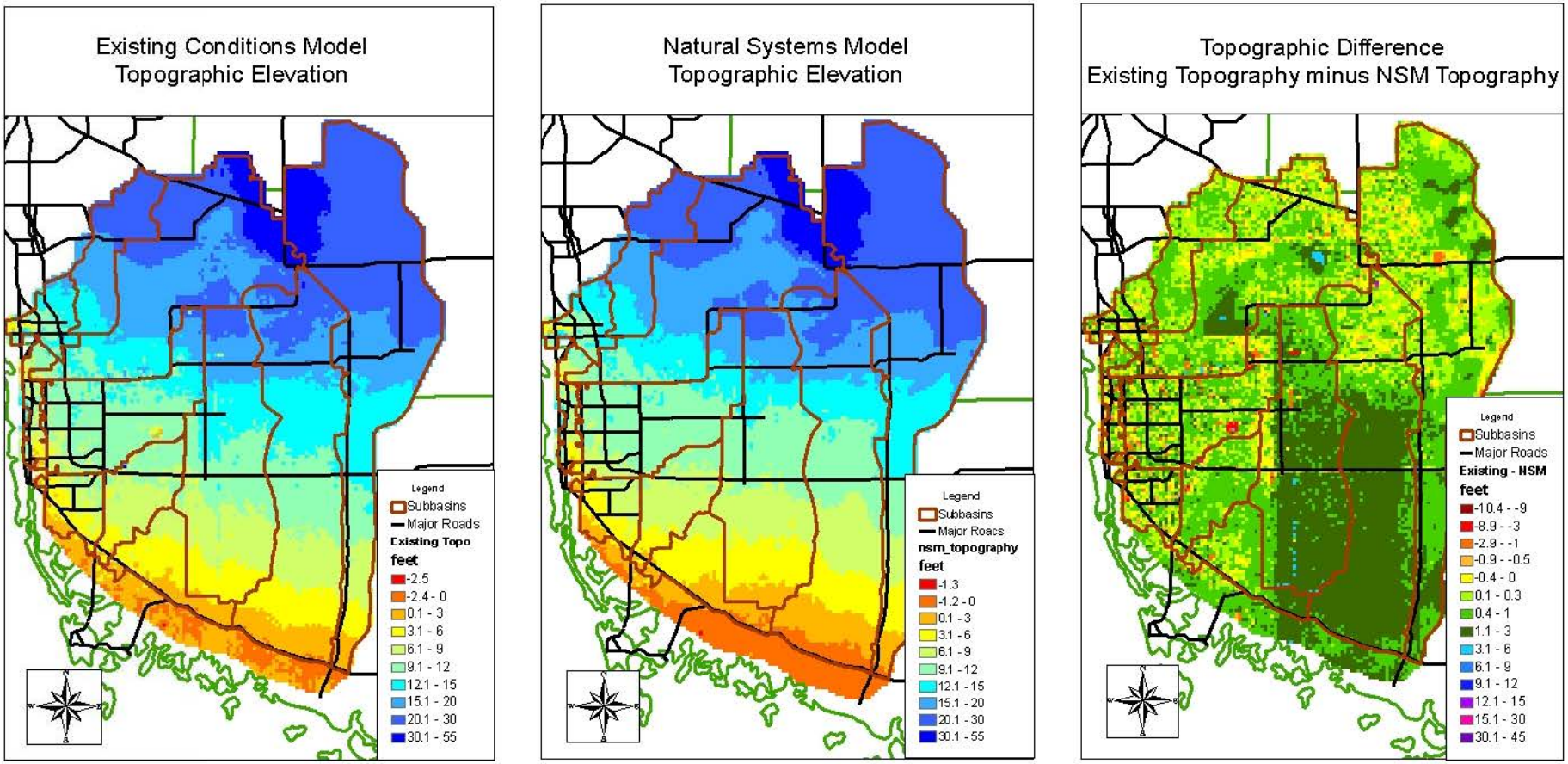
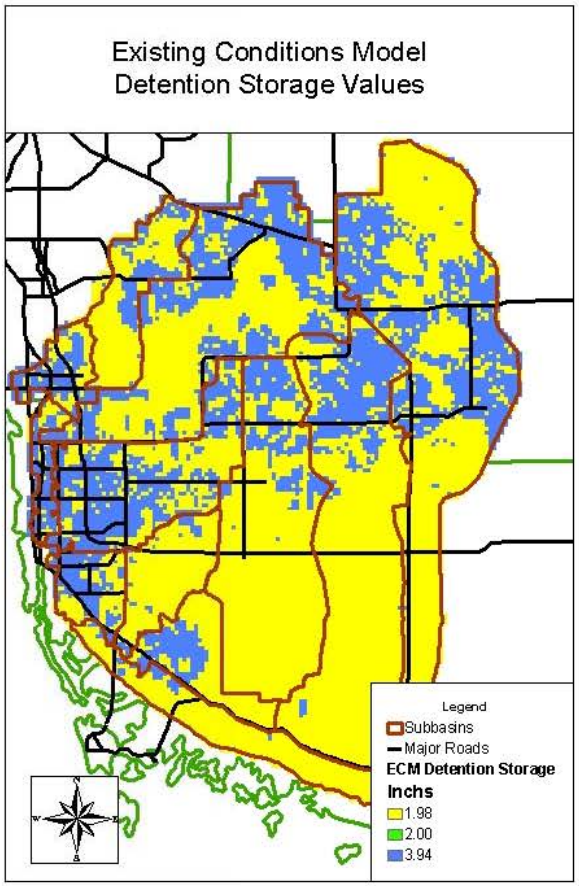
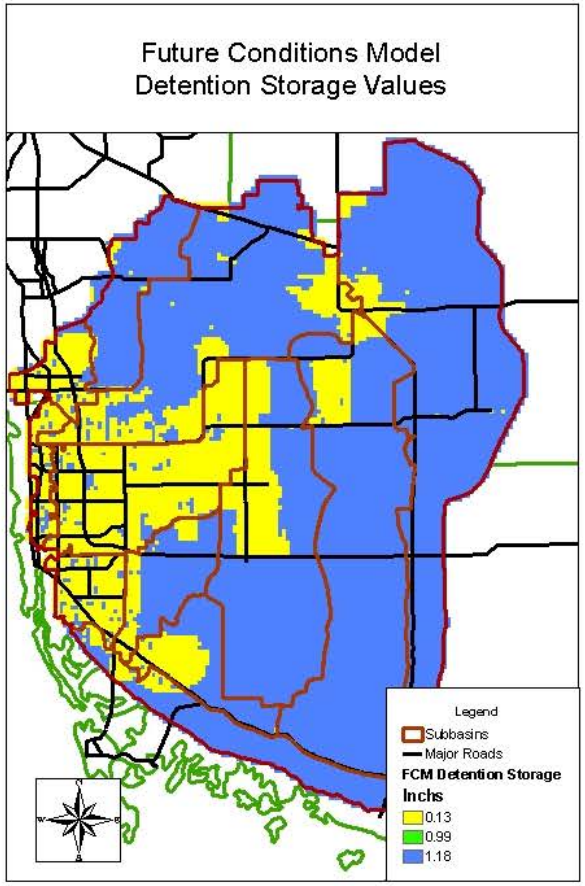


Plate 2. Detention Storage Model Input Values





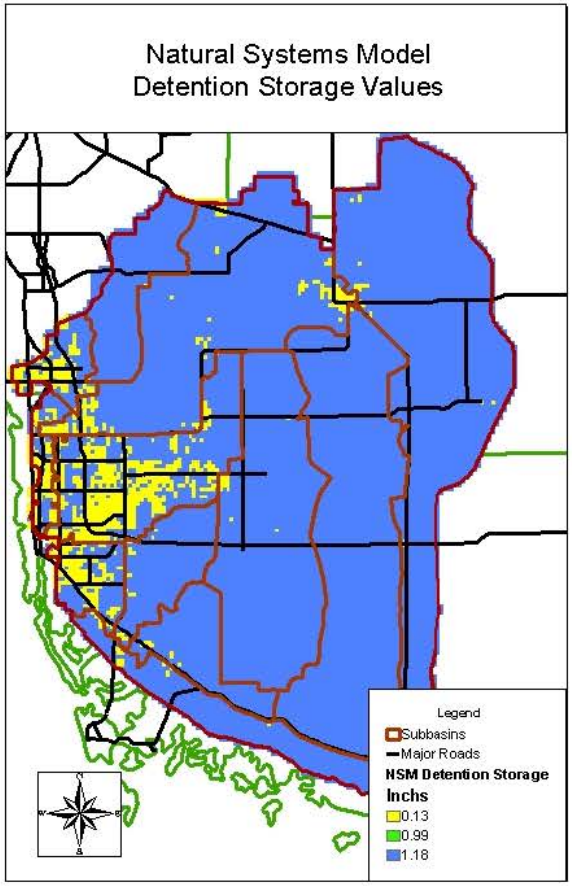
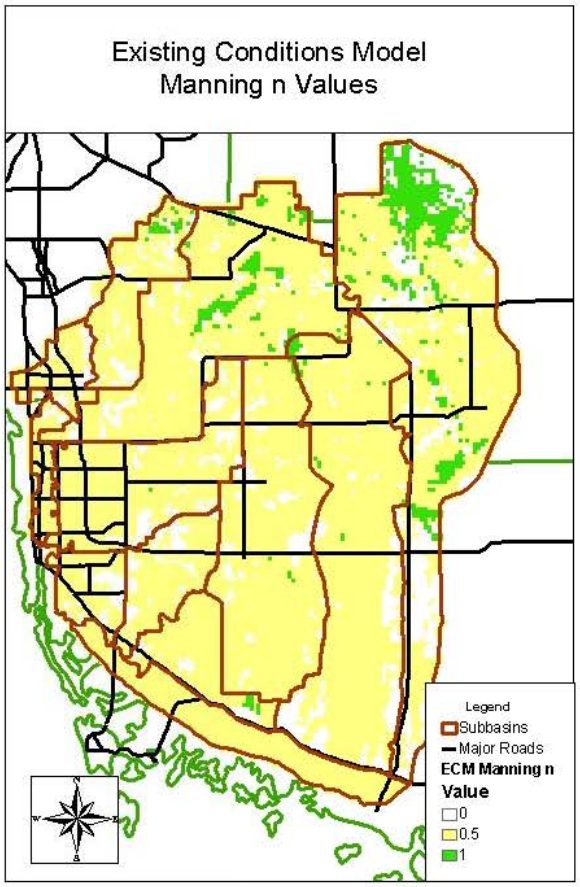
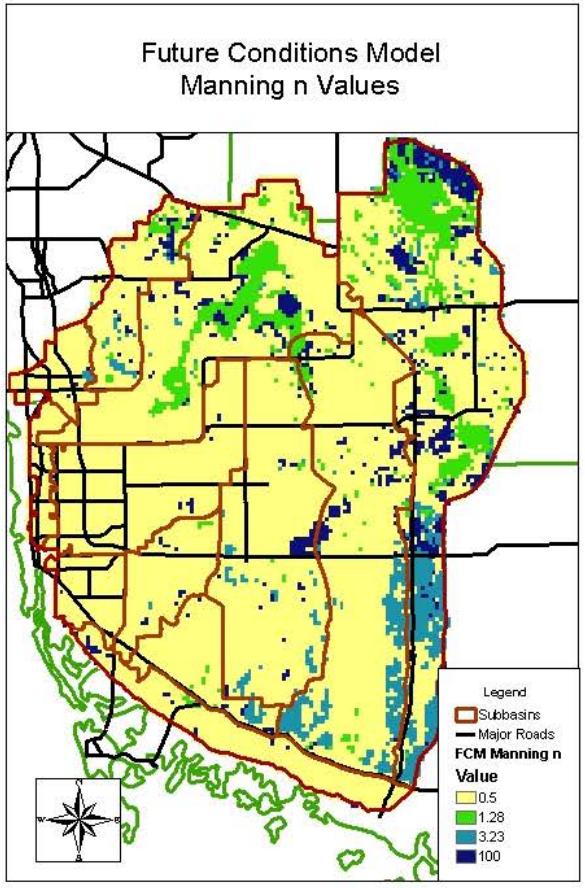


Plate 3. Manning n Model Input Values





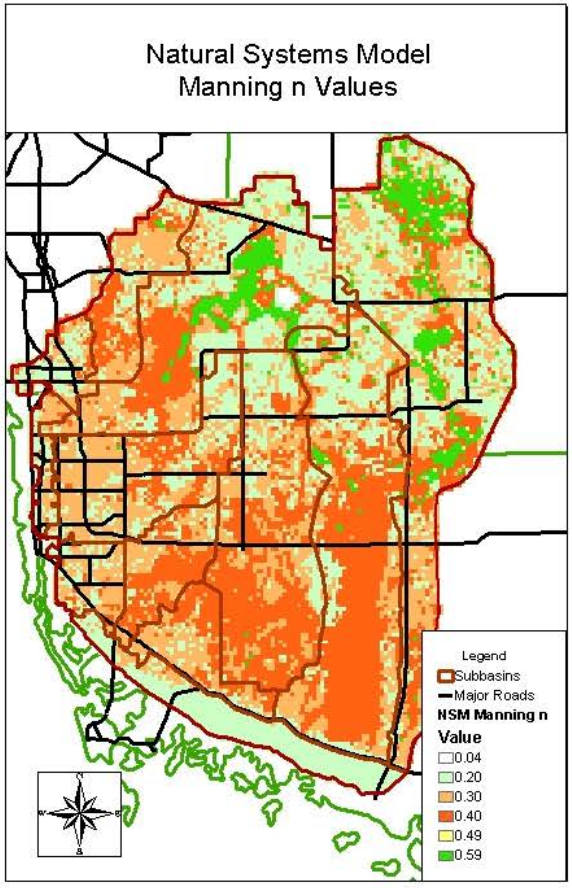
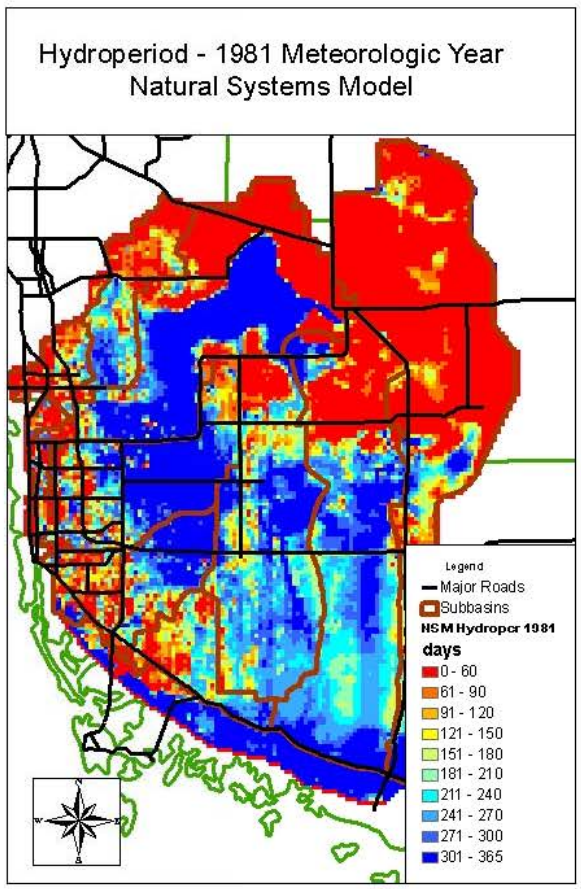
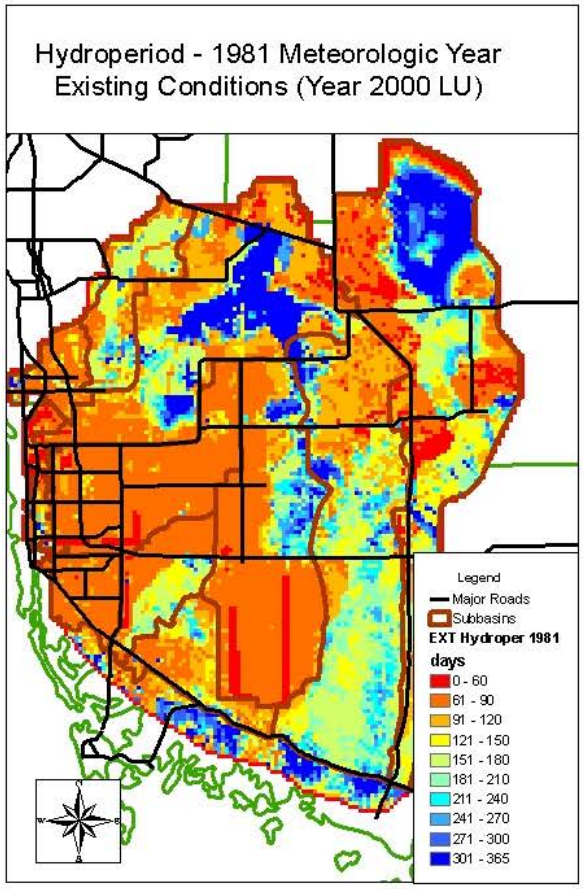


Plate 4. Annual Hydroperiod Maps for the Dry (44.29 inchs) Year





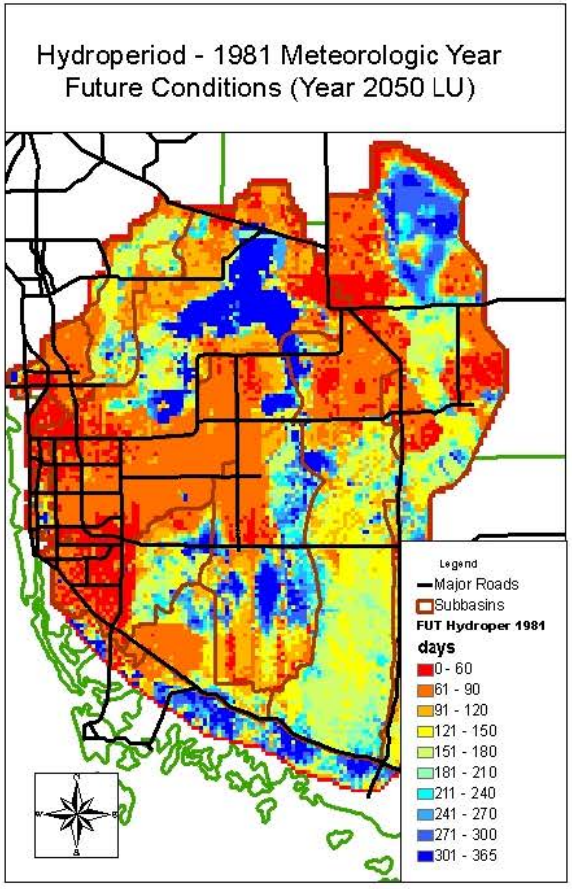


Plate 5. Annual Hydroperiod Maps for Wet (76.18 inchs) Year

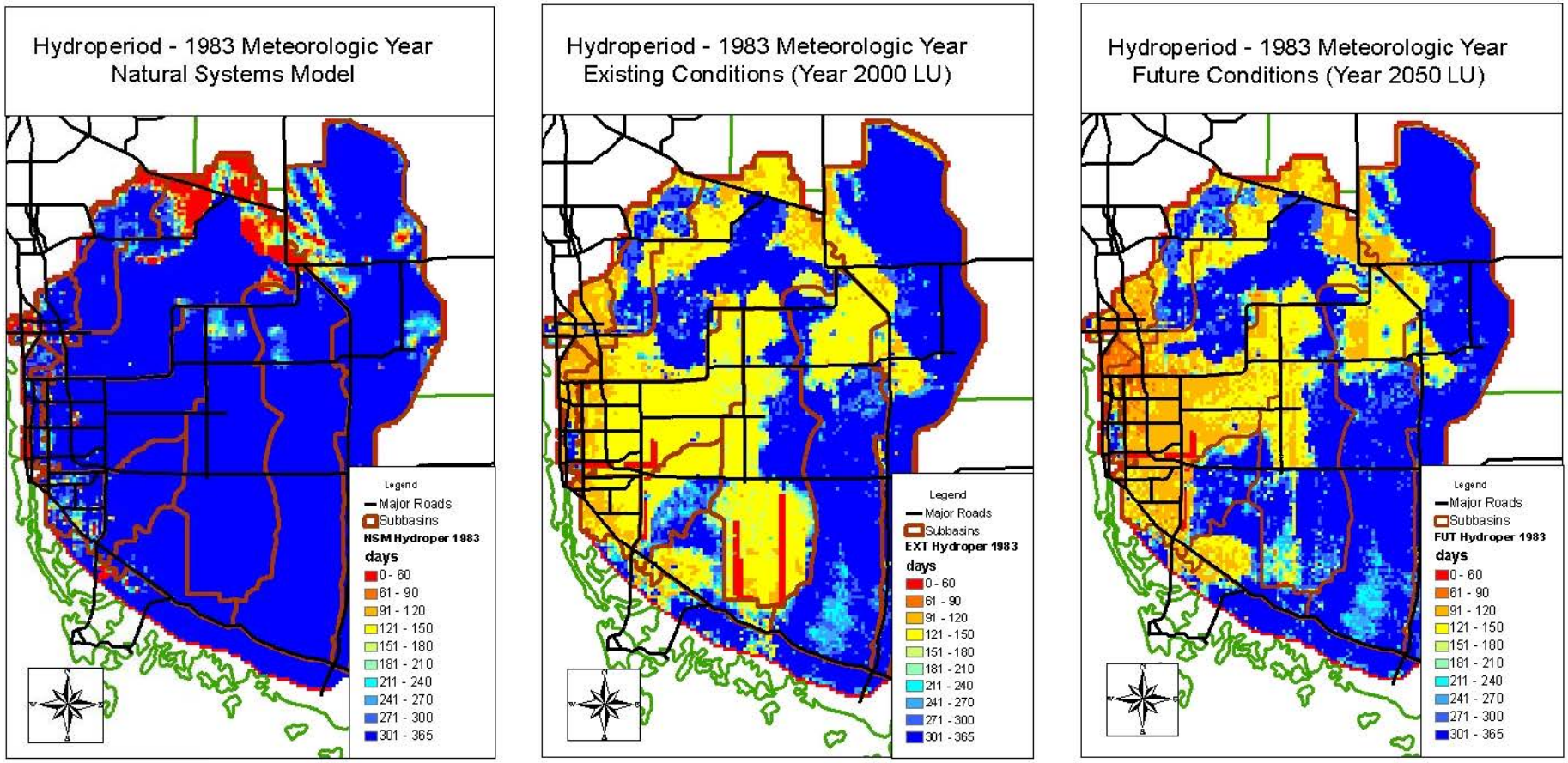
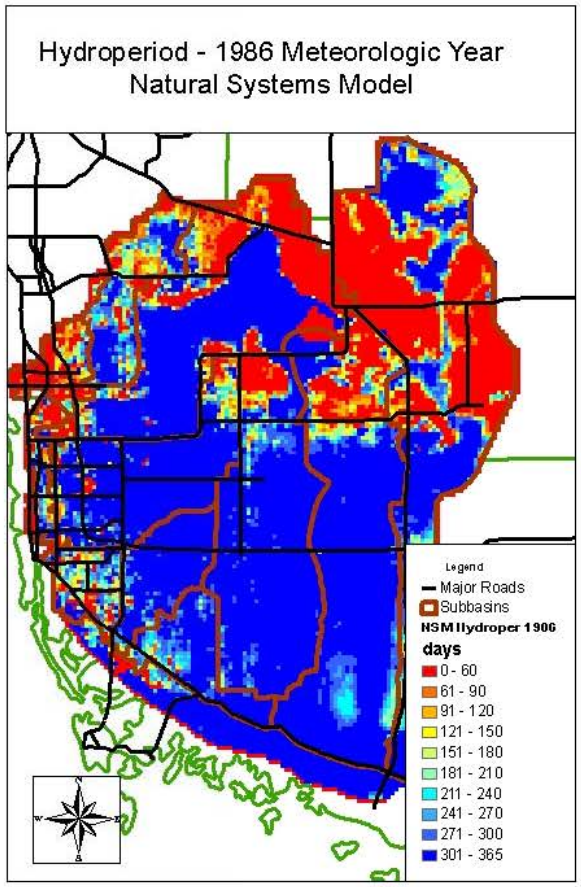
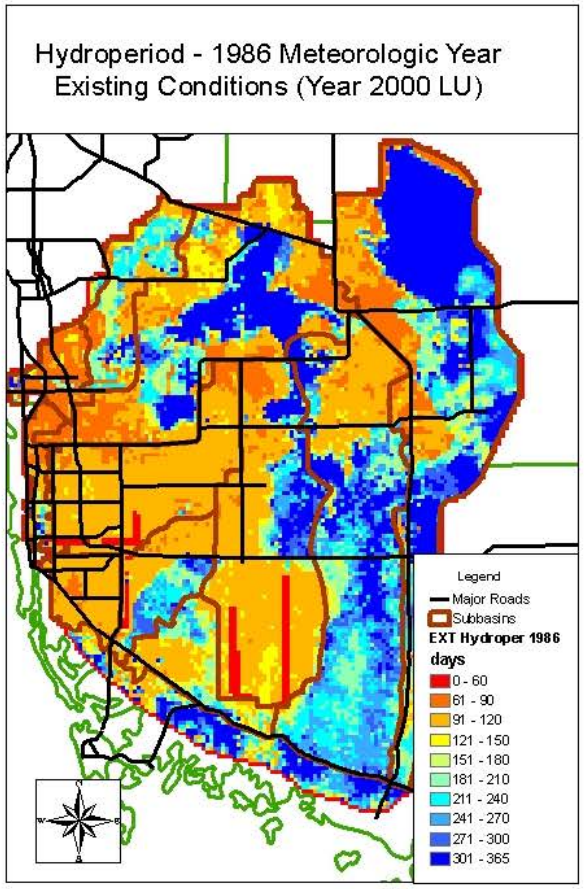


Plate 6. Annual Hydroperiod Maps for the Average (52.67 inchs) Year





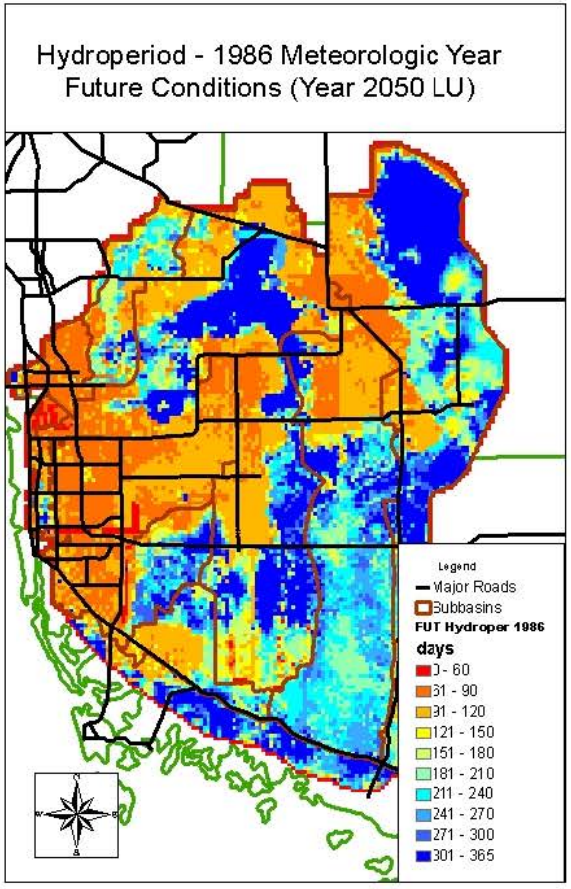
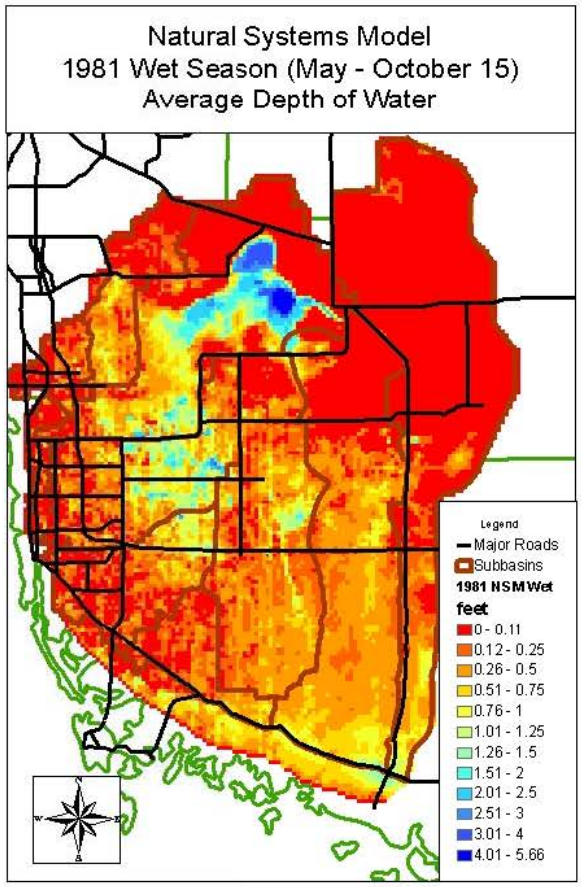
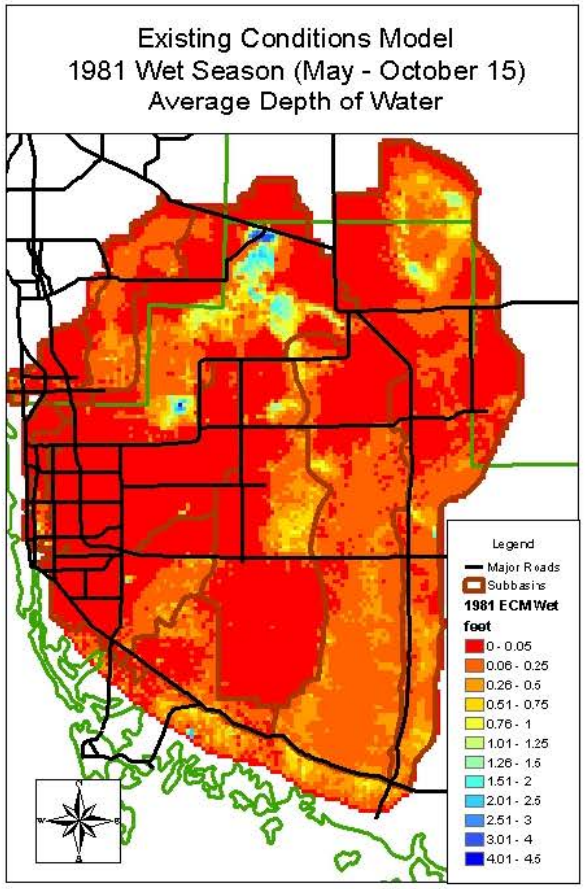


Plate 7. Average Depth of Water for Wet Season During Average (52.47 inchs) Year





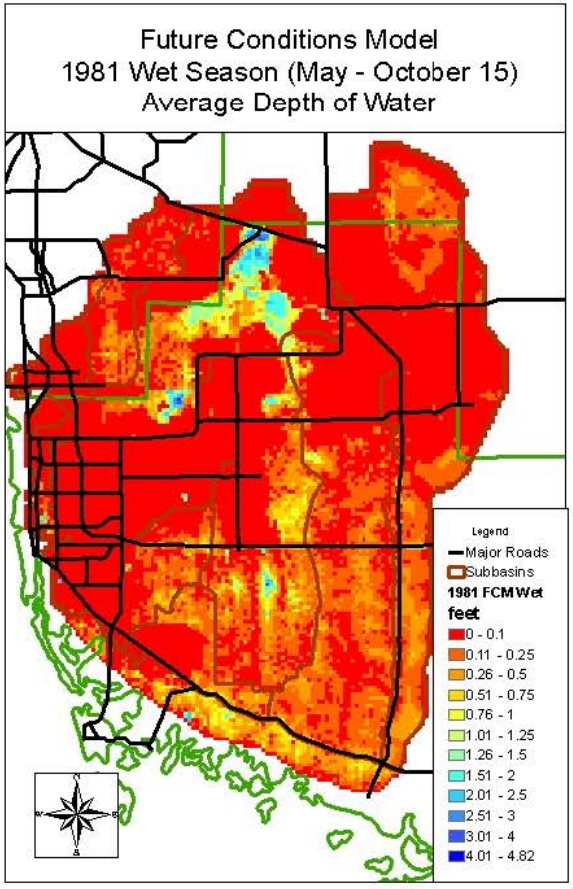
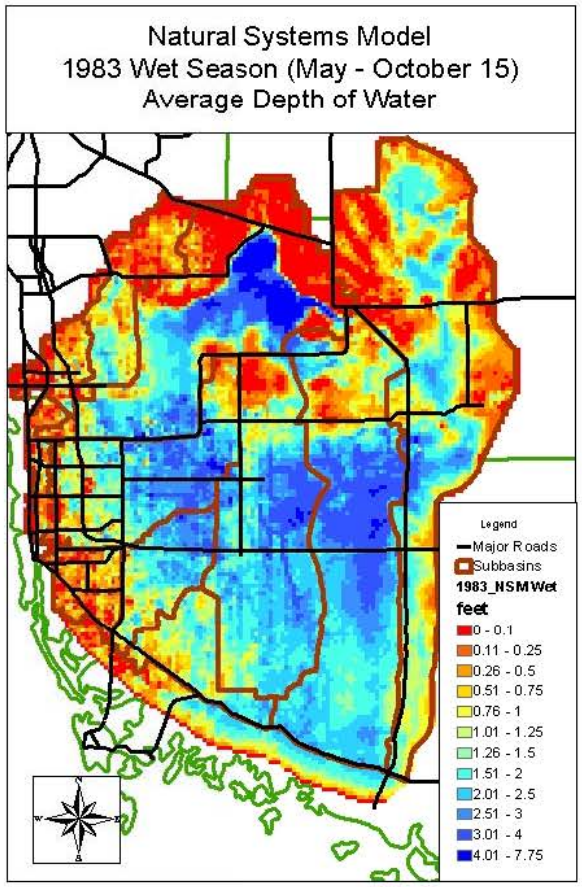
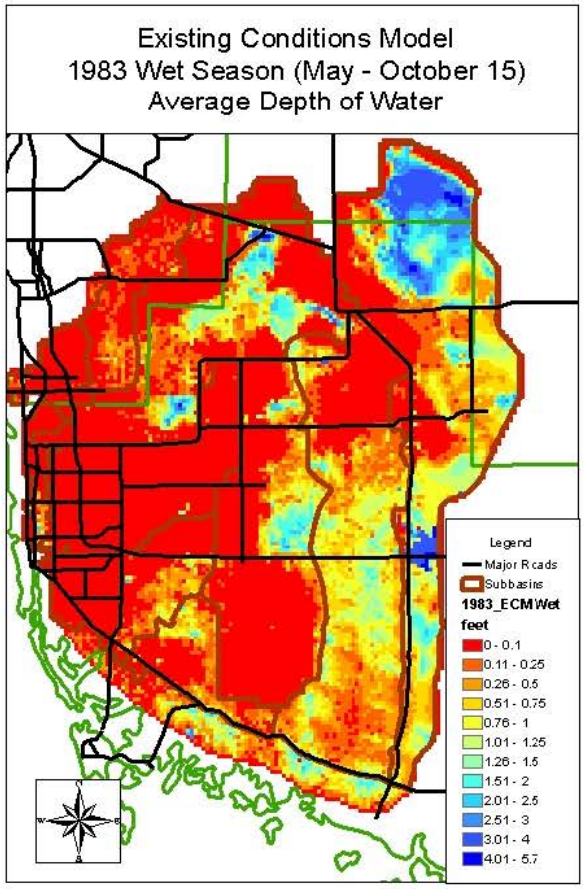


Plate 8. Average Depth of Water for Wet Season During Wet (74.58 inchs) Year





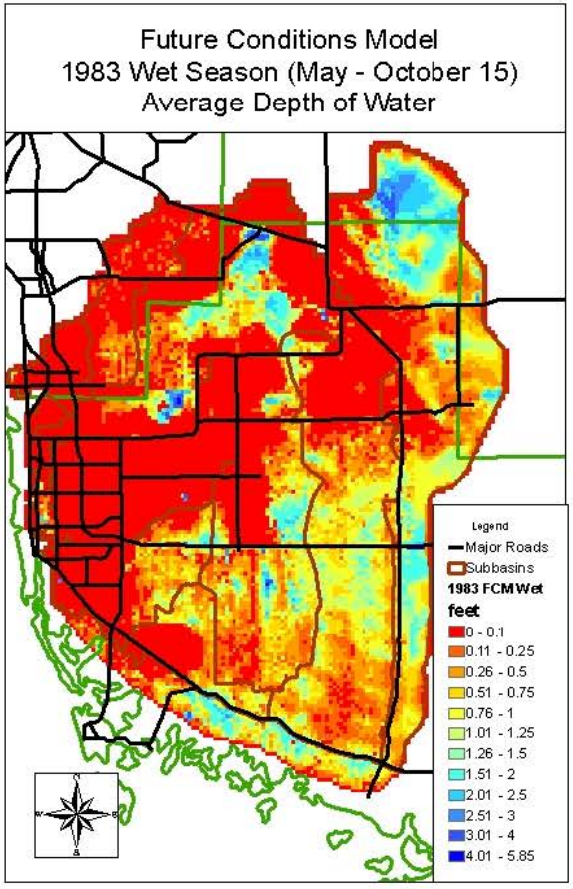
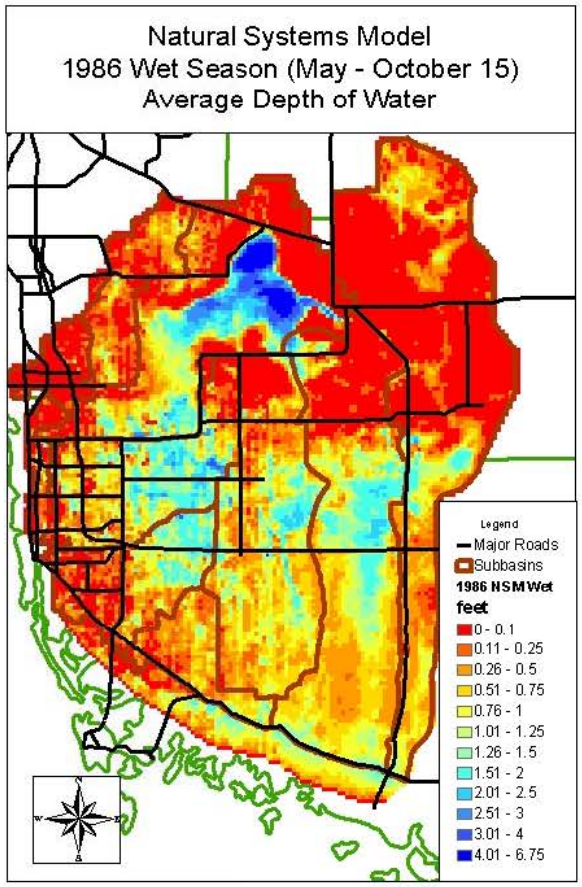
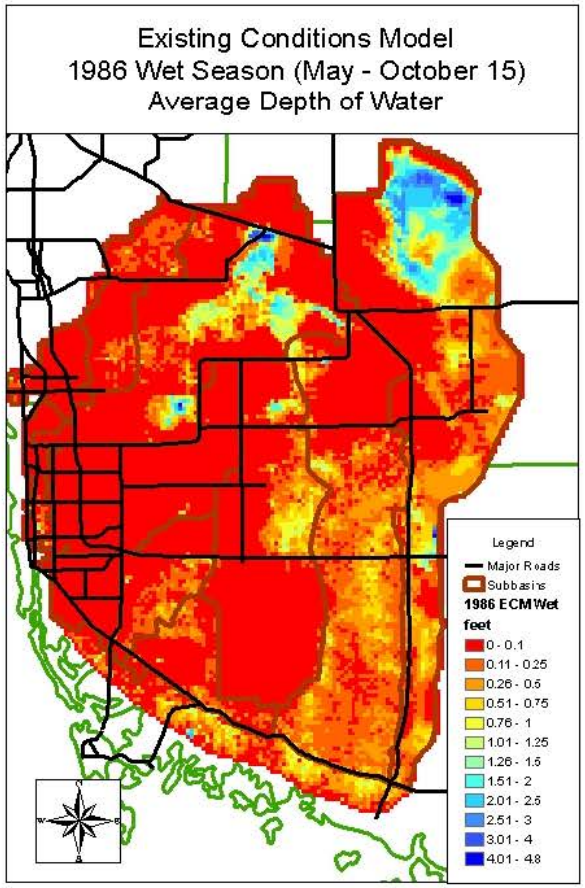


Plate 9. Average Depth of Water for Wet Season During Dry (45.98 inchs) Year





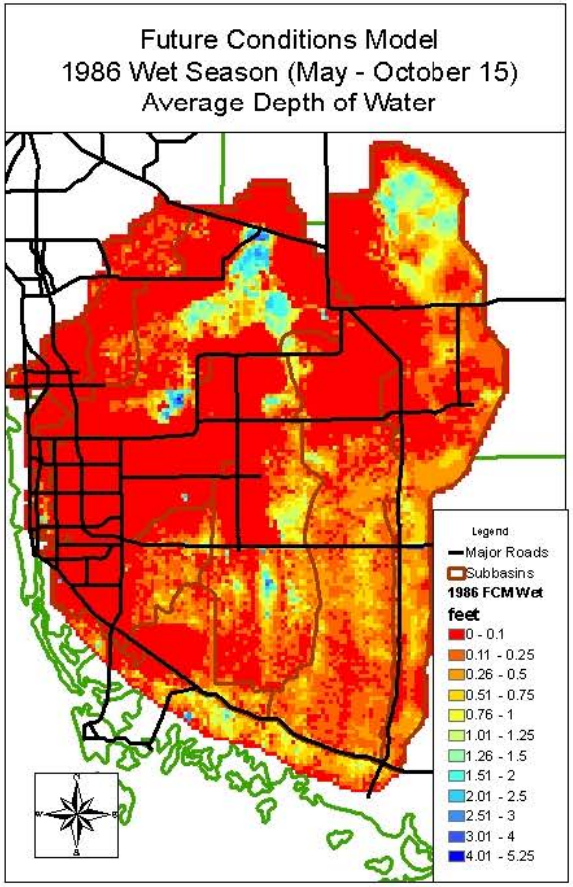
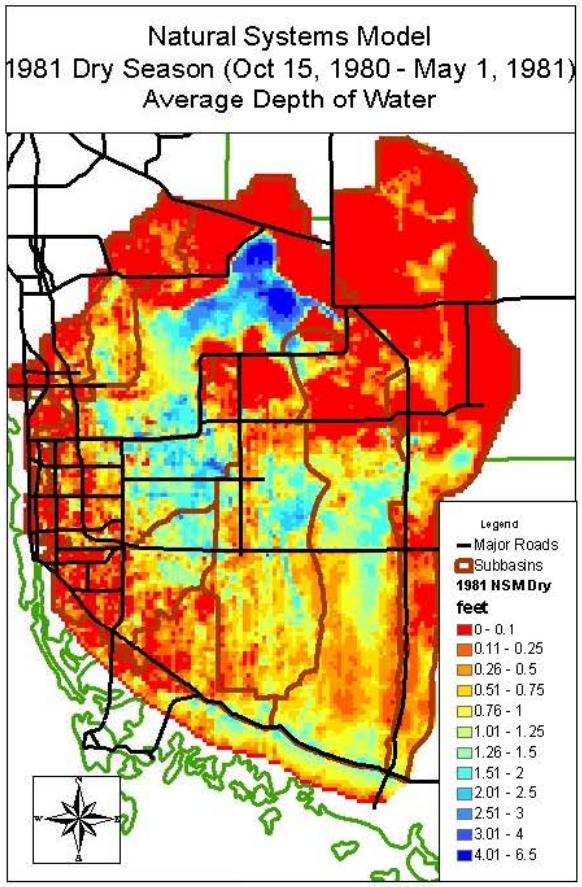
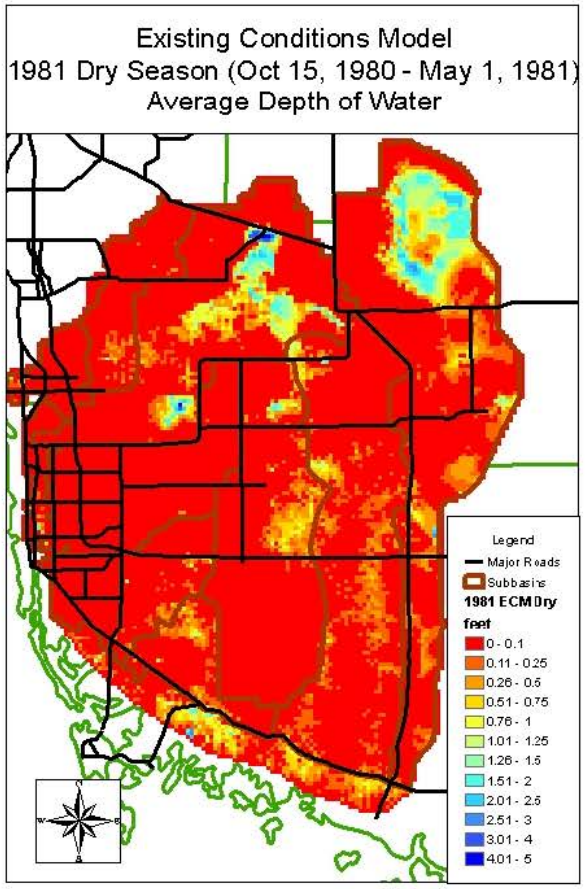


Plate 10. Average Depth of Water for Dry Season During Average (52.45 inchs) Year





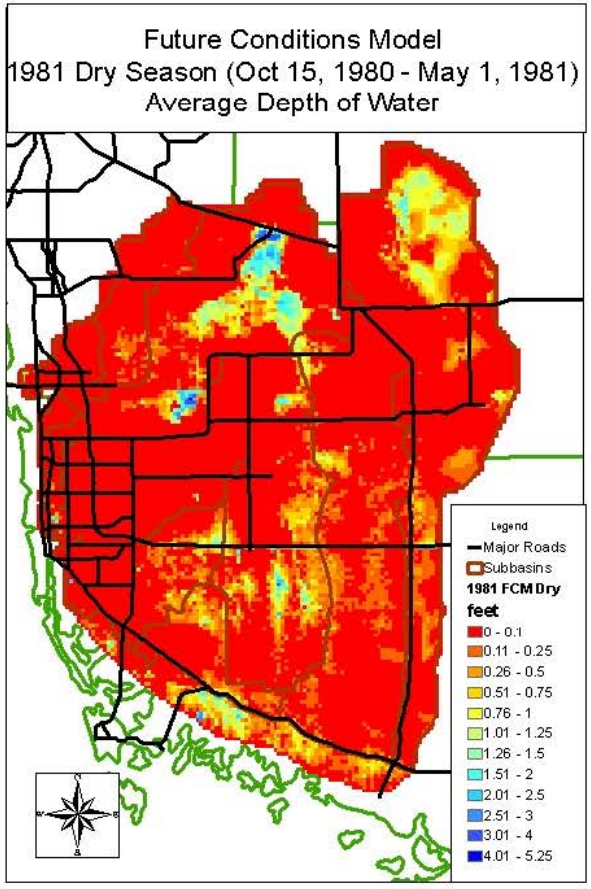
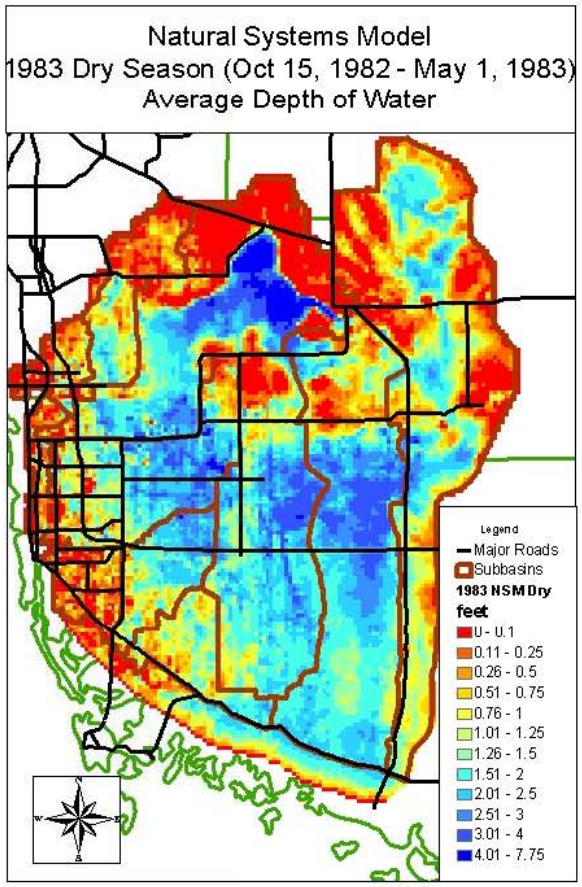
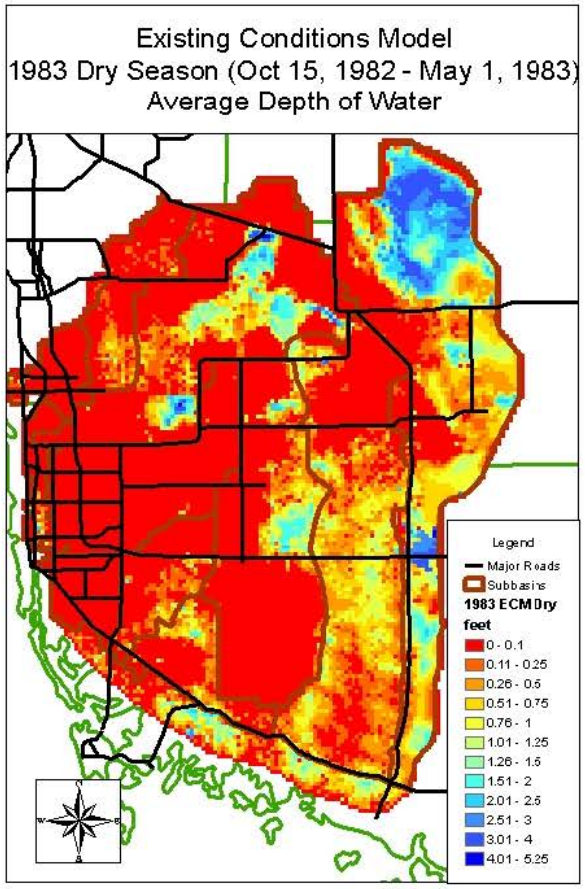


Plate 11. Average Depth of Water for Dry Season During Wet (74.58 inchs) Year





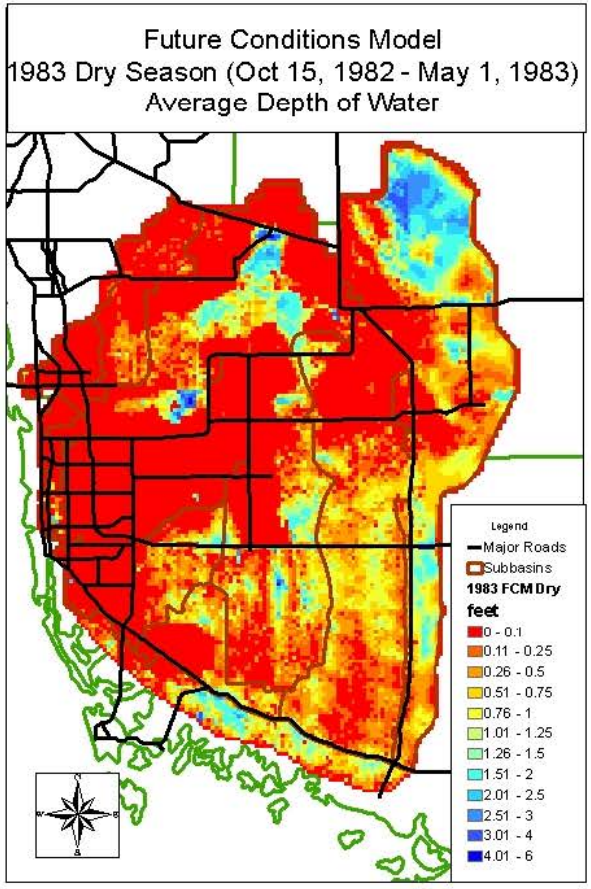
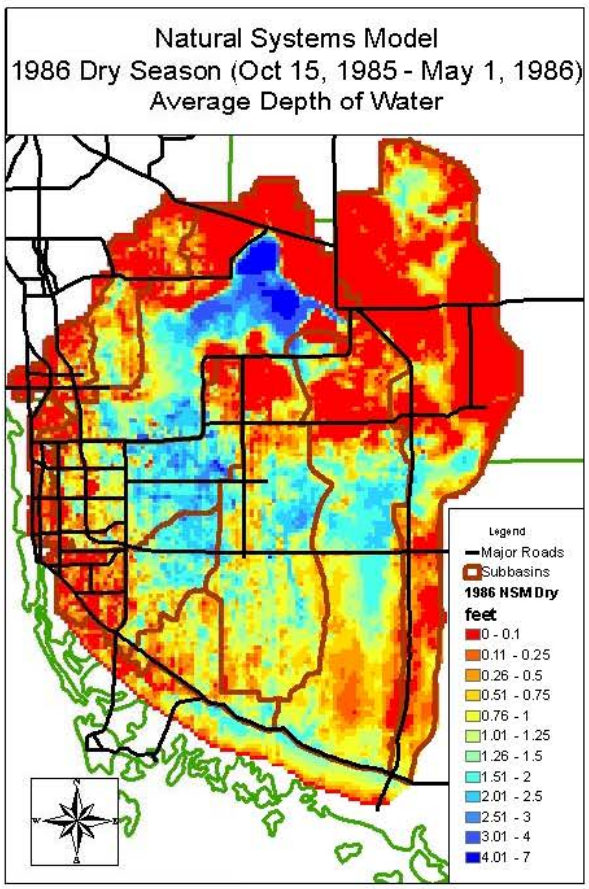
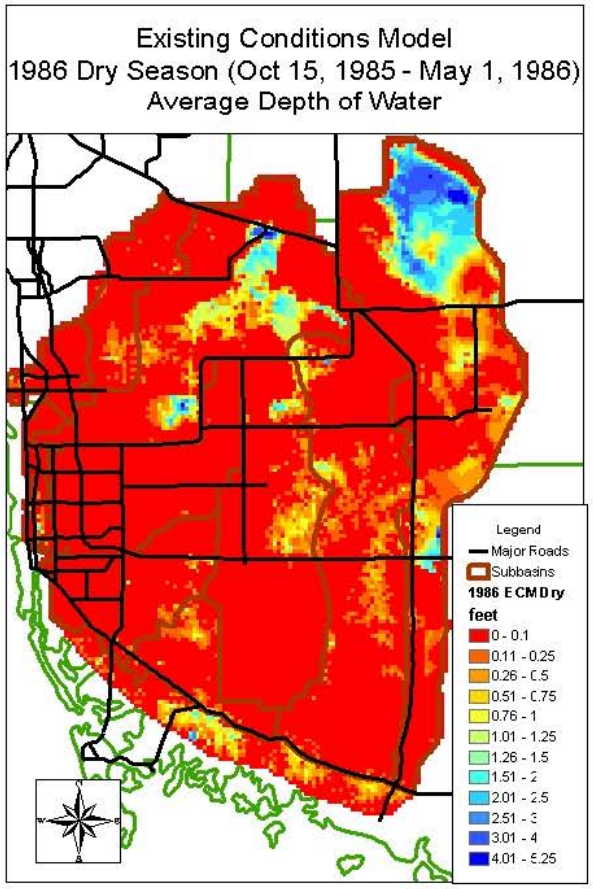


Plate 12. Average Depth of Water for Dry Season During Dry (45.98 inchs) Year





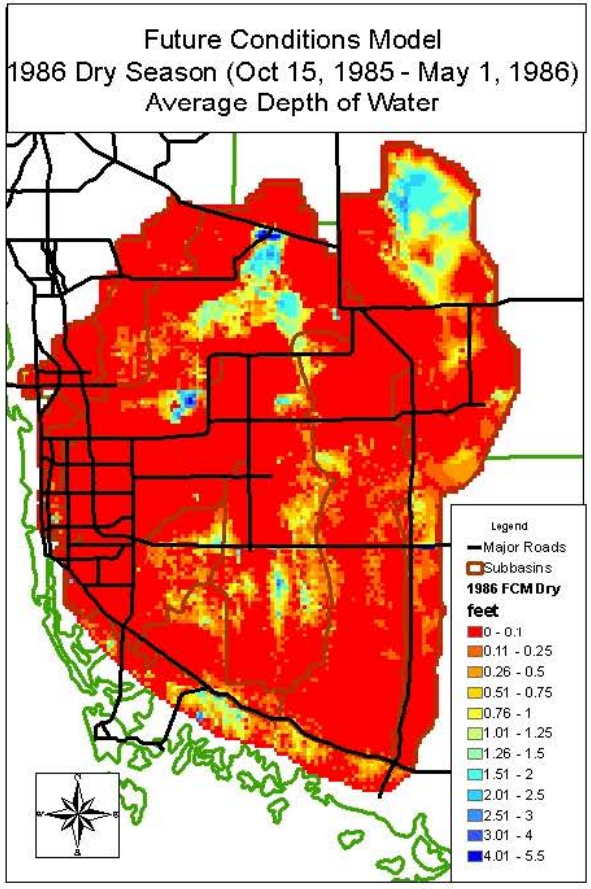
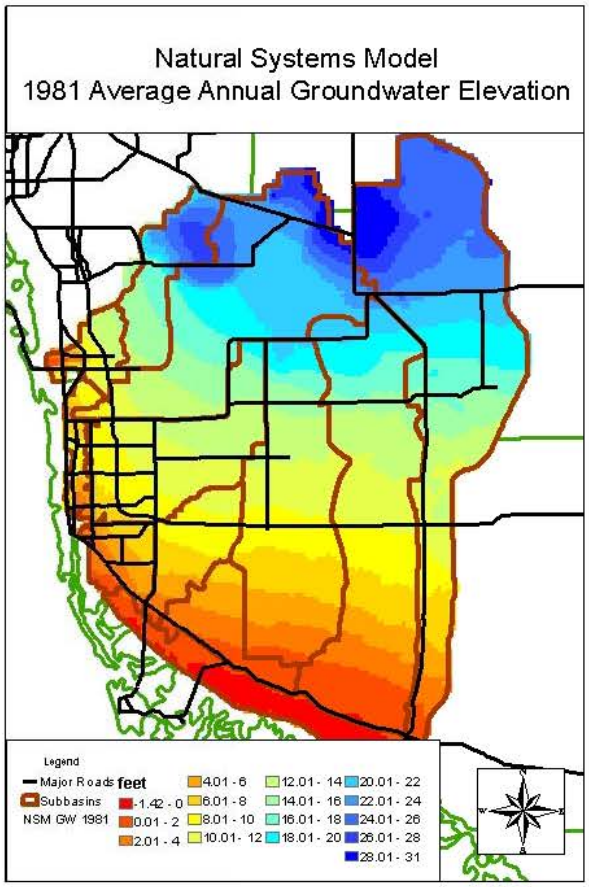
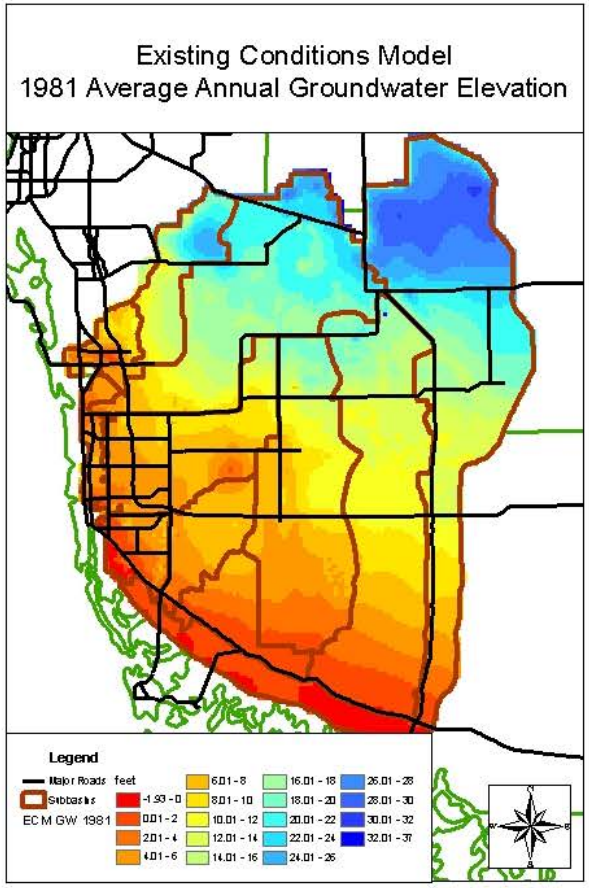


Plate 13. 1981 Average Annual Groundwater Comparison
Natural Systems minus Existing Conditions





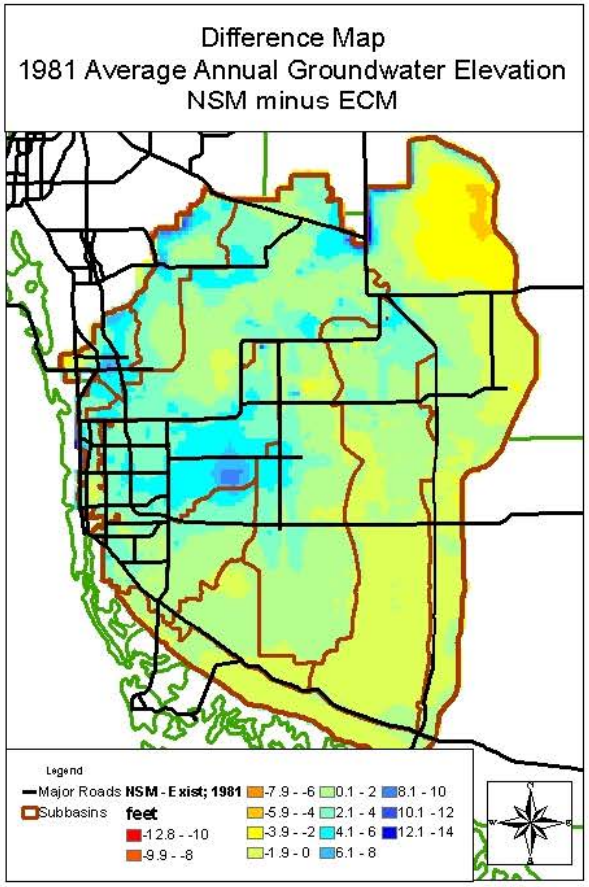
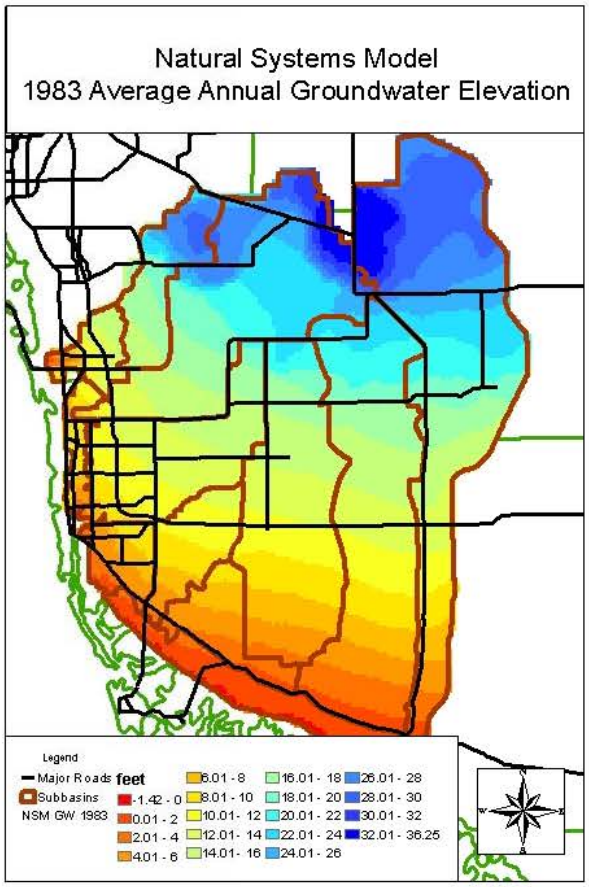
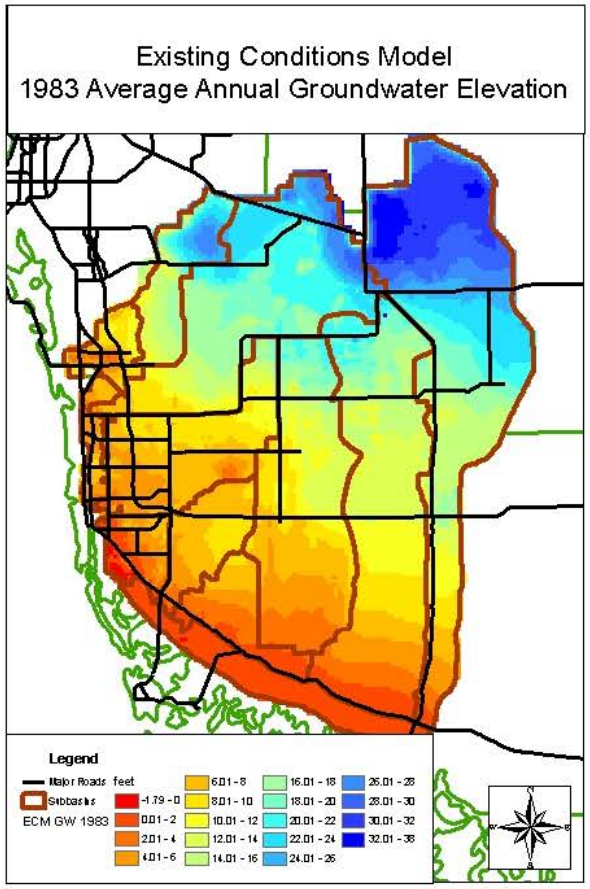


Plate 14. 1983 Average Annual Groundwater Comparison
Natural Systems minus Existing Conditions





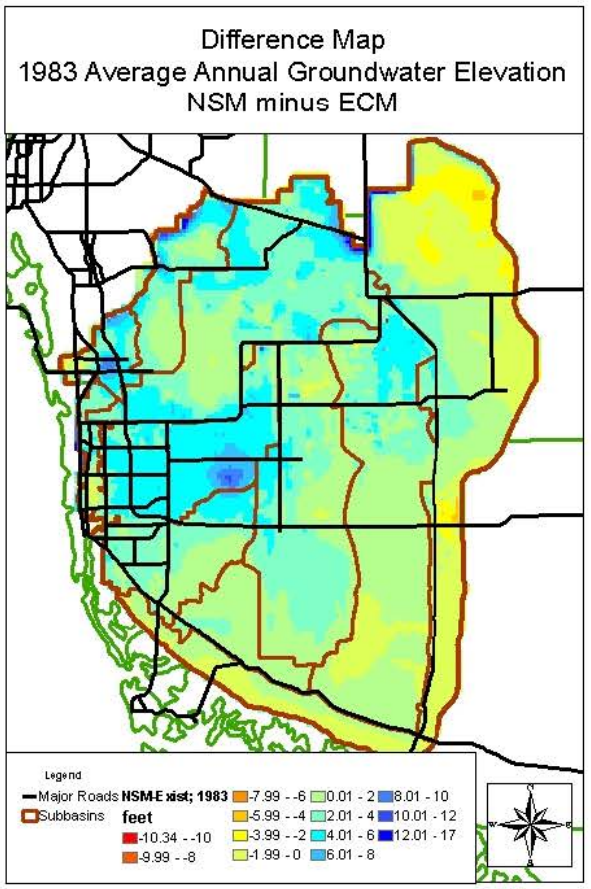
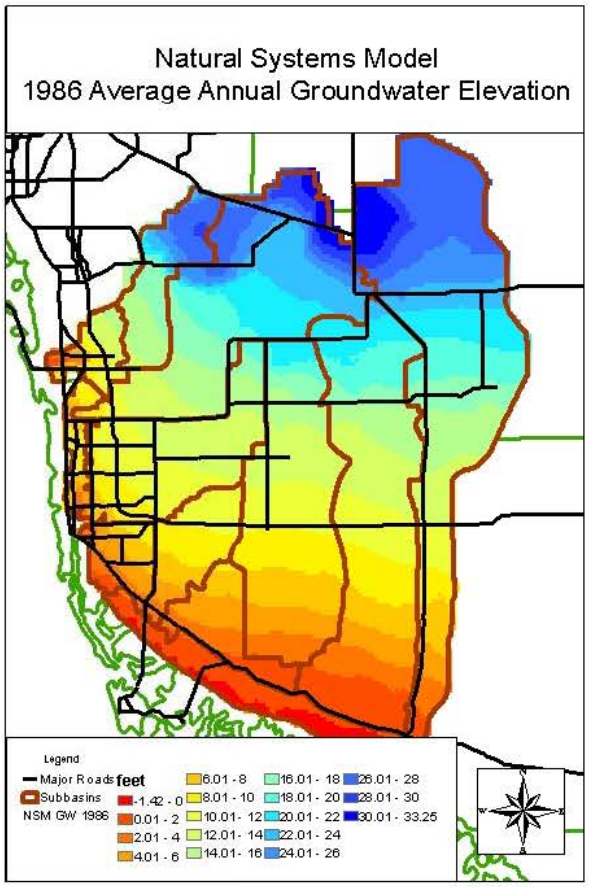
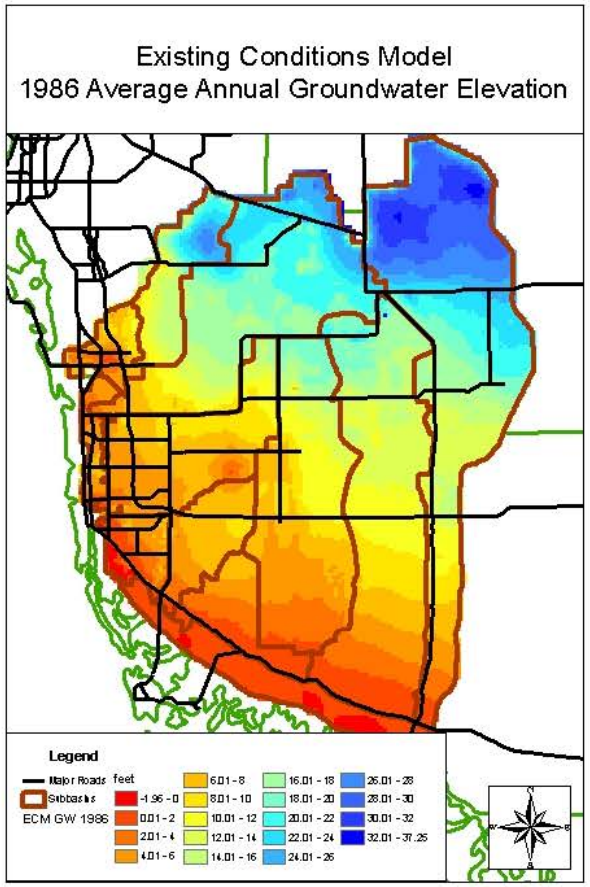


Plate 15. 1986 Average Annual Groundwater Comparison
Natural Systems minus Existing Conditions





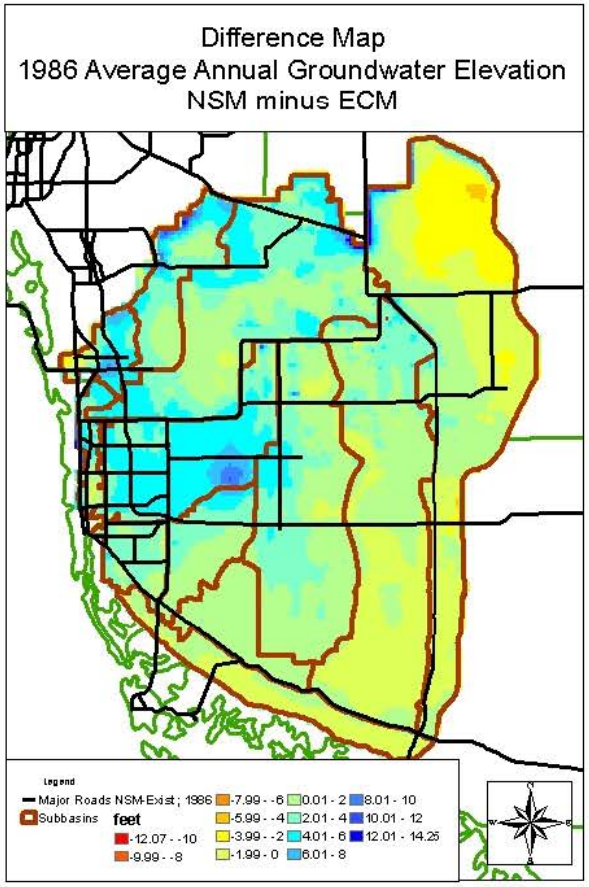
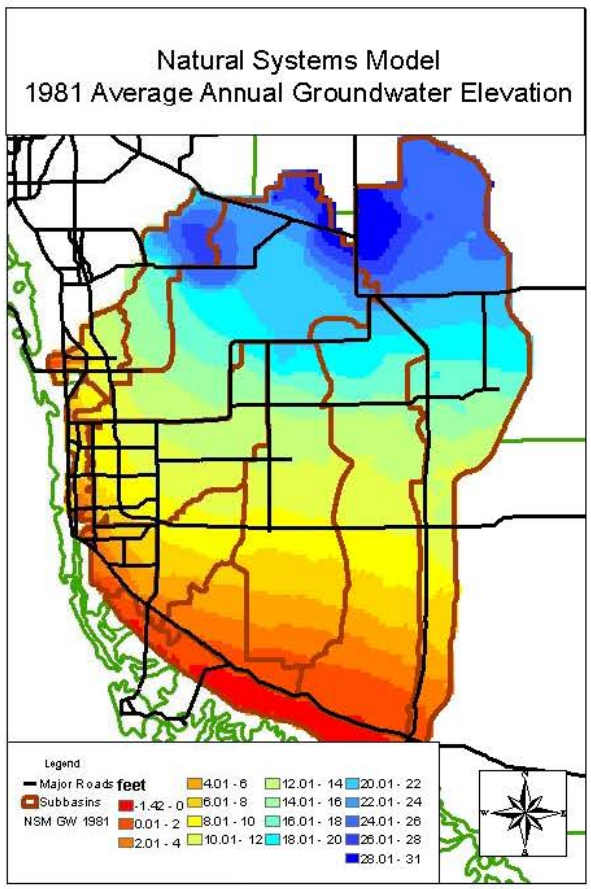
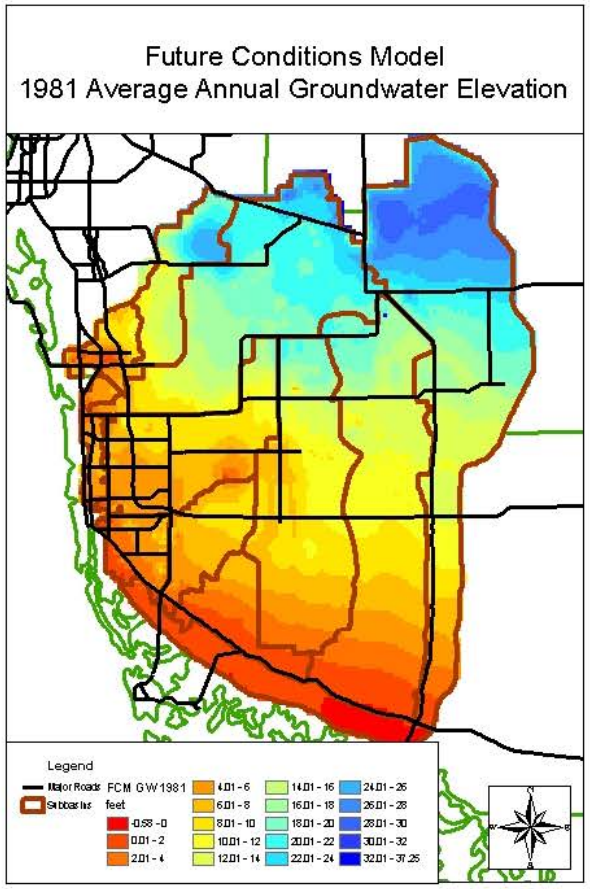


Plate 16. 1981 Average Annual Groundwater Comparison
Natural Systems minus Future Conditions





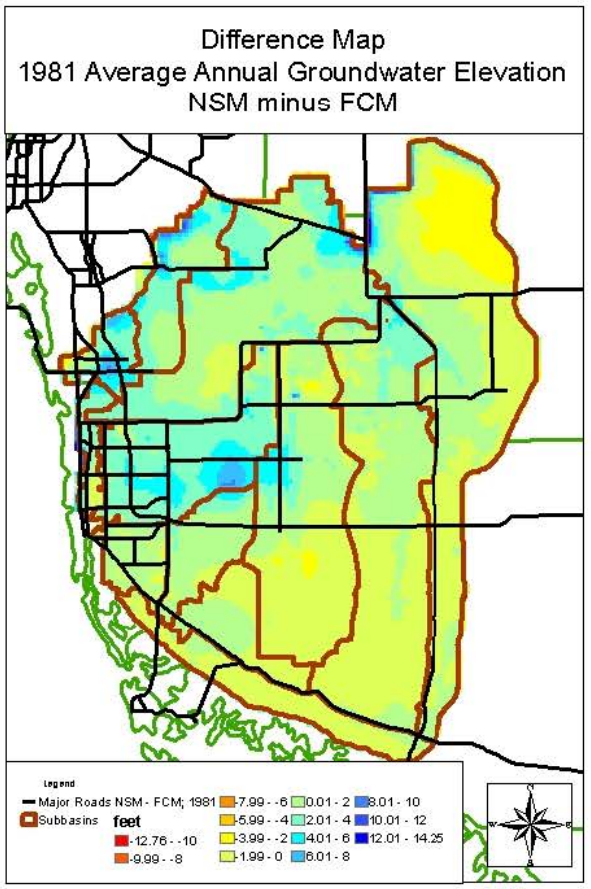
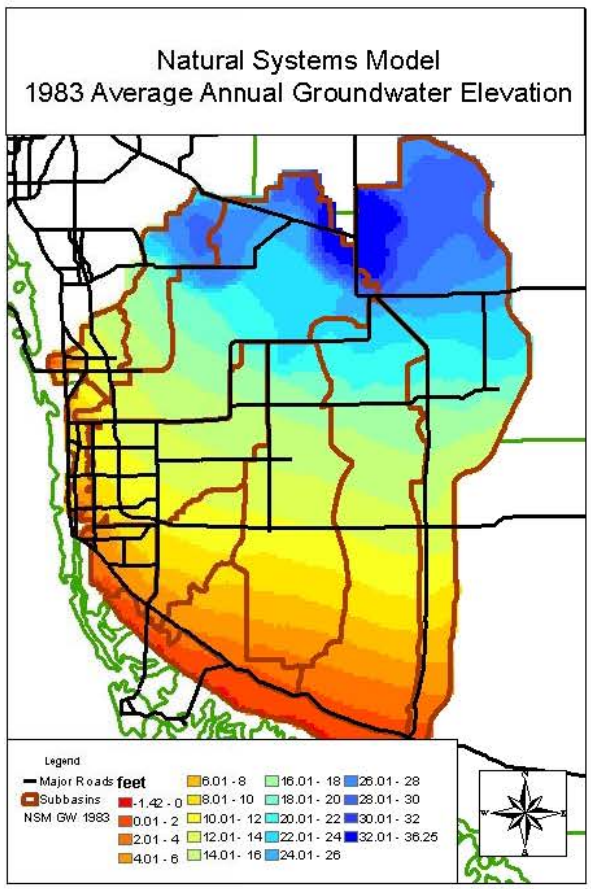
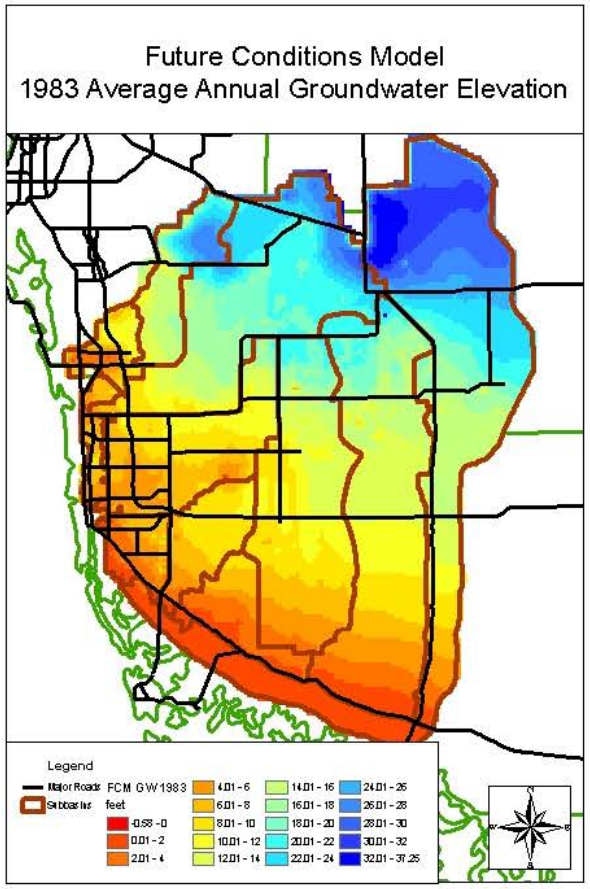


Plate 17. 1983 Average Annual Groundwater Comparison
Natural Systems minus Future Conditions





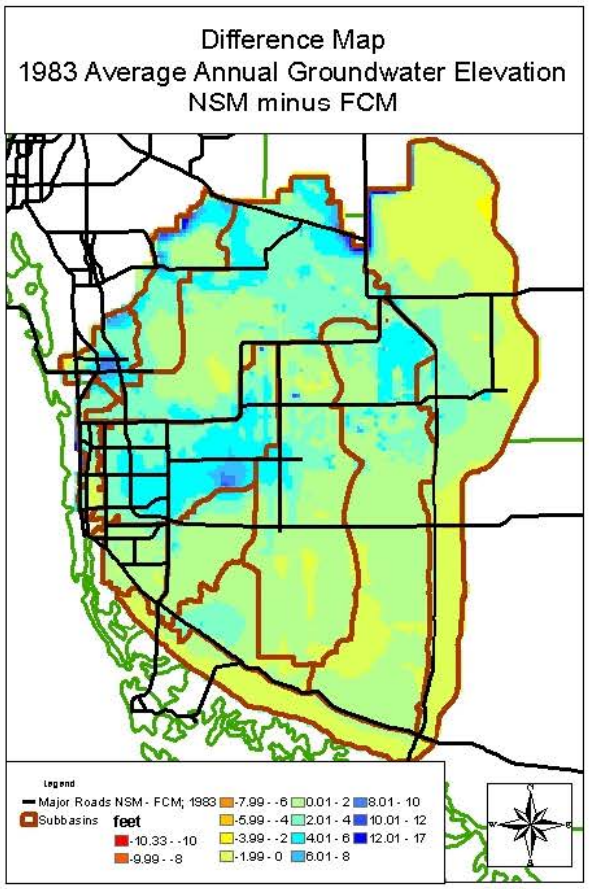
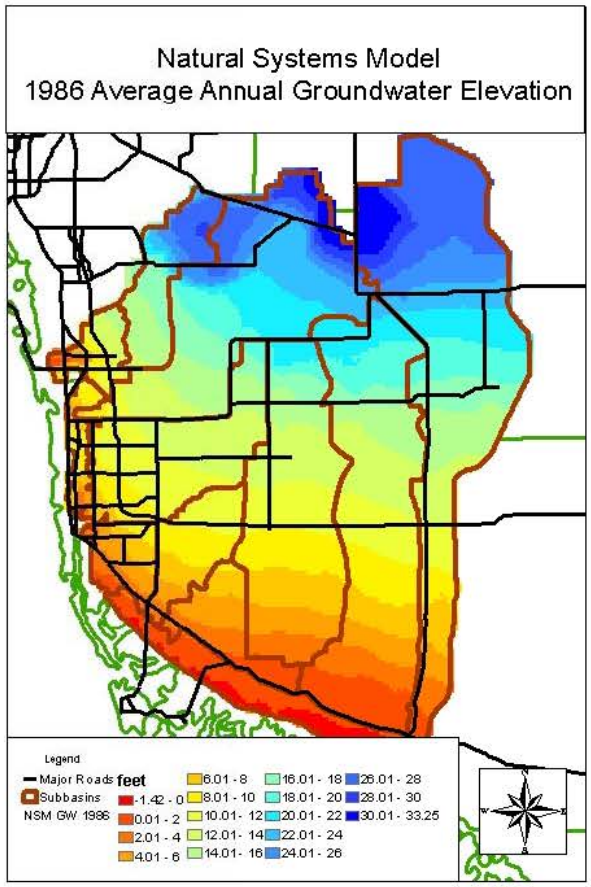
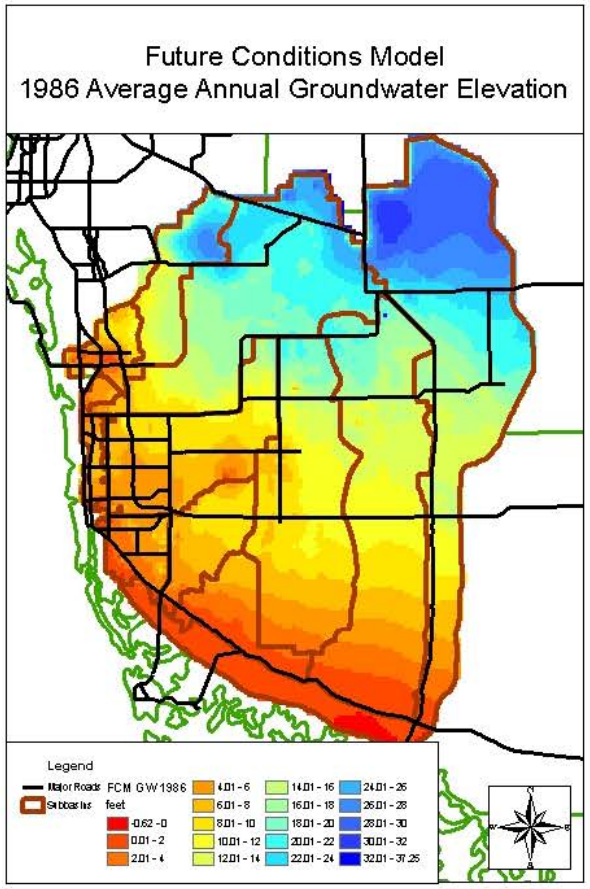
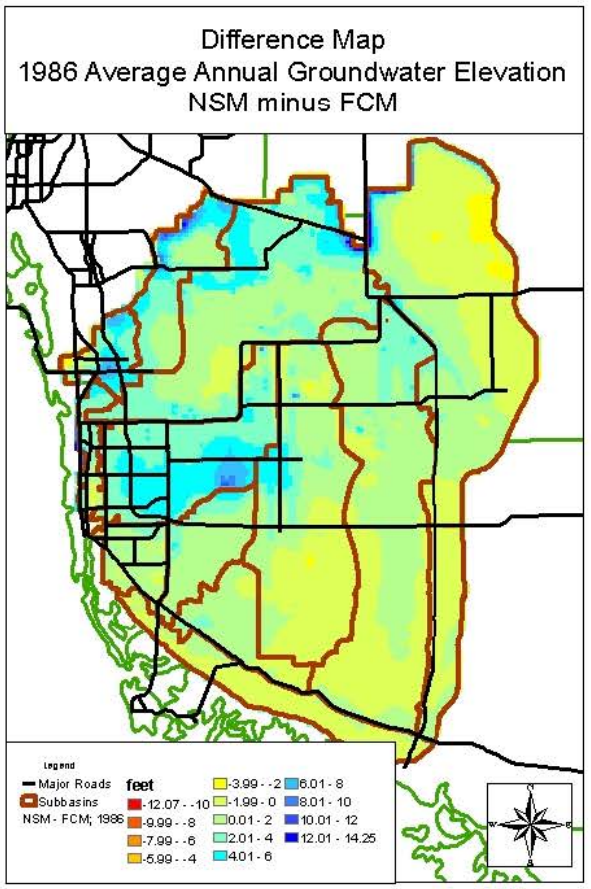


Plate 18. 1986 Average Annual Groundwater Comparison
Natural Systems minus Future Conditions







Appendix 4-B

Water Quality Monitoring Station List

Station Name	Merged Name	Station Description	LAT	LON
21FLSFWMTTI53	21FLSFWMTTI53	Lopez Bay	25.784200	-81.332200
21FLFMRISTK200216	21FLFMRISTK200216	S 10K Islands - Chokoloskee Bay	25.790000	-81.400000
CHOKO	CHOKO	None	25.799600	-81.369100
21FLA 66011SEAS	21FLA 66011SEAS	Indian Key Pass Channel Marker 1	25.800000	-81.467800
21FLSFWMTTI51	21FLSFWMTTI51	Chokolos kee	25.807500	-81.349400
21FLCOLLSANDFLY	21FLCOLLSANDFLY	None	25.812180	-81.405650
CROSSBAY	CROSSBAY	None	25.813200	-81.312500
21FLSFWMC-00039	21FLSFWMC-00039	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	25.814300	-81.362900
21FLFMRISTK200212	21FLFMRISTK200212	S 10K Islands - Gaskin Bay	25.820000	-81.470000
21FLFMRISTK200214	21FLFMRISTK200214	S 10K Islands - Gaskin Bay	25.820000	-81.460000
TURNRIV	TURNRIV	None	25.821000	-81.350000
21FLA 66010SEAS	SEAS010_IndianKey	Indian Key Pass Channel Marker 7	25.827000	-81.439800
21FLSFWMTTI65	21FLSFWMTTI65	Indian Key Pass	25.827200	-81.441100
21FLSFWMTTI67	21FLSFWMTTI67	West Pass	25.830300	-81.502800
COL-COL16-861	COL16	Collier-COL16-861	25.831017	-81.379450
COL-COL16-870	COL16	Collier-COL16-870	25.831167	-81.398650
COL-COL16-894	COL16	Collier-COL16-894	25.831567	-81.397967
21FLFMRISTK200210	21FLFMRISTK200210	S 10K Islands - Gaskin Bay	25.840000	-81.480000
21FLFMRISTK200211	21FLFMRISTK200211	S 10K Islands - Chokoloskee Bay	25.840000	-81.400000
21FLCOLLCHOKBAY26	21FLCOLLCHOKBAY26	None	25.840900	-81.405700
COL-COL15-496	COL15	Collier-COL15-496	25.841600	-81.400950
COL-COL15-504	COL15	Collier-COL15-504	25.841733	-81.399450
COL-COL15-513	COL15	Collier-COL15-513	25.841883	-81.399683
21FLFTM EVRGWC0001FTM	21FLFTM EVRGWC0001FTM	SR 29 @ Bridge 030161	25.842330	-81.381690
21FLCOLLHALFCRK	21FLCOLLHALFCRK	None	25.842900	-81.376000
21FLFTM EVRGWC0003FTM	21FLFTM EVRGWC0003FTM	Canal @ Plantation Pkwy	25.846390	-81.371830
21FLCOLLHALFCRK2	21FLCOLLHALFCRK2	None	25.848100	-81.364300
21FLSFWMTTI68	21FLSFWMTTI68	Panther Key	25.849400	-81.542200
21FLA 66187SEAS	187_Fakahatchee	Fakahatchee Pass entrance	25.851700	-81.524700

Station Name	Merged Name	Station Description	LAT	LON
21FLFTM EVRGWC0002FTM	21FLFTM EVRGWC0002FTM	Canal @ Bridge 030210	25.851890	-81.383780
112WRD 255110081233500	BRMouth	BARRON RIVER AT MOUTH NR CHOKOLOSKEE	25.852800	-81.393100
21FLCOLLBARRIVE	21FLCOLLBARRIVE	None	25.852900	-81.389600
21FLSFWMTTI64	BRMouth	Barron River	25.853300	-81.393300
COL-COL14-315	COL14	Collier-COL14-315	25.855250	-81.415050
COL-COL14-320	COL14	Collier-COL14-320	25.855333	-81.415083
COL-COL14-341	COL14	Collier-COL14-341	25.855683	-81.415783
21FLCOLLGOMEZ	21FLCOLLGOMEZ	None	25.856400	-81.538200
21FLCOLLLANECOVE	21FLCOLLLANECOVE	None	25.857700	-81.422800
21FLSFWMC-00445A	21FLSFWMC-00445A	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	25.857900	-81.385600
21FLFTM EVRGWC0004FTM	21FLFTM EVRGWC0004FTM	Canal @ 200 SR 29	25.858420	-81.382220
21FLA 66007SEAS	SEAS007_Ferguson	Mouth of Ferguson River	25.861700	-81.435500
21FLCOLLFERG1	21FLCOLLFERG1	None	25.867300	-81.441400
21FLFMRISTK200208	21FLFMRISTK200208	S 10K Islands - Fakahatchee Bay	25.870000	-81.490000
112WRD 255212081164700	112WRD 255212081164700	TURNER RIVER CANAL AT SOUTH END NR EVERGLADES	25.870000	-81.279700
21FLA 66771SEAS	SEAS771_FakaUnion	Faka Union Channel Marker 15	25.870800	-81.534200
21FLFTM EVRGWC0005FTM	Bridge030122	Canal @ Bridge 030122	25.871780	-81.382420
112WRD 255218081225700	Bridge030122	None	25.872040	-81.382300
21FLSFWMTTI69	21FLSFWMTTI69	Faka Union Pas	25.874200	-81.516100
21FLCOLLFAKABAY	21FLCOLLFAKABAY	None	25.874900	-81.487100
21FLA 66113SEAS	SEAS113_Fakahatchee	Ruins at south end Fakahatchee Bay	25.875800	-81.494000
21FLA 66028SEAS	SEAS028_Turtle	Southern tip of Turtle Key	25.881200	-81.587300
21FLA 66111SEAS	SEAS111_Fakahatchee	Middle of Fakahatchee Bay	25.882800	-81.487000
21FLA 66401SEAS	SEAS401_FakaUnion	Faka Union Channel Marker 23	25.883000	-81.529500
21FLSFWMTTI70	21FLSFWMTTI70	Faka Union Bay	25.883300	-81.516100
ROOK453	ROOK453	Fred Key, G5	25.883333	-81.683331
21FLA 66112SEAS	SEAS112_Fakahatchee	West end of Fakahatchee Bay	25.885800	-81.504200
21FLSFWMTTI76	21FLSFWMTTI76	Fakahatchee Bay (project: TTI)	25.889500	-81.476500
21FLCOLLFERG2	21FLCOLLFERG2	None	25.889800	-81.427700

Station Name	Merged Name	Station Description	LAT	LON
STK200206	STK200206	S 10K Islands - Lake Cove	25.890000	-81.470000
21FLFMRISTK200205	21FLFMRISTK200205	S 10K Islands - Santina Bay	25.890000	-81.530000
21FLA 66038SEAS	21FLA 66038SEAS	Faka Union Channel Marker 19	25.890000	-81.527300
21FLA 66281SEAS	SEAS281_FishHawk	Mouth of Fish Hawk Creek	25.890800	-81.578800
21FLCOLLEASTRIV	21FLCOLLEASTRIV	None	25.890800	-81.472200
21FLA 66029SEAS	SEAS029_SnagShoal	SE tip of Snag's Shoal	25.891200	-81.598300
21FLA 66037SEAS	SEAS037_Santina	Island E of Santina Bay	25.891500	-81.536800
21FLA 66302SEAS	SEAS302_SnagShoal	SW tip of Snag's Shoal	25.891700	-81.608800
21FLA 66114SEAS	SEAS114_Fakahatchee	Mouth of Fakahatchee River	25.891700	-81.476700
13734	21FLGW13734	SFC-SL-1049 UNKNOWN	25.891956	-81.379086
COL-FA-EEBAY-1	FakahatcheeBay	Collier-Fakahatchee Bay-1	25.892194	-81.477000
COL-FA-EEBAY-2	FakahatcheeBay	Collier-Fakahatchee Bay-2	25.892194	-81.477000
COL-FA-EEBAY-3	FakahatcheeBay	Collier-Fakahatchee Bay-3	25.892194	-81.477000
FB	FakahatcheeBay	Fakahatchee Bay	25.892200	-81.477000
21FLA 66035SEAS	SEAS035_SantinaBay	Santina Bay western entrance	25.893300	-81.545500
21FLSFWMTTI72	21FLSFWMTTI72	Dismal Key	25.894400	-81.558900
21FLA 66034SEAS	SEAS034_DismalKey	Dismal Key at pier	25.898300	-81.557000
21FLFMRISTK200202	21FLFMRISTK200202	S 10K Islands - Caxabas Bay	25.900000	-81.710000
21FLFMRISTK200203	21FLFMRISTK200203	S 10K Islands - Caxabas Bay	25.900000	-81.660000
21FLSFWMROOK454	21FLSFWMROOK454	Caxambas Pass, R4	25.900100	-81.717800
FU	FU	Faka Union Bay	25.900500	-81.515900
21FLSFWMROOK451	21FLSFWMROOK451	Coon Key Pass, G3	25.901000	-81.633400
21FLKWATCOL-FA-AUNION-1	Fa-Aunion	Collier-Fakaunion-1	25.901390	-81.515890
21FLKWATCOL-FA-AUNION-2	Fa-Aunion	Collier-Fakaunion-2	25.901390	-81.515890
21FLKWATCOL-FA-AUNION-3	Fa-Aunion	Collier-Fakaunion-3	25.901390	-81.515890
21FLA 66077SEAS	Seas077	Faka Union Channel Marker 59	25.901700	-81.511700
21FLCOLLFAKAUCAN	Fa-Aunion	None	25.901800	-81.514600
21FLCOLLFAKARIV	21FLCOLLFAKARIV	None	25.902700	-81.478000
21FLA 66301SEAS	SEAS301_ShellKey	Southern tip of Shell Key at marker	25.907700	-81.612300

Station Name	Merged Name	Station Description	LAT	LON
21FLSFWMC-311	21FLSFWMC-311	C-311 OCHOPEE COLLIER CORP	25.908690	-81.369220
21FLSFWMBARRIVN	BARRIVN	Off dock at Sheriff?s substation on corner of US *	25.909770	-81.363480
21FLCOLLBARRIVN	BARRIVN	None	25.909800	-81.363500
21FLSFWMC-00311	21FLSFWMC-00311	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	25.910700	-81.364800
21FLSFWMTTI74	21FLSFWMTTI74	Shell Key	25.911100	-81.615300
21FLA 66036SEAS	SEAS036_Pumpkin	Mouth of Pumpkin River	25.912800	-81.544700
21FLA 28030060	21FLA 28030060	BARRON RIVER NEAR US41/SR29	25.913900	-81.362800
21FLA 66021SEAS	SEAS021_CoonKey	Coon Key Pass Channel Marker 2	25.914300	-81.640000
21FLA 66303SEAS	SEAS303_Buttonwood	Buttonwood Bay entrance	25.917500	-81.592500
COL-PU-INBAY-1	PumpkinBay	Collier-Pumpkin Bay-1	25.917611	-81.548389
COL-PU-INBAY-2	PumpkinBay	Collier-Pumpkin Bay-2	25.917611	-81.548389
COL-PU-INBAY-3	PumpkinBay	Collier-Pumpkin Bay-3	25.917611	-81.548389
21FLSFWMBC18	21FLSFWMBC18	Bridge #73 on US 41E	25.918670	-81.390960
112WRD 255511081213000	112WRD 255511081213000	None	25.920100	-81.358130
21FLA 66299SEAS	SEAS299_Blackwater	Blackwater River Channel Marker 11	25.922000	-81.609800
21FLCOLLROBBAYBR	WinterberryDr	None	25.925800	-81.703500
21FLFTM EVRGWC0037FTM	WinterberryDr	Canal @ Winterberry Drive	25.925860	-81.703030
21FLSFWMBC19	21FLSFWMBC19	Bridge #69 on US 41E	25.926960	-81.417650
21FLSFWMTTI75	21FLSFWMTTI75	Blackwat er River	25.929700	-81.600300
STK200228	STK200228	S 10K Islands - Rookery Bay	25.930000	-81.690000
21FLA 66020SEAS	SEAS020_Goodland	S tip of island due E of Goodland	25.930300	-81.643800
21FLA 66300SEAS	SEAS300_Blackwater	Blackwater River Channel Marker 14	25.930800	-81.596300
21FLA 66298SEAS	21FLA 66298SEAS	SE corner of Palm Bay	25.931200	-81.617200
21FLCOLLCHIAPOND	21FLCOLLCHIAPOND	None	25.931500	-81.444300
21FLCOLLBLACKW13	21FLCOLLBLACKW13	None	25.931800	-81.599300
21FLCOLLGOODBAY	21FLCOLLGOODBAY	None	25.932300	-81.653700
21FLKWATCOL-BL-KWATER-1	BL_Kwater	Collier-Blackwater-1	25.934300	-81.595600
21FLKWATCOL-BL-KWATER-2	BL_Kwater	Collier-Blackwater-2	25.934300	-81.595600
21FLKWATCOL-BL-KWATER-3	BL_Kwater	Collier-Blackwater-3	25.934300	-81.595600

Station Name	Merged Name	Station Description	LAT	LON
MB	BL_Kwater	Middle Blackwater River	25.934300	-81.595600
21FLFTM EVRGWC0036FTM	21FLFTM EVRGWC0036FTM	Canal @ 1010 Coronado	25.934610	-81.724190
ROOK458	ROOK458	Goodland Bridge, G15	25.934669	-81.653250
21FLCOLLBLACKW	21FLCOLLBLACKW	None	25.936700	-81.592700
21FLFMRISTK200201	21FLFMRISTK200201	S 10K Islands - Palm Bay	25.940000	-81.610000
21FLSFWMC-00269	21FLSFWMC-00269	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	25.940700	-81.469800
21FLFTM EVRGWC0035FTM	21FLFTM EVRGWC0035FTM	Canal @ Buccaneer Ct.	25.941280	-81.703560
21FLCOLLTAMBR62	21FLCOLLTAMBR62	None	25.944100	-81.474600
21FLA 28030002	21FLA 28030002	SMOKE HOUSE BAY N COLLIER BLV BR	25.950000	-81.770000
21FLSFWMROOK457	BigMarcoRiver	Big Marco River, R24	25.950000	-81.683700
21FLFMRINTK200127	BigMarcoRiver	N 10K Islands - Big Marco River	25.950000	-81.680000
21FLSFWMC-496	21FLSFWMC-496	C-496	25.950000	-81.330000
21FLSFWMC-269	21FLSFWMC-269	C-269 NORRIS, WEAVERS STATION	25.950380	-81.462300
21FLSFWMROOK456	21FLSFWMROOK456	Rt. 951 Bridge, R26	25.951200	-81.700800
21FLFTM EVRGWC0034FTM	21FLFTM EVRGWC0034FTM	Canal @ Collier Blvd. Bridge	25.952080	-81.730530
21FLGW 3494	21FLGW 3494	BARRON RIVER AT S.R. 29 NEAR COPELAND	25.952600	-81.355910
21FLCOLLFAKAUPOI	FAKAUPOI	None	25.955900	-81.510500
21FLSFWMFAKAUPOI	FAKAUPOI	Faka-Union Canal at entrance to Port of the Islan*	25.955940	-81.510510
21FLSFWMBC21	21FLSFWMBC21	Bridge #55 on US 41E (TAMBR55)	25.960470	-81.500220
21FLCOLLTAMBR55	21FLCOLLTAMBR55	None	25.960500	-81.500200
21FLSFWMFAKA	21FLSFWMFAKA	FAKA UNION CANAL AT WEIR #1 (U.S.41 NEAR COPELAND)	25.960510	-81.509510
21FLSFWMBC20	21FLSFWMBC20	Bridge #52 on US 41E	25.961040	-81.516640
21FLCOLLCOLLBAY	21FLCOLLCOLLBAY	None	25.961100	-81.737800
21FLFTM EVRGWC0032FTM	21FLFTM EVRGWC0032FTM	Canal @ Barfield Bridge	25.961440	-81.722310
14163	21FLGW14163	SFC-HS-1006 UNKNOWN	25.962107	-81.519480
15173	21FLGW15173	SFC-LL-1022 MUD BAY	25.963496	-81.605131
21FLCOLLBARRON	21FLCOLLBARRON	None	25.964400	-81.354200
21FLFTM EVRGWC0033FTM	21FLFTM EVRGWC0033FTM	Bay @ End of Perrine CT.	25.965720	-81.731500
21FLCOLLMARCPAS	21FLCOLLMARCPAS	None	25.966400	-81.707500

Station Name	Merged Name	Station Description	LAT	LON
112WRD 02291000	Barron	BARRON RIVER NR EVERGLADES, FLA.	25.966700	-81.350000
21FLCOLLEMARCOBY	21FLCOLLEMARCOBY	None	25.966800	-81.702100
21FLSFWMBARRON	Barron	BARRON RIVER NR EVERGLADES, FLA.	25.967040	-81.349800
21FLCOLLFAKA	21FLCOLLFAKA	None	25.968000	-81.509800
NTK200125	NTK200125	N 10K Islands - Bear Point Cove	25.970000	-81.690000
NTK200126	NTK200126	N 10K Islands - Addison Bay	25.970000	-81.690000
21FLA 28030056	21FLA 28030056	FAKA UNION CANAL AT US 41 1.5 KM NORTH	25.977200	-81.509700
RBAY205	RBAY205	None	25.977222	-81.728056
COL-PON BAY 2-2	TarponBay	Collier-Tarpon Bay 2-2	25.978600	-81.729500
COL-PON BAY 2-3	TarponBay	Collier-Tarpon Bay 2-3	25.978600	-81.729500
COL-TARPON BA-1	TarponBay	Collier-Tarpon Bay 2-1	25.978600	-81.729500
COL-TARPON BA-2	TarponBay	Collier-Tarpon Bay 2-2	25.978600	-81.729500
COL-TARPON BA-3	TarponBay	Collier-Tarpon Bay 2-3	25.978600	-81.729500
RBAY206	RBAY206	None	25.979167	-81.708889
COL-JO-BAY3-1	JohnsonBay3	Collier-Johnson Bay 3-1	25.979600	-81.732000
COL-JO-BAY3-2	JohnsonBay3	Collier-Johnson Bay 3-2	25.979600	-81.732000
COL-JO-BAY3-3	JohnsonBay3	Collier-Johnson Bay 3-3	25.979600	-81.732000
COL-JOHNSON B-1	JohnsonBay3	Collier-Johnson Bay 3-1	25.979600	-81.732000
COL-JOHNSON B-2	JohnsonBay3	Collier-Johnson Bay 3-2	25.979600	-81.732000
COL-JOHNSON B-3	JohnsonBay3	Collier-Johnson Bay 3-3	25.979600	-81.732000
21FLCOLLJANES5	21FLCOLLJANES5	None	25.980100	-81.374900
21FLFTM EVRGWC0031FTM	21FLFTM EVRGWC0031FTM	SR 951 Canal @ Boat Ramp	25.980580	-81.703170
21758	21FLGW21758	SF1-LR-2039 TAMIAMI CANAL	25.984747	-81.566728
COL-JO-BAY1-1	JohnsonBay1	Collier-Johnson Bay 1-1	25.985778	-81.725611
COL-JO-BAY1-2	JohnsonBay1	Collier-Johnson Bay 1-2	25.985778	-81.725611
COL-JO-BAY1-3	JohnsonBay1	Collier-Johnson Bay 1-3	25.985778	-81.725611
COL-SON BAY 1-1	JohnsonBay1	Collier-Johnson Bay 1-1	25.985778	-81.725611
COL-SON BAY 1-2	JohnsonBay1	Collier-Johnson Bay 1-2	25.985778	-81.725611
COL-SON BAY 1-3	JohnsonBay1	Collier-Johnson Bay 1-3	25.985778	-81.725611

Station Name	Merged Name	Station Description	LAT	LON
21FLCOLLMILLEXPO	21FLCOLLMILLEXPO	None	25.985800	-81.570500
COL-PON BAY 1-1	TarponBay1	Collier-Tarpon Bay 1-1	25.986000	-81.724083
COL-PON BAY 1-2	TarponBay1	Collier-Tarpon Bay 1-2	25.986000	-81.724083
COL-PON BAY 1-3	TarponBay1	Collier-Tarpon Bay 1-3	25.986000	-81.724083
21FLKWATCOL-TA-ONBAY-1	TarponBay1	Collier-Tarpon Bay-1	25.986000	-81.724080
21FLKWATCOL-TA-ONBAY-2	TarponBay1	Collier-Tarpon Bay-2	25.986000	-81.724080
21FLKWATCOL-TA-ONBAY-3	TarponBay1	Collier-Tarpon Bay-3	25.986000	-81.724080
RBAY192	RBAY192	None	25.987500	-81.699722
ROOK459	ROOK459	Johnson Bay-0.25 nautical mile W of Bob Everett Point	25.988181	-81.729131
21FLCOLLJOHNSBAY	21FLCOLLJOHNSBAY	None	25.990000	-81.728600
21FLA 28030061	TAMBR39	BLACKWATER RIVER AT US41	25.990300	-81.587500
21FLCOLLTAMBR39	TAMBR39	None	25.990300	-81.587100
COL-JO-BAY2-1	JohnsonBay2	Collier-Johnson Bay 2-1	25.991806	-81.720694
COL-JO-BAY2-2	JohnsonBay2	Collier-Johnson Bay 2-2	25.991806	-81.720694
COL-JO-BAY2-3	JohnsonBay2	Collier-Johnson Bay 2-3	25.991806	-81.720694
COL-SON BAY 2-1	JohnsonBay2	Collier-Johnson Bay 2-1	25.991806	-81.720694
COL-SON BAY 2-2	JohnsonBay2	Collier-Johnson Bay 2-2	25.991806	-81.720694
COL-SON BAY 2-3	JohnsonBay2	Collier-Johnson Bay 2-3	25.991806	-81.720694
21FLSFWMBC7	21FLSFWMBC7	Faka Union Canal at west bend of "T"	25.992760	-81.521810
14166	21FLGW14166	SFC-HS-1011 UNKNOWN	25.992930	-81.502816
21FLSFWMBC8	21FLSFWMBC8	Merritt Canal at east bend of "T"	25.993300	-81.490380
112WRD 255937081205000	112WRD 255937081205000	None	25.993980	-81.347020
RBAY191	RBAY191	None	25.994167	-81.703333
21FLFTM EVRGWC0029FTM	21FLFTM EVRGWC0029FTM	SR 951 Bridge South of Mainsail	25.995500	-81.701780
21757	21FLGW21757	SF1-LR-2017 TAMIAMI CANAL	25.996118	-81.594480
21FLFTM EVRGWC0028FTM	21FLFTM EVRGWC0028FTM	Lake @ Mainsail Avenue	25.998060	-81.699610
NTK200130	NTK200130	N 10K Islands - Henderson Creek	26.000000	-81.710000
21FLFMRINTK200124	21FLFMRINTK200124	N 10K Islands - Johnson Bay	26.000000	-81.750000
13733	21FLGW13733	SFC-SL-1048 UNKNOWN	26.002762	-81.680446

Station Name	Merged Name	Station Description	LAT	LON
21FLCOLLLKMRCOSH	21FLCOLLLKMRCOSH	None	26.002800	-81.676900
21FLFTM EVRGWC0058FTM	21FLFTM EVRGWC0058FTM	8063-5	26.007190	-81.782250
21FLCOLLTOMATO41	21FLCOLLTOMATO41	None	26.008000	-81.609100
21FLSFWMBC12	21FLSFWMBC12	Prairie Canal at the end of 82nd Ave. S.E.	26.008830	-81.458110
21FLSFWMHALDCRK	21FLSFWMHALDCRK	Upstream of amil gate at intersection of US41 and*	26.012370	-81.762630
ROOK460	ROOK460	Hall Bay-Pilings N of red daymarker 22	26.015531	-81.743000
21FLCOLLROOKERY6	21FLCOLLROOKERY6	None	26.017300	-81.741800
21FLSFWMROOK461	21FLSFWMROOK461	Rookery Bay	26.017900	-81.734900
21FLSFWMC-00496	21FLSFWMC-00496	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.020100	-81.410600
21FLFTM EVRGWC0030FTM	21FLFTM EVRGWC0030FTM	Canal @ Marsh Drive Bridge	26.020140	-81.671640
21FLFTM PORTAUPR5	PORTAUPR5	Canal @ S. End of Moonbay Ct.	26.020970	-81.693810
PORTAUPR5	PORTAUPR5	None	26.021015	-81.693650
15163	21FLGW15163	SFC-LL-1005 UNKNOWN	26.021539	-81.704660
14168	21FLGW14168	SFC-HS-1014 UNKNOWN	26.021990	-81.345273
21FLCOLLPORTAUPR	21FLCOLLPORTAUPR	None	26.022900	-81.695000
21FLFTM EVRGWC0027FTM	21FLFTM EVRGWC0027FTM	Canal @ Port Au Prince Road	26.024420	-81.692060
PORTAUPR1	PORTAUPR1	None	26.024517	-81.695317
PORTAUPR2	PORTAUPR2	None	26.024517	-81.694617
PORTAUPR4	PORTAUPR4	None	26.024517	-81.694332
PORTAUPR6	PORTAUPR6	None	26.024533	-81.693250
PORTAUPR7	PORTAUPR7	None	26.024533	-81.692283
COL-HE-CREEK-1	HendersonCreek	Collier-Henderson Creek-1-1	26.025694	-81.733194
COL-HE-CREEK-2	HendersonCreek	Collier-Henderson Creek-2-2	26.025694	-81.733194
COL-HE-CREEK-3	HendersonCreek	Collier-Henderson Creek-3-3	26.025694	-81.733194
21FLSFWMROOK479	HendersonCreek	Henderson Creek (project: ROOK)	26.025700	-81.733200
LH	HendersonCreek	Lower Henderson Creek	26.025700	-81.733200
21FLCOLLHCKEST	HCKEST	None	26.026500	-81.735500
SGGE22SW	SGGE22SW	SGGE22SW	26.027260	-81.478318
21FLSFWMCOCPALM	21FLSFWMCOCPALM	Bridge at intersection of Palm River Drive and Co*	26.027780	-81.778060

Station Name	Merged Name	Station Description	LAT	LON
21FLFMRINTK200123	21FLFMRINTK200123	N 10K Islands - Henderson Creek	26.030000	-81.730000
21FLSFWMAGCANAL	21FLSFWMAGCANAL	AGRICULTURAL CANAL SURFACE WATER	26.031570	-81.630690
21FLSFWMROOK462	21FLSFWMROOK462	First National	26.034200	-81.751200
21FLCOLLHNDRCRK	21FLCOLLHNDRCRK	None	26.035000	-81.719800
21FLFTM EVRGWC0057FTM	21FLFTM EVRGWC0057FTM	8063-4	26.036420	-81.807720
21FLFMRINTK200129	21FLFMRINTK200129	N 10K Islands - Rookery Bay	26.040000	-81.770000
21FLFMRINTK200122	21FLFMRINTK200122	N 10K Islands - Rookery Bay	26.040000	-81.760000
SGGE23SW	SGGE23SW	SGGE Prairie Canal Transect 4 Surface Water	26.040405	-81.463266
21FLCOLLROOKERY2	Rookery2	None	26.041500	-81.767300
112WRD 260231081203900	112WRD 260231081203900	None	26.042310	-81.343970
21FLFTM EVRGWC0062FTM	21FLFTM EVRGWC0062FTM	Henderson Creek @ KOA Boat Ramp	26.046030	-81.708360
21FLSFWMSGGE17SW	21FLSFWMSGGE17SW	SGGE Prairie Canal Transect 3 Surface Water	26.047600	-81.441320
UH	UH	Upper Henderson Creek	26.049000	-81.701200
21FLFTM EVRGWC0059FTM	21FLFTM EVRGWC0059FTM	Henderson Creek @ Enchanting Shores Boat Ramp	26.049360	-81.687360
21FLFTM EVRGWC0061FTM	21FLFTM EVRGWC0061FTM	Henderson Creek @ Rookery Bay Dock	26.049440	-81.701470
21FLFTM EVRGWC0060FTM	21FLFTM EVRGWC0060FTM	Henderson Creek @ Riverwood Boat Ramp	26.050530	-81.699250
21FLSFWMROOK463	21FLSFWMROOK463	Kewaydin Channel, G55	26.051300	-81.767800
21FLFTM EVRGWC0063FTM	21FLFTM EVRGWC0063FTM	Culvert @ Tower Rd.	26.051500	-81.707690
SGGE16SW	SGGE16SW	SGGE Prairie Canal Transect 3 Surface Water	26.055066	-81.471817
21FLSFWMBC6	HendersonCrk@41	Downstream of weir in Henderson Creek south of US*	26.056670	-81.689860
21FLA 28030054	HendersonCrk@41	HENDERSON CREEK AT US 41 IN NAPLESCANALIZED NO	26.056900	-81.690300
21FLSFWMBC22	21FLSFWMBC22	Gauging Station North of intersection of US41 and*	26.057110	-81.683960
21FLCOLLHENDCRK	21FLCOLLHENDCRK	None	26.057600	-81.689380
RBAY180	RBAY180	None	26.059444	-81.776111
21FLCOLLSANDHILL	21FLCOLLSANDHILL	None	26.060000	-81.753400
21FLFTM EVRGWC0056FTM	21FLFTM EVRGWC0056FTM	8063-3	26.060860	-81.818190
RBAY170	RBAY170	None	26.067222	-81.777222
21750	21FLGW21750	SF1-LR-2015 UNNAMED LARGE RIVER	26.068327	-81.522358
21FLCOLLBLHERON	21FLCOLLBLHERON	None	26.073500	-81.404400

Station Name	Merged Name	Station Description	LAT	LON
21FLCOLLLELYICW	21FLCOLLLELYICW	None	26.076800	-81.778900
21FLCOLLLMANOR2	21FLCOLLLMANOR2	None	26.080100	-81.749700
COL-COL7-988	COL7	Collier-COL7-988	26.083133	-81.806717
COL-COL7-998	COL7	Collier-COL7-998	26.083300	-81.806783
COL-COL7-009	COL7	Collier-COL7-009	26.083483	-81.806750
COL-COL10-017	COL10	Collier-COL10-017	26.083617	-81.785517
COL-COL10-034	COL10	Collier-COL10-034	26.083900	-81.785717
COL-COL10-041	COL10	Collier-COL10-041	26.084017	-81.785783
21FLSFWMROOK465	21FLSFWMROOK465	Outer Gordon Pass, G1	26.084100	-81.801100
21FLCOLLLMAIN2	21FLCOLLLMAIN2	None	26.086700	-81.761900
21FLKWATCOL-NAPDOLLBA-	DollarBay15	Collier-Naples Bay-DOLLAR 15-1	26.089450	-81.786770
21FLKWATCOL-NB-DOL-15-1	DollarBay15	Collier-Naples Bay-DOLLAR-15-1	26.089450	-81.786770
21FLCOLLDOLLAR15	DollarBay15	None	26.089500	-81.786800
21FLFMRINTK200121	21FLFMRINTK200121	N 10K Islands - Naples Bay	26.090000	-81.790000
21FLCOLLGORD10	21FLCOLLGORD10	None	26.093000	-81.798600
21FLKWATCOL-NAPGOR1BA-	GORD10	Collier-Naples Bay-GORD 10-1	26.093000	-81.798580
21FLKWATCOL-NB-GOR-10-1	GORD10	Collier-Naples Bay-GORD-10-1	26.093000	-81.798580
21FLNAPLGPASS6	GORD10	Naples Bay just inside Gordon's Pass by marker 6	26.093000	-81.798580
21FLFTM EVRGWC0055FTM	21FLFTM EVRGWC0055FTM	8063-2	26.093030	-81.822610
SGGE11SW	SGGE11SW	SGGE Prairie Canal Transect 2 Surface Water	26.093083	-81.460796
21FLCOLLLMANOR	21FLCOLLLMANOR	None	26.094200	-81.737200
21FLBRA 3259G-B	21FLBRA 3259G-B	3259G - Naples Bay - side inlet at end of Gordon *	26.095650	-81.800750
21FLSFWMC-00447	21FLSFWMC-00447	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.097600	-81.687300
21FLBRA 3259G-E	21FLBRA 3259G-E	3259G - Naples Bay - at channel marker 16	26.098730	-81.791380
21FLBRA 3259G-D	21FLBRA 3259G-D	3259G - Naples Bay - S of channel marker 18	26.099890	-81.789310
ROOK464	ROOK464	Dollar Bay, G73	26.100000	-81.787181
21FLNAPLNBAY13	21FLNAPLNBAY13	Naples Bay just inside Doubloon Bay in Port Royal	26.100330	-81.797470
21FLNAPLNBAYBV	21FLNAPLNBAYBV	Naples Bay just south of BayView Park	26.101360	-81.785190
21FLBRA 3259G-C	21FLBRA 3259G-C	3259G - Naples Bay - at channel marker 19	26.101580	-81.787670

Station Name	Merged Name	Station Description	LAT	LON
21FLNAPLNBAY21	Bay20	Naples Bay at channel marker 21	26.102500	-81.787020
21FLCOLLNBAY20	Bay20	None	26.102500	-81.787000
21FLFTM NBAY20	Bay20	NBAY-3	26.102500	-81.787000
21FLA 28030035	JayceePark	NAP BAY JAYCEE PK	26.103100	-81.786100
21FLSFWMBC10	21FLSFWMBC10	Faka Union Canal at intersection of I-75 (FAKAUC75)	26.103140	-81.052340
21FLBRA 3259G-A	JayceePark	3259G - Naples Bay - end of walkway in park	26.103580	-81.785080
21FLCOLLLELY	21FLCOLLLELY	None	26.104700	-81.746300
21744	21FLGW21744	SF1-LR-2037 UNNAMED LARGE RIVER	26.107329	-81.344644
21FLSFWMC-00599	21FLSFWMC-00599	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.108700	-81.687000
21FLKWATCOL-NAPNBA2BA-	NaplesBay22	Collier-Naples Bay-NBAY 22-1	26.109480	-81.792210
21FLKWATCOL-NB-NBAY22-1	NaplesBay22	Collier-Naples Bay-NBAY-22-1	26.109480	-81.792210
21FLNAPLNBAYTC	NaplesBay22	Naples Bay in a canal and at entrance to Treasure*	26.109480	-81.792210
21FLCOLLNBAY22	NaplesBay22	None	26.109500	-81.792200
21FLFTM NBAY22	NaplesBay22	NBAY-4	26.109500	-81.792200
SGGE10SW	SGGE10SW	SGGE Prairie Canal Transect 2 Surface Water	26.109816	-81.476218
C-296	C-296	50S30E18 C-296	26.110001	-81.330002
COL-COL6-617	COL6	Collier-COL6-617	26.110283	-81.810333
COL-COL6-631	COL6	Collier-COL6-631	26.110517	-81.810483
COL-COL6-633	COL6	Collier-COL6-633	26.110550	-81.810250
21FLSFWMC-00296	21FLSFWMC-00296	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.111500	-81.345100
COL-COL9-716	COL9	Collier-COL9-716	26.111933	-81.785850
COL-COL9-742	COL9	Collier-COL9-742	26.112367	-81.786200
COL-COL9-775	COL9	Collier-COL9-775	26.112917	-81.786417
21FLCOLLAVALON	21FLCOLLAVALON	None	26.113000	-81.762000
21FLKWATCOL-NAPNBAYBA-	NaplesBay24	Collier-Naples Bay-NBAY 24-1	26.113170	-81.786040
21FLKWATCOL-NB-NBAY24-1	NaplesBay24	Collier-Naples Bay-NBAY-24-1	26.113170	-81.786040
21FLNAPLNBAYWS	NaplesBay24	Naples Bay near marker 24 and Windstar dock/shoal	26.113170	-81.786040
21FLCOLLNBAY24	NaplesBay24	None	26.113200	-81.786000
21FLFTM NBAY24	NaplesBay24	NBAY-2	26.113200	-81.786000

Station Name	Merged Name	Station Description	LAT	LON
21FLA 28030068	21FLA 28030068	LAKE AVALON,MID-LAKE	26.113900	-81.762200
112WRD 260650081204100	112WRD 260650081204100	None	26.114260	-81.344520
21FLFTM EVRGWC0054FTM	21FLFTM EVRGWC0054FTM	8063-1	26.115250	-81.824000
21FLNAPLNBAYLLO	21FLNAPLNBAYLLO	Naples Bay in Morgan's Cove at dead end of canal	26.115780	-81.796830
21745	21FLGW21745	SF1-LR-2011 UNNAMED LARGE RIVER	26.116223	-81.686684
21FLCOLLNBAY41	NaplesBay41	None	26.118500	-81.788800
21FLFTM NBAY41	NaplesBay41	NBAY-1	26.118500	-81.788800
21FLNAPLNBAYKF	NaplesBay41	Naples Bay at mouth of Kingfish Rd canal	26.118500	-81.788750
21FLCOLLBARRETT	21FLCOLLBARRETT	None	26.119900	-81.765400
21FLNAPLNBAYHC	HaldemanBay	Naples Bay in Haldeman Creek	26.120830	-81.785060
21FLCOLLHALDNB	HaldemanBay	None	26.121200	-81.784500
21FLNAPLNBAY29	21FLNAPLNBAY29	Naples Bay just west of marker 29	26.122560	-81.792250
21FLCOLLHALDCRK	21FLCOLLHALDCRK	None	26.123700	-81.762600
21751	21FLGW21751	SF1-LR-2033 UNNAMED LARGE RIVER	26.123903	-81.744353
21FLCOLLHALD32	HaldCk	None	26.124800	-81.779000
21FLA 28030057	HC@Bayshore	HALDEMAN CREEK AT SR 858 BRIDGE COLLIER COUN	26.125000	-81.771100
21FLSFWMBC5	HC@Bayshore	Bridge at intersection of Haldeman Creek and Bays*	26.125360	-81.770370
21FLCOLLNBAY50	NaplesBay50	None	26.129200	-81.791200
21FLFTM NBAY50	NaplesBay50	GORDON RIVER SITE 4	26.129200	-81.791200
21FLNAPLNBAY33	NaplesBay50	Naples Bay at Marker 33	26.129200	-81.791160
21FLKWATCOL-NAPBAAQS8-	AQS8-1	Collier-Naples Bay-AQS 8-1	26.129250	-81.801170
COL-NB-AQS-8-1	AQS8-1	Collier-Naples Bay-AQS 8-1	26.129250	-81.801169
21FLA 28030033	21FLA 28030033	NAP BAY YACHT BASIN	26.129700	-81.793900
21FLKWATCOL-NA-ESBAY-1	ESBAY	Collier-Naples Bay-1	26.129780	-81.792080
21FLKWATCOL-NA-ESBAY-2	ESBAY	Collier-Naples Bay-2	26.129780	-81.792080
21FLKWATCOL-NA-ESBAY-3	ESBAY	Collier-Naples Bay-3	26.129780	-81.792080
21FLFMRINTK200120	21FLFMRINTK200120	N 10K Islands - Naples Bay	26.130000	-81.790000
21749	21FLGW21749	SF1-LR-2024 UNNAMED LARGE RIVER	26.130521	-81.522988
COL-COL8-972	COL8	Collier-COL8-972	26.132867	-81.790167

Station Name	Merged Name	Station Description	LAT	LON
COL-COL8-973	COL8	Collier-COL8-973	26.132883	-81.790183
COL-COL8-986	COL8	Collier-COL8-986	26.133100	-81.790167
21FLSFWMBC1	21FLSFWMBC1	Channel marker 38 in Naples Bay	26.134120	-81.807130
21FLNAPLNBAYNL	21FLNAPLNBAYNL	Naples Bay near Naples Landing	26.134720	-81.791970
21748	21FLGW21748	SF1-LR-2025 UNNAMED LARGE RIVER	26.136684	-81.344816
21FLNAPLNBAYCC	21FLNAPLNBAYCC	Naples Bay at entrance to Curlew Canal	26.137030	-81.788170
21FLCOLLGORD60	Gord60	None	26.140600	-81.786500
21FLFTM GORD60	Gord60	GORDON RIVER SITE 3	26.140600	-81.786500
21FLFTM 28030069FTM	21FLFTM 28030069FTM	Spring Lake in Naples	26.140640	-81.800280
21FLCOLLBC2	BC2	None	26.140900	-81.785100
21FLSFWMBC2	BC2	Just inside the mouth of Rock Creek	26.140940	-81.785130
21FLA 28030032	21FLA 28030032	NAP BAY ROCK CK	26.141400	-81.784200
21FLA 28030049	21FLA 28030049	NAPLES BAY 5 AV S BR W	26.141700	-81.790300
21FLNAPLGORDJOE	21FLNAPLGORDJOE	Gordon River by Joe's Crab Shack	26.142000	-81.786750
21FLCOLLROCK62	21FLCOLLROCK62	None	26.142900	-81.782800
21FLA 28030052	21FLA 28030052	ROCK CREEK BELOW ROCK CREEK CAMP. NEAR SR 31 I	26.143100	-81.770800
21FLCOLLCHKMATE	Chkmate	None	26.143600	-81.389300
21FLSFWMCHKMATE	Chkmate	Middle of Checkmate Pond Fakahatchee Strand	26.143610	-81.389290
21FLSFWMC-00972	21FLSFWMC-00972	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.144000	-81.524000
21FLCOLLROCKE	21FLCOLLROCKE	None	26.145500	-81.766200
21FLCOLLROCKW	21FLCOLLROCKW	None	26.146000	-81.766700
13736	21FLGW13736	SFC-SL-1054 UNKNOWN	26.147307	-81.347057
14160	21FLGW14160	SFC-HS-1002 UNKNOWN	26.147703	-81.754851
21FLNAPLGORDPK	21FLNAPLGORDPK	Gordon River by Pulling Park	26.148690	-81.786220
21FLA 28030031	21FLA 28030031	NAP BAY S OF NAP STP EFF	26.149400	-81.786400
28030031	21FLFTM28030031	NAP BAY S OF NAP STP EFF	26.149444	-81.786389
21FLCOLLHEND951	21FLCOLLHEND951	None	26.151100	-81.685000
21FLKWATCOL-NAPGOR7BA-	GORD70	Collier-Naples Bay-GORD 70-1	26.151980	-81.785620
21FLKWATCOL-NB-GOR-70-1	GORD70	Collier-Naples Bay-GORD-70-1	26.151980	-81.785620

Station Name	Merged Name	Station Description	LAT	LON
21FLNAPLGORDWW	GORD70	Naples Bay adjacent to Wastewater Outfall	26.152000	-81.785620
21FLCOLLGORD70	GORD70	None	26.152000	-81.785600
21FLSFWMBC9	21FLSFWMBC9	Miller Canal at intersection of I-75	26.153170	-81.555260
21FLCOLLFAKAUC75	FAKAUC75	None	26.153200	-81.523300
21FLSFWMBC11	21FLSFWMBC11	Merritt Canal at intersection of I-75	26.153510	-81.490640
21FLFTM 28030030	GORD30	NAP BAY GORD R @ PORT AVE	26.153890	-81.786390
21FLNAPLGORDPT	GORD31	Gordon River near Port Ave	26.153890	-81.785390
21FLA 28030041	SR29 at SR84	SR 29 CAN SR 84 BR	26.153900	-81.345000
21FLSFWMC-00450	FLSFWMC-450	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.154000	-81.686700
21FLSFWMC-450	FLSFWMC-450	C-450	26.154250	-81.687560
21FLCOLLFAKA84	21FLCOLLFAKA84	None	26.154500	-81.389500
21FLCOLLLANDFILL	21FLCOLLLANDFILL	None	26.156200	-81.661700
21747	21FLGW21747	SF1-LR-2036 I-75 CANAL	26.156202	-81.667959
14164	21FLGW14164	SFC-HS-1008 UNKNOWN	26.159706	-81.344354
21FLCOLLGORD80	Gord80	None	26.159900	-81.783800
21FLKWATCOL-NAPGORDBA-	Gord80	Collier-Naples Bay-GORD 80-1	26.159940	-81.783840
21FLKWATCOL-NB-GOR-80-1	Gord80	Collier-Naples Bay-GORD-80-1	26.159940	-81.783840
21FLSFWMBC3	21FLSFWMBC3	Gordon River Ext. at mouth of canal leading to Ma*	26.163280	-81.786540
21FLA 28030048	21FLA 28030048	GORDON R BEMBURY CANAL	26.163300	-81.787500
22543	21FLGW22543	SF1-SS-2035 UNNAMED SMALL STREAM	26.164148	-81.780909
21FLCOLLGGC10	21FLCOLLGGC10	None	26.166800	-81.718600
21FLA 28030053	21FLA 28030053	GOLDEN GATE CANAL BETWEEN SR31/I75UPSTREAM OF	26.167200	-81.752800
21FLCOLLLUCKYLAKE	21FLCOLLLUCKYLAKE	None	26.167400	-81.493300
21FLA 28030038	GGCAT31	GOLD GATE CAN SR 951 BR	26.167500	-81.767500
21FLSFWMBC4	21FLSFWMBC4	Dwnstrm. weir in Golden Gate Canal across from *	26.167770	-81.775740
21FLSFWMGGCAT31	GGCAT31	AIRPORT PULLING ROAD AT GOLDEN GATE CANAL	26.167870	-81.767310
21FLCOLLGGCAT31	GGCAT31	None	26.168100	-81.767500
21FLGW 3495	21FLGW 3495	GOLDEN GATE CANAL AT C.R. 31	26.168150	-81.766750
21FLSTBAHURRICANE HBR	HurricaneHbr	ENT. TO HURRICANE HARBOUR S OF SPRING DR.	26.168200	-81.809000

Station Name	Merged Name	Station Description	LAT	LON
21FLNAPLMB4	HurricaneHbr	South of Mooring Line Dr. in Hurricane Harbor.	26.168660	-81.808930
21FLSFWMI75-260M	21FLSFWMI75-260M	MONITOR SITE LOWER WEST COAST RECON.	26.169080	-81.728670
21FLSFWMGGCAT951	GGCAT951	GOLDEN GATE CANAL AT S.R. 951	26.169530	-81.686750
21FLFTM MGG03@32	GGO3@32	MGG03@32 - WBID-3259D	26.169760	-81.705480
21FLSFWMI75-100M	21FLSFWMI75-100M	MONITOR SITE LOWER WEST COAST RECON.	26.169850	-81.729710
21FLCOLLMGG03@32	GGO3@32	None	26.170000	-81.705200
21FLCOLLGGCAT951	GGCAT951	None	26.170300	-81.686700
21FLCOLLCOCHRANL	21FLCOLLCOCHRANL	None	26.170300	-81.382600
21FLSFWMBC23	GGCAT951	Bridge at intersection of Main Golden Gate Canal *	26.170340	-81.686740
21FLFTM EVRGWC0051FTM	21FLFTM EVRGWC0051FTM	Canal @ Bridge 034011	26.172030	-81.702060
112WRD 02291280	112WRD 02291280	GORDON RIVER AT NAPLES,FLA	26.172500	-81.785000
21FLFTM EVRGWC0050FTM	21FLFTM EVRGWC0050FTM	Canal @ 31st Ave SW	26.172690	-81.671170
21FLCOLLSAPPHIRE	21FLCOLLSAPPHIRE	None	26.173000	-81.708000
21FLSFWMGORDONRV	GordonRiv	NO DESCRIPTION AVAILABLE FOR THIS STATION	26.173150	-81.785080
GRESTA10	GordonRiv	None	26.173217	-81.784500
21FLCOLLGORDONRIV	GordonRiv	None	26.173280	-81.784580
21FLFTM 28030047	GordonRiv	GORDON R ABOVE WIER 951	26.173330	-81.784720
COL-NAPGRE8BA-1	GRE896-1	Collier-Naples Bay-GRE 896-1	26.173800	-81.784608
COL-NB-GRE896-1	GRE896-1	Collier-Naples Bay-GRE 896-1	26.173800	-81.784608
21FLSFWMC-00409A	21FLSFWMC-00409A	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.174000	-81.800100
21FLCOLLD2886	21FLCOLLD2886	None	26.174000	-81.733800
GRESTA7	GRESTA7	None	26.175517	-81.786850
21FLCOLLAIRPORT886	21FLCOLLAIRPORT886	None	26.176300	-81.765100
21FLFTM EVRGWC0052FTM	21FLFTM EVRGWC0052FTM	Canal @ Bridge 030123	26.176810	-81.711080
112WRD 261036081204400	112WRD 261036081204400	None	26.177030	-81.345350
21FLSTBAMOORINGS	MOORINGS	MOORINGS BAY BETWEEN DR. PASS & HARBOUR DR.	26.178200	-81.811600
21FLNAPLMB3	MOORINGS	Just north of Doctors Pass and the flood shoal	26.178200	-81.811200
COL-COL4-749	COL4	Collier-COL4-749	26.179150	-81.810250
COL-COL4-758	COL4	Collier-COL4-758	26.179300	-81.810183

Station Name	Merged Name	Station Description	LAT	LON
21FLCOLLDOCTORS	21FLCOLLDOCTORS	None	26.180900	-81.811800
21746	21FLGW21746	SF1-LR-2014 UNNAMED LARGE RIVER	26.182074	-81.671016
21FLFTM EVRGWC0053FTM	21FLFTM EVRGWC0053FTM	Canal @ Bridge 034103	26.183060	-81.716310
21FLFTM EVRGWC0049FTM	21FLFTM EVRGWC0049FTM	Canal @ 25th Ave SW	26.183060	-81.671250
GRESTA8	GRESTA8	None	26.183732	-81.779767
21FLFTM EVRGWC0045FTM	21FLFTM EVRGWC0045FTM	Lagoon @ Leeward and Baypoint	26.183810	-81.809250
21FLNAPLMB2	21FLNAPLMB2	South of Venetian Village	26.188200	-81.811870
21FLSFWMC-392	21FLSFWMC-392	C-392	26.190000	-81.790000
21FLCOLLGCB01@20	21FLCOLLGCB01@20	None	26.190200	-81.707900
21FLSFWMC-00392	21FLSFWMC-00392	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.190400	-81.791500
14181	21FLGW14181	SFC-HS-1033 UNKNOWN	26.190853	-81.527762
21FLCOLLGCB02@SUN	21FLCOLLGCB02@SUN	None	26.191900	-81.696500
21FLCOLLWILSONLK	21FLCOLLWILSONLK	None	26.193500	-81.413200
21FLCOLLROYALP	21FLCOLLROYALP	None	26.196100	-81.784200
GRESTA5	GRESTA5	None	26.196232	-81.783550
GRESTA4	GRESTA4	None	26.196250	-81.786833
21FLCOLLGREEN@SB	21FLCOLLGREEN@SB	None	26.197400	-81.719400
21FLCOLLGGC05@23	21FLCOLLGGC05@23	None	26.198100	-81.652800
21FLFTM EVRGWC0044FTM	21FLFTM EVRGWC0044FTM	Canal @ 304 Turtle Hatch Road	26.198310	-81.810690
21FLCOLLGGC14	21FLCOLLGGC14	None	26.198800	-81.703600
GRESTA3	GRESTA3	None	26.201750	-81.782350
21FLSFWMBC24	21FLSFWMBC24	Bridge #30211 on SR 29 approx. 3.1 miles north of*	26.203520	-81.346460
14162	21FLGW14162	SFC-HS-1005 UNKNOWN	26.204698	-81.346039
21FLSTBASEAGATE	VenetianBay	NW CORNER OF VENETIAN BAY S OF SEAGATE DR	26.206300	-81.814000
21FLNAPLMB1	VenetianBay	Moorings Bay/Venetian Bay just south of Seagate D*	26.207010	-81.813670
21FLSTBASTATION 1	VenetianBay	NW CORNER OF SEAGATE DR & SEAHORSE AVE	26.207400	-81.813800
21FLSTBASTATION 6	21FLSTBASTATION 6	THE S END OF CARRIBEAN CANAL	26.207800	-81.809300
21FLSTBASTATION 2	21FLSTBASTATION 2	W OF N END OF SEAHORSE AVE.	26.210100	-81.814200
21FLSTBASTATION 5	21FLSTBASTATION 5	AT GULF STREAM CANAL & CARRIBEAN CANAL	26.210400	-81.810100

Station Name	Merged Name	Station Description	LAT	LON
21FLFTM EVRGWC0043FTM	21FLFTM EVRGWC0043FTM	Canal @ End of Starfish Avenue	26.210780	-81.810310
21FLCOLLGRE896	21FLCOLLGRE896	None	26.211200	-81.784700
21FLCOLLARS@896	21FLCOLLARS@896	None	26.211400	-81.768200
COL-NAPARS8BA-1	ARS896-1	Collier-Naples Bay-ARS 896-1	26.211439	-81.768181
COL-NB-ARS896-1	ARS896-1	Collier-Naples Bay-ARS 896-1	26.211439	-81.768181
GRESTA2	GRESTA2	None	26.211567	-81.784467
21752	21FLGW21752	SF1-LR-2031 UNNAMED LARGE RIVER	26.211969	-81.573732
C-490	C-490	C-490	26.212311	-81.800640
21FLSTBASTATION 3	21FLSTBASTATION 3	CENTER OF OUTER CLAM BAY	26.212500	-81.814600
21FLCOLLGGC@WHITE	21FLCOLLGGC@WHITE	None	26.212700	-81.655300
21753	21FLGW21753	SF1-LR-2021 UNNAMED LARGE RIVER	26.212942	-81.594353
21FLGW 37106	21FLGW 37106	Z5-LR-3010 Main Golden Gate Canal	26.214480	-81.649330
21FLFTM EVRGWC0048FTM	21FLFTM EVRGWC0048FTM	Canal @ 7th Ave SW	26.216000	-81.670920
112WRD 261306081204000	112WRD 261306081204000	None	26.218700	-81.344240
21FLSFWMC-00490	C-490	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.220600	-81.800400
C-575	C-575	C - 575	26.221755	-81.801195
21FLSFWMC-00575	C-575	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.222000	-81.801700
21FLKWATCOL-CL-YWEST-3	21FLKWATCOL-CL-YWEST-3	Collier-Clam Bay West-3	26.223000	-81.816700
GRESTA1	GRESTA1	None	26.227067	-81.784683
21FLFTM EVRGWC0047FTM	21FLFTM EVRGWC0047FTM	Canal @ Big Cypress Elem.	26.227610	-81.671280
21FLCOLL9CN@GGBL	21FLCOLL9CN@GGBL	None	26.228900	-81.687300
21FLCOLLCYPR@GGB	21FLCOLLCYPR@GGB	None	26.229000	-81.671100
21FLCOLLGGC@GGBE	21FLCOLLGGC@GGBE	None	26.229900	-81.588600
21FLKWATCOL-CL-YEAST-1	21FLKWATCOL-CL-YEAST-1	Collier-Clam Bay East-1	26.231080	-81.812900
14167	21FLGW14167	SFC-HS-1013 UNKNOWN	26.233295	-81.343194
21FLKWATCOL-CL-YWEST-2	21FLKWATCOL-CL-YWEST-2	Collier-Clam Bay West-2	26.237500	-81.812900
14184	21FLGW14184	SFC-HS-1039 UNKNOWN	26.238363	-81.528474
21FLKWATCOL-CL-YEAST-3	21FLKWATCOL-CL-YEAST-3	Collier-Clam Bay East-3	26.238500	-81.817080
21FLKWATCOL-CL-YEAST-2	21FLKWATCOL-CL-YEAST-2	Collier-Clam Bay East-2	26.241580	-81.816080

Station Name	Merged Name	Station Description	LAT	LON
11NPSWRDBICY_A01	A01_Nbear	NORTH BEAR ISLAND	26.242600	-81.320400
21FLSFWMBCWQA1	A01_Nbear	NORTH BEAR ISLAND	26.242970	-81.320210
21FLKWATCOL-CL-YWEST-1	21FLKWATCOL-CL-YWEST-1	Collier-Clam Bay West-1	26.243920	-81.820550
21FLFTM EVRGWC0046FTM	21FLFTM EVRGWC0046FTM	Canal @ 8th Ave NW	26.243920	-81.671280
21FLCOLLARN@VAND	21FLCOLLARN@VAND	None	26.244000	-81.768700
21FLCOLLI75C@VAN	21FLCOLLI75C@VAN	None	26.244100	-81.736100
21FLSFWMC-999	FLSFWMC-999	C - 999	26.252580	-81.813420
21FLSFWMC-00999	FLSFWMC-999	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.252600	-81.813400
BCAP1	BCAP1	BCAP1	26.253033	-81.289467
21FLFTM EVRGWC0042FTM	21FLFTM EVRGWC0042FTM	Lagoon @ 179 Southbay Drive	26.255250	-81.822060
21FLCOLLVICLAK	21FLCOLLVICLAK	None	26.258000	-81.785600
21FLFTM EVRGWC0041FTM	21FLFTM EVRGWC0041FTM	Canal Southeast of 368 Bayside Avenue	26.259360	-81.819060
21FLFTM EVRGWC0040FTM	Canal@99thAve	Canal @ 99th Ave. and Vanderbelt Drive	26.261500	-81.817530
21FLCOLLVBILT	21FLCOLLVBILT	None	26.261850	-81.822670
14182	21FLGW14182	SFC-HS-1035 UNKNOWN	26.262406	-81.624948
21FLA 28030006	21FLA 28030006	VANDERBILT WWAY CHAN DR FINGER V	26.264200	-81.820800
14183	21FLGW14183	SFC-HS-1036 UNKNOWN	26.264508	-81.790471
21FLA 28030013	21FLA 28030013	VANDERBILT WWAY BETW CONNERS AVE	26.266700	-81.823300
21FLCOLLWCOCO2	21FLCOLLWCOCO2	None	26.267200	-81.788500
21FLSFWMC-00303	21FLSFWMC-00303	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.267300	-81.689500
21FLCOLLWCOCO3	21FLCOLLWCOCO3	None	26.267700	-81.789400
21FLFTM EVRGWC0038FTM	21FLFTM EVRGWC0038FTM	CR 951 Canal at Tuscany Cove Drive	26.267970	-81.688920
21FLSFWMCOCAT41	21FLSFWMCOCAT41	Cocohatchee River at US 41	26.268250	-81.801880
COL-LONGSHORE-1	Longshore	Collier-Longshore-1	26.268528	-81.721361
COL-LONGSHORE-2	Longshore	Collier-Longshore-2	26.268528	-81.721361
COL-LONGSHORE-3	Longshore	Collier-Longshore-3	26.268528	-81.721361
BC15	21FLFTMBC15	Airport Rd. Canal @ Sam's Club	26.271080	-81.769410
21FLSFWMBC15	21FLSFWMBC15	Airport Rd. Canal at entrance to Sam's Club	26.271090	-81.769430
21FLFTM EVRGWC0079FTM	21FLFTM EVRGWC0079FTM	Cocohatchee @ Creekside Rd.	26.271260	-81.791900

Station Name	Merged Name	Station Description	LAT	LON
21FLCOLLNNAPLES	21FLCOLLNNAPLES	None	26.272000	-81.791800
21FLCOLLECOCORIV	ECocoRiv	None	26.272100	-81.783800
21FLFTM ECOCORIV	ECocoRiv	E. Branch of Cocohatchee River @ S.R. 846	26.272100	-81.783800
21FLCOLLWCOCORIV	21FLCOLLWCOCORIV	None	26.272200	-81.786700
21FLA 28030037	21FLA 28030037	COCOHAT R SR 846 BR	26.272200	-81.784400
21FLSFWMECOCORIV	ECocoRiv	E. BRANCH OF COCOHATCHEE RIVER AT S.R. 846 NEAR P*	26.272310	-81.783970
21FLCOLLCOCAT951	I951_Immokalee	None	26.272400	-81.689400
21FLSFWMBC26	I951_Immokalee	Intersection of 951 Canal and Immokalee Rd. Canal*	26.272420	-81.689360
13713	21FLGW13713	SFC-SL-1006 UNKNOWN	26.272436	-81.352160
21FLSFWMC-384	FLSFWMC-384	48S26E30 C-384	26.272580	-81.751720
21FLSFWMCOCEOF31	COCEOF31	COCOHATCHEE CANAL AT S.R. 846, 1/2 MILEEAST OF S.*	26.272590	-81.779810
21FLSFWMC-00384	FLSFWMC-384	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.272600	-81.751200
21FLSFWMBC14	21FLSFWMBC14	Immokalee Rd. Canal at intersection of Palm River*	26.272680	-81.778320
21FLFTM BC14	21FLFTM BC14	Cocohatchee River Canal @ Palm River Blvd	26.272680	-81.778300
21FLFTM COCEOF31	COCEOF31	Cocohatchee R. @ Piper Blvd -- WBID 3259B	26.272690	-81.779750
21FLFTM 28020265FTM	COCEOF31	Cocohatchee River at Immokalee Rd and Palm River *	26.272690	-81.779690
21FLA 28030007	21FLA 28030007	VANDERBILT WWAY SR 846 BR VANDER	26.272800	-81.823900
21FLCOLLCOCEOF31	21FLCOLLCOCEOF31	None	26.272800	-81.763500
21FLSFWMC-303	21FLSFWMC-303	C-303 SR846 &SR951	26.272860	-81.689500
21FLFTM COC@LAKE	Coco@Lake	Cocohatchee River Canal @ Lakeland Ave Bridge	26.272970	-81.759880
21FLSFWMCOC@LAKE	Coco@Lake	BRIDGE AT INTERSECION LAKELAND AVE&COCOHATCHEE RI*	26.272980	-81.759890
21FLSFWMBC13	21FLSFWMBC13	Downstream of weir in Immokalee Rd. Canal west of*	26.273080	-81.779890
21FLCOLLQUAILCK	21FLCOLLQUAILCK	None	26.273400	-81.735000
21FLSFWMCOCAT951	21FLSFWMCOCAT951	Location from geographic positioning system (accu*	26.273420	-81.689250
21FLFTM EVRGWC0077FTM	21FLFTM EVRGWC0077FTM	Cocohatchee @ Remington Reserve Path	26.274510	-81.792330
21FLFTM EVRGWC0039FTM	21FLFTM EVRGWC0039FTM	CR 846 Canal@ Twin Eagles Blvd.	26.274780	-81.639140
21FLCOLLPIPERS	21FLCOLLPIPERS	None	26.275000	-81.635200
21FLCOLLWILSON846	21FLCOLLWILSON846	None	26.276700	-81.607500
C-304	C-304	C - 304	26.276752	-81.603412

Station Name	Merged Name	Station Description	LAT	LON
21FLFTM EVRGWC0078FTM	Coco @ Collier Reserve	Cocohatchee @ Collier Reserve Dr.	26.276770	-81.790450
21FLSFWMC-00304	C-304	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.276800	-81.603400
21FLCOLLCOCOHOSP	Coco @ Collier Reserve	None	26.276900	-81.790600
21FLFTM 28030071FTM	21FLFTM 28030071FTM	VANDERBILT SURF CLUB AT TURKEY BAY	26.276970	-81.824080
21FLSFWMCOCPALMR	CocoPalm	NORTH OF S.R. 846 IN PALM RIVER ESTATES	26.277310	-81.777580
21FLCOLLORANGETR	21FLCOLLORANGETR	None	26.277600	-81.581100
21FLFTM EVRGWC0076FTM	21FLFTM EVRGWC0076FTM	Cocohatchee @ Dimock St.	26.277720	-81.793150
21FLCOLLCOCPALM	CocoPalm	None	26.277800	-81.778100
COCPALM	21FLFTMCOCPALM	Palm River Blvd. @ Bridge	26.277800	-81.778100
21FLSFWMCORK@846	Cork@846	Bridge at intersection of Corkscrew Canal and CR8*	26.277980	-81.601020
21FLCOLLCORK@846	Cork@846	None	26.278000	-81.601000
21FLFTM CORK@846	Cork@846	Corkscrew Canal @ CR 846	26.278000	-81.601000
21FLFTM EVRGWC0024FTM	21FLFTM EVRGWC0024FTM	Collier Reserve at Cart Bridge	26.278860	-81.791170
TurkBay	TURKBAY	In middle of Channel of Water Turkey Bay	26.278889	-81.823889
15184	21FLGW15184	SFC-LL-1039 UNKNOWN	26.279057	-81.344583
21FLFTM EVRGWC0081FTM	21FLFTM EVRGWC0081FTM	Cocohatchee River @ Collier Reserve Clubhouse Ca*	26.280880	-81.795410
COC@IBIS	21FLFTMCOC@IBIS	Coconut Palm River Bridge @ Ibis Way	26.281970	-81.770110
21FLSFWMCOC@IBIS	21FLSFWMCOC@IBIS	Bridge at intersection of Coconut Palm River and *	26.281970	-81.770110
21FLA 28030036	28030036	COCOHAT R US 41 BR	26.282200	-81.801900
21FLFTM 28030036	28030036	COCOHAT R US 41 BR	26.282220	-81.801940
21FLA 28030571	Coco at SR 865	S FRK COCOHATCHEE R AT SR 865	26.282600	-81.818300
21FLFTM EVRGWC0025FTM	Coco at SR 865	Cocohatchee at Vanderbilt Rd. Br.	26.282940	-81.818220
21FLSFWMC-00503	MSWQA_1	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.283400	-81.398100
21FLSFWMC-00684	MSWQA_1	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.283400	-81.398100
21FLSFWMC-00689	MSWQA_1	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.283400	-81.398100
21FLSFWMROOK467	21FLSFWMROOK467	Wiggins Pass Bridge	26.284200	-81.816700
COCOR2	COCOR2	Cocohatchee River	26.285278	-81.814167
COCORVW	COCORVW	Cocohatchee River near Venitian Way	26.285556	-81.808611
EVRGWC0080FTM	21FLFTMEVRGWC0080FTM	Collier Reserve @ Cart Path for Hole # 16	26.286780	-81.798810

Station Name	Merged Name	Station Description	LAT	LON
21FLCOLLIMPGC	21FLCOLLIMPGC	None	26.287000	-81.793800
C-503	C-503	48S29E14 C-503	26.290001	-81.370003
C-688	C-688	C - 688	26.290001	-81.580002
CoCoR1	COCOR1	South of Pelican Isle Yacht Club between Marker 13 and old pole to the	26.290278	-81.825556
21FLCOLLCOCOREST	21FLCOLLCOCOREST	None	26.290600	-81.819000
21FLA 28030574	21FLA 28030574	MIDWAY BETWEEN MOUTH OF WIGGINS PASS AND SR865	26.290700	-81.824100
21FLA 28030009	28030009	COCOHAT R SR 865 A BR	26.290800	-81.818100
21FLFTM 28030009	28030009	COCOHAT R SR 865 A BR	26.290830	-81.818060
21FLSFWMC-984	SFWMC_98	C - 984	26.292860	-81.481720
21FLSFWMC-985	SFWMC_98	C - 985	26.292860	-81.481720
21FLSFWMC-989	SFWMC_98	C-989 SFWMD IMMOKALEE SW	26.292860	-81.481720
21FLSFWMFAKA858	CR858	South side of bridge at Faka Union Canal and CR858	26.292880	-81.529640
21FLCOLLFAKA858	CR858	None	26.292900	-81.529600
21FLSFWMC-00984	MSWQA_2	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.292900	-81.481700
21FLSFWMC-00985	MSWQA_2	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.292900	-81.481700
21FLSFWMC-00989	MSWQA_2	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.292900	-81.481700
21FLA 28030575	21FLA 28030575	WIGGINS PASS ESTUARY AT MOUTH TO WIGGIN MARINA	26.293100	-81.822700
21FLCOLLGGC@858	GC@858	None	26.293300	-81.561800
21FLFTM GGC@858	GC@858	Golden Gate Canal @ CR 858	26.293310	-81.561810
21FLFTM 28030070FTM	CR858	FAKA UNION CANAL AT CR-858	26.293310	-81.529470
21FLSFWMGGC@858	GC@858	Bridge at intersection of Golden Gate Canal and C*	26.293320	-81.561760
21FLFTM EVRGWC0026FTM	21FLFTM EVRGWC0026FTM	Pelican Isles Yacht Club	26.293440	-81.820720
21FLCOLLKEAISS	21FLCOLLKEAISS	None	26.293600	-81.479300
21FLA 28030576	21FLA 28030576	SOUTHERN END OF WIGGINS BAY	26.293900	-81.825600
21FLSFWMBC25	21FLSFWMBC25	Bridge just east of Oil Well Grade Rd. on CR 858 *	26.293960	-81.479430
21FLSFWMC-684	SFWMC_68	C - 684	26.294810	-81.398110
21FLSFWMC-689	SFWMC_68	C - 689	26.294810	-81.398110
21FLA 28030577	21FLA 28030577	CENTER OF WIGGINS BAY	26.298100	-81.827300
21FLSFWMC-00688	21FLSFWMC-00688	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.300900	-81.596500

Station Name	Merged Name	Station Description	LAT	LON
21FLCOLLBRN	21FLCOLLBRN	None	26.303200	-81.341800
112WRD 261812081203400	112WRD 261812081203400	None	26.303690	-81.342580
21FLCOLLOKALA858	OKALA858	None	26.304800	-81.292100
21FLSFWMOKALA858	OKALA858	Okaloacoochee Slough crossing on CR 858	26.304830	-81.292060
21FLA 28030579	21FLA 28030579	S END OF PASS LINKING WIGGINS & LITTLE HCKRY BAY	26.308500	-81.832600
21756	21FLGW21756	SF1-LR-2002 UNNAMED LARGE RIVER	26.308710	-81.529711
BFBSP	BFBSP	Attached to red PATON #10	26.309444	-81.835278
21FLGW 13716	21FLGW 13716	SFC-SL-1011 UNKNOWN	26.315080	-81.815910
21FLA 28030621	21FLA 28030621	SOUTH END LITTLE HICKORY BAY	26.315700	-81.830200
21FLA 28030622	21FLA 28030622	SW END OF LITTLE HICKORY BAY	26.318800	-81.833800
21FLSFWMLV-04	21FLSFWMLV-04	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.319810	-81.787860
21FLA 28030623	21FLA 28030623	CENTER LITTLE HICKORY BAY OFF SEAWALL	26.323800	-81.832400
21FLGW 13744	21FLGW 13744	SFC-LS-1007 OAK CREEK	26.328120	-81.765680
21FLGW 13766	21FLGW 13766	SFC-LS-1031 OAK CREEK	26.328390	-81.766260
21FLA 28030624	21FLA 28030624	N END OF LITTLE HICKORY BAY AT SR 865 BRIDGE	26.330100	-81.837000
BBM	BBM	Bonita Beach Middle	26.330480	-81.846020
21FLEECOSCM	BBM	SANIBEL CAUSEWAY MID	26.330480	-81.846020
BBN	BBN	Bonita Beach North	26.332000	-81.846770
21FLGW 13752	21FLGW 13752	SFC-LS-1015 OAK CREEK	26.333620	-81.778440
21FLA 28020056	21FLA 28020056	OAK CR US 41 BR BONITA SPRINGS	26.333900	-81.779400
21FLA 28020219	21FLA 28020219	IMPERIAL RIVER NEAR FISH TRAP BAY	26.334700	-81.838600
21FLSFWMIMPERIAL	21FLSFWMIMPERIAL	IMPERIAL RIVER NR BONITA SPR	26.335080	-81.755360
21FLFTM 28020264FTM	Imperial River	Imperial River at Orr Rd in Bonita	26.335280	-81.749720
112WRD 02291500	Imperial River	IMPERIAL RIVER NEAR BONITA SPRINGS, FL	26.335300	-81.749700
21FLFTM 28020244	28020244	IMPERIAL RIVER AT ORR ROAD	26.335560	-81.750000
21FLA 28020187	21FLA 28020187	IMPERIAL RIVER EAST OF US41 AT BONITA SP	26.335600	-81.759700
21FLA 28020244	28020244	IMPERIAL RIVER AT ORR ROAD	26.335600	-81.750000
13741	21FLGW13741	SFC-LS-1004 UNKNOWN	26.335736	-81.750106
13763	21FLGW13763	SFC-LS-1028 IMPERIAL RIVER	26.335826	-81.811206

Station Name	Merged Name	Station Description	LAT	LON
21FLEECOIMPRGR80	21FLEECOIMPRGR80	Imperial River	26.335860	-81.749360
21FLGW 13762	21FLGW 13762	SFC-LS-1027 OAK CREEK	26.335900	-81.780630
21FLA 28030625	21FLA 28030625	IMPERIAL RIVER UPSTREAM OF MOUTH	26.336400	-81.832100
21FLGW 13761	21FLGW 13761	SFC-LS-1026 OAK CREEK	26.336500	-81.784520
112WRD 02291510	112WRD 02291510	None	26.337030	-81.831200
21FLEECOIMPRGR70	21FLEECOIMPRGR70	IMPERIAL RIVER- I-75	26.337350	-81.751760
13748	21FLGW13748	SFC-LS-1011 IMPERIAL RIVER	26.337460	-81.764274
13753	21FLGW13753	SFC-LS-1016 UNKNOWN	26.338592	-81.740614
21FLSFWMLV-05	21FLSFWMLV-05	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.338700	-81.794500
21FLEECOIMPRGR30	21FLEECOIMPRGR30	IMPERIAL RIVER- US 41	26.338800	-81.804910
21755	21FLGW21755	SF1-LR-2028 UNNAMED LARGE RIVER	26.338834	-81.738805
21FLEECOKEHLGR	21FLEECOKEHLGR	Kehl Canal on Bonita Grande Road	26.338890	-81.738520
21FLEECOIMPRGR41	21FLEECOIMPRGR41	IMPERIAL RIVER- Oak Creek @ Pennsylvania	26.338920	-81.786270
13750	Imperial River @ 41	SFC-LS-1013 IMPERIAL RIVER	26.339282	-81.807288
21FLA 28020193	Imperial River @ 41	IMPERIAL RIVER AT NEW US 41	26.339400	-81.806900
13740	21FLGW13740	SFC-LS-1002 IMPERIAL RIVER	26.339448	-81.803820
21FLEECOIMPRGR01	21FLEECOIMPRGR01	Imperial River	26.340000	-81.830000
21FLSFWMLV-02	21FLSFWMLV-02	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.340100	-81.778400
21FLFTM 28020267FTM	21FLFTM 28020267FTM	Bonita Bay at Oal Knoll	26.340390	-81.823670
21FLSFWMLV-01D	MSWQA_3	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.340400	-81.800100
21FLSFWMLV-01S	MSWQA_3	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.340400	-81.800100
13751	21FLGW13751	SFC-LS-1014 IMPERIAL RIVER	26.340409	-81.803124
13756	21FLGW13756	SFC-LS-1020 IMPERIAL RIVER	26.341046	-81.783406
21FLFTM EVRGWC0068FTM	21FLFTM EVRGWC0068FTM	Imperial R. @ Gasparilla Dr. -- WBID 3258E1	26.341250	-81.801170
13765	21FLGW13765	SFC-LS-1030 IMPERIAL RIVER	26.341358	-81.786474
13757	21FLGW13757	SFC-LS-1021 IMPERIAL RIVER	26.341915	-81.798054
13749	21FLGW13749	SFC-LS-1012 IMPERIAL RIVER	26.342522	-81.773766
21FLEECOIMPRGR51	21FLEECOIMPRGR51	IMPERIAL RIVER- Leitner Creek @ Goodwin Rd	26.343840	-81.777690
13759	21FLGW13759	SFC-LS-1024 LEITNER CREEK	26.345109	-81.773256

Station Name	Merged Name	Station Description	LAT	LON
21FLSFWMHENDCRK	21FLSFWMHENDCRK	HENDERSON CREEK CANAL AT S.R. 951	26.345360	-81.687020
21FLFTM 28020234	21FLFTM 28020234	LEITNER CR NEAR E TERRY ST, BONITA SPR	26.345560	-81.771670
13743	21FLGW13743	SFC-LS-1006 LETTMER CREEK	26.348105	-81.768739
13745	21FLGW13745	SFC-LS-1008 LEITNER CREEK	26.348416	-81.767614
CHNEPEB 646	CHNEPEB 646	CHNEP646POR	26.350000	-81.833330
CHNEPEB 647	CHNEPEB 647	CHNEP647POR	26.350000	-81.816670
CHNEPEB 648	CHNEPEB 648	CHNEP648POR	26.350000	-81.800000
CHNEPEB 649	CHNEPEB 649	CHNEP649POR	26.350000	-81.783330
21FLSFWMLV-03	21FLSFWMLV-03	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.352900	-81.795900
21FLCOLLCORKS	21FLCOLLCORKS	None	26.353700	-81.618800
21FLSFWMLELY	21FLSFWMLELY	LELY CANAL AT U.S. 41	26.355360	-81.745080
EBV005	21FLCHAREBV005	Estero Bay/Pelican Bay Nature Park Pier	26.355556	-81.835833
21FLCOLLCORKSW	21FLCOLLCORKSW	None	26.356000	-81.641300
21FLFTM 28020263FTM	Spring Creek	Spring Creek in Bonita	26.361670	-81.790830
21FLA 28020243	21FLA 28020243	SPRING CREEK AT POWER LINE CROSSING	26.361700	-81.799400
112WRD 02291524	Spring Creek	SPRING CREEK HEADWATER NEAR BONITA SPRINGS, FL	26.361700	-81.790800
21FLEECO48-25GR	21FLEECO48-25GR	SPRING CREEK- Old 41 @ Spring Creek	26.362250	-81.790430
21FLA 28020192	21FLA 28020192	SPRING CREEK AT US 41(NEW)	26.363300	-81.806700
48-15GR	SpringCreek41	SPRING CREEK- US 41S. @ Spring Creek	26.365087	-81.807608
21FLSFWMSPRINGCR	SpringCreek42	SPRING CREEK BRIDGE AND US-41	26.365470	-81.807710
21FLCOLLKEAISN	21FLCOLLKEAISN	None	26.366600	-81.484600
21FLSFWMC-00492	MSWQA_4	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.373400	-81.605400
21FLSFWMC-01080	MSWQA_4	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.373400	-81.605400
21FLSFWMC-1080	MSWQA_4	C -1080	26.374780	-81.605060
14159	21FLGW14159	SFC-HS-1001 UNKNOWN	26.376239	-81.361277
112WRD 262247081215500	112WRD 262247081215500	None	26.380080	-81.365080
112WRD 262405081200001	112WRD 262405081200001	C-554	26.401400	-81.333300
21FLSFWMIMKSLGH	21FLSFWMIMKSLGH	CULVERT CONNECTING SLOUGH UNDER SANITATION RD. B*	26.406550	-81.429260
112WRD 262431081254202	112WRD 262431081254202	C-549	26.408600	-81.428300

Station Name	Merged Name	Station Description	LAT	LON
21FLSFWMIMKBRN	21FLSFWMIMKBRN	LOCATED ALONG THE US29 DITCH COLLECTED FROM THE 1*	26.409050	-81.397840
21FLCOLLLKTRAF5	21FLCOLLLKTRAF5	None	26.409500	-81.493400
21FLGW 22723	21FLGW 22723	SF1-LL-2016 LAKE TRAFFORD	26.409560	-81.493050
21FLGW 22733	21FLGW 22733	SF1-LL-2084 LAKE TRAFFORD	26.410640	-81.494210
21FLGW 15188	21FLGW 15188	SFC-LL-1043 LAKE TRAFFORD	26.411060	-81.494950
21FLGW 15187	21FLGW 15187	SFC-LL-1042 LAKE TRAFFORD	26.411970	-81.497530
21FLGW 22731	21FLGW 22731	SF1-LL-2075 LAKE TRAFFORD	26.413160	-81.496660
21FLGW 22730	21FLGW 22730	SF1-LL-2074 LAKE TRAFFORD	26.414670	-81.490360
21FLGW 22728	21FLGW 22728	SF1-LL-2063 LAKE TRAFFORD	26.414910	-81.486770
21FLCOLLLKTRAF4	21FLCOLLLKTRAF4	None	26.415200	-81.499000
21FLGW 22727	21FLGW 22727	SF1-LL-2054 LAKE TRAFFORD	26.416130	-81.497250
21FLGW 15162	21FLGW 15162	SFC-LL-1004 LAKE TRAFFORD	26.417680	-81.491380
21FLSFWMIMK6STS	21FLSFWMIMK6STS	SOUTH 6TH STREET. LOCATED AT THE SECOND CULVERT *	26.417750	-81.422140
21FLGW 15165	21FLGW 15165	SFC-LL-1007 LAKE TRAFFORD	26.417910	-81.485870
21FLGW 22741	21FLGW 22741	SF1-LL-2136 LAKE TRAFFORD	26.418020	-81.485410
21FLSFWMC-00258	21FLSFWMC-258	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.418100	-81.416200
21FLSFWMC-258	21FLSFWMC-258	C - 258	26.418110	-81.416170
21FLA 28030015	21FLA 28030015	LK TRAFF S BOAT RAMP	26.418600	-81.481900
21FLSFWMC-298	21FLSFWMC-298	C - 298	26.418940	-81.397560
21FLSFWMC-00298	21FLSFWMC-298	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.419000	-81.397600
21FLGW 15181	21FLGW 15181	SFC-LL-1032 LAKE TRAFFORD	26.419030	-81.496140
21FLGW 22747	21FLGW 22747	SF1-LL-2096 LAKE TRAFFORD	26.419050	-81.504980
21FLGW 22742	21FLGW 22742	SF1-LL-2137 LAKE TRAFFORD	26.419370	-81.500390
21FLKWATCOL-TRAFFORD-1	Trafford	Collier-Trafford-1	26.419580	-81.489280
21FLKWATCOL-TRAFFORD-2	Trafford	Collier-Trafford-2	26.419580	-81.489280
21FLKWATCOL-TRAFFORD-3	Trafford	Collier-Trafford-3	26.419580	-81.489280
21FLGW 22724	21FLGW 22724	SF1-LL-2022 LAKE TRAFFORD	26.419810	-81.488650
21FLGW 22736	21FLGW 22736	SF1-LL-2033 LAKE TRAFFORD	26.420410	-81.496970
21FLGW 22738	21FLGW 22738	SF1-LL-2115 LAKE TRAFFORD	26.420540	-81.493960

Station Name	Merged Name	Station Description	LAT	LON
21FLGW 22719	21FLGW 22719	SF1-LL-2001 LAKE TRAFFORD	26.420820	-81.497980
21FLGW 15169	21FLGW 15169	SFC-LL-1014 LAKE TRAFFORD	26.420860	-81.490740
21FLGW 22726	21FLGW 22726	SF1-LL-2053 LAKE TRAFFORD	26.420900	-81.484910
21FLCOLLLKTRAF8	21FLCOLLLKTRAF8	None	26.421600	-81.478300
21FLCOLLCORKN	21FLCOLLCORKN	None	26.422000	-81.578500
21FLCOLLOKALA846	21FLCOLLOKALA846	None	26.422200	-81.305200
21FLGW 22743	21FLGW 22743	SF1-LL-2104 LAKE TRAFFORD	26.422720	-81.484280
21FLGW 22745	21FLGW 22745	SF1-LL-2114 LAKE TRAFFORD	26.422860	-81.493040
21FLGW 22729	21FLGW 22729	SF1-LL-2064 LAKE TRAFFORD	26.422880	-81.505520
21FLGW 15185	21FLGW 15185	SFC-LL-1040 LAKE TRAFFORD	26.422960	-81.499150
21FLGW 22737	21FLGW 22737	SF1-LL-2059 LAKE TRAFFORD	26.423120	-81.497620
21FLGW 3496	21FLGW 3496	LAKE TRAFFORD 2 BOAT RAMP	26.423130	-81.493410
21FLA 28030024	21FLA 28030024	LK TRAFF CENTER	26.423600	-81.494700
21FLGW 15171	21FLGW 15171	SFC-LL-1020 LAKE TRAFFORD	26.424810	-81.505830
21FLGW 22720	21FLGW 22720	SF1-LL-2011 LAKE TRAFFORD	26.425190	-81.484750
21FLGW 15160	21FLGW 15160	SFC-LL-1002 LAKE TRAFFORD	26.425870	-81.485560
21FLGW 22735	21FLGW 22735	SF1-LL-2095 LAKE TRAFFORD	26.426440	-81.487470
21FLCOLLLKTRAF7	21FLCOLLLKTRAF7	None	26.426600	-81.481000
21FLGW 22722	21FLGW 22722	SF1-LL-2007 LAKE TRAFFORD	26.427790	-81.481850
14186	21FLGW14186	SFC-HS-1022 UNKNOWN	26.427868	-81.790562
21FLGW 22725	21FLGW 22725	SF1-LL-2039 LAKE TRAFFORD	26.428060	-81.501580
21FLCOLLLKTRAF3	21FLCOLLLKTRAF3	None	26.428100	-81.494900
112WRD 02291597	112WRD 02291597	SOUTH BRANCH ESTERO RIVER AT ESTERO, FL	26.428600	-81.693300
21FLCOLLLKTRAF6	21FLCOLLLKTRAF6	None	26.429200	-81.482900
21FLGW 22746	21FLGW 22746	SF1-LL-2023 LAKE TRAFFORD	26.429530	-81.483920
21FLGW 22734	21FLGW 22734	SF1-LL-2085 LAKE TRAFFORD	26.429870	-81.495590
21FLSFWMIMKMAD	21FLSFWMIMKMAD	LOCATED AT ENTRANCE TO GOPHER RIDGE GROVE ALONG M*	26.430280	-81.411340
21FLGW 22721	21FLGW 22721	SF1-LL-2012 LAKE TRAFFORD	26.430440	-81.493980
21FLGW 22732	21FLGW 22732	SF1-LL-2080 LAKE TRAFFORD	26.430460	-81.504550

Station Name	Merged Name	Station Description	LAT	LON
21FLGW 22739	21FLGW 22739	SF1-LL-2121 LAKE TRAFFORD	26.431010	-81.500160
21FLA 28030025	21FLA 28030025	LK TRAFF 50 OUT MARINA	26.431900	-81.486900
21FLSFWMC-00687	C-687	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.432000	-81.477000
C-687	C-687	C - 687	26.432023	-81.477019
21FLCOLLLKTRAFF	21FLCOLLLKTRAFF	None	26.432100	-81.486500
21FLGW 22744	21FLGW 22744	SF1-LL-2105 LAKE TRAFFORD	26.432210	-81.495860
21FLCOLLLKTRAF1	21FLCOLLLKTRAF1	None	26.432900	-81.486300
21FLSFWMIMKFSHCK	21FLSFWMIMKFSHCK	SITE LOCATED ALONG LAKE TRAFFORD ROAD AT FISH CRE*	26.433320	-81.462600
21FLFTM 28020343FTM	21FLFTM 28020343FTM	Estero River above Sandy Lane	26.434860	-81.801940
21FLEECO47A-15GR	47A-15GR	ESTERO RIVER- US 41	26.434990	-81.810620
21FLFTM 47A-15GR	47A-15GR	Estero River @ US 41 -- WBID 3258D	26.435000	-81.810670
21FLSFWMESTERO	21FLSFWMESTERO	ESTERO RIVER AT S.R. 45 NEAR ESTERO	26.435080	-80.810890
21FLA 28020197	21FLA 28020197	ESTERO RIVER .2MI. ABOVE US. 41	26.435300	-81.807800
21FLGW 22740	21FLGW 22740	SF1-LL-2126 LAKE TRAFFORD	26.435480	-81.491520
21FLCOLLLKTRAF2	21FLCOLLLKTRAF2	None	26.435500	-81.495100
112WRD 02291200	112WRD 02291200	LAKE TRAFFORD NR IMMOKALEE, FLA.	26.435600	-81.490300
14165	21FLGW14165	SFC-HS-1010 UNKNOWN	26.439584	-81.796869
21FLFTM 28020262FTM	21FLFTM 28020262FTM	Estero River at East Broadway	26.441670	-81.795830
112WRD 02291580	112WRD 02291580	NORTH BRANCH ESTERO RIVER AT ESTERO, FL	26.441700	-81.795800
21FLEECO47A-28GR	21FLEECO47A-28GR	ESTERO RIVER- Three Oaks Blvd.	26.445000	-81.788680
13732	21FLGW13732	SFC-SL-1045 UNKNOWN	26.445241	-81.456013
21FLFTM 28030073FTM	21FLFTM 28030073FTM	Canal @ Corkscrew Limes Blvd & CR 850	26.450940	-81.579280
21FLEECOIMPRGR90	21FLEECOIMPRGR90	IMPERIAL RIVER- Corkscrew Rd.	26.451320	-81.691110
21FLFTM 28030072FTM	21FLFTM 28030072FTM	Canal @ Southest Corner CR 850	26.451470	-81.562640
21FLSFWML-02319	21FLSFWML-02319	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.457900	-81.695100
21FLEECO46B-L6GR	21FLEECO46B-L6GR	MULLOCK CREEK- US 41 and Hickory Rd.	26.459110	-81.826560
21FLSFWML-000D1	21FLSFWML-000D1	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.460900	-81.704500
15166	21FLGW15166	SFC-LL-1008 UNKNOWN	26.466764	-81.715403
21FLSFWMCREW9	21FLSFWMCREW9	DISCHARGE DITCH THAT FLOWS INTO CORK- SCREW SWAM*	26.469240	-81.501740

Station Name	Merged Name	Station Description	LAT	LON
21FLWQSPLEE674US	Mullock Creek	Mullock Creek At Constitution Circle (WBID 3258C)	26.473340	-81.830610
21FLFTM 28020261FTM	Mullock Creek	Mullock creek at Constitution Circle	26.473800	-81.830680
15186	21FLGW15186	SFC-LL-1041 UNKNOWN	26.476448	-81.769874
21FLSFWMCREW1	21FLSFWMCREW1	DRAINAGE DITCH UNDER HWY 850 3.5 MILES SOUTHWEST *	26.476470	-81.555080
15161	21FLGW15161	SFC-LL-1003 UNKNOWN	26.479108	-81.762522
21FLSFWMCREW8	21FLSFWMCREW8	UPSTREAM SIDE OF THROWOUT PUMP AT EDGE OF ALICO O*	26.480350	-81.502300
15183	21FLGW15183	SFC-LL-1034 UNKNOWN	26.480441	-81.753448
21FLSFWMCREW2	21FLSFWMCREW2	DRAINAGE TCH UNDER HWY 850 2.55 MILES SOUTHWEST *	26.483130	-81.546740
21FLFTM CREW2	21FLFTM CREW2	Canal to C.R.E.W. under CR 850 - WBID-3259X	26.483440	-81.528860
15182	21FLGW15182	SFC-LL-1033 UNKNOWN	26.484495	-81.770651
15175	21FLGW15175	SFC-LL-1026 UNKNOWN	26.484813	-81.752062
21FLSFWMCREW6T	21FLSFWMCREW6T	DISCHARGE CANAL INTO CORKSCREW SWAMP DOWNSTREAM O*	26.487580	-81.507850
21FLSFWMCREW6	21FLSFWMCREW6	UPSTREAM SIDE OF THROWOUT PUMP AT EDGE OF ALICO O*	26.488970	-81.505630
21FLSFWMCREW3	21FLSFWMCREW3	DRAINAGE DITCH UNDER HWY 850 1.8 MILES SOUTHWEST	26.489720	-81.538060
15168	21FLGW15168	SFC-LL-1012 UNKNOWN	26.490039	-81.743046
13738	21FLGW13738	SFC-SL-1056 UNKNOWN	26.491433	-81.766829
21FLSFWMC-00531	MSWQA_5	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.491500	-81.457800
21FLSFWMC-00532	MSWQA_5	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.491500	-81.457800
21FLSFWMCREW5	21FLSFWMCREW5	CARSON GULLEY AS IT LEAVES ALICO GROVE NEAR THROW*	26.493410	-81.514520
21FLEECO47A-40GR	21FLEECO47A-40GR	ESTERO RIVER- Alico Rd.	26.493570	-81.726620
13722	21FLGW13722	SFC-SL-1023 UNKNOWN	26.494707	-81.761173
21FLSFWMCREW4	21FLSFWMCREW4	DRAINAGE DITCH UNDER HWY 850 1.15 MILESSOUTHWEST *	26.495350	-81.528690
21FLFTM CORKSCRD	Corkscrd	CR 850 Bridge 030022	26.495640	-81.528860
21FLCOLLCORKSCRD	Corkscrd	None	26.495800	-81.528800
21FLSFWMCORKN	21FLSFWMCORKN	Bridge S. of USGS gauge n on tram rd. to Little C*	26.495980	-81.453870
21FLSFWML-05649	MSWQA_6	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.496500	-81.787000
21FLSFWML-05721	MSWQA_6	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.496500	-81.787000
21FLSFWMCORKS	21FLSFWMCORKS	Southern most bridge on tram road in Corkscrew Sw*	26.498950	-81.520980
21FLSFWML-01999	21FLSFWML-01999	MONITOR SITE FOR WATER QUALITY ASSURANCE PROGRAM	26.501500	-81.724800

Station Name	Merged Name	Station Description	LAT	LON
21FLSFWMCORKSW	21FLSFWMCORKSW	Canal along tram road at southwest corner of Cork*	26.504630	-81.561050
21FLFTM 28030044	21FLFTM 28030044	CARSON GUL SR 82 BR	26.504720	-81.511670
22545	21FLGW22545	SF1-SS-2098 UNNAMED SMALL STREAM	26.510444	-81.818738
21FLFTM 28020302FTM	21FLFTM 28020302FTM	TOWNSEND A SITE 1	26.515430	-81.435230
11114	21FLGW11114	SFD-SL-1048 UNKNOWN	26.541676	-81.407466
13719	21FLGW13719	SFC-SL-1018 UNKNOWN	26.547866	-81.749283
22544	21FLGW22544	SF1-SS-2177 UNNAMED SMALL STREAM	26.556436	-81.823200
21FLFTM 28020305FTM	21FLFTM 28020305FTM	TOWNSEND A SITE 4	26.557330	-81.471150
21FLFTM 28020304FTM	21FLFTM 28020304FTM	TOWNSEND A SITE 3	26.557470	-81.467070
21FLFTM 28020303FTM	21FLFTM 28020303FTM	TOWNSEND A SITE 2	26.557880	-81.463780
21FLFTM 28020336FTM	21FLFTM 28020336FTM	TOWNSEND A SITE 5	26.559000	-81.455470
21FLGW 30448	21FLGW 30448	SF3-SS-2070 UNNAMED SMALL STREAM	26.559390	-81.463700
21FLGW 10141	21FLGW 10141	SFD-HS-1002 UNKNOWN	26.566220	-81.596160
SIXMILE3	SIXMILECYPRESS	SIX MILE CYPRESS- Six Mile Slough	26.573232	-81.825603
13731	SIXMILECYPRESS	SFC-SL-1044 GATOR LAKE	26.573322	-81.825555
21FLGW 30434	21FLGW 30434	SF3-SS-2048 UNNAMED SMALL STREAM	26.585440	-81.585420
13726	21FLGW13726	SFC-SL-1033 UNKNOWN	26.589500	-81.800616
SIXMILE2	SIXMILE2	SIX MILE CYPRESS- I-75	26.603084	-81.800096
13718	21FLGW13718	SFC-SL-1015 UNKNOWN	26.617771	-81.821249
11122	21FLGW11122	SFD-SL-1077 LAKE DENISE	26.618793	-81.593311
21FLFTM 28020290FTM	21FLFTM 28020290FTM	DOG CANAL SITE 1	26.621670	-81.597530
SIXMILE1	SIXMILE1	SIX MILE CYPRESS- Buckingham Rd.	26.626731	-81.777991
21FLFTM 28020291FTM	21FLFTM 28020291FTM	DOG CANAL SITE 2	26.635470	-81.565780
21FLGW 10151	21FLGW 10151	SFD-HS-1052 DOG CANAL	26.636100	-81.565810
21FLGW 30443	21FLGW 30443	SF3-SS-2064 UNNAMED SMALL STREAM	26.644010	-81.577940
37412	21FLGW37412	Z5-SS-3009 UNNAMED SMALL STREAM	26.646516	-81.482952
21FLFTM 28020292FTM	21FLFTM 28020292FTM	DOG CANAL SITE 3	26.658280	-81.586430
21FLGW 30441	21FLGW 30441	SF3-SS-2061 UNNAMED SMALL STREAM	26.659350	-81.517430
21FLSFWMTOWNCNL	21FLSFWMTOWNCNL	LOCATED SOUTH OF THE SOUTH WEST PROPERTY LINE OF *	26.669530	-81.556780

Station Name	Merged Name	Station Description	LAT	LON
21FLSFWMROBCNL	21FLSFWMROBCNL	LOCATED AT THE SOUTHEAST PROPERTY LINE OF BERRY G*	26.669620	-81.468850
21FLFTM 28020317FTM	21FLFTM 28020317FTM	DOG CANAL SITE 5	26.672390	-81.598110
21FLGW 10152	21FLGW 10152	SFD-HS-1057 UNKNOWN	26.674040	-81.477580
21FLSFWMCRASRDIS	21FLSFWMCRASRDIS	Caloosahatchee River Discharge Site	26.687910	-81.554060
C43HC-A	C43HC-A	C43Res-Head Canal - Upstream (West) of Test Cell 1 pump	26.688270	-81.536180
C43HC-B	C43HC-B	C43Res-Head Canal - Upstream (West) of Test Cell 2 pump	26.688330	-81.529090
21FLFTM CALUSA0015FTM	21FLFTM CALUSA0015FTM	Roberts Canal @ Berry Weir - WB 3235N	26.688780	-81.477580
C43TC-1A	C43TC-1A	C43 Reservoir - Test Cell 1 - SW Corner	26.690160	-81.536380
C43TC-2A	C43TC-2A	C43 Reservoir - Test Cell 2 - SE Corner	26.690180	-81.528960
37417	21FLGW37417	Z5-SS-3041 UNNAMED SMALL STREAM	26.690268	-81.444054
C43TC-2B	C43TC-2B	C43 Reservoir - Test Cell 2 - Center	26.690440	-81.557128
C43TC-1B	C43TC-1B	C43 Reservoir - Test Cell 1 - Center	26.690480	-81.535840
C43TC-1C	C43TC-1C	C43 Reservoir - Test Cell 1 - NE Corner	26.690830	-81.535580
C43SC-2B	C43SC-2B	C43Res-Test Cell 2 Seepage Canal - N of Test Cell of Brdwlk	26.691970	-81.529340
CALUSA0001FTM	21FLFTMCALUSA0001FTM	Carlos Waterway @ Upstream Weir	26.696361	-81.558639
21FLFTM CALUSA0016FTM	21FLFTM CALUSA0016FTM	Roberts Canal @ Berry Concrete Bridge - WB 3235N	26.702080	-81.490140
21FLFTM 28020308FTM	21FLFTM28020308FTM	TOWNSEND CANAL DRAINAGE SITE 2- WBID 3235K	26.707940	-81.537310
21FLGW 30428	21FLGW 30428	SF3-SS-2027 UNNAMED SMALL STREAM	26.708320	-81.496980
21FLFTM 28020030	28020030	TOWNSEND C SR 80 BR E LEE-HENDRY	26.709170	-81.559170
21FLA 28020030	28020030	TOWNSEND C SR 80 BR E LEE-HENDRY	26.709200	-81.559200
112WRD 02292780	28020030	TOWNSEND CANAL NEAR ALVA,FL	26.709200	-81.558300
21FLSFWMCR-33.5T	28020030	TOWNSEND CANAL AT S.R.80	26.709510	-81.558130
21FLSFWMTOWNSCAN	28020030	TOWNSEND CANAL BRIDGE AND SR-80	26.709840	-81.557760
21FLGW 30430	21FLGW 30430	SF3-SS-2052 UNNAMED SMALL STREAM	26.710180	-81.444120
21FLFTM 28020250FTM	21FLFTM 28020250FTM	Townsend canal	26.711580	-81.559220
21FLFTM 28020032	28020032	ROBERTS C SR 80 BR S FT DENAUD H	26.712500	-81.504720
21FLA 28020032	28020032	ROBERTS C SR 80 BR S FT DENAUD H	26.712500	-81.504700
21FLGW 10143	21FLGW 10143	SFD-HS-1009 UNKNOWN	26.716810	-81.496940
21FLFTM 28020241	28020241	BANANA BRANCH AT CR 78A, HENDRY CO	26.720280	-81.516670

Station Name	Merged Name	Station Description	LAT	LON
21FLA 28020241	28020241	BANANA BRANCH AT CR 78A, HENDRY CO	26.720300	-81.516700
21FLFTM 28020252FTM	21FLFTM 28020252FTM	Robert's canal(aka Banana Branch)	26.720890	-81.517640
21FLSFWMCORKSCRD	21FLSFWMCORKSCRD	Bridge at intersect Corkscrew Rd.& canal NE. of Corkscrew Ma	26.736740	-81.371950
21FLSFWMWCOCORIV	21FLSFWMWCOCORIV	WEST BRANCH OF COCOHATCHEE RIVER AT S.R. 846 NEAR PALM	26.740350	-81.787580
21FLSFWMNNAPLES	21FLSFWMNNAPLES	NORTH NAPLES CANAL NEAR S.R. 846 UPSTREAM OF WEIR NEAR PALM	26.740620	-81.793410

Appendix 4-C

Water Quality Monitoring
Discharge Station Summary Statistics

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259B Station=21FLFTM 28030072FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	3	0.71	0.71	1.20	1.40	1.50	1.50	.
Chlorophyll-a, ug/l	3	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Color, PCU	3	100.00	100.00	133.33	140.00	160.00	160.00	66.67
Conductivity, umhos/cm	3	538.00	538.00	563.00	571.00	580.00	580.00	.
Copper, ug/l	3	1.69	1.69	3.06	3.35	4.13	4.13	0.00
Dissolved Oxygen, mg/l	3	2.12	2.12	6.00	6.61	9.26	9.26	33.33
Fecal Coliform, #/100ml	3	220.00	220.00	463.33	260.00	910.00	910.00	33.33
Iron, ug/l	3	1410.00	1410.00	1496.67	1420.00	1660.00	1660.00	100.00
Nitrate-Nitrite, mg/l	3	0.02	0.02	0.07	0.03	0.16	0.16	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	2	0.20	0.20	0.60	0.60	1.00	1.00	50.00
Total Kjeldahl Nitrogen, mg/l	3	1.00	1.00	1.23	1.30	1.40	1.40	.
Total Nitrogen, mg/l	3	1.02	1.02	1.30	1.33	1.56	1.56	0.00
Orthophosphate as P, mg/l	1	0.04	0.04	0.04	0.04	0.04	0.04	.
Total Phosphorus, mg/l	3	0.15	0.15	0.19	0.17	0.25	0.25	33.33
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	3	8.80	8.80	10.10	10.50	11.00	11.00	.
Unionized Ammonia, mg/l	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259B Station=21FLFTM 28030073FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	4	1.40	1.60	1.83	1.85	2.05	2.20	.
Chlorophyll-a, ug/l	4	1.00	1.00	6.03	2.05	11.05	19.00	0
Color, PCU	4	80.00	90.00	110.00	100.00	130.00	160.00	25
Conductivity, umhos/cm	4	456.00	471.00	505.75	504.00	540.50	559.00	.
Copper, ug/l	4	1.14	1.16	1.23	1.21	1.30	1.34	0
Dissolved Oxygen, mg/l	4	1.60	2.10	7.34	3.67	12.57	20.40	75
Fecal Coliform, #/100ml	4	60.00	65.00	137.00	80.00	209.00	328.00	0
Iron, ug/l	4	387.00	635.50	857.00	935.50	1078.50	1170.00	25
Nitrate-Nitrite, mg/l	4	0.02	0.03	0.04	0.04	0.05	0.05	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	0.30	0.30	0.43	0.50	0.50	0.50	100
Total Kjeldahl Nitrogen, mg/l	4	0.86	0.90	1.03	1.02	1.15	1.20	.
Total Nitrogen, mg/l	4	0.91	0.94	1.07	1.05	1.20	1.25	0
Orthophosphate as P, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	.
Total Phosphorus, mg/l	4	0.04	0.04	0.06	0.06	0.08	0.08	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	4	2.20	2.40	4.70	4.70	7.00	7.20	.
Unionized Ammonia, mg/l	4	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259B Station=21FLSFWMCORKSW

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	5	2.00	2.00	2.32	2.00	2.00	3.60	.
Chlorophyll-a, ug/l	18	3.00	3.00	5.45	3.00	3.00	37.40	5.56
Color, PCU	16	40.00	100.00	146.25	130.00	155.00	350.00	68.75
Conductivity, umhos/cm	18	210.00	249.00	299.72	281.50	341.00	422.00	.
Copper, ug/l	5	0.30	0.30	0.85	1.00	1.00	1.64	0.00
Dissolved Oxygen, mg/l	19	0.29	1.22	1.59	1.50	2.08	2.79	100.00
Fecal Coliform, #/100ml	18	8.00	22.00	280.83	140.50	286.00	1550.00	16.67
Iron, ug/l	5	100.00	110.00	272.00	120.00	360.00	670.00	0.00
Nitrate-Nitrite, mg/l	17	0.00	0.01	0.02	0.01	0.01	0.19	.
Salinity, ppt	19	0.00	0.11	0.13	0.13	0.16	0.20	.
Secchi Depth, m	19	0.20	0.40	0.67	0.80	0.90	1.00	94.74
Total Kjeldahl Nitrogen, mg/l	13	0.60	0.93	1.38	1.20	1.60	3.74	.
Total Nitrogen, mg/l	15	0.01	0.16	1.03	0.97	1.55	3.74	13.33
Orthophosphate as P, mg/l	17	0.00	0.01	0.03	0.01	0.03	0.17	.
Total Phosphorus, mg/l	17	0.01	0.02	0.05	0.03	0.07	0.22	0.00
Total Suspended Solids, mg/l	18	2.00	2.00	2.94	2.00	2.00	19.00	5.56
Turbidity, NTU	11	0.30	0.40	0.80	0.50	0.90	2.70	.
Unionized Ammonia, mg/l	17	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLCOLLLKTRAF2

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	36	2.65	3.90	4.86	4.10	4.88	16.20	.
Chlorophyll-a, ug/l	37	5.90	27.35	58.53	51.00	72.10	170.00	78.38
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	37	41.90	256.50	277.71	278.00	292.00	370.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	37	2.68	6.47	8.17	8.17	9.42	14.45	10.81
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	37	0.00	0.12	0.13	0.13	0.14	0.20	.
Secchi Depth, m	37	0.20	0.30	0.41	0.35	0.50	1.00	100.00
Total Kjeldahl Nitrogen, mg/l	37	1.15	2.30	2.94	2.70	3.50	5.70	.
Total Nitrogen, mg/l	22	1.46	2.13	2.85	2.64	3.17	5.20	95.45
Orthophosphate as P, mg/l	37	0.00	0.03	0.17	0.20	0.29	0.38	.
Total Phosphorus, mg/l	14	0.04	0.05	0.09	0.07	0.11	0.25	21.43
Total Suspended Solids, mg/l	35	2.00	7.00	21.43	18.00	31.00	64.00	57.14
Turbidity, NTU	37	2.25	6.30	19.23	11.10	18.30	107.00	.
Unionized Ammonia, mg/l	34	0.00	0.00	0.01	0.00	0.01	0.08	17.65

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLCOLLLKTRAF3

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	38	2.00	3.35	4.31	4.08	5.05	10.85	.
Chlorophyll-a, ug/l	38	5.35	22.00	50.58	44.63	72.00	131.00	76.32
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	38	221.50	256.00	286.57	281.00	302.50	421.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	38	4.09	8.02	9.12	8.95	10.75	14.57	5.26
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	38	0.00	0.12	0.13	0.13	0.14	0.20	.
Secchi Depth, m	37	0.20	0.30	0.45	0.40	0.55	1.10	100.00
Total Kjeldahl Nitrogen, mg/l	38	1.25	2.05	2.86	2.58	3.40	7.50	.
Total Nitrogen, mg/l	21	1.26	2.12	2.74	2.61	3.42	4.59	90.48
Orthophosphate as P, mg/l	38	0.00	0.03	0.16	0.18	0.26	0.40	.
Total Phosphorus, mg/l	14	0.03	0.05	0.08	0.07	0.09	0.24	14.29
Total Suspended Solids, mg/l	35	4.00	8.00	20.00	16.00	27.00	63.00	54.29
Turbidity, NTU	38	1.75	7.35	17.75	11.10	18.40	75.45	.
Unionized Ammonia, mg/l	34	0.00	0.00	0.02	0.01	0.02	0.09	17.65

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLCOLLLKTRAF4

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	38	2.00	3.60	5.12	4.43	5.05	26.70	.
Chlorophyll-a, ug/l	38	4.65	22.50	55.83	40.53	78.75	251.00	81.58
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	38	221.50	259.00	287.79	281.75	304.00	421.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	38	3.03	6.48	8.35	8.12	10.05	15.34	7.89
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	38	0.00	0.12	0.13	0.13	0.14	0.20	.
Secchi Depth, m	38	0.20	0.30	0.42	0.39	0.50	1.30	100.00
Total Kjeldahl Nitrogen, mg/l	38	1.05	2.10	2.80	2.48	3.30	6.55	.
Total Nitrogen, mg/l	22	1.08	1.98	2.80	2.44	3.51	6.59	95.45
Orthophosphate as P, mg/l	38	0.00	0.03	0.17	0.17	0.28	0.38	.
Total Phosphorus, mg/l	14	0.04	0.05	0.09	0.07	0.10	0.24	14.29
Total Suspended Solids, mg/l	35	2.00	10.00	20.83	16.00	34.00	52.00	54.29
Turbidity, NTU	38	1.70	6.85	21.90	12.43	18.30	106.55	.
Unionized Ammonia, mg/l	34	0.00	0.00	0.01	0.00	0.01	0.07	11.76

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLCOLLLKTRAF5

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	38	2.00	3.60	4.69	4.33	5.15	11.45	.
Chlorophyll-a, ug/l	38	4.45	17.35	45.96	34.05	68.10	187.00	71.05
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	38	222.00	258.00	287.17	283.00	301.00	423.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	38	3.11	6.02	8.31	7.99	9.81	16.84	10.53
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	38	0.00	0.12	0.13	0.13	0.14	0.20	.
Secchi Depth, m	38	0.25	0.30	0.43	0.38	0.55	0.75	100.00
Total Kjeldahl Nitrogen, mg/l	38	0.92	2.05	2.70	2.50	3.20	6.05	.
Total Nitrogen, mg/l	23	0.93	1.93	2.75	2.67	3.30	6.12	86.96
Orthophosphate as P, mg/l	38	0.00	0.03	0.16	0.18	0.28	0.40	.
Total Phosphorus, mg/l	14	0.04	0.06	0.09	0.08	0.10	0.24	21.43
Total Suspended Solids, mg/l	36	2.00	7.50	18.21	15.50	26.00	50.00	52.78
Turbidity, NTU	38	1.25	5.15	13.40	8.58	14.35	81.00	.
Unionized Ammonia, mg/l	35	0.00	0.00	0.01	0.00	0.01	0.09	8.57

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLCOLLLKTRAF6

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	27	2.40	3.40	4.55	4.15	5.30	11.15	.
Chlorophyll-a, ug/l	27	3.75	18.95	39.62	33.40	48.55	115.00	74.07
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	27	221.50	261.00	281.37	282.00	294.00	344.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	27	3.12	5.86	7.64	8.10	9.29	13.05	18.52
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	27	0.10	0.12	0.13	0.13	0.14	0.17	.
Secchi Depth, m	26	0.20	0.35	0.49	0.48	0.55	1.00	100.00
Total Kjeldahl Nitrogen, mg/l	27	1.25	1.75	2.31	2.25	2.70	4.10	.
Total Nitrogen, mg/l	20	1.27	1.81	2.33	2.28	2.80	3.82	90.00
Orthophosphate as P, mg/l	27	0.00	0.03	0.16	0.17	0.26	0.40	.
Total Phosphorus, mg/l	13	0.03	0.06	0.12	0.11	0.13	0.24	46.15
Total Suspended Solids, mg/l	25	2.00	6.00	9.62	9.00	13.00	20.00	20.00
Turbidity, NTU	27	3.10	5.35	10.03	8.20	11.70	28.35	.
Unionized Ammonia, mg/l	24	0.00	0.00	0.01	0.00	0.01	0.13	8.33

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLCOLLLKTRAF7

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	26	2.00	3.25	4.61	4.23	5.75	8.55	.
Chlorophyll-a, ug/l	27	3.00	19.00	36.85	26.00	43.80	131.00	74.07
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	27	2.64	261.00	275.63	284.50	297.00	369.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	27	3.57	5.59	7.49	6.64	9.45	12.09	18.52
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	27	0.10	0.12	0.13	0.14	0.14	0.17	.
Secchi Depth, m	26	0.20	0.40	0.50	0.50	0.60	1.00	100.00
Total Kjeldahl Nitrogen, mg/l	27	1.25	1.65	2.20	2.20	2.50	4.05	.
Total Nitrogen, mg/l	19	1.31	1.73	2.22	2.21	2.59	3.49	78.95
Orthophosphate as P, mg/l	27	0.00	0.03	0.16	0.17	0.28	0.41	.
Total Phosphorus, mg/l	13	0.03	0.06	0.10	0.08	0.13	0.22	30.77
Total Suspended Solids, mg/l	25	2.00	5.00	9.32	8.00	14.00	20.00	32.00
Turbidity, NTU	27	2.20	4.45	9.75	8.10	11.70	29.00	.
Unionized Ammonia, mg/l	24	0.00	0.00	0.01	0.00	0.01	0.08	12.50

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 15160

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	52.00	52.00	52.00	52.00	52.00	52.00	100
Color, PCU	1	120.00	120.00	120.00	120.00	120.00	120.00	100
Conductivity, umhos/cm	1	255.00	255.00	255.00	255.00	255.00	255.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	7.25	7.25	7.25	7.25	7.25	7.25	0
Fecal Coliform, #/100ml	1	1.00	1.00	1.00	1.00	1.00	1.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.35	0.35	0.35	0.35	0.35	0.35	100
Total Kjeldahl Nitrogen, mg/l	1	2.50	2.50	2.50	2.50	2.50	2.50	.
Total Nitrogen, mg/l	1	2.50	2.50	2.50	2.50	2.50	2.50	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.22	0.22	0.22	0.22	0.22	0.22	100
Total Suspended Solids, mg/l	1	34.00	34.00	34.00	34.00	34.00	34.00	100
Turbidity, NTU	1	13.00	13.00	13.00	13.00	13.00	13.00	.
Unionized Ammonia, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 15162

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	24.00	24.00	24.00	24.00	24.00	24.00	100
Color, PCU	1	140.00	140.00	140.00	140.00	140.00	140.00	100
Conductivity, umhos/cm	1	254.00	254.00	254.00	254.00	254.00	254.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	7.11	7.11	7.11	7.11	7.11	7.11	0
Fecal Coliform, #/100ml	1	1.00	1.00	1.00	1.00	1.00	1.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.36	0.36	0.36	0.36	0.36	0.36	100
Total Kjeldahl Nitrogen, mg/l	1	2.70	2.70	2.70	2.70	2.70	2.70	.
Total Nitrogen, mg/l	1	2.70	2.70	2.70	2.70	2.70	2.70	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.23	0.23	0.23	0.23	0.23	0.23	100
Total Suspended Solids, mg/l	1	32.00	32.00	32.00	32.00	32.00	32.00	100
Turbidity, NTU	1	14.00	14.00	14.00	14.00	14.00	14.00	.
Unionized Ammonia, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 15165

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	72.00	72.00	72.00	72.00	72.00	72.00	100
Color, PCU	1	120.00	120.00	120.00	120.00	120.00	120.00	100
Conductivity, umhos/cm	1	256.00	256.00	256.00	256.00	256.00	256.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	7.29	7.29	7.29	7.29	7.29	7.29	0
Fecal Coliform, #/100ml	1	1.00	1.00	1.00	1.00	1.00	1.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.38	0.38	0.38	0.38	0.38	0.38	100
Total Kjeldahl Nitrogen, mg/l	1	2.30	2.30	2.30	2.30	2.30	2.30	.
Total Nitrogen, mg/l	1	2.30	2.30	2.30	2.30	2.30	2.30	100
Orthophosphate as P, mg/l	1	0.07	0.07	0.07	0.07	0.07	0.07	.
Total Phosphorus, mg/l	1	0.22	0.22	0.22	0.22	0.22	0.22	100
Total Suspended Solids, mg/l	1	30.00	30.00	30.00	30.00	30.00	30.00	100
Turbidity, NTU	1	11.00	11.00	11.00	11.00	11.00	11.00	.
Unionized Ammonia, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 15169

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	13.00	13.00	13.00	13.00	13.00	13.00	0
Color, PCU	1	120.00	120.00	120.00	120.00	120.00	120.00	100
Conductivity, umhos/cm	1	247.00	247.00	247.00	247.00	247.00	247.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	7.10	7.10	7.10	7.10	7.10	7.10	0
Fecal Coliform, #/100ml	1	1.00	1.00	1.00	1.00	1.00	1.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.38	0.38	0.38	0.38	0.38	0.38	100
Total Kjeldahl Nitrogen, mg/l	1	2.30	2.30	2.30	2.30	2.30	2.30	.
Total Nitrogen, mg/l	1	2.30	2.30	2.30	2.30	2.30	2.30	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.22	0.22	0.22	0.22	0.22	0.22	100
Total Suspended Solids, mg/l	1	33.00	33.00	33.00	33.00	33.00	33.00	100
Turbidity, NTU	1	11.00	11.00	11.00	11.00	11.00	11.00	.
Unionized Ammonia, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 15171

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	34.00	34.00	34.00	34.00	34.00	34.00	100
Color, PCU	1	140.00	140.00	140.00	140.00	140.00	140.00	100
Conductivity, umhos/cm	1	253.00	253.00	253.00	253.00	253.00	253.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	6.97	6.97	6.97	6.97	6.97	6.97	0
Fecal Coliform, #/100ml	1	1.00	1.00	1.00	1.00	1.00	1.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.33	0.33	0.33	0.33	0.33	0.33	100
Total Kjeldahl Nitrogen, mg/l	1	2.50	2.50	2.50	2.50	2.50	2.50	.
Total Nitrogen, mg/l	1	2.50	2.50	2.50	2.50	2.50	2.50	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.23	0.23	0.23	0.23	0.23	0.23	100
Total Suspended Solids, mg/l	1	35.00	35.00	35.00	35.00	35.00	35.00	100
Turbidity, NTU	1	16.00	16.00	16.00	16.00	16.00	16.00	.
Unionized Ammonia, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 15181

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	25.00	25.00	25.00	25.00	25.00	25.00	100
Color, PCU	1	140.00	140.00	140.00	140.00	140.00	140.00	100
Conductivity, umhos/cm	1	248.00	248.00	248.00	248.00	248.00	248.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	7.80	7.80	7.80	7.80	7.80	7.80	0
Fecal Coliform, #/100ml	1	1.00	1.00	1.00	1.00	1.00	1.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.34	0.34	0.34	0.34	0.34	0.34	100
Total Kjeldahl Nitrogen, mg/l	1	2.60	2.60	2.60	2.60	2.60	2.60	.
Total Nitrogen, mg/l	1	2.60	2.60	2.60	2.60	2.60	2.60	100
Orthophosphate as P, mg/l	1	0.04	0.04	0.04	0.04	0.04	0.04	.
Total Phosphorus, mg/l	1	0.25	0.25	0.25	0.25	0.25	0.25	100
Total Suspended Solids, mg/l	1	35.00	35.00	35.00	35.00	35.00	35.00	100
Turbidity, NTU	1	15.00	15.00	15.00	15.00	15.00	15.00	.
Unionized Ammonia, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 15185

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	90.00	90.00	90.00	90.00	90.00	90.00	100
Color, PCU	1	140.00	140.00	140.00	140.00	140.00	140.00	100
Conductivity, umhos/cm	1	245.00	245.00	245.00	245.00	245.00	245.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	8.33	8.33	8.33	8.33	8.33	8.33	0
Fecal Coliform, #/100ml	1	1.00	1.00	1.00	1.00	1.00	1.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.35	0.35	0.35	0.35	0.35	0.35	100
Total Kjeldahl Nitrogen, mg/l	1	2.50	2.50	2.50	2.50	2.50	2.50	.
Total Nitrogen, mg/l	1	2.50	2.50	2.50	2.50	2.50	2.50	100
Orthophosphate as P, mg/l	1	0.04	0.04	0.04	0.04	0.04	0.04	.
Total Phosphorus, mg/l	1	0.22	0.22	0.22	0.22	0.22	0.22	100
Total Suspended Solids, mg/l	1	35.00	35.00	35.00	35.00	35.00	35.00	100
Turbidity, NTU	1	16.00	16.00	16.00	16.00	16.00	16.00	.
Unionized Ammonia, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 15187

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	63.00	63.00	63.00	63.00	63.00	63.00	100
Color, PCU	1	140.00	140.00	140.00	140.00	140.00	140.00	100
Conductivity, umhos/cm	1	254.00	254.00	254.00	254.00	254.00	254.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	5.45	5.45	5.45	5.45	5.45	5.45	0
Fecal Coliform, #/100ml	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.33	0.33	0.33	0.33	0.33	0.33	100
Total Kjeldahl Nitrogen, mg/l	1	2.50	2.50	2.50	2.50	2.50	2.50	.
Total Nitrogen, mg/l	1	2.50	2.50	2.50	2.50	2.50	2.50	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.27	0.27	0.27	0.27	0.27	0.27	100
Total Suspended Solids, mg/l	1	39.00	39.00	39.00	39.00	39.00	39.00	100
Turbidity, NTU	1	17.00	17.00	17.00	17.00	17.00	17.00	.
Unionized Ammonia, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 15188

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	34.00	34.00	34.00	34.00	34.00	34.00	100
Color, PCU	1	150.00	150.00	150.00	150.00	150.00	150.00	100
Conductivity, umhos/cm	1	251.00	251.00	251.00	251.00	251.00	251.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	5.66	5.66	5.66	5.66	5.66	5.66	0
Fecal Coliform, #/100ml	1	1.00	1.00	1.00	1.00	1.00	1.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.39	0.39	0.39	0.39	0.39	0.39	100
Total Kjeldahl Nitrogen, mg/l	1	2.50	2.50	2.50	2.50	2.50	2.50	.
Total Nitrogen, mg/l	1	2.50	2.50	2.50	2.50	2.50	2.50	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.25	0.25	0.25	0.25	0.25	0.25	100
Total Suspended Solids, mg/l	1	36.00	36.00	36.00	36.00	36.00	36.00	100
Turbidity, NTU	1	17.00	17.00	17.00	17.00	17.00	17.00	.
Unionized Ammonia, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22719

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	6.80	6.80	6.80	6.80	6.80	6.80	0
Color, PCU	1	70.00	70.00	70.00	70.00	70.00	70.00	0
Conductivity, umhos/cm	1	279.00	279.00	279.00	279.00	279.00	279.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	9.50	9.50	9.50	9.50	9.50	9.50	0
Fecal Coliform, #/100ml	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.35	0.35	0.35	0.35	0.35	0.35	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	6.90	6.90	6.90	6.90	6.90	6.90	.
Unionized Ammonia, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22720

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	3.40	3.40	3.40	3.40	3.40	3.40	0
Color, PCU	1	100.00	100.00	100.00	100.00	100.00	100.00	100
Conductivity, umhos/cm	1	283.00	283.00	283.00	283.00	283.00	283.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	10.24	10.24	10.24	10.24	10.24	10.24	0
Fecal Coliform, #/100ml	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.35	0.35	0.35	0.35	0.35	0.35	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	9.40	9.40	9.40	9.40	9.40	9.40	.
Unionized Ammonia, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22721

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	9.40	9.40	9.40	9.40	9.40	9.40	0
Color, PCU	1	100.00	100.00	100.00	100.00	100.00	100.00	100
Conductivity, umhos/cm	1	283.00	283.00	283.00	283.00	283.00	283.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	9.65	9.65	9.65	9.65	9.65	9.65	0
Fecal Coliform, #/100ml	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.35	0.35	0.35	0.35	0.35	0.35	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	8.60	8.60	8.60	8.60	8.60	8.60	.
Unionized Ammonia, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22722

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	2.10	2.10	2.10	2.10	2.10	2.10	0
Color, PCU	1	100.00	100.00	100.00	100.00	100.00	100.00	100
Conductivity, umhos/cm	1	286.50	286.50	286.50	286.50	286.50	286.50	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	8.83	8.83	8.83	8.83	8.83	8.83	0
Fecal Coliform, #/100ml	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.35	0.35	0.35	0.35	0.35	0.35	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	8.80	8.80	8.80	8.80	8.80	8.80	.
Unionized Ammonia, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22723

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	29.00	29.00	29.00	29.00	29.00	29.00	100
Color, PCU	1	100.00	100.00	100.00	100.00	100.00	100.00	100
Conductivity, umhos/cm	1	286.00	286.00	286.00	286.00	286.00	286.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	9.69	9.69	9.69	9.69	9.69	9.69	0
Fecal Coliform, #/100ml	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.55	0.55	0.55	0.55	0.55	0.55	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	6.00	6.00	6.00	6.00	6.00	6.00	.
Unionized Ammonia, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22724

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	2.80	2.80	2.80	2.80	2.80	2.80	0
Color, PCU	1	100.00	100.00	100.00	100.00	100.00	100.00	100
Conductivity, umhos/cm	1	284.00	284.00	284.00	284.00	284.00	284.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	11.76	11.76	11.76	11.76	11.76	11.76	0
Fecal Coliform, #/100ml	1	4.00	4.00	4.00	4.00	4.00	4.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.45	0.45	0.45	0.45	0.45	0.45	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	6.50	6.50	6.50	6.50	6.50	6.50	.
Unionized Ammonia, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22725

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	5.70	5.70	5.70	5.70	5.70	5.70	0
Color, PCU	1	100.00	100.00	100.00	100.00	100.00	100.00	100
Conductivity, umhos/cm	1	298.00	298.00	298.00	298.00	298.00	298.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	11.96	11.96	11.96	11.96	11.96	11.96	0
Fecal Coliform, #/100ml	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.50	0.50	0.50	0.50	0.50	0.50	100
Total Kjeldahl Nitrogen, mg/l	1	2.80	2.80	2.80	2.80	2.80	2.80	.
Total Nitrogen, mg/l	1	2.80	2.80	2.80	2.80	2.80	2.80	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.29	0.29	0.29	0.29	0.29	0.29	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	7.60	7.60	7.60	7.60	7.60	7.60	.
Unionized Ammonia, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22726

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	4.20	4.20	4.20	4.20	4.20	4.20	0
Color, PCU	1	100.00	100.00	100.00	100.00	100.00	100.00	100
Conductivity, umhos/cm	1	300.00	300.00	300.00	300.00	300.00	300.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	10.70	10.70	10.70	10.70	10.70	10.70	0
Fecal Coliform, #/100ml	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.50	0.50	0.50	0.50	0.50	0.50	100
Total Kjeldahl Nitrogen, mg/l	1	2.60	2.60	2.60	2.60	2.60	2.60	.
Total Nitrogen, mg/l	1	2.60	2.60	2.60	2.60	2.60	2.60	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.30	0.30	0.30	0.30	0.30	0.30	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	6.90	6.90	6.90	6.90	6.90	6.90	.
Unionized Ammonia, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22727

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	56.00	56.00	56.00	56.00	56.00	56.00	100
Color, PCU	1	100.00	100.00	100.00	100.00	100.00	100.00	100
Conductivity, umhos/cm	1	283.00	283.00	283.00	283.00	283.00	283.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	10.41	10.41	10.41	10.41	10.41	10.41	0
Fecal Coliform, #/100ml	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.40	0.40	0.40	0.40	0.40	0.40	100
Total Kjeldahl Nitrogen, mg/l	1	2.40	2.40	2.40	2.40	2.40	2.40	.
Total Nitrogen, mg/l	1	2.40	2.40	2.40	2.40	2.40	2.40	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.36	0.36	0.36	0.36	0.36	0.36	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	13.00	13.00	13.00	13.00	13.00	13.00	.
Unionized Ammonia, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22728

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	33.00	33.00	33.00	33.00	33.00	33.00	100
Color, PCU	1	100.00	100.00	100.00	100.00	100.00	100.00	100
Conductivity, umhos/cm	1	281.00	281.00	281.00	281.00	281.00	281.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	8.71	8.71	8.71	8.71	8.71	8.71	0
Fecal Coliform, #/100ml	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.40	0.40	0.40	0.40	0.40	0.40	100
Total Kjeldahl Nitrogen, mg/l	1	2.30	2.30	2.30	2.30	2.30	2.30	.
Total Nitrogen, mg/l	1	2.30	2.30	2.30	2.30	2.30	2.30	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.32	0.32	0.32	0.32	0.32	0.32	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	8.30	8.30	8.30	8.30	8.30	8.30	.
Unionized Ammonia, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22729

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	55.00	55.00	55.00	55.00	55.00	55.00	100
Color, PCU	1	100.00	100.00	100.00	100.00	100.00	100.00	100
Conductivity, umhos/cm	1	285.00	285.00	285.00	285.00	285.00	285.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	10.33	10.33	10.33	10.33	10.33	10.33	0
Fecal Coliform, #/100ml	1	5.00	5.00	5.00	5.00	5.00	5.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.40	0.40	0.40	0.40	0.40	0.40	100
Total Kjeldahl Nitrogen, mg/l	1	2.90	2.90	2.90	2.90	2.90	2.90	.
Total Nitrogen, mg/l	1	2.90	2.90	2.90	2.90	2.90	2.90	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.36	0.36	0.36	0.36	0.36	0.36	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	10.00	10.00	10.00	10.00	10.00	10.00	.
Unionized Ammonia, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22730

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	43.00	43.00	43.00	43.00	43.00	43.00	100
Color, PCU	1	100.00	100.00	100.00	100.00	100.00	100.00	100
Conductivity, umhos/cm	1	286.00	286.00	286.00	286.00	286.00	286.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	9.32	9.32	9.32	9.32	9.32	9.32	0
Fecal Coliform, #/100ml	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.45	0.45	0.45	0.45	0.45	0.45	100
Total Kjeldahl Nitrogen, mg/l	1	2.70	2.70	2.70	2.70	2.70	2.70	.
Total Nitrogen, mg/l	1	2.70	2.70	2.70	2.70	2.70	2.70	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.36	0.36	0.36	0.36	0.36	0.36	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	11.00	11.00	11.00	11.00	11.00	11.00	.
Unionized Ammonia, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22731

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	63.00	63.00	63.00	63.00	63.00	63.00	100
Color, PCU	1	100.00	100.00	100.00	100.00	100.00	100.00	100
Conductivity, umhos/cm	1	279.00	279.00	279.00	279.00	279.00	279.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	9.62	9.62	9.62	9.62	9.62	9.62	0
Fecal Coliform, #/100ml	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.30	0.30	0.30	0.30	0.30	0.30	100
Total Kjeldahl Nitrogen, mg/l	1	2.70	2.70	2.70	2.70	2.70	2.70	.
Total Nitrogen, mg/l	1	2.70	2.70	2.70	2.70	2.70	2.70	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.38	0.38	0.38	0.38	0.38	0.38	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	10.00	10.00	10.00	10.00	10.00	10.00	.
Unionized Ammonia, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22732

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	4.30	4.30	4.30	4.30	4.30	4.30	0
Color, PCU	1	150.00	150.00	150.00	150.00	150.00	150.00	100
Conductivity, umhos/cm	1	289.00	289.00	289.00	289.00	289.00	289.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	8.35	8.35	8.35	8.35	8.35	8.35	0
Fecal Coliform, #/100ml	1	5.00	5.00	5.00	5.00	5.00	5.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.20	0.20	0.20	0.20	0.20	0.20	100
Total Kjeldahl Nitrogen, mg/l	1	3.10	3.10	3.10	3.10	3.10	3.10	.
Total Nitrogen, mg/l	1	3.10	3.10	3.10	3.10	3.10	3.10	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.37	0.37	0.37	0.37	0.37	0.37	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	16.00	16.00	16.00	16.00	16.00	16.00	.
Unionized Ammonia, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22733

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	17.00	17.00	17.00	17.00	17.00	17.00	0
Color, PCU	1	150.00	150.00	150.00	150.00	150.00	150.00	100
Conductivity, umhos/cm	1	289.00	289.00	289.00	289.00	289.00	289.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	8.02	8.02	8.02	8.02	8.02	8.02	0
Fecal Coliform, #/100ml	1	3.00	3.00	3.00	3.00	3.00	3.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.20	0.20	0.20	0.20	0.20	0.20	100
Total Kjeldahl Nitrogen, mg/l	1	3.80	3.80	3.80	3.80	3.80	3.80	.
Total Nitrogen, mg/l	1	3.81	3.81	3.81	3.81	3.81	3.81	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.43	0.43	0.43	0.43	0.43	0.43	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	23.00	23.00	23.00	23.00	23.00	23.00	.
Unionized Ammonia, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22734

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	26.00	26.00	26.00	26.00	26.00	26.00	100
Color, PCU	1	150.00	150.00	150.00	150.00	150.00	150.00	100
Conductivity, umhos/cm	1	292.00	292.00	292.00	292.00	292.00	292.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	8.39	8.39	8.39	8.39	8.39	8.39	0
Fecal Coliform, #/100ml	1	4.00	4.00	4.00	4.00	4.00	4.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.20	0.20	0.20	0.20	0.20	0.20	100
Total Kjeldahl Nitrogen, mg/l	1	3.20	3.20	3.20	3.20	3.20	3.20	.
Total Nitrogen, mg/l	1	3.20	3.20	3.20	3.20	3.20	3.20	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.39	0.39	0.39	0.39	0.39	0.39	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	18.00	18.00	18.00	18.00	18.00	18.00	.
Unionized Ammonia, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22735

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	4.30	4.30	4.30	4.30	4.30	4.30	0
Color, PCU	1	100.00	100.00	100.00	100.00	100.00	100.00	100
Conductivity, umhos/cm	1	294.00	294.00	294.00	294.00	294.00	294.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	11.46	11.46	11.46	11.46	11.46	11.46	0
Fecal Coliform, #/100ml	1	4.00	4.00	4.00	4.00	4.00	4.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.40	0.40	0.40	0.40	0.40	0.40	100
Total Kjeldahl Nitrogen, mg/l	1	2.90	2.90	2.90	2.90	2.90	2.90	.
Total Nitrogen, mg/l	1	2.90	2.90	2.90	2.90	2.90	2.90	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.30	0.30	0.30	0.30	0.30	0.30	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	10.00	10.00	10.00	10.00	10.00	10.00	.
Unionized Ammonia, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22736

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	120.00	120.00	120.00	120.00	120.00	120.00	100
Color, PCU	1	60.00	60.00	60.00	60.00	60.00	60.00	0
Conductivity, umhos/cm	1	304.00	304.00	304.00	304.00	304.00	304.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	10.93	10.93	10.93	10.93	10.93	10.93	0
Fecal Coliform, #/100ml	1	25.00	25.00	25.00	25.00	25.00	25.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.03	0.03	0.03	0.03	0.03	0.03	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.40	0.40	0.40	0.40	0.40	0.40	100
Total Kjeldahl Nitrogen, mg/l	1	3.50	3.50	3.50	3.50	3.50	3.50	.
Total Nitrogen, mg/l	1	3.53	3.53	3.53	3.53	3.53	3.53	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.32	0.32	0.32	0.32	0.32	0.32	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	27.00	27.00	27.00	27.00	27.00	27.00	.
Unionized Ammonia, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22737

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	100.00	100.00	100.00	100.00	100.00	100.00	100
Color, PCU	1	100.00	100.00	100.00	100.00	100.00	100.00	100
Conductivity, umhos/cm	1	299.00	299.00	299.00	299.00	299.00	299.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	12.29	12.29	12.29	12.29	12.29	12.29	0
Fecal Coliform, #/100ml	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.30	0.30	0.30	0.30	0.30	0.30	100
Total Kjeldahl Nitrogen, mg/l	1	3.20	3.20	3.20	3.20	3.20	3.20	.
Total Nitrogen, mg/l	1	3.21	3.21	3.21	3.21	3.21	3.21	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.31	0.31	0.31	0.31	0.31	0.31	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	19.00	19.00	19.00	19.00	19.00	19.00	.
Unionized Ammonia, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22738

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	120.00	120.00	120.00	120.00	120.00	120.00	100
Color, PCU	1	100.00	100.00	100.00	100.00	100.00	100.00	100
Conductivity, umhos/cm	1	299.00	299.00	299.00	299.00	299.00	299.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	9.74	9.74	9.74	9.74	9.74	9.74	0
Fecal Coliform, #/100ml	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.05	0.05	0.05	0.05	0.05	0.05	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.50	0.50	0.50	0.50	0.50	0.50	100
Total Kjeldahl Nitrogen, mg/l	1	3.70	3.70	3.70	3.70	3.70	3.70	.
Total Nitrogen, mg/l	1	3.75	3.75	3.75	3.75	3.75	3.75	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.35	0.35	0.35	0.35	0.35	0.35	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	19.00	19.00	19.00	19.00	19.00	19.00	.
Unionized Ammonia, mg/l	1	0.03	0.03	0.03	0.03	0.03	0.03	100

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22739

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	61.00	61.00	61.00	61.00	61.00	61.00	100
Color, PCU	1	100.00	100.00	100.00	100.00	100.00	100.00	100
Conductivity, umhos/cm	1	295.00	295.00	295.00	295.00	295.00	295.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	10.44	10.44	10.44	10.44	10.44	10.44	0
Fecal Coliform, #/100ml	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.60	0.60	0.60	0.60	0.60	0.60	100
Total Kjeldahl Nitrogen, mg/l	1	3.60	3.60	3.60	3.60	3.60	3.60	.
Total Nitrogen, mg/l	1	3.61	3.61	3.61	3.61	3.61	3.61	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.33	0.33	0.33	0.33	0.33	0.33	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	14.00	14.00	14.00	14.00	14.00	14.00	.
Unionized Ammonia, mg/l	1	0.04	0.04	0.04	0.04	0.04	0.04	100

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22740

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	4.30	4.30	4.30	4.30	4.30	4.30	0
Color, PCU	1	100.00	100.00	100.00	100.00	100.00	100.00	100
Conductivity, umhos/cm	1	299.50	299.50	299.50	299.50	299.50	299.50	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	8.77	8.77	8.77	8.77	8.77	8.77	0
Fecal Coliform, #/100ml	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.60	0.60	0.60	0.60	0.60	0.60	100
Total Kjeldahl Nitrogen, mg/l	1	3.50	3.50	3.50	3.50	3.50	3.50	.
Total Nitrogen, mg/l	1	3.52	3.52	3.52	3.52	3.52	3.52	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.31	0.31	0.31	0.31	0.31	0.31	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	10.00	10.00	10.00	10.00	10.00	10.00	.
Unionized Ammonia, mg/l	1	0.04	0.04	0.04	0.04	0.04	0.04	100

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22741

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	96.00	96.00	96.00	96.00	96.00	96.00	100
Color, PCU	1	100.00	100.00	100.00	100.00	100.00	100.00	100
Conductivity, umhos/cm	1	295.00	295.00	295.00	295.00	295.00	295.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	11.46	11.46	11.46	11.46	11.46	11.46	0
Fecal Coliform, #/100ml	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.50	0.50	0.50	0.50	0.50	0.50	100
Total Kjeldahl Nitrogen, mg/l	1	3.10	3.10	3.10	3.10	3.10	3.10	.
Total Nitrogen, mg/l	1	3.12	3.12	3.12	3.12	3.12	3.12	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.31	0.31	0.31	0.31	0.31	0.31	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	13.00	13.00	13.00	13.00	13.00	13.00	.
Unionized Ammonia, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22742

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	97.00	97.00	97.00	97.00	97.00	97.00	100
Color, PCU	1	100.00	100.00	100.00	100.00	100.00	100.00	100
Conductivity, umhos/cm	1	292.00	292.00	292.00	292.00	292.00	292.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	12.12	12.12	12.12	12.12	12.12	12.12	0
Fecal Coliform, #/100ml	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.03	0.03	0.03	0.03	0.03	0.03	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.50	0.50	0.50	0.50	0.50	0.50	100
Total Kjeldahl Nitrogen, mg/l	1	3.40	3.40	3.40	3.40	3.40	3.40	.
Total Nitrogen, mg/l	1	3.43	3.43	3.43	3.43	3.43	3.43	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.29	0.29	0.29	0.29	0.29	0.29	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	14.00	14.00	14.00	14.00	14.00	14.00	.
Unionized Ammonia, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22743

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	32.00	32.00	32.00	32.00	32.00	32.00	100
Color, PCU	1	100.00	100.00	100.00	100.00	100.00	100.00	100
Conductivity, umhos/cm	1	301.00	301.00	301.00	301.00	301.00	301.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	8.67	8.67	8.67	8.67	8.67	8.67	0
Fecal Coliform, #/100ml	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.40	0.40	0.40	0.40	0.40	0.40	100
Total Kjeldahl Nitrogen, mg/l	1	2.80	2.80	2.80	2.80	2.80	2.80	.
Total Nitrogen, mg/l	1	2.80	2.80	2.80	2.80	2.80	2.80	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.36	0.36	0.36	0.36	0.36	0.36	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	12.00	12.00	12.00	12.00	12.00	12.00	.
Unionized Ammonia, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22744

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	5.30	5.30	5.30	5.30	5.30	5.30	0
Color, PCU	1	120.00	120.00	120.00	120.00	120.00	120.00	100
Conductivity, umhos/cm	1	296.00	296.00	296.00	296.00	296.00	296.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	9.49	9.49	9.49	9.49	9.49	9.49	0
Fecal Coliform, #/100ml	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.30	0.30	0.30	0.30	0.30	0.30	100
Total Kjeldahl Nitrogen, mg/l	1	3.00	3.00	3.00	3.00	3.00	3.00	.
Total Nitrogen, mg/l	1	3.00	3.00	3.00	3.00	3.00	3.00	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.38	0.38	0.38	0.38	0.38	0.38	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	16.00	16.00	16.00	16.00	16.00	16.00	.
Unionized Ammonia, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22745

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	4.30	4.30	4.30	4.30	4.30	4.30	0
Color, PCU	1	100.00	100.00	100.00	100.00	100.00	100.00	100
Conductivity, umhos/cm	1	298.00	298.00	298.00	298.00	298.00	298.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	9.81	9.81	9.81	9.81	9.81	9.81	0
Fecal Coliform, #/100ml	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.35	0.35	0.35	0.35	0.35	0.35	100
Total Kjeldahl Nitrogen, mg/l	1	2.80	2.80	2.80	2.80	2.80	2.80	.
Total Nitrogen, mg/l	1	2.80	2.80	2.80	2.80	2.80	2.80	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.32	0.32	0.32	0.32	0.32	0.32	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	14.00	14.00	14.00	14.00	14.00	14.00	.
Unionized Ammonia, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22746

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	4.3	4.3	4.3	4.3	4.3	4.3	0
Color, PCU	1	100.0	100.0	100.0	100.0	100.0	100.0	100
Conductivity, umhos/cm	1	296.0	296.0	296.0	296.0	296.0	296.0	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	10.3	10.3	10.3	10.3	10.3	10.3	0
Fecal Coliform, #/100ml	1	9.0	9.0	9.0	9.0	9.0	9.0	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.0	0.0	0.0	0.0	0.0	0.0	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.4	0.4	0.4	0.4	0.4	0.4	100
Total Kjeldahl Nitrogen, mg/l	1	2.6	2.6	2.6	2.6	2.6	2.6	.
Total Nitrogen, mg/l	1	2.6	2.6	2.6	2.6	2.6	2.6	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.3	0.3	0.3	0.3	0.3	0.3	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	7.9	7.9	7.9	7.9	7.9	7.9	.
Unionized Ammonia, mg/l	1	0.0	0.0	0.0	0.0	0.0	0.0	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 22747

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	22.00	22.00	22.00	22.00	22.00	22.00	100
Color, PCU	1	100.00	100.00	100.00	100.00	100.00	100.00	100
Conductivity, umhos/cm	1	295.00	295.00	295.00	295.00	295.00	295.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	12.37	12.37	12.37	12.37	12.37	12.37	0
Fecal Coliform, #/100ml	1	17.00	17.00	17.00	17.00	17.00	17.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.45	0.45	0.45	0.45	0.45	0.45	100
Total Kjeldahl Nitrogen, mg/l	1	3.00	3.00	3.00	3.00	3.00	3.00	.
Total Nitrogen, mg/l	1	3.00	3.00	3.00	3.00	3.00	3.00	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.33	0.33	0.33	0.33	0.33	0.33	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	11.00	11.00	11.00	11.00	11.00	11.00	.
Unionized Ammonia, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=21FLGW 3496

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	53	1.00	32.00	60.74	60.00	84.00	180.00	83.02
Color, PCU	52	50.00	80.00	114.04	100.00	120.00	300.00	63.46
Conductivity, umhos/cm	54	206.00	244.00	273.88	270.00	290.00	425.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	54	0.44	7.78	8.92	9.08	10.40	14.05	5.56
Fecal Coliform, #/100ml	53	1.00	1.00	4.11	1.00	2.00	100.00	0.00
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	52	0.00	0.00	0.06	0.00	0.02	0.60	.
Salinity, ppt	4	0.00	0.09	0.13	0.17	0.18	0.18	.
Secchi Depth, m	53	0.20	0.30	0.46	0.45	0.55	1.10	100.00
Total Kjeldahl Nitrogen, mg/l	52	0.20	2.10	2.52	2.40	2.90	4.80	.
Total Nitrogen, mg/l	52	0.26	2.20	2.58	2.52	2.91	4.80	96.15
Orthophosphate as P, mg/l	52	0.00	0.01	0.09	0.03	0.12	0.38	.
Total Phosphorus, mg/l	52	0.06	0.13	0.22	0.18	0.31	0.51	82.69
Total Suspended Solids, mg/l	52	4.00	13.00	22.54	18.00	27.00	84.00	73.08
Turbidity, NTU	52	1.50	7.75	13.03	9.60	17.50	34.00	.
Unionized Ammonia, mg/l	52	0.00	0.00	0.02	0.01	0.02	0.22	23.08

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3259W Station=Trafford

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	84.00	84.00	84.00	84.00	84.00	84.00	100
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	0	.	.	.	.	.	.	.
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.31	0.31	0.31	0.31	0.31	0.31	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	1	5.55	5.55	5.55	5.55	5.55	5.55	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.29	0.29	0.29	0.29	0.29	0.29	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278C Station=21FLGW 13716

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	49.00	49.00	49.00	49.00	49.00	49.00	100
Color, PCU	1	60.00	60.00	60.00	60.00	60.00	60.00	0
Conductivity, umhos/cm	1	808.00	808.00	808.00	808.00	808.00	808.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	10.94	10.94	10.94	10.94	10.94	10.94	0
Fecal Coliform, #/100ml	1	12.00	12.00	12.00	12.00	12.00	12.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.60	0.60	0.60	0.60	0.60	0.60	100
Total Kjeldahl Nitrogen, mg/l	1	2.00	2.00	2.00	2.00	2.00	2.00	.
Total Nitrogen, mg/l	1	2.00	2.00	2.00	2.00	2.00	2.00	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.09	0.09	0.09	0.09	0.09	0.09	0
Total Suspended Solids, mg/l	1	10.00	10.00	10.00	10.00	10.00	10.00	100
Turbidity, NTU	1	4.90	4.90	4.90	4.90	4.90	4.90	.
Unionized Ammonia, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278D Station=21FLFTM BC14

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	37	405.00	790.0	913.54	910.00	987.00	1527.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	36	3.09	6.5	7.70	8.41	9.13	10.92	16.67
Fecal Coliform, #/100ml	33	1.00	25.0	259.27	92.00	330.00	2100.00	21.21
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	37	0.20	1.0	1.78	1.80	2.00	3.60	18.92
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278D Station=21FLFTM EVRGWC0076FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	37	507.00	839.00	18655.70	5076.00	40462.00	48188.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	37	2.35	4.71	6.35	5.42	6.81	14.08	29.73
Fecal Coliform, #/100ml	36	2.00	30.00	654.53	100.50	510.00	5800.00	33.33
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	37	0.20	0.30	0.47	0.50	0.50	1.00	97.30
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278D Station=21FLFTM EVRGWC0077FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	37	674.00	822.00	8131.11	1030.00	14234.00	42679.0	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	37	2.72	5.26	7.54	6.04	9.71	15.7	18.92
Fecal Coliform, #/100ml	36	1.00	50.00	606.69	126.00	460.00	8500.0	27.78
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	36	0.10	0.20	0.39	0.30	0.40	2.0	91.67
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278D Station=21FLFTM EVRGWC0079FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	37	677.0	825.0	952.35	994.00	1088.00	1222.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	37	2.2	4.2	6.07	6.43	7.73	9.79	40.54
Fecal Coliform, #/100ml	34	1.0	14.0	257.21	87.00	270.00	2200.00	11.76
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	37	0.4	1.0	1.13	1.20	1.30	2.00	21.62
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278D Station=21FLFTMCOC@IBIS

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	38	16.39	878.00	1321.38	1417.50	1745.00	1955.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	37	0.70	4.19	6.08	5.71	7.10	16.36	32.43
Fecal Coliform, #/100ml	37	33.00	78.00	843.00	160.00	736.00	5300.00	35.14
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	36	0.30	0.40	0.56	0.50	0.78	1.00	97.22
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278D Station=21FLFTMCOCPALM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	36	323.00	773.50	1144.19	1262.00	1524.00	1769.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	35	3.48	4.91	6.39	6.48	7.57	9.86	28.57
Fecal Coliform, #/100ml	35	1.00	16.00	192.40	56.00	290.00	1253.00	17.14
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	36	0.50	0.80	1.05	1.00	1.30	1.80	38.89
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278D Station=21FLFTMEVRGWC0080FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	9	630.00	776.00	849.78	860.00	919.00	1033.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	9	3.05	3.31	3.78	3.45	4.31	5.17	88.89
Fecal Coliform, #/100ml	9	76.00	105.00	411.44	143.00	280.00	2000.00	22.22
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	9	0.50	0.90	0.93	1.00	1.00	1.30	33.33
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278D Station=21FLGW14183

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	52.00	52.00	52.00	52.00	52.00	52.00	100
Color, PCU	1	100.00	100.00	100.00	100.00	100.00	100.00	0
Conductivity, umhos/cm	1	963.50	963.50	963.50	963.50	963.50	963.50	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	12.91	12.91	12.91	12.91	12.91	12.91	0
Fecal Coliform, #/100ml	1	4.00	4.00	4.00	4.00	4.00	4.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.61	0.61	0.61	0.61	0.61	0.61	100
Total Kjeldahl Nitrogen, mg/l	1	2.10	2.10	2.10	2.10	2.10	2.10	.
Total Nitrogen, mg/l	1	2.10	2.10	2.10	2.10	2.10	2.10	100
Orthophosphate as P, mg/l	1	0.11	0.11	0.11	0.11	0.11	0.11	.
Total Phosphorus, mg/l	1	0.29	0.29	0.29	0.29	0.29	0.29	100
Total Suspended Solids, mg/l	1	16.00	16.00	16.00	16.00	16.00	16.00	100
Turbidity, NTU	1	6.30	6.30	6.30	6.30	6.30	6.30	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278D Station=21FLSFWMBC13

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	21	1.60	2.00	2.32	2.00	2.00	6.00	.
Chlorophyll-a, ug/l	75	3.00	3.00	7.59	3.00	6.40	71.60	8.00
Color, PCU	73	40.00	60.00	72.53	70.00	80.00	200.00	8.22
Conductivity, umhos/cm	75	394.00	598.00	13824.55	8931.00	27648.00	44667.00	.
Copper, ug/l	25	0.45	1.50	3.04	2.00	3.00	16.50	0.00
Dissolved Oxygen, mg/l	75	0.42	3.74	5.49	4.95	6.54	16.74	50.67
Fecal Coliform, #/100ml	64	1.00	18.00	323.06	73.00	193.50	4000.00	9.38
Iron, ug/l	25	120.00	370.00	519.60	520.00	610.00	1100.00	8.00
Nitrate-Nitrite, mg/l	73	0.01	0.04	0.10	0.08	0.14	0.42	.
Salinity, ppt	76	0.19	0.30	8.35	3.50	16.88	28.76	.
Secchi Depth, m	66	0.10	0.60	0.83	0.85	1.00	1.80	69.70
Total Kjeldahl Nitrogen, mg/l	66	0.28	0.63	0.76	0.76	0.88	1.80	.
Total Nitrogen, mg/l	68	0.01	0.40	0.77	0.87	0.97	2.50	4.41
Orthophosphate as P, mg/l	57	0.01	0.01	0.04	0.02	0.05	0.14	.
Total Phosphorus, mg/l	69	0.01	0.03	0.08	0.05	0.12	0.35	4.35
Total Suspended Solids, mg/l	60	2.00	2.00	5.13	2.00	4.00	35.00	15.00
Turbidity, NTU	46	0.90	1.50	2.46	2.00	3.20	7.20	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278D Station=21FLSFWMBC14

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	22	2.00	2.00	2.03	2.00	2.00	2.60	.
Chlorophyll-a, ug/l	72	3.00	3.00	3.85	3.00	3.70	11.20	0.00
Color, PCU	70	30.00	40.00	66.71	60.00	80.00	200.00	10.00
Conductivity, umhos/cm	72	390.00	560.00	664.01	657.00	743.50	1057.00	.
Copper, ug/l	25	0.43	1.00	2.47	1.59	2.62	17.00	0.00
Dissolved Oxygen, mg/l	72	2.30	3.99	6.06	6.14	8.13	10.43	40.28
Fecal Coliform, #/100ml	59	1.00	3.00	192.36	41.00	127.00	2950.00	11.86
Iron, ug/l	23	100.00	120.00	368.26	330.00	560.00	950.00	0.00
Nitrate-Nitrite, mg/l	70	0.01	0.01	0.07	0.04	0.12	0.26	.
Salinity, ppt	73	0.19	0.27	0.32	0.32	0.36	0.52	.
Secchi Depth, m	64	0.50	1.25	1.66	1.80	2.16	2.30	10.94
Total Kjeldahl Nitrogen, mg/l	63	0.20	0.56	0.67	0.69	0.77	0.98	.
Total Nitrogen, mg/l	65	0.01	0.41	0.61	0.68	0.89	1.41	0.00
Orthophosphate as P, mg/l	60	0.00	0.00	0.01	0.01	0.01	0.02	.
Total Phosphorus, mg/l	67	0.00	0.01	0.02	0.02	0.03	0.06	0.00
Total Suspended Solids, mg/l	63	2.00	2.00	2.14	2.00	2.00	5.00	0.00
Turbidity, NTU	43	0.60	1.40	2.43	1.70	2.50	17.00	.
Unionized Ammonia, mg/l	66	0.00	0.00	0.00	0.00	0.00	0.01	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278D Station=21FLSFWMCOC@IBIS

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	16	1.60	2.00	1.99	2.00	2.00	2.30	.
Chlorophyll-a, ug/l	17	3.00	3.00	3.89	3.20	3.70	8.00	0.00
Color, PCU	17	40.00	50.00	55.88	50.00	60.00	75.00	0.00
Conductivity, umhos/cm	18	594.00	814.00	1338.89	1207.00	1903.00	2136.00	.
Copper, ug/l	7	1.00	1.01	1.35	1.06	1.46	2.52	0.00
Dissolved Oxygen, mg/l	19	2.37	4.09	5.54	5.80	6.71	8.63	31.58
Fecal Coliform, #/100ml	18	9.00	74.00	184.44	100.50	200.00	757.00	16.67
Iron, ug/l	6	290.00	530.00	775.00	650.00	780.00	1750.00	16.67
Nitrate-Nitrite, mg/l	17	0.01	0.04	0.10	0.07	0.12	0.36	.
Salinity, ppt	19	0.29	0.39	0.68	0.64	0.96	1.09	.
Secchi Depth, m	19	0.30	0.40	0.43	0.40	0.50	0.60	100.00
Total Kjeldahl Nitrogen, mg/l	14	0.42	0.55	0.68	0.64	0.79	0.95	.
Total Nitrogen, mg/l	15	0.07	0.52	0.62	0.68	0.80	1.06	0.00
Orthophosphate as P, mg/l	17	0.00	0.00	0.01	0.01	0.01	0.03	.
Total Phosphorus, mg/l	17	0.02	0.03	0.04	0.03	0.05	0.09	0.00
Total Suspended Solids, mg/l	18	2.00	2.00	4.49	2.50	7.00	11.00	16.67
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278D Station=21FLSFWMCOCAT41

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	21	1.60	2.00	2.13	2.00	2.00	3.50	.
Chlorophyll-a, ug/l	75	3.00	3.00	6.08	4.30	6.90	26.20	5.33
Color, PCU	73	5.00	40.00	65.96	60.00	80.00	200.00	6.85
Conductivity, umhos/cm	74	454.00	1807.00	22732.41	22446.00	41435.00	49624.00	.
Copper, ug/l	25	0.30	1.56	2.93	2.30	4.20	9.10	0.00
Dissolved Oxygen, mg/l	75	1.46	3.71	4.80	4.83	5.51	13.93	56.00
Fecal Coliform, #/100ml	68	14.00	58.00	232.07	114.50	205.00	2950.00	14.71
Iron, ug/l	23	120.00	340.00	477.83	460.00	580.00	930.00	0.00
Nitrate-Nitrite, mg/l	72	0.01	0.03	0.10	0.08	0.15	0.33	.
Salinity, ppt	75	0.22	0.92	14.26	13.00	26.52	32.39	.
Secchi Depth, m	68	0.35	0.60	0.80	0.80	0.98	1.30	75.00
Total Kjeldahl Nitrogen, mg/l	65	0.15	0.53	0.69	0.72	0.83	1.20	.
Total Nitrogen, mg/l	68	0.01	0.38	0.65	0.74	0.97	1.34	0.00
Orthophosphate as P, mg/l	56	0.00	0.03	0.04	0.03	0.05	0.14	.
Total Phosphorus, mg/l	73	0.01	0.05	0.07	0.06	0.08	0.18	0.00
Total Suspended Solids, mg/l	58	2.00	2.00	10.22	2.00	5.00	102.00	20.69
Turbidity, NTU	46	1.10	1.90	2.59	2.25	3.00	9.80	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278D Station=21FLSFWMCOCPALM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	20	2.00	2.00	3.07	2.00	4.15	6.80	.
Chlorophyll-a, ug/l	76	3.00	5.95	19.82	9.85	20.80	246.30	25.00
Color, PCU	74	40.00	60.00	67.58	60.00	80.00	200.00	1.35
Conductivity, umhos/cm	76	599.00	925.50	1117.63	1142.50	1281.50	1636.00	.
Copper, ug/l	26	1.00	2.59	16.12	4.45	10.19	178.00	15.38
Dissolved Oxygen, mg/l	77	3.10	5.59	7.39	6.85	8.35	15.92	15.58
Fecal Coliform, #/100ml	75	3.00	42.00	277.11	108.00	270.00	3400.00	16.00
Iron, ug/l	21	100.00	140.00	320.48	340.00	440.00	800.00	0.00
Nitrate-Nitrite, mg/l	74	0.01	0.01	0.13	0.08	0.21	0.78	.
Salinity, ppt	69	0.29	0.44	0.54	0.54	0.60	0.82	.
Secchi Depth, m	76	0.30	0.85	1.08	1.10	1.30	1.70	36.84
Total Kjeldahl Nitrogen, mg/l	66	0.47	0.86	1.07	1.00	1.20	4.30	.
Total Nitrogen, mg/l	69	0.01	0.77	1.01	1.01	1.28	4.30	5.80
Orthophosphate as P, mg/l	59	0.00	0.02	0.07	0.05	0.10	0.29	.
Total Phosphorus, mg/l	73	0.01	0.05	0.13	0.10	0.16	0.56	16.44
Total Suspended Solids, mg/l	60	2.00	2.00	2.90	2.00	2.50	9.00	5.00
Turbidity, NTU	47	0.90	1.90	3.95	3.54	5.00	24.00	.
Unionized Ammonia, mg/l	67	0.00	0.00	0.00	0.00	0.00	0.01	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278D Station=BC15

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	22	1.60	2.00	2.03	2.00	2.00	2.60	.
Chlorophyll-a, ug/l	75	3.00	3.00	6.24	3.20	5.30	40.10	5.33
Color, PCU	73	20.00	40.00	50.62	50.00	60.00	100.00	0.00
Conductivity, umhos/cm	85	317.00	578.00	656.88	674.00	738.00	853.00	.
Copper, ug/l	26	0.60	1.90	5.01	3.57	6.00	13.30	0.00
Dissolved Oxygen, mg/l	87	0.62	3.50	5.19	5.21	6.60	10.54	44.83
Fecal Coliform, #/100ml	72	1.00	17.50	174.76	82.00	235.00	1214.00	9.72
Iron, ug/l	24	100.00	130.00	252.50	210.00	375.00	580.00	0.00
Nitrate-Nitrite, mg/l	74	0.01	0.02	0.08	0.06	0.11	0.37	.
Salinity, ppt	77	0.19	0.29	0.33	0.33	0.37	0.42	.
Secchi Depth, m	86	0.40	1.20	1.46	1.60	1.80	2.00	10.47
Total Kjeldahl Nitrogen, mg/l	67	0.08	0.70	0.83	0.82	0.97	1.90	.
Total Nitrogen, mg/l	69	0.01	0.49	0.77	0.87	1.05	1.95	1.45
Orthophosphate as P, mg/l	59	0.00	0.01	0.02	0.02	0.03	0.06	.
Total Phosphorus, mg/l	72	0.01	0.03	0.05	0.04	0.06	0.13	0.00
Total Suspended Solids, mg/l	63	2.00	2.00	3.74	2.00	2.00	77.00	3.17
Turbidity, NTU	47	0.50	1.10	1.59	1.40	2.10	3.30	.
Unionized Ammonia, mg/l	68	0.00	0.00	0.00	0.00	0.00	0.01	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278D Station=Coco@Lake

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	22	1.60	2.00	2.10	2.00	2.00	3.40	.
Chlorophyll-a, ug/l	36	3.00	3.00	4.42	3.00	4.55	14.40	0.00
Color, PCU	34	30.00	45.00	56.32	50.00	70.00	100.00	0.00
Conductivity, umhos/cm	45	296.00	510.00	650.16	662.00	814.00	894.00	.
Copper, ug/l	13	0.30	1.51	10.69	1.75	2.27	89.70	15.38
Dissolved Oxygen, mg/l	47	1.69	3.06	5.35	5.79	7.06	8.79	36.17
Fecal Coliform, #/100ml	31	2.00	10.00	106.55	60.00	140.00	800.00	3.23
Iron, ug/l	12	360.00	385.00	530.00	525.00	640.00	790.00	0.00
Nitrate-Nitrite, mg/l	34	0.01	0.02	0.07	0.06	0.11	0.22	.
Salinity, ppt	37	0.18	0.27	0.34	0.37	0.40	0.44	.
Secchi Depth, m	45	0.20	1.00	1.25	1.30	1.55	2.50	22.22
Total Kjeldahl Nitrogen, mg/l	27	0.25	0.42	0.60	0.60	0.73	0.94	.
Total Nitrogen, mg/l	27	0.01	0.05	0.37	0.39	0.75	1.01	0.00
Orthophosphate as P, mg/l	34	0.00	0.00	0.01	0.00	0.01	0.06	.
Total Phosphorus, mg/l	33	0.01	0.02	0.03	0.02	0.03	0.26	3.03
Total Suspended Solids, mg/l	35	2.00	2.00	2.19	2.00	2.00	5.00	0.00
Turbidity, NTU	7	1.90	2.30	3.01	2.80	3.90	4.50	.
Unionized Ammonia, mg/l	31	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278D Station=ECocoRiv

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	19	2.00	2.00	2.86	2.50	3.60	4.90	.
Chlorophyll-a, ug/l	76	3.00	3.45	10.36	6.90	14.15	51.80	11.84
Color, PCU	74	50.00	80.00	108.92	100.00	120.00	300.00	45.95
Conductivity, umhos/cm	113	677.00	1363.00	3697.62	1655.00	2225.00	26874.00	.
Copper, ug/l	26	0.30	1.02	1.84	1.30	2.10	6.40	0.00
Dissolved Oxygen, mg/l	113	0.74	2.47	4.34	3.78	5.93	13.83	67.26
Fecal Coliform, #/100ml	104	3.00	47.00	321.97	111.50	280.00	4500.00	16.35
Iron, ug/l	24	100.00	120.00	170.00	120.00	170.00	520.00	0.00
Nitrate-Nitrite, mg/l	72	0.01	0.01	0.02	0.01	0.01	0.39	.
Salinity, ppt	77	0.33	0.65	1.18	0.79	0.91	11.18	.
Secchi Depth, m	111	0.30	0.75	1.11	1.10	1.40	2.50	35.14
Total Kjeldahl Nitrogen, mg/l	67	0.05	0.87	1.10	1.09	1.30	2.02	.
Total Nitrogen, mg/l	68	0.01	0.76	0.91	1.00	1.23	2.03	7.35
Orthophosphate as P, mg/l	56	0.00	0.02	0.08	0.05	0.12	0.22	.
Total Phosphorus, mg/l	74	0.01	0.06	0.12	0.11	0.18	0.43	12.16
Total Suspended Solids, mg/l	61	1.30	2.00	2.97	2.00	2.00	34.00	4.92
Turbidity, NTU	47	0.40	0.70	1.14	1.00	1.30	3.80	.
Unionized Ammonia, mg/l	65	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278E Station=21FLCOLLLKTRAF1

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	36	2.00	3.45	4.55	4.25	4.93	11.45	.
Chlorophyll-a, ug/l	37	5.60	22.15	54.12	49.15	70.50	187.70	78.38
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	37	220.00	259.00	287.84	279.00	300.50	422.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	37	2.34	7.23	8.49	8.59	9.85	14.12	8.11
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	37	0.00	0.12	0.13	0.13	0.14	0.20	.
Secchi Depth, m	37	0.20	0.30	0.44	0.40	0.50	0.85	100.00
Total Kjeldahl Nitrogen, mg/l	37	1.06	2.10	2.81	2.65	3.25	5.20	.
Total Nitrogen, mg/l	21	1.07	2.21	2.68	2.38	3.27	3.86	90.48
Orthophosphate as P, mg/l	37	0.00	0.02	0.16	0.19	0.27	0.39	.
Total Phosphorus, mg/l	14	0.02	0.05	0.08	0.07	0.10	0.24	7.14
Total Suspended Solids, mg/l	36	2.00	6.50	18.99	12.00	23.00	84.00	66.67
Turbidity, NTU	37	2.30	7.00	17.35	11.05	22.75	72.25	.
Unionized Ammonia, mg/l	34	0.00	0.00	0.01	0.00	0.01	0.21	14.71

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278E Station=21FLCOLLLKTRAF8

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	23	2.00	2.65	4.34	3.70	5.45	11.60	.
Chlorophyll-a, ug/l	23	3.00	16.00	41.13	30.30	50.70	148.50	65.22
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	23	223.50	270.00	292.17	287.00	304.50	378.50	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	23	0.23	4.05	5.63	5.79	7.44	11.90	30.43
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	23	0.10	0.13	0.14	0.14	0.15	0.19	.
Secchi Depth, m	23	0.20	0.35	0.47	0.40	0.55	1.15	95.65
Total Kjeldahl Nitrogen, mg/l	23	1.30	1.75	2.38	2.15	2.65	6.65	.
Total Nitrogen, mg/l	17	1.31	1.76	2.25	2.06	2.41	4.48	88.24
Orthophosphate as P, mg/l	23	0.01	0.09	0.23	0.27	0.31	0.46	.
Total Phosphorus, mg/l	9	0.06	0.08	0.21	0.12	0.35	0.58	33.33
Total Suspended Solids, mg/l	19	2.00	6.00	11.00	8.00	19.00	21.00	57.89
Turbidity, NTU	23	1.55	3.15	11.30	5.60	10.55	52.55	.
Unionized Ammonia, mg/l	22	0.00	0.00	0.00	0.00	0.00	0.01	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278E Station=21FLGW13732

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	4.60	4.60	4.60	4.60	4.60	4.60	0
Color, PCU	1	20.00	20.00	20.00	20.00	20.00	20.00	0
Conductivity, umhos/cm	1	126.50	126.50	126.50	126.50	126.50	126.50	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	7.24	7.24	7.24	7.24	7.24	7.24	0
Fecal Coliform, #/100ml	1	56.00	56.00	56.00	56.00	56.00	56.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	1.35	1.35	1.35	1.35	1.35	1.35	0
Total Kjeldahl Nitrogen, mg/l	1	0.64	0.64	0.64	0.64	0.64	0.64	.
Total Nitrogen, mg/l	1	0.64	0.64	0.64	0.64	0.64	0.64	0
Orthophosphate as P, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Total Phosphorus, mg/l	1	0.03	0.03	0.03	0.03	0.03	0.03	0
Total Suspended Solids, mg/l	1	5.00	5.00	5.00	5.00	5.00	5.00	0
Turbidity, NTU	1	2.80	2.80	2.80	2.80	2.80	2.80	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278E Station=21FLSFWMIMKFSHCK

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	10	2.00	2.00	2.28	2.15	2.40	3.20	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	28	60.00	120.00	153.21	150.00	190.00	280.00	78.57
Conductivity, umhos/cm	30	93.00	259.00	374.70	366.00	504.00	604.00	.
Copper, ug/l	26	0.52	1.30	2.16	1.85	2.31	7.92	0.00
Dissolved Oxygen, mg/l	30	0.84	2.75	4.48	4.31	5.99	8.84	60.00
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	17	0.00	0.01	0.06	0.04	0.09	0.27	.
Salinity, ppt	31	0.04	0.10	0.17	0.17	0.23	0.29	.
Secchi Depth, m	29	0.10	0.25	0.35	0.30	0.40	0.78	100.00
Total Kjeldahl Nitrogen, mg/l	27	0.58	0.87	1.19	1.20	1.44	2.20	.
Total Nitrogen, mg/l	25	0.01	0.62	0.93	1.02	1.42	2.02	12.00
Orthophosphate as P, mg/l	28	0.01	0.08	0.16	0.13	0.24	0.45	.
Total Phosphorus, mg/l	21	0.12	0.17	0.23	0.20	0.31	0.46	38.10
Total Suspended Solids, mg/l	30	2.00	2.00	3.67	2.00	4.00	15.00	10.00
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	26	0.00	0.00	0.00	0.00	0.00	0.01	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278F Station=21FLFTM 28030044

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	4	0.45	0.66	0.85	0.88	1.05	1.20	.
Chlorophyll-a, ug/l	4	1.00	1.00	1.00	1.00	1.00	1.00	0
Color, PCU	4	30.00	40.00	57.50	60.00	75.00	80.00	0
Conductivity, umhos/cm	4	525.00	530.50	560.75	559.50	591.00	599.00	.
Copper, ug/l	4	0.59	0.82	1.02	1.05	1.22	1.39	0
Dissolved Oxygen, mg/l	4	1.26	1.41	3.45	2.82	5.49	6.90	75
Fecal Coliform, #/100ml	4	4.00	17.00	91.00	55.00	165.00	250.00	0
Iron, ug/l	4	194.00	242.50	606.00	621.50	969.50	987.00	0
Nitrate-Nitrite, mg/l	4	0.00	0.01	0.02	0.02	0.04	0.04	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	2	1.50	1.50	1.50	1.50	1.50	1.50	0
Total Kjeldahl Nitrogen, mg/l	4	0.71	0.75	0.80	0.82	0.86	0.86	.
Total Nitrogen, mg/l	4	0.72	0.77	0.83	0.84	0.88	0.90	0
Orthophosphate as P, mg/l	4	0.03	0.03	0.04	0.04	0.05	0.06	.
Total Phosphorus, mg/l	4	0.06	0.07	0.09	0.10	0.12	0.12	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	4	1.40	1.40	4.30	3.60	7.20	8.60	.
Unionized Ammonia, mg/l	4	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278F Station=21FLFTM CREW2

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	1	3.10	3.10	3.10	3.10	3.10	3.10	.
Chlorophyll-a, ug/l	1	16.00	16.00	16.00	16.00	16.00	16.00	0
Color, PCU	1	160.00	160.00	160.00	160.00	160.00	160.00	100
Conductivity, umhos/cm	1	573.00	573.00	573.00	573.00	573.00	573.00	.
Copper, ug/l	1	0.96	0.96	0.96	0.96	0.96	0.96	0
Dissolved Oxygen, mg/l	1	4.76	4.76	4.76	4.76	4.76	4.76	100
Fecal Coliform, #/100ml	1	600.00	600.00	600.00	600.00	600.00	600.00	100
Iron, ug/l	1	2500.00	2500.00	2500.00	2500.00	2500.00	2500.00	100
Nitrate-Nitrite, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	1.00	1.00	1.00	1.00	1.00	1.00	0
Total Kjeldahl Nitrogen, mg/l	1	1.30	1.30	1.30	1.30	1.30	1.30	.
Total Nitrogen, mg/l	1	1.32	1.32	1.32	1.32	1.32	1.32	0
Orthophosphate as P, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	1	0.13	0.13	0.13	0.13	0.13	0.13	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	13.90	13.90	13.90	13.90	13.90	13.90	.
Unionized Ammonia, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278F Station=21FLSFWMCORKN

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	6	2.00	2.00	2.00	2.00	2.00	2.00	.
Chlorophyll-a, ug/l	20	3.00	3.00	3.77	3.00	3.20	10.10	0.00
Color, PCU	18	30.00	80.00	98.33	100.00	120.00	180.00	38.89
Conductivity, umhos/cm	20	281.00	309.00	402.40	391.50	489.50	523.00	.
Copper, ug/l	5	0.30	0.84	0.80	0.87	1.00	1.00	0.00
Dissolved Oxygen, mg/l	21	0.57	1.24	2.05	1.78	2.64	4.96	100.00
Fecal Coliform, #/100ml	20	3.00	59.50	314.60	147.00	550.00	1129.00	35.00
Iron, ug/l	6	120.00	180.00	343.33	290.00	370.00	810.00	0.00
Nitrate-Nitrite, mg/l	19	0.00	0.01	0.02	0.01	0.03	0.14	.
Salinity, ppt	19	0.00	0.14	0.18	0.18	0.23	0.25	.
Secchi Depth, m	17	0.20	0.30	0.51	0.45	0.60	1.00	88.24
Total Kjeldahl Nitrogen, mg/l	14	0.63	0.70	1.16	0.90	1.10	3.62	.
Total Nitrogen, mg/l	16	0.01	0.38	0.75	0.78	1.02	1.90	6.25
Orthophosphate as P, mg/l	20	0.00	0.00	0.01	0.01	0.01	0.07	.
Total Phosphorus, mg/l	17	0.01	0.01	0.05	0.03	0.05	0.33	5.88
Total Suspended Solids, mg/l	20	2.00	2.00	3.60	2.00	3.00	17.00	10.00
Turbidity, NTU	13	0.30	0.40	1.57	0.50	1.40	10.00	.
Unionized Ammonia, mg/l	18	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278F Station=21FLSFWMCORKS

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	6	2.00	2.00	2.52	2.00	2.30	4.80	.
Chlorophyll-a, ug/l	18	3.00	3.00	4.11	3.00	3.00	13.00	0.00
Color, PCU	16	70.00	120.00	176.88	155.00	200.00	420.00	81.25
Conductivity, umhos/cm	18	130.00	242.00	265.61	263.00	310.00	348.00	.
Copper, ug/l	5	0.28	0.30	0.58	0.33	1.00	1.00	0.00
Dissolved Oxygen, mg/l	19	0.08	0.31	0.88	0.84	1.25	2.40	100.00
Fecal Coliform, #/100ml	18	3.00	35.00	122.33	90.00	220.00	320.00	0.00
Iron, ug/l	5	100.00	150.00	182.00	170.00	240.00	250.00	0.00
Nitrate-Nitrite, mg/l	17	0.00	0.01	0.02	0.01	0.01	0.19	.
Salinity, ppt	19	0.00	0.11	0.12	0.12	0.14	0.17	.
Secchi Depth, m	19	0.30	0.50	0.74	0.80	0.95	1.15	78.95
Total Kjeldahl Nitrogen, mg/l	13	0.72	1.30	2.21	1.50	2.40	5.53	.
Total Nitrogen, mg/l	15	0.01	0.03	1.46	1.31	1.70	4.77	26.67
Orthophosphate as P, mg/l	17	0.00	0.01	0.08	0.02	0.03	0.57	.
Total Phosphorus, mg/l	17	0.01	0.02	0.11	0.03	0.06	0.71	11.76
Total Suspended Solids, mg/l	18	2.00	2.00	2.06	2.00	2.00	3.00	0.00
Turbidity, NTU	11	0.30	0.40	0.69	0.50	0.60	2.40	.
Unionized Ammonia, mg/l	17	0.00	0.00	0.00	0.00	0.00	0.03	5.88

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278F Station=21FLSFWMCORKSCRD

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	6	2.00	2.00	2.13	2.00	2.00	2.80	.
Chlorophyll-a, ug/l	20	3.00	3.00	5.58	3.00	6.40	16.90	0.00
Color, PCU	18	40.00	50.00	81.94	65.00	120.00	150.00	27.78
Conductivity, umhos/cm	20	339.00	461.50	482.85	491.50	515.50	573.00	.
Copper, ug/l	6	0.54	1.00	1.27	1.01	1.08	2.99	0.00
Dissolved Oxygen, mg/l	21	0.92	3.40	4.77	5.36	6.45	8.36	47.62
Fecal Coliform, #/100ml	20	1.00	66.50	157.40	101.00	124.50	1150.00	5.00
Iron, ug/l	6	270.00	280.00	683.33	550.00	620.00	1830.00	16.67
Nitrate-Nitrite, mg/l	19	0.01	0.02	0.11	0.07	0.15	0.35	.
Salinity, ppt	18	0.00	0.22	0.22	0.23	0.24	0.28	.
Secchi Depth, m	19	0.15	0.60	0.82	0.90	1.05	1.25	57.89
Total Kjeldahl Nitrogen, mg/l	15	0.39	0.59	1.20	0.88	1.10	3.90	.
Total Nitrogen, mg/l	17	0.01	0.40	1.12	0.99	1.19	3.93	17.65
Orthophosphate as P, mg/l	19	0.00	0.01	0.03	0.01	0.03	0.11	.
Total Phosphorus, mg/l	18	0.02	0.03	0.08	0.05	0.08	0.25	11.11
Total Suspended Solids, mg/l	19	2.00	2.00	12.16	2.00	10.00	69.00	26.32
Turbidity, NTU	12	1.80	3.45	4.61	4.00	6.10	7.70	.
Unionized Ammonia, mg/l	18	0.00	0.00	0.01	0.00	0.00	0.07	11.11

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278F Station=Corkscrd

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	3	0.82	0.82	1.04	1.10	1.20	1.20	.
Chlorophyll-a, ug/l	3	1.00	1.00	1.03	1.00	1.10	1.10	0
Color, PCU	3	80.00	80.00	86.67	80.00	100.00	100.00	0
Conductivity, umhos/cm	3	477.00	477.00	510.00	508.00	545.00	545.00	.
Copper, ug/l	3	0.95	0.95	1.26	1.38	1.46	1.46	0
Dissolved Oxygen, mg/l	3	5.65	5.65	6.39	6.69	6.83	6.83	0
Fecal Coliform, #/100ml	3	50.00	50.00	130.00	90.00	250.00	250.00	0
Iron, ug/l	3	230.00	230.00	397.67	240.00	723.00	723.00	0
Nitrate-Nitrite, mg/l	3	0.01	0.01	0.02	0.02	0.04	0.04	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	2	1.00	1.00	1.50	1.50	2.00	2.00	0
Total Kjeldahl Nitrogen, mg/l	3	0.60	0.60	0.69	0.72	0.76	0.76	.
Total Nitrogen, mg/l	3	0.61	0.61	0.72	0.76	0.78	0.78	0
Orthophosphate as P, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	3	0.02	0.02	0.02	0.02	0.03	0.03	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	3	1.60	1.60	3.23	2.70	5.40	5.40	.
Unionized Ammonia, mg/l	3	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278L Station=21FLSFWMIMK6STS

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	6	2.00	2.00	2.07	2.00	2.00	2.40	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	17	5.00	20.00	36.76	30.00	50.00	120.00	5.88
Conductivity, umhos/cm	17	58.00	186.00	283.29	280.00	362.00	507.00	.
Copper, ug/l	15	1.00	1.30	2.61	1.50	2.92	9.37	6.67
Dissolved Oxygen, mg/l	18	0.78	4.00	5.87	5.76	7.52	11.21	38.89
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	10	0.01	0.08	0.81	1.09	1.30	1.33	.
Salinity, ppt	18	0.03	0.09	0.13	0.13	0.17	0.24	.
Secchi Depth, m	18	0.03	0.10	0.18	0.18	0.20	0.35	100.00
Total Kjeldahl Nitrogen, mg/l	14	0.28	0.46	0.54	0.51	0.64	0.86	.
Total Nitrogen, mg/l	14	0.35	0.60	1.34	1.25	2.11	2.70	42.86
Orthophosphate as P, mg/l	16	0.05	0.07	0.11	0.08	0.11	0.29	.
Total Phosphorus, mg/l	16	0.07	0.12	0.27	0.19	0.34	0.93	43.75
Total Suspended Solids, mg/l	18	2.00	2.00	21.67	2.00	6.00	323.00	16.67
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	15	0.00	0.00	0.00	0.00	0.00	0.01	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278L Station=21FLSFWMIMKMAD

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	5	2.00	2.00	3.08	2.90	4.10	4.40	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	16	60.00	85.00	119.38	120.00	145.00	200.00	56.25
Conductivity, umhos/cm	16	190.00	218.50	266.44	250.50	318.00	350.00	.
Copper, ug/l	16	0.95	1.60	2.32	2.14	2.95	4.30	0.00
Dissolved Oxygen, mg/l	17	1.31	3.11	4.70	4.09	6.48	10.56	70.59
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	7	0.01	0.04	0.19	0.11	0.40	0.54	.
Salinity, ppt	17	0.09	0.10	0.13	0.14	0.15	0.17	.
Secchi Depth, m	16	0.10	0.29	0.34	0.30	0.35	0.70	100.00
Total Kjeldahl Nitrogen, mg/l	15	0.61	1.10	1.35	1.31	1.50	2.30	.
Total Nitrogen, mg/l	10	0.01	1.13	1.28	1.34	1.80	1.90	40.00
Orthophosphate as P, mg/l	15	0.03	0.10	0.19	0.20	0.24	0.58	.
Total Phosphorus, mg/l	15	0.13	0.30	0.39	0.35	0.47	0.79	80.00
Total Suspended Solids, mg/l	17	2.00	3.00	7.05	4.00	6.00	39.00	23.53
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	16	0.00	0.00	0.00	0.00	0.01	0.01	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Cocohatchee-Corkscrew WBID=3278L Station=21FLSFWMIMKSLGH

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	7	2.00	2.00	5.83	2.00	5.60	23.80	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	23	30.00	60.00	96.09	100.00	120.00	180.00	34.78
Conductivity, umhos/cm	24	189.00	280.50	373.46	381.00	451.00	566.00	.
Copper, ug/l	24	0.15	0.38	1.19	1.07	1.50	4.10	0.00
Dissolved Oxygen, mg/l	25	0.04	0.45	0.96	0.67	1.39	3.35	100.00
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	13	0.00	0.01	0.01	0.01	0.01	0.05	.
Salinity, ppt	25	0.10	0.14	0.18	0.19	0.22	0.27	.
Secchi Depth, m	24	0.20	0.30	0.41	0.40	0.53	0.75	100.00
Total Kjeldahl Nitrogen, mg/l	21	0.40	0.66	0.88	0.88	0.99	1.50	.
Total Nitrogen, mg/l	20	0.01	0.01	0.63	0.72	1.00	1.54	0.00
Orthophosphate as P, mg/l	20	0.01	0.06	0.16	0.13	0.19	0.45	.
Total Phosphorus, mg/l	20	0.04	0.10	0.79	0.23	0.43	11.00	50.00
Total Suspended Solids, mg/l	25	2.00	2.00	2.63	2.00	3.00	5.00	0.00
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	21	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Faka Union WBID=3278H Station=21FLGW14181

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	1.30	1.30	1.30	1.30	1.30	1.30	0
Color, PCU	1	20.00	20.00	20.00	20.00	20.00	20.00	0
Conductivity, umhos/cm	1	337.50	337.50	337.50	337.50	337.50	337.50	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	9.35	9.35	9.35	9.35	9.35	9.35	0
Fecal Coliform, #/100ml	1	1.00	1.00	1.00	1.00	1.00	1.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.48	0.48	0.48	0.48	0.48	0.48	100
Total Kjeldahl Nitrogen, mg/l	1	0.60	0.60	0.60	0.60	0.60	0.60	.
Total Nitrogen, mg/l	1	0.60	0.60	0.60	0.60	0.60	0.60	0
Orthophosphate as P, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	1	0.03	0.03	0.03	0.03	0.03	0.03	0
Total Suspended Solids, mg/l	1	4.00	4.00	4.00	4.00	4.00	4.00	0
Turbidity, NTU	1	1.60	1.60	1.60	1.60	1.60	1.60	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Faka Union WBID=3278H Station=21FLGW14184

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	1.20	1.20	1.20	1.20	1.20	1.20	0
Color, PCU	1	80.00	80.00	80.00	80.00	80.00	80.00	0
Conductivity, umhos/cm	1	525.00	525.00	525.00	525.00	525.00	525.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	7.70	7.70	7.70	7.70	7.70	7.70	0
Fecal Coliform, #/100ml	1	3.00	3.00	3.00	3.00	3.00	3.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.37	0.37	0.37	0.37	0.37	0.37	100
Total Kjeldahl Nitrogen, mg/l	1	0.81	0.81	0.81	0.81	0.81	0.81	.
Total Nitrogen, mg/l	1	0.81	0.81	0.81	0.81	0.81	0.81	0
Orthophosphate as P, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	1	0.06	0.06	0.06	0.06	0.06	0.06	0
Total Suspended Solids, mg/l	1	9.00	9.00	9.00	9.00	9.00	9.00	100
Turbidity, NTU	1	7.80	7.80	7.80	7.80	7.80	7.80	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Faka Union WBID=3278H Station=21FLGW21752

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	20.00	20.00	20.00	20.00	20.00	20.00	0
Color, PCU	1	150.00	150.00	150.00	150.00	150.00	150.00	100
Conductivity, umhos/cm	1	589.50	589.50	589.50	589.50	589.50	589.50	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	3.29	3.29	3.29	3.29	3.29	3.29	100
Fecal Coliform, #/100ml	1	60.00	60.00	60.00	60.00	60.00	60.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.22	0.22	0.22	0.22	0.22	0.22	100
Total Kjeldahl Nitrogen, mg/l	1	2.30	2.30	2.30	2.30	2.30	2.30	.
Total Nitrogen, mg/l	1	2.31	2.31	2.31	2.31	2.31	2.31	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.06	0.06	0.06	0.06	0.06	0.06	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	32.00	32.00	32.00	32.00	32.00	32.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Faka Union WBID=3278H Station=21FLGW21756

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	0.85	0.85	0.85	0.85	0.85	0.85	0
Color, PCU	1	80.00	80.00	80.00	80.00	80.00	80.00	0
Conductivity, umhos/cm	1	351.00	351.00	351.00	351.00	351.00	351.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	6.66	6.66	6.66	6.66	6.66	6.66	0
Fecal Coliform, #/100ml	1	1.00	1.00	1.00	1.00	1.00	1.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.60	0.60	0.60	0.60	0.60	0.60	100
Total Kjeldahl Nitrogen, mg/l	1	0.66	0.66	0.66	0.66	0.66	0.66	.
Total Nitrogen, mg/l	1	0.67	0.67	0.67	0.67	0.67	0.67	0
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.03	0.03	0.03	0.03	0.03	0.03	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	3.20	3.20	3.20	3.20	3.20	3.20	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Faka Union WBID=3278H Station=21FLSFWMBC10

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	19	1.60	2.00	1.98	2.00	2.00	2.00	.
Chlorophyll-a, ug/l	77	3.00	3.00	4.71	3.20	4.80	22.40	1.30
Color, PCU	72	5.00	30.00	43.96	40.00	50.00	140.00	4.17
Conductivity, umhos/cm	75	211.00	425.00	487.31	514.00	583.00	638.00	.
Copper, ug/l	25	0.15	0.45	1.04	1.00	1.00	4.90	0.00
Dissolved Oxygen, mg/l	78	1.02	4.97	6.78	6.89	8.30	14.54	25.64
Fecal Coliform, #/100ml	64	1.00	2.00	103.42	8.00	79.50	1486.00	6.25
Iron, ug/l	23	100.00	120.00	261.30	240.00	340.00	610.00	0.00
Nitrate-Nitrite, mg/l	72	0.00	0.01	0.01	0.01	0.01	0.06	.
Salinity, ppt	68	0.00	0.22	0.24	0.26	0.28	0.31	.
Secchi Depth, m	77	0.40	1.30	1.57	1.61	1.81	2.50	9.09
Total Kjeldahl Nitrogen, mg/l	64	0.04	0.33	0.46	0.45	0.57	1.30	.
Total Nitrogen, mg/l	66	0.01	0.06	0.37	0.39	0.57	1.30	0.00
Orthophosphate as P, mg/l	58	0.00	0.00	0.01	0.01	0.01	0.03	.
Total Phosphorus, mg/l	71	0.01	0.01	0.02	0.02	0.03	0.08	0.00
Total Suspended Solids, mg/l	62	2.00	2.00	2.05	2.00	2.00	4.00	0.00
Turbidity, NTU	47	0.60	1.00	1.28	1.20	1.50	2.60	.
Unionized Ammonia, mg/l	69	0.00	0.00	0.00	0.00	0.00	0.01	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Faka Union WBID=3278H Station=21FLSFWMBC9

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	17	1.60	2.00	2.38	2.00	2.00	8.50	.
Chlorophyll-a, ug/l	77	3.00	3.00	3.54	3.00	3.20	9.10	0.00
Color, PCU	71	30.00	50.00	70.28	60.00	90.00	160.00	8.45
Conductivity, umhos/cm	75	279.00	567.00	588.33	596.00	636.50	745.00	.
Copper, ug/l	25	0.26	0.50	1.15	1.00	1.06	6.80	0.00
Dissolved Oxygen, mg/l	77	1.55	3.54	5.52	5.20	7.29	12.82	46.75
Fecal Coliform, #/100ml	63	1.00	6.00	57.17	16.00	46.00	700.00	1.59
Iron, ug/l	24	120.00	190.00	523.75	485.00	760.00	1390.00	4.17
Nitrate-Nitrite, mg/l	72	0.01	0.01	0.03	0.02	0.05	0.14	.
Salinity, ppt	76	0.10	0.27	0.37	0.29	0.31	7.28	.
Secchi Depth, m	74	0.60	1.00	1.22	1.24	1.40	2.10	20.27
Total Kjeldahl Nitrogen, mg/l	63	0.04	0.40	0.54	0.50	0.62	1.50	.
Total Nitrogen, mg/l	66	0.01	0.24	0.47	0.50	0.65	1.54	0.00
Orthophosphate as P, mg/l	60	0.00	0.00	0.01	0.00	0.01	0.01	.
Total Phosphorus, mg/l	70	0.01	0.01	0.01	0.01	0.01	0.03	0.00
Total Suspended Solids, mg/l	63	2.00	2.00	2.08	2.00	2.00	4.00	0.00
Turbidity, NTU	47	0.80	2.30	3.43	3.40	4.40	7.00	.
Unionized Ammonia, mg/l	70	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Faka Union WBID=3278H Station=CR858

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	22	1.20	2.00	2.01	2.00	2.00	4.30	.
Chlorophyll-a, ug/l	74	1.00	3.00	5.45	3.70	6.40	25.00	1.35
Color, PCU	74	5.00	70.00	104.66	100.00	120.00	240.00	43.24
Conductivity, umhos/cm	78	240.00	379.00	444.13	449.00	499.00	620.00	.
Copper, ug/l	27	0.30	1.00	2.06	1.52	2.29	7.00	0.00
Dissolved Oxygen, mg/l	81	1.73	3.76	5.09	5.25	6.19	9.20	45.68
Fecal Coliform, #/100ml	68	1.00	5.00	147.75	23.00	125.50	2600.00	2.94
Iron, ug/l	28	100.00	200.00	481.43	315.00	790.00	1170.00	7.14
Nitrate-Nitrite, mg/l	76	0.00	0.01	0.05	0.04	0.09	0.20	.
Salinity, ppt	74	0.11	0.18	0.21	0.21	0.24	0.30	.
Secchi Depth, m	76	0.30	0.60	0.91	0.80	1.25	1.60	61.84
Total Kjeldahl Nitrogen, mg/l	68	0.04	0.58	0.70	0.72	0.82	1.20	.
Total Nitrogen, mg/l	70	0.01	0.43	0.62	0.72	0.88	1.24	0.00
Orthophosphate as P, mg/l	57	0.00	0.01	0.01	0.01	0.01	0.10	.
Total Phosphorus, mg/l	73	0.01	0.03	0.04	0.03	0.04	0.16	0.00
Total Suspended Solids, mg/l	62	2.00	2.00	3.41	2.00	2.00	28.00	8.06
Turbidity, NTU	49	0.20	2.10	3.15	2.70	3.60	7.10	.
Unionized Ammonia, mg/l	60	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Faka Union WBID=3278I Station=21FLGW14163

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	38.00	38.00	38.00	38.00	38.00	38.00	100
Color, PCU	1	100.00	100.00	100.00	100.00	100.00	100.00	0
Conductivity, umhos/cm	1	56535.00	56535.00	56535.00	56535.00	56535.00	56535.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	4.87	4.87	4.87	4.87	4.87	4.87	100
Fecal Coliform, #/100ml	1	4.00	4.00	4.00	4.00	4.00	4.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.58	0.58	0.58	0.58	0.58	0.58	100
Total Kjeldahl Nitrogen, mg/l	1	2.00	2.00	2.00	2.00	2.00	2.00	.
Total Nitrogen, mg/l	1	2.01	2.01	2.01	2.01	2.01	2.01	100
Orthophosphate as P, mg/l	1	0.05	0.05	0.05	0.05	0.05	0.05	.
Total Phosphorus, mg/l	1	0.18	0.18	0.18	0.18	0.18	0.18	0
Total Suspended Solids, mg/l	1	31.00	31.00	31.00	31.00	31.00	31.00	100
Turbidity, NTU	1	3.40	3.40	3.40	3.40	3.40	3.40	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Faka Union WBID=3278I Station=21FLGW14166

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	0.96	0.96	0.96	0.96	0.96	0.96	0
Color, PCU	1	15.00	15.00	15.00	15.00	15.00	15.00	0
Conductivity, umhos/cm	1	406.50	406.50	406.50	406.50	406.50	406.50	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	10.11	10.11	10.11	10.11	10.11	10.11	0
Fecal Coliform, #/100ml	1	1.00	1.00	1.00	1.00	1.00	1.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	2.22	2.22	2.22	2.22	2.22	2.22	0
Total Kjeldahl Nitrogen, mg/l	1	0.46	0.46	0.46	0.46	0.46	0.46	.
Total Nitrogen, mg/l	1	0.46	0.46	0.46	0.46	0.46	0.46	0
Orthophosphate as P, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	0
Total Suspended Solids, mg/l	1	4.00	4.00	4.00	4.00	4.00	4.00	0
Turbidity, NTU	1	0.45	0.45	0.45	0.45	0.45	0.45	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Faka Union WBID=3278I Station=21FLGW21749

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	0.85	0.85	0.85	0.85	0.85	0.85	0
Color, PCU	1	15.00	15.00	15.00	15.00	15.00	15.00	0
Conductivity, umhos/cm	1	563.00	563.00	563.00	563.00	563.00	563.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	6.95	6.95	6.95	6.95	6.95	6.95	0
Fecal Coliform, #/100ml	1	5.00	5.00	5.00	5.00	5.00	5.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	1.25	1.25	1.25	1.25	1.25	1.25	0
Total Kjeldahl Nitrogen, mg/l	1	0.48	0.48	0.48	0.48	0.48	0.48	.
Total Nitrogen, mg/l	1	0.48	0.48	0.48	0.48	0.48	0.48	0
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	0.80	0.80	0.80	0.80	0.80	0.80	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Faka Union WBID=3278I Station=21FLGW21750

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	0.85	0.85	0.85	0.85	0.85	0.85	0
Color, PCU	1	10.00	10.00	10.00	10.00	10.00	10.00	0
Conductivity, umhos/cm	1	445.00	445.00	445.00	445.00	445.00	445.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	8.69	8.69	8.69	8.69	8.69	8.69	0
Fecal Coliform, #/100ml	1	7.00	7.00	7.00	7.00	7.00	7.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	1.10	1.10	1.10	1.10	1.10	1.10	0
Total Kjeldahl Nitrogen, mg/l	1	0.47	0.47	0.47	0.47	0.47	0.47	.
Total Nitrogen, mg/l	1	0.48	0.48	0.48	0.48	0.48	0.48	0
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	1.50	1.50	1.50	1.50	1.50	1.50	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Faka Union WBID=3278I Station=21FLGW21758

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	1.90	1.90	1.90	1.90	1.90	1.90	0
Color, PCU	1	100.00	100.00	100.00	100.00	100.00	100.00	0
Conductivity, umhos/cm	1	41904.50	41904.50	41904.50	41904.50	41904.50	41904.50	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	1.86	1.86	1.86	1.86	1.86	1.86	100
Fecal Coliform, #/100ml	1	12.00	12.00	12.00	12.00	12.00	12.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.81	0.81	0.81	0.81	0.81	0.81	100
Total Kjeldahl Nitrogen, mg/l	1	1.30	1.30	1.30	1.30	1.30	1.30	.
Total Nitrogen, mg/l	1	1.30	1.30	1.30	1.30	1.30	1.30	0
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.04	0.04	0.04	0.04	0.04	0.04	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	1.40	1.40	1.40	1.40	1.40	1.40	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Faka Union WBID=3278I Station=21FLSFWMBC20

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	17	2.00	2.00	3.05	2.70	3.50	7.70	.
Chlorophyll-a, ug/l	75	3.00	3.00	19.21	8.00	24.00	206.00	33.33
Color, PCU	72	40.00	65.00	93.06	80.00	120.00	220.00	26.39
Conductivity, umhos/cm	74	454.00	659.00	10683.24	1790.50	18790.00	62047.00	.
Copper, ug/l	22	0.23	0.71	1.12	1.00	1.00	4.90	0.00
Dissolved Oxygen, mg/l	76	1.17	2.19	4.04	3.96	5.34	12.88	71.05
Fecal Coliform, #/100ml	70	1.00	21.00	239.74	77.50	220.00	3850.00	14.29
Iron, ug/l	26	120.00	130.00	230.00	190.00	260.00	660.00	0.00
Nitrate-Nitrite, mg/l	74	0.00	0.01	0.04	0.01	0.02	1.31	.
Salinity, ppt	75	0.22	0.32	6.49	0.88	11.18	41.65	.
Secchi Depth, m	78	0.40	0.80	1.10	1.10	1.40	2.40	37.18
Total Kjeldahl Nitrogen, mg/l	71	0.10	0.53	1.04	0.79	1.30	4.90	.
Total Nitrogen, mg/l	68	0.01	0.28	0.88	0.67	1.24	5.03	14.71
Orthophosphate as P, mg/l	62	0.00	0.01	0.01	0.01	0.01	0.06	.
Total Phosphorus, mg/l	71	0.00	0.02	0.04	0.04	0.06	0.20	0.00
Total Suspended Solids, mg/l	63	2.00	2.00	6.70	2.00	6.00	62.00	22.22
Turbidity, NTU	47	0.30	0.50	1.46	1.20	1.90	4.70	.
Unionized Ammonia, mg/l	61	0.00	0.00	0.00	0.00	0.00	0.01	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Faka Union WBID=3278I Station=21FLSFWMBC7

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	19	1.50	2.00	1.95	2.00	2.00	2.00	.
Chlorophyll-a, ug/l	73	3.00	3.00	4.02	3.00	3.20	16.60	0.00
Color, PCU	74	10.00	30.00	43.92	40.00	55.00	100.00	0.00
Conductivity, umhos/cm	76	324.00	552.00	659.92	615.50	656.00	2451.00	.
Copper, ug/l	22	0.15	0.36	1.12	1.00	1.50	4.20	0.00
Dissolved Oxygen, mg/l	77	1.61	5.79	7.12	7.55	8.66	12.14	18.18
Fecal Coliform, #/100ml	68	1.00	1.50	199.90	9.50	263.50	2900.00	20.59
Iron, ug/l	26	100.00	120.00	257.69	225.00	310.00	960.00	0.00
Nitrate-Nitrite, mg/l	72	0.00	0.01	0.02	0.01	0.02	0.08	.
Salinity, ppt	77	0.10	0.26	0.32	0.29	0.32	1.25	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	64	0.04	0.32	0.49	0.45	0.55	3.43	.
Total Nitrogen, mg/l	67	0.01	0.24	0.44	0.44	0.55	3.44	1.49
Orthophosphate as P, mg/l	59	0.00	0.00	0.01	0.00	0.01	0.02	.
Total Phosphorus, mg/l	71	0.00	0.01	0.01	0.01	0.02	0.04	0.00
Total Suspended Solids, mg/l	63	2.00	2.00	2.30	2.00	2.00	8.00	1.59
Turbidity, NTU	47	0.10	0.60	1.13	1.00	1.52	3.00	.
Unionized Ammonia, mg/l	64	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Faka Union WBID=3278I Station=21FLSFWMBC8

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	19	1.50	2.00	1.95	2.00	2.00	2.00	.
Chlorophyll-a, ug/l	73	3.00	3.00	3.35	3.00	3.00	9.10	0.00
Color, PCU	74	10.00	20.00	39.53	35.00	50.00	100.00	0.00
Conductivity, umhos/cm	76	336.00	462.00	509.71	519.00	555.00	703.00	.
Copper, ug/l	22	0.15	0.45	1.72	1.00	1.10	17.70	0.00
Dissolved Oxygen, mg/l	77	2.09	4.55	6.99	7.27	9.36	12.61	29.87
Fecal Coliform, #/100ml	67	1.00	6.00	88.24	17.00	112.00	420.00	1.49
Iron, ug/l	26	100.00	120.00	213.85	200.00	280.00	540.00	0.00
Nitrate-Nitrite, mg/l	75	0.00	0.01	0.02	0.01	0.02	0.11	.
Salinity, ppt	77	0.00	0.22	0.24	0.25	0.27	0.34	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	64	0.09	0.31	0.45	0.41	0.54	1.46	.
Total Nitrogen, mg/l	68	0.01	0.24	0.38	0.38	0.54	1.47	0.00
Orthophosphate as P, mg/l	59	0.00	0.00	0.01	0.00	0.01	0.01	.
Total Phosphorus, mg/l	71	0.00	0.01	0.01	0.01	0.02	0.08	0.00
Total Suspended Solids, mg/l	65	2.00	2.00	2.81	2.00	2.00	24.00	7.69
Turbidity, NTU	47	0.30	0.50	0.98	0.70	1.10	6.90	.
Unionized Ammonia, mg/l	63	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Faka Union WBID=3278I Station=21FLSFWMFAKA

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	19	1.60	2.00	1.96	2.00	2.00	2.00	.
Chlorophyll-a, ug/l	75	3.00	3.00	3.49	3.00	3.00	12.30	0.00
Color, PCU	72	10.00	30.00	39.17	40.00	50.00	100.00	0.00
Conductivity, umhos/cm	74	410.00	548.00	1155.30	594.50	649.00	9215.00	.
Copper, ug/l	23	0.20	0.64	1.30	1.00	1.10	6.14	0.00
Dissolved Oxygen, mg/l	76	2.92	5.18	6.59	6.71	8.10	10.51	23.68
Fecal Coliform, #/100ml	56	1.00	12.00	88.70	38.00	103.50	560.00	5.36
Iron, ug/l	26	100.00	120.00	193.46	150.00	230.00	540.00	0.00
Nitrate-Nitrite, mg/l	73	0.01	0.01	0.02	0.01	0.02	0.11	.
Salinity, ppt	75	0.00	0.26	0.58	0.29	0.31	5.11	.
Secchi Depth, m	14	0.50	0.75	0.87	0.80	0.90	1.45	78.57
Total Kjeldahl Nitrogen, mg/l	69	0.07	0.35	0.47	0.42	0.57	1.65	.
Total Nitrogen, mg/l	68	0.01	0.24	0.43	0.40	0.58	2.70	2.94
Orthophosphate as P, mg/l	63	0.00	0.00	0.01	0.00	0.01	0.01	.
Total Phosphorus, mg/l	69	0.00	0.01	0.02	0.01	0.02	0.44	1.45
Total Suspended Solids, mg/l	63	2.00	2.00	2.59	2.00	2.00	8.00	1.59
Turbidity, NTU	47	0.50	0.70	1.16	1.00	1.30	3.10	.
Unionized Ammonia, mg/l	62	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Faka Union WBID=3278I Station=SGGE10SW

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	4	3.00	3.10	5.55	3.75	8.00	11.70	0
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	5	441.00	513.00	523.20	540.00	540.00	582.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	6	0.41	0.93	1.12	1.06	1.53	1.74	100
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	6	100.00	100.00	163.33	125.00	160.00	370.00	0
Nitrate-Nitrite, mg/l	4	0.00	0.00	0.01	0.01	0.01	0.01	.
Salinity, ppt	6	0.21	0.22	0.25	0.26	0.26	0.28	.
Secchi Depth, m	2	0.40	0.40	0.45	0.45	0.50	0.50	100
Total Kjeldahl Nitrogen, mg/l	3	0.21	0.21	0.29	0.25	0.41	0.41	.
Total Nitrogen, mg/l	2	0.22	0.22	0.31	0.31	0.41	0.41	0
Orthophosphate as P, mg/l	4	0.00	0.00	0.00	0.00	0.01	0.01	.
Total Phosphorus, mg/l	5	0.01	0.03	0.03	0.04	0.04	0.04	0
Total Suspended Solids, mg/l	5	2.00	2.00	3.80	4.00	5.00	6.00	0
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Faka Union WBID=3278I Station=SGGE11SW

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	1.13	1.13	1.13	1.13	1.13	1.13	100
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	1	100.00	100.00	100.00	100.00	100.00	100.00	0
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	1	0.17	0.17	0.17	0.17	0.17	0.17	.
Secchi Depth, m	1	0.20	0.20	0.20	0.20	0.20	0.20	100
Total Kjeldahl Nitrogen, mg/l	1	0.56	0.56	0.56	0.56	0.56	0.56	.
Total Nitrogen, mg/l	1	0.56	0.56	0.56	0.56	0.56	0.56	0
Orthophosphate as P, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Total Phosphorus, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	0
Total Suspended Solids, mg/l	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Faka Union WBID=3278I Station=SGGE16SW

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	0.70	0.70	0.70	0.70	0.70	0.70	100
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	1	1070.00	1070.00	1070.00	1070.00	1070.00	1070.00	100
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	1	0.22	0.22	0.22	0.22	0.22	0.22	.
Secchi Depth, m	1	0.30	0.30	0.30	0.30	0.30	0.30	100
Total Kjeldahl Nitrogen, mg/l	1	0.82	0.82	0.82	0.82	0.82	0.82	.
Total Nitrogen, mg/l	1	0.82	0.82	0.82	0.82	0.82	0.82	0
Orthophosphate as P, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	1	0.04	0.04	0.04	0.04	0.04	0.04	0
Total Suspended Solids, mg/l	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Faka Union WBID=3278I Station=SGGE22SW

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	3.00	3.00	3.00	3.00	3.00	3.00	0
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	2.28	2.28	2.28	2.28	2.28	2.28	100
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	2	110.00	110.00	110.00	110.00	110.00	110.00	0
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	1	0.16	0.16	0.16	0.16	0.16	0.16	.
Secchi Depth, m	1	0.25	0.25	0.25	0.25	0.25	0.25	100
Total Kjeldahl Nitrogen, mg/l	1	0.71	0.71	0.71	0.71	0.71	0.71	.
Total Nitrogen, mg/l	1	0.71	0.71	0.71	0.71	0.71	0.71	0
Orthophosphate as P, mg/l	2	0.00	0.00	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	2	0.02	0.02	0.04	0.04	0.05	0.05	0
Total Suspended Solids, mg/l	2	2.00	2.00	2.00	2.00	2.00	2.00	0
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Faka Union WBID=3278I Station=SGGE23SW

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	6.40	6.40	6.40	6.40	6.40	6.40	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	1	100.00	100.00	100.00	100.00	100.00	100.00	0
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	1	0.16	0.16	0.16	0.16	0.16	0.16	.
Secchi Depth, m	1	0.10	0.10	0.10	0.10	0.10	0.10	100
Total Kjeldahl Nitrogen, mg/l	1	0.57	0.57	0.57	0.57	0.57	0.57	.
Total Nitrogen, mg/l	1	0.57	0.57	0.57	0.57	0.57	0.57	0
Orthophosphate as P, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Total Phosphorus, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	0
Total Suspended Solids, mg/l	1	3.00	3.00	3.00	3.00	3.00	3.00	0
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Fakahatchee WBID=3259I Station=21FLSFWMBC11

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	19	1.60	2.00	2.00	2.00	2.00	2.40	.
Chlorophyll-a, ug/l	75	3.00	3.00	4.58	3.00	4.80	18.70	0.00
Color, PCU	70	20.00	40.00	61.29	50.00	80.00	200.00	8.57
Conductivity, umhos/cm	73	239.00	364.00	436.71	457.00	516.00	557.00	.
Copper, ug/l	25	0.15	0.39	0.92	1.00	1.00	4.30	0.00
Dissolved Oxygen, mg/l	76	0.39	2.60	3.97	3.52	5.00	10.26	75.00
Fecal Coliform, #/100ml	65	1.00	13.00	113.86	44.00	177.00	588.00	7.69
Iron, ug/l	23	100.00	140.00	247.83	200.00	270.00	860.00	0.00
Nitrate-Nitrite, mg/l	71	0.00	0.01	0.02	0.01	0.01	0.09	.
Salinity, ppt	74	0.00	0.17	0.21	0.22	0.25	0.27	.
Secchi Depth, m	57	0.60	1.50	1.81	1.90	2.10	2.80	5.26
Total Kjeldahl Nitrogen, mg/l	65	0.04	0.46	0.65	0.57	0.72	1.70	.
Total Nitrogen, mg/l	65	0.01	0.43	0.56	0.54	0.72	1.75	3.08
Orthophosphate as P, mg/l	59	0.00	0.00	0.01	0.01	0.01	0.03	.
Total Phosphorus, mg/l	68	0.01	0.01	0.02	0.02	0.02	0.06	0.00
Total Suspended Solids, mg/l	60	2.00	2.00	2.32	2.00	2.00	13.00	1.67
Turbidity, NTU	47	0.30	0.50	0.81	0.60	0.90	2.60	.
Unionized Ammonia, mg/l	62	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Fakahatchee WBID=3259I Station=21FLSFWMBC25

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	17	1.50	2.00	2.02	2.00	2.00	2.80	.
Chlorophyll-a, ug/l	70	3.00	3.00	8.77	3.00	6.40	74.80	11.43
Color, PCU	69	40.00	80.00	106.01	100.00	120.00	350.00	42.03
Conductivity, umhos/cm	72	197.00	301.00	463.10	537.00	593.00	655.00	.
Copper, ug/l	22	0.18	1.00	2.15	1.38	2.80	8.00	0.00
Dissolved Oxygen, mg/l	76	0.33	1.43	2.33	2.01	3.11	8.03	93.42
Fecal Coliform, #/100ml	69	1.00	42.00	177.43	80.00	250.00	943.00	11.59
Iron, ug/l	26	0.12	120.00	221.16	175.00	280.00	710.00	0.00
Nitrate-Nitrite, mg/l	73	0.00	0.01	0.02	0.01	0.02	0.22	.
Salinity, ppt	73	0.09	0.14	0.22	0.25	0.29	0.32	.
Secchi Depth, m	75	0.20	0.80	0.98	1.05	1.15	1.60	32.00
Total Kjeldahl Nitrogen, mg/l	62	0.21	0.71	0.96	0.94	1.10	3.00	.
Total Nitrogen, mg/l	66	0.01	0.49	0.79	0.81	1.12	3.00	3.03
Orthophosphate as P, mg/l	54	0.01	0.04	0.09	0.07	0.11	0.37	.
Total Phosphorus, mg/l	66	0.02	0.07	0.13	0.10	0.15	0.56	12.12
Total Suspended Solids, mg/l	61	2.00	2.00	4.09	2.00	2.00	54.00	11.48
Turbidity, NTU	47	0.30	0.50	1.02	0.80	1.10	4.80	.
Unionized Ammonia, mg/l	56	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Fakahatchee WBID=3278G Station=21FLSFWMBC12

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	15	1.50	2.00	2.03	2.00	2.00	3.50	.
Chlorophyll-a, ug/l	65	3.00	3.00	5.32	3.00	3.20	98.30	1.54
Color, PCU	65	5.00	20.00	23.77	20.00	30.00	80.00	0.00
Conductivity, umhos/cm	67	395.00	579.00	624.24	622.00	681.00	974.00	.
Copper, ug/l	19	0.15	0.30	1.03	1.00	1.00	4.60	0.00
Dissolved Oxygen, mg/l	68	0.51	3.47	5.69	5.44	7.18	12.13	41.18
Fecal Coliform, #/100ml	55	1.00	3.00	193.13	8.00	200.00	3100.00	16.36
Iron, ug/l	21	100.00	130.00	235.24	200.00	300.00	570.00	0.00
Nitrate-Nitrite, mg/l	64	0.00	0.01	0.01	0.01	0.01	0.22	.
Salinity, ppt	67	0.00	0.28	0.30	0.30	0.33	0.46	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	56	0.04	0.24	0.34	0.26	0.38	1.25	.
Total Nitrogen, mg/l	59	0.01	0.22	0.28	0.24	0.36	1.26	0.00
Orthophosphate as P, mg/l	50	0.00	0.00	0.01	0.00	0.01	0.01	.
Total Phosphorus, mg/l	62	0.00	0.01	0.01	0.01	0.02	0.04	0.00
Total Suspended Solids, mg/l	55	2.00	2.00	2.77	2.00	2.00	17.00	5.45
Turbidity, NTU	46	0.30	0.50	0.73	0.70	0.90	1.80	.
Unionized Ammonia, mg/l	53	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Fakahatchee WBID=3278G Station=21FLSFWMBC18

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	19	2.00	2.00	2.59	2.00	2.60	7.60	.
Chlorophyll-a, ug/l	76	3.00	3.00	9.78	3.00	9.85	115.90	9.21
Color, PCU	73	10.00	50.00	78.90	60.00	100.00	240.00	17.81
Conductivity, umhos/cm	75	307.00	413.00	7937.68	987.00	8631.00	59168.00	.
Copper, ug/l	23	0.15	0.48	0.92	1.00	1.00	3.40	0.00
Dissolved Oxygen, mg/l	77	0.30	1.86	3.32	3.17	4.22	8.06	84.42
Fecal Coliform, #/100ml	65	1.00	18.00	207.65	44.00	230.00	5450.00	9.23
Iron, ug/l	26	0.12	100.00	126.93	120.00	130.00	260.00	0.00
Nitrate-Nitrite, mg/l	74	0.00	0.01	0.01	0.01	0.01	0.13	.
Salinity, ppt	76	0.14	0.20	4.78	0.43	4.45	39.47	.
Secchi Depth, m	76	0.25	0.55	0.70	0.70	0.81	2.30	93.42
Total Kjeldahl Nitrogen, mg/l	72	0.24	0.56	0.94	0.70	1.06	5.19	.
Total Nitrogen, mg/l	68	0.01	0.42	0.79	0.65	0.97	5.32	11.76
Orthophosphate as P, mg/l	63	0.00	0.00	0.01	0.01	0.01	0.09	.
Total Phosphorus, mg/l	69	0.00	0.01	0.05	0.02	0.04	1.18	2.90
Total Suspended Solids, mg/l	65	2.00	2.00	6.03	2.00	4.00	94.00	15.38
Turbidity, NTU	48	0.10	0.40	0.80	0.55	1.00	2.90	.
Unionized Ammonia, mg/l	59	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Fakahatchee WBID=3278G Station=21FLSFWMBC19

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	19	2.00	2.00	2.99	2.00	3.40	9.80	.
Chlorophyll-a, ug/l	74	3.00	3.00	17.09	3.00	12.80	404.50	18.92
Color, PCU	70	30.00	80.00	107.43	100.00	120.00	240.00	44.29
Conductivity, umhos/cm	74	414.00	561.00	8398.96	1782.00	10234.00	60109.00	.
Copper, ug/l	22	0.15	0.51	1.02	1.00	1.00	4.30	0.00
Dissolved Oxygen, mg/l	75	0.24	1.47	3.39	3.16	4.61	10.16	78.67
Fecal Coliform, #/100ml	67	1.00	19.00	218.24	60.00	280.00	1386.00	17.91
Iron, ug/l	26	0.12	130.00	264.62	165.00	360.00	1300.00	3.85
Nitrate-Nitrite, mg/l	73	0.00	0.01	0.01	0.01	0.01	0.04	.
Salinity, ppt	75	0.20	0.27	5.03	0.80	5.76	40.10	.
Secchi Depth, m	75	0.20	0.60	0.83	0.85	1.00	1.40	64.00
Total Kjeldahl Nitrogen, mg/l	69	0.38	0.73	1.17	0.99	1.40	4.22	.
Total Nitrogen, mg/l	67	0.01	0.59	0.93	0.85	1.32	4.23	11.94
Orthophosphate as P, mg/l	62	0.00	0.00	0.01	0.01	0.01	0.10	.
Total Phosphorus, mg/l	71	0.00	0.01	0.05	0.03	0.06	0.31	4.23
Total Suspended Solids, mg/l	63	2.00	2.00	6.57	2.00	4.00	97.00	12.70
Turbidity, NTU	46	0.30	0.40	1.23	0.70	1.50	5.90	.
Unionized Ammonia, mg/l	59	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Fakahatchee WBID=3278G Station=21FLSFWMBC21

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	18	2.00	2.00	2.37	2.00	2.00	4.40	.
Chlorophyll-a, ug/l	75	3.00	3.00	9.78	3.20	7.50	68.50	10.67
Color, PCU	71	40.00	60.00	90.21	80.00	120.00	210.00	25.35
Conductivity, umhos/cm	75	383.00	840.00	14895.87	2300.00	32208.00	72958.00	.
Copper, ug/l	22	0.15	0.42	0.95	1.00	1.00	3.10	0.00
Dissolved Oxygen, mg/l	76	0.83	2.90	4.33	4.14	5.36	12.77	72.37
Fecal Coliform, #/100ml	66	2.00	14.00	293.05	39.50	91.00	5300.00	10.61
Iron, ug/l	25	0.12	100.00	194.40	120.00	200.00	780.00	0.00
Nitrate-Nitrite, mg/l	73	0.00	0.01	0.02	0.01	0.02	0.19	.
Salinity, ppt	76	0.18	0.41	9.36	1.15	19.39	50.25	.
Secchi Depth, m	78	0.35	0.90	1.04	1.00	1.20	1.70	39.74
Total Kjeldahl Nitrogen, mg/l	71	0.28	0.68	1.12	0.90	1.37	4.34	.
Total Nitrogen, mg/l	68	0.01	0.36	0.89	0.82	1.21	4.52	10.29
Orthophosphate as P, mg/l	63	0.00	0.00	0.01	0.00	0.01	0.04	.
Total Phosphorus, mg/l	71	0.00	0.01	0.03	0.02	0.03	0.16	0.00
Total Suspended Solids, mg/l	64	2.00	2.00	6.72	2.00	4.00	90.00	14.06
Turbidity, NTU	47	0.30	0.50	1.27	0.70	1.40	5.50	.
Unionized Ammonia, mg/l	64	0.00	0.00	0.00	0.00	0.00	0.02	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Fakahatchee WBID=3278G Station=21FLSFWMSGGE17SW

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	2.04	2.04	2.04	2.04	2.04	2.04	100
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	1	210.00	210.00	210.00	210.00	210.00	210.00	0
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	1	0.16	0.16	0.16	0.16	0.16	0.16	.
Secchi Depth, m	1	0.10	0.10	0.10	0.10	0.10	0.10	100
Total Kjeldahl Nitrogen, mg/l	1	0.67	0.67	0.67	0.67	0.67	0.67	.
Total Nitrogen, mg/l	1	0.67	0.67	0.67	0.67	0.67	0.67	0
Orthophosphate as P, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Total Phosphorus, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	0
Total Suspended Solids, mg/l	1	62.00	62.00	62.00	62.00	62.00	62.00	100
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Fakahatchee WBID=3278G Station=Chkmate

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	5	2.00	2.00	2.50	2.00	2.00	4.50	.
Chlorophyll-a, ug/l	19	3.00	3.00	62.70	8.50	10.70	993.00	21.05
Color, PCU	20	60.00	65.00	106.50	85.00	110.00	400.00	25.00
Conductivity, umhos/cm	20	254.00	332.50	412.75	421.00	486.00	572.00	.
Copper, ug/l	5	0.19	0.30	0.56	0.30	1.00	1.00	0.00
Dissolved Oxygen, mg/l	21	0.17	1.10	2.89	1.71	3.91	9.54	80.95
Fecal Coliform, #/100ml	19	12.00	41.00	138.26	91.00	250.00	297.00	0.00
Iron, ug/l	6	100.00	100.00	160.00	155.00	190.00	260.00	0.00
Nitrate-Nitrite, mg/l	18	0.00	0.01	0.01	0.01	0.01	0.03	.
Salinity, ppt	21	0.00	0.13	0.18	0.19	0.22	0.28	.
Secchi Depth, m	18	0.50	0.80	0.99	0.95	1.25	1.48	55.56
Total Kjeldahl Nitrogen, mg/l	18	0.52	0.77	1.29	0.89	1.12	6.75	.
Total Nitrogen, mg/l	17	0.01	0.72	0.84	0.88	1.03	2.00	5.88
Orthophosphate as P, mg/l	21	0.00	0.00	0.01	0.01	0.01	0.03	.
Total Phosphorus, mg/l	19	0.01	0.01	0.08	0.02	0.05	0.88	5.26
Total Suspended Solids, mg/l	21	2.00	2.00	4.67	2.00	2.00	19.00	23.81
Turbidity, NTU	12	0.30	0.45	13.27	0.60	0.75	150.00	.
Unionized Ammonia, mg/l	19	0.00	0.00	0.00	0.00	0.00	0.01	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Golden Gate Naples Bay WBID=3278K Station=21FLSFWMBC3

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	19	1.50	2.00	2.04	2.00	2.00	2.70	.
Chlorophyll-a, ug/l	75	3.00	3.00	8.87	5.90	10.70	58.70	9.33
Color, PCU	75	30.00	60.00	72.53	80.00	80.00	150.00	4.00
Conductivity, umhos/cm	76	697.00	1561.00	13583.24	7663.00	24322.00	40222.00	.
Copper, ug/l	23	0.30	1.10	2.28	2.16	3.31	4.84	0.00
Dissolved Oxygen, mg/l	75	0.17	1.75	2.73	2.32	3.34	16.10	96.00
Fecal Coliform, #/100ml	76	1.00	61.50	284.58	90.50	221.50	3150.00	13.16
Iron, ug/l	25	100.00	180.00	303.60	260.00	400.00	680.00	0.00
Nitrate-Nitrite, mg/l	71	0.01	0.04	0.08	0.07	0.12	0.23	.
Salinity, ppt	77	0.34	0.84	8.28	4.54	14.18	25.62	.
Secchi Depth, m	75	0.44	0.90	1.05	1.05	1.20	1.60	33.33
Total Kjeldahl Nitrogen, mg/l	64	0.10	0.63	0.79	0.78	0.96	1.98	.
Total Nitrogen, mg/l	63	0.01	0.27	0.73	0.83	1.02	2.01	3.17
Orthophosphate as P, mg/l	56	0.00	0.03	0.05	0.04	0.07	0.22	.
Total Phosphorus, mg/l	74	0.03	0.06	0.08	0.07	0.11	0.21	0.00
Total Suspended Solids, mg/l	57	2.00	2.00	6.19	2.00	3.00	94.00	12.28
Turbidity, NTU	47	0.70	1.20	1.67	1.50	1.90	4.50	.
Unionized Ammonia, mg/l	66	0.00	0.00	0.00	0.00	0.00	0.01	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Golden Gate Naples Bay WBID=3278K Station=GRE896-1

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	22	4.00	7.00	11.95	10.50	15.00	35.00	13.64
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	0	.	.	.	.	.	.	.
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	10	0.24	0.46	0.62	0.61	0.76	0.91	100.00
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	21	0.02	0.03	0.04	0.04	0.06	0.07	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Golden Gate Naples Bay WBID=3278K Station=GordonRiv

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	4	1.00	1.00	14.50	13.50	28.00	30.00	50.00
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	6	741.00	777.00	912.00	885.00	1017.00	1167.00	.
Copper, ug/l	6	2.80	5.90	8.78	7.50	13.00	16.00	0.00
Dissolved Oxygen, mg/l	6	1.35	2.66	3.04	2.92	3.46	4.95	100.00
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	7	0.06	0.10	0.15	0.17	0.19	0.22	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	5	0.50	1.10	1.16	1.30	1.40	1.50	20.00
Total Kjeldahl Nitrogen, mg/l	7	0.86	0.90	1.32	1.20	1.30	2.70	.
Total Nitrogen, mg/l	7	0.96	1.12	1.47	1.26	1.47	2.88	14.29
Orthophosphate as P, mg/l	6	0.03	0.08	0.09	0.09	0.11	0.15	.
Total Phosphorus, mg/l	7	0.02	0.04	0.05	0.06	0.06	0.08	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Golden Gate Naples Bay WBID=3278S Station=21FLFTM EVRGWC0038FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	2	0.62	0.62	0.71	0.71	0.79	0.79	.
Chlorophyll-a, ug/l	2	1.00	1.00	1.55	1.55	2.10	2.10	0
Color, PCU	2	5.00	5.00	42.50	42.50	80.00	80.00	0
Conductivity, umhos/cm	2	390.00	390.00	431.50	431.50	473.00	473.00	.
Copper, ug/l	2	1.08	1.08	1.09	1.09	1.09	1.09	0
Dissolved Oxygen, mg/l	2	2.30	2.30	3.01	3.01	3.71	3.71	100
Fecal Coliform, #/100ml	2	1.00	1.00	5.50	5.50	10.00	10.00	0
Iron, ug/l	2	370.00	370.00	436.00	436.00	502.00	502.00	0
Nitrate-Nitrite, mg/l	2	0.05	0.05	0.06	0.06	0.08	0.08	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.15	0.15	0.15	0.15	0.15	0.15	100
Total Kjeldahl Nitrogen, mg/l	2	0.64	0.64	0.68	0.68	0.72	0.72	.
Total Nitrogen, mg/l	2	0.72	0.72	0.74	0.74	0.77	0.77	0
Orthophosphate as P, mg/l	2	0.01	0.01	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	2	0.02	0.02	0.02	0.02	0.02	0.02	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	2	0.20	0.20	0.96	0.96	1.72	1.72	.
Unionized Ammonia, mg/l	2	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Golden Gate Naples Bay WBID=3278S Station=21FLFTM EVRGWC0039FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	2	1.30	1.30	1.70	1.70	2.10	2.10	.
Chlorophyll-a, ug/l	2	1.00	1.00	1.35	1.35	1.70	1.70	0
Color, PCU	2	5.00	5.00	72.50	72.50	140.00	140.00	50
Conductivity, umhos/cm	2	315.00	315.00	461.50	461.50	608.00	608.00	.
Copper, ug/l	2	0.94	0.94	1.03	1.03	1.11	1.11	0
Dissolved Oxygen, mg/l	2	1.82	1.82	4.19	4.19	6.56	6.56	50
Fecal Coliform, #/100ml	2	1.00	1.00	10.50	10.50	20.00	20.00	0
Iron, ug/l	2	503.00	503.00	515.50	515.50	528.00	528.00	0
Nitrate-Nitrite, mg/l	2	0.00	0.00	0.05	0.05	0.10	0.10	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	2	1.30	1.30	1.55	1.55	1.80	1.80	.
Total Nitrogen, mg/l	2	1.40	1.40	1.60	1.60	1.80	1.80	50
Orthophosphate as P, mg/l	2	0.01	0.01	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	2	0.02	0.02	0.07	0.07	0.12	0.12	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	2	0.20	0.20	2.30	2.30	4.40	4.40	.
Unionized Ammonia, mg/l	2	0.00	0.00	0.02	0.02	0.03	0.03	50

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Golden Gate Naples Bay WBID=3278S Station=21FLFTM EVRGWC0046FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	4	1.20	1.25	1.45	1.45	1.65	1.70	.
Chlorophyll-a, ug/l	4	1.00	1.05	1.30	1.25	1.55	1.70	0
Color, PCU	4	70.00	85.00	102.50	110.00	120.00	120.00	50
Conductivity, umhos/cm	4	0.00	205.00	373.75	445.00	542.50	605.00	.
Copper, ug/l	4	0.62	0.63	0.68	0.66	0.74	0.80	0
Dissolved Oxygen, mg/l	4	1.67	4.06	6.18	6.73	8.29	9.57	25
Fecal Coliform, #/100ml	4	1.00	1.00	58.00	10.50	115.00	210.00	0
Iron, ug/l	4	951.00	953.00	1109.00	992.50	1265.00	1500.00	50
Nitrate-Nitrite, mg/l	4	0.02	0.03	0.04	0.04	0.05	0.06	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	0.30	0.30	0.47	0.50	0.60	0.60	100
Total Kjeldahl Nitrogen, mg/l	4	0.94	0.95	1.02	0.97	1.09	1.20	.
Total Nitrogen, mg/l	4	0.99	1.00	1.06	1.00	1.11	1.22	0
Orthophosphate as P, mg/l	4	0.00	0.00	0.02	0.01	0.03	0.05	.
Total Phosphorus, mg/l	4	0.02	0.02	0.06	0.05	0.10	0.11	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	4	2.00	2.30	2.98	2.75	3.65	4.40	.
Unionized Ammonia, mg/l	4	0.00	0.00	0.01	0.00	0.03	0.06	25

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Golden Gate Naples Bay WBID=3278S Station=21FLFTM EVRGWC0047FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	4	1.00	1.20	1.45	1.40	1.70	2.00	.
Chlorophyll-a, ug/l	4	1.00	1.05	1.40	1.40	1.75	1.80	0
Color, PCU	4	50.00	75.00	97.50	110.00	120.00	120.00	50
Conductivity, umhos/cm	4	430.00	442.00	513.25	516.00	584.50	591.00	.
Copper, ug/l	4	0.54	0.56	0.62	0.60	0.67	0.72	0
Dissolved Oxygen, mg/l	4	1.59	3.70	5.67	6.35	7.64	8.39	25
Fecal Coliform, #/100ml	4	1.00	1.00	30.50	10.50	60.00	100.00	0
Iron, ug/l	4	308.00	563.50	804.25	924.50	1045.00	1060.00	50
Nitrate-Nitrite, mg/l	4	0.00	0.00	0.04	0.03	0.07	0.09	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	4	0.50	0.55	0.78	0.80	1.00	1.00	50
Total Kjeldahl Nitrogen, mg/l	4	0.90	0.91	0.98	0.96	1.05	1.10	.
Total Nitrogen, mg/l	4	0.90	0.94	1.02	1.03	1.10	1.10	0
Orthophosphate as P, mg/l	4	0.00	0.00	0.01	0.01	0.02	0.03	.
Total Phosphorus, mg/l	4	0.02	0.02	0.03	0.02	0.04	0.06	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	4	1.90	1.95	2.43	2.40	2.90	3.00	.
Unionized Ammonia, mg/l	4	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Golden Gate Naples Bay WBID=3278S Station=21FLFTM EVRGWC0048FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	4	1.10	1.15	1.48	1.50	1.80	1.80	.
Chlorophyll-a, ug/l	4	1.00	1.05	1.58	1.40	2.10	2.50	0
Color, PCU	4	50.00	75.00	97.50	110.00	120.00	120.00	50
Conductivity, umhos/cm	4	412.00	429.50	473.00	453.50	516.50	573.00	.
Copper, ug/l	4	0.39	0.47	0.57	0.58	0.67	0.72	0
Dissolved Oxygen, mg/l	4	1.38	3.80	5.13	6.24	6.47	6.67	25
Fecal Coliform, #/100ml	4	1.00	5.50	37.75	15.00	70.00	120.00	0
Iron, ug/l	4	141.00	541.00	781.50	967.50	1022.00	1050.00	25
Nitrate-Nitrite, mg/l	4	0.00	0.00	0.04	0.02	0.07	0.09	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	0.00	0.00	0.30	0.40	0.50	0.50	100
Total Kjeldahl Nitrogen, mg/l	4	0.73	0.81	0.90	0.89	1.00	1.10	.
Total Nitrogen, mg/l	4	0.73	0.84	0.94	0.96	1.04	1.10	0
Orthophosphate as P, mg/l	4	0.01	0.01	0.01	0.01	0.02	0.03	.
Total Phosphorus, mg/l	4	0.02	0.03	0.04	0.04	0.05	0.06	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	4	2.00	2.35	2.88	2.75	3.40	4.00	.
Unionized Ammonia, mg/l	4	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Golden Gate Naples Bay WBID=3278S Station=21FLFTM EVRGWC0049FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	4	0.99	1.35	2.40	2.00	3.45	4.60	.
Chlorophyll-a, ug/l	4	1.00	1.35	2.80	2.20	4.25	5.80	0
Color, PCU	4	80.00	90.00	100.00	100.00	110.00	120.00	25
Conductivity, umhos/cm	4	416.00	479.50	559.25	568.00	639.00	685.00	.
Copper, ug/l	4	0.36	0.47	0.59	0.60	0.72	0.82	0
Dissolved Oxygen, mg/l	4	2.17	4.33	6.71	7.23	9.09	10.22	25
Fecal Coliform, #/100ml	4	1.00	1.00	20.50	15.50	40.00	50.00	0
Iron, ug/l	4	1080.00	1135.00	1270.00	1240.00	1405.00	1520.00	100
Nitrate-Nitrite, mg/l	4	0.00	0.00	0.02	0.01	0.03	0.05	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	0.20	0.20	0.37	0.30	0.60	0.60	100
Total Kjeldahl Nitrogen, mg/l	4	0.64	0.76	0.84	0.89	0.92	0.94	.
Total Nitrogen, mg/l	4	0.66	0.78	0.86	0.92	0.94	0.94	0
Orthophosphate as P, mg/l	4	0.01	0.01	0.01	0.01	0.02	0.02	.
Total Phosphorus, mg/l	4	0.02	0.02	0.03	0.03	0.04	0.04	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	4	3.30	3.55	5.95	4.95	8.35	10.60	.
Unionized Ammonia, mg/l	4	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Golden Gate Naples Bay WBID=3278S Station=21FLFTM EVRGWC0050FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	4	0.93	0.97	1.16	1.15	1.35	1.40	.
Chlorophyll-a, ug/l	4	1.00	1.35	1.83	1.70	2.30	2.90	0.00
Color, PCU	4	60.00	80.00	95.00	100.00	110.00	120.00	25.00
Conductivity, umhos/cm	4	425.00	499.50	598.00	609.50	696.50	748.00	.
Copper, ug/l	4	0.45	0.47	0.51	0.51	0.55	0.55	0.00
Dissolved Oxygen, mg/l	4	1.88	3.64	5.63	5.46	7.63	9.73	25.00
Fecal Coliform, #/100ml	4	10.00	10.00	125.00	60.00	240.00	370.00	0.00
Iron, ug/l	4	181.00	610.50	847.75	1050.00	1085.00	1110.00	75.00
Nitrate-Nitrite, mg/l	4	0.00	0.00	0.02	0.01	0.03	0.04	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	0.50	0.50	0.70	0.50	1.10	1.10	66.67
Total Kjeldahl Nitrogen, mg/l	4	0.72	0.77	0.83	0.84	0.90	0.93	.
Total Nitrogen, mg/l	4	0.74	0.80	0.85	0.86	0.90	0.93	0.00
Orthophosphate as P, mg/l	4	0.01	0.01	0.01	0.01	0.02	0.02	.
Total Phosphorus, mg/l	4	0.02	0.02	0.03	0.02	0.03	0.04	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	4	1.50	1.90	2.95	3.15	4.00	4.00	.
Unionized Ammonia, mg/l	4	0.00	0.00	0.00	0.00	0.01	0.01	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Golden Gate Naples Bay WBID=3278S Station=21FLFTM EVRGWC0051FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	2	7.40	7.40	7.50	7.50	7.60	7.60	.
Chlorophyll-a, ug/l	2	100.00	100.00	125.00	125.00	150.00	150.00	100
Color, PCU	2	80.00	80.00	80.00	80.00	80.00	80.00	0
Conductivity, umhos/cm	2	881.00	881.00	913.50	913.50	946.00	946.00	.
Copper, ug/l	2	1.25	1.25	2.02	2.02	2.79	2.79	0
Dissolved Oxygen, mg/l	2	10.28	10.28	11.09	11.09	11.89	11.89	0
Fecal Coliform, #/100ml	2	30.00	30.00	40.00	40.00	50.00	50.00	0
Iron, ug/l	2	272.00	272.00	313.00	313.00	354.00	354.00	0
Nitrate-Nitrite, mg/l	2	0.39	0.39	0.57	0.57	0.75	0.75	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	2	1.00	1.00	1.10	1.10	1.20	1.20	0
Total Kjeldahl Nitrogen, mg/l	2	3.70	3.70	4.50	4.50	5.30	5.30	.
Total Nitrogen, mg/l	2	4.45	4.45	5.07	5.07	5.69	5.69	100
Orthophosphate as P, mg/l	2	0.51	0.51	0.81	0.81	1.10	1.10	.
Total Phosphorus, mg/l	2	0.80	0.80	1.15	1.15	1.50	1.50	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	2	8.70	8.70	9.85	9.85	11.00	11.00	.
Unionized Ammonia, mg/l	2	0.02	0.02	0.12	0.12	0.22	0.22	100

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Golden Gate Naples Bay WBID=3278S Station=21FLFTM EVRGWC0052FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	2	2.10	2.10	4.90	4.90	7.70	7.70	.
Chlorophyll-a, ug/l	2	1.00	1.00	43.50	43.50	86.00	86.00	50
Color, PCU	2	30.00	30.00	55.00	55.00	80.00	80.00	0
Conductivity, umhos/cm	2	699.00	699.00	853.00	853.00	1007.00	1007.00	.
Copper, ug/l	2	1.23	1.23	1.55	1.55	1.87	1.87	0
Dissolved Oxygen, mg/l	2	10.45	10.45	11.34	11.34	12.22	12.22	0
Fecal Coliform, #/100ml	2	40.00	40.00	65.00	65.00	90.00	90.00	0
Iron, ug/l	2	62.00	62.00	63.00	63.00	64.00	64.00	0
Nitrate-Nitrite, mg/l	2	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	2	0.60	0.60	1.10	1.10	1.60	1.60	50
Total Kjeldahl Nitrogen, mg/l	2	0.92	0.92	1.91	1.91	2.90	2.90	.
Total Nitrogen, mg/l	2	0.92	0.92	1.91	1.91	2.90	2.90	50
Orthophosphate as P, mg/l	2	0.00	0.00	0.08	0.08	0.16	0.16	.
Total Phosphorus, mg/l	2	0.02	0.02	0.20	0.20	0.38	0.38	50
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	2	1.30	1.30	7.35	7.35	13.40	13.40	.
Unionized Ammonia, mg/l	2	0.00	0.00	0.01	0.01	0.01	0.01	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Golden Gate Naples Bay WBID=3278S Station=21FLFTM EVRGWC0053FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	2	1.60	1.60	2.80	2.80	4.00	4.00	.
Chlorophyll-a, ug/l	2	1.00	1.00	8.00	8.00	15.00	15.00	0
Color, PCU	2	40.00	40.00	50.00	50.00	60.00	60.00	0
Conductivity, umhos/cm	2	726.00	726.00	873.00	873.00	1020.00	1020.00	.
Copper, ug/l	2	1.34	1.34	2.07	2.07	2.80	2.80	0
Dissolved Oxygen, mg/l	2	9.80	9.80	10.78	10.78	11.76	11.76	0
Fecal Coliform, #/100ml	2	30.00	30.00	40.00	40.00	50.00	50.00	0
Iron, ug/l	2	79.00	79.00	119.50	119.50	160.00	160.00	0
Nitrate-Nitrite, mg/l	2	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	2	0.90	0.90	1.50	1.50	2.10	2.10	50
Total Kjeldahl Nitrogen, mg/l	2	0.78	0.78	1.34	1.34	1.90	1.90	.
Total Nitrogen, mg/l	2	0.78	0.78	1.34	1.34	1.90	1.90	50
Orthophosphate as P, mg/l	2	0.01	0.01	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	2	0.02	0.02	0.07	0.07	0.11	0.11	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	2	1.00	1.00	2.35	2.35	3.70	3.70	.
Unionized Ammonia, mg/l	2	0.00	0.00	0.00	0.00	0.01	0.01	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Golden Gate Naples Bay WBID=3278S Station=21FLGW 3495

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	115	1.00	1.00	4.54	1.00	3.40	83.00	5.22
Color, PCU	115	10.00	40.00	60.70	60.00	70.00	300.00	3.48
Conductivity, umhos/cm	116	463.00	620.00	691.95	711.50	766.75	871.00	.
Copper, ug/l	2	0.57	0.57	1.01	1.01	1.45	1.45	0.00
Dissolved Oxygen, mg/l	116	2.32	4.91	6.23	6.13	7.57	11.27	27.59
Fecal Coliform, #/100ml	115	1.00	9.00	116.79	23.00	52.00	5400.00	3.48
Iron, ug/l	1	1070.00	1070.00	1070.00	1070.00	1070.00	1070.00	100.00
Nitrate-Nitrite, mg/l	115	0.00	0.01	0.06	0.06	0.10	0.26	.
Salinity, ppt	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Secchi Depth, m	109	0.00	1.30	1.71	1.75	2.00	6.00	8.26
Total Kjeldahl Nitrogen, mg/l	115	0.08	0.70	0.79	0.76	0.84	1.80	.
Total Nitrogen, mg/l	115	0.09	0.74	0.86	0.83	0.95	2.03	0.87
Orthophosphate as P, mg/l	101	0.00	0.00	0.01	0.01	0.02	0.11	.
Total Phosphorus, mg/l	115	0.01	0.02	0.03	0.03	0.04	0.27	0.87
Total Suspended Solids, mg/l	115	4.00	4.00	4.39	4.00	4.00	15.00	5.22
Turbidity, NTU	115	0.50	1.30	2.20	1.70	2.60	9.80	.
Unionized Ammonia, mg/l	112	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Golden Gate Naples Bay WBID=3278S Station=21FLGW 37106

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	3.00	3.00	3.00	3.00	3.00	3.00	0
Color, PCU	1	50.00	50.00	50.00	50.00	50.00	50.00	0
Conductivity, umhos/cm	1	409.00	409.00	409.00	409.00	409.00	409.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	8.94	8.94	8.94	8.94	8.94	8.94	0
Fecal Coliform, #/100ml	1	3.00	3.00	3.00	3.00	3.00	3.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	1.50	1.50	1.50	1.50	1.50	1.50	0
Total Kjeldahl Nitrogen, mg/l	1	0.83	0.83	0.83	0.83	0.83	0.83	.
Total Nitrogen, mg/l	1	0.83	0.83	0.83	0.83	0.83	0.83	0
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	0
Total Suspended Solids, mg/l	1	4.00	4.00	4.00	4.00	4.00	4.00	0
Turbidity, NTU	1	2.30	2.30	2.30	2.30	2.30	2.30	.
Unionized Ammonia, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Golden Gate Naples Bay WBID=3278S Station=21FLGW14182

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	6.80	6.80	6.80	6.80	6.80	6.80	0
Color, PCU	1	60.00	60.00	60.00	60.00	60.00	60.00	0
Conductivity, umhos/cm	1	449.00	449.00	449.00	449.00	449.00	449.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	6.88	6.88	6.88	6.88	6.88	6.88	0
Fecal Coliform, #/100ml	1	5000.00	5000.00	5000.00	5000.00	5000.00	5000.00	100
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.73	0.73	0.73	0.73	0.73	0.73	100
Total Kjeldahl Nitrogen, mg/l	1	0.81	0.81	0.81	0.81	0.81	0.81	.
Total Nitrogen, mg/l	1	0.81	0.81	0.81	0.81	0.81	0.81	0
Orthophosphate as P, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	1	0.05	0.05	0.05	0.05	0.05	0.05	0
Total Suspended Solids, mg/l	1	4.00	4.00	4.00	4.00	4.00	4.00	0
Turbidity, NTU	1	2.80	2.80	2.80	2.80	2.80	2.80	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Golden Gate Naples Bay WBID=3278S Station=21FLGW21746

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	0.85	0.85	0.85	0.85	0.85	0.85	0
Color, PCU	1	50.00	50.00	50.00	50.00	50.00	50.00	0
Conductivity, umhos/cm	1	607.00	607.00	607.00	607.00	607.00	607.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	7.12	7.12	7.12	7.12	7.12	7.12	0
Fecal Coliform, #/100ml	1	20.00	20.00	20.00	20.00	20.00	20.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	1.62	1.62	1.62	1.62	1.62	1.62	0
Total Kjeldahl Nitrogen, mg/l	1	0.76	0.76	0.76	0.76	0.76	0.76	.
Total Nitrogen, mg/l	1	0.76	0.76	0.76	0.76	0.76	0.76	0
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	1.70	1.70	1.70	1.70	1.70	1.70	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Golden Gate Naples Bay WBID=3278S Station=21FLGW21753

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	24.00	24.00	24.00	24.00	24.00	24.00	100
Color, PCU	1	80.00	80.00	80.00	80.00	80.00	80.00	0
Conductivity, umhos/cm	1	586.00	586.00	586.00	586.00	586.00	586.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	6.88	6.88	6.88	6.88	6.88	6.88	0
Fecal Coliform, #/100ml	1	84.00	84.00	84.00	84.00	84.00	84.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.62	0.62	0.62	0.62	0.62	0.62	100
Total Kjeldahl Nitrogen, mg/l	1	0.65	0.65	0.65	0.65	0.65	0.65	.
Total Nitrogen, mg/l	1	0.66	0.66	0.66	0.66	0.66	0.66	0
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	11.00	11.00	11.00	11.00	11.00	11.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Golden Gate Naples Bay WBID=3278S Station=ARS896-1

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	23	3.00	6.00	11.26	11.00	16.00	21.00	4.35
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	0	.	.	.	.	.	.	.
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	22	0.76	1.07	1.25	1.22	1.37	1.83	9.09
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	21	0.02	0.04	0.04	0.04	0.06	0.08	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Golden Gate Naples Bay WBID=3278S Station=Cork@846

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	21	0.66	2.00	1.99	2.00	2.00	3.30	.
Chlorophyll-a, ug/l	76	1.00	3.00	5.96	3.20	7.45	24.00	1.32
Color, PCU	75	5.00	120.00	160.00	150.00	200.00	400.00	77.33
Conductivity, umhos/cm	76	184.00	287.50	433.01	427.00	577.50	675.00	.
Copper, ug/l	25	0.15	0.48	1.02	1.00	1.10	4.90	0.00
Dissolved Oxygen, mg/l	79	1.06	3.36	4.54	4.42	5.56	9.50	63.29
Fecal Coliform, #/100ml	73	1.00	10.00	103.62	48.00	106.00	914.00	4.11
Iron, ug/l	28	100.00	459.00	768.50	640.00	1105.00	1500.00	32.14
Nitrate-Nitrite, mg/l	77	0.00	0.01	0.02	0.01	0.02	0.22	.
Salinity, ppt	74	0.09	0.14	0.21	0.21	0.28	0.40	.
Secchi Depth, m	75	0.10	0.50	0.69	0.70	0.90	1.35	84.00
Total Kjeldahl Nitrogen, mg/l	70	0.46	1.00	1.28	1.20	1.50	3.30	.
Total Nitrogen, mg/l	72	0.01	0.90	1.10	1.16	1.47	3.33	15.28
Orthophosphate as P, mg/l	59	0.00	0.00	0.01	0.01	0.01	0.05	.
Total Phosphorus, mg/l	72	0.01	0.02	0.03	0.03	0.03	0.16	0.00
Total Suspended Solids, mg/l	61	2.00	2.00	5.15	2.00	3.00	46.00	18.03
Turbidity, NTU	49	0.20	1.30	2.62	1.90	2.80	19.50	.
Unionized Ammonia, mg/l	60	0.00	0.00	0.00	0.00	0.00	0.01	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Golden Gate Naples Bay WBID=3278S Station=GC@858

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	22	1.00	2.00	1.92	2.00	2.00	2.30	.
Chlorophyll-a, ug/l	75	1.00	3.00	6.22	4.30	6.90	29.90	2.67
Color, PCU	73	5.00	80.00	113.70	120.00	120.00	240.00	53.42
Conductivity, umhos/cm	76	247.00	427.50	438.80	444.25	455.50	570.00	.
Copper, ug/l	26	0.15	0.54	1.02	1.00	1.12	3.70	0.00
Dissolved Oxygen, mg/l	79	1.17	4.66	5.73	5.94	6.81	8.83	27.85
Fecal Coliform, #/100ml	60	1.00	6.00	63.07	10.50	26.00	647.00	6.67
Iron, ug/l	27	260.00	480.00	764.59	730.00	1050.00	1340.00	33.33
Nitrate-Nitrite, mg/l	75	0.00	0.02	0.06	0.06	0.08	0.33	.
Salinity, ppt	74	0.12	0.21	0.21	0.21	0.22	0.28	.
Secchi Depth, m	74	0.15	0.90	0.98	1.00	1.10	1.30	32.43
Total Kjeldahl Nitrogen, mg/l	68	0.04	0.57	0.70	0.64	0.78	1.84	.
Total Nitrogen, mg/l	71	0.01	0.39	0.63	0.65	0.83	1.87	4.23
Orthophosphate as P, mg/l	59	0.00	0.00	0.01	0.01	0.01	0.02	.
Total Phosphorus, mg/l	70	0.01	0.01	0.02	0.02	0.02	0.05	0.00
Total Suspended Solids, mg/l	62	2.00	2.00	2.52	2.00	2.00	13.00	1.61
Turbidity, NTU	48	0.20	3.10	3.61	3.50	4.45	6.00	.
Unionized Ammonia, mg/l	61	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Golden Gate Naples Bay WBID=3278S Station=GGCAT31

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	19	1.50	2.00	1.97	2.00	2.00	2.50	.
Chlorophyll-a, ug/l	76	3.00	3.00	3.47	3.00	3.20	7.50	0.00
Color, PCU	75	30.00	50.00	81.67	60.00	100.00	800.00	12.00
Conductivity, umhos/cm	75	438.00	614.00	697.36	721.00	766.00	920.00	.
Copper, ug/l	27	0.30	0.70	1.20	1.00	1.10	4.77	0.00
Dissolved Oxygen, mg/l	77	2.44	4.54	5.85	5.78	7.00	12.80	35.06
Fecal Coliform, #/100ml	60	1.00	10.00	138.03	37.50	205.00	1886.00	8.33
Iron, ug/l	25	100.00	210.00	454.80	410.00	700.00	1010.00	4.00
Nitrate-Nitrite, mg/l	72	0.01	0.01	0.07	0.06	0.11	0.27	.
Salinity, ppt	76	0.21	0.30	0.34	0.35	0.37	0.45	.
Secchi Depth, m	70	0.90	1.30	1.67	1.70	1.95	2.42	4.29
Total Kjeldahl Nitrogen, mg/l	67	0.24	0.46	0.60	0.60	0.73	1.00	.
Total Nitrogen, mg/l	68	0.01	0.37	0.56	0.65	0.78	1.09	0.00
Orthophosphate as P, mg/l	61	0.00	0.01	0.01	0.01	0.02	0.04	.
Total Phosphorus, mg/l	68	0.01	0.02	0.03	0.03	0.03	0.07	0.00
Total Suspended Solids, mg/l	64	2.00	2.00	2.23	2.00	2.00	6.00	0.00
Turbidity, NTU	47	0.80	1.30	1.86	1.60	2.20	4.30	.
Unionized Ammonia, mg/l	66	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Golden Gate Naples Bay WBID=3278S Station=GGCAT951

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	20	0.78	2.00	1.94	2.00	2.00	2.80	.
Chlorophyll-a, ug/l	76	3.00	3.00	4.99	3.00	5.30	33.60	1.32
Color, PCU	75	30.00	60.00	97.00	80.00	120.00	800.00	25.33
Conductivity, umhos/cm	75	387.00	538.00	642.43	641.00	702.00	970.00	.
Copper, ug/l	26	0.15	0.45	0.82	1.00	1.00	1.50	0.00
Dissolved Oxygen, mg/l	77	2.22	4.77	6.01	5.77	7.30	12.37	31.17
Fecal Coliform, #/100ml	64	1.00	15.00	113.38	45.00	197.00	1071.00	3.13
Iron, ug/l	24	100.00	335.00	575.42	485.00	810.00	1310.00	8.33
Nitrate-Nitrite, mg/l	70	0.01	0.01	0.04	0.03	0.07	0.13	.
Salinity, ppt	76	0.18	0.26	0.31	0.32	0.34	0.47	.
Secchi Depth, m	71	0.70	1.10	1.26	1.20	1.40	2.40	5.63
Total Kjeldahl Nitrogen, mg/l	70	0.21	0.61	0.71	0.72	0.83	1.20	.
Total Nitrogen, mg/l	70	0.01	0.44	0.62	0.73	0.84	1.20	0.00
Orthophosphate as P, mg/l	61	0.00	0.00	0.01	0.01	0.01	0.02	.
Total Phosphorus, mg/l	66	0.01	0.01	0.02	0.02	0.02	0.04	0.00
Total Suspended Solids, mg/l	63	2.00	2.00	2.35	2.00	2.00	6.00	0.00
Turbidity, NTU	47	0.90	1.50	2.06	2.00	2.50	4.80	.
Unionized Ammonia, mg/l	66	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Golden Gate Naples Bay WBID=3278S Station=GGO3@32

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	2	6.70	6.70	7.40	7.40	8.10	8.10	.
Chlorophyll-a, ug/l	2	52.00	52.00	101.00	101.00	150.00	150.00	100
Color, PCU	2	80.00	80.00	90.00	90.00	100.00	100.00	0
Conductivity, umhos/cm	2	804.00	804.00	812.50	812.50	821.00	821.00	.
Copper, ug/l	2	0.77	0.77	1.00	1.00	1.23	1.23	0
Dissolved Oxygen, mg/l	2	9.57	9.57	12.05	12.05	14.52	14.52	0
Fecal Coliform, #/100ml	2	20.00	20.00	35.00	35.00	50.00	50.00	0
Iron, ug/l	2	156.00	156.00	335.50	335.50	515.00	515.00	0
Nitrate-Nitrite, mg/l	2	0.15	0.15	0.45	0.45	0.75	0.75	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	2	0.70	0.70	0.80	0.80	0.90	0.90	100
Total Kjeldahl Nitrogen, mg/l	2	2.30	2.30	3.55	3.55	4.80	4.80	.
Total Nitrogen, mg/l	2	2.45	2.45	4.00	4.00	5.55	5.55	100
Orthophosphate as P, mg/l	2	0.23	0.23	0.52	0.52	0.81	0.81	.
Total Phosphorus, mg/l	2	0.32	0.32	0.76	0.76	1.20	1.20	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	2	6.20	6.20	9.85	9.85	13.50	13.50	.
Unionized Ammonia, mg/l	2	0.01	0.01	0.13	0.13	0.24	0.24	50

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Golden Gate Naples Bay WBID=3278S Station=I951_Immokalee

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	18	1.50	2.00	2.16	2.00	2.00	5.70	.
Chlorophyll-a, ug/l	65	3.00	3.00	3.85	3.00	3.70	13.40	0.00
Color, PCU	65	30.00	50.00	82.15	80.00	100.00	300.00	18.46
Conductivity, umhos/cm	64	313.00	424.00	484.93	487.00	544.50	819.00	.
Copper, ug/l	22	0.15	0.62	1.20	1.00	1.50	4.20	0.00
Dissolved Oxygen, mg/l	67	0.90	3.63	5.52	5.22	7.03	12.02	47.76
Fecal Coliform, #/100ml	54	1.00	4.00	38.74	12.00	33.00	547.00	1.85
Iron, ug/l	23	120.00	200.00	384.78	420.00	530.00	660.00	0.00
Nitrate-Nitrite, mg/l	65	0.00	0.01	0.02	0.01	0.03	0.12	.
Salinity, ppt	65	0.15	0.20	0.23	0.24	0.26	0.40	.
Secchi Depth, m	61	0.20	0.55	0.77	0.80	1.00	1.25	63.93
Total Kjeldahl Nitrogen, mg/l	56	0.24	0.57	0.78	0.73	0.91	2.10	.
Total Nitrogen, mg/l	59	0.01	0.24	0.64	0.66	0.88	2.11	5.08
Orthophosphate as P, mg/l	53	0.00	0.00	0.01	0.01	0.01	0.06	.
Total Phosphorus, mg/l	60	0.01	0.01	0.02	0.02	0.03	0.17	0.00
Total Suspended Solids, mg/l	56	2.00	2.00	2.54	2.00	2.00	10.00	1.79
Turbidity, NTU	41	0.50	1.40	2.44	2.30	2.90	7.20	.
Unionized Ammonia, mg/l	47	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Golden Gate Naples Bay WBID=3278S Station=Longshore

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	3	5.00	5.00	16.00	5.00	38.00	38.00	33.33
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	0	.	.	.	.	.	.	.
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	2	2.29	2.29	2.36	2.36	2.44	2.44	0.00
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	3	0.02	0.02	0.03	0.03	0.05	0.05	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Okaloacochee-SR29 WBID=3261C Station=112WRD 260231081203900

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	4	40.00	50.00	68.75	67.50	87.50	100.00	0
Conductivity, umhos/cm	4	379.00	381.00	425.00	387.00	469.00	547.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	4	1.40	1.60	2.35	2.00	3.10	4.00	100
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	4	0.01	0.02	0.02	0.02	0.03	0.04	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	4	0.68	0.73	0.77	0.79	0.82	0.83	.
Total Nitrogen, mg/l	4	0.69	0.75	0.79	0.82	0.84	0.84	0
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	4	0.03	0.03	0.04	0.04	0.05	0.06	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	4	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Okaloacochee-SR29 WBID=3261C Station=21FLGW 3494

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	116	1.00	1.00	1.26	1.00	1.35	4.90	0.00
Color, PCU	116	5.00	30.00	41.98	40.00	50.00	100.00	0.00
Conductivity, umhos/cm	116	272.00	408.00	498.40	542.00	580.00	616.00	.
Copper, ug/l	2	0.50	0.50	0.50	0.50	0.50	0.50	0.00
Dissolved Oxygen, mg/l	116	0.66	1.99	2.69	2.48	3.24	7.99	96.55
Fecal Coliform, #/100ml	116	2.00	11.00	38.18	20.00	47.00	440.00	0.86
Iron, ug/l	1	130.00	130.00	130.00	130.00	130.00	130.00	0.00
Nitrate-Nitrite, mg/l	116	0.00	0.00	0.01	0.01	0.01	0.09	.
Salinity, ppt	3	0.00	0.00	0.10	0.00	0.29	0.29	.
Secchi Depth, m	116	0.50	1.30	1.63	1.75	2.00	2.60	12.07
Total Kjeldahl Nitrogen, mg/l	116	0.06	0.51	0.60	0.57	0.69	1.30	.
Total Nitrogen, mg/l	116	0.07	0.52	0.62	0.58	0.70	1.38	0.00
Orthophosphate as P, mg/l	103	0.00	0.00	0.01	0.01	0.01	0.03	.
Total Phosphorus, mg/l	116	0.01	0.01	0.02	0.02	0.02	0.05	0.00
Total Suspended Solids, mg/l	116	4.00	4.00	4.10	4.00	4.00	15.00	0.86
Turbidity, NTU	116	0.20	0.45	0.86	0.55	0.80	20.00	.
Unionized Ammonia, mg/l	112	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Okaloacochee-SR29 WBID=3261C Station=21FLGW13736

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	1.30	1.30	1.30	1.30	1.30	1.30	0
Color, PCU	1	5.00	5.00	5.00	5.00	5.00	5.00	0
Conductivity, umhos/cm	1	268.50	268.50	268.50	268.50	268.50	268.50	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	7.78	7.78	7.78	7.78	7.78	7.78	0
Fecal Coliform, #/100ml	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	2.60	2.60	2.60	2.60	2.60	2.60	0
Total Kjeldahl Nitrogen, mg/l	1	0.41	0.41	0.41	0.41	0.41	0.41	.
Total Nitrogen, mg/l	1	0.41	0.41	0.41	0.41	0.41	0.41	0
Orthophosphate as P, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Total Phosphorus, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	0
Total Suspended Solids, mg/l	1	4.00	4.00	4.00	4.00	4.00	4.00	0
Turbidity, NTU	1	1.00	1.00	1.00	1.00	1.00	1.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Okaloacochee-SR29 WBID=3261C Station=21FLGW14162

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	25.00	25.00	25.00	25.00	25.00	25.00	100
Color, PCU	1	80.00	80.00	80.00	80.00	80.00	80.00	0
Conductivity, umhos/cm	1	721.50	721.50	721.50	721.50	721.50	721.50	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	2.54	2.54	2.54	2.54	2.54	2.54	100
Fecal Coliform, #/100ml	1	6.00	6.00	6.00	6.00	6.00	6.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.54	0.54	0.54	0.54	0.54	0.54	100
Total Kjeldahl Nitrogen, mg/l	1	1.20	1.20	1.20	1.20	1.20	1.20	.
Total Nitrogen, mg/l	1	1.22	1.22	1.22	1.22	1.22	1.22	0
Orthophosphate as P, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	1	0.10	0.10	0.10	0.10	0.10	0.10	0
Total Suspended Solids, mg/l	1	9.00	9.00	9.00	9.00	9.00	9.00	100
Turbidity, NTU	1	11.00	11.00	11.00	11.00	11.00	11.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Okaloacochee-SR29 WBID=3261C Station=21FLGW14164

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	30.00	30.00	30.00	30.00	30.00	30.00	100
Color, PCU	1	60.00	60.00	60.00	60.00	60.00	60.00	0
Conductivity, umhos/cm	1	707.50	707.50	707.50	707.50	707.50	707.50	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	4.79	4.79	4.79	4.79	4.79	4.79	100
Fecal Coliform, #/100ml	1	8.00	8.00	8.00	8.00	8.00	8.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.70	0.70	0.70	0.70	0.70	0.70	100
Total Kjeldahl Nitrogen, mg/l	1	1.10	1.10	1.10	1.10	1.10	1.10	.
Total Nitrogen, mg/l	1	1.12	1.12	1.12	1.12	1.12	1.12	0
Orthophosphate as P, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Total Phosphorus, mg/l	1	0.07	0.07	0.07	0.07	0.07	0.07	0
Total Suspended Solids, mg/l	1	9.00	9.00	9.00	9.00	9.00	9.00	100
Turbidity, NTU	1	7.80	7.80	7.80	7.80	7.80	7.80	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Okaloacochee-SR29 WBID=3261C Station=21FLGW14168

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	1.10	1.10	1.10	1.10	1.10	1.10	0
Color, PCU	1	30.00	30.00	30.00	30.00	30.00	30.00	0
Conductivity, umhos/cm	1	582.00	582.00	582.00	582.00	582.00	582.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	4.87	4.87	4.87	4.87	4.87	4.87	100
Fecal Coliform, #/100ml	1	6.00	6.00	6.00	6.00	6.00	6.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.71	0.71	0.71	0.71	0.71	0.71	100
Total Kjeldahl Nitrogen, mg/l	1	0.70	0.70	0.70	0.70	0.70	0.70	.
Total Nitrogen, mg/l	1	0.72	0.72	0.72	0.72	0.72	0.72	0
Orthophosphate as P, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	1	0.03	0.03	0.03	0.03	0.03	0.03	0
Total Suspended Solids, mg/l	1	4.00	4.00	4.00	4.00	4.00	4.00	0
Turbidity, NTU	1	1.00	1.00	1.00	1.00	1.00	1.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Okaloacochee-SR29 WBID=3261C Station=21FLGW21744

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	47.00	47.00	47.00	47.00	47.00	47.00	100
Color, PCU	1	40.00	40.00	40.00	40.00	40.00	40.00	0
Conductivity, umhos/cm	1	606.00	606.00	606.00	606.00	606.00	606.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	7.84	7.84	7.84	7.84	7.84	7.84	0
Fecal Coliform, #/100ml	1	5.00	5.00	5.00	5.00	5.00	5.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	1.01	1.01	1.01	1.01	1.01	1.01	0
Total Kjeldahl Nitrogen, mg/l	1	1.00	1.00	1.00	1.00	1.00	1.00	.
Total Nitrogen, mg/l	1	1.00	1.00	1.00	1.00	1.00	1.00	0
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.04	0.04	0.04	0.04	0.04	0.04	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	6.50	6.50	6.50	6.50	6.50	6.50	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Okaloacochee-SR29 WBID=3261C Station=21FLGW21748

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	30.00	30.00	30.00	30.00	30.00	30.00	100
Color, PCU	1	50.00	50.00	50.00	50.00	50.00	50.00	0
Conductivity, umhos/cm	1	564.00	564.00	564.00	564.00	564.00	564.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	4.36	4.36	4.36	4.36	4.36	4.36	100
Fecal Coliform, #/100ml	1	53.00	53.00	53.00	53.00	53.00	53.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	1.03	1.03	1.03	1.03	1.03	1.03	0
Total Kjeldahl Nitrogen, mg/l	1	0.98	0.98	0.98	0.98	0.98	0.98	.
Total Nitrogen, mg/l	1	0.99	0.99	0.99	0.99	0.99	0.99	0
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.08	0.08	0.08	0.08	0.08	0.08	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	5.00	5.00	5.00	5.00	5.00	5.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Okaloacochee-SR29 WBID=3261C Station=21FLSFWMBC24

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	19	1.60	2.00	2.18	2.00	2.00	5.00	.
Chlorophyll-a, ug/l	74	3.00	3.00	7.89	3.10	9.60	33.10	14.86
Color, PCU	69	30.00	80.00	104.06	100.00	120.00	350.00	34.78
Conductivity, umhos/cm	73	253.00	361.00	498.72	479.00	638.00	792.00	.
Copper, ug/l	25	0.30	0.57	1.17	1.00	1.08	4.30	0.00
Dissolved Oxygen, mg/l	75	0.78	1.72	2.87	2.52	3.34	7.46	86.67
Fecal Coliform, #/100ml	62	1.00	19.00	194.61	46.00	220.00	3050.00	9.68
Iron, ug/l	24	120.00	235.00	685.42	340.00	1240.00	1910.00	33.33
Nitrate-Nitrite, mg/l	73	0.01	0.01	0.04	0.03	0.05	0.37	.
Salinity, ppt	74	0.00	0.17	0.23	0.22	0.31	0.38	.
Secchi Depth, m	71	0.30	0.70	1.05	1.10	1.30	1.90	39.44
Total Kjeldahl Nitrogen, mg/l	65	0.12	0.87	1.10	1.00	1.30	3.31	.
Total Nitrogen, mg/l	65	0.01	0.70	0.93	1.00	1.26	2.44	9.23
Orthophosphate as P, mg/l	59	0.00	0.01	0.02	0.02	0.03	0.08	.
Total Phosphorus, mg/l	69	0.01	0.04	0.06	0.05	0.07	0.47	1.45
Total Suspended Solids, mg/l	60	2.00	2.00	3.02	2.00	2.00	18.00	6.67
Turbidity, NTU	47	0.40	0.90	2.33	1.40	3.90	7.90	.
Unionized Ammonia, mg/l	62	0.00	0.00	0.00	0.00	0.00	0.01	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Okaloacochee-SR29 WBID=3278T Station=21FLGW11114

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	31.00	31.00	31.00	31.00	31.00	31.00	100
Color, PCU	1	60.00	60.00	60.00	60.00	60.00	60.00	0
Conductivity, umhos/cm	1	296.50	296.50	296.50	296.50	296.50	296.50	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	4.18	4.18	4.18	4.18	4.18	4.18	100
Fecal Coliform, #/100ml	1	12.00	12.00	12.00	12.00	12.00	12.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.55	0.55	0.55	0.55	0.55	0.55	100
Total Kjeldahl Nitrogen, mg/l	1	1.70	1.70	1.70	1.70	1.70	1.70	.
Total Nitrogen, mg/l	1	1.71	1.71	1.71	1.71	1.71	1.71	100
Orthophosphate as P, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Total Phosphorus, mg/l	1	0.10	0.10	0.10	0.10	0.10	0.10	0
Total Suspended Solids, mg/l	1	9.00	9.00	9.00	9.00	9.00	9.00	100
Turbidity, NTU	1	6.00	6.00	6.00	6.00	6.00	6.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Okaloacochee-SR29 WBID=3278T Station=21FLGW14167

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	1.20	1.20	1.20	1.20	1.20	1.20	0
Color, PCU	1	100.00	100.00	100.00	100.00	100.00	100.00	0
Conductivity, umhos/cm	1	702.50	702.50	702.50	702.50	702.50	702.50	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	1.67	1.67	1.67	1.67	1.67	1.67	100
Fecal Coliform, #/100ml	1	20.00	20.00	20.00	20.00	20.00	20.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.57	0.57	0.57	0.57	0.57	0.57	100
Total Kjeldahl Nitrogen, mg/l	1	1.00	1.00	1.00	1.00	1.00	1.00	.
Total Nitrogen, mg/l	1	1.02	1.02	1.02	1.02	1.02	1.02	0
Orthophosphate as P, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	1	0.12	0.12	0.12	0.12	0.12	0.12	0
Total Suspended Solids, mg/l	1	9.00	9.00	9.00	9.00	9.00	9.00	100
Turbidity, NTU	1	14.00	14.00	14.00	14.00	14.00	14.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Okaloacochee-SR29 WBID=3278T Station=A01_Nbear

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	33	234.00	326.00	375.63	366.00	429.00	549.00	.
Copper, ug/l	21	1.20	1.20	1.82	1.31	2.00	6.29	0
Dissolved Oxygen, mg/l	32	0.18	0.55	1.12	0.65	2.01	3.50	100
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	33	0.00	0.00	0.01	0.01	0.01	0.02	.
Salinity, ppt	1	0.30	0.30	0.30	0.30	0.30	0.30	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	34	0.77	1.12	1.60	1.36	1.61	7.46	.
Total Nitrogen, mg/l	32	0.77	1.11	1.62	1.36	1.61	7.47	25
Orthophosphate as P, mg/l	34	0.00	0.00	0.01	0.00	0.01	0.06	.
Total Phosphorus, mg/l	35	0.01	0.01	0.03	0.02	0.03	0.17	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	32	0.00	0.00	0.00	0.00	0.00	0.00	0

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Okaloacochee-SR29 WBID=3278T Station=BCAP1

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	3	348.80	348.80	417.2	415.3	487.50	487.50	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	2	0.78	0.78	0.9	0.9	1.01	1.01	100
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Okaloacochee-SR29 WBID=3278T Station=OKALA858

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	19	2.00	2.00	2.42	2.00	2.60	5.10	.
Chlorophyll-a, ug/l	76	3.00	3.00	13.23	5.60	18.75	69.40	25.00
Color, PCU	70	80.00	120.00	156.71	150.00	180.00	450.00	78.57
Conductivity, umhos/cm	75	103.00	370.00	523.05	511.00	656.00	905.00	.
Copper, ug/l	25	0.15	1.00	1.20	1.00	1.50	2.87	0.00
Dissolved Oxygen, mg/l	76	0.12	0.78	2.70	1.85	4.25	8.60	81.58
Fecal Coliform, #/100ml	65	1.00	29.00	165.31	52.00	124.00	2280.00	9.23
Iron, ug/l	24	0.12	125.00	285.42	175.00	275.00	1210.00	4.17
Nitrate-Nitrite, mg/l	73	0.00	0.01	0.02	0.01	0.02	0.11	.
Salinity, ppt	76	0.00	0.18	0.25	0.25	0.32	0.45	.
Secchi Depth, m	75	0.10	0.65	0.96	0.90	1.20	2.00	56.00
Total Kjeldahl Nitrogen, mg/l	67	0.04	1.20	2.23	1.70	2.10	35.35	.
Total Nitrogen, mg/l	67	0.01	0.88	1.94	1.50	2.10	35.35	46.27
Orthophosphate as P, mg/l	58	0.00	0.02	0.04	0.02	0.05	0.31	.
Total Phosphorus, mg/l	70	0.01	0.04	0.10	0.07	0.13	0.42	7.14
Total Suspended Solids, mg/l	62	2.00	2.00	6.90	2.00	3.00	174.00	12.90
Turbidity, NTU	47	0.30	0.60	1.62	1.00	2.30	7.90	.
Unionized Ammonia, mg/l	61	0.00	0.00	0.01	0.00	0.00	0.32	3.28

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Okaloacochee-SR29 WBID=3278W Station=21FLGW13713

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	0.85	0.85	0.85	0.85	0.85	0.85	0
Color, PCU	1	0.00	0.00	0.00	0.00	0.00	0.00	0
Conductivity, umhos/cm	1	281.00	281.00	281.00	281.00	281.00	281.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	8.54	8.54	8.54	8.54	8.54	8.54	0
Fecal Coliform, #/100ml	1	1.00	1.00	1.00	1.00	1.00	1.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	4.30	4.30	4.30	4.30	4.30	4.30	0
Total Kjeldahl Nitrogen, mg/l	1	0.50	0.50	0.50	0.50	0.50	0.50	.
Total Nitrogen, mg/l	1	0.50	0.50	0.50	0.50	0.50	0.50	0
Orthophosphate as P, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	0
Total Suspended Solids, mg/l	1	4.00	4.00	4.00	4.00	4.00	4.00	0
Turbidity, NTU	1	0.60	0.60	0.60	0.60	0.60	0.60	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Okaloacochee-SR29 WBID=3278W Station=21FLGW14159

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	43.00	43.00	43.00	43.00	43.00	43.00	100
Color, PCU	1	120.00	120.00	120.00	120.00	120.00	120.00	100
Conductivity, umhos/cm	1	570.00	570.00	570.00	570.00	570.00	570.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	9.32	9.32	9.32	9.32	9.32	9.32	0
Fecal Coliform, #/100ml	1	8.00	8.00	8.00	8.00	8.00	8.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.30	0.30	0.30	0.30	0.30	0.30	100
Total Kjeldahl Nitrogen, mg/l	1	1.70	1.70	1.70	1.70	1.70	1.70	.
Total Nitrogen, mg/l	1	1.72	1.72	1.72	1.72	1.72	1.72	100
Orthophosphate as P, mg/l	1	0.06	0.06	0.06	0.06	0.06	0.06	.
Total Phosphorus, mg/l	1	0.27	0.27	0.27	0.27	0.27	0.27	100
Total Suspended Solids, mg/l	1	32.00	32.00	32.00	32.00	32.00	32.00	100
Turbidity, NTU	1	18.00	18.00	18.00	18.00	18.00	18.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009
Source = Discharge

Subbasin=Okaloacochee-SR29 WBID=3278W Station=21FLGW15184

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	0.85	0.85	0.85	0.85	0.85	0.85	0
Color, PCU	1	30.00	30.00	30.00	30.00	30.00	30.00	0
Conductivity, umhos/cm	1	355.00	355.00	355.00	355.00	355.00	355.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	5.47	5.47	5.47	5.47	5.47	5.47	0
Fecal Coliform, #/100ml	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	1.50	1.50	1.50	1.50	1.50	1.50	0
Total Kjeldahl Nitrogen, mg/l	1	0.64	0.64	0.64	0.64	0.64	0.64	.
Total Nitrogen, mg/l	1	0.64	0.64	0.64	0.64	0.64	0.64	0
Orthophosphate as P, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	0
Total Suspended Solids, mg/l	1	4.00	4.00	4.00	4.00	4.00	4.00	0
Turbidity, NTU	1	0.45	0.45	0.45	0.45	0.45	0.45	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Okaloacochee-SR29 WBID=3278W Station=21FLSFWMIMKBRN

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	10	2.00	2.00	2.04	2.00	2.00	2.40	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	31	20.00	150.00	166.77	160.00	200.00	300.00	87.10
Conductivity, umhos/cm	32	134.00	249.50	277.19	271.50	304.00	430.00	.
Copper, ug/l	30	1.20	3.40	6.18	4.84	6.70	19.07	20.00
Dissolved Oxygen, mg/l	31	1.92	3.23	4.33	4.04	5.02	8.89	74.19
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	21	0.01	0.21	0.55	0.42	0.65	1.67	.
Salinity, ppt	33	0.07	0.12	0.13	0.13	0.14	0.21	.
Secchi Depth, m	31	0.20	0.35	0.43	0.40	0.50	0.90	100.00
Total Kjeldahl Nitrogen, mg/l	29	0.85	1.50	1.81	1.65	2.20	3.87	.
Total Nitrogen, mg/l	26	0.03	1.31	2.01	1.87	2.85	4.54	61.54
Orthophosphate as P, mg/l	28	0.11	0.18	0.29	0.24	0.41	0.63	.
Total Phosphorus, mg/l	26	0.02	0.34	0.44	0.46	0.56	0.72	88.46
Total Suspended Solids, mg/l	32	2.00	2.00	5.88	3.50	8.00	28.00	28.13
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	29	0.00	0.00	0.00	0.00	0.00	0.01	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Rookery Bay WBID=3278V Station=21FLGW21745

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	88.00	88.00	88.00	88.00	88.00	88.00	100
Color, PCU	1	150.00	150.00	150.00	150.00	150.00	150.00	100
Conductivity, umhos/cm	1	675.00	675.00	675.00	675.00	675.00	675.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	1.26	1.26	1.26	1.26	1.26	1.26	100
Fecal Coliform, #/100ml	1	110.00	110.00	110.00	110.00	110.00	110.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.10	0.10	0.10	0.10	0.10	0.10	100
Total Kjeldahl Nitrogen, mg/l	1	4.40	4.40	4.40	4.40	4.40	4.40	.
Total Nitrogen, mg/l	1	4.41	4.41	4.41	4.41	4.41	4.41	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.63	0.63	0.63	0.63	0.63	0.63	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	60.00	60.00	60.00	60.00	60.00	60.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Rookery Bay WBID=3278V Station=21FLGW21747

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	9.80	9.80	9.80	9.80	9.80	9.80	0
Color, PCU	1	30.00	30.00	30.00	30.00	30.00	30.00	0
Conductivity, umhos/cm	1	655.00	655.00	655.00	655.00	655.00	655.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	7.54	7.54	7.54	7.54	7.54	7.54	0
Fecal Coliform, #/100ml	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.78	0.78	0.78	0.78	0.78	0.78	100
Total Kjeldahl Nitrogen, mg/l	1	1.40	1.40	1.40	1.40	1.40	1.40	.
Total Nitrogen, mg/l	1	1.40	1.40	1.40	1.40	1.40	1.40	0
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.03	0.03	0.03	0.03	0.03	0.03	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	5.10	5.10	5.10	5.10	5.10	5.10	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Rookery Bay WBID=3278V Station=21FLGW21757

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	45.00	45.00	45.00	45.00	45.00	45.00	100
Color, PCU	1	100.00	100.00	100.00	100.00	100.00	100.00	0
Conductivity, umhos/cm	1	7336.00	7336.00	7336.00	7336.00	7336.00	7336.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	6.53	6.53	6.53	6.53	6.53	6.53	0
Fecal Coliform, #/100ml	1	68.00	68.00	68.00	68.00	68.00	68.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.42	0.42	0.42	0.42	0.42	0.42	100
Total Kjeldahl Nitrogen, mg/l	1	2.00	2.00	2.00	2.00	2.00	2.00	.
Total Nitrogen, mg/l	1	2.00	2.00	2.00	2.00	2.00	2.00	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.50	0.50	0.50	0.50	0.50	0.50	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	8.70	8.70	8.70	8.70	8.70	8.70	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Rookery Bay WBID=3278V Station=21FLSFWMBC22

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	17	1.50	2.00	2.04	2.00	2.00	3.60	.
Chlorophyll-a, ug/l	74	3.00	3.00	4.90	3.00	4.80	22.40	1.35
Color, PCU	73	20.00	40.00	62.95	50.00	80.00	240.00	13.70
Conductivity, umhos/cm	72	283.00	936.50	1524.72	1027.50	1156.00	11100.00	.
Copper, ug/l	25	0.30	0.63	0.96	1.00	1.00	3.50	0.00
Dissolved Oxygen, mg/l	74	2.09	4.90	6.24	6.38	7.71	11.42	27.03
Fecal Coliform, #/100ml	66	1.00	2.00	67.62	11.50	74.00	667.00	4.55
Iron, ug/l	24	0.12	100.00	177.09	125.00	205.00	690.00	0.00
Nitrate-Nitrite, mg/l	70	0.00	0.01	0.03	0.01	0.04	0.15	.
Salinity, ppt	73	0.13	0.44	0.78	0.51	0.57	6.29	.
Secchi Depth, m	73	0.20	0.85	1.10	1.20	1.50	1.80	30.14
Total Kjeldahl Nitrogen, mg/l	65	0.24	0.52	0.66	0.62	0.73	1.80	.
Total Nitrogen, mg/l	66	0.01	0.44	0.59	0.64	0.77	1.80	1.52
Orthophosphate as P, mg/l	62	0.00	0.00	0.01	0.00	0.01	0.02	.
Total Phosphorus, mg/l	65	0.01	0.01	0.02	0.02	0.03	0.04	0.00
Total Suspended Solids, mg/l	63	2.00	2.00	3.98	2.00	2.00	56.00	6.35
Turbidity, NTU	45	0.40	0.70	1.25	0.90	1.80	3.30	.
Unionized Ammonia, mg/l	65	0.00	0.00	0.00	0.00	0.00	0.01	0.00

Summary Statistics for Specified Subbasin, WBID and Station for Parameters of Interest, 2000-2009 Source = Discharge

Subbasin=Rookery Bay WBID=3278Y Station=21FLSFWMLELY

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	18	0.78	2.00	2.14	2.00	2.00	4.70	.
Chlorophyll-a, ug/l	73	3.00	3.00	5.55	3.70	5.90	24.60	2.74
Color, PCU	71	20.00	40.00	51.97	50.00	60.00	120.00	1.41
Conductivity, umhos/cm	71	182.00	658.00	1605.73	732.00	787.00	24400.00	.
Copper, ug/l	25	0.30	1.18	5.70	2.10	3.60	54.00	4.00
Dissolved Oxygen, mg/l	73	1.41	3.55	4.93	4.98	5.99	8.83	50.68
Fecal Coliform, #/100ml	65	1.00	31.00	146.89	68.00	127.00	2600.00	7.69
Iron, ug/l	21	100.00	240.00	331.90	310.00	390.00	770.00	0.00
Nitrate-Nitrite, mg/l	69	0.01	0.01	0.05	0.04	0.07	0.25	.
Salinity, ppt	64	0.09	0.32	0.93	0.36	0.38	14.74	.
Secchi Depth, m	65	0.30	0.70	0.90	0.90	1.00	1.60	58.46
Total Kjeldahl Nitrogen, mg/l	64	0.24	0.56	0.74	0.65	0.80	4.30	.
Total Nitrogen, mg/l	66	0.01	0.39	0.67	0.69	0.86	4.30	3.03
Orthophosphate as P, mg/l	58	0.00	0.00	0.01	0.01	0.01	0.07	.
Total Phosphorus, mg/l	64	0.01	0.02	0.04	0.03	0.05	0.22	0.00
Total Suspended Solids, mg/l	59	2.00	2.00	3.12	2.00	3.00	14.00	5.08
Turbidity, NTU	43	0.60	1.30	2.04	1.80	2.40	7.50	.
Unionized Ammonia, mg/l	59	0.00	0.00	0.00	0.00	0.00	0.01	0.00

Appendix 4-D

Water Quality Monitoring
Estuarine Station Summary Statistics

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Cocohatchee-Corkscrew Station=21FLFTM 28030071FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	1	51414.00	51414.00	51414.00	51414.00	51414.00	51414.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	8.13	8.13	8.13	8.13	8.13	8.13	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	1	840.00	840.00	840.00	840.00	840.00	840.00	100
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	4.60	4.60	4.60	4.60	4.60	4.60	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Cocohatchee-Corkscrew Station=21FLFTM EVRGWC0024FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	5	1.40	1.40	2.06	2.10	2.60	2.80	.
Chlorophyll-a, ug/l	5	1.00	1.00	1.42	1.00	1.00	3.10	0.00
Color, PCU	5	50.00	60.00	84.00	70.00	80.00	160.00	20.00
Conductivity, umhos/cm	14	413.00	460.00	5831.21	568.50	1921.00	39863.00	.
Copper, ug/l	5	1.60	2.11	2.67	2.37	2.44	4.82	20.00
Dissolved Oxygen, mg/l	14	3.04	3.44	4.85	3.97	5.93	10.48	50.00
Fecal Coliform, #/100ml	14	16.00	68.00	217.71	130.00	174.00	1320.00	85.71
Iron, ug/l	5	209.00	215.00	269.20	219.00	311.00	392.00	40.00
Nitrate-Nitrite, mg/l	5	0.01	0.04	0.10	0.09	0.09	0.27	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	13	0.50	0.80	0.92	1.00	1.00	1.40	38.46
Total Kjeldahl Nitrogen, mg/l	5	1.00	1.00	1.08	1.10	1.10	1.20	.
Total Nitrogen, mg/l	5	1.01	1.09	1.18	1.14	1.19	1.47	0.00
Orthophosphate as P, mg/l	5	0.03	0.04	0.06	0.06	0.07	0.13	.
Total Phosphorus, mg/l	5	0.06	0.10	0.12	0.12	0.13	0.18	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	5	2.50	2.80	3.04	3.10	3.20	3.60	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Cocohatchee-Corkscrew Station=21FLFTM EVRGWC0026FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	5	1.10	1.10	2.00	1.20	2.40	4.20	.
Chlorophyll-a, ug/l	5	1.00	1.00	1.00	1.00	1.00	1.00	0
Color, PCU	5	15.00	20.00	39.00	30.00	30.00	100.00	0
Conductivity, umhos/cm	5	8620.00	39445.00	37282.00	43709.00	44756.00	49880.00	.
Copper, ug/l	5	1.40	2.23	2.43	2.39	2.92	3.22	0
Dissolved Oxygen, mg/l	5	3.57	4.94	7.19	7.53	8.93	10.98	20
Fecal Coliform, #/100ml	5	1.00	1.00	22.60	1.00	50.00	60.00	40
Iron, ug/l	5	35.00	54.00	116.00	58.00	102.00	331.00	20
Nitrate-Nitrite, mg/l	5	0.01	0.01	0.05	0.06	0.08	0.08	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	5	1.00	1.40	1.76	1.40	1.50	3.50	0
Total Kjeldahl Nitrogen, mg/l	5	0.72	0.77	0.80	0.79	0.82	0.90	.
Total Nitrogen, mg/l	5	0.73	0.80	0.85	0.83	0.90	0.98	0
Orthophosphate as P, mg/l	5	0.02	0.02	0.02	0.03	0.03	0.03	.
Total Phosphorus, mg/l	5	0.03	0.04	0.05	0.04	0.06	0.06	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	5	2.80	2.90	3.38	3.10	3.60	4.50	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Cocohatchee-Corkscrew Station=21FLFTM EVRGWC0041FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	4	1.60	1.75	2.90	2.00	4.05	6.00	.
Chlorophyll-a, ug/l	4	1.00	1.00	6.00	3.00	11.00	17.00	25
Color, PCU	4	30.00	30.00	32.50	30.00	35.00	40.00	0
Conductivity, umhos/cm	4	48337.00	48407.00	49585.75	49188.00	50764.50	51630.00	.
Copper, ug/l	4	1.04	1.24	1.43	1.52	1.62	1.63	0
Dissolved Oxygen, mg/l	4	5.22	5.45	6.20	5.73	6.95	8.12	0
Fecal Coliform, #/100ml	4	1.00	1.00	4.00	2.50	7.00	10.00	0
Iron, ug/l	4	98.00	109.00	171.75	156.00	234.50	277.00	0
Nitrate-Nitrite, mg/l	4	0.00	0.00	0.01	0.01	0.01	0.02	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	4	0.15	0.43	1.16	1.25	1.90	2.00	50
Total Kjeldahl Nitrogen, mg/l	4	0.64	0.75	0.85	0.87	0.94	1.00	.
Total Nitrogen, mg/l	4	0.65	0.76	0.85	0.88	0.95	1.00	0
Orthophosphate as P, mg/l	3	0.01	0.01	0.01	0.01	0.02	0.02	.
Total Phosphorus, mg/l	4	0.04	0.04	0.06	0.05	0.08	0.10	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	4	4.40	5.45	6.88	7.10	8.30	8.90	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Cocohatchee-Corkscrew Station=21FLFTM EVRGWC0042FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	4	1.60	1.85	2.08	2.15	2.30	2.40	.
Chlorophyll-a, ug/l	4	1.00	1.00	2.15	1.00	3.30	5.60	0
Color, PCU	4	30.00	30.00	30.00	30.00	30.00	30.00	0
Conductivity, umhos/cm	4	47367.00	47700.00	48719.25	48230.50	49738.50	51049.00	.
Copper, ug/l	4	1.80	1.86	2.17	1.97	2.48	2.93	0
Dissolved Oxygen, mg/l	4	5.82	6.48	6.94	7.21	7.41	7.53	0
Fecal Coliform, #/100ml	4	1.00	1.00	5.50	5.50	10.00	10.00	0
Iron, ug/l	4	88.00	104.00	156.75	155.50	209.50	228.00	0
Nitrate-Nitrite, mg/l	4	0.00	0.00	0.02	0.01	0.03	0.03	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	1.10	1.10	1.53	1.50	2.00	2.00	0
Total Kjeldahl Nitrogen, mg/l	4	0.61	0.75	0.85	0.92	0.96	0.96	.
Total Nitrogen, mg/l	4	0.63	0.76	0.87	0.93	0.97	0.98	0
Orthophosphate as P, mg/l	3	0.00	0.00	0.01	0.01	0.02	0.02	.
Total Phosphorus, mg/l	4	0.03	0.03	0.05	0.04	0.06	0.07	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	4	3.40	3.90	4.68	4.90	5.45	5.50	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Cocohatchee-Corkscrew Station=21FLFTM EVRGWC0081FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	28	788.0	29697.50	34137.07	35523.00	46115.00	52568.0	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	28	1.3	3.08	3.99	3.89	4.74	6.7	50.00
Fecal Coliform, #/100ml	27	18.0	99.00	183.67	132.00	280.00	654.0	92.59
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	26	0.4	0.80	0.97	1.00	1.20	1.4	38.46
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Cocohatchee-Corkscrew Station=21FLSFWMROOK467

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	59	1.00	2.80	5.34	4.30	6.60	17.40	8.47
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	63	2.60	4.00	5.14	4.90	5.70	19.40	20.63
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	60	0.00	0.01	1.69	0.01	0.07	99.00	.
Salinity, ppt	63	0.00	21.15	28.58	31.30	35.50	66.85	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	48	0.19	0.33	0.46	0.43	0.52	1.11	0.00
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	60	0.02	0.04	0.05	0.05	0.06	0.09	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	60	0.30	3.50	4.98	4.40	5.50	18.10	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Cocohatchee-Corkscrew Station=28030009

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	37	3549.00	27331.00	39768.32	48984.00	53609.00	57059.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	37	3.04	4.26	5.75	6.02	6.67	9.48	16.22
Fecal Coliform, #/100ml	35	3.00	34.00	358.71	93.00	370.00	5700.00	74.29
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	37	0.40	0.50	0.78	0.80	1.00	2.00	70.27
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Cocohatchee-Corkscrew Station=28030036

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	5	1.20	1.40	1.98	2.00	2.60	2.70	.
Chlorophyll-a, ug/l	5	1.00	1.00	1.18	1.00	1.00	1.90	0.00
Color, PCU	5	50.00	50.00	70.00	50.00	80.00	120.00	20.00
Conductivity, umhos/cm	42	457.00	2114.00	26663.40	33913.50	44772.00	50987.00	.
Copper, ug/l	5	1.30	2.24	3.54	3.08	3.47	7.60	20.00
Dissolved Oxygen, mg/l	42	1.66	3.52	4.42	4.19	5.44	8.15	40.48
Fecal Coliform, #/100ml	41	8.00	81.00	329.95	140.00	350.00	3000.00	90.24
Iron, ug/l	5	135.00	152.00	241.20	193.00	237.00	489.00	20.00
Nitrate-Nitrite, mg/l	5	0.00	0.04	0.11	0.10	0.14	0.25	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	42	0.20	0.50	0.60	0.50	0.80	1.00	83.33
Total Kjeldahl Nitrogen, mg/l	5	0.89	0.90	1.00	0.99	1.00	1.20	.
Total Nitrogen, mg/l	5	0.89	1.00	1.10	1.03	1.14	1.45	0.00
Orthophosphate as P, mg/l	5	0.03	0.04	0.05	0.04	0.04	0.09	.
Total Phosphorus, mg/l	5	0.07	0.08	0.09	0.09	0.09	0.13	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	5	2.50	2.90	3.54	3.00	4.20	5.10	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Cocohatchee-Corkscrew Station=BFBSP

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	13	2.00	2.00	2.08	2.00	2.00	3.10	.
Chlorophyll-a, ug/l	13	3.00	3.00	3.14	3.00	3.00	4.80	0.00
Color, PCU	13	5.00	5.00	22.69	15.00	30.00	80.00	0.00
Conductivity, umhos/cm	13	24204.00	44414.00	49127.15	52846.00	54312.00	56347.50	.
Copper, ug/l	5	0.96	1.18	1.32	1.20	1.40	1.86	0.00
Dissolved Oxygen, mg/l	12	3.24	3.64	5.35	5.55	6.82	7.45	33.33
Fecal Coliform, #/100ml	13	1.00	1.00	14.00	9.00	21.00	42.00	0.00
Iron, ug/l	5	100.00	180.00	242.00	230.00	320.00	380.00	40.00
Nitrate-Nitrite, mg/l	13	0.00	0.02	0.03	0.02	0.04	0.05	.
Salinity, ppt	13	14.74	28.75	32.15	34.90	35.88	37.44	.
Secchi Depth, m	13	0.50	1.00	1.07	1.00	1.20	1.50	15.38
Total Kjeldahl Nitrogen, mg/l	13	0.08	0.32	0.56	0.53	0.66	1.23	.
Total Nitrogen, mg/l	9	0.08	0.30	0.58	0.57	0.77	1.27	0.00
Orthophosphate as P, mg/l	13	0.00	0.01	0.01	0.01	0.01	0.02	.
Total Phosphorus, mg/l	13	0.02	0.02	0.02	0.03	0.03	0.03	0.00
Total Suspended Solids, mg/l	13	2.00	5.00	16.38	15.00	18.00	62.00	69.23
Turbidity, NTU	13	1.00	1.20	1.55	1.50	1.70	3.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Cocohatchee-Corkscrew Station=COCEOF31

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	12	1.40	1.75	2.83	1.95	2.40	8.10	.
Chlorophyll-a, ug/l	54	1.00	3.00	5.93	3.00	4.80	70.00	9.26
Color, PCU	53	30.00	50.00	74.45	60.00	80.00	200.00	16.98
Conductivity, umhos/cm	65	305.00	519.00	4888.02	725.00	901.00	39503.00	.
Copper, ug/l	19	1.00	1.10	1.66	1.50	2.25	2.60	0.00
Dissolved Oxygen, mg/l	65	0.93	3.54	5.46	5.03	7.48	11.33	30.77
Fecal Coliform, #/100ml	48	8.00	19.00	232.54	71.00	143.00	2100.00	62.50
Iron, ug/l	15	120.00	214.00	442.53	410.00	620.00	840.00	66.67
Nitrate-Nitrite, mg/l	57	0.00	0.02	0.06	0.05	0.08	0.19	.
Salinity, ppt	40	0.18	0.26	0.33	0.33	0.42	0.45	.
Secchi Depth, m	57	0.10	0.85	1.11	1.10	1.50	1.80	29.82
Total Kjeldahl Nitrogen, mg/l	54	0.28	0.66	0.81	0.81	0.90	2.00	.
Total Nitrogen, mg/l	57	0.05	0.74	0.87	0.86	0.99	2.09	1.75
Orthophosphate as P, mg/l	29	0.00	0.01	0.01	0.01	0.01	0.02	.
Total Phosphorus, mg/l	54	0.01	0.02	0.04	0.02	0.04	0.31	1.85
Total Suspended Solids, mg/l	26	2.00	2.00	2.08	2.00	2.00	4.00	0.00
Turbidity, NTU	53	0.60	1.60	2.74	2.10	2.60	15.00	.
Unionized Ammonia, mg/l	34	0.00	0.00	0.00	0.00	0.00	0.00	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Cocohatchee-Corkscrew Station=COCOR1

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	13	2.00	2.00	2.01	2.00	2.00	2.10	.
Chlorophyll-a, ug/l	13	3.00	3.00	3.05	3.00	3.00	3.70	0.00
Color, PCU	13	5.00	5.00	17.69	15.00	20.00	80.00	0.00
Conductivity, umhos/cm	13	20705.00	48701.00	50211.69	52970.00	54595.00	55975.00	.
Copper, ug/l	5	1.12	1.28	1.76	1.44	1.92	3.02	0.00
Dissolved Oxygen, mg/l	12	4.70	5.29	6.14	5.94	6.87	8.34	0.00
Fecal Coliform, #/100ml	13	1.00	1.00	8.00	3.00	8.00	48.00	7.69
Iron, ug/l	5	120.00	240.00	276.00	310.00	320.00	390.00	60.00
Nitrate-Nitrite, mg/l	13	0.00	0.02	0.03	0.02	0.03	0.14	.
Salinity, ppt	13	12.43	31.63	32.96	35.00	36.18	37.14	.
Secchi Depth, m	13	0.50	0.50	0.81	1.00	1.00	1.02	38.46
Total Kjeldahl Nitrogen, mg/l	13	0.08	0.38	0.54	0.51	0.66	1.16	.
Total Nitrogen, mg/l	9	0.08	0.08	0.52	0.55	0.70	1.20	0.00
Orthophosphate as P, mg/l	13	0.00	0.01	0.01	0.01	0.01	0.02	.
Total Phosphorus, mg/l	13	0.01	0.02	0.03	0.03	0.03	0.04	0.00
Total Suspended Solids, mg/l	13	2.00	15.00	16.85	16.00	19.00	28.00	92.31
Turbidity, NTU	13	0.30	1.50	2.19	2.20	2.70	4.30	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Cocohatchee-Corkscrew Station=COCOR2

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	13	2.00	2.00	2.00	2.00	2.00	2.00	.
Chlorophyll-a, ug/l	13	3.00	3.00	3.42	3.00	3.00	5.30	0.00
Color, PCU	13	5.00	20.00	38.85	30.00	50.00	100.00	0.00
Conductivity, umhos/cm	13	7159.50	29183.00	38975.23	44445.50	52521.00	55505.00	.
Copper, ug/l	5	1.65	1.71	2.22	1.75	2.69	3.30	0.00
Dissolved Oxygen, mg/l	12	1.94	3.32	4.56	4.54	5.78	6.82	33.33
Fecal Coliform, #/100ml	13	2.00	7.00	31.77	32.00	40.00	107.00	23.08
Iron, ug/l	5	140.00	290.00	340.00	410.00	410.00	450.00	60.00
Nitrate-Nitrite, mg/l	13	0.00	0.03	0.05	0.04	0.07	0.17	.
Salinity, ppt	13	3.96	17.90	25.11	28.78	34.62	36.81	.
Secchi Depth, m	13	0.50	1.00	0.98	1.00	1.00	1.50	15.38
Total Kjeldahl Nitrogen, mg/l	13	0.08	0.58	0.71	0.76	0.97	1.23	.
Total Nitrogen, mg/l	9	0.08	0.62	0.79	0.81	1.20	1.25	0.00
Orthophosphate as P, mg/l	13	0.00	0.01	0.02	0.02	0.02	0.03	.
Total Phosphorus, mg/l	13	0.02	0.03	0.03	0.04	0.04	0.04	0.00
Total Suspended Solids, mg/l	13	2.00	4.00	11.85	10.00	18.00	26.00	53.85
Turbidity, NTU	13	1.40	1.90	2.28	2.10	2.40	3.90	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Cocohatchee-Corkscrew Station=COCORVW

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	12	2.00	2.00	2.05	2.00	2.00	2.60	.
Chlorophyll-a, ug/l	12	3.00	3.00	3.97	3.00	4.00	8.00	0.00
Color, PCU	12	20.00	30.00	63.33	45.00	90.00	200.00	8.33
Conductivity, umhos/cm	12	6089.00	18628.50	35942.67	45442.00	49910.00	52569.00	.
Copper, ug/l	4	2.08	2.13	2.60	2.52	3.07	3.28	0.00
Dissolved Oxygen, mg/l	11	0.40	2.15	3.71	3.79	5.11	6.45	54.55
Fecal Coliform, #/100ml	12	1.00	3.50	28.58	28.00	43.00	76.00	25.00
Iron, ug/l	4	220.00	295.00	410.00	415.00	525.00	590.00	75.00
Nitrate-Nitrite, mg/l	12	0.00	0.02	0.05	0.03	0.05	0.15	.
Salinity, ppt	12	3.29	11.01	23.02	29.33	32.57	34.60	.
Secchi Depth, m	12	0.50	1.00	0.94	1.00	1.00	1.20	16.67
Total Kjeldahl Nitrogen, mg/l	12	0.08	0.30	0.64	0.70	0.90	1.30	.
Total Nitrogen, mg/l	8	0.08	0.34	0.70	0.70	1.04	1.33	0.00
Orthophosphate as P, mg/l	12	0.00	0.01	0.01	0.01	0.02	0.03	.
Total Phosphorus, mg/l	12	0.00	0.02	0.03	0.03	0.04	0.04	0.00
Total Suspended Solids, mg/l	12	2.00	2.50	5.58	4.50	8.50	12.00	33.33
Turbidity, NTU	12	0.10	1.40	1.72	1.80	2.30	3.10	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Cocohatchee-Corkscrew Station=Canal@99thAve

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	4	1.00	1.45	2.75	2.45	4.05	5.10	.
Chlorophyll-a, ug/l	4	1.00	3.30	7.65	7.80	12.00	14.00	25
Color, PCU	4	30.00	30.00	35.00	30.00	40.00	50.00	0
Conductivity, umhos/cm	4	47460.00	47910.50	49179.50	48872.00	50448.50	51514.00	.
Copper, ug/l	4	1.42	1.51	2.28	1.95	3.05	3.79	25
Dissolved Oxygen, mg/l	4	5.42	5.87	6.18	6.38	6.49	6.54	0
Fecal Coliform, #/100ml	4	1.00	1.00	1.00	1.00	1.00	1.00	0
Iron, ug/l	4	77.00	132.50	223.50	193.50	314.50	430.00	25
Nitrate-Nitrite, mg/l	4	0.00	0.01	0.01	0.01	0.02	0.02	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	0.20	0.20	0.30	0.20	0.50	0.50	100
Total Kjeldahl Nitrogen, mg/l	4	0.66	0.71	0.82	0.84	0.92	0.92	.
Total Nitrogen, mg/l	4	0.67	0.73	0.83	0.85	0.93	0.93	0
Orthophosphate as P, mg/l	3	0.01	0.01	0.01	0.01	0.02	0.02	.
Total Phosphorus, mg/l	4	0.04	0.05	0.06	0.06	0.08	0.09	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	4	6.30	6.35	7.13	6.40	7.90	9.40	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Cocohatchee-Corkscrew Station=Coco @ Collier Reserve

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	9	407.0	454.00	627.78	508.00	616.00	1412.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	9	2.6	3.34	4.13	3.87	4.85	6.02	55.56
Fecal Coliform, #/100ml	9	32.0	76.00	197.67	135.00	183.00	740.00	88.89
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	9	0.5	0.70	0.79	0.80	1.00	1.10	66.67
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Cocohatchee-Corkscrew Station=Coco at SR 865

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	5	2.00	2.00	2.72	2.20	2.50	4.90	.
Chlorophyll-a, ug/l	5	1.00	1.00	1.32	1.00	1.00	2.60	0
Color, PCU	5	30.00	60.00	70.00	80.00	80.00	100.00	0
Conductivity, umhos/cm	5	43886.00	45305.00	47283.80	46721.00	49383.00	51124.00	.
Copper, ug/l	5	0.51	0.68	0.91	0.82	1.19	1.34	0
Dissolved Oxygen, mg/l	5	0.06	0.89	3.52	2.23	6.30	8.10	60
Fecal Coliform, #/100ml	5	10.00	16.00	63.20	20.00	100.00	170.00	40
Iron, ug/l	5	94.00	95.00	182.60	158.00	270.00	296.00	0
Nitrate-Nitrite, mg/l	5	0.00	0.01	0.01	0.01	0.01	0.01	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	5	0.40	0.50	0.65	0.60	0.75	1.00	80
Total Kjeldahl Nitrogen, mg/l	5	0.91	1.00	1.10	1.10	1.20	1.30	.
Total Nitrogen, mg/l	5	0.92	1.01	1.11	1.11	1.20	1.31	0
Orthophosphate as P, mg/l	5	0.02	0.07	0.09	0.09	0.12	0.14	.
Total Phosphorus, mg/l	5	0.07	0.11	0.13	0.13	0.15	0.17	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	5	3.30	3.50	6.36	5.30	7.20	12.50	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Cocohatchee-Corkscrew Station=TURKBAY

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	13	2.00	2.00	2.02	2.00	2.00	2.30	.
Chlorophyll-a, ug/l	13	3.00	3.00	3.29	3.00	3.00	4.80	0.00
Color, PCU	13	5.00	5.00	12.69	10.00	20.00	25.00	0.00
Conductivity, umhos/cm	13	48033.00	51769.00	52939.92	53320.00	54489.00	56378.00	.
Copper, ug/l	5	1.12	1.22	1.31	1.30	1.43	1.46	0.00
Dissolved Oxygen, mg/l	12	4.98	6.14	6.78	6.57	7.38	9.03	0.00
Fecal Coliform, #/100ml	13	1.00	1.00	2.00	1.00	2.00	7.00	0.00
Iron, ug/l	5	100.00	200.00	244.00	240.00	340.00	340.00	40.00
Nitrate-Nitrite, mg/l	13	0.00	0.01	0.02	0.02	0.04	0.05	.
Salinity, ppt	13	31.29	34.11	34.87	35.26	36.10	37.47	.
Secchi Depth, m	13	0.50	1.00	1.04	1.00	1.00	1.50	15.38
Total Kjeldahl Nitrogen, mg/l	13	0.08	0.13	0.43	0.42	0.63	1.14	.
Total Nitrogen, mg/l	9	0.08	0.26	0.55	0.60	0.70	1.19	0.00
Orthophosphate as P, mg/l	13	0.00	0.01	0.01	0.01	0.01	0.02	.
Total Phosphorus, mg/l	13	0.02	0.02	0.03	0.02	0.03	0.04	0.00
Total Suspended Solids, mg/l	13	8.00	11.00	15.31	13.00	18.00	30.00	100.00
Turbidity, NTU	13	0.70	1.40	1.96	1.70	2.20	4.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=21FLBRA 3259G-B

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	2	2.00	2.00	2.00	2.00	2.00	2.00	.
Chlorophyll-a, ug/l	2	1.00	1.00	1.83	1.83	2.65	2.65	0
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	2	49440.00	49440.00	50850.00	50850.00	52260.00	52260.00	.
Copper, ug/l	2	4.80	4.80	8.65	8.65	12.50	12.50	100
Dissolved Oxygen, mg/l	2	4.46	4.46	4.90	4.90	5.34	5.34	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	2	125.00	125.00	160.00	160.00	195.00	195.00	0
Nitrate-Nitrite, mg/l	2	0.09	0.09	0.11	0.11	0.13	0.13	.
Salinity, ppt	2	32.42	32.42	33.39	33.39	34.35	34.35	.
Secchi Depth, m	2	0.20	0.20	0.20	0.20	0.20	0.20	100
Total Kjeldahl Nitrogen, mg/l	2	0.30	0.30	0.56	0.56	0.81	0.81	.
Total Nitrogen, mg/l	2	0.43	0.43	0.66	0.66	0.90	0.90	0
Orthophosphate as P, mg/l	2	0.05	0.05	0.06	0.06	0.07	0.07	.
Total Phosphorus, mg/l	2	0.05	0.05	0.08	0.08	0.12	0.12	0
Total Suspended Solids, mg/l	2	8.20	8.20	25.35	25.35	42.50	42.50	50
Turbidity, NTU	2	3.65	3.65	7.33	7.33	11.00	11.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=21FLBRA 3259G-C

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	1	2.00	2.00	2.00	2.00	2.00	2.00	.
Chlorophyll-a, ug/l	1	1.00	1.00	1.00	1.00	1.00	1.00	0
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	1	49550.00	49550.00	49550.00	49550.00	49550.00	49550.00	.
Copper, ug/l	1	4.80	4.80	4.80	4.80	4.80	4.80	100
Dissolved Oxygen, mg/l	1	4.55	4.55	4.55	4.55	4.55	4.55	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	1	68.00	68.00	68.00	68.00	68.00	68.00	0
Nitrate-Nitrite, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	.
Salinity, ppt	1	32.29	32.29	32.29	32.29	32.29	32.29	.
Secchi Depth, m	1	1.00	1.00	1.00	1.00	1.00	1.00	100
Total Kjeldahl Nitrogen, mg/l	1	0.31	0.31	0.31	0.31	0.31	0.31	.
Total Nitrogen, mg/l	1	0.33	0.33	0.33	0.33	0.33	0.33	0
Orthophosphate as P, mg/l	1	0.03	0.03	0.03	0.03	0.03	0.03	.
Total Phosphorus, mg/l	1	0.04	0.04	0.04	0.04	0.04	0.04	0
Total Suspended Solids, mg/l	1	22.00	22.00	22.00	22.00	22.00	22.00	100
Turbidity, NTU	1	1.50	1.50	1.50	1.50	1.50	1.50	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=21FLBRA 3259G-D

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	1	2.00	2.00	2.00	2.00	2.00	2.00	.
Chlorophyll-a, ug/l	1	1.00	1.00	1.00	1.00	1.00	1.00	0
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	1	53910.00	53910.00	53910.00	53910.00	53910.00	53910.00	.
Copper, ug/l	1	4.80	4.80	4.80	4.80	4.80	4.80	100
Dissolved Oxygen, mg/l	1	5.03	5.03	5.03	5.03	5.03	5.03	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	1	57.00	57.00	57.00	57.00	57.00	57.00	0
Nitrate-Nitrite, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	.
Salinity, ppt	1	35.48	35.48	35.48	35.48	35.48	35.48	.
Secchi Depth, m	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Total Kjeldahl Nitrogen, mg/l	1	0.23	0.23	0.23	0.23	0.23	0.23	.
Total Nitrogen, mg/l	1	0.25	0.25	0.25	0.25	0.25	0.25	0
Orthophosphate as P, mg/l	1	0.03	0.03	0.03	0.03	0.03	0.03	.
Total Phosphorus, mg/l	1	0.04	0.04	0.04	0.04	0.04	0.04	0
Total Suspended Solids, mg/l	1	26.00	26.00	26.00	26.00	26.00	26.00	100
Turbidity, NTU	1	0.94	0.94	0.94	0.94	0.94	0.94	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=21FLBRA 3259G-E

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	1	2.00	2.00	2.00	2.00	2.00	2.00	.
Chlorophyll-a, ug/l	1	1.00	1.00	1.00	1.00	1.00	1.00	0
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	1	54210.00	54210.00	54210.00	54210.00	54210.00	54210.00	.
Copper, ug/l	1	4.80	4.80	4.80	4.80	4.80	4.80	100
Dissolved Oxygen, mg/l	1	5.07	5.07	5.07	5.07	5.07	5.07	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	1	48.00	48.00	48.00	48.00	48.00	48.00	0
Nitrate-Nitrite, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	.
Salinity, ppt	1	35.71	35.71	35.71	35.71	35.71	35.71	.
Secchi Depth, m	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Total Kjeldahl Nitrogen, mg/l	1	0.25	0.25	0.25	0.25	0.25	0.25	.
Total Nitrogen, mg/l	1	0.27	0.27	0.27	0.27	0.27	0.27	0
Orthophosphate as P, mg/l	1	0.03	0.03	0.03	0.03	0.03	0.03	.
Total Phosphorus, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	0
Total Suspended Solids, mg/l	1	31.00	31.00	31.00	31.00	31.00	31.00	100
Turbidity, NTU	1	0.93	0.93	0.93	0.93	0.93	0.93	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=21FLFMRINTK200120

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	12.07	12.07	12.07	12.07	12.07	12.07	100
Color, PCU	1	154.50	154.50	154.50	154.50	154.50	154.50	100
Conductivity, umhos/cm	1	19900.00	19900.00	19900.00	19900.00	19900.00	19900.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	5.60	5.60	5.60	5.60	5.60	5.60	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.05	0.05	0.05	0.05	0.05	0.05	.
Salinity, ppt	1	11.60	11.60	11.60	11.60	11.60	11.60	.
Secchi Depth, m	1	1.10	1.10	1.10	1.10	1.10	1.10	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	1	0.77	0.77	0.77	0.77	0.77	0.77	0
Orthophosphate as P, mg/l	1	0.07	0.07	0.07	0.07	0.07	0.07	.
Total Phosphorus, mg/l	1	0.14	0.14	0.14	0.14	0.14	0.14	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	14.02	14.02	14.02	14.02	14.02	14.02	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=21FLFTM 28030069FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	3	16.20	16.20	38.97	26.40	74.30	74.30	100.00
Color, PCU	4	50.00	50.00	85.00	65.00	120.00	160.00	100.00
Conductivity, umhos/cm	6	449.00	488.00	598.17	575.50	667.00	834.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	5	2.84	2.88	4.83	4.11	6.04	8.27	40.00
Fecal Coliform, #/100ml	3	1200.00	1200.00	2933.33	3000.00	4600.00	4600.00	100.00
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	4	0.01	0.01	0.02	0.01	0.03	0.05	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	0.50	0.50	0.50	0.50	0.50	0.50	100.00
Total Kjeldahl Nitrogen, mg/l	3	0.67	0.67	1.08	0.88	1.70	1.70	.
Total Nitrogen, mg/l	3	0.72	0.72	1.11	0.89	1.71	1.71	33.33
Orthophosphate as P, mg/l	2	0.02	0.02	0.04	0.04	0.05	0.05	.
Total Phosphorus, mg/l	3	0.02	0.02	0.05	0.06	0.07	0.07	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	4	7.00	9.80	17.65	14.80	25.50	34.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=21FLFTM28030031

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	4	0.63	0.68	0.83	0.80	0.99	1.10	.
Chlorophyll-a, ug/l	6	0.85	0.85	1.76	0.85	0.85	6.30	0.00
Color, PCU	6	30.00	40.00	71.67	80.00	100.00	100.00	66.67
Conductivity, umhos/cm	6	579.00	816.00	14607.50	4582.00	30246.00	46840.00	.
Copper, ug/l	6	1.07	1.66	2.95	2.47	5.00	5.00	33.33
Dissolved Oxygen, mg/l	6	4.05	4.46	5.12	5.15	5.91	5.98	0.00
Fecal Coliform, #/100ml	6	28.00	40.00	158.00	105.00	130.00	540.00	66.67
Iron, ug/l	6	120.00	400.00	522.00	583.00	721.00	725.00	83.33
Nitrate-Nitrite, mg/l	6	0.01	0.01	0.10	0.12	0.14	0.20	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	4	1.20	1.25	1.30	1.30	1.35	1.40	75.00
Total Kjeldahl Nitrogen, mg/l	6	0.78	0.83	0.94	0.92	1.10	1.10	.
Total Nitrogen, mg/l	6	0.79	0.89	1.04	1.01	1.24	1.30	50.00
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	6	0.04	0.05	0.06	0.05	0.07	0.08	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	6	2.90	2.90	3.97	3.05	3.30	8.60	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=21FLGW14160

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	0.85	0.85	0.85	0.85	0.85	0.85	0
Color, PCU	1	100.00	100.00	100.00	100.00	100.00	100.00	100
Conductivity, umhos/cm	1	821.00	821.00	821.00	821.00	821.00	821.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	1.06	1.06	1.06	1.06	1.06	1.06	100
Fecal Coliform, #/100ml	1	4700.00	4700.00	4700.00	4700.00	4700.00	4700.00	100
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.16	0.16	0.16	0.16	0.16	0.16	100
Total Kjeldahl Nitrogen, mg/l	1	1.50	1.50	1.50	1.50	1.50	1.50	.
Total Nitrogen, mg/l	1	1.50	1.50	1.50	1.50	1.50	1.50	100
Orthophosphate as P, mg/l	1	0.06	0.06	0.06	0.06	0.06	0.06	.
Total Phosphorus, mg/l	1	0.21	0.21	0.21	0.21	0.21	0.21	100
Total Suspended Solids, mg/l	1	10.00	10.00	10.00	10.00	10.00	10.00	0
Turbidity, NTU	1	7.60	7.60	7.60	7.60	7.60	7.60	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=21FLGW21751

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	110.00	110.00	110.00	110.00	110.00	110.00	100
Color, PCU	1	80.00	80.00	80.00	80.00	80.00	80.00	100
Conductivity, umhos/cm	1	731.00	731.00	731.00	731.00	731.00	731.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	4.66	4.66	4.66	4.66	4.66	4.66	0
Fecal Coliform, #/100ml	1	240.00	240.00	240.00	240.00	240.00	240.00	100
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.39	0.39	0.39	0.39	0.39	0.39	100
Total Kjeldahl Nitrogen, mg/l	1	2.30	2.30	2.30	2.30	2.30	2.30	.
Total Nitrogen, mg/l	1	2.30	2.30	2.30	2.30	2.30	2.30	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.11	0.11	0.11	0.11	0.11	0.11	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	9.40	9.40	9.40	9.40	9.40	9.40	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=21FLGW22543

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	1.70	1.70	1.70	1.70	1.70	1.70	0
Color, PCU	1	60.00	60.00	60.00	60.00	60.00	60.00	100
Conductivity, umhos/cm	1	559.00	559.00	559.00	559.00	559.00	559.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	6.50	6.50	6.50	6.50	6.50	6.50	0
Fecal Coliform, #/100ml	1	40.00	40.00	40.00	40.00	40.00	40.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.12	0.12	0.12	0.12	0.12	0.12	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	1	0.78	0.78	0.78	0.78	0.78	0.78	.
Total Nitrogen, mg/l	1	0.90	0.90	0.90	0.90	0.90	0.90	0
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.03	0.03	0.03	0.03	0.03	0.03	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	1.80	1.80	1.80	1.80	1.80	1.80	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=21FLNAPLGORDJOE

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	22	0.78	2.00	2.38	2.00	2.70	5.30	.
Chlorophyll-a, ug/l	22	3.00	3.00	8.65	4.80	8.00	37.10	22.73
Color, PCU	22	5.00	25.00	58.41	40.00	80.00	200.00	45.45
Conductivity, umhos/cm	21	528.00	12914.00	30655.57	29709.00	50607.00	53580.00	.
Copper, ug/l	22	0.15	1.71	2.73	3.03	3.53	4.95	22.73
Dissolved Oxygen, mg/l	20	0.59	4.18	5.08	5.34	5.89	7.59	20.00
Fecal Coliform, #/100ml	22	1.00	10.00	31.41	17.50	36.00	170.00	22.73
Iron, ug/l	10	150.00	290.00	411.00	355.00	580.00	720.00	60.00
Nitrate-Nitrite, mg/l	22	0.01	0.03	0.07	0.04	0.10	0.19	.
Salinity, ppt	21	0.27	7.32	19.55	18.20	33.09	35.39	.
Secchi Depth, m	20	0.50	0.95	1.07	1.05	1.20	1.50	90.00
Total Kjeldahl Nitrogen, mg/l	22	0.04	0.50	0.72	0.79	0.89	1.53	.
Total Nitrogen, mg/l	22	0.04	0.57	0.78	0.83	1.03	1.56	27.27
Orthophosphate as P, mg/l	21	0.00	0.02	0.03	0.03	0.03	0.06	.
Total Phosphorus, mg/l	22	0.03	0.04	0.06	0.05	0.06	0.15	0.00
Total Suspended Solids, mg/l	21	2.00	5.00	10.38	8.00	11.00	32.00	19.05
Turbidity, NTU	22	1.10	1.80	2.14	2.10	2.30	3.50	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=21FLNAPLGORDPK

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	23	1.50	2.00	2.21	2.00	2.42	3.60	.
Chlorophyll-a, ug/l	23	3.00	3.00	5.53	4.80	7.50	12.30	13.04
Color, PCU	23	15.00	30.00	48.26	40.00	60.00	150.00	34.78
Conductivity, umhos/cm	23	640.00	5886.00	34531.24	46741.00	49700.00	53060.00	.
Copper, ug/l	22	0.15	2.40	2.84	2.79	3.48	5.50	13.64
Dissolved Oxygen, mg/l	22	3.03	4.51	5.61	5.66	6.46	8.47	18.18
Fecal Coliform, #/100ml	22	3.00	16.00	51.18	38.50	79.00	170.00	45.45
Iron, ug/l	9	370.00	400.00	581.67	490.00	730.00	980.00	100.00
Nitrate-Nitrite, mg/l	23	0.01	0.03	0.07	0.04	0.10	0.24	.
Salinity, ppt	23	0.33	3.30	22.29	30.11	32.58	35.10	.
Secchi Depth, m	20	0.30	0.85	0.94	1.00	1.20	1.40	95.00
Total Kjeldahl Nitrogen, mg/l	23	0.04	0.13	0.51	0.47	0.83	1.30	.
Total Nitrogen, mg/l	23	0.04	0.15	0.57	0.56	0.87	1.42	8.70
Orthophosphate as P, mg/l	23	0.00	0.02	0.03	0.02	0.03	0.06	.
Total Phosphorus, mg/l	23	0.00	0.04	0.05	0.06	0.06	0.10	0.00
Total Suspended Solids, mg/l	22	2.00	2.00	15.61	6.25	13.00	202.00	4.55
Turbidity, NTU	23	1.50	1.80	2.27	2.30	2.50	3.30	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=21FLNAPLNBAY13

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	23	0.78	2.00	2.07	2.00	2.00	3.60	.
Chlorophyll-a, ug/l	23	3.00	3.00	4.47	3.00	4.80	12.30	4.35
Color, PCU	23	5.00	10.00	16.52	10.00	20.00	50.00	8.70
Conductivity, umhos/cm	23	29092.00	46420.00	50678.57	54049.00	55300.00	57220.00	.
Copper, ug/l	22	0.51	1.55	2.32	1.92	2.29	10.10	9.09
Dissolved Oxygen, mg/l	22	4.94	6.04	6.30	6.41	6.79	7.12	0.00
Fecal Coliform, #/100ml	22	1.00	1.00	14.32	2.50	17.00	64.00	18.18
Iron, ug/l	9	75.00	340.00	465.00	490.00	590.00	740.00	77.78
Nitrate-Nitrite, mg/l	23	0.00	0.01	0.03	0.03	0.04	0.06	.
Salinity, ppt	23	18.09	30.14	33.34	35.81	36.68	38.17	.
Secchi Depth, m	22	0.60	1.00	1.22	1.25	1.50	1.70	59.09
Total Kjeldahl Nitrogen, mg/l	23	0.04	0.21	0.45	0.47	0.68	1.10	.
Total Nitrogen, mg/l	23	0.04	0.25	0.47	0.51	0.73	1.10	4.35
Orthophosphate as P, mg/l	23	0.00	0.00	0.01	0.01	0.01	0.04	.
Total Phosphorus, mg/l	23	0.00	0.02	0.03	0.03	0.04	0.05	0.00
Total Suspended Solids, mg/l	22	2.00	7.00	11.50	10.50	14.00	26.00	18.18
Turbidity, NTU	23	0.10	1.40	1.95	1.90	2.40	3.30	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=21FLNAPLNBAY29

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	21	0.78	2.00	2.71	2.00	2.00	12.00	.
Chlorophyll-a, ug/l	22	3.00	3.00	5.43	3.10	6.40	15.50	13.64
Color, PCU	21	5.00	15.00	27.86	20.00	20.00	100.00	19.05
Conductivity, umhos/cm	22	6909.00	45298.00	43605.68	52809.50	53741.00	56908.00	.
Copper, ug/l	22	1.72	2.54	3.17	3.13	3.60	4.70	13.64
Dissolved Oxygen, mg/l	21	2.61	5.28	6.06	6.13	6.88	8.17	4.76
Fecal Coliform, #/100ml	21	1.00	2.00	14.21	3.00	12.00	111.00	9.52
Iron, ug/l	9	240.00	350.00	493.33	390.00	660.00	760.00	88.89
Nitrate-Nitrite, mg/l	22	0.00	0.02	0.05	0.03	0.05	0.20	.
Salinity, ppt	22	3.86	29.39	28.52	34.84	35.60	37.95	.
Secchi Depth, m	22	0.80	1.00	1.11	1.10	1.30	1.60	90.91
Total Kjeldahl Nitrogen, mg/l	22	0.04	0.17	0.44	0.40	0.67	1.20	.
Total Nitrogen, mg/l	22	0.04	0.24	0.49	0.44	0.70	1.20	4.55
Orthophosphate as P, mg/l	22	0.00	0.01	0.02	0.02	0.03	0.04	.
Total Phosphorus, mg/l	22	0.02	0.03	0.04	0.04	0.05	0.07	0.00
Total Suspended Solids, mg/l	22	2.00	2.00	9.09	6.00	14.00	32.00	13.64
Turbidity, NTU	22	1.10	1.70	2.26	2.15	2.40	4.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=21FLNAPLNBAYBV

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	23	0.78	2.00	2.02	2.00	2.00	3.10	.
Chlorophyll-a, ug/l	23	3.00	3.00	4.44	3.00	3.20	14.40	8.70
Color, PCU	23	5.00	10.00	21.30	10.00	15.00	80.00	17.39
Conductivity, umhos/cm	23	16570.00	49163.00	48140.70	54092.00	55540.00	57171.00	.
Copper, ug/l	22	0.48	1.55	2.31	2.37	3.01	4.58	4.55
Dissolved Oxygen, mg/l	22	5.01	5.55	6.40	6.51	7.24	7.77	0.00
Fecal Coliform, #/100ml	22	1.00	1.00	13.68	4.00	13.00	138.00	4.55
Iron, ug/l	9	130.00	360.00	471.11	450.00	640.00	710.00	77.78
Nitrate-Nitrite, mg/l	23	0.01	0.02	0.04	0.04	0.05	0.11	.
Salinity, ppt	23	9.65	32.17	31.61	35.84	36.83	38.14	.
Secchi Depth, m	17	0.30	0.30	0.67	0.50	1.20	1.40	88.24
Total Kjeldahl Nitrogen, mg/l	23	0.04	0.15	0.45	0.59	0.68	0.81	.
Total Nitrogen, mg/l	23	0.04	0.25	0.49	0.64	0.72	0.90	0.00
Orthophosphate as P, mg/l	23	0.00	0.01	0.01	0.01	0.02	0.04	.
Total Phosphorus, mg/l	23	0.02	0.03	0.03	0.03	0.04	0.06	0.00
Total Suspended Solids, mg/l	22	2.00	6.00	11.23	9.50	14.00	40.00	18.18
Turbidity, NTU	23	1.10	1.60	2.30	2.10	3.10	4.10	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=21FLNAPLNBAYCC

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	23	0.78	2.00	2.26	2.00	2.30	5.30	.
Chlorophyll-a, ug/l	22	3.00	3.00	4.63	3.10	4.80	16.60	4.55
Color, PCU	23	5.00	20.00	39.57	30.00	60.00	120.00	30.43
Conductivity, umhos/cm	23	830.00	13001.00	39298.54	49804.00	52180.00	54829.00	.
Copper, ug/l	22	1.30	2.87	3.63	3.62	3.90	8.06	45.45
Dissolved Oxygen, mg/l	22	2.32	4.30	5.40	5.24	6.37	7.95	9.09
Fecal Coliform, #/100ml	22	1.00	11.00	32.45	18.00	34.00	140.00	22.73
Iron, ug/l	9	300.00	380.00	528.89	400.00	660.00	900.00	88.89
Nitrate-Nitrite, mg/l	23	0.01	0.04	0.06	0.05	0.08	0.15	.
Salinity, ppt	23	0.43	7.43	25.62	32.62	34.20	36.39	.
Secchi Depth, m	23	0.50	0.80	0.97	1.00	1.10	1.50	95.65
Total Kjeldahl Nitrogen, mg/l	23	0.04	0.15	0.48	0.39	0.85	1.22	.
Total Nitrogen, mg/l	23	0.04	0.19	0.54	0.43	0.91	1.30	8.70
Orthophosphate as P, mg/l	23	0.00	0.02	0.03	0.02	0.04	0.07	.
Total Phosphorus, mg/l	23	0.03	0.04	0.05	0.05	0.06	0.08	0.00
Total Suspended Solids, mg/l	22	2.00	5.00	11.32	8.00	17.00	36.00	22.73
Turbidity, NTU	23	1.40	2.20	2.50	2.40	2.90	4.80	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=21FLNAPLNBAYLLO

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	23	0.78	2.00	3.10	2.15	3.25	10.90	.
Chlorophyll-a, ug/l	23	3.00	3.00	10.04	3.00	6.90	95.20	21.74
Color, PCU	23	10.00	15.00	25.54	15.00	30.00	100.00	17.39
Conductivity, umhos/cm	23	19681.00	37676.00	47624.91	53350.00	54682.00	56844.00	.
Copper, ug/l	22	1.69	2.00	2.72	2.62	3.39	4.90	13.64
Dissolved Oxygen, mg/l	22	2.80	5.79	6.49	6.65	7.26	8.70	4.55
Fecal Coliform, #/100ml	22	1.00	1.00	28.09	7.00	22.00	168.50	13.64
Iron, ug/l	9	83.00	290.00	409.78	400.00	520.00	745.00	66.67
Nitrate-Nitrite, mg/l	23	0.01	0.01	0.03	0.03	0.04	0.05	.
Salinity, ppt	23	11.57	23.98	31.26	35.56	36.30	37.90	.
Secchi Depth, m	22	0.60	0.90	1.27	1.15	1.60	2.10	63.64
Total Kjeldahl Nitrogen, mg/l	23	0.04	0.26	0.44	0.40	0.70	0.88	.
Total Nitrogen, mg/l	23	0.04	0.29	0.47	0.41	0.72	0.92	0.00
Orthophosphate as P, mg/l	23	0.00	0.01	0.02	0.01	0.03	0.05	.
Total Phosphorus, mg/l	23	0.02	0.03	0.05	0.04	0.06	0.13	0.00
Total Suspended Solids, mg/l	22	2.00	5.00	10.52	9.25	15.00	23.50	13.64
Turbidity, NTU	23	0.90	1.55	2.13	1.80	2.40	5.90	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=21FLNAPLNBAYNL

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	23	0.78	2.00	2.18	2.00	2.30	4.50	.
Chlorophyll-a, ug/l	23	3.00	3.00	5.45	3.20	5.30	18.20	13.04
Color, PCU	23	10.00	20.00	35.22	20.00	50.00	120.00	26.09
Conductivity, umhos/cm	22	5859.00	28196.00	40985.95	49222.50	52070.00	54654.00	.
Copper, ug/l	22	2.88	3.95	4.44	4.44	4.93	6.08	86.36
Dissolved Oxygen, mg/l	22	4.54	5.54	6.35	6.20	6.78	8.58	0.00
Fecal Coliform, #/100ml	22	1.00	4.00	24.55	10.50	29.00	110.00	22.73
Iron, ug/l	9	230.00	370.00	502.22	420.00	640.00	830.00	88.89
Nitrate-Nitrite, mg/l	23	0.01	0.03	0.05	0.05	0.07	0.18	.
Salinity, ppt	22	3.17	17.30	26.66	32.28	34.31	36.19	.
Secchi Depth, m	20	0.30	0.80	0.98	0.95	1.10	1.60	90.00
Total Kjeldahl Nitrogen, mg/l	23	0.04	0.18	0.46	0.43	0.74	1.20	.
Total Nitrogen, mg/l	23	0.04	0.22	0.51	0.48	0.80	1.20	4.35
Orthophosphate as P, mg/l	23	0.00	0.02	0.03	0.02	0.03	0.05	.
Total Phosphorus, mg/l	23	0.01	0.04	0.05	0.04	0.06	0.08	0.00
Total Suspended Solids, mg/l	22	2.00	4.00	9.95	9.50	14.00	20.00	13.64
Turbidity, NTU	23	1.00	1.90	2.38	2.30	2.60	4.10	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=21FLSFWMBC1

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	20	1.50	2.00	2.06	2.00	2.00	3.50	.
Chlorophyll-a, ug/l	76	3.00	3.00	7.44	4.55	8.50	87.00	13.16
Color, PCU	75	5.00	30.00	44.07	40.00	60.00	120.00	40.00
Conductivity, umhos/cm	76	4032.00	22804.50	35414.92	41099.50	48693.50	56985.00	.
Copper, ug/l	24	1.00	2.05	3.58	3.58	4.40	9.60	37.50
Dissolved Oxygen, mg/l	75	1.18	4.59	5.81	5.81	6.92	9.43	12.00
Fecal Coliform, #/100ml	64	1.00	8.00	217.42	59.00	200.00	3600.00	57.81
Iron, ug/l	23	100.00	360.00	503.48	440.00	630.00	1180.00	86.96
Nitrate-Nitrite, mg/l	68	0.01	0.02	0.05	0.03	0.08	0.14	.
Salinity, ppt	69	2.24	13.63	22.05	25.95	30.67	35.95	.
Secchi Depth, m	74	0.40	0.90	1.14	1.13	1.40	1.85	72.97
Total Kjeldahl Nitrogen, mg/l	63	0.06	0.35	0.56	0.53	0.69	1.91	.
Total Nitrogen, mg/l	61	0.02	0.24	0.52	0.47	0.70	2.00	6.56
Orthophosphate as P, mg/l	59	0.00	0.01	0.02	0.02	0.03	0.06	.
Total Phosphorus, mg/l	73	0.02	0.03	0.04	0.04	0.04	0.11	0.00
Total Suspended Solids, mg/l	54	2.00	2.00	11.46	3.00	11.00	118.00	14.81
Turbidity, NTU	47	1.30	2.00	2.54	2.40	3.00	4.90	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=21FLSFWMBC4

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	20	1.50	2.00	2.09	2.00	2.00	3.40	.
Chlorophyll-a, ug/l	74	3.00	3.00	5.66	3.10	4.80	48.60	12.16
Color, PCU	74	20.00	50.00	71.62	60.00	90.00	200.00	83.78
Conductivity, umhos/cm	75	504.00	595.00	15820.81	10831.00	33966.00	48727.00	.
Copper, ug/l	21	0.30	1.00	1.45	1.09	1.82	3.18	0.00
Dissolved Oxygen, mg/l	75	1.81	4.41	5.62	5.72	6.65	14.00	18.67
Fecal Coliform, #/100ml	58	1.00	28.00	136.40	71.50	210.00	853.00	68.97
Iron, ug/l	25	100.00	260.00	486.00	510.00	680.00	900.00	72.00
Nitrate-Nitrite, mg/l	70	0.01	0.02	0.07	0.07	0.11	0.26	.
Salinity, ppt	76	0.24	0.29	9.72	4.80	19.82	31.72	.
Secchi Depth, m	63	0.15	1.20	1.40	1.40	1.70	2.40	49.21
Total Kjeldahl Nitrogen, mg/l	62	0.21	0.50	0.64	0.61	0.70	1.79	.
Total Nitrogen, mg/l	62	0.01	0.37	0.60	0.67	0.79	1.82	6.45
Orthophosphate as P, mg/l	57	0.00	0.01	0.02	0.02	0.03	0.06	.
Total Phosphorus, mg/l	73	0.02	0.03	0.04	0.04	0.05	0.10	0.00
Total Suspended Solids, mg/l	58	2.00	2.00	7.29	2.00	8.00	77.00	8.62
Turbidity, NTU	46	0.90	1.50	2.44	2.00	2.90	14.20	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=AQS8-1

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	20	3.00	8.00	12.40	11.50	16.50	31.00	50.00
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	0	.	.	.	.	.	.	.
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	19	0.76	0.91	1.07	1.07	1.22	1.31	100.00
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	7	0.40	0.56	0.69	0.75	0.83	0.88	0.00
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	18	0.04	0.06	0.08	0.07	0.09	0.19	5.56
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=BC2

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	19	1.50	2.00	2.13	2.00	2.00	2.90	.
Chlorophyll-a, ug/l	75	3.00	3.00	6.68	4.80	7.50	27.20	13.33
Color, PCU	74	10.00	30.00	57.57	50.00	80.00	120.00	59.46
Conductivity, umhos/cm	75	632.00	6678.60	26834.29	30675.00	45260.00	54548.00	.
Copper, ug/l	22	1.00	1.70	2.86	2.38	3.67	6.40	22.73
Dissolved Oxygen, mg/l	74	1.57	4.20	5.21	5.26	6.25	8.55	18.92
Fecal Coliform, #/100ml	70	3.00	54.00	271.09	101.50	210.00	3250.00	84.29
Iron, ug/l	25	150.00	300.00	547.20	440.00	650.00	2530.00	72.00
Nitrate-Nitrite, mg/l	68	0.01	0.03	0.06	0.06	0.08	0.19	.
Salinity, ppt	76	0.31	3.72	16.87	19.05	29.12	36.03	.
Secchi Depth, m	75	0.45	0.85	0.99	1.00	1.10	1.50	94.67
Total Kjeldahl Nitrogen, mg/l	62	0.04	0.45	0.60	0.61	0.71	1.75	.
Total Nitrogen, mg/l	61	0.02	0.32	0.60	0.64	0.83	2.40	9.84
Orthophosphate as P, mg/l	58	0.00	0.02	0.03	0.02	0.03	0.07	.
Total Phosphorus, mg/l	73	0.02	0.04	0.05	0.05	0.05	0.09	0.00
Total Suspended Solids, mg/l	54	2.00	2.00	7.06	2.00	7.00	56.00	7.41
Turbidity, NTU	46	1.20	1.80	2.45	2.10	2.80	9.80	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=Bay20

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	30	0.44	1.30	1.84	2.00	2.00	6.40	.
Chlorophyll-a, ug/l	31	1.00	3.00	3.57	3.00	5.30	8.40	0.00
Color, PCU	30	5.00	5.00	29.67	17.50	30.00	140.00	16.67
Conductivity, umhos/cm	30	7716.00	35448.00	42737.80	49079.50	53665.00	56218.00	.
Copper, ug/l	31	0.15	1.61	2.71	2.10	3.20	15.00	16.13
Dissolved Oxygen, mg/l	29	2.13	5.77	6.40	6.31	7.01	9.37	3.45
Fecal Coliform, #/100ml	31	1.00	1.00	24.74	4.00	20.00	203.00	16.13
Iron, ug/l	16	45.00	80.50	293.63	324.50	430.00	620.00	56.25
Nitrate-Nitrite, mg/l	31	0.00	0.02	0.04	0.03	0.05	0.12	.
Salinity, ppt	21	4.04	27.86	29.37	33.05	36.25	37.42	.
Secchi Depth, m	24	0.50	1.20	1.34	1.40	1.60	2.30	37.50
Total Kjeldahl Nitrogen, mg/l	31	0.04	0.34	0.59	0.62	0.82	1.31	.
Total Nitrogen, mg/l	31	0.04	0.36	0.63	0.63	0.86	1.38	9.68
Orthophosphate as P, mg/l	25	0.00	0.01	0.02	0.01	0.02	0.06	.
Total Phosphorus, mg/l	31	0.02	0.03	0.04	0.03	0.04	0.10	0.00
Total Suspended Solids, mg/l	21	2.00	5.00	12.50	10.00	15.00	37.00	23.81
Turbidity, NTU	30	0.30	1.50	2.88	2.00	4.00	11.10	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=COL8

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	3	10.30	10.30	11.13	11.50	11.60	11.60	66.67
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	0	.	.	.	.	.	.	.
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	0.70	0.70	0.83	0.90	0.90	0.90	100.00
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	2	0.05	0.05	0.05	0.05	0.05	0.05	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=COL9

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	3	3.10	3.10	4.50	4.00	6.40	6.40	0
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	0	.	.	.	.	.	.	.
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	0.80	0.80	1.13	1.30	1.30	1.30	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	3	0.03	0.03	0.04	0.04	0.04	0.04	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=ESBAY

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	3	7.00	7.00	8.67	9.00	10.00	10.00	0
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	0	.	.	.	.	.	.	.
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	0.85	0.85	0.95	0.92	1.07	1.07	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	3	0.41	0.41	0.51	0.52	0.59	0.59	0
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	3	0.05	0.05	0.06	0.05	0.09	0.09	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=GORD10

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	20	0.78	2.00	2.03	2.00	2.00	5.60	.
Chlorophyll-a, ug/l	20	3.00	3.00	3.64	3.00	3.65	7.50	0.00
Color, PCU	20	5.00	5.00	18.50	5.00	17.50	100.00	10.00
Conductivity, umhos/cm	20	20613.00	49425.00	50000.00	53968.50	55602.00	56353.00	.
Copper, ug/l	20	0.15	1.40	1.93	2.03	2.47	3.69	0.00
Dissolved Oxygen, mg/l	19	5.13	5.48	6.09	5.73	6.72	7.58	0.00
Fecal Coliform, #/100ml	20	1.00	1.00	11.35	1.50	11.00	96.00	5.00
Iron, ug/l	9	75.00	320.00	442.78	490.00	530.00	680.00	77.78
Nitrate-Nitrite, mg/l	20	0.00	0.02	0.03	0.03	0.04	0.07	.
Salinity, ppt	20	12.40	32.41	32.92	35.76	36.86	37.53	.
Secchi Depth, m	11	0.50	0.90	1.83	1.60	3.00	3.90	45.45
Total Kjeldahl Nitrogen, mg/l	19	0.04	0.08	0.41	0.33	0.67	0.99	.
Total Nitrogen, mg/l	19	0.04	0.10	0.45	0.40	0.69	0.99	0.00
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	19	0.00	0.02	0.03	0.02	0.04	0.07	0.00
Total Suspended Solids, mg/l	19	2.00	8.00	13.92	10.00	20.00	41.00	31.58
Turbidity, NTU	20	0.10	0.75	1.69	1.40	2.10	5.90	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=GORD30

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	6	0.55	0.72	1.15	1.07	1.50	2.00	.
Chlorophyll-a, ug/l	6	1.00	1.00	1.82	1.00	1.00	5.90	0.00
Color, PCU	6	20.00	40.00	73.33	90.00	100.00	100.00	66.67
Conductivity, umhos/cm	6	540.00	630.00	14094.33	1557.00	33012.00	47270.00	.
Copper, ug/l	6	0.52	1.11	2.76	2.46	5.00	5.00	33.33
Dissolved Oxygen, mg/l	6	3.98	4.20	5.21	5.26	6.06	6.50	16.67
Fecal Coliform, #/100ml	6	10.00	24.00	44.33	30.00	32.00	140.00	16.67
Iron, ug/l	6	110.00	330.00	550.17	659.00	722.00	821.00	83.33
Nitrate-Nitrite, mg/l	6	0.01	0.01	0.09	0.12	0.12	0.14	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	4	1.10	1.15	1.28	1.25	1.40	1.50	75.00
Total Kjeldahl Nitrogen, mg/l	6	0.68	0.78	0.86	0.87	0.96	1.00	.
Total Nitrogen, mg/l	6	0.79	0.79	0.95	0.94	1.10	1.12	33.33
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	6	0.03	0.04	0.04	0.05	0.05	0.06	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	6	2.50	2.90	4.22	3.20	5.50	8.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=GORD31

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	22	0.78	2.00	2.27	2.00	2.10	5.10	.
Chlorophyll-a, ug/l	23	3.00	3.00	9.79	5.90	10.10	55.25	17.39
Color, PCU	22	5.00	35.00	62.39	43.75	75.00	200.00	54.55
Conductivity, umhos/cm	21	517.00	3510.00	23793.81	23552.00	44010.00	50200.00	.
Copper, ug/l	22	0.15	1.61	2.47	2.18	3.28	6.69	9.09
Dissolved Oxygen, mg/l	20	0.60	3.92	4.71	4.52	5.44	8.38	25.00
Fecal Coliform, #/100ml	22	1.00	16.00	68.70	46.00	70.00	440.00	54.55
Iron, ug/l	10	190.00	260.00	400.50	320.00	510.00	720.00	50.00
Nitrate-Nitrite, mg/l	22	0.01	0.03	0.07	0.07	0.10	0.23	.
Salinity, ppt	21	0.26	4.39	15.53	14.14	28.28	32.94	.
Secchi Depth, m	15	0.80	0.90	1.10	1.10	1.20	1.50	86.67
Total Kjeldahl Nitrogen, mg/l	22	0.04	0.58	0.75	0.68	1.01	1.55	.
Total Nitrogen, mg/l	22	0.04	0.62	0.82	0.73	1.10	1.56	27.27
Orthophosphate as P, mg/l	21	0.00	0.01	0.03	0.02	0.04	0.07	.
Total Phosphorus, mg/l	22	0.03	0.04	0.06	0.05	0.07	0.16	0.00
Total Suspended Solids, mg/l	21	2.00	3.00	8.29	8.00	12.00	24.00	4.76
Turbidity, NTU	22	0.10	1.50	2.00	2.05	2.50	3.80	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=GORD70

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	1	3.30	3.30	3.30	3.30	3.30	3.30	.
Chlorophyll-a, ug/l	21	2.00	4.00	10.00	8.00	15.00	25.00	38.10
Color, PCU	1	40.00	40.00	40.00	40.00	40.00	40.00	0.00
Conductivity, umhos/cm	1	40470.00	40470.00	40470.00	40470.00	40470.00	40470.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	6.87	6.87	6.87	6.87	6.87	6.87	0.00
Fecal Coliform, #/100ml	1	40.00	40.00	40.00	40.00	40.00	40.00	0.00
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Salinity, ppt	1	25.95	25.95	25.95	25.95	25.95	25.95	.
Secchi Depth, m	18	0.31	0.92	1.15	1.22	1.53	1.83	72.22
Total Kjeldahl Nitrogen, mg/l	1	0.27	0.27	0.27	0.27	0.27	0.27	.
Total Nitrogen, mg/l	20	0.27	0.51	0.65	0.58	0.79	1.18	10.00
Orthophosphate as P, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Total Phosphorus, mg/l	18	0.03	0.04	0.06	0.05	0.07	0.16	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	2.20	2.20	2.20	2.20	2.20	2.20	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=Gord60

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	6	0.47	0.78	0.98	1.05	1.20	1.30	.
Chlorophyll-a, ug/l	6	1.00	1.00	3.17	1.00	1.00	14.00	16.67
Color, PCU	6	30.00	30.00	60.00	60.00	80.00	100.00	66.67
Conductivity, umhos/cm	6	800.00	1355.00	22609.83	20125.00	44126.00	49128.00	.
Copper, ug/l	6	2.00	2.48	4.04	4.38	5.00	6.00	66.67
Dissolved Oxygen, mg/l	6	4.20	4.41	5.27	5.13	6.16	6.58	0.00
Fecal Coliform, #/100ml	6	4.00	10.00	59.33	76.00	90.00	100.00	66.67
Iron, ug/l	6	120.00	180.00	388.00	298.00	707.00	725.00	50.00
Nitrate-Nitrite, mg/l	6	0.01	0.02	0.07	0.08	0.11	0.14	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	4	1.10	1.15	1.25	1.25	1.35	1.40	75.00
Total Kjeldahl Nitrogen, mg/l	6	0.72	0.76	0.92	0.91	1.00	1.20	.
Total Nitrogen, mg/l	6	0.73	0.78	0.99	0.99	1.11	1.34	50.00
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	6	0.03	0.03	0.05	0.05	0.05	0.06	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	6	3.00	3.00	4.15	3.55	4.60	7.20	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=Gord80

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	20	2.00	4.00	7.95	8.50	11.00	16.00	25.00
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	0	.	.	.	.	.	.	.
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	11	0.61	0.92	1.05	0.92	1.22	1.53	90.91
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	19	0.44	0.56	0.68	0.68	0.78	0.92	0.00
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	18	0.03	0.04	0.05	0.05	0.06	0.08	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=HC@Bayshore

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	20	1.50	2.00	2.04	2.00	2.00	2.90	.
Chlorophyll-a, ug/l	75	3.00	3.00	6.61	5.30	8.50	27.80	10.67
Color, PCU	75	5.00	40.00	49.87	50.00	60.00	80.00	60.00
Conductivity, umhos/cm	76	555.00	4774.00	29408.03	40858.50	45842.50	54161.00	.
Copper, ug/l	26	2.25	5.60	8.55	8.10	10.40	25.30	88.46
Dissolved Oxygen, mg/l	75	1.78	3.35	3.93	3.71	4.48	7.74	62.67
Fecal Coliform, #/100ml	74	1.00	127.00	455.93	290.00	420.00	3627.00	91.89
Iron, ug/l	24	100.00	175.00	299.79	255.00	385.00	790.00	41.67
Nitrate-Nitrite, mg/l	70	0.00	0.02	0.04	0.04	0.05	0.12	.
Salinity, ppt	77	0.27	2.54	18.71	25.31	29.56	35.73	.
Secchi Depth, m	75	0.60	0.95	1.12	1.10	1.25	1.50	85.33
Total Kjeldahl Nitrogen, mg/l	63	0.04	0.53	0.78	0.68	0.83	5.90	.
Total Nitrogen, mg/l	64	0.01	0.33	0.95	0.72	0.86	17.00	10.94
Orthophosphate as P, mg/l	61	0.00	0.01	0.02	0.02	0.03	0.08	.
Total Phosphorus, mg/l	73	0.02	0.03	0.05	0.04	0.06	0.11	0.00
Total Suspended Solids, mg/l	58	2.00	2.00	5.16	2.00	5.00	75.00	3.45
Turbidity, NTU	47	0.90	1.30	1.76	1.60	2.20	3.95	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=HaldemanBay

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	23	0.78	2.00	2.17	2.00	2.20	3.30	.
Chlorophyll-a, ug/l	23	3.00	3.00	6.46	3.00	7.50	29.90	13.04
Color, PCU	23	5.00	15.00	28.26	20.00	50.00	75.00	26.09
Conductivity, umhos/cm	21	11068.00	31702.00	43149.57	51660.00	53125.00	56518.00	.
Copper, ug/l	22	1.84	2.69	3.60	3.24	3.77	7.17	31.82
Dissolved Oxygen, mg/l	21	4.46	4.97	5.62	5.51	6.36	7.02	0.00
Fecal Coliform, #/100ml	22	1.00	6.00	21.91	9.00	29.00	106.00	13.64
Iron, ug/l	9	190.00	310.00	417.78	320.00	590.00	760.00	77.78
Nitrate-Nitrite, mg/l	23	0.01	0.02	0.04	0.03	0.05	0.12	.
Salinity, ppt	22	6.28	19.72	28.47	34.05	35.20	37.63	.
Secchi Depth, m	21	0.30	1.00	1.11	1.10	1.20	1.60	85.71
Total Kjeldahl Nitrogen, mg/l	23	0.04	0.16	0.53	0.35	0.79	1.80	.
Total Nitrogen, mg/l	23	0.04	0.22	0.57	0.40	0.83	1.80	13.04
Orthophosphate as P, mg/l	23	0.01	0.01	0.02	0.01	0.02	0.04	.
Total Phosphorus, mg/l	23	0.02	0.04	0.04	0.04	0.04	0.07	0.00
Total Suspended Solids, mg/l	22	2.00	4.00	9.14	6.00	14.00	32.00	13.64
Turbidity, NTU	23	1.50	1.70	2.16	2.00	2.30	3.80	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=JayceePark

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	5	2.00	2.00	2.10	2.00	2.00	2.50	.
Chlorophyll-a, ug/l	5	1.00	1.00	1.74	1.10	1.30	4.30	0
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	5	46480.00	47030.00	50744.00	47850.00	55770.00	56590.00	.
Copper, ug/l	5	2.60	7.10	9.54	11.00	12.00	15.00	80
Dissolved Oxygen, mg/l	5	4.40	5.39	5.65	5.60	6.10	6.75	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	5	68.00	71.00	733.80	830.00	1300.00	1400.00	60
Nitrate-Nitrite, mg/l	5	0.02	0.02	0.03	0.03	0.03	0.05	.
Salinity, ppt	5	30.54	31.06	33.75	32.49	37.18	37.47	.
Secchi Depth, m	5	0.20	0.20	0.46	0.20	0.20	1.50	80
Total Kjeldahl Nitrogen, mg/l	5	0.08	0.41	0.66	0.58	0.65	1.60	.
Total Nitrogen, mg/l	5	0.11	0.43	0.69	0.61	0.67	1.65	20
Orthophosphate as P, mg/l	5	0.02	0.03	0.03	0.03	0.03	0.04	.
Total Phosphorus, mg/l	5	0.04	0.04	0.12	0.04	0.19	0.31	20
Total Suspended Solids, mg/l	5	21.00	31.00	90.20	34.00	95.00	270.00	100
Turbidity, NTU	5	1.50	2.30	20.50	3.70	32.00	63.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=NaplesBay22

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	30	0.99	1.50	2.04	2.00	2.10	6.10	.
Chlorophyll-a, ug/l	51	1.00	3.00	6.71	5.00	10.00	24.25	19.61
Color, PCU	30	5.00	10.00	29.08	17.50	30.00	150.00	16.67
Conductivity, umhos/cm	29	9961.00	40674.00	43597.31	48847.00	53477.00	55740.00	.
Copper, ug/l	31	0.15	1.97	2.91	2.47	3.15	15.00	12.90
Dissolved Oxygen, mg/l	28	5.12	6.05	6.94	6.64	7.68	10.77	0.00
Fecal Coliform, #/100ml	31	1.00	1.00	19.81	3.00	19.00	200.00	9.68
Iron, ug/l	16	29.00	94.00	269.56	222.50	445.00	600.00	37.50
Nitrate-Nitrite, mg/l	31	0.00	0.01	0.03	0.03	0.04	0.09	.
Salinity, ppt	20	5.62	30.04	30.31	33.39	36.12	37.01	.
Secchi Depth, m	46	0.61	0.92	1.23	1.20	1.50	2.10	71.74
Total Kjeldahl Nitrogen, mg/l	31	0.04	0.41	0.60	0.66	0.81	1.09	.
Total Nitrogen, mg/l	49	0.04	0.34	0.56	0.54	0.72	1.20	6.12
Orthophosphate as P, mg/l	25	0.00	0.01	0.01	0.01	0.02	0.05	.
Total Phosphorus, mg/l	49	0.02	0.03	0.04	0.04	0.05	0.09	0.00
Total Suspended Solids, mg/l	21	2.00	6.00	9.00	9.50	11.50	17.00	0.00
Turbidity, NTU	30	0.80	1.60	2.42	2.00	2.85	9.40	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=NaplesBay24

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	30	0.43	1.20	1.80	2.00	2.00	4.65	.
Chlorophyll-a, ug/l	49	1.00	3.00	5.18	3.70	6.90	26.00	4.08
Color, PCU	30	5.00	15.00	34.17	20.00	40.00	150.00	16.67
Conductivity, umhos/cm	30	6887.00	33780.00	40583.55	44800.00	53602.00	55720.00	.
Copper, ug/l	31	0.15	2.16	3.31	2.46	3.60	17.00	22.58
Dissolved Oxygen, mg/l	29	2.07	5.21	6.06	6.03	6.76	9.02	6.90
Fecal Coliform, #/100ml	31	1.00	1.00	24.50	4.00	20.00	184.00	16.13
Iron, ug/l	16	63.00	104.50	301.25	305.00	422.00	670.00	50.00
Nitrate-Nitrite, mg/l	31	0.00	0.02	0.04	0.04	0.07	0.12	.
Salinity, ppt	21	3.82	26.25	28.28	29.10	35.88	36.99	.
Secchi Depth, m	45	0.46	0.92	1.10	1.07	1.37	1.83	75.56
Total Kjeldahl Nitrogen, mg/l	31	0.04	0.41	0.62	0.62	0.89	1.39	.
Total Nitrogen, mg/l	49	0.05	0.30	0.57	0.54	0.77	1.45	8.16
Orthophosphate as P, mg/l	25	0.00	0.01	0.02	0.02	0.03	0.05	.
Total Phosphorus, mg/l	49	0.02	0.03	0.04	0.04	0.05	0.11	0.00
Total Suspended Solids, mg/l	21	2.00	4.00	10.38	9.00	14.00	29.00	23.81
Turbidity, NTU	30	1.00	1.70	2.66	2.10	3.25	7.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=NaplesBay41

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	30	0.66	1.50	2.08	2.00	2.00	6.30	.
Chlorophyll-a, ug/l	31	1.00	3.00	5.39	3.00	6.90	33.40	12.90
Color, PCU	30	5.00	15.00	38.17	20.00	40.00	200.00	23.33
Conductivity, umhos/cm	30	5489.00	29970.00	38285.67	44179.50	53307.00	55590.00	.
Copper, ug/l	31	0.94	2.54	4.04	3.39	4.38	22.00	35.48
Dissolved Oxygen, mg/l	29	2.69	5.35	6.01	6.08	6.68	8.95	6.90
Fecal Coliform, #/100ml	31	1.00	1.00	29.81	4.00	28.00	200.00	19.35
Iron, ug/l	16	39.00	94.00	288.75	305.00	445.00	530.00	50.00
Nitrate-Nitrite, mg/l	31	0.00	0.03	0.05	0.05	0.07	0.13	.
Salinity, ppt	21	3.02	24.24	27.08	28.81	35.83	36.91	.
Secchi Depth, m	27	0.60	1.20	1.30	1.30	1.50	2.00	62.96
Total Kjeldahl Nitrogen, mg/l	31	0.04	0.49	0.66	0.63	0.93	1.20	.
Total Nitrogen, mg/l	31	0.04	0.50	0.71	0.65	1.00	1.27	22.58
Orthophosphate as P, mg/l	25	0.00	0.01	0.02	0.02	0.02	0.06	.
Total Phosphorus, mg/l	31	0.03	0.03	0.04	0.04	0.05	0.12	0.00
Total Suspended Solids, mg/l	21	2.00	4.00	9.95	8.00	12.00	28.00	19.05
Turbidity, NTU	30	0.90	1.60	2.32	1.90	2.40	7.10	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=NaplesBay50

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	28	0.30	1.55	2.04	2.00	2.10	4.90	.
Chlorophyll-a, ug/l	28	1.00	3.00	6.13	3.15	7.20	23.50	17.86
Color, PCU	28	5.00	20.00	44.11	27.50	55.00	200.00	28.57
Conductivity, umhos/cm	27	4810.00	26312.00	37132.93	41807.00	52240.00	54560.00	.
Copper, ug/l	28	1.84	3.21	4.05	4.24	4.75	7.30	64.29
Dissolved Oxygen, mg/l	26	1.95	5.40	5.92	6.08	6.72	8.26	7.69
Fecal Coliform, #/100ml	28	1.00	5.00	42.00	11.00	45.00	320.00	25.00
Iron, ug/l	16	55.00	192.00	326.81	325.00	470.00	610.00	50.00
Nitrate-Nitrite, mg/l	28	0.00	0.03	0.05	0.05	0.07	0.11	.
Salinity, ppt	21	2.57	21.03	25.82	27.23	34.96	36.12	.
Secchi Depth, m	19	0.30	0.90	1.01	1.10	1.20	1.30	100.00
Total Kjeldahl Nitrogen, mg/l	28	0.04	0.42	0.68	0.68	0.88	1.36	.
Total Nitrogen, mg/l	28	0.04	0.45	0.72	0.71	0.94	1.43	21.43
Orthophosphate as P, mg/l	21	0.00	0.02	0.02	0.02	0.03	0.06	.
Total Phosphorus, mg/l	28	0.03	0.04	0.05	0.04	0.05	0.11	0.00
Total Suspended Solids, mg/l	21	2.00	3.00	8.71	7.00	12.00	34.00	9.52
Turbidity, NTU	28	0.70	1.95	2.75	2.33	2.80	13.30	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Golden Gate Naples Bay Station=ROOK464

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	3	5.91	5.91	6.22	6.34	6.41	6.41	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	3	37.29	37.29	37.77	38.02	38.02	38.02	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Marco Island Station=21FLFMRISTK200202

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	2.58	2.58	2.58	2.58	2.58	2.58	0
Color, PCU	1	15.10	15.10	15.10	15.10	15.10	15.10	0
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	6.80	6.80	6.80	6.80	6.80	6.80	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	1	35.20	35.20	35.20	35.20	35.20	35.20	.
Secchi Depth, m	1	2.00	2.00	2.00	2.00	2.00	2.00	0
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	1	0.31	0.31	0.31	0.31	0.31	0.31	0
Orthophosphate as P, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	1	0.03	0.03	0.03	0.03	0.03	0.03	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	1.71	1.71	1.71	1.71	1.71	1.71	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Marco Island Station=21FLFMRISTK200203

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	3.49	3.49	3.49	3.49	3.49	3.49	0
Color, PCU	1	17.10	17.10	17.10	17.10	17.10	17.10	0
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	6.40	6.40	6.40	6.40	6.40	6.40	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	1	31.50	31.50	31.50	31.50	31.50	31.50	.
Secchi Depth, m	1	1.30	1.30	1.30	1.30	1.30	1.30	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	1	0.45	0.45	0.45	0.45	0.45	0.45	0
Orthophosphate as P, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	1	0.04	0.04	0.04	0.04	0.04	0.04	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	6.17	6.17	6.17	6.17	6.17	6.17	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Marco Island Station=21FLFTM EVRGWC0032FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	3	1.10	1.10	2.93	1.80	5.90	5.90	.
Chlorophyll-a, ug/l	3	1.00	1.00	4.67	1.00	12.00	12.00	33.33
Color, PCU	3	15.00	15.00	21.67	20.00	30.00	30.00	0.00
Conductivity, umhos/cm	3	44998.00	44998.00	50176.33	50570.00	54961.00	54961.00	.
Copper, ug/l	3	0.70	0.70	0.97	0.86	1.35	1.35	0.00
Dissolved Oxygen, mg/l	3	5.01	5.01	7.47	6.91	10.48	10.48	0.00
Fecal Coliform, #/100ml	3	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Iron, ug/l	3	20.00	20.00	50.00	51.00	79.00	79.00	0.00
Nitrate-Nitrite, mg/l	3	0.00	0.00	0.01	0.01	0.01	0.01	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	1.10	1.10	1.97	1.30	3.50	3.50	66.67
Total Kjeldahl Nitrogen, mg/l	3	0.16	0.16	0.56	0.68	0.85	0.85	.
Total Nitrogen, mg/l	3	0.16	0.16	0.57	0.69	0.86	0.86	0.00
Orthophosphate as P, mg/l	2	0.01	0.01	0.02	0.02	0.02	0.02	.
Total Phosphorus, mg/l	3	0.02	0.02	0.05	0.06	0.07	0.07	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	3	3.50	3.50	4.70	5.00	5.60	5.60	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Marco Island Station=21FLFTM EVRGWC0033FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	3	1.00	1.00	1.80	1.50	2.90	2.90	.
Chlorophyll-a, ug/l	3	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Color, PCU	3	15.00	15.00	21.67	20.00	30.00	30.00	0.00
Conductivity, umhos/cm	3	45847.00	45847.00	50514.33	50616.00	55080.00	55080.00	.
Copper, ug/l	3	0.64	0.64	0.73	0.73	0.83	0.83	0.00
Dissolved Oxygen, mg/l	3	5.04	5.04	7.10	6.17	10.10	10.10	0.00
Fecal Coliform, #/100ml	3	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Iron, ug/l	3	20.00	20.00	104.67	114.00	180.00	180.00	0.00
Nitrate-Nitrite, mg/l	3	0.00	0.00	0.01	0.01	0.01	0.01	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	0.80	0.80	1.77	1.00	3.50	3.50	66.67
Total Kjeldahl Nitrogen, mg/l	3	0.15	0.15	0.56	0.74	0.79	0.79	.
Total Nitrogen, mg/l	3	0.15	0.15	0.57	0.75	0.80	0.80	0.00
Orthophosphate as P, mg/l	2	0.01	0.01	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	3	0.02	0.02	0.05	0.05	0.06	0.06	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	3	3.20	3.20	10.30	10.00	17.70	17.70	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Marco Island Station=21FLFTM EVRGWC0034FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	2	1.00	1.00	2.05	2.05	3.10	3.10	.
Chlorophyll-a, ug/l	2	1.00	1.00	1.00	1.00	1.00	1.00	0
Color, PCU	2	10.00	10.00	20.00	20.00	30.00	30.00	0
Conductivity, umhos/cm	2	42744.00	42744.00	46414.50	46414.50	50085.00	50085.00	.
Copper, ug/l	2	0.86	0.86	0.99	0.99	1.11	1.11	0
Dissolved Oxygen, mg/l	2	5.73	5.73	7.90	7.90	10.07	10.07	0
Fecal Coliform, #/100ml	2	1.00	1.00	1.00	1.00	1.00	1.00	0
Iron, ug/l	2	23.00	23.00	33.00	33.00	43.00	43.00	0
Nitrate-Nitrite, mg/l	2	0.00	0.00	0.01	0.01	0.02	0.02	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	2	1.40	1.40	2.95	2.95	4.50	4.50	0
Total Kjeldahl Nitrogen, mg/l	2	0.26	0.26	0.49	0.49	0.72	0.72	.
Total Nitrogen, mg/l	2	0.26	0.26	0.50	0.50	0.74	0.74	0
Orthophosphate as P, mg/l	2	0.01	0.01	0.02	0.02	0.02	0.02	.
Total Phosphorus, mg/l	2	0.02	0.02	0.04	0.04	0.05	0.05	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	2	0.20	0.20	0.46	0.46	0.72	0.72	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Marco Island Station=21FLFTM EVRGWC0035FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	3	1.10	1.10	2.13	1.70	3.60	3.60	.
Chlorophyll-a, ug/l	3	1.00	1.00	1.10	1.00	1.30	1.30	0.00
Color, PCU	3	10.00	10.00	18.33	15.00	30.00	30.00	0.00
Conductivity, umhos/cm	3	40283.00	40283.00	48226.67	49593.00	54804.00	54804.00	.
Copper, ug/l	3	1.10	1.10	1.45	1.41	1.84	1.84	0.00
Dissolved Oxygen, mg/l	3	2.93	2.93	5.97	5.53	9.44	9.44	33.33
Fecal Coliform, #/100ml	3	1.00	1.00	4.00	1.00	10.00	10.00	0.00
Iron, ug/l	3	26.00	26.00	41.67	30.00	69.00	69.00	0.00
Nitrate-Nitrite, mg/l	3	0.00	0.00	0.02	0.01	0.04	0.04	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	0.15	0.15	1.32	1.30	2.50	2.50	66.67
Total Kjeldahl Nitrogen, mg/l	3	0.64	0.64	0.80	0.77	1.00	1.00	.
Total Nitrogen, mg/l	3	0.64	0.64	0.82	0.81	1.01	1.01	33.33
Orthophosphate as P, mg/l	2	0.02	0.02	0.02	0.02	0.02	0.02	.
Total Phosphorus, mg/l	3	0.04	0.04	0.06	0.07	0.07	0.07	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	3	1.86	1.86	2.42	2.40	3.00	3.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Marco Island Station=21FLFTM EVRGWC0036FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	3	1.00	1.00	2.27	1.20	4.60	4.60	.
Chlorophyll-a, ug/l	3	1.00	1.00	2.63	1.00	5.90	5.90	0.00
Color, PCU	3	10.00	10.00	13.33	10.00	20.00	20.00	0.00
Conductivity, umhos/cm	3	44235.00	44235.00	49629.00	50227.00	54425.00	54425.00	.
Copper, ug/l	3	0.72	0.72	0.92	0.76	1.28	1.28	0.00
Dissolved Oxygen, mg/l	3	3.09	3.09	5.07	4.23	7.88	7.88	33.33
Fecal Coliform, #/100ml	3	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Iron, ug/l	3	15.00	15.00	23.00	24.00	30.00	30.00	0.00
Nitrate-Nitrite, mg/l	3	0.00	0.00	0.02	0.01	0.03	0.03	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	0.15	0.15	2.72	2.50	5.50	5.50	33.33
Total Kjeldahl Nitrogen, mg/l	3	0.43	0.43	0.63	0.68	0.78	0.78	.
Total Nitrogen, mg/l	3	0.43	0.43	0.65	0.69	0.81	0.81	0.00
Orthophosphate as P, mg/l	2	0.01	0.01	0.02	0.02	0.03	0.03	.
Total Phosphorus, mg/l	3	0.02	0.02	0.04	0.05	0.06	0.06	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	3	0.70	0.70	1.66	1.07	3.20	3.20	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Marco Island Station=21FLSFWMROOK454

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	59	1.00	1.70	2.90	2.40	3.40	9.90	0
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	64	4.40	5.70	6.51	6.30	7.10	17.20	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	61	0.00	0.00	0.00	0.00	0.00	0.05	.
Salinity, ppt	60	31.00	34.10	35.13	35.15	36.40	38.60	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	49	0.08	0.16	0.26	0.24	0.35	0.57	0
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	61	0.01	0.02	0.03	0.02	0.03	0.08	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	61	0.40	1.40	2.90	2.00	4.00	9.90	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Marco Island Station=21FLSFWMROOK456

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	59	1.00	3.30	5.36	5.00	7.00	12.90	6.78
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	64	3.80	5.35	6.30	6.05	6.60	20.40	1.56
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	61	0.00	0.00	0.00	0.00	0.01	0.03	.
Salinity, ppt	63	27.00	33.10	34.47	34.80	36.70	38.94	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	49	0.11	0.20	0.29	0.27	0.35	0.91	0.00
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	61	0.01	0.03	0.04	0.03	0.04	0.06	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	61	1.40	2.80	4.47	4.00	5.60	11.70	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Marco Island Station=ROOK453

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	3	5.81	5.81	6.20	6.06	6.75	6.75	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	3	37.07	37.07	38.18	38.36	39.12	39.12	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Marco Island Station=SEAS020_Goodland

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	10	5.7	6.1	6.63	6.4	7.1	7.7	0.00
Fecal Coliform, #/100ml	11	1.0	1.0	154.73	1.0	13.0	1600.0	9.09
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	10	33.3	34.0	34.04	34.1	34.2	34.5	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	11	1.4	3.6	4.96	3.9	5.1	17.0	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Marco Island Station=SEAS021_CoonKey

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	9	5.80	6.1	6.52	6.20	6.9	7.4	0
Fecal Coliform, #/100ml	11	1.00	1.0	4.00	1.00	1.0	33.0	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	10	33.60	34.1	34.28	34.35	34.5	34.7	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	11	0.32	1.3	3.73	3.40	5.0	11.0	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Marco Island Station=STK200228

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	24.50	24.50	24.50	24.50	24.50	24.50	100
Color, PCU	1	46.40	46.40	46.40	46.40	46.40	46.40	100
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	2.25	2.25	2.25	2.25	2.25	2.25	100
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	1	30.05	30.05	30.05	30.05	30.05	30.05	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	.
Total Phosphorus, mg/l	1	0.07	0.07	0.07	0.07	0.07	0.07	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	2.39	2.39	2.39	2.39	2.39	2.39	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Marco Island Station=WinterberryDr

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	3	1.90	1.90	2.50	2.00	3.60	3.60	.
Chlorophyll-a, ug/l	3	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Color, PCU	3	10.00	10.00	15.00	15.00	20.00	20.00	0.00
Conductivity, umhos/cm	3	46032.00	46032.00	50252.67	50338.00	54388.00	54388.00	.
Copper, ug/l	3	0.78	0.78	1.13	0.93	1.68	1.68	0.00
Dissolved Oxygen, mg/l	3	5.56	5.56	6.74	6.08	8.58	8.58	0.00
Fecal Coliform, #/100ml	3	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Iron, ug/l	3	30.00	30.00	54.33	37.00	96.00	96.00	0.00
Nitrate-Nitrite, mg/l	3	0.00	0.00	0.01	0.00	0.01	0.01	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	0.15	0.15	1.55	1.00	3.50	3.50	66.67
Total Kjeldahl Nitrogen, mg/l	3	0.28	0.28	0.68	0.65	1.10	1.10	.
Total Nitrogen, mg/l	3	0.28	0.28	0.68	0.65	1.11	1.11	33.33
Orthophosphate as P, mg/l	2	0.01	0.01	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	3	0.02	0.02	0.05	0.04	0.07	0.07	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	3	2.30	2.30	3.53	3.10	5.20	5.20	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Naples Station=21FLFTM EVRGWC0043FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	4	2.40	2.40	3.18	2.95	3.95	4.40	.
Chlorophyll-a, ug/l	4	1.00	1.00	2.85	2.75	4.70	4.90	0
Color, PCU	4	30.00	30.00	40.00	40.00	50.00	50.00	50
Conductivity, umhos/cm	4	47008.00	47707.50	48979.00	49178.50	50250.50	50551.00	.
Copper, ug/l	4	1.04	1.16	1.35	1.29	1.55	1.79	0
Dissolved Oxygen, mg/l	4	5.20	5.42	6.38	6.27	7.34	7.78	0
Fecal Coliform, #/100ml	4	1.00	2.50	28.75	7.00	55.00	100.00	0
Iron, ug/l	4	168.00	170.00	185.50	182.00	201.00	210.00	0
Nitrate-Nitrite, mg/l	4	0.00	0.00	0.01	0.00	0.01	0.01	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	4	0.15	0.33	0.54	0.50	0.75	1.00	100
Total Kjeldahl Nitrogen, mg/l	4	0.60	0.72	0.88	0.92	1.05	1.10	.
Total Nitrogen, mg/l	4	0.61	0.72	0.89	0.92	1.05	1.10	50
Orthophosphate as P, mg/l	3	0.00	0.00	0.01	0.01	0.02	0.02	.
Total Phosphorus, mg/l	4	0.04	0.04	0.05	0.05	0.06	0.07	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	4	3.80	4.20	4.63	4.80	5.05	5.10	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Naples Station=21FLFTM EVRGWC0044FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	4	1.70	1.75	2.23	2.10	2.70	3.00	.
Chlorophyll-a, ug/l	4	1.00	1.00	1.80	1.00	2.60	4.20	0
Color, PCU	4	20.00	20.00	22.50	20.00	25.00	30.00	0
Conductivity, umhos/cm	4	47203.00	48602.00	50276.50	50671.50	51951.00	52560.00	.
Copper, ug/l	4	1.21	1.28	1.41	1.41	1.54	1.60	0
Dissolved Oxygen, mg/l	4	6.73	7.21	7.50	7.72	7.80	7.84	0
Fecal Coliform, #/100ml	4	1.00	1.00	1.75	1.00	2.50	4.00	0
Iron, ug/l	4	16.00	21.00	35.25	36.00	49.50	53.00	0
Nitrate-Nitrite, mg/l	4	0.00	0.00	0.01	0.01	0.01	0.02	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	4	0.15	0.78	1.36	1.60	1.95	2.10	25
Total Kjeldahl Nitrogen, mg/l	4	0.51	0.57	0.68	0.69	0.80	0.84	.
Total Nitrogen, mg/l	4	0.52	0.57	0.69	0.69	0.80	0.86	0
Orthophosphate as P, mg/l	3	0.00	0.00	0.00	0.00	0.01	0.01	.
Total Phosphorus, mg/l	4	0.02	0.03	0.03	0.03	0.04	0.05	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	4	2.10	2.55	3.18	3.30	3.80	4.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Naples Station=21FLFTM EVRGWC0045FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	4	1.90	2.15	3.70	3.55	5.25	5.80	.
Chlorophyll-a, ug/l	4	1.00	1.00	2.13	1.05	3.25	5.40	0
Color, PCU	4	20.00	20.00	22.50	20.00	25.00	30.00	0
Conductivity, umhos/cm	4	48600.00	48932.50	50581.00	50421.50	52229.50	52881.00	.
Copper, ug/l	4	0.91	0.98	1.12	1.13	1.25	1.30	0
Dissolved Oxygen, mg/l	4	7.84	8.01	8.11	8.18	8.21	8.23	0
Fecal Coliform, #/100ml	4	1.00	1.00	1.00	1.00	1.00	1.00	0
Iron, ug/l	4	32.00	34.50	54.25	54.00	74.00	77.00	0
Nitrate-Nitrite, mg/l	4	0.00	0.00	0.01	0.00	0.01	0.01	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	4	0.15	0.33	0.61	0.55	0.90	1.20	100
Total Kjeldahl Nitrogen, mg/l	4	0.45	0.58	0.69	0.75	0.79	0.80	.
Total Nitrogen, mg/l	4	0.46	0.58	0.69	0.75	0.80	0.80	0
Orthophosphate as P, mg/l	3	0.00	0.00	0.01	0.00	0.01	0.01	.
Total Phosphorus, mg/l	4	0.03	0.03	0.04	0.04	0.04	0.04	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	4	2.80	3.65	4.95	5.25	6.25	6.50	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Naples Station=21FLKWATCOL-CL-YEAST-1

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	20	5.00	13.50	37.30	32.00	53.50	123.00	80.0
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	0	.	.	.	.	.	.	.
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	12	0.09	0.15	0.24	0.27	0.31	0.31	100.0
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	23	1.71	2.43	3.03	2.83	3.13	7.24	100.0
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	23	0.15	0.34	0.41	0.40	0.50	0.70	91.3
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Naples Station=21FLKWATCOL-CL-YEAST-2

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	20	2.00	11.00	17.65	17.50	21.00	45.00	75.00
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	0	.	.	.	.	.	.	.
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	20	0.15	0.31	0.47	0.53	0.61	0.92	100.00
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	21	0.52	0.89	0.96	1.01	1.06	1.16	52.38
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	21	0.06	0.10	0.11	0.11	0.14	0.16	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Naples Station=21FLKWATCOL-CL-YEAST-3

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	20	4.00	11.00	16.00	15.00	20.00	33.00	70.00
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	0	.	.	.	.	.	.	.
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	15	0.31	0.31	0.48	0.46	0.61	0.76	100.00
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	22	0.48	0.93	0.96	0.98	1.04	1.37	36.36
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	22	0.06	0.09	0.12	0.11	0.14	0.20	4.55
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Naples Station=21FLKWATCOL-CL-YWEST-1

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	13	12.00	25.00	47.62	31.00	77.00	124.00	100
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	0	.	.	.	.	.	.	.
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	5	0.03	0.06	0.15	0.15	0.21	0.31	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	12	1.83	2.15	4.54	3.87	4.69	16.01	100
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	12	0.25	0.44	0.85	0.64	1.05	2.81	100
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Naples Station=21FLKWATCOL-CL-YWEST-2

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	19	6.00	13.00	24.68	18.00	32.00	93.00	84.21
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	0	.	.	.	.	.	.	.
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	8	0.06	0.12	0.39	0.34	0.61	0.92	100.00
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	23	0.31	1.15	1.80	1.49	2.17	4.09	91.30
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	23	0.07	0.13	0.21	0.14	0.24	0.77	34.78
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Naples Station=21FLKWATCOL-CL-YWEST-3

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	20	1.00	2.50	6.50	4.50	9.00	27.00	10
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	0	.	.	.	.	.	.	.
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	15	0.31	0.31	0.49	0.61	0.61	0.61	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	22	0.29	0.44	0.52	0.53	0.62	0.72	0
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	22	0.03	0.04	0.06	0.06	0.08	0.11	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Naples Station=21FLNAPLMB2

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	14	2.00	2.00	2.18	2.00	2.25	3.30	.
Chlorophyll-a, ug/l	14	3.00	3.00	5.46	3.10	3.70	32.60	7.14
Color, PCU	14	7.50	10.00	17.00	15.00	20.00	40.00	0.00
Conductivity, umhos/cm	14	45040.00	52200.00	52690.36	53505.00	54890.00	56280.00	.
Copper, ug/l	14	1.32	1.71	2.11	2.17	2.34	3.05	0.00
Dissolved Oxygen, mg/l	14	5.57	6.29	6.66	6.60	7.09	8.01	0.00
Fecal Coliform, #/100ml	14	1.00	1.00	15.29	1.00	1.00	178.00	0.00
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	14	0.02	0.03	0.03	0.03	0.04	0.05	.
Salinity, ppt	14	29.00	34.44	34.70	35.35	36.16	37.34	.
Secchi Depth, m	14	0.30	1.00	1.39	1.55	1.70	2.10	35.71
Total Kjeldahl Nitrogen, mg/l	14	0.08	0.28	0.44	0.43	0.62	0.90	.
Total Nitrogen, mg/l	14	0.12	0.33	0.49	0.46	0.64	0.94	0.00
Orthophosphate as P, mg/l	14	0.00	0.00	0.01	0.01	0.01	0.02	.
Total Phosphorus, mg/l	14	0.02	0.02	0.03	0.03	0.03	0.04	0.00
Total Suspended Solids, mg/l	14	5.50	11.00	16.39	14.00	18.00	52.00	35.71
Turbidity, NTU	14	0.90	1.20	1.75	1.48	1.80	5.05	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Naples Station=COL4

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	3	4.20	4.20	5.67	5.00	7.80	7.80	0
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	0	.	.	.	.	.	.	.
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	0.80	0.80	0.93	0.90	1.10	1.10	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	3	0.04	0.04	0.04	0.04	0.04	0.04	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Naples Station=HurricaneHbr

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	14	2.00	2.00	2.36	2.15	2.60	3.90	.
Chlorophyll-a, ug/l	14	3.00	3.00	3.92	3.00	3.00	11.20	7.14
Color, PCU	14	5.00	10.00	15.57	15.00	15.00	35.00	0.00
Conductivity, umhos/cm	14	46542.00	52037.00	52926.21	53573.50	54790.00	56150.00	.
Copper, ug/l	14	0.31	1.64	1.81	1.84	2.16	2.54	0.00
Dissolved Oxygen, mg/l	14	6.10	6.36	7.08	7.03	7.29	10.42	0.00
Fecal Coliform, #/100ml	14	1.00	1.00	26.50	1.00	40.00	129.00	0.00
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	14	0.00	0.02	0.03	0.04	0.05	0.06	.
Salinity, ppt	14	30.33	34.27	34.87	35.39	36.08	37.23	.
Secchi Depth, m	11	0.90	1.00	1.35	1.30	1.70	1.90	63.64
Total Kjeldahl Nitrogen, mg/l	14	0.08	0.10	0.31	0.26	0.38	0.93	.
Total Nitrogen, mg/l	14	0.08	0.10	0.34	0.30	0.43	0.97	0.00
Orthophosphate as P, mg/l	14	0.00	0.00	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	14	0.01	0.03	0.03	0.03	0.04	0.04	0.00
Total Suspended Solids, mg/l	14	2.00	12.00	15.07	15.50	20.00	24.00	35.71
Turbidity, NTU	14	0.10	1.60	1.93	1.75	2.50	4.50	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Naples Station=MOORINGS

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	14	2.00	2.00	2.18	2.00	2.00	4.30	.
Chlorophyll-a, ug/l	14	3.00	3.00	3.18	3.00	3.00	4.80	0.00
Color, PCU	14	5.00	10.00	12.71	10.00	15.00	30.00	0.00
Conductivity, umhos/cm	14	49956.00	52658.00	53985.43	54202.50	55420.00	57340.00	.
Copper, ug/l	14	1.18	1.52	1.83	1.83	2.12	2.46	0.00
Dissolved Oxygen, mg/l	14	5.17	6.03	6.53	6.50	7.01	7.44	0.00
Fecal Coliform, #/100ml	14	1.00	1.00	7.71	2.00	4.50	70.00	0.00
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	14	0.00	0.02	0.03	0.03	0.05	0.06	.
Salinity, ppt	14	32.79	34.78	35.66	35.78	36.65	38.06	.
Secchi Depth, m	11	0.50	1.20	1.29	1.40	1.50	1.70	45.45
Total Kjeldahl Nitrogen, mg/l	14	0.08	0.18	0.46	0.36	0.74	1.30	.
Total Nitrogen, mg/l	14	0.08	0.23	0.49	0.39	0.80	1.36	7.14
Orthophosphate as P, mg/l	14	0.00	0.00	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	14	0.02	0.02	0.03	0.03	0.03	0.04	0.00
Total Suspended Solids, mg/l	14	8.00	10.00	18.61	18.50	25.00	30.00	57.14
Turbidity, NTU	14	1.20	1.20	1.77	1.53	1.90	3.90	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Naples Station=VenetianBay

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	14	2.00	2.00	2.88	2.70	3.30	4.90	.
Chlorophyll-a, ug/l	14	3.00	3.00	6.11	5.10	7.50	18.20	7.14
Color, PCU	14	10.00	15.00	22.00	17.50	25.00	50.00	7.14
Conductivity, umhos/cm	14	45289.00	51466.00	52223.29	52980.00	53307.00	56070.00	.
Copper, ug/l	14	1.72	2.03	2.37	2.25	2.74	3.47	0.00
Dissolved Oxygen, mg/l	14	2.23	4.60	5.18	5.42	6.01	6.41	7.14
Fecal Coliform, #/100ml	14	1.00	1.00	12.32	2.50	17.00	85.00	0.00
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	14	0.00	0.04	0.04	0.04	0.05	0.12	.
Salinity, ppt	14	29.36	33.90	34.35	34.91	35.26	37.16	.
Secchi Depth, m	14	0.90	1.30	1.41	1.40	1.60	2.20	42.86
Total Kjeldahl Nitrogen, mg/l	14	0.08	0.17	0.44	0.38	0.72	1.04	.
Total Nitrogen, mg/l	14	0.08	0.21	0.48	0.42	0.76	1.08	7.14
Orthophosphate as P, mg/l	14	0.00	0.01	0.01	0.01	0.01	0.03	.
Total Phosphorus, mg/l	14	0.03	0.03	0.04	0.04	0.05	0.07	0.00
Total Suspended Solids, mg/l	14	2.00	9.00	14.18	11.50	15.00	60.00	7.14
Turbidity, NTU	14	1.10	1.30	1.79	1.75	2.10	3.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=21FLFMRINTK200121

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	8.40	8.40	8.40	8.40	8.40	8.40	0
Color, PCU	1	129.10	129.10	129.10	129.10	129.10	129.10	100
Conductivity, umhos/cm	1	52000.00	52000.00	52000.00	52000.00	52000.00	52000.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	5.40	5.40	5.40	5.40	5.40	5.40	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	1	34.20	34.20	34.20	34.20	34.20	34.20	.
Secchi Depth, m	1	0.70	0.70	0.70	0.70	0.70	0.70	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	1	0.31	0.31	0.31	0.31	0.31	0.31	0
Orthophosphate as P, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Total Phosphorus, mg/l	1	0.06	0.06	0.06	0.06	0.06	0.06	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	9.64	9.64	9.64	9.64	9.64	9.64	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=21FLFMRINTK200122

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	12.42	12.42	12.42	12.42	12.42	12.42	100
Color, PCU	1	186.30	186.30	186.30	186.30	186.30	186.30	100
Conductivity, umhos/cm	1	46200.00	46200.00	46200.00	46200.00	46200.00	46200.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	6.10	6.10	6.10	6.10	6.10	6.10	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.04	0.04	0.04	0.04	0.04	0.04	.
Salinity, ppt	1	30.30	30.30	30.30	30.30	30.30	30.30	.
Secchi Depth, m	1	0.60	0.60	0.60	0.60	0.60	0.60	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	1	0.49	0.49	0.49	0.49	0.49	0.49	0
Orthophosphate as P, mg/l	1	0.03	0.03	0.03	0.03	0.03	0.03	.
Total Phosphorus, mg/l	1	0.09	0.09	0.09	0.09	0.09	0.09	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	10.43	10.43	10.43	10.43	10.43	10.43	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=21FLFMRINTK200123

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	20.80	20.80	20.80	20.80	20.80	20.80	100
Color, PCU	1	244.80	244.80	244.80	244.80	244.80	244.80	100
Conductivity, umhos/cm	1	48500.00	48500.00	48500.00	48500.00	48500.00	48500.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	6.80	6.80	6.80	6.80	6.80	6.80	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	.
Salinity, ppt	1	31.70	31.70	31.70	31.70	31.70	31.70	.
Secchi Depth, m	1	0.70	0.70	0.70	0.70	0.70	0.70	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	1	0.55	0.55	0.55	0.55	0.55	0.55	0
Orthophosphate as P, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	1	0.14	0.14	0.14	0.14	0.14	0.14	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	32.27	32.27	32.27	32.27	32.27	32.27	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=21FLFMRINTK200124

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	6.69	6.69	6.69	6.69	6.69	6.69	0
Color, PCU	1	142.10	142.10	142.10	142.10	142.10	142.10	100
Conductivity, umhos/cm	1	53700.00	53700.00	53700.00	53700.00	53700.00	53700.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	7.10	7.10	7.10	7.10	7.10	7.10	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Salinity, ppt	1	35.30	35.30	35.30	35.30	35.30	35.30	.
Secchi Depth, m	1	0.80	0.80	0.80	0.80	0.80	0.80	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	1	0.31	0.31	0.31	0.31	0.31	0.31	0
Orthophosphate as P, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	1	0.05	0.05	0.05	0.05	0.05	0.05	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	9.79	9.79	9.79	9.79	9.79	9.79	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=21FLFMRINTK200129

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	15.39	15.39	15.39	15.39	15.39	15.39	100
Color, PCU	1	249.40	249.40	249.40	249.40	249.40	249.40	100
Conductivity, umhos/cm	1	34000.00	34000.00	34000.00	34000.00	34000.00	34000.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	3.60	3.60	3.60	3.60	3.60	3.60	100
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.03	0.03	0.03	0.03	0.03	0.03	.
Salinity, ppt	1	21.30	21.30	21.30	21.30	21.30	21.30	.
Secchi Depth, m	1	0.50	0.50	0.50	0.50	0.50	0.50	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	1	0.67	0.67	0.67	0.67	0.67	0.67	0
Orthophosphate as P, mg/l	1	0.05	0.05	0.05	0.05	0.05	0.05	.
Total Phosphorus, mg/l	1	0.13	0.13	0.13	0.13	0.13	0.13	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	16.32	16.32	16.32	16.32	16.32	16.32	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=21FLFTM EVRGWC0027FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	2	2.80	2.80	3.00	3.00	3.20	3.20	.
Chlorophyll-a, ug/l	2	11.00	11.00	15.50	15.50	20.00	20.00	50
Color, PCU	2	80.00	80.00	140.00	140.00	200.00	200.00	100
Conductivity, umhos/cm	2	2649.00	2649.00	2761.00	2761.00	2873.00	2873.00	.
Copper, ug/l	2	0.25	0.25	0.25	0.25	0.25	0.25	0
Dissolved Oxygen, mg/l	2	0.82	0.82	2.20	2.20	3.58	3.58	100
Fecal Coliform, #/100ml	2	80.00	80.00	125.00	125.00	170.00	170.00	100
Iron, ug/l	2	50.00	50.00	178.00	178.00	306.00	306.00	50
Nitrate-Nitrite, mg/l	2	0.00	0.00	0.00	0.00	0.00	0.00	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	2	0.15	0.15	0.38	0.38	0.60	0.60	100
Total Kjeldahl Nitrogen, mg/l	2	1.50	1.50	1.50	1.50	1.50	1.50	.
Total Nitrogen, mg/l	2	1.50	1.50	1.50	1.50	1.50	1.50	100
Orthophosphate as P, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	2	0.08	0.08	0.09	0.09	0.09	0.09	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	2	2.40	2.40	4.70	4.70	7.00	7.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=21FLFTM EVRGWC0028FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	3	1.10	1.10	1.40	1.40	1.70	1.70	.
Chlorophyll-a, ug/l	3	1.00	1.00	10.67	1.00	30.00	30.00	33.33
Color, PCU	3	50.00	50.00	70.00	80.00	80.00	80.00	100.00
Conductivity, umhos/cm	3	4271.00	4271.00	5036.67	4306.00	6533.00	6533.00	.
Copper, ug/l	3	0.45	0.45	0.71	0.80	0.89	0.89	0.00
Dissolved Oxygen, mg/l	3	7.35	7.35	9.77	10.20	11.76	11.76	0.00
Fecal Coliform, #/100ml	3	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Iron, ug/l	3	16.00	16.00	17.00	16.00	19.00	19.00	0.00
Nitrate-Nitrite, mg/l	3	0.00	0.00	0.04	0.01	0.09	0.09	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.50	0.50	0.50	0.50	0.50	0.50	100.00
Total Kjeldahl Nitrogen, mg/l	3	1.00	1.00	1.13	1.20	1.20	1.20	.
Total Nitrogen, mg/l	3	1.00	1.00	1.17	1.21	1.29	1.29	100.00
Orthophosphate as P, mg/l	1	0.05	0.05	0.05	0.05	0.05	0.05	.
Total Phosphorus, mg/l	3	0.03	0.03	0.05	0.04	0.09	0.09	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	3	1.50	1.50	1.97	1.72	2.70	2.70	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=21FLFTM EVRGWC0029FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	3	1.60	1.60	1.87	1.80	2.20	2.20	.
Chlorophyll-a, ug/l	3	1.40	1.40	2.60	1.70	4.70	4.70	0.00
Color, PCU	3	80.00	80.00	126.67	140.00	160.00	160.00	100.00
Conductivity, umhos/cm	3	7321.00	7321.00	33310.33	38040.00	54570.00	54570.00	.
Copper, ug/l	3	0.25	0.25	0.31	0.25	0.43	0.43	0.00
Dissolved Oxygen, mg/l	3	3.14	3.14	3.44	3.45	3.74	3.74	100.00
Fecal Coliform, #/100ml	3	20.00	20.00	63.33	40.00	130.00	130.00	33.33
Iron, ug/l	3	26.00	26.00	63.67	42.00	123.00	123.00	0.00
Nitrate-Nitrite, mg/l	3	0.00	0.00	0.00	0.00	0.01	0.01	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	0.15	0.15	0.38	0.30	0.70	0.70	100.00
Total Kjeldahl Nitrogen, mg/l	3	1.00	1.00	1.17	1.20	1.30	1.30	.
Total Nitrogen, mg/l	3	1.00	1.00	1.17	1.21	1.30	1.30	100.00
Orthophosphate as P, mg/l	1	0.04	0.04	0.04	0.04	0.04	0.04	.
Total Phosphorus, mg/l	3	0.05	0.05	0.07	0.06	0.09	0.09	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	3	2.80	2.80	4.57	3.40	7.50	7.50	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=21FLFTM EVRGWC0030FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	3	0.93	0.93	1.68	1.90	2.20	2.20	.
Chlorophyll-a, ug/l	3	1.00	1.00	6.30	1.90	16.00	16.00	33.33
Color, PCU	3	30.00	30.00	90.00	80.00	160.00	160.00	66.67
Conductivity, umhos/cm	3	713.00	713.00	985.67	888.00	1356.00	1356.00	.
Copper, ug/l	3	0.59	0.59	3.30	4.17	5.13	5.13	66.67
Dissolved Oxygen, mg/l	3	8.32	8.32	9.12	8.50	10.55	10.55	0.00
Fecal Coliform, #/100ml	3	1.00	1.00	40.33	30.00	90.00	90.00	33.33
Iron, ug/l	3	65.00	65.00	279.33	104.00	669.00	669.00	33.33
Nitrate-Nitrite, mg/l	3	0.02	0.02	0.05	0.05	0.09	0.09	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	1.20	1.20	1.50	1.50	1.80	1.80	33.33
Total Kjeldahl Nitrogen, mg/l	3	1.00	1.00	1.13	1.10	1.30	1.30	.
Total Nitrogen, mg/l	3	1.02	1.02	1.19	1.15	1.39	1.39	100.00
Orthophosphate as P, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Total Phosphorus, mg/l	3	0.03	0.03	0.05	0.04	0.07	0.07	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	3	3.30	3.30	4.40	3.40	6.50	6.50	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=21FLFTM EVRGWC0031FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	3	1.30	1.30	1.43	1.40	1.60	1.60	.
Chlorophyll-a, ug/l	3	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Color, PCU	3	15.00	15.00	35.00	40.00	50.00	50.00	33.33
Conductivity, umhos/cm	3	48246.00	48246.00	51378.00	50582.00	55306.00	55306.00	.
Copper, ug/l	3	0.25	0.25	1.98	0.50	5.18	5.18	33.33
Dissolved Oxygen, mg/l	3	6.50	6.50	8.01	7.38	10.16	10.16	0.00
Fecal Coliform, #/100ml	3	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Iron, ug/l	3	152.00	152.00	286.00	336.00	370.00	370.00	66.67
Nitrate-Nitrite, mg/l	3	0.01	0.01	0.01	0.01	0.01	0.01	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	0.50	0.50	0.77	0.80	1.00	1.00	100.00
Total Kjeldahl Nitrogen, mg/l	3	0.80	0.80	0.95	0.84	1.20	1.20	.
Total Nitrogen, mg/l	3	0.81	0.81	0.96	0.85	1.21	1.21	33.33
Orthophosphate as P, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	3	0.05	0.05	0.08	0.09	0.10	0.10	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	3	11.90	11.90	21.63	24.00	29.00	29.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=21FLFTM EVRGWC0059FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	3	1.10	1.10	1.67	1.40	2.50	2.50	.
Chlorophyll-a, ug/l	3	1.00	1.00	12.80	1.40	36.00	36.00	33.33
Color, PCU	3	50.00	50.00	70.00	80.00	80.00	80.00	100.00
Conductivity, umhos/cm	3	23634.00	23634.00	32710.33	26551.00	47946.00	47946.00	.
Copper, ug/l	3	0.77	0.77	1.04	1.16	1.18	1.18	0.00
Dissolved Oxygen, mg/l	3	2.00	2.00	3.08	3.14	4.10	4.10	66.67
Fecal Coliform, #/100ml	3	1.00	1.00	103.67	100.00	210.00	210.00	66.67
Iron, ug/l	3	518.00	518.00	671.67	718.00	779.00	779.00	100.00
Nitrate-Nitrite, mg/l	3	0.00	0.00	0.01	0.01	0.03	0.03	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	0.90	0.90	1.13	1.00	1.50	1.50	66.67
Total Kjeldahl Nitrogen, mg/l	3	1.10	1.10	1.23	1.20	1.40	1.40	.
Total Nitrogen, mg/l	3	1.10	1.10	1.25	1.21	1.43	1.43	100.00
Orthophosphate as P, mg/l	3	0.01	0.01	0.01	0.01	0.02	0.02	.
Total Phosphorus, mg/l	3	0.03	0.03	0.05	0.05	0.06	0.06	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	3	4.00	4.00	5.57	4.30	8.40	8.40	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=21FLFTM EVRGWC0060FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	3	0.82	0.82	2.11	2.70	2.80	2.80	.
Chlorophyll-a, ug/l	3	1.00	1.00	13.33	14.00	25.00	25.00	66.67
Color, PCU	3	50.00	50.00	63.33	60.00	80.00	80.00	100.00
Conductivity, umhos/cm	3	23464.00	23464.00	35580.67	33251.00	50027.00	50027.00	.
Copper, ug/l	3	1.57	1.57	2.20	1.60	3.43	3.43	0.00
Dissolved Oxygen, mg/l	3	4.91	4.91	5.23	5.26	5.51	5.51	0.00
Fecal Coliform, #/100ml	3	1.00	1.00	9.00	10.00	16.00	16.00	0.00
Iron, ug/l	3	150.00	150.00	326.33	264.00	565.00	565.00	33.33
Nitrate-Nitrite, mg/l	3	0.01	0.01	0.02	0.01	0.03	0.03	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	0.70	0.70	0.80	0.70	1.00	1.00	100.00
Total Kjeldahl Nitrogen, mg/l	3	1.10	1.10	1.13	1.10	1.20	1.20	.
Total Nitrogen, mg/l	3	1.11	1.11	1.15	1.11	1.23	1.23	100.00
Orthophosphate as P, mg/l	3	0.01	0.01	0.01	0.01	0.03	0.03	.
Total Phosphorus, mg/l	3	0.04	0.04	0.05	0.05	0.05	0.05	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	3	2.50	2.50	4.27	3.30	7.00	7.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=21FLFTM EVRGWC0061FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	3	1.60	1.60	2.73	2.50	4.10	4.10	.
Chlorophyll-a, ug/l	3	1.00	1.00	16.00	19.00	28.00	28.00	66.67
Color, PCU	3	50.00	50.00	56.67	60.00	60.00	60.00	100.00
Conductivity, umhos/cm	3	26945.00	26945.00	37794.67	36519.00	49920.00	49920.00	.
Copper, ug/l	3	1.60	1.60	1.85	1.71	2.25	2.25	0.00
Dissolved Oxygen, mg/l	3	5.41	5.41	5.92	6.04	6.32	6.32	0.00
Fecal Coliform, #/100ml	3	1.00	1.00	25.67	36.00	40.00	40.00	0.00
Iron, ug/l	3	223.00	223.00	313.33	319.00	398.00	398.00	66.67
Nitrate-Nitrite, mg/l	3	0.01	0.01	0.02	0.01	0.03	0.03	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	0.25	0.25	0.52	0.50	0.80	0.80	100.00
Total Kjeldahl Nitrogen, mg/l	3	0.98	0.98	1.19	1.20	1.40	1.40	.
Total Nitrogen, mg/l	3	0.99	0.99	1.21	1.23	1.41	1.41	66.67
Orthophosphate as P, mg/l	3	0.01	0.01	0.01	0.01	0.03	0.03	.
Total Phosphorus, mg/l	3	0.05	0.05	0.05	0.05	0.07	0.07	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	3	3.20	3.20	6.03	6.40	8.50	8.50	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=21FLFTM EVRGWC0062FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	3	1.00	1.00	1.87	2.30	2.30	2.30	.
Chlorophyll-a, ug/l	3	1.00	1.00	5.73	1.20	15.00	15.00	33.33
Color, PCU	3	50.00	50.00	90.00	60.00	160.00	160.00	100.00
Conductivity, umhos/cm	3	27613.00	27613.00	39858.67	40983.00	50980.00	50980.00	.
Copper, ug/l	3	1.51	1.51	2.63	2.09	4.30	4.30	33.33
Dissolved Oxygen, mg/l	3	4.95	4.95	5.80	5.45	7.00	7.00	0.00
Fecal Coliform, #/100ml	3	1.00	1.00	24.33	12.00	60.00	60.00	33.33
Iron, ug/l	3	311.00	311.00	709.00	566.00	1250.00	1250.00	100.00
Nitrate-Nitrite, mg/l	3	0.01	0.01	0.02	0.02	0.03	0.03	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.20	0.20	0.20	0.20	0.20	0.20	100.00
Total Kjeldahl Nitrogen, mg/l	3	1.10	1.10	1.23	1.20	1.40	1.40	.
Total Nitrogen, mg/l	3	1.11	1.11	1.25	1.23	1.42	1.42	100.00
Orthophosphate as P, mg/l	3	0.01	0.01	0.01	0.01	0.03	0.03	.
Total Phosphorus, mg/l	3	0.06	0.06	0.08	0.06	0.12	0.12	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	3	7.30	7.30	19.33	17.70	33.00	33.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=21FLFTM EVRGWC0063FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	2	2.70	2.70	2.85	2.85	3.00	3.00	.
Chlorophyll-a, ug/l	2	1.40	1.40	3.85	3.85	6.30	6.30	0
Color, PCU	2	60.00	60.00	70.00	70.00	80.00	80.00	100
Conductivity, umhos/cm	2	3333.00	3333.00	26479.50	26479.50	49626.00	49626.00	.
Copper, ug/l	2	2.26	2.26	3.66	3.66	5.06	5.06	50
Dissolved Oxygen, mg/l	2	5.48	5.48	6.67	6.67	7.85	7.85	0
Fecal Coliform, #/100ml	2	44.00	44.00	47.00	47.00	50.00	50.00	100
Iron, ug/l	2	264.00	264.00	306.00	306.00	348.00	348.00	50
Nitrate-Nitrite, mg/l	2	0.01	0.01	0.01	0.01	0.02	0.02	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	2	0.80	0.80	0.80	0.80	0.80	0.80	100
Total Kjeldahl Nitrogen, mg/l	2	1.40	1.40	1.45	1.45	1.50	1.50	.
Total Nitrogen, mg/l	2	1.41	1.41	1.46	1.46	1.52	1.52	100
Orthophosphate as P, mg/l	2	0.01	0.01	0.02	0.02	0.04	0.04	.
Total Phosphorus, mg/l	2	0.07	0.07	0.08	0.08	0.10	0.10	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	2	7.20	7.20	9.05	9.05	10.90	10.90	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=21FLGW13733

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	10.00	10.00	10.00	10.00	10.00	10.00	0
Color, PCU	1	70.00	70.00	70.00	70.00	70.00	70.00	100
Conductivity, umhos/cm	1	1673.50	1673.50	1673.50	1673.50	1673.50	1673.50	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	4.95	4.95	4.95	4.95	4.95	4.95	0
Fecal Coliform, #/100ml	1	1.00	1.00	1.00	1.00	1.00	1.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	1.20	1.20	1.20	1.20	1.20	1.20	100
Total Kjeldahl Nitrogen, mg/l	1	0.97	0.97	0.97	0.97	0.97	0.97	.
Total Nitrogen, mg/l	1	0.98	0.98	0.98	0.98	0.98	0.98	0
Orthophosphate as P, mg/l	1	0.06	0.06	0.06	0.06	0.06	0.06	.
Total Phosphorus, mg/l	1	0.09	0.09	0.09	0.09	0.09	0.09	0
Total Suspended Solids, mg/l	1	4.00	4.00	4.00	4.00	4.00	4.00	0
Turbidity, NTU	1	1.20	1.20	1.20	1.20	1.20	1.20	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=21FLGW15163

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	0.85	0.85	0.85	0.85	0.85	0.85	0
Color, PCU	1	80.00	80.00	80.00	80.00	80.00	80.00	100
Conductivity, umhos/cm	1	3781.50	3781.50	3781.50	3781.50	3781.50	3781.50	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	6.50	6.50	6.50	6.50	6.50	6.50	0
Fecal Coliform, #/100ml	1	18.00	18.00	18.00	18.00	18.00	18.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.48	0.48	0.48	0.48	0.48	0.48	100
Total Kjeldahl Nitrogen, mg/l	1	2.90	2.90	2.90	2.90	2.90	2.90	.
Total Nitrogen, mg/l	1	2.91	2.91	2.91	2.91	2.91	2.91	100
Orthophosphate as P, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Total Phosphorus, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	0
Total Suspended Solids, mg/l	1	5.00	5.00	5.00	5.00	5.00	5.00	0
Turbidity, NTU	1	1.50	1.50	1.50	1.50	1.50	1.50	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=21FLSFWMHALDCRK

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	18	0.78	2.00	2.42	2.00	2.00	5.80	.
Chlorophyll-a, ug/l	77	3.00	3.00	7.05	4.80	8.00	25.10	18.18
Color, PCU	75	30.00	45.00	51.53	50.00	60.00	80.00	77.33
Conductivity, umhos/cm	75	462.00	677.00	811.21	731.00	779.00	6828.00	.
Copper, ug/l	27	6.17	9.22	15.30	12.50	17.41	51.00	100.00
Dissolved Oxygen, mg/l	77	3.07	4.87	6.35	6.47	8.12	11.30	10.39
Fecal Coliform, #/100ml	67	7.00	42.00	152.79	103.00	195.00	914.00	74.63
Iron, ug/l	24	100.00	100.00	169.17	130.00	165.00	600.00	8.33
Nitrate-Nitrite, mg/l	70	0.01	0.02	0.04	0.03	0.06	0.14	.
Salinity, ppt	76	0.22	0.33	0.40	0.36	0.38	3.71	.
Secchi Depth, m	77	0.30	1.00	1.18	1.20	1.35	1.90	76.62
Total Kjeldahl Nitrogen, mg/l	68	0.24	0.63	0.75	0.71	0.81	1.70	.
Total Nitrogen, mg/l	68	0.01	0.55	0.67	0.72	0.86	1.72	13.24
Orthophosphate as P, mg/l	61	0.00	0.01	0.02	0.01	0.02	0.13	.
Total Phosphorus, mg/l	68	0.01	0.03	0.05	0.04	0.05	0.21	1.47
Total Suspended Solids, mg/l	64	2.00	2.00	2.72	2.00	2.00	11.00	0.00
Turbidity, NTU	47	0.50	0.80	1.11	1.00	1.40	2.50	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=21FLSFWMROOK461

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	59	1.40	3.10	5.75	4.90	7.20	17.70	10.17
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	64	3.80	5.05	5.93	5.80	6.30	20.60	4.69
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	61	0.00	0.00	0.01	0.00	0.01	0.02	.
Salinity, ppt	63	18.00	29.50	33.04	34.50	36.90	39.43	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	48	0.10	0.23	0.31	0.30	0.39	0.70	0.00
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	60	0.01	0.03	0.04	0.04	0.06	0.10	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	61	1.50	4.30	6.35	5.60	7.90	15.90	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=21FLSFWMROOK462

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	59	1.00	2.70	4.95	4.10	6.10	15.30	5.08
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	64	2.70	4.33	5.32	5.13	5.78	20.30	10.94
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	61	0.00	0.00	0.01	0.01	0.01	0.03	.
Salinity, ppt	63	13.20	29.10	32.77	34.60	36.80	39.59	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	48	0.09	0.23	0.30	0.30	0.39	0.67	0.00
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	60	0.02	0.03	0.04	0.04	0.06	0.07	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	61	1.80	3.50	5.37	4.90	6.20	15.10	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=21FLSFWMROOK463

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	59	1.00	2.70	4.81	4.10	6.00	18.20	5.08
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	64	2.50	4.40	5.43	5.17	6.00	19.30	10.94
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	61	0.00	0.00	0.01	0.01	0.01	0.04	.
Salinity, ppt	63	19.70	30.20	32.77	33.50	36.15	41.40	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	49	0.07	0.23	0.30	0.28	0.36	0.67	0.00
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	60	0.01	0.03	0.04	0.04	0.05	0.09	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	61	1.60	2.70	4.39	4.10	5.40	9.90	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=BigMarcoRiver

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	60	1.00	3.00	5.79	5.45	7.60	20.90	8.33
Color, PCU	1	206.50	206.50	206.50	206.50	206.50	206.50	100.00
Conductivity, umhos/cm	1	49700.00	49700.00	49700.00	49700.00	49700.00	49700.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	65	3.40	5.20	6.20	6.06	6.63	20.60	6.15
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	62	0.00	0.00	0.01	0.00	0.01	0.03	.
Salinity, ppt	64	25.70	32.05	34.01	34.55	36.80	39.25	.
Secchi Depth, m	1	0.90	0.90	0.90	0.90	0.90	0.90	100.00
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	50	0.11	0.21	0.32	0.29	0.40	0.76	0.00
Orthophosphate as P, mg/l	1	0.04	0.04	0.04	0.04	0.04	0.04	.
Total Phosphorus, mg/l	62	0.01	0.03	0.04	0.04	0.06	0.11	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	62	1.40	4.10	6.23	5.55	7.50	16.60	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=COL10

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	3	2.50	2.50	3.73	4.20	4.50	4.50	0
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	0	.	.	.	.	.	.	.
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	2	0.75	0.75	0.93	0.93	1.10	1.10	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	3	0.03	0.03	0.04	0.04	0.04	0.04	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=DollarBay15

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	20	2.00	3.50	6.30	5.50	9.00	15.00	10
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	0	.	.	.	.	.	.	.
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	20	0.61	0.92	1.28	1.22	1.53	2.53	70
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	18	0.11	0.27	0.38	0.39	0.44	0.64	0
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	18	0.02	0.03	0.04	0.04	0.05	0.07	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=HendersonCreek

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	159	0.77	2.27	4.85	3.81	6.49	28.30	5.66
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	28	3.20	4.30	5.04	5.03	5.79	8.05	21.43
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	25	0.00	0.00	0.01	0.01	0.01	0.03	.
Salinity, ppt	28	16.60	27.60	30.79	32.68	34.95	39.50	.
Secchi Depth, m	3	0.76	0.76	0.81	0.76	0.91	0.91	100.00
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	26	0.18	0.24	0.39	0.32	0.47	1.06	3.85
Orthophosphate as P, mg/l	160	0.00	0.00	0.01	0.01	0.01	0.04	.
Total Phosphorus, mg/l	28	0.00	0.03	0.04	0.04	0.05	0.07	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	25	2.50	4.30	5.68	5.30	7.20	9.90	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=HendersonCrk@41

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	17	1.50	2.00	2.10	2.00	2.00	3.60	.
Chlorophyll-a, ug/l	76	3.00	3.00	5.20	3.00	4.80	29.90	9.21
Color, PCU	75	30.00	50.00	71.67	60.00	80.00	250.00	82.67
Conductivity, umhos/cm	75	125.00	3884.00	22499.06	22449.00	35230.00	60964.00	.
Copper, ug/l	26	0.30	1.00	1.30	1.14	1.50	2.87	0.00
Dissolved Oxygen, mg/l	77	0.63	2.51	3.96	3.61	5.16	9.28	57.14
Fecal Coliform, #/100ml	66	1.00	23.00	165.65	85.00	260.00	1143.00	63.64
Iron, ug/l	24	130.00	295.00	551.67	480.00	675.00	1440.00	70.83
Nitrate-Nitrite, mg/l	72	0.01	0.02	0.03	0.03	0.04	0.12	.
Salinity, ppt	76	0.06	1.66	13.49	13.21	21.67	40.73	.
Secchi Depth, m	73	0.30	0.60	0.77	0.80	0.90	1.20	100.00
Total Kjeldahl Nitrogen, mg/l	66	0.19	0.53	0.68	0.72	0.80	1.41	.
Total Nitrogen, mg/l	69	0.01	0.28	0.58	0.67	0.81	1.42	7.25
Orthophosphate as P, mg/l	63	0.00	0.01	0.01	0.01	0.02	0.07	.
Total Phosphorus, mg/l	67	0.01	0.02	0.03	0.03	0.04	0.10	0.00
Total Suspended Solids, mg/l	61	2.00	2.00	8.48	2.00	6.00	70.00	13.11
Turbidity, NTU	47	0.50	1.00	1.67	1.60	2.00	4.20	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=JohnsonBay1

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	20	2.00	3.00	4.85	4.00	6.00	11.00	0.00
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	0	.	.	.	.	.	.	.
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	16	0.61	1.07	1.19	1.19	1.34	1.68	81.25
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	19	0.02	0.03	0.04	0.04	0.04	0.06	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=JohnsonBay2

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	19	1.00	2.00	4.95	4.00	8.00	12.00	5.26
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	0	.	.	.	.	.	.	.
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	6	0.61	0.67	0.97	0.96	1.22	1.37	100.00
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	18	0.02	0.03	0.04	0.04	0.04	0.06	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=JohnsonBay3

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	10	2.00	3.00	4.80	5.00	6.00	7.00	0
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	0	.	.	.	.	.	.	.
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	10	1.07	1.22	1.58	1.75	1.83	1.98	40
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	9	0.02	0.03	0.03	0.03	0.04	0.06	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=NTK200125

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	4.26	4.26	4.26	4.26	4.26	4.26	0
Color, PCU	1	120.70	120.70	120.70	120.70	120.70	120.70	100
Conductivity, umhos/cm	1	51000.00	51000.00	51000.00	51000.00	51000.00	51000.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	3.40	3.40	3.40	3.40	3.40	3.40	100
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	.
Salinity, ppt	1	33.60	33.60	33.60	33.60	33.60	33.60	.
Secchi Depth, m	1	1.20	1.20	1.20	1.20	1.20	1.20	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	.
Total Phosphorus, mg/l	1	0.04	0.04	0.04	0.04	0.04	0.04	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	2.33	2.33	2.33	2.33	2.33	2.33	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=NTK200126

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	4.18	4.18	4.18	4.18	4.18	4.18	0
Color, PCU	1	209.10	209.10	209.10	209.10	209.10	209.10	100
Conductivity, umhos/cm	1	51100.00	51100.00	51100.00	51100.00	51100.00	51100.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	3.00	3.00	3.00	3.00	3.00	3.00	100
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.03	0.03	0.03	0.03	0.03	0.03	.
Salinity, ppt	1	33.70	33.70	33.70	33.70	33.70	33.70	.
Secchi Depth, m	1	1.10	1.10	1.10	1.10	1.10	1.10	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	1	0.03	0.03	0.03	0.03	0.03	0.03	.
Total Phosphorus, mg/l	1	0.06	0.06	0.06	0.06	0.06	0.06	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	13.47	13.47	13.47	13.47	13.47	13.47	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=NTK200130

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	23.79	23.79	23.79	23.79	23.79	23.79	100
Color, PCU	1	277.30	277.30	277.30	277.30	277.30	277.30	100
Conductivity, umhos/cm	1	32400.00	32400.00	32400.00	32400.00	32400.00	32400.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	2.05	2.05	2.05	2.05	2.05	2.05	100
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	.
Salinity, ppt	1	20.20	20.20	20.20	20.20	20.20	20.20	.
Secchi Depth, m	1	0.70	0.70	0.70	0.70	0.70	0.70	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	1	0.03	0.03	0.03	0.03	0.03	0.03	.
Total Phosphorus, mg/l	1	0.09	0.09	0.09	0.09	0.09	0.09	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	5.97	5.97	5.97	5.97	5.97	5.97	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=PORTAUPR5

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	3	4.00	4.00	4.33	4.40	4.60	4.60	.
Chlorophyll-a, ug/l	3	22.00	22.00	46.00	42.00	74.00	74.00	100.00
Color, PCU	3	80.00	80.00	113.33	100.00	160.00	160.00	100.00
Conductivity, umhos/cm	3	1369.00	1369.00	1902.33	1753.00	2585.00	2585.00	.
Copper, ug/l	3	0.37	0.37	0.89	0.54	1.75	1.75	0.00
Dissolved Oxygen, mg/l	3	4.12	4.12	5.83	5.07	8.31	8.31	0.00
Fecal Coliform, #/100ml	3	1.00	1.00	77.00	110.00	120.00	120.00	66.67
Iron, ug/l	3	71.00	71.00	195.33	159.00	356.00	356.00	33.33
Nitrate-Nitrite, mg/l	3	0.00	0.00	0.01	0.01	0.03	0.03	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.60	0.60	0.60	0.60	0.60	0.60	100.00
Total Kjeldahl Nitrogen, mg/l	3	1.60	1.60	1.77	1.80	1.90	1.90	.
Total Nitrogen, mg/l	3	1.60	1.60	1.78	1.81	1.93	1.93	100.00
Orthophosphate as P, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	3	0.06	0.06	0.09	0.10	0.11	0.11	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	3	2.60	2.60	5.67	6.40	8.00	8.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=ROOK458

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	3	5.47	5.47	5.74	5.72	6.02	6.02	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	3	38.95	38.95	39.14	39.23	39.24	39.24	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=ROOK459

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	3	6.35	6.35	6.54	6.58	6.69	6.69	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	3	38.14	38.14	38.39	38.16	38.86	38.86	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=ROOK460

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	3	6.12	6.12	6.59	6.45	7.19	7.19	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	3	37.72	37.72	38.55	38.71	39.22	39.22	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=TarponBay

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	10	3.00	3.00	5.30	4.00	7.00	11.00	0
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	0	.	.	.	.	.	.	.
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	10	0.91	1.22	1.57	1.45	1.98	2.59	50
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	10	0.02	0.03	0.03	0.03	0.04	0.05	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=TarponBay1

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	19	3.00	5.00	9.74	8.00	12.00	23.00	26.32
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	0	.	.	.	.	.	.	.
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	14	0.91	1.31	1.48	1.45	1.52	2.29	50.00
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	4	0.32	0.36	0.39	0.41	0.43	0.43	0.00
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	19	0.03	0.04	0.04	0.04	0.04	0.06	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Rookery Bay Station=UH

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	329	340.0	34285.0	38198.34	40445.00	45340.00	54620.0	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	282	0.8	3.0	3.74	3.90	4.70	6.5	53.9
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	329	0.2	21.4	24.47	25.85	29.35	36.0	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	265	-1.0	1.0	5.46	4.00	7.00	70.5	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=187_Fakahatchee

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	9	6.4	6.6	7.03	6.9	7.6	7.9	0.00
Fecal Coliform, #/100ml	12	1.0	1.0	8.75	1.0	1.0	94.0	8.33
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	9	32.3	33.8	33.91	34.0	34.5	34.7	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	12	0.5	1.1	2.37	1.5	4.3	5.0	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=21FLA 66011SEAS

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	9	6.3	6.70	7.10	6.90	7.7	8.0	0.00
Fecal Coliform, #/100ml	12	1.0	1.00	5.00	1.00	1.0	49.0	8.33
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	9	32.4	33.90	34.09	34.20	34.5	35.1	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	12	0.4	1.05	2.40	1.35	4.1	5.5	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=21FLA 66038SEAS

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	9	6.70	6.8	7.00	6.8	6.90	8.0	0
Fecal Coliform, #/100ml	12	1.00	1.0	3.67	1.0	1.00	33.0	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	9	31.50	32.0	32.49	32.3	33.00	33.7	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	12	0.62	1.2	3.13	2.1	4.65	7.4	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=21FLFMRISTK200201

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	44.71	44.71	44.71	44.71	44.71	44.71	100
Color, PCU	1	184.40	184.40	184.40	184.40	184.40	184.40	100
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	4.70	4.70	4.70	4.70	4.70	4.70	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.03	0.03	0.03	0.03	0.03	0.03	.
Salinity, ppt	1	21.90	21.90	21.90	21.90	21.90	21.90	.
Secchi Depth, m	1	0.90	0.90	0.90	0.90	0.90	0.90	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	1	1.09	1.09	1.09	1.09	1.09	1.09	100
Orthophosphate as P, mg/l	1	0.05	0.05	0.05	0.05	0.05	0.05	.
Total Phosphorus, mg/l	1	0.15	0.15	0.15	0.15	0.15	0.15	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	5.46	5.46	5.46	5.46	5.46	5.46	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=21FLFMRISTK200205

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	7.05	7.05	7.05	7.05	7.05	7.05	0
Color, PCU	1	56.20	56.20	56.20	56.20	56.20	56.20	100
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	6.30	6.30	6.30	6.30	6.30	6.30	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.03	0.03	0.03	0.03	0.03	0.03	.
Salinity, ppt	1	13.90	13.90	13.90	13.90	13.90	13.90	.
Secchi Depth, m	1	0.80	0.80	0.80	0.80	0.80	0.80	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	1	0.54	0.54	0.54	0.54	0.54	0.54	0
Orthophosphate as P, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	1	0.04	0.04	0.04	0.04	0.04	0.04	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	5.80	5.80	5.80	5.80	5.80	5.80	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=21FLFMRISTK200208

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	5.60	5.60	5.60	5.60	5.60	5.60	0
Color, PCU	1	53.30	53.30	53.30	53.30	53.30	53.30	100
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	5.10	5.10	5.10	5.10	5.10	5.10	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.05	0.05	0.05	0.05	0.05	0.05	.
Salinity, ppt	1	20.70	20.70	20.70	20.70	20.70	20.70	.
Secchi Depth, m	1	1.00	1.00	1.00	1.00	1.00	1.00	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	1	0.66	0.66	0.66	0.66	0.66	0.66	0
Orthophosphate as P, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	.
Total Phosphorus, mg/l	1	0.06	0.06	0.06	0.06	0.06	0.06	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	9.40	9.40	9.40	9.40	9.40	9.40	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=21FLFMRISTK200210

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	8.92	8.92	8.92	8.92	8.92	8.92	0
Color, PCU	1	53.30	53.30	53.30	53.30	53.30	53.30	100
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	5.50	5.50	5.50	5.50	5.50	5.50	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.04	0.04	0.04	0.04	0.04	0.04	.
Salinity, ppt	1	22.80	22.80	22.80	22.80	22.80	22.80	.
Secchi Depth, m	1	1.50	1.50	1.50	1.50	1.50	1.50	0
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	1	0.67	0.67	0.67	0.67	0.67	0.67	0
Orthophosphate as P, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	1	0.07	0.07	0.07	0.07	0.07	0.07	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	10.70	10.70	10.70	10.70	10.70	10.70	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=21FLFMRISTK200211

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	11.68	11.68	11.68	11.68	11.68	11.68	100
Color, PCU	1	127.70	127.70	127.70	127.70	127.70	127.70	100
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	8.30	8.30	8.30	8.30	8.30	8.30	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	.
Salinity, ppt	1	15.10	15.10	15.10	15.10	15.10	15.10	.
Secchi Depth, m	1	0.60	0.60	0.60	0.60	0.60	0.60	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	1	0.58	0.58	0.58	0.58	0.58	0.58	0
Orthophosphate as P, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Total Phosphorus, mg/l	1	0.04	0.04	0.04	0.04	0.04	0.04	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	3.95	3.95	3.95	3.95	3.95	3.95	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=21FLFMRISTK200212

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	13.85	13.85	13.85	13.85	13.85	13.85	100
Color, PCU	1	52.30	52.30	52.30	52.30	52.30	52.30	100
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	6.50	6.50	6.50	6.50	6.50	6.50	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.03	0.03	0.03	0.03	0.03	0.03	.
Salinity, ppt	1	22.90	22.90	22.90	22.90	22.90	22.90	.
Secchi Depth, m	1	1.00	1.00	1.00	1.00	1.00	1.00	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	1	0.64	0.64	0.64	0.64	0.64	0.64	0
Orthophosphate as P, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Total Phosphorus, mg/l	1	0.07	0.07	0.07	0.07	0.07	0.07	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	9.13	9.13	9.13	9.13	9.13	9.13	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=21FLFMRISTK200214

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	13.32	13.32	13.32	13.32	13.32	13.32	100
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	7.00	7.00	7.00	7.00	7.00	7.00	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.03	0.03	0.03	0.03	0.03	0.03	.
Salinity, ppt	1	23.30	23.30	23.30	23.30	23.30	23.30	.
Secchi Depth, m	1	0.90	0.90	0.90	0.90	0.90	0.90	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	1	0.61	0.61	0.61	0.61	0.61	0.61	0
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.05	0.05	0.05	0.05	0.05	0.05	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	9.16	9.16	9.16	9.16	9.16	9.16	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=21FLFMRISTK200216

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	5.46	5.46	5.46	5.46	5.46	5.46	0
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	6.10	6.10	6.10	6.10	6.10	6.10	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.08	0.08	0.08	0.08	0.08	0.08	.
Salinity, ppt	1	17.30	17.30	17.30	17.30	17.30	17.30	.
Secchi Depth, m	1	0.90	0.90	0.90	0.90	0.90	0.90	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	1	0.75	0.75	0.75	0.75	0.75	0.75	0
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	1	0.05	0.05	0.05	0.05	0.05	0.05	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	6.73	6.73	6.73	6.73	6.73	6.73	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=21FLFTM EVRGWC0001FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	3	0.87	0.87	1.26	1.20	1.70	1.70	.
Chlorophyll-a, ug/l	3	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Color, PCU	3	40.00	40.00	50.00	50.00	60.00	60.00	66.67
Conductivity, umhos/cm	3	26913.00	26913.00	40811.33	39626.00	55895.00	55895.00	.
Copper, ug/l	3	0.33	0.33	1.11	1.00	2.00	2.00	0.00
Dissolved Oxygen, mg/l	3	3.92	3.92	5.17	5.11	6.47	6.47	33.33
Fecal Coliform, #/100ml	3	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Iron, ug/l	3	65.00	65.00	107.33	99.00	158.00	158.00	0.00
Nitrate-Nitrite, mg/l	3	0.00	0.00	0.01	0.01	0.02	0.02	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	1.00	1.00	1.00	1.00	1.00	1.00	100.00
Total Kjeldahl Nitrogen, mg/l	3	0.90	0.90	0.95	0.97	0.99	0.99	.
Total Nitrogen, mg/l	3	0.91	0.91	0.96	0.97	1.01	1.01	33.33
Orthophosphate as P, mg/l	3	0.02	0.02	0.02	0.02	0.02	0.02	.
Total Phosphorus, mg/l	3	0.04	0.04	0.05	0.05	0.06	0.06	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	3	4.60	4.60	6.50	5.50	9.40	9.40	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=21FLFTM EVRGWC0002FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	3	0.63	0.63	1.18	1.20	1.70	1.70	.
Chlorophyll-a, ug/l	3	1.00	1.00	1.23	1.00	1.70	1.70	0.00
Color, PCU	3	60.00	60.00	76.67	70.00	100.00	100.00	100.00
Conductivity, umhos/cm	3	18452.00	18452.00	34615.67	29400.00	55995.00	55995.00	.
Copper, ug/l	3	0.29	0.29	1.10	1.00	2.00	2.00	0.00
Dissolved Oxygen, mg/l	3	2.51	2.51	5.99	6.10	9.36	9.36	33.33
Fecal Coliform, #/100ml	3	1.00	1.00	60.67	1.00	180.00	180.00	33.33
Iron, ug/l	3	140.00	140.00	157.67	155.00	178.00	178.00	0.00
Nitrate-Nitrite, mg/l	3	0.00	0.00	0.02	0.02	0.04	0.04	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	2	0.50	0.50	0.70	0.70	0.90	0.90	100.00
Total Kjeldahl Nitrogen, mg/l	3	1.00	1.00	1.10	1.10	1.20	1.20	.
Total Nitrogen, mg/l	3	1.02	1.02	1.12	1.10	1.24	1.24	100.00
Orthophosphate as P, mg/l	3	0.01	0.01	0.02	0.02	0.03	0.03	.
Total Phosphorus, mg/l	3	0.04	0.04	0.06	0.06	0.08	0.08	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	3	6.40	6.40	9.90	8.50	14.80	14.80	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=21FLFTM EVRGWC0003FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	3	0.95	0.95	1.62	1.50	2.40	2.40	.
Chlorophyll-a, ug/l	3	1.00	1.00	1.13	1.00	1.40	1.40	0.00
Color, PCU	3	80.00	80.00	93.33	80.00	120.00	120.00	100.00
Conductivity, umhos/cm	3	20302.00	20302.00	37477.00	36236.00	55893.00	55893.00	.
Copper, ug/l	3	0.26	0.26	1.09	1.00	2.00	2.00	0.00
Dissolved Oxygen, mg/l	3	1.73	1.73	3.78	4.45	5.15	5.15	33.33
Fecal Coliform, #/100ml	3	1.00	1.00	7.33	1.00	20.00	20.00	0.00
Iron, ug/l	3	151.00	151.00	201.67	154.00	300.00	300.00	0.00
Nitrate-Nitrite, mg/l	3	0.00	0.00	0.01	0.00	0.01	0.01	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	2	0.20	0.20	0.35	0.35	0.50	0.50	100.00
Total Kjeldahl Nitrogen, mg/l	3	1.20	1.20	1.30	1.30	1.40	1.40	.
Total Nitrogen, mg/l	3	1.20	1.20	1.31	1.30	1.41	1.41	100.00
Orthophosphate as P, mg/l	3	0.02	0.02	0.03	0.03	0.05	0.05	.
Total Phosphorus, mg/l	3	0.07	0.07	0.08	0.09	0.10	0.10	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	3	6.10	6.10	10.83	10.40	16.00	16.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=21FLFTM EVRGWC0004FTM

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	3	0.96	0.96	1.35	1.20	1.90	1.90	.
Chlorophyll-a, ug/l	3	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Color, PCU	3	60.00	60.00	86.67	80.00	120.00	120.00	100.00
Conductivity, umhos/cm	3	11474.00	11474.00	30329.67	23613.00	55902.00	55902.00	.
Copper, ug/l	3	0.36	0.36	1.28	1.48	2.00	2.00	0.00
Dissolved Oxygen, mg/l	3	3.62	3.62	6.09	5.66	8.99	8.99	33.33
Fecal Coliform, #/100ml	3	1.00	1.00	17.00	10.00	40.00	40.00	0.00
Iron, ug/l	3	136.00	136.00	205.67	225.00	256.00	256.00	0.00
Nitrate-Nitrite, mg/l	3	0.00	0.00	0.02	0.02	0.02	0.02	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	0.50	0.50	0.60	0.60	0.70	0.70	100.00
Total Kjeldahl Nitrogen, mg/l	3	1.10	1.10	1.17	1.10	1.30	1.30	.
Total Nitrogen, mg/l	3	1.12	1.12	1.18	1.12	1.30	1.30	100.00
Orthophosphate as P, mg/l	3	0.01	0.01	0.01	0.02	0.02	0.02	.
Total Phosphorus, mg/l	3	0.04	0.04	0.05	0.04	0.08	0.08	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	3	4.60	4.60	9.67	11.90	12.50	12.50	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=21FLGW13734

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	2.70	2.70	2.70	2.70	2.70	2.70	0
Color, PCU	1	140.00	140.00	140.00	140.00	140.00	140.00	100
Conductivity, umhos/cm	1	5650.50	5650.50	5650.50	5650.50	5650.50	5650.50	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	0.59	0.59	0.59	0.59	0.59	0.59	100
Fecal Coliform, #/100ml	1	64.00	64.00	64.00	64.00	64.00	64.00	100
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.01	0.01	0.01	0.01	0.01	0.01	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	1.00	1.00	1.00	1.00	1.00	1.00	100
Total Kjeldahl Nitrogen, mg/l	1	1.20	1.20	1.20	1.20	1.20	1.20	.
Total Nitrogen, mg/l	1	1.21	1.21	1.21	1.21	1.21	1.21	100
Orthophosphate as P, mg/l	1	0.00	0.00	0.00	0.00	0.00	0.00	.
Total Phosphorus, mg/l	1	0.03	0.03	0.03	0.03	0.03	0.03	0
Total Suspended Solids, mg/l	1	4.00	4.00	4.00	4.00	4.00	4.00	0
Turbidity, NTU	1	1.50	1.50	1.50	1.50	1.50	1.50	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=21FLGW15173

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	1.30	1.30	1.30	1.30	1.30	1.30	0
Color, PCU	1	140.00	140.00	140.00	140.00	140.00	140.00	100
Conductivity, umhos/cm	1	23915.00	23915.00	23915.00	23915.00	23915.00	23915.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	2.52	2.52	2.52	2.52	2.52	2.52	100
Fecal Coliform, #/100ml	1	6.00	6.00	6.00	6.00	6.00	6.00	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.72	0.72	0.72	0.72	0.72	0.72	100
Total Kjeldahl Nitrogen, mg/l	1	1.30	1.30	1.30	1.30	1.30	1.30	.
Total Nitrogen, mg/l	1	1.32	1.32	1.32	1.32	1.32	1.32	100
Orthophosphate as P, mg/l	1	0.03	0.03	0.03	0.03	0.03	0.03	.
Total Phosphorus, mg/l	1	0.09	0.09	0.09	0.09	0.09	0.09	0
Total Suspended Solids, mg/l	1	17.00	17.00	17.00	17.00	17.00	17.00	0
Turbidity, NTU	1	4.70	4.70	4.70	4.70	4.70	4.70	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=21FLSFWMROOK451

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	59	1.00	3.30	5.78	5.30	7.50	13.40	6.78
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	64	3.30	5.35	6.19	6.00	6.50	20.30	4.69
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	61	0.00	0.00	0.01	0.00	0.01	0.05	.
Salinity, ppt	63	21.30	31.30	33.54	34.10	36.70	40.40	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	49	0.08	0.22	0.33	0.31	0.43	0.76	0.00
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	60	0.01	0.03	0.05	0.04	0.06	0.16	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	61	1.10	5.50	7.52	6.70	8.70	23.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=21FLSFWMTTI51

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	60	1.00	1.90	3.13	2.70	3.50	10.90	0.00
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	60	2.90	4.18	5.35	5.43	6.40	8.10	16.67
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	60	0.00	0.01	0.02	0.01	0.03	0.09	.
Salinity, ppt	60	4.05	18.90	25.86	27.50	33.63	40.55	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	48	0.09	0.30	0.43	0.42	0.52	1.61	2.08
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	60	0.01	0.02	1.68	0.03	0.04	99.00	1.67
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	60	2.00	4.75	8.11	6.35	7.70	99.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=21FLSFWMTTI53

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	60	1.00	1.40	2.57	2.25	3.05	10.80	0.00
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	63	2.45	4.27	5.24	5.45	6.15	8.25	17.46
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	60	0.00	0.01	0.02	0.01	0.03	0.09	.
Salinity, ppt	60	3.45	18.35	25.35	26.48	34.05	40.60	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	48	0.10	0.33	0.41	0.37	0.45	1.43	2.08
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	60	0.01	0.02	0.03	0.03	0.03	0.19	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	60	1.80	3.15	4.29	4.20	5.10	7.30	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=21FLSFWMTTI65

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	60	1.00	2.35	3.45	3.35	4.30	7.90	0.00
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	63	3.60	4.70	5.53	5.50	6.30	10.40	9.52
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	60	0.00	0.01	0.02	0.01	0.02	0.09	.
Salinity, ppt	63	15.40	24.90	29.72	31.00	36.60	41.62	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	48	0.16	0.28	0.40	0.38	0.45	1.95	2.08
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	60	0.02	0.02	0.04	0.03	0.04	0.12	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	60	0.60	3.30	5.38	4.45	6.70	17.30	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=21FLSFWMTTI67

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	60	1.0	1.85	3.73	3.10	5.05	13.10	1.67
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	62	3.5	5.00	5.66	5.60	6.50	8.00	4.84
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	60	0.0	0.00	0.01	0.01	0.01	0.05	.
Salinity, ppt	62	19.8	27.90	31.66	31.65	37.10	40.10	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	48	0.1	0.27	0.36	0.33	0.40	1.72	2.08
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	60	0.0	0.02	0.03	0.03	0.04	0.08	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	60	0.6	2.60	4.64	3.50	5.55	15.90	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=21FLSFWMTTI68

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	60	1.00	2.20	3.95	3.25	5.10	12.90	1.67
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	60	2.50	5.20	5.76	5.60	6.40	7.80	3.33
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	60	0.00	0.00	0.01	0.01	0.01	0.05	.
Salinity, ppt	60	14.90	26.25	30.96	31.70	36.60	40.70	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	48	0.11	0.26	0.36	0.34	0.41	1.60	2.08
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	60	0.00	0.02	0.03	0.03	0.04	0.07	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	60	0.60	3.20	5.47	5.10	6.50	19.40	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=21FLSFWMTTI69

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	60	1.0	1.85	3.30	2.85	4.15	8.20	0.00
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	63	1.4	4.30	5.14	5.00	6.10	7.20	11.11
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	60	0.0	0.01	0.02	0.01	0.02	0.07	.
Salinity, ppt	63	7.2	22.70	28.74	30.70	36.90	40.10	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	48	0.1	0.25	0.36	0.34	0.41	1.21	2.08
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	60	0.0	0.03	0.04	0.03	0.05	0.07	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	60	0.5	4.00	5.74	5.30	6.80	13.70	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=21FLSFWMTTI70

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	60	1.00	1.80	2.50	2.25	2.90	6.60	0.00
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	63	0.40	3.95	4.79	4.60	5.75	7.24	25.40
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	60	0.00	0.01	0.02	0.02	0.02	0.05	.
Salinity, ppt	63	0.30	10.05	22.72	23.50	36.30	40.50	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	48	0.12	0.29	0.38	0.36	0.42	1.67	2.08
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	60	0.01	0.02	0.03	0.03	0.04	0.06	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	60	0.40	2.25	4.40	3.80	6.25	12.20	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=21FLSFWMTTI72

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	60	1.00	2.55	4.25	3.75	5.10	11.40	1.67
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	63	1.50	4.40	5.05	5.10	5.90	6.90	15.87
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	60	0.00	0.01	0.01	0.01	0.02	0.05	.
Salinity, ppt	63	16.10	26.90	31.02	32.30	37.30	40.40	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	48	0.11	0.27	0.39	0.37	0.45	1.43	2.08
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	60	0.00	0.03	0.04	0.04	0.05	0.08	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	60	0.60	4.55	6.36	5.60	8.05	13.30	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=21FLSFWMTTI74

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	60	1.00	2.40	4.08	3.55	5.20	11.60	1.67
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	63	1.10	4.30	5.06	4.90	5.90	7.30	15.87
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	60	0.00	0.01	0.02	0.01	0.02	0.07	.
Salinity, ppt	63	15.10	30.60	32.36	33.50	37.10	40.27	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	48	0.09	0.26	0.38	0.36	0.45	1.38	2.08
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	59	0.01	0.04	0.05	0.05	0.06	0.08	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	60	0.50	5.05	7.58	6.75	10.00	17.10	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=21FLSFWMTTI75

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	60	1.00	2.30	3.44	2.90	4.30	11.90	1.67
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	63	0.20	3.50	4.50	4.45	5.65	8.20	38.10
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	60	0.00	0.01	0.02	0.01	0.03	0.09	.
Salinity, ppt	63	5.90	26.30	30.20	32.35	37.20	40.52	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	49	0.08	0.32	0.42	0.41	0.50	1.34	2.04
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	59	0.03	0.05	0.06	0.06	0.06	0.24	1.69
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	60	1.00	4.95	7.27	6.60	8.20	27.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=21FLSFWMTTI76

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	23	1.70	2.90	4.83	4.50	6.80	9.30	0.00
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	26	2.20	3.80	5.09	4.90	5.92	7.55	26.92
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	23	0.00	0.00	0.01	0.01	0.01	0.04	.
Salinity, ppt	26	9.20	18.05	24.95	24.48	32.70	40.34	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	25	0.29	0.37	0.44	0.43	0.50	0.66	0.00
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	23	0.02	0.03	0.05	0.04	0.04	0.27	4.35
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	23	1.00	3.40	5.12	4.90	6.90	10.20	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=BARRIVN

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	19	1.50	2.00	2.37	2.00	2.00	8.30	.
Chlorophyll-a, ug/l	72	3.00	3.00	5.90	3.00	4.80	47.50	12.50
Color, PCU	71	20.00	50.00	64.72	60.00	80.00	200.00	81.69
Conductivity, umhos/cm	75	306.00	452.00	11879.23	4909.00	18120.00	51115.00	.
Copper, ug/l	22	0.29	0.62	1.01	1.00	1.00	4.00	4.55
Dissolved Oxygen, mg/l	77	2.05	3.26	4.52	4.07	5.07	12.16	46.75
Fecal Coliform, #/100ml	71	1.00	28.00	195.01	58.00	180.00	2300.00	63.38
Iron, ug/l	25	100.00	130.00	234.80	170.00	260.00	930.00	12.00
Nitrate-Nitrite, mg/l	72	0.00	0.01	0.02	0.01	0.02	0.06	.
Salinity, ppt	76	0.15	0.23	7.20	2.23	10.24	33.54	.
Secchi Depth, m	75	0.50	1.30	1.67	1.70	2.00	2.90	30.67
Total Kjeldahl Nitrogen, mg/l	65	0.14	0.46	0.63	0.62	0.75	2.26	.
Total Nitrogen, mg/l	66	0.01	0.26	0.54	0.59	0.74	2.27	6.06
Orthophosphate as P, mg/l	58	0.00	0.00	0.01	0.01	0.01	0.02	.
Total Phosphorus, mg/l	70	0.00	0.01	0.02	0.02	0.02	0.05	0.00
Total Suspended Solids, mg/l	64	2.00	2.00	4.99	2.00	2.00	113.00	3.13
Turbidity, NTU	46	0.30	0.50	0.89	0.75	1.10	3.40	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=BL_Kwater

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	63	0.76	2.10	4.21	3.40	5.07	15.19	3.17
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	3437	1300.00	42465.00	47493.12	51800.00	55485.00	62830.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	2560	0.45	3.20	4.40	4.40	5.50	8.70	41.52
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	3437	0.60	27.20	31.08	34.10	36.85	42.30	.
Secchi Depth, m	1	0.70	0.70	0.70	0.70	0.70	0.70	100.00
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	3	0.38	0.38	0.50	0.49	0.62	0.62	0.00
Orthophosphate as P, mg/l	60	0.01	0.02	0.02	0.02	0.03	0.05	.
Total Phosphorus, mg/l	3	0.05	0.05	0.06	0.07	0.07	0.07	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	3234	0.50	8.00	11.39	10.00	13.00	120.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=BRMouth

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	60	1.00	1.65	2.94	2.50	3.60	8.80	0.00
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	63	1.80	3.40	4.60	4.70	5.50	7.80	31.75
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	60	0.00	0.01	0.02	0.02	0.03	0.06	.
Salinity, ppt	63	1.00	12.30	21.67	21.30	33.30	40.20	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	48	0.05	0.33	0.45	0.43	0.52	2.03	2.08
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	60	0.01	0.02	0.04	0.03	0.05	0.09	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	60	0.90	3.40	5.41	4.80	6.70	16.40	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=Bridge030122

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	3	0.62	0.62	0.91	0.81	1.30	1.30	.
Chlorophyll-a, ug/l	3	1.00	1.00	1.23	1.00	1.70	1.70	0.00
Color, PCU	3	50.00	50.00	66.67	50.00	100.00	100.00	100.00
Conductivity, umhos/cm	3	5212.00	5212.00	24253.00	11730.00	55817.00	55817.00	.
Copper, ug/l	3	0.31	0.31	1.15	1.14	2.00	2.00	0.00
Dissolved Oxygen, mg/l	3	2.89	2.89	5.78	6.40	8.05	8.05	33.33
Fecal Coliform, #/100ml	3	4.00	4.00	8.00	10.00	10.00	10.00	0.00
Iron, ug/l	3	108.00	108.00	137.00	147.00	156.00	156.00	0.00
Nitrate-Nitrite, mg/l	3	0.01	0.01	0.03	0.03	0.04	0.04	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	0.30	0.30	0.50	0.50	0.70	0.70	100.00
Total Kjeldahl Nitrogen, mg/l	3	1.00	1.00	1.03	1.00	1.10	1.10	.
Total Nitrogen, mg/l	3	1.01	1.01	1.06	1.04	1.13	1.13	100.00
Orthophosphate as P, mg/l	3	0.01	0.01	0.02	0.02	0.02	0.02	.
Total Phosphorus, mg/l	3	0.03	0.03	0.04	0.03	0.06	0.06	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	3	3.40	3.40	5.70	6.50	7.20	7.20	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=COL14

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	3	5.10	5.10	6.67	7.10	7.80	7.80	0
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	0	.	.	.	.	.	.	.
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	0.50	0.50	0.74	0.80	0.93	0.93	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	3	0.04	0.04	0.04	0.04	0.05	0.05	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=COL15

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	3	1.80	1.80	7.10	9.40	10.10	10.10	0
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	0	.	.	.	.	.	.	.
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	0.80	0.80	1.01	1.02	1.20	1.20	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	3	0.03	0.03	0.04	0.04	0.05	0.05	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=COL16

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	3	5.30	5.30	7.97	6.40	12.20	12.20	33.33
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	0	.	.	.	.	.	.	.
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	2	0.80	0.80	0.95	0.95	1.10	1.10	100.00
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	3	0.04	0.04	0.04	0.05	0.05	0.05	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=FAKAUPOI

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	18	1.60	2.00	2.02	2.00	2.00	3.00	.
Chlorophyll-a, ug/l	75	3.00	3.00	4.71	3.00	4.30	19.20	6.67
Color, PCU	72	10.00	40.00	47.29	40.00	60.00	100.00	45.83
Conductivity, umhos/cm	74	449.00	691.00	17625.71	4840.00	29974.00	60085.00	.
Copper, ug/l	26	0.33	1.00	1.70	1.26	2.20	5.13	7.69
Dissolved Oxygen, mg/l	76	3.36	5.03	6.45	6.66	7.48	11.54	7.89
Fecal Coliform, #/100ml	57	1.00	1.00	14.56	3.00	10.00	340.00	5.26
Iron, ug/l	26	130.00	170.00	271.54	215.00	330.00	980.00	26.92
Nitrate-Nitrite, mg/l	76	0.01	0.01	0.02	0.02	0.03	0.11	.
Salinity, ppt	75	0.21	0.33	11.09	2.23	18.57	40.10	.
Secchi Depth, m	77	1.00	1.40	1.74	1.70	2.00	2.60	22.08
Total Kjeldahl Nitrogen, mg/l	70	0.04	0.32	0.51	0.48	0.62	2.02	.
Total Nitrogen, mg/l	69	0.01	0.24	0.45	0.43	0.63	2.04	5.80
Orthophosphate as P, mg/l	63	0.00	0.00	0.01	0.01	0.01	0.02	.
Total Phosphorus, mg/l	68	0.00	0.01	0.02	0.02	0.02	0.15	0.00
Total Suspended Solids, mg/l	64	2.00	2.00	8.67	2.00	3.50	83.00	12.50
Turbidity, NTU	47	0.40	0.70	1.01	0.90	1.20	2.10	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=FU

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	60	0.53	1.92	2.77	2.39	3.31	6.55	0.0
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	2786	420.00	25800.00	38235.93	43842.50	52480.00	61865.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	2022	1.20	4.30	5.19	5.05	6.05	8.60	13.3
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	2786	0.20	15.65	24.71	28.28	34.60	41.60	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	58	0.00	0.00	0.01	0.01	0.01	0.03	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	2617	1.00	5.00	7.60	7.00	8.50	207.50	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=Fa-Aunion

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	3	2.00	2.00	4.33	5.00	6.00	6.00	0
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	0	.	.	.	.	.	.	.
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	1	0.88	0.88	0.88	0.88	0.88	0.88	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	3	0.34	0.34	0.38	0.39	0.40	0.40	0
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	3	0.02	0.02	0.03	0.03	0.05	0.05	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=FakahatcheeBay

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	60	0.98	2.50	4.61	4.05	6.65	12.42	1.67
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	2761	9580.00	36010.00	43834.79	46700.00	53085.00	64190.00	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1840	1.70	4.30	5.30	5.30	6.25	9.15	16.14
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	2761	5.35	22.60	28.40	30.30	35.00	43.40	.
Secchi Depth, m	1	0.76	0.76	0.76	0.76	0.76	0.76	100.00
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	56	0.00	0.01	0.01	0.01	0.02	0.05	.
Total Phosphorus, mg/l	3	0.05	0.05	0.05	0.05	0.06	0.06	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	2735	1.00	7.00	10.75	9.00	12.00	249.00	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=PumpkinBay

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	3	3.00	3.00	11.33	14.00	17.00	17.00	66.67
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	0	.	.	.	.	.	.	.
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	0	.	.	.	.	.	.	.
Secchi Depth, m	3	0.61	0.61	0.69	0.61	0.85	0.85	100.00
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	3	0.04	0.04	0.05	0.05	0.07	0.07	0.00
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	0	.	.	.	.	.	.	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=SEAS007_Ferguson

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	9	6.30	6.7	7.01	6.90	7.40	7.6	0.00
Fecal Coliform, #/100ml	12	1.00	1.0	7.58	1.00	1.00	79.0	8.33
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	9	28.90	31.4	31.47	31.60	32.00	32.8	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	12	0.77	1.9	3.82	3.25	4.05	14.0	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=SEAS010_IndianKey

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	9	6.50	6.70	7.14	7.10	7.5	8.1	0.00
Fecal Coliform, #/100ml	12	1.00	1.00	5.00	1.00	1.0	49.0	8.33
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	9	32.00	33.60	33.69	33.90	34.2	34.3	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	12	0.47	0.92	2.43	1.75	3.7	5.8	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=SEAS028_Turtle

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	9	6.40	6.50	6.94	6.70	7.60	7.8	0.00
Fecal Coliform, #/100ml	12	1.00	1.00	5.17	1.00	1.50	49.0	8.33
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	9	32.90	33.10	33.69	33.90	34.20	34.3	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	12	0.58	1.05	2.82	2.45	4.55	6.0	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=SEAS029_SnagShoal

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	9	6.30	6.60	6.88	6.8	7.00	8.0	0.00
Fecal Coliform, #/100ml	12	1.00	1.00	4.92	1.0	1.50	46.0	8.33
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	9	33.00	33.20	33.74	34.1	34.10	34.2	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	12	0.26	1.05	2.92	2.1	4.75	7.8	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=SEAS034_DismalKey

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	9	6.40	6.60	6.86	6.9	7.10	7.4	0.00
Fecal Coliform, #/100ml	12	1.00	1.00	5.00	1.0	1.00	49.0	8.33
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	9	32.10	32.70	33.18	33.4	33.70	33.8	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	12	0.52	0.97	3.25	2.7	4.95	8.9	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=SEAS035_SantinaBay

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	9	6.40	6.7	6.83	6.80	6.90	7.3	0
Fecal Coliform, #/100ml	12	1.00	1.0	3.67	1.00	1.00	33.0	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	9	31.90	32.3	32.89	33.10	33.40	33.9	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	12	0.45	0.9	2.90	2.15	4.05	8.6	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=SEAS036_Pumpkin

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	9	6.5	6.80	7.01	7.00	7.1	7.9	0.00
Fecal Coliform, #/100ml	12	1.0	1.00	6.75	1.00	1.0	70.0	8.33
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	9	30.1	32.00	32.02	32.10	32.6	32.7	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	12	0.4	0.97	2.92	3.05	4.5	6.3	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=SEAS037_Santina

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	9	6.3	6.7	7.09	7.10	7.40	8.1	0.00
Fecal Coliform, #/100ml	12	1.0	1.0	12.67	1.00	1.00	140.0	8.33
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	9	31.5	31.9	32.31	32.00	32.80	33.4	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	12	0.4	1.2	2.76	2.25	4.05	6.5	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=SEAS111_Fakahatchee

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	9	6.4	6.70	7.00	6.9	7.4	7.7	0
Fecal Coliform, #/100ml	12	1.0	1.00	4.08	1.0	2.5	31.0	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	9	29.1	31.00	31.28	31.2	32.1	32.4	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	12	0.5	0.78	4.17	1.9	4.8	23.0	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=SEAS112_Fakahatchee

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	9	5.90	6.80	7.03	6.90	7.3	8.0	0.00
Fecal Coliform, #/100ml	12	1.00	1.00	11.92	1.00	1.5	130.0	8.33
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	9	29.20	29.90	30.26	30.10	30.9	31.1	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	12	0.72	2.05	4.42	3.15	4.8	19.0	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=SEAS113_Fakahatchee

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	9	6.7	6.8	7.14	7.1	7.4	8.2	0.00
Fecal Coliform, #/100ml	12	1.0	1.0	20.92	1.0	1.0	240.0	8.33
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	9	29.4	30.8	31.46	31.1	32.4	32.8	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	12	0.4	0.8	3.70	2.1	4.5	19.0	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=SEAS114_Fakahatchee

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	9	6.3	6.5	6.99	6.8	7.30	8.3	0.00
Fecal Coliform, #/100ml	12	1.0	1.0	11.83	1.0	1.00	130.0	8.33
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	9	29.0	30.6	30.94	30.9	31.80	32.1	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	12	0.6	1.5	3.15	2.6	4.95	6.5	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=SEAS281_FishHawk

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	9	6.50	6.50	6.89	6.80	6.90	7.8	0
Fecal Coliform, #/100ml	12	1.00	1.00	3.75	1.00	1.00	33.0	0
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	9	32.40	32.90	33.42	33.70	34.00	34.1	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	12	0.42	1.12	2.57	2.05	4.35	5.6	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=SEAS299_Blackwater

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	9	6.30	6.4	6.82	6.7	7.1	7.6	0.00
Fecal Coliform, #/100ml	12	1.00	1.0	6.75	1.0	1.0	70.0	8.33
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	9	30.10	32.2	32.49	32.8	33.1	33.2	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	12	0.69	1.1	3.51	2.6	4.7	13.0	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=SEAS300_Blackwater

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	9	5.60	6.2	6.63	6.4	7.20	7.6	0.00
Fecal Coliform, #/100ml	12	1.00	1.0	6.83	1.0	1.00	70.0	8.33
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	9	28.60	31.1	31.16	31.5	31.80	32.7	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	12	0.93	1.9	4.64	3.4	6.25	14.0	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=SEAS301_ShellKey

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	9	6.10	6.50	6.72	6.7	6.8	7.4	0.00
Fecal Coliform, #/100ml	12	1.00	1.00	11.92	1.0	1.5	130.0	8.33
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	9	32.90	33.30	33.69	33.9	34.1	34.2	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	12	0.38	1.04	3.62	2.4	5.5	13.0	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=SEAS302_SnagShoal

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	9	6.3	6.70	7.01	6.90	7.20	7.9	0.00
Fecal Coliform, #/100ml	12	1.0	1.00	5.17	1.00	1.50	49.0	8.33
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	9	33.3	33.40	33.63	33.80	33.80	34.0	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	12	0.5	1.09	3.37	2.75	4.75	8.5	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=SEAS303_Buttonwood

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	9	6.10	6.6	6.94	6.9	7.4	7.7	0.00
Fecal Coliform, #/100ml	12	1.00	1.0	4.83	1.0	1.0	46.0	8.33
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	9	30.10	31.9	32.04	32.2	32.3	32.9	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	12	0.88	1.4	3.55	2.8	5.7	7.8	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=SEAS401_FakaUnion

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	9	6.3	6.5	6.84	6.7	7.2	7.6	0.00
Fecal Coliform, #/100ml	11	1.0	1.0	324.18	1.0	110.0	1700.0	27.27
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	9	30.8	31.0	31.53	31.5	32.0	32.5	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	11	1.2	2.3	4.36	3.6	5.7	10.0	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=SEAS771_FakaUnion

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	9	6.3	6.90	7.17	7.1	7.20	8.1	0.00
Fecal Coliform, #/100ml	12	1.0	1.00	10.17	1.0	1.00	110.0	8.33
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	9	32.1	33.50	33.70	33.7	34.00	34.7	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	12	0.5	1.05	2.48	1.5	4.55	5.9	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=STK200206

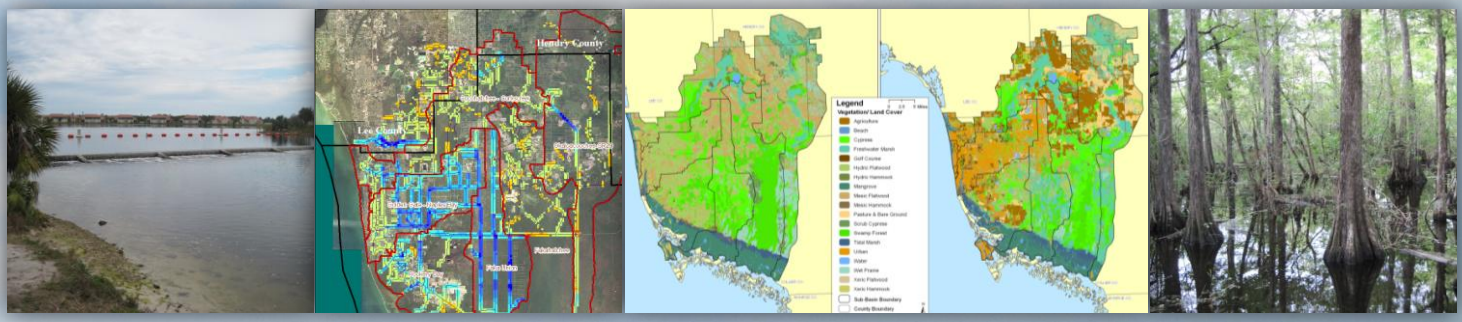
Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	1	15.23	15.23	15.23	15.23	15.23	15.23	100
Color, PCU	1	144.30	144.30	144.30	144.30	144.30	144.30	100
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	1	6.00	6.00	6.00	6.00	6.00	6.00	0
Fecal Coliform, #/100ml	0	.	.	.	.	.	.	.
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	.
Salinity, ppt	1	15.80	15.80	15.80	15.80	15.80	15.80	.
Secchi Depth, m	1	0.60	0.60	0.60	0.60	0.60	0.60	100
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	1	0.02	0.02	0.02	0.02	0.02	0.02	.
Total Phosphorus, mg/l	1	0.06	0.06	0.06	0.06	0.06	0.06	0
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	1	8.55	8.55	8.55	8.55	8.55	8.55	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Summary Statistics for Specified Subbasin and Station for Parameters of Interest, 2000-2009
Source = Estuarine

Subbasin=Ten Thousand Islands Station=Seas077

Parameter	N	Min	P25	Mean	Median	P75	Max	Percent Exceed
Biochemical Oxygen Demand, mg/l	0	.	.	.	.	.	.	.
Chlorophyll-a, ug/l	0	.	.	.	.	.	.	.
Color, PCU	0	.	.	.	.	.	.	.
Conductivity, umhos/cm	0	.	.	.	.	.	.	.
Copper, ug/l	0	.	.	.	.	.	.	.
Dissolved Oxygen, mg/l	9	4.1	6.9	6.77	7.1	7.1	7.9	0.00
Fecal Coliform, #/100ml	11	1.0	1.0	309.64	8.0	70.0	1700.0	27.27
Iron, ug/l	0	.	.	.	.	.	.	.
Nitrate-Nitrite, mg/l	0	.	.	.	.	.	.	.
Salinity, ppt	9	24.9	28.7	28.84	28.7	29.8	31.0	.
Secchi Depth, m	0	.	.	.	.	.	.	.
Total Kjeldahl Nitrogen, mg/l	0	.	.	.	.	.	.	.
Total Nitrogen, mg/l	0	.	.	.	.	.	.	.
Orthophosphate as P, mg/l	0	.	.	.	.	.	.	.
Total Phosphorus, mg/l	0	.	.	.	.	.	.	.
Total Suspended Solids, mg/l	0	.	.	.	.	.	.	.
Turbidity, NTU	11	1.3	1.5	3.85	2.9	6.5	8.3	.
Unionized Ammonia, mg/l	0	.	.	.	.	.	.	.

Collier County
Watershed Management Plan



Final Report
Volume 4A
Technical Report
Assessment of Existing Conditions and Performance Measures

Collier County

Prepared by ATKINS

November 2011

Document No. 110082
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FINAL REPORT

COLLIER COUNTY WATERSHED MANAGEMENT PLAN COLLIER COUNTY, FLORIDA

VOLUME 3: RECOMMENDED NON-STRUCTURAL INITIATIVES

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November 2011

Contents of Volume 4

Volume 4 is a compilation of the individual technical memoranda completed to describe results of the existing conditions analysis in the watersheds and estuaries of Collier County, as well as the performance measures utilized to assess the benefit of proposed structural projects. The technical memoranda are presented as individual chapters and sections in this document and address the following items in the project's scope of work:

- Literature Review
- Element 1: Assessment of Existing Conditions – Watersheds
- Element 2: Assessment of Existing Conditions – Estuaries
- Element 3: Development of Performance Measures

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Acronyms and Abbreviations

ACSC	Area of Critical State Concern
ACSC-ST	Area of Critical State Concern – Special Treatment
BCB	Big Cypress Basin
BCC	Board of County Commissioners
BCE	Black, Crow, and Eidsness
BCNP	Big Cypress National Preserve
BMAP	Basin Management Action Plan
BMP	Best Management Practices
BOD-5	5-Day Biochemical Oxygen Demand
CC	Cocohatchee-Corkscrew Watershed
CCME	Conservation Coastal Management Element
CCPC	Collier County Planning Commission
CCWMP	Collier County Watershed Management Plan
CDU	Community Development Unit
CERP	Comprehensive Everglades Restoration Plan
cfs	Cubic feet per second
CN	Curve Number
Cu	Copper
DCIA	Directly Connected Impervious Area
DEM	Digital Elevation Model
DO	Dissolved Oxygen
EAC	Environmental Advisory Council
ECM	Existing Conditions Model
EDDMapS	Early Detection and Distribution Mapping System
EMC	Event Mean Concentration
ENP	Everglades National Park
EPA	Environmental Protection Agency
ERD	Environmental Research and Design
ERP	Environmental Resource Permit
ERU	Equivalent Residential Unit
ET	Evapotranspiration
F.A.C.	Florida Administrative Code
FAS	Floridan Aquifer System
FCM	Future Conditions Model
FDEP	Florida Department of Environmental Protection
FDoH	Florida Department of Health
FLInv	Florida Invasive Plants Geodatabase
FLUCCS	Florida Land Use, Land Cover Classification System
FLUE	Future Land Use Element
FLUM	Future Land Use Map

FNAI	Florida Natural Areas Inventory
FPLOS	Flood Protection Level of Service
FRESP	Florida Ranchlands Environmental Services Project
FUFHOK	Faka Union, Fakahatchee, and Okaloacoochee-SR29 Watersheds
FWRI	Fish and Wildlife Research Institute
GGAMP	Golden Gate Area Master Plan
GGNB	Golden Gate-Naples Bay Watershed
GIS	Geographic Information Systems
GMP	Growth Management Plan
H&H	Hydraulic and Hydrologic
HOA	Homeowners Association
IAS	Intermediate Aquifer System
IWR	Impaired Waters Rule
JEI	Janicki Environmental Inc.
LASIP	Lely Area Stormwater Improvement Plan
LDC	Land Development Code
LID	Low Impact Development
LSI	Landscape Suitability Index
MAL	Minimum Aquifer Level
mg/l	milligrams/liter
MPN	Most Probable Number
MSL	Mean Sea Level
MSTU	Municipal Services Taxing Unit
NAVD	North American Vertical Datum
NEXRAD	High Resolution Radar
NGGE	Northern Golden Gates Estates
NGGEFRA	North Golden Gate Estates Flowway Restoration Area
NGGEFRP	North Golden Gate Estates Flowway Restoration Program
NGVD	National Geodetic Vertical Datum
NOx	Nitrate + Nitrite
NSG	Natural Systems Group
NSM	Natural Systems Model
OFW	Outstanding Florida Water
OL	Overland
Pb	Lead
PBS&J	Post Buckley Schuh and Jernigan
PCU	Platinum Cobalt Units
PDVM	Pre-Development Vegetation Map
PIR	Project Implementation Report
PSRP	Picayune Strand Restoration Project
PUD	Planned Unit Development
RB	Rookery Bay Watershed

RFMU	Rural Fringe Mixed Use
RIDS	Regional Irrigation Distribution System
RLSA	Rural Lands Stewardship Area
ROMA	Regional Offsite Mitigation Area
RSF	Residential Single Family
RWCA	Recyclable Water Containment Areas
SAS	Surficial Aquifer System
SCS	Soil Conservation Service
SFWMD	South Florida Water Management District
SGGE	Southern Golden Gate Estates
SOW	Scope of Work
S.R.	State Road
ST	Special Treatment
SWFFS	Southwest Florida Feasibility Study
SWIM	Surface Water Improvement and Management
SZ	Saturated Zone
TDR	Transfer of Development Rights
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TKN	Total Kjeldahl Nitrogen
TM	Technical Memorandum
TP	Total Phosphorus
TSS	Total Suspended Solids
TTI	Ten Thousand Islands
ug/l	micrograms/liter
UMAM	Uniform Mitigation Assessment Method
URF	Urban Residential Fringe
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USGS	United States Geologic Survey
UZ	Unsaturated Zone
WBID	Water body Identification Number
WMD	Water Management District
WMPs	Watershed Management Plans
Zn	Zinc

INTRODUCTION

Collier County is developing Watershed Management Plans (WMPs) with the purpose of protecting the County's estuarine and wetland systems, consistent with Florida Statute (Subsection 163.3177 (5)(d)). Under the statute, a Conservation Element that addresses "the conservation, use, and protection of natural resources in the area, including air, water, water recharge areas, wetlands, water wells, estuarine marshes, soils, beaches, shores, flood plains, rivers, bays, lakes, harbors, forests, fisheries and wildlife, marine habitat, minerals, and other natural and environmental resources" is required as part of Local Government Comprehensive Plans.

This volume of the CCWMP provides a historical perspective and summary of previously completed studies. This volume also presents a detailed assessment of existing conditions in Collier County and performance measures that were used to evaluate the projects described in Volume 2.

DOCUMENT ORGANIZATION

This volume of the WMP describes the link between water quality, water quantity, and natural systems issues in Collier County watersheds and estuaries. This volume is presented in four (4) chapters, consistent with the work elements outlined in the County's Scope of Work.

Chapter 1: Literature Review and Preliminary Assessment Based on Review of Previously Developed Models. This section provides a historical perspective on water resource issues in Collier County. This chapter also describes other models previously applied for in BCB and compares model results in order to lay the groundwater necessary to fully understand the evaluation of existing conditions

Chapter 2: Assessment of Existing Conditions – Watersheds. Surface water, ground water, and natural systems conditions in the Cocohatchee-Corkscrew, Golden Gate, and Rookery Bay watersheds, and the rural Faka Union/Okaloacoochee/Fakahatchee basins combined are presented and assessed against performance measures to evaluate historical habitat loss.

Chapter 3: Assessment of Existing Conditions – Estuaries. Freshwater inflows, water quality of inflows and receiving waters, and coastal habitat conditions in Wiggins Pass, Naples Bay, Rookery Bay, and Ten Thousand Islands estuaries will be characterized and evaluated in terms of performance measures developed for the estuaries.

Chapter 4: Development of Performance Measures. Performance measures used for assessing watershed and estuary conditions are described in this chapter.

Chapter 5: References.

1.0 LITERATURE REVIEW AND PRELIMINARY ASSESSMENT BASED ON REVIEW OF PREVIOUSLY DEVELOPED MODELS

An initial task conducted as part of this project included a literature review and a comparison of simulation results of MIKE SHE computer models developed for the Big Cypress Basin Project Implementation Report (PIR). Three MIKE SHE models were developed for the PIR to evaluate the potential benefits of restoring the Southern Golden Gates Estates (SGGE) area of Collier County. This project is now referred to as the Picayune Strand Restoration Project (PSRP). The three models include an existing conditions model that is based on year 2000 land use, a future conditions models that is based on year 2050 land use, and a pre-development (or natural systems) model developed for the Southwest Florida Feasibility Study (SWFFS). Each of the PIR models was originally developed using the software version 2000 and were later updated to run with version 2003. For this analysis, each of the models was rerun using version 2009 of the software.

1.1 LITERATURE REVIEW

In order to adequately define future water management strategies, it is necessary to understand the history of water management in Collier County. For this task, more than 50 documents were reviewed. These are listed in the bibliography. This section summarizes 11 documents that were found to provide the most information in describing the historical hydrology and flow conditions in Collier County. It is noted that in many of the older documents, the Faka Union Canal Basin was referred to as the Fahka Union Basin. Following are summary descriptions of the relevant documents identified as part of this task.

Davis, John H. October 1943. The Natural Features of Southern Florida, Especially the Vegetation, and the Everglades. Florida Geological Survey Bulletin No. 25.

This bulletin describes some of the cultural history and the main physical and biological features of South Florida prior to major development and construction of the existing drainage network, although it does not provide quantified estimates about historic flows or water levels in Collier County. In this document, Collier County is described as consisting of three physiographic regions; the Flatlands, the Big Cypress Swamp, and the Southwest Coast and Ten Thousand Islands (Figure 1-1). Davis states that the county is 2,025.5 square miles in size, making it the largest land mass county east of the Mississippi River.

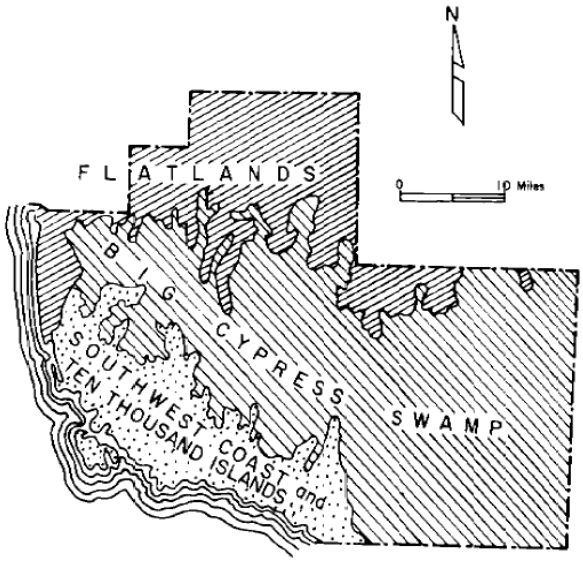


Figure 1-1
Physiographic Regions of Collier County, Florida (from Davis 1943)

The Flatlands region is described as consisting mainly of low, nearly flat to gently rolling land with some rivers dissecting the plains. There are many small ponds, sloughs and other depressions. The Collier County portion of the Flatlands regions is less well drained and of lower elevation than portions of the Flatlands region in Lee County and other counties to the north. Another feature of the Flatlands region is the great number of marsh, swamp, and open-water depressions including Lake Trafford and the Corkscrew marsh.

The Big Cypress Swamp region was described as covering about 1,200 square miles, most in Collier County with small areas in southeastern Hendry County and northern Monroe County. Davis describes the chief characteristics of the Big Cypress as "vegetational with an abundance of the cypress and mixed swamps of large trees, open elongated forest of cypress and medium sized trees, are large areas of scrubby stunted cypress trees growing in marsh-like seasonally wet prairies. The region is of low elevation, low relief and very confused drainage. Most of it lies between elevations of 5 and 20 feet. A number of sloughs drain the Big Cypress, some draining to the Gulf of Mexico, and others into the Everglades. Most of the west part drains toward the south through the Fakahatchee Swamp."

The Southwest Coast and Ten Thousand Islands regions is described as a very low-lying coastal region of small shoal-water islands, It is one of the most dissected coastal regions of Florida and one of the least accurately known due to dense mangrove swamps. These mangrove swamps and salt-water marshes are among the largest in the world. The tidal range is approximately two (2) feet, but combined with the flat topography causes the tidal inundation of large areas far inland and forces salt water far up the estuaries.

Kenner, W. E., 1966, "Runoff in Florida," Map Series No. 22, U.S. Geologic Survey.

In 1966, the United States Geologic Survey and W. E. Kenner produced Map Series No. 22 titled, "Runoff in Florida." This map suggests that the total runoff from the Collier County area at that time was between 0–10 inches annually.

Klein, H., W.J. Schneider, B.F. McPherson and T.J. Buchanan. May 1970. Some Hydrologic and Biologic Aspects of the Big Cypress Swamp Drainage Area, Southern Florida. United States Geologic Survey Open-file Report 70003.

In May 1970, the United States Geologic Survey and specifically, H. Klein, W.J. Schneider, B.F. McPherson and T.J. Buchanan published Open File Report 70003 entitled, "Some Hydrologic and Biologic Aspects of the Big Cypress Swamp Drainage Area, Southern Florida." The prime purpose of the report was to determine the importance of the Big Cypress in maintaining an adequate water supply for (1) the Everglades National Park, for (2) the expanding population of southwest Florida, and for (3) the adjacent estuaries, which constitute nurseries for fish.

For this report, the Big Cypress was divided into three subareas as shown in Figure 1-2. Each subarea has a reasonably distinct internal drainage determined largely by topographic configuration and man-made drainage. Subarea A lies northeast of a low ridge and drains southeastward into Conservation Area 3 of the Central and Southern Florida Flood Control District.

Subarea B includes approximately 550 square miles at the west edge of the Big Cypress. It is characterized by an extensive system of canals, which drain southward and westward into the Gulf Coast estuaries. This canal system includes primarily the Golden Gate Estates canal system.

Subarea C occupies the central part of the Big Cypress and drains toward the Everglades National Park. It consists of about 1,450 square miles.

Klein stated that during the rainy season, shallow depressions fill with water and, because of the poor drainage, water stands on the land until it evaporates or slowly drains off. Thus, as much as 90 percent of the undrained part of the Big Cypress is inundated to depths ranging from a few inches to more than three (3) feet at the height of the rainy season.

Klein stated that in southern Florida, land development usually began with the construction of canals to drain swampy land and to assure protection from high water during the rainy seasons. Significant development affecting the Big Cypress region began in the early 1920s, when two major roads were built. First was the north-south road (U.S. Highway 29) from Everglades City to Immokalee, completed in 1926. Second was the completion of the Tamiami Trail in 1928. Both were constructed of borrow material from continuous pits adjacent to the roads. The borrow pits became canals.

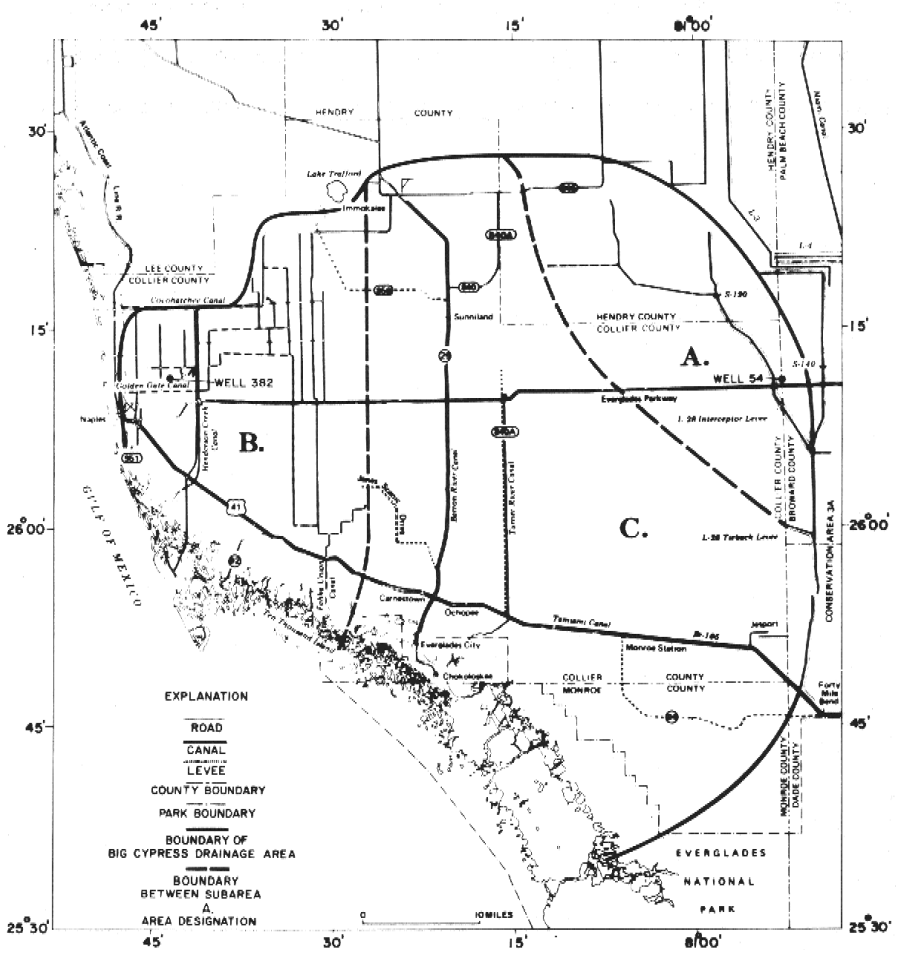


Figure 1-2
Map of the Big Cypress showing the delineation of the drainage area and the subareas as defined by Klein (1970)

The Everglades Parkway (Alligator Alley) was completed in 1967. Numerous bridges along the parkway permit southward flow of water. Land development for housing in the 188-square-mile Golden Gate Estates area in western Collier County began in the 1960s. Drainage canals, most notably the Golden Gate Main Canal and the Cocohatchee River Canal were dug to drain the western part of the estates. The Fahka Union Canal (later called Faka Union) was completed to drain the southern portion in November 1969.

The Golden Gate Canal system is described as extending inland from the Gulf about 20 miles. The bottom of the canal is excavated to about five (5) feet below sea level near the coast and to 6–8 feet above sea level in the interior. The shallow depth of the canal and the distribution of weirs in the canal network limit the drainage of water from the shallow aquifer in inland areas. Prior to construction of the drainage network, the area inland from Naples was inundated each year during the rainy season.

In 1968, construction was started on the Fahka Union Canal. Klein reports that when completed, this canal will extend northward nearly to Lake Trafford. Weirs will be distributed throughout this canal system to limit the drainage of water from the shallow aquifer and to maintain water levels in conformance with the general slope of the land surface. Canals will connect the Fahka Union system with the Golden Gate system. This canal system was subsequently completed in the early 1970's.

Klein reported that of the various canals in Collier County, the Golden Gate Canal has been most frequently monitored and studied. Surface water has flowed continuously over the Golden Gate Canal outlet weir since its completion in August 1963. The northern most weirs in the system were completed between mid-1969 and mid-1970. Flow over the primary weir of the Golden Gate Canal (measured from 1965 through 1968) ranged from a high of 2,390 cubic feet per second (cfs) on July 1, 1966 to a low of 28 cfs on May 27, 1967. The average flow over the weir during the period was 350 cfs. Figure 1-3 shows hydrographs of discharge for the 1966 and 1968 water years.

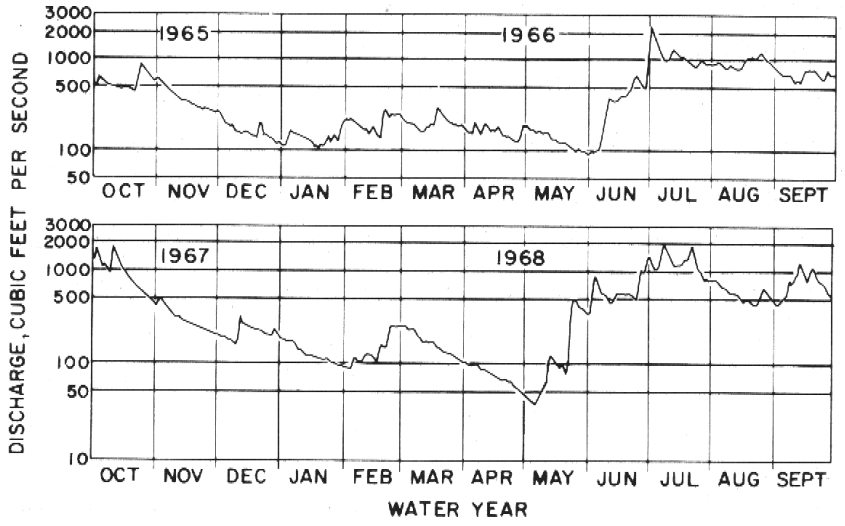


Figure 1-3
Hydrographs of Discharge for the Golden Gate Canal for the 1966 and 1968 Water Years (From Figure 18 of Klein, 1970)

McCoy, Jack. 1972. Hydrology of Western Collier County, Florida. State of Florida, Department of Natural Resources, Division of Interior Resources, Bureau of Geology Report of Investigations No. 63.

This project was a study of the Hydrology of Western Collier County and was completed at the request of the County. The driving issue was development of additional freshwater supplies to meet the demands of the rapidly growing population. McCoy states that although the water supply potential of western Collier County is large, water problems exist in that the 54 inches of annual rainfall are not evenly distributed throughout the year. In addition, salt-water intrusion threatens

the Naples well field during prolonged dry periods, and contamination of existing and future ground water supplies is possible by man related activities.

The study focused on the areas drained by the Golden Gate and Faka Union Canal systems and included Henderson Creek. McCoy states that prior to construction of the canal system, much of Collier County was inundated each year during the rainy season. McCoy (1972) describes the canal system as follows:

- The Golden Gate Canal extends about 20 miles inland from the Gordon River. The bottom of the canal is 5 feet below mean sea level (msl) at its outlet to Gordon River and 6 to 8 feet above msl in the interior. The design plans for the Fahka Union Canal call for similar bottom elevations. Distributed throughout the canal system are about 30 weirs, with increase in elevation toward the interior. The elevations of the coastal weirs on the Golden Gate and Faka Union Canals are 3 and 2 feet above msl. The elevation of the highest interior weir (near Immokalee) is 17 feet above msl (it is assumed to mean NGVD29).

- The function of the canals is to lower annual peak water levels to prevent flooding during the rainy season. The function of the weirs is to control the canal flow and reduce the possibilities of over drainage. During the rainy season, when water levels in the interior are high, water moves from aquifer storage into the canals and downstream over the weirs. At the beginning of the dry season, flow over the inlandmost weirs ceases but continues over the downstream weirs. Flow over the weirs ceases in succession downstream, as the dry season continues, until flow occurs only at coastal weirs on the primary canals. By limiting drainage from aquifer storage, regional water levels near the coast are not lowered excessively, and therefore, the problem of sea-water intrusion is not magnified.

- The Golden Gate Canal is about 100 feet wide, less than 8 feet deep and has several fixed weirs throughout its reach of 26 miles; the Faka Union Canal is similar in width and depth and about 30 miles long; the Henderson Creek and Cocohatchee River Canals are 25 feet wide, less than 5 feet deep, and 7 to 13 miles in length respectively. The Henderson Creek Canal is uncontrolled except for a constriction at Alligator Alley which acts as a surface water divide most of the time. However, at the peak of the rainy season, the Henderson Creek Canal probably receives some flow from the Golden Gate Canal. The Cocohatchee River Canal has a control a short distance upstream from the gaging station. Farmers regulated the control according to irrigation needs. The Cocohatchee River Canal drains most of the area southwest of Lake Trafford, but it also helps drain the Golden Gate area during peak wet periods.

McCoy reports that during 1970, the average discharge at each of the four monitoring stations was: 250 cfs from the Golden Gate Canal, 270 cfs from the Faka Union Canal, 25 cfs from the Henderson Creek Canal, and 15 cfs from the Cocohatchee River Canal. It was further noted that during the dry season of 1971, discharge at the Golden Gate Canal outlet reached a record low of less than 20 cfs. This was approximately twice the average daily pumpage of the Naples water system in 1970.

Freiberger, H.J. 1972. Stream Flow Variation and Distribution in the Big Cypress Watershed during Wet and Dry Periods. Map Series 45. Bureau of Geology, Florida Dept. of Natural Resources, Tallahassee, FL.

In 1972, the Florida Bureau of Geology and Herbert Freiberger published Map Series No. 45 to present the Streamflow Variation and Distribution in the Big Cypress Watershed during wet and dry periods. This was based on measured flows from 1969 through 1971.

Figure 1-4 shows post-canal construction flow paths as estimated by Freiberger. This figure indicates that the overland sheet flow is reduced when compared to the natural system. The majority of flow is intercepted by the canal system and carried to tide via the Cocohatchee, Golden Gate, Henderson Creek, and Faka Union Canals. Figure 1-5 provides a comparison of average measured flows at the end of the rainy season in 1969 versus measured flows during the dry season of 1971.

Black, Crow, and Eidsness, Inc. 1974. Hydrologic Study of the G. A. C. Canal Network. Gainesville, FL. Project no. 449-73-53.

In 1974, Black, Crow, and Eidsness (BCE) completed a Hydrologic Study of the G. A. C. Canal Network. This study investigated the changes in the historical watersheds of Collier County and the resulting increase in wet season inflows through the Golden Gate Canal system into Naples Bay.

BCE presented a diagram of pre-canal construction basin boundaries of western Collier County. This diagram is shown in Figure 1-6. In the pre-canal time period, surface water in the Belle Meade Basin, which includes the existing Golden Gate basin, was integrated with the Corkscrew Swamp to the north and the Fakahatchee Strand to the east. Historical outlets from the Golden Gate Watershed were the Cocohatchee River, Gordon River (Naples Bay), Rock Creek, Henderson Creek, and the Fakahatchee Strand. Figure 1-7 shows the post-canal construction drainage basins as defined by BCE (1974).

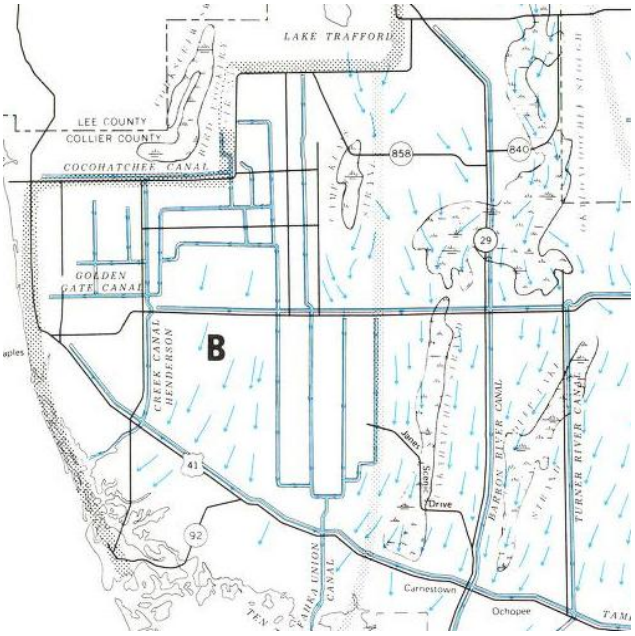
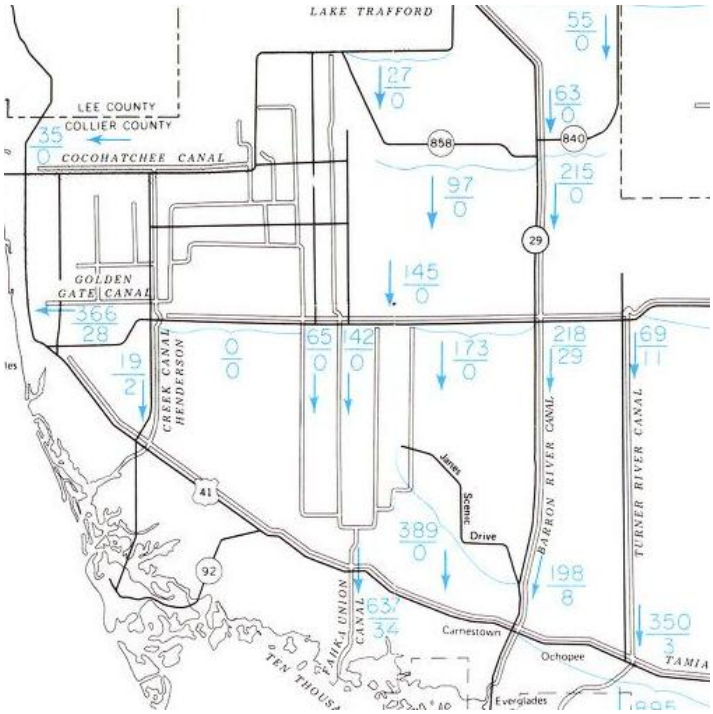


Figure 1-4
Map of the Big Cypress Basin Showing Direction of Overland Flow
for the Period November 18–20, 1969 (From Figure 1 in Freiberger 1972)



Top line = November 18–20, 1969 (cfs)
Bottom line = March 9, 1971 (cfs)

Figure 1-5
Average Measured Flow Data (From Freiberger 1972)

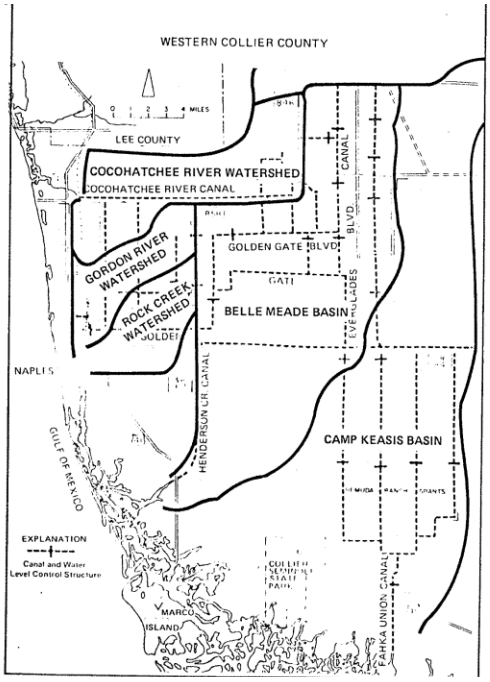


Figure 1-6
Pre-Canal Construction Basin Boundaries in Western Collier County
(From Figure 2.3 in BCE 1974)

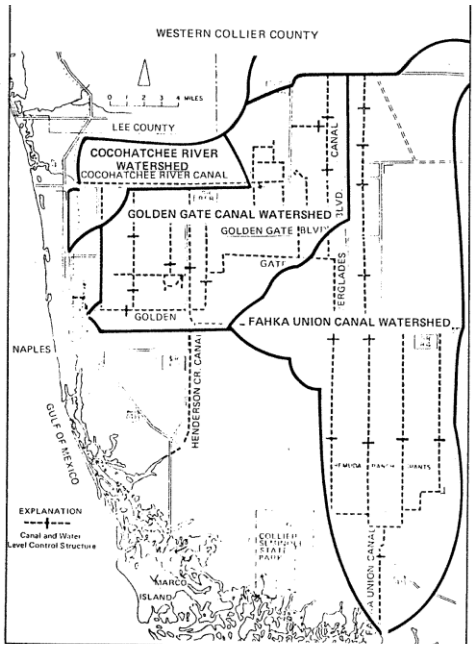


Figure 1-7
Post-Canal Construction Basin Boundaries in Western Collier County
(From Figure 2.2 in BCE 1974)

BCE presented the following conclusions concerning changes in the surface water drainage patterns which are attributed to construction of the canal network:

- The Cocohatchee River Watershed has been reduced in size. This is due to construction of a system of canals which drain the Southern portion of Corkscrew Swamp. The main flow from these canals is directed to the Golden Gate Canal system.
- The Gordon River Watershed has also been reduced in size from approximately 25 square miles to approximately 8 square miles. Flows from a major portion of this watershed are now directed to the Golden Gate Canal system.
- Substantial portions of the Rock Creek Watershed have been incorporated into the Golden Gate Canal Watershed.
- Most of the area north of Alligator Alley (State Route 84) and east of State Route 951, which was once tributary to the Henderson Creek estuary, is now part of the Golden Gate Canal system. This is the single most significant change from pre-construction conditions.
- The Faka Union Canal Watershed has increased in drainage area by a small amount.
- Observed mean annual runoff for the four outlets of the G.A.C. Canal Network is nearly 500,000 acre feet per year, which is equivalent to 24 inches of water. This is probably 2 to 3 times greater than the pre-construction runoff value.

Table 1-1 summarizes the general data related to the major drainage basins of western Collier County as defined by BCE in 1974. Each of these basins is monitored by the United States Geologic Survey and/or the South Florida Water Management District.

Table 1-1
General Data of Major Drainage Basins of Western Collier County[1]

Drainage Basin	Drainage Area sq. miles	Total Length of Canals (miles)	Number of Weirs	Drainage Density miles/sq. mile
Cocohatchee River	18.7	8	None	0.428
Golden Gate Canal	130	102	13	0.785
Henderson Creek Canal[2]	7.4	4	None	0.541
Faka Union Canal	234	88	12	0.376

[1] All values are based on the watershed defined by the location of the USGS stream gages.

[2] Also serves as an overflow outlet for Golden Gate Canal during periods of high flow. Effective drainage area and drainage density are actually indeterminate.

From this table, it appears that in 1974, the majority of flow in western Collier County was routed through the Golden Gate and Faka Union Canals as these basins incorporate more than 90 percent of the drainage area, all of the weir structures, and more than 90 percent of the constructed canals. Flow control structures have subsequently been installed on both the Cocohatchee and Henderson Creek Canals.

BCE reported that the Golden Gate Canal drains about one-third of the area served by the western Collier County drainage network, yet accounted for approximately 50 percent of the total runoff. This is shown in Table 1-2, which lists estimated annual runoff volumes from 1965 to 1973.

Table 1-2
Annual Runoff at Stream Gaging Stations

Water Year	Annual Runoff in acre-feet Water Year (Oct.–Sept.)			
	Cocohatchee River	Golden Gate Canal	Henderson Creek Canal	Faka Union Canal
1965	--	164,800	--	--
1966	--	302,400	--	--
1967	--	222,200	--	--
1968	--	323,600	--	--
1969	19,470	221,400	13,050	--
1970	25,540	278,000	23,400	--
1971	18,010	197,100	13,310	247,400
1972	22,460	239,900	16,230	177,000
1973	39,590	294,600	17,740	195,300
Mean Annual Runoff	25,014	249,333	16,746	206,600

To address potential reductions in discharge to the estuary system, BCE considered several alternatives, including:

- Fill the existing canal network.
- Enlarge the present canal system to create additional storage.
- Redistribute canal flows to natural areas and enlarge the canal network to create additional storage.

The final alternative suggested major enlargements to the existing canal system to allow a raising of the weirs to within 2 feet of the ground surface. Wet season flows in the Golden Gate Canal System would be redistributed to former historical patterns. The estimated cost was more than $18 million dollars for the Golden Gate Canal system alone. Comparable funds would be required for the Belle Meade and Faka Union Canal systems.

McPherson, B.F., G.Y. Hendrix, Howard Klein, and H.M. Tyus. 1976. The Environment of South Florida, A Summary Report. Geologic Survey Professional Paper 1011. Department of the Interior, Resource and Land Investigations Program.

This project was triggered by the planned construction of an international jetport in the Big Cypress Swamp by the Dade County Port Authority. This report summarizes the effort to develop the scientific information base required by land resource managers to make informed decisions affecting the economy and environment of south Florida.

Much of the information presented in this report is for areas located in the easternmost portions of Collier County and the western portions of Dade County. However, McPherson does reiterate that the purpose of the canal system in western Collier County was to lower groundwater levels, making the land suitable for urbanization, and reduce flooding.

McPherson states that "the Golden Gate Canal system and the Faka Union Canal system are cut into the highly permeable limestone of the shallow aquifer. Because of the high permeability, ground water drains rapidly to the canals and thereby lowers annual peak groundwater levels in the watershed. Where ever ponding occurs within those drainage areas during the rainy season, it is likely to be local and short lived. Thus, the pattern of slow prolonged southward sheet flow of freshwater through the west part of the Big Cypress to the Gulf estuaries was changed to one of accelerated and shortened-period runoff, primarily through the canal systems."

The report also states that water levels in the watershed were lowered approximately two (2) feet or more over a span of 4 or 5 years as a result of construction of the Golden Gate Canal network. Before the area was drained, it was inundated during most of the rainy season and for 2 or 3 months afterward. The Faka Union Canal network has also lowered water levels.

McPherson concluded that accelerated flow through the canal systems tends to increase the opportunity for transport of pollutants and water of poor quality to be discharged to the estuaries. It was suggested that the weir elevations in the Golden Gate and Faka Union Canal systems be raised by 1 to 2 feet. McPherson postulated that "the reduction in runoff would salvage for potential use a large part of the flow to the sea. The resulting rise in water levels would tend to reduce damage to the environment and the possibility of saltwater intrusion and would probably reinundate some of the sloughs that became dry as a result of drainage. The possibility of environmental changes in the Fakahatchee Strand, and in the Corkscrew Marsh northeast of Naples, would be reduced because diversion of freshwater toward canals would be reduced."

CH2M Hill. February 1980. Gordon River Watershed Study: Engineering Report. South Florida Water Management District.

In 1980, CH2M Hill completed a study of the existing conditions within the Gordon River Watershed. The study evaluated the flood hydrology of the basin during the 25- and 100-year storm

events, determined the water surface profiles, and evaluated the economic impact of flooding on existing and potential development.

In the report, CH2M Hill stated that "Historically, the Gordon River Watershed was over 25 square miles in size, extending northeast from Naples Bay beyond the present intersection of S.R 551 and S. R. 846. With the development that has occurred in the area-specifically the construction of Airport Road (S. R. 31) and the Golden Gate Canal system, the watershed has been significantly reduced in size to about 8.5 square miles.

The main conclusions of the report are:

- Flooding in the watershed does not vary significantly between the 25- and 100-year storms.
- Flooding is generally limited to natural low-lying mangrove areas, golf courses, and portions of the area north of Pine Ridge Road (S.R. 896).
- Except for the area north of Pine Ridge Road, flooding is limited to areas which experience either no or moderate use. Economic impacts due to flooding south of Pine Ridge Road were considered negligible.
- Shallow flooding — up to one foot in depth — occurs over large portions of the area north of Pine Ridge Road. This flooding does affect buildings, equipment, and materials in the area.
- Economic impacts due to flooding in the industrial park area were estimated at $4,667 per year and possibly as much as $14,000 per year at full development
- Large improvements within the Gordon River Watershed consistent with the Master Plan for Water Management District No. 7 were recommended to benefit surface water management within the basin. These primarily consisted of culvert replacements.

Johnson Engineering, Inc. December 1981. Golden Gate Water Management Study. Big Cypress Basin Board, South Florida Water Management District.

This study (Golden Gate Water Management Study) was completed on behalf of the South Florida Water Management District. The goals were to determine the feasibility of diverting a portion of the normal outflow from the Golden Gate Canal into other areas for water conservation purposes and/or retaining increased amounts of surface water in the Golden Gate Canal system.

Johnson Engineering stated that, in the early 1900s, this watershed was basically a "sheet-flow type system." It was a large flat prairie-cypress area on which water stood much of the year. Johnson Engineering quoted a Naples Bay study completed in 1979 indicating that the greatest concern for Naples Bay was not the quality of water discharged from the Golden Gate Canal, but the increase in quantitative surges during the wet season.

Johnson Engineering considered several alternative approaches for this project, including:

- Diversion of water between basins to promote storage.
- Alteration of proposed land uses to promote wetland protection and groundwater recharge.
- Increased retention in the canal system.
- Increased operable flexibility in the canal system.
- Maintain the status quo.

Recommendations included increasing the operable flexibility and retention in the canal system. It was also suggested that purchasing low lying areas along the canal for retention and increasing the open space along major waterways would provide significant benefit to the environment and water quality.

United States Army Corps of Engineers – Jacksonville District. February 1986. Golden Gate Estates Collier County, Florida – Draft Feasibility Report.

In 1986, the United States Army Corps of Engineers completed a Draft Feasibility Study for Golden Gate Estates. The primary study objective was to assess the feasibility of modifying the existing, privately constructed water control works within the Faka Union basin of Golden Gates Estates for protection and enhancement of the basin's resources. This effort considers the restoration of the basin's wetland environmental values and other natural resources to the extent possible, while maintaining and protecting compatible human resources within the basin.

In describing flows within the canal network, the USACE states:

- Although weirs were placed within the canals to retard canal discharge and prevent overdrainage during periods of low flow, the canal system has more than doubled the pre-canal surface water runoff. The total mean annual surface run-off from the Golden Gate Estates Canal network is 497,693 acre-feet or 162,115 million gallons of water. Over 90 percent of the observed runoff is discharged through the Golden Gate Canal (50 percent) and the Faka Union Canal (42 percent).
- Under natural conditions, there was a lag of several months between peak rainfall and peak runoff and the magnitude of season variation in runoff was dampened by storage in the basin. The pattern of canal discharge more closely approximates the rainfall pattern by responding quickly to rainfall events.

An resource protective assessment of Faka Union Bay concluded that canal discharge affects abundance of some estuarine organisms by affecting salinity distributions.

After detailed review of six proposed management strategies for the Faka Union basin, including the proposal by BCE and proposals suggested by the Golden Gate Estates Study Committee, the USACE concluded that, "after review of current Federal policies and guidelines, there is no basis for Federal implementation of modifications to the Faka Union Basin portion of the existing Golden Gate Estates water control system." However, it was suggested that the conceptual information in

the report could be used by State and local interests to determine long-term solutions to local water management problems within the basin.

South Florida Water Management District. January 2007. Naples Bay Surface Water Improvement and Management (SWIM) Plan.

This plan, prepared by the South Florida Water Management District focuses on strategies to improve the health and habitat of Naples Bay. Key strategies consider initiatives on water quality, stormwater quantity, watershed master planning, and implementation, and habitat assessment, restoration and improvement.

With regards to the flow and timing of discharges from the Golden Gate Estates Canal system, this report states that, "the results of 60 years of canal drainage and urban development activities have reduced water clarity, increased concentrations of contaminants and nutrients, increases in freshwater and reduced dissolved oxygen levels in the NBW. The Watershed now collects surface water input from approximately 120 square miles, over a ten-fold increase from the historic drainage condition. Extensive areas of mangroves and salt marsh have been replaced by canals, seawalls and bulkheads. Development activities in the watershed have altered the volume, quality, timing and mixing characteristics of freshwater flows reaching Naples Bay.

Natural tributaries, Gordon River, Rock Creek, and Haldeman Creek, have been altered by urban infrastructure which has significantly changed the historic flowways to Naples Bay and impacted its biology. Seasonal influxes of freshwater from the Golden Gate Canal system have altered the natural salinity regime of the Bay, resulting in declines in seagrass beds, and harmful impacts to all levels of flora and fauna in the aquatic ecosystem."

Summary and Conclusions

The literature review was unable to identify any flow monitoring data for the period prior to development of the canal system in Collier Canal. However, it has been estimated that flows from western Collier County were typically between 0–10 inches annually prior to construction of the canal network.

It has been documented that construction of the canal network has significantly changed the flow regime into the receiving water bodies. The combined current annual flow from the primary canals in western Collier County averages approximately 36 inches. This is approximately 3.5 times the maximum annual volume of runoff estimated by Kenner (1966). The percentage of rainfall that discharges to tide has increased from approximately 17 percent (10 inches of runoff/57 inches of rainfall) prior to construction of the canal network to more than 60 percent (36 inches of runoff/57 inches of rainfall) after construction of the canal network.

For Naples Bay it was estimated that the volume of freshwater discharge has increased by 20 to 40 percent which has significantly changed the salinity balance in the estuary. Historically, the Gordon and Rock Creek watersheds were the primary sources of inflow to Naples Bay. These two basins had a combined area of approximately 50 square miles. Now, the Golden Gate Canal watershed is the primary source of inflow to Naples Bay. This basin has an area of approximately 130–175 square miles.

1.2 PRELIMINARY ASSESSMENT OF EXISTING WATERSHED MODELS

The three MIKE SHE models that were developed for the Big Cypress Basin Project Implementation Report (PIR) in order to evaluate the methods and benefits of restoring the wetland system within the Southern Golden Gates Estates (SGGE) area of the Big Cypress Basin (BCB) were compared to conduct a preliminary assessment of discharge volumes from the Collier County watersheds. These models were received from the United States Army Corps of Engineers (USACE) for this analysis and represent the existing condition (year 2000 land use), the future condition (year 2050 land use), and the natural system (pre-development) condition.

The following three sections provide a description of the models and document the differences between the model input files. In addition, comparative results are presented to evaluate basin discharge to the estuary systems and to review predicted water budgets and hydro-periods.

1.2.1 Description of Computer Models

Three models, existing conditions, future conditions, and natural systems (pre-development), were received from the USACE. Each of these models is described below.

Existing Conditions Model

The original existing conditions MIKE SHE model developed for the Big Cypress Basin is documented in a report titled "Big Cypress Basin Integrated Hydrologic-Hydraulic Model" (DHI, 2002). The model received from the USACE was updated in 2006 and is documented in a reported titled "Southwest Florida Feasibility Study, Hydrologic Model Development, Scope of Work Modification IDC DACW17-01-D-0013, Big Cypress Basin, Final Report (CDM, 2006). This model is referred to as the Existing Conditions Model (ECM).

The ECM model is based on year 2000 land use conditions and was updated to the 1988 (NAVD) vertical datum from the 1929 (NGVD) vertical datum in 2006. In addition, the rules that determine structure operations were changed during the model update to reflect the operational guidance specified by the South Florida Water Management District (SFWMD). Figure 1-8 shows the model domain and canal network used in the ECM simulation.

This model was run using meteorological data for 1976–1986 in order evaluate the system under a range of hydrologic conditions. The USACE determined that this period of time included wet, dry, and average year conditions in the study area.

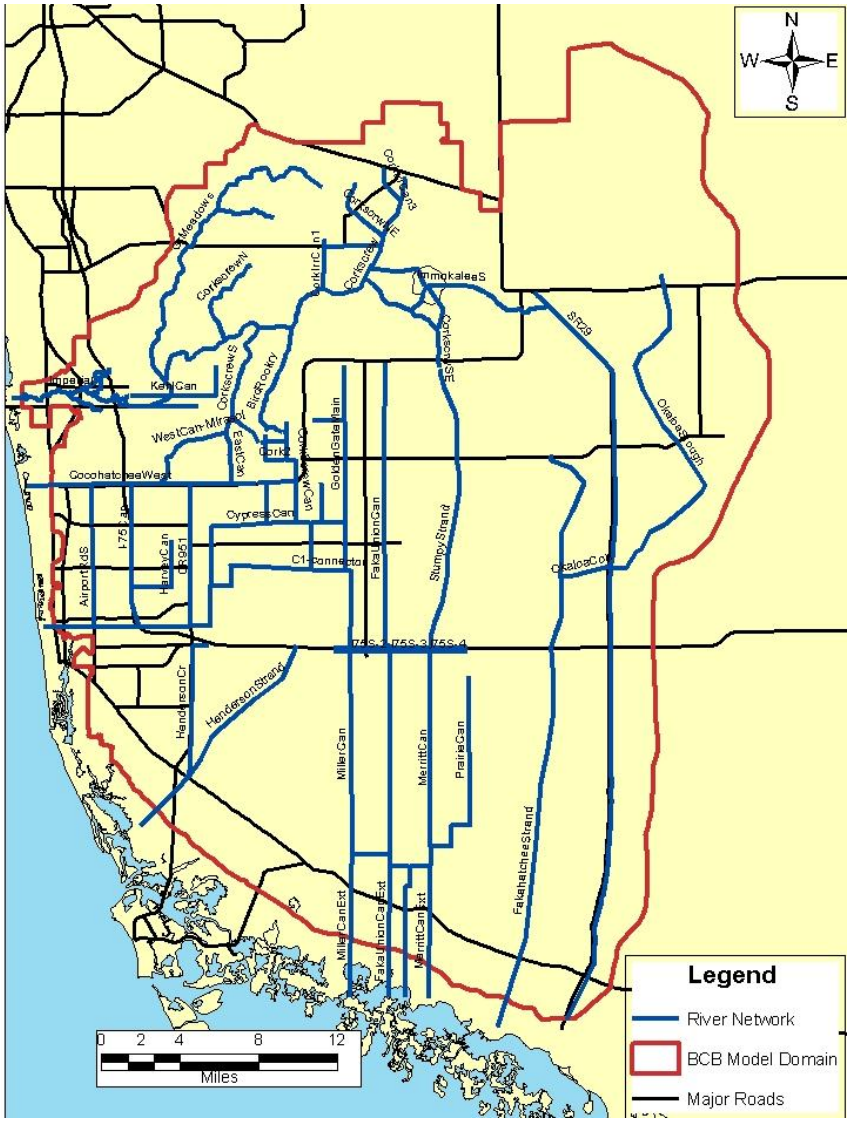


Figure 1-8
Modeled Canal Network for the BCB Existing Conditions Model

Future Conditions Model

The BCB Future Conditions Model (FCM) is based on a projected year 2050 land use map that was generated by the SFWMD. This model includes the canal network defined in the ECM as well as the pumps and spreader canals recommended for the proposed Picayune Strand Wetland Restoration Project (PSRP). Figure 1-9 shows the canal network for the BCB Future Conditions model. This project was formally known as the SGGE. The PSRP considers the installation of canal blocks in the Miller, Faka Union, Merritt and Prairie Canals south of I-75. In addition, it calls for construction of spreader swales and large pump stations to prevent flooding in the Northern Golden Gate Estates north of I-75.

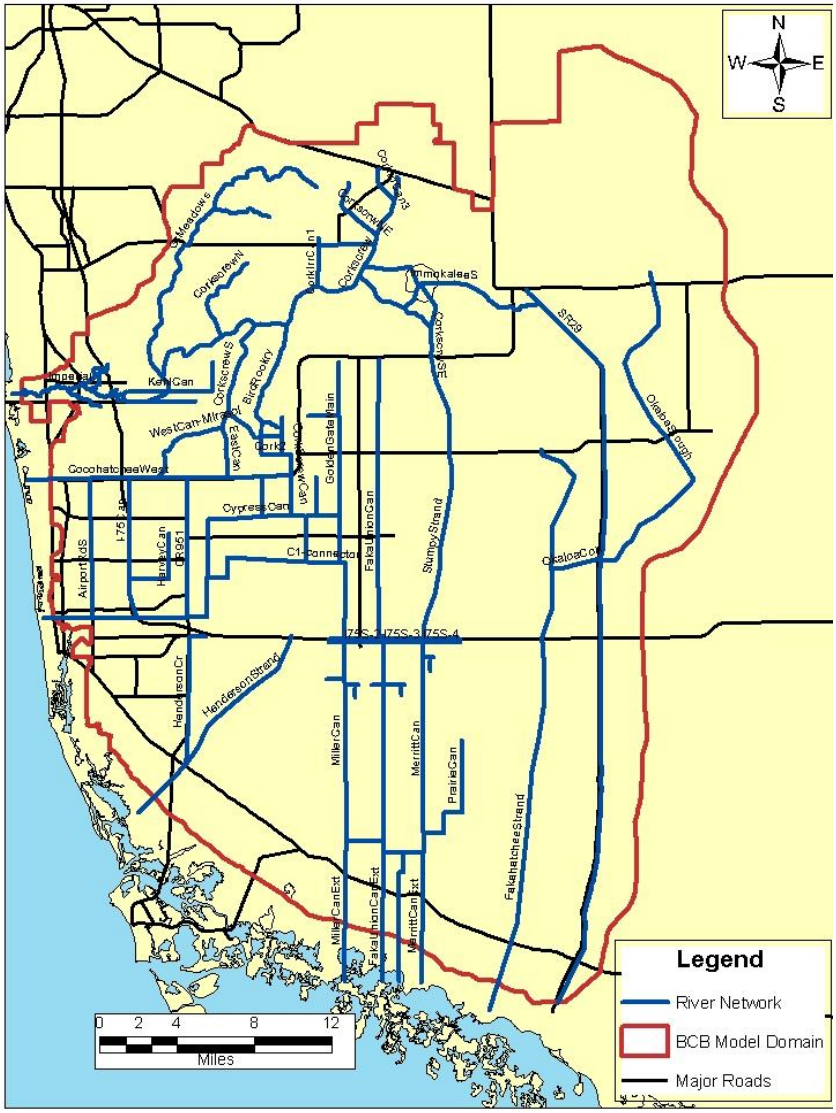


Figure 1-9
Modeled Canal Network for the BCB Future Conditions Model

Natural Systems Model

The Natural Systems, or pre-development, model was developed for the entire Southwest Florida Feasibility Study (SWFFS) area. A full description of the model can be found in the report titled "Final Report, Natural Systems Model (NSM) Scenario Southwest Florida Feasibility Study" (SDI, 2007). The model domain includes the BCB as well as the Caloosahatchee and Estero River Basins. The SWFFS and BCB model domains are shown in Figure 1-10. Figure 1-10 also shows the modeled natural systems river network. In the BCB model area, only the Imperial and Cocohatchee Rivers are explicitly modeled. In order to accurately compare the three models, the NSM model was rerun as part of this project using the same BCB model domain as was defined for the ECM and the FCM.

Groundwater results were extracted from the larger SWFFS NSM model and used to define a time varying boundary condition for the northern edge of the BCB NSM model.

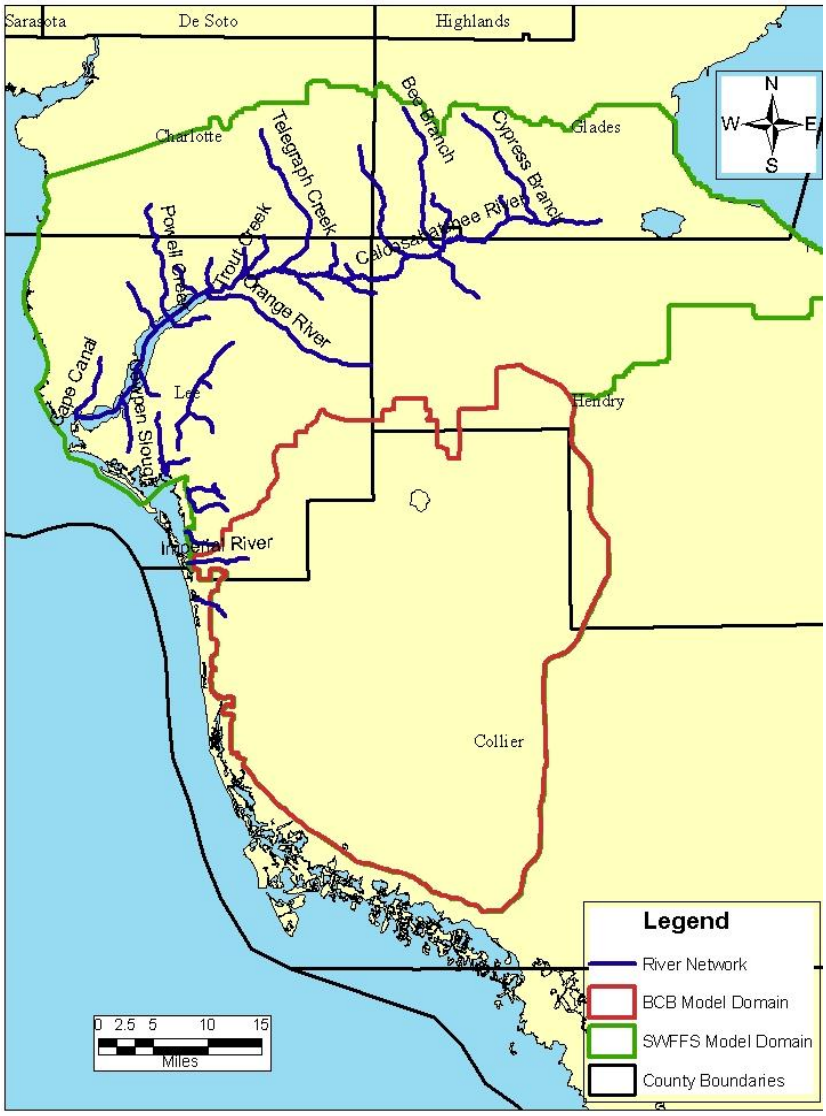


Figure 1-10
Model Domains and Canal Network for the Natural Systems Model

1.2.2 Comparison of Key Model Input Parameters

In this section, results of comparisons among several of the input parameters for the three MIKE SHE models are presented. The discussion focuses on model inputs related to overland flow and discharge to the estuarine system because the saturated components of the three models are equivalent.

River Network

As discussed above, the NSM includes only the Imperial and Cocohatchee Rivers within the Big Cypress Basin model domain. This representation assumes that no structures exist within the river network and is assumed to be representative of the pre-development time period. The model does not include the Gordon River or Henderson Creek, although both were present in the pre-development time.

The ECM and FCM river/canal networks include many of the canals and structures that have been constructed in Collier County since the 1960s. The models are set up using a 1,500-foot grid cell size where the river/canal network consists of the primary drainage canals and structures maintained by the SFWMD and do not explicitly represent the secondary canals maintained by Collier County or within private developments.

Topography

The ECM and FCM models utilize the same topographic input data file that is based on a 750-foot grid. The topographic data input file was prepared by the SFWMD and includes a mixture of data sources, including LiDAR and topographic survey maps. To define topographic characteristics within each of the 1,500-foot grid cells, the model calculates the average of four (4) 750-foot grid cells from the original data set to determine the value used in a single grid cell. The 1,500-foot grid cell topographic data file was used in the comparative analysis.

The NSM report did not clearly define the sources of information used to define the topographic input file used in the NSM. Therefore, it is difficult to determine the level of reliability for the data. The data set was provided to the modeling team by the SFWMD and is also based on a 1,500-foot grid. Therefore, it was possible to directly compare to the ECM and FCM topographic data files.

Plate 1 (Appendix 4-A) shows the topographic elevation for the ECM and NSM models. In addition, a map showing the difference for each cell between the ECM and NSM topographic maps is included in Plate 1. Positive values indicate that the ESM topographic elevation is higher than the NSM topographic elevation. Negative values, on the other hand, indicate that the NSM topographic elevation is higher.

As shown in Plate 1, there is a significant difference in ground surface elevation between the models. In the Okaloacoochee Slough and Faka Union Canal area south of I-75, the ECM and FCM topographic elevation is as much as three (3) feet higher than the NSM. In the Faka Union Canal area south of I-75, this may be reasonable and could be attributed to road building and other development activities. The Okaloacoochee Slough is a natural area that has little development; therefore, it seems that the difference in elevation would be much less three (3) feet. The elevation difference is likely due to the quality of data available when the models were developed.

The new LiDAR data that will be used to define the Collier County ECM should be an improvement over the current topographical data set. However, caution is advised when comparing results against the NSM model.

Detention Storage

In the MIKE SHE model, detention storage is used to define the volume of water (inches or millimeters) that will be stored in a grid cell before overland flow occurs. The values are typically related directly to land use characteristics. In natural areas, this value is indicative of the volume of storage available in local depressions or micro-topography. In urban areas, this value represents the volume of water stored in ponds or other storm water management features that are not explicitly modeled.

Plate 2 (see Appendix 4-A) shows the detention storage values used in each of the models. The FCM and NSM models used similar detention storage values for the same land uses throughout the model domain. However, the ECM used significantly higher values. The ECM will detain anywhere from 0.8 to 3.8 inches more water in each cell before overland flow will occur.

These differences significantly determine model results which may impact the validity of model comparisons. Potential effects would include (but not be limited to) changes in evapotranspiration, infiltration, overland flow and annual hydroperiod.

Overland Manning Values

In MIKE SHE, Manning n values are assigned to each grid cell and are typically associated with land use. These values influence the rate of overland flow from cell to cell. It is expected that natural areas will offer more resistance to overland flow; while urbanized areas would offer less resistance to overland flow.

Plate 3 (see Appendix 4-A) shows the Manning n values used in each grid of the models. These maps show inconsistency in the application of Manning values between the models, although the models all utilize the same land use categories. The range of values varies from 0–1 for the ECM, from 0.5–100 for the FCM, and from 0.04–0.59 for the NSM.

The Natural Systems Model documentation report (SDI, 2007) provides a table that documents the relationship between the land use classification and the assigned Manning value. The initial Big Cypress Basin Integrated Hydrologic-Hydraulic Model report (DHI, 2002) reported that a uniform value of n = 0.5 was specified for all land uses in the ECM. However, the 2006 modeling report (CDM) does not provide any information describing the basis of the revised Manning values used in the final ECM and FCM models.

Soils

For each soil type in the model, retention and conductivity curves are defined based upon soil moisture. In the unsaturated zone soils database, there is a slight difference in the definition of the Plantation soil type between the models. This soil type is observed primarily in the wetland areas of the model. The soils database used for the ECM and FCM models extends the conductivity and retention curves for the Plantation soil.

The curves defined for the NSM are not defined to the same extent as for the ECM and FCM. Therefore, the NSM generates a warning for most time steps indicating that calculated soil moisture values are outside the range of values provided for the conductivity curve. For each of those time steps, the conductivity value was subsequently set to zero (0). These warning are not generated for the ECM and FCM models.

It is likely that the NSM underestimated infiltration; however, it is not clear what the full effect of this warning had on the overall model results.

1.2.3 Comparison of Model Results

Table 1-3 provides a summary of average annual rainfall data across the entire model domain. The model input file uses a distributed rainfall pattern, meaning that different rainfall time series are associated with each grid cell in the model. The volume of rainfall applied to each grid cell varies widely across the model domain.

Table 1-3
Average Annual Rainfall Comparison

Year	Average Model Rainfall Basin-wide (inches)
1976	58.58
1977	55.23
1978	53.62
1979	58.18
1980	53.26
1981	44.29
1982	69.01
1983	76.18
1984	51.53
1985	50.74
1986	52.68

For comparison purposes, and based on the basin-wide average annual rainfall values, comparative model results were generated for the years 1981 (dry year), 1983 (wet year) and 1986 (average year). Model results are presented in the following sections. Because of the inconsistency among the models, these results and conclusions should be considered preliminary.

Basin Discharges

Table 1-4 provides a summary of discharge to the estuaries from the contributing basin during the simulation period. The values for the NSM model are taken from the total water budget for each basin, and represent the total overland flow out of each basin. The results for the ECM and FCM models were extracted from the results of the canal system portion of the model. These results represent the discharge from the canal system directly into the receiving estuary.

When reviewing results, it should be kept in mind that the Cocohatchee Basin discharges to the Cocohatchee Estuary, the Golden Gate Basin discharges to Naples Bay, the Henderson Creek Basin discharges primarily to Rookery Bay, and the Faka Union Basin discharges to the Ten Thousand Islands Estuary. It should also be noted that interbasin flow transfers occur during wet dry periods, which does not allow for a direct correlation between basin and estuary discharge; however, the overall conclusions are still valid.

Review of the results indicates that they are consistent with the historical discharges discussed in the Literature Review of this report. Discharge from the NSM model is generally consistent with the average annual discharge value of 10 inches estimated by Kenner (1966). The flow to Naples Bay from the Golden Gate Basin has increased significantly since construction the canal network. On average, the increase is about four (4) times the volume predicted by the NSM, although there were years where the increased flow predicted by the ECM and the FCM for the Golden Gate Basin was more than 10 times the volume predicted by the NSM. This is also generally true for flow to the 10,000 Islands estuary from the Faka Union Basin. Flow to Rookery Bay from Henderson Creek Basin in the ECM and the FCM is approximately double that predicted by the NSM.

The model results also indicate little difference in average annual discharge from the Cocohatchee Basin. This may be due to the fact that comparatively little development has occurred in Corkscrew Swamp that forms the headwaters of this basin. In addition, structural operations in the Cocohatchee Canal are able to route water south into the larger Golden Gate Canal system.

Hydroperiods

Calculated annual hydroperiod maps for the three modeled conditions are presented in Plates 4–6 (see Appendix 4-A). Hydroperiods were calculated by determining the number of days per year that the depth of water was greater than 0.1 inches above the ground surface.

Table 1-4. Annual Total Discharge per Basin

Year	Rainfall (In)	Cocohatchee			Golden Gate			Henderson Creek			Faka Union		
		NSM (In)	Existing (In)	Future (In)	NSM (In)	Existing (In)	Future (In)	NSM (In)	Existing (In)	Future (In)	NSM (In)	Existing (In)	Future (In)
1977	55.23	0.79	4.43	6.62	2.20	44.22	48.29	1.81	35.04	27.76	4.57	38.38	25.29
1978	53.62	0.75	3.26	5.79	2.09	37.95	48.15	4.29	31.10	27.40	5.24	31.04	26.19
1979	58.18	1.69	6.00	8.83	1.93	43.08	51.51	1.73	23.19	20.37	3.98	35.17	31.17
1980	53.26	4.25	6.43	10.27	4.69	51.15	57.28	3.07	27.02	23.81	5.47	40.86	35.63
1981	44.29	2.91	4.17	6.02	4.06	35.86	45.26	2.09	20.19	18.26	2.83	26.74	21.00
1982	69.01	6.54	8.68	11.26	12.80	55.98	64.44	14.45	39.48	36.18	13.27	59.70	57.74
1983	76.18	19.61	10.82	15.19	36.02	72.54	77.09	54.17	45.54	40.60	37.44	72.57	69.73
1984	51.53	16.06	6.76	10.81	27.01	53.25	59.66	37.44	21.34	18.05	23.74	35.75	31.02
1985	50.74	6.57	4.88	7.71	13.82	42.95	50.79	20.16	28.40	25.22	8.98	30.28	25.70
1986	52.67	3.86	2.81	5.60	9.37	38.90	48.46	12.56	19.71	17.40	6.61	30.96	26.62
Average	56.47	6.30	5.82	8.81	11.40	47.59	55.09	15.18	29.10	25.51	11.21	40.14	35.01

The hydroperiod results appear to be reasonable over most of the BCB model domain. In general, the hydroperiod predicted for the NSM is much longer than that predicted for the ECM and FCM. The maps also demonstrate the effect on the PSRP on the wetland areas south of I-75 between the ECM and the FCM.

However, in the Okaloacoochee Slough (northeast portion of the model domain) there appears to be a discrepancy. This is an area that has been kept in its natural state and one would expect that the hydroperiod would be very similar between all of the models. The model results indicate that the hydroperiod predicted by the ECM and FCM is longer than in the NSM in 1981 and 1986. This is unexpected given that the topographic elevation in this area is lower in the NSM than in the ECM or FCM.

The discrepancy may be a function of the boundary conditions used in the NSM or the effect of differences in model input parameters. This discrepancy will have to be evaluated if the NSM is to be used as a baseline for evaluating future projects.

Average Water Depth Above the Ground Surface

Average depth of water calculations were completed for the wet and dry seasons for each year of the simulation that was analyzed herein. The analysis was made consistent with the USACE definition of the wet season as being from May 1–October 15 of each year. Therefore, the dry season is from October 16–April 30. These time periods were used for the average season calculations.

The results of the average depth of water calculations for 1981, 1983, and 1986 wet and dry seasons are presented on Plates 7–12 (see Appendix 4-A). Results are consistent with the hydroperiod results described above.

Groundwater Levels

Plates 13–18 (see Appendix 4-A) present comparisons of annual groundwater elevations in the Water Table aquifer for 1981, 1983, and 1986. Each plate includes three (3) maps. The first map shows the average NSM groundwater elevation in the Water Table aquifer. The second map shows the average groundwater elevation in the Water Table aquifer associated with either the ECM or the FCM.

The third map on each plate presents the difference between the average elevations in the other two maps. A positive value means that the NSM groundwater elevation is higher than the ECM or FCM groundwater elevation. A negative value means that the ECM or FCM groundwater elevation is higher.

As with the Hydroperiod and Average Depth of Water results, the predicted groundwater elevations for each model appear to be reasonable over most of the model domain. The ECM and FCM model

results show a depression in the water surface elevation of the Water Table aquifer consistent with the location of the Collier County well field. The difference represents the extent of the Water Table aquifer drawdown relative to the NSM model.

The groundwater results also show a significant difference in head elevation in the Okaloacoochee Slough area. The difference maps indicate that the average head elevation in Okaloacoochee Slough is as much as five (5) feet higher in the ECM and FCM than in the NSM. This result is consistent with the observed hydroperiod results and may be due to the groundwater boundary conditions defined in the NSM. This issue will have to be investigated if the NSM is to be used as a baseline for evaluating future projects.

Water Budgets

The MIKE SHE model provides many options for producing water budgets. Total water budgets can be produced in tabular or graphical format. In addition, detailed water budgets may be produced for each component (overland, groundwater, unsaturated zone, etc.) of the MIKE SHE model. Figure 1-11 shows the Total Water Budget graphical output produced for 1986 year meteorological conditions in the Future Conditions Model.

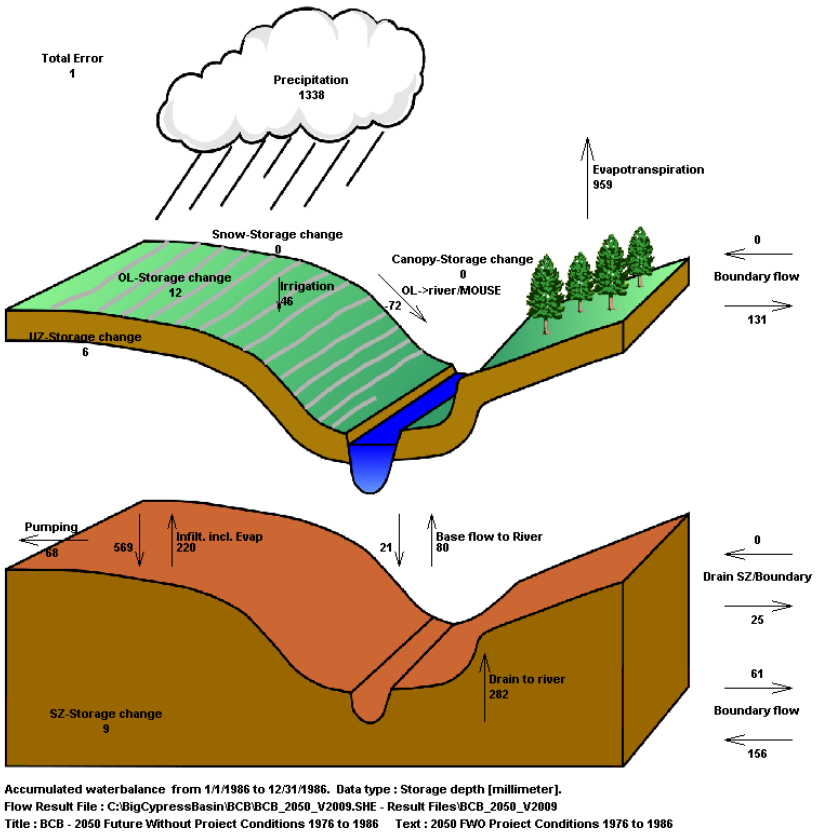


Figure 1-11
Graphical Water Balance Output for 1986 of the FCM

Equation 1 (below) describes the components used to calculate the change in storage for the overland (OL) and unsaturated (UZ) components of the model. Equations 2 and 3 show the components used to calculate the change in storage for the saturated zone (SZ) and the water volume contributed to the MIKE 11 model, respectively.

$$\text{OL+UZ Change in Storage} = \text{Prec} - \text{ET} + \text{Irr} - \text{OL to Riv} + \text{O/UZ In} - \text{O/UZ Out} - \text{GW Infil} + \text{GW Evap} \quad (1)$$

$$\text{SZ Change in Storage} = \text{D/SZ in} - \text{D/SZ Out} + \text{SZ In} - \text{SZ Out} + \text{GW Infil} - \text{GW Evap} - \text{Pump} - \text{BF to Riv} + \text{BF from Riv} - \text{Dr to Riv} - \text{Dr to Ex} \quad (2)$$

$$\text{Contribution to MIKE 11} = \text{OL to Riv} + \text{BF to Riv} - \text{BF from Riv} + \text{Dr to River} \quad (3)$$

Where:

Prec	=	Precipitation
ET	=	Evapotranspiration
Irr	=	Irrigation
OL to Riv	=	Overland Flow to River
O/UZ in	=	Overland/UZ Boundary In
O/UZ Out	=	Overland/UZ Boundary Out
D/SZ In	=	Drain SZ/Boundary In
D/SZ Out	=	Drain SZ/Boundary Out
SZ In	=	SZ Boundary In
SZ Out	=	SZ Boundary Out
GW Infil	=	Infiltration to GW
GW Evap	=	Infiltration from GW
Pump	=	Pumping
BF to Riv	=	Baseflow to River
BF from Riv	=	Baseflow from River
Dr to Riv	=	Drain to River
Dr to Ex	=	Drain to External River

Water budgets for the MIKE SHE model were extracted from the results for the entire BCB model domain and for the Golden Gate, Cocohatchee, Henderson Creek and Faka Union Canal subcatchments (basins). Subcatchment locations are shown in Figure 1-12.

The water budget comparisons for the entire BCB model domain and the four subcatchments are shown in Tables 1-5 through 1-9. It is noted that the subcatchment water budgets only consider the hydrologic processes that occur within the subcatchment. They do not consider inflows from outside the subcatchment within the canal/river network.

Table 1-5. Total Water Budget Comparison for BCB Model Domain

BCB Model Domain									
Water Budget Component	1981			1983			1986		
	NSM (inches)	ECM (inches)	FCM (inches)	NSM (inches)	ECM (inches)	FCM (inches)	NSM (inches)	ECM (inches)	FCM (inches)
Precipitation	44.29	44.29	44.29	76.18	76.18	76.18	52.68	52.68	52.68
Evapotranspiration	50.35	36.77	36.69	51.18	38.78	38.98	50.39	37.76	37.76
Irrigation	0.00	3.07	2.99	0.00	0.94	0.94	0.00	1.85	1.81
Overland (OL) Flow to River	0.08	-4.17	-3.15	0.94	-1.10	0.08	0.08	3.94	-2.83
OL/UZ Boundary Flow In	0.55	0.00	0.00	0.16	0.00	0.00	0.43	0.00	0.00
OL/UZ Boundary Flow Out	4.41	3.86	4.84	18.58	5.47	9.80	5.67	3.90	5.16
Overland Storage Change	-4.69	-0.75	-0.75	6.34	1.38	1.10	-0.28	0.28	0.47
Unsaturated Zone (UZ) Storage Change	-0.39	-0.35	-0.31	0.08	0.47	0.31	0.00	0.35	0.24
Infiltration to GW	5.35	19.88	18.54	7.95	41.50	37.17	6.97	24.02	22.40
Evaporation from GW	10.24	7.76	8.54	8.70	9.33	10.31	9.69	7.80	8.66
GW Pumping	0.00	3.90	3.86	0.00	1.85	1.81	0.00	2.76	2.68
Drain to River	0.00	11.93	9.88	0.00	27.83	22.68	0.00	13.35	11.10
Baseflow to River	0.28	3.27	2.95	0.39	4.33	3.86	0.24	3.54	3.15
Baseflow from River	0.00	0.71	0.83	0.00	1.14	1.46	0.00	0.75	0.83
GW Boundary Flow In	3.46	6.46	6.38	3.54	5.98	5.98	3.54	6.22	6.14
GW Boundary Flow Out	0.75	2.01	2.05	0.94	3.07	3.27	0.79	2.40	2.40
Drain SZ/Boundary Flow Out	0.00	0.59	0.79	0.00	1.26	1.65	0.00	0.71	0.98
Saturated Zone (SZ) Storage Change	-2.40	-2.44	-2.28	1.46	0.98	0.94	-0.20	0.47	0.35
Total Error	0.00	0.08	0.08	0.00	0.04	0.04	0.00	0.04	0.04

Table 1-6. Total Water Budget Comparison for Golden Gate Basin

Golden Gate Basin									
Water Budget Component	1981			1983			1986		
	NSM (inches)	ECM (inches)	FCM (inches)	NSM (inches)	ECM (inches)	FCM (inches)	NSM (inches)	ECM (inches)	FCM (inches)
Precipitation	47.52	47.52	47.52	79.33	79.33	79.33	54.57	54.57	54.57
Evapotranspiration	54.29	27.99	24.88	53.11	32.60	30.87	51.57	30.67	28.31
Irrigation	0.00	1.38	1.18	0.00	0.55	0.47	0.00	0.79	0.67
Overland (OL) Flow to River	0.00	-1.30	7.13	0.00	-1.34	13.70	0.00	-0.91	7.36
OL/UZ Boundary Flow In	3.86	0.28	0.71	20.35	1.02	2.32	5.00	0.16	0.43
OL/UZ Boundary Flow Out	4.06	0.04	0.20	36.02	0.08	0.67	9.37	0.00	0.08
Overland Storage Change	-5.98	0.00	0.00	7.80	0.28	0.20	-1.89	0.04	0.00
Unsaturated Zone (UZ) Storage Change	-0.51	-1.22	-1.06	0.08	1.26	1.22	0.04	1.22	0.91
Infiltration to GW	6.93	24.06	18.46	6.61	48.66	35.71	6.02	24.80	19.09
Evaporation from GW	7.40	0.28	0.12	3.90	0.59	0.12	5.55	0.28	0.08
GW Pumping	0.00	5.00	4.84	0.00	4.37	4.33	0.00	4.57	4.45
Drain to River	0.00	19.02	9.88	0.00	38.03	20.08	0.00	17.01	8.70
Baseflow to River	0.00	6.89	9.37	0.00	10.79	15.20	0.00	8.19	10.31
Baseflow from River	0.00	3.46	2.09	0.00	2.72	1.65	0.00	2.95	1.73
GW Boundary Flow In	1.42	3.86	3.90	1.73	4.72	4.61	1.30	4.06	4.02
GW Boundary Flow Out	1.77	1.46	1.26	2.44	1.34	1.34	2.13	1.34	1.18
Drain SZ/Boundary Flow Out	0.00	0.04	0.00	0.00	0.12	0.08	0.00	0.04	0.04
Saturated Zone (SZ) Storage Change	-0.83	-1.34	-1.06	2.01	0.87	0.91	-0.31	0.39	0.08
Total Error	0.00	0.00	0.04	0.00	0.00	0.04	0.00	0.00	0.00

Table 1-7. Total Water Budget Comparison for Cocohatchee Basin

Cocohatchee Basin									
Water Budget Component	1981			1983			1986		
	NSM (inches)	ECM (inches)	FCM (inches)	NSM (inches)	ECM (inches)	FCM (inches)	NSM (inches)	ECM (inches)	FCM (inches)
Precipitation	45.16	45.16	45.16	74.76	74.76	74.76	50.59	50.59	50.59
Evapotranspiration	50.39	39.45	38.46	50.35	39.37	38.46	48.94	38.35	37.32
Irrigation	0.00	6.18	5.94	0.00	2.20	2.09	0.00	3.98	3.78
Overland (OL) Flow to River	0.28	-32.48	-29.76	2.48	-34.61	-30.94	0.43	-33.54	-30.00
OL/UZ Boundary Flow In	0.55	0.47	0.16	5.51	0.87	0.43	0.63	0.59	0.20
OL/UZ Boundary Flow Out	2.60	0.20	0.51	17.09	0.75	1.61	3.39	0.20	0.43
Overland Storage Change	-5.59	-0.28	-0.28	6.02	0.63	0.63	-2.68	0.08	0.08
Unsaturated Zone (UZ) Storage Change	-1.06	-0.47	-0.47	0.47	0.55	0.51	0.16	0.39	0.28
Infiltration to GW	5.67	47.24	44.84	13.07	73.46	69.41	8.62	51.46	48.46
Evaporation from GW	6.54	1.77	1.93	9.25	2.24	2.32	7.64	1.69	1.93
GW Pumping	0.00	6.22	5.98	0.00	2.36	2.28	0.00	4.09	3.90
Drain to River	0.00	40.28	37.68	0.00	64.49	61.26	0.00	43.35	40.51
Baseflow to River	0.04	1.10	1.26	0.04	0.98	1.10	0.04	1.06	1.18
Baseflow from River	0.00	0.67	0.83	0.00	1.22	1.26	0.00	0.63	0.91
GW Boundary Flow In	1.06	4.02	3.82	1.65	3.35	3.46	1.22	3.39	3.19
GW Boundary Flow Out	1.97	4.65	4.41	3.66	6.73	6.02	2.72	5.59	5.28
Drain SZ/Boundary Flow Out	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Saturated Zone (SZ) Storage Change	-1.81	-2.09	-1.81	1.77	1.14	1.14	-0.51	-0.28	-0.28
Total Error	0.00	0.12	0.12	0.04	0.08	0.04	0.00	0.12	0.04

Table 1-8. Total Water Budget Comparison for Henderson Creek Basin

Henderson Creek Basin									
Water Budget Component	1981			1983			1986		
	NSM (inches)	ECM (inches)	FCM (inches)	NSM (inches)	ECM (inches)	FCM (inches)	NSM (inches)	ECM (inches)	FCM (inches)
Precipitation	46.34	46.34	46.34	77.20	77.20	77.20	55.87	55.87	55.87
Evapotranspiration	55.43	32.20	31.89	53.39	34.49	34.33	53.19	33.43	33.23
Irrigation	0.00	0.16	0.12	0.00	0.08	0.94	0.00	0.08	0.04
Overland (OL) Flow to River	0.00	-3.11	-4.02	0.00	-2.87	0.83	0.00	-2.64	-1.22
OL/UZ Boundary Flow In	6.18	0.12	0.24	43.03	0.63	1.30	13.11	0.08	0.28
OL/UZ Boundary Flow Out	2.09	1.10	1.85	54.17	2.56	4.76	12.56	1.34	2.48
Overland Storage Change	-6.46	-0.04	-0.79	7.28	0.51	0.94	-0.87	0.35	0.31
Unsaturated Zone (UZ) Storage Change	-0.08	-1.30	-0.87	0.00	0.63	0.35	0.00	0.55	0.28
Infiltration to GW	10.51	20.00	22.20	8.03	46.10	42.52	8.58	24.96	24.61
Evaporation from GW	8.98	2.28	3.54	2.68	3.46	5.12	4.53	1.89	3.46
GW Pumping	0.00	2.44	2.48	0.00	2.32	2.32	0.00	2.32	2.36
Drain to River	0.00	12.48	11.97	0.00	31.81	25.51	0.00	13.86	11.10
Baseflow to River	0.00	0.51	1.30	0.00	0.63	1.69	0.00	0.63	1.42
Baseflow from River	0.00	1.93	1.65	0.00	1.57	1.57	0.00	1.69	1.42
GW Boundary Flow In	3.07	3.23	3.31	3.19	3.43	3.78	2.99	3.19	3.35
GW Boundary Flow Out	6.46	9.57	9.76	7.56	11.57	11.89	7.36	10.20	10.35
Drain SZ/Boundary Flow Out	0.00	0.04	0.16	0.00	0.24	0.67	0.00	0.08	0.28
Saturated Zone (SZ) Storage Change	-1.89	-2.17	-2.09	1.02	1.06	0.71	-0.31	0.91	0.43
Total Error	-0.04	0.00	0.08	0.00	0.04	0.08	0.00	0.04	0.04

Table 1-9, Total Water Budget Comparison for Faka Union Canal Basin

Faka Union Canal Basin									
Water Budget Component	1981			1983			1986		
	NSM (inches)	ECM (inches)	FCM (inches)	NSM (inches)	ECM (inches)	FCM (inches)	NSM (inches)	ECM (inches)	FCM (inches)
Precipitation	45.91	45.91	45.91	78.78	78.78	78.78	55.12	55.12	55.12
Evapotranspiration	53.58	32.28	35.67	52.09	35.04	37.56	52.32	33.82	36.54
Irrigation	0.00	1.77	1.61	0.00	0.51	0.47	0.00	1.02	0.91
Overland (OL) Flow to River	0.00	-2.44	-1.42	0.00	-2.17	14.88	0.00	-1.54	0.47
OL/UZ Boundary Flow In	1.50	1.22	1.50	20.91	9.41	11.22	3.90	2.52	2.68
OL/UZ Boundary Flow Out	2.83	-0.12	0.47	37.44	-0.28	2.80	6.61	-0.28	0.55
Overland Storage Change	-7.48	-0.12	-0.79	8.94	0.55	1.06	0.16	0.20	0.71
Unsaturated Zone (UZ) Storage Change	-0.28	-0.98	-0.59	0.08	0.91	0.43	0.00	0.87	0.31
Infiltration to GW	5.87	21.42	21.61	2.99	56.46	43.03	4.17	26.77	26.61
Evaporation from GW	7.17	1.18	5.94	1.85	1.81	9.29	4.29	1.18	6.46
GW Pumping	0.00	3.46	3.31	0.00	2.24	2.17	0.00	2.72	2.60
Drain to River	0.00	10.12	7.05	0.00	37.83	20.63	0.00	12.01	8.58
Baseflow to River	0.00	11.14	7.48	0.00	17.01	11.22	0.00	13.27	9.17
Baseflow from River	0.00	0.43	1.34	0.00	0.20	0.87	0.00	0.28	1.10
GW Boundary Flow In	0.94	3.50	1.34	0.87	4.29	1.93	0.91	3.94	1.38
GW Boundary Flow Out	0.98	1.26	1.93	1.02	1.14	1.73	0.98	1.18	1.93
Drain SZ/Boundary Flow Out	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Saturated Zone (SZ) Storage Change	-1.38	-1.77	-1.42	0.98	0.94	0.75	-0.16	0.67	0.39
Total Error	-0.04	0.00	0.00	0.00	0.04	0.04	0.00	0.00	0.00

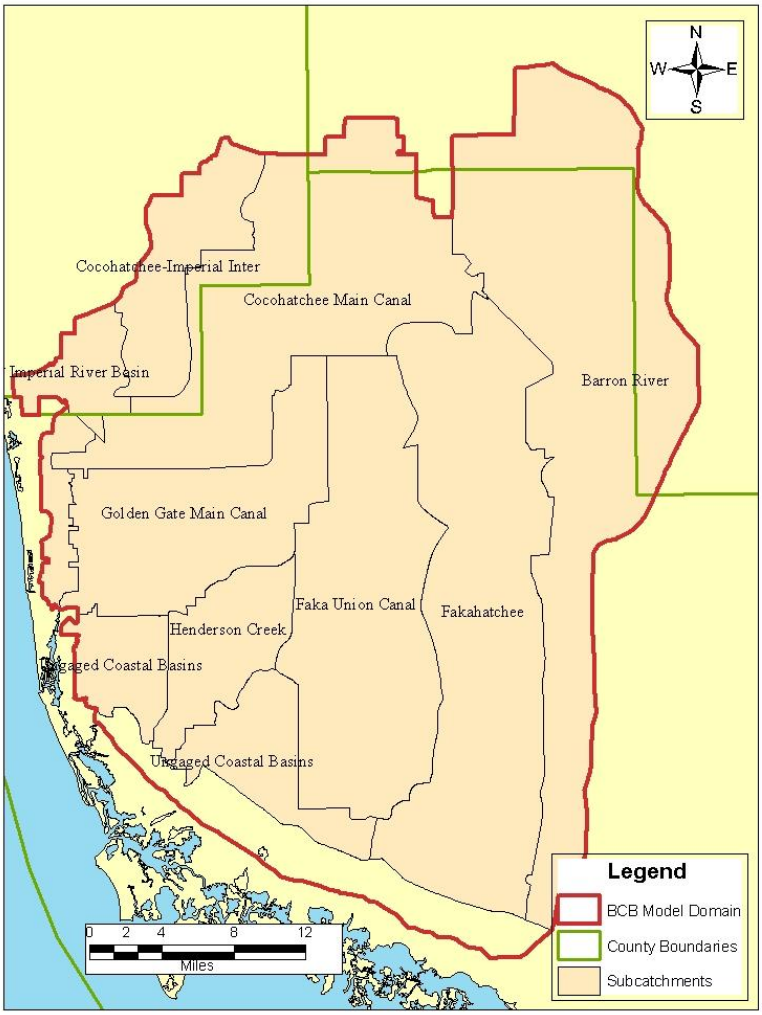


Figure 1-12
Defined Subcatchments (basins) in the Big Cypress Model Domain

The total contribution from the entire BCB model domain to the estuary system via overland flow can be calculated using the following equation:

BCB Flow to Estuaries = OL to Riv + O/UZ Out + Dr to Riv + BF to Riv – BF from Riv

Table 1-10 provides a summary of calculated total flow to the estuaries for each of the BCB models during the three rainfall years evaluated during this analysis. Results indicate that the discharge ratio compared to the NSM is largest during average years. During dry years, runoff and baseflow are limited which reduces discharges to the receiving water bodies. In addition, structures during those periods are operated such that flows are retained in the drainage system. During wet years, discharges from both natural and developed areas are large due to high groundwater elevation and soil saturation. It should be noted that values in Table 1-10 represent the total flow from the entire

model domain and may differ significantly from discharge rates from individual sub-basins, as shown in Table 1-4.

Table 1-10
Total Runoff from the BCB MIKE SHE Models

Year	MIKE SHE Model		
	NSM	ECM	FCM
1981	4.76	14.17	13.70
1983	19.92	35.39	34.96
1986	5.98	23.98	15.75
Avg.	10.22	24.51	21.47

1.3 SUMMARY AND CONCLUSIONS

In this section, the MIKE SHE models used for the BCB PIR were reviewed and the discharge results were evaluated relative to values reported in the literature. The model review indicated that there appears to be inconsistency in how some parameters were defined in the MIKE SHE models. The Manning's "n" values and the detention storage values show the most variation between the models.

In general, the model predicted discharge results are consistent with the values identified in the literature. However, the review of the NSM model results raised some questions about input values used in the NSM model in the vicinity of Okaloacoochee Slough. The Okaloacoochee Slough area is mostly undeveloped; however, the NSM predicted groundwater levels and hydroperiod in this area are substantially different from the results predicted by the ECM and FCM models. These differences will have to be investigated if the NSM is to be used as a baseline for evaluating future projects.

The model results indicate that the average annual discharge from the NSM model is generally consistent with the average annual discharge value of 10 inches estimated by Kenner (1966).

The model comparison results (see Table 1-4) also indicate that the flow to Naples Bay from the Golden Gate basin and to the Ten Thousand Islands from the Faka Union basin has increased significantly since construction of the canal network. On average, the increase in flow in these basins is approximately four (4) times the volume predicted by the NSM over the simulation period. However, there were years where the increased flow predicted by the ECM and the FCM for these basins was estimated to be more than 10 times the volume predicted by the NSM. These values are also consistent with those reported by BCE (1974) and others as described in the literature review.

2.0 ASSESSMENT OF EXISTING CONDITIONS: WATERSHED

This chapter describes the results of the assessment of existing conditions in the study area in terms of surface water, ground water, and natural system conditions. The assessment included evaluations of the areal extent and functional quality of native wetland and upland communities, as well as a comparison of existing conditions with performance measures (described in Chapter 4) to identify watershed issues and potential opportunities for addressing those issues.

2.1 SURFACE WATER QUANTITY

This chapter section presents water budget results of the Collier County MIKE SHE/MIKE11 Existing Conditions Model (ECM), summarizes the predicted water budgets simulated by the ECM, and discusses potential issues identified through the water budgeting process. It addresses the following items:

- **Water Budget Components.** This section describes the components used to define the water budget in MIKE SHE.
- **Surface Water and Groundwater Budgets.** This section describes the overall surface water and groundwater budgets, and the water budgets developed for each watershed (**Figure 2-1**).
- **Baseflow and Structure Operations.** This section focuses on the distribution of baseflow contributions within the Golden Gate-Naples Bay Watershed. The section will also evaluate the potential effect of changes in structure operations.
- **Canal Capacity.** This section will identify locations at which water elevations in the canal are predicted to exceed the top of bank elevation during storm events. This is another factor that could help define potential changes in structure operations.
- **Conclusions.** This section presents the conclusions of these analyses.

Figure 2-1. Collier County Watersheds and Coastal WBIDs

2.1.1 Water Budget Components

A water budget analysis was conducted to understand the distribution of watershed inflows and outflows. **Figure 2-2** is a schematic of the water budget components. As shown, the primary sources of inflow to a watershed are precipitation and applied irrigation. This water accumulates on the ground surface as basin storage, runs off as overland flow or infiltrates into the ground. Overland flow can be evaporated, discharged into the canal, or flow across watershed boundaries. Water that infiltrates into the soils can be taken up by plants or percolate into the Water Table aquifer. This water can then be removed from the Water Table Aquifer by plant uptake, by moving laterally across the watershed boundary, by pumping to meet potable water and irrigation needs, or by percolation to underlying aquifers. Any residual water is stored in the aquifer. Similar processes occur in each of the deeper aquifers.

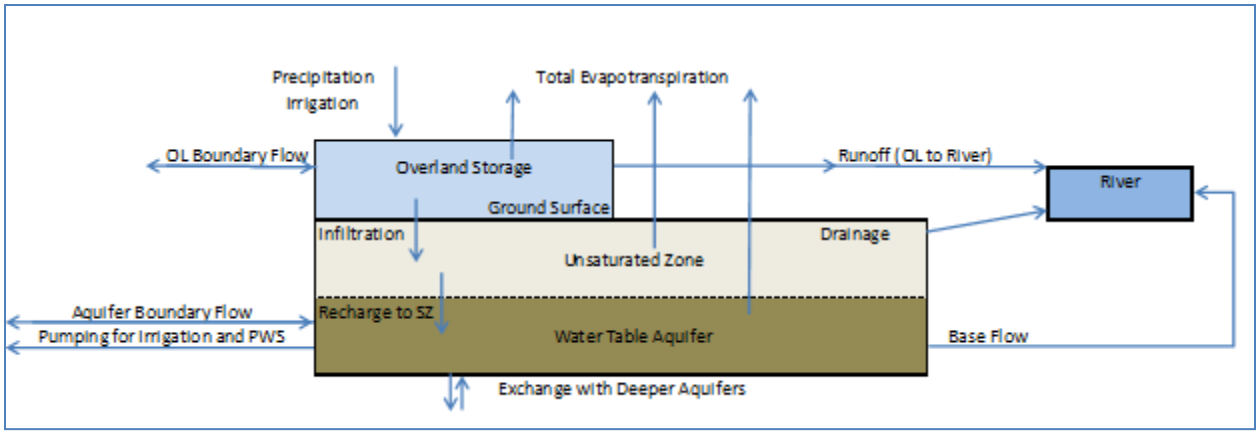


Figure 2-2. Schematic of MIKE SHE Water Budget

The components of the water budget are described in further detail below:

Inflows:

- **Precipitation:** This is water entering the watershed as rainfall. Some portion of precipitation is intercepted by the vegetative canopy. The rest is applied to the ground surface.
- **Irrigation:** This is the sum of all model predicted irrigation applied to the ground surface in the watershed. This consists of water pumped from the Water Table and Lower Tamiami aquifers and water applied from external sources such as reuse water provided by Collier County or the City of Naples.
- **Overland Boundary Inflow:** This is water that enters a watershed as sheet flow from adjacent watersheds. This typically occurs during large storm events in the wet season when water ponded on the ground surface crosses a watershed boundary.
- **Aquifer Boundary Inflow:** This is groundwater that enters a watershed via subsurface flow from adjacent watersheds. There are four aquifers in the model, so this component can be broken in inflows per aquifer layer.

Outflows:

- **Evapotranspiration (ET):** The ET represents the combined total of direct evaporation of water ponded on the ground surface or captured in the vegetative canopy and water transpired from the soils and Water Table aquifer by plant uptake.
- **Runoff:** This represents the model predicted amount of overland flow that discharges into the river and canal network. This component also includes stormwater runoff from secondary and tertiary urban and agricultural drainage networks that are not explicitly represented in the model.
- **Baseflow:** This component of the model represents groundwater inflows to the canal network.

- **Pumping for irrigation and potable water supply:** This item represents the total volume of water pumped out of the aquifer system. Some portion of this water is applied to the ground surface as irrigation. Water pumped for potable water supply is used as reuse irrigation water or is injected into deep aquifers.
- **Overland Boundary Outflow:** This is water that leaves a watershed as overland flow into adjacent watersheds or across the model boundary and typically occurs during large storm events.
- **Aquifer Boundary Inflow:** This is groundwater that exits a watershed or the model via subsurface flow. There are four aquifers in the model, so this component can be broken in outflows per aquifer layer.

Storage Change:

- This component represents the total change in watershed storage. This includes overland storage, storage in the unsaturated zone and storage in groundwater.

2.1.2 Water Budget Analysis

For the water budget analyses, data were extracted from the MIKE SHE/MIKE11 model results files using a pre-defined Total Water Budget tool in the program. The model results were then post processed to create water budgets for the entire model study area as well as for each of the watersheds, Cocohatchee-Corkscrew (CC), Golden Gate Naples Bay (GGNB), Rookery Bay (RB), and the combined Faka Union, Fakahatchee, and Okaloacoochee-SR29 (FUFHOK) watersheds. These watersheds are comprised of aggregated WBID areas.

Water budgets were generated for the model simulation period of January 1, 2002 through October 31, 2007. Budgets were developed for different time periods based on model simulation data availability. The time periods include:

- **Annual:** The water budget represents average conditions during the water year. The budget represents the period from November 1–October 31. For example, the 2003 water year is the period from November 1, 2002–October 31, 2003. Water year budgets were calculated for 2003 through 2007.
- **Wet Season:** The wet season is defined as July 1–October 31. Wet season water budgets were developed for the years 2002–2007. This period includes all the wet seasons incorporated in the model simulation period.
- **Dry Season:** The dry season is defined as the period from November 1–June 30. The 2003 dry season represents November 2002–June 2003. Dry season water budgets were developed for the years 2003–2007.

In this section, the results of the water budget analysis in terms of annual average, wet season and dry season are described. In addition, water budgets were prepared for a wet year and a dry year

relative to the average annual conditions. Finally, seasonal water budgets were developed for each watershed.

2.1.3 Seasonal Water Budgets

Table 2-1 shows the annual water year and seasonal water budget components for the study area. **Figure 2-3** shows the average water year budget for the entire study area. **Figure 2-4 and Figure 2-5** show the corresponding average wet season and dry season water budgets. The data indicate that rainfall during the four (4) month wet season represents about 54 percent of the total annual amount and that most is lost through ET.

Table 2-1. Annual Water Year and Seasonal Water Budgets for Study Area

Period	Inflows (inches)		Outflows (inches)				Change in Storage
	Precipitation	Irrigation	Evapo Transpiration	Runoff	Baseflow to River	Pumping	
Dry Season Average							
2003	31.10	1.57	24.45	1.65	1.93	2.17	3.15
2004	24.72	1.81	25.55	1.26	2.28	2.44	-4.45
2005	35.79	1.81	25.08	3.31	2.24	2.44	4.41
2006	19.45	2.60	25.47	1.22	2.13	3.27	-9.57
2007	17.17	3.50	24.69	0.16	1.06	4.21	-7.99
Average	25.65	2.26	25.05	1.52	1.93	2.91	-2.89
Wet Season Average							
2002	21.14	0.31	16.22	1.38	1.85	0.63	1.14
2003	29.65	0.12	15.67	8.86	3.11	0.39	-0.35
2004	34.72	0.08	16.26	8.70	2.87	0.39	4.53
2005	33.86	0.08	17.36	10.16	3.50	0.39	-0.51
2006	30.59	0.43	17.17	5.31	2.80	0.71	3.62
2007	26.38	0.39	17.44	0.83	1.61	0.71	6.26
Average	29.39	0.24	16.69	5.87	2.62	0.54	2.45
Annual Average							
2003	60.75	1.69	40.12	10.51	5.04	2.56	2.80
2004	59.45	1.89	41.81	9.96	5.16	2.83	0.08
2005	69.65	1.89	42.44	13.46	5.75	2.83	3.90
2006	50.04	3.03	42.64	6.54	4.92	3.98	-5.94
2007	43.54	3.90	42.13	0.98	2.68	4.92	-1.73
Average	56.69	2.48	41.83	8.29	4.71	3.43	-0.18

Runoff and base flow are important components of the water budget as they represent about 15 and 8 percent of annual rainfall (8.3 and 4.7 inches, respectively). In other words, the volume of groundwater that enters the canal network as base flow is approximately 36 percent of the total fresh water discharged into the canal network. It is important to point out that base flow discharges are the result of the construction of the drainage canals that cut into the Water Table aquifer.

During the wet period, runoff is about 70 percent of the total contributions to the canal network. However, in the dry season, the runoff volume decreases to about 44 percent of the total

contribution the canal network. Therefore, the majority of the dry season canal flow is baseflow. This is because runoff is highly sensitive to varying meteorological conditions, whereas baseflow is relatively stable. The ratio of average runoff to average rainfall ranges from 20 percent in the wet season to 6 percent in the dry season. On the other hand, baseflow (wet season = 2.62 inches and dry season = 1.93 inches) remains at about 8 percent of rainfall.

Figures 2-4 and 2-5 also illustrate the seasonal variations in pumping and irrigation. As expected, pumping and irrigation demand during the dry season represents about 85 percent of the annual water budget for these two items.

Finally, the water budget also includes watershed storage. As shown in **Figure 2-3**, change in storage as an annual average is negligible. **Figures 2-4 and 2-5** show that about 2.5 inches of storage is lost in the dry season, but that volume is recovered in the wet season. This indicates that, at least during the simulation period 2002–2007, hydrologic characteristics of the study area did not worsen, although no recovery is apparent.

To assess the system characteristics during critical conditions, water budgets were developed for both the driest dry season and the wettest wet season in the simulation period. **Figure 2-6** shows the results of the 2007 dry season (November 2006 through June 2007). Total precipitation during this period amounted to about 17 inches, which is about 33 percent less than the average dry season rainfall for the entire simulation period. **Figure 2-7** represents the extremely wet 2004 rainy season (July through October 2004) when Florida experienced three hurricanes in less than 45 days. Total rainfall accumulated during that season was almost 35 inches, which is about 20 percent more than the wet season average for the model simulation period.

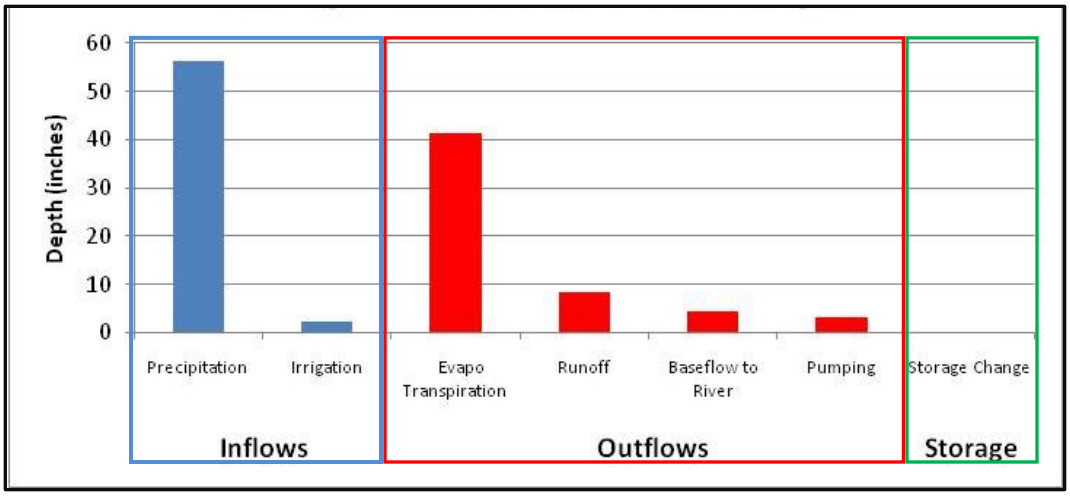


Figure 2-3. Average Water Year (2003–2007) Water Budget

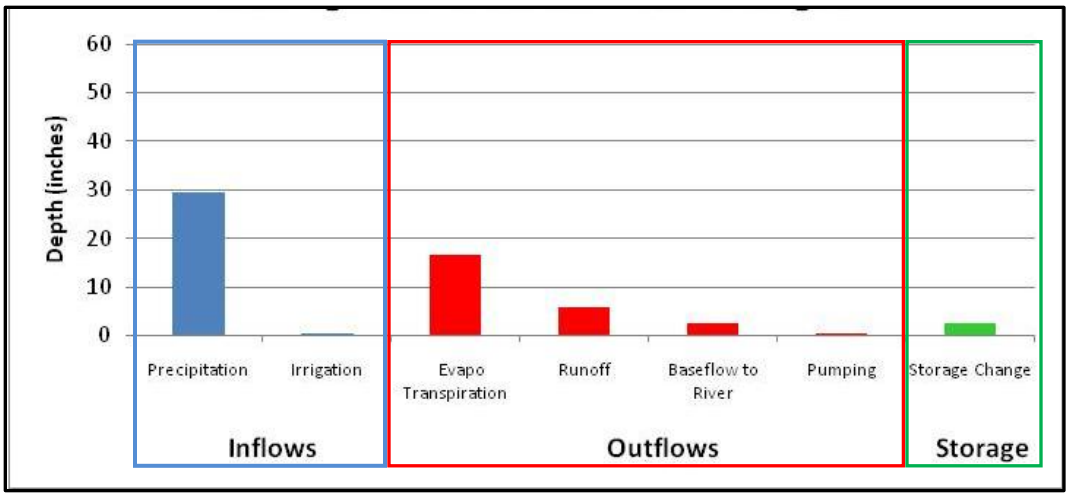


Figure 2-4. Average Wet Season (2002–2007) Water Budget

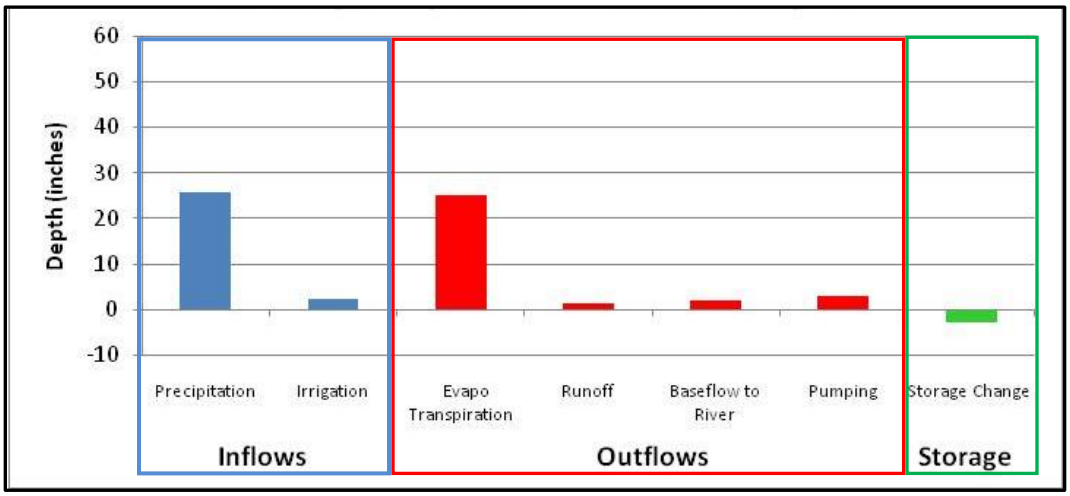


Figure 2-5. Average Dry Season (2003–2007) Water Budget

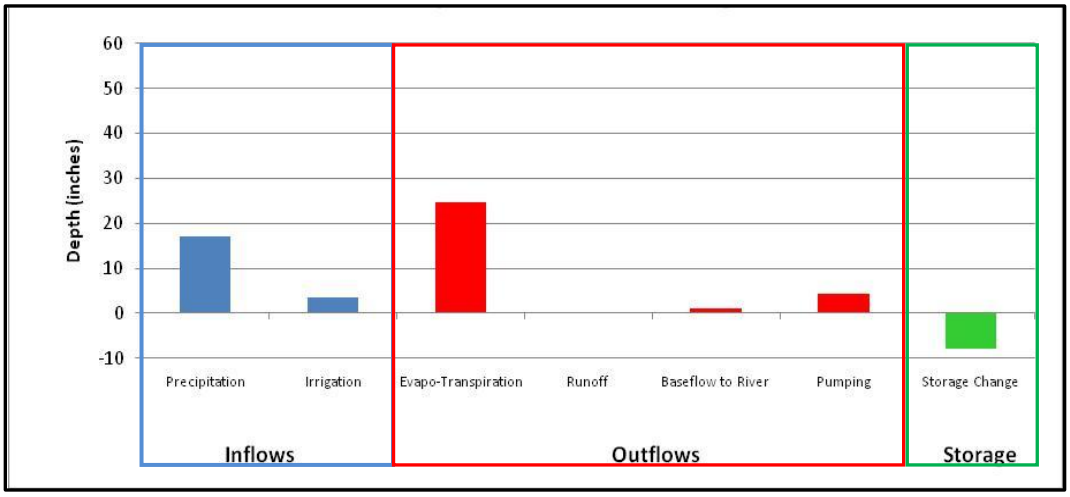


Figure 2-6. 2007–Driest Dry Season Water Budget

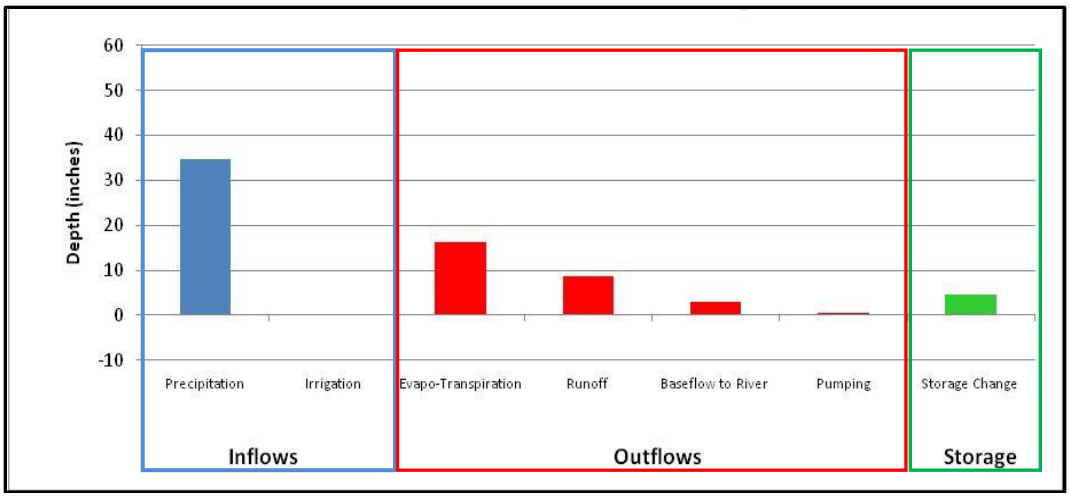


Figure 2-7. 2004–Wettest Wet Season Water Budget

Results of the analysis confirm that the change in runoff volume is much larger than the change in precipitation. During the 2007 dry season, a 33 percent reduction in precipitation from the period average resulted in an approximately 90 percent reduction in runoff volume. Similarly, the 20 percent increase in precipitation during the 2004 wet season resulted in an about 50 percent increase in runoff volume. As stated previously, baseflow is not affected as drastically as runoff volume. The change in baseflow contribution is small during extremely wet conditions as demonstrated by the 10 percent increase from average during the 2004 wet season. The impact is more severe during dry weather conditions when it was reduced by about 50 percent from average. It is important to point out that this also indicates that fresh water flows in the canal in the 2007 dry conditions was almost exclusively baseflow.

The results of the annual and seasonal water budgets indicate that the management of both runoff and base flow are key to reducing the volume of water discharged to the estuaries. During the dry season, the reduction of baseflow to the canal network appears to be the more critical issue. It should be noted that structure operations are important to managing both discharge and baseflow in the canal network.

During extreme dry weather, irrigation and pumping also increase substantially, accompanied by a substantial reduction in watershed storage. Similarly to the annual average analysis, irrigation and pumping are drastically reduced during extreme wet weather conditions and the watershed storage is quickly recovered.

2.1.4 Water Budgets by Watershed

Average water year and seasonal water budgets were also generated for each of the watersheds in Collier County. As described for the entire study area, the majority of the precipitation is lost to ET, which ranges between 50 and 60 percent in the wet season for all watersheds. During the dry

season, ET losses equal precipitation in all watersheds except Golden Gate–Naples Bay, where ET is about 80 percent of precipitation. This is due to the high level of watershed urban development, as water is quickly routed to the drainage network.

Cocohatchee-Corkscrew Watershed. The budgets for the Cocohatchee-Corkscrew watershed are shown in **Figures 2-8 through 2-10** and in **Table 2-2.** Model results indicate that the annual average runoff volume is approximately 14 percent of rainfall. Most of the runoff comes from urban and agricultural development. As an example, in the 2003 wet season results indicate that runoff was more than nine (9) inches. Of that, 8.5 inches came from urban and agricultural development.

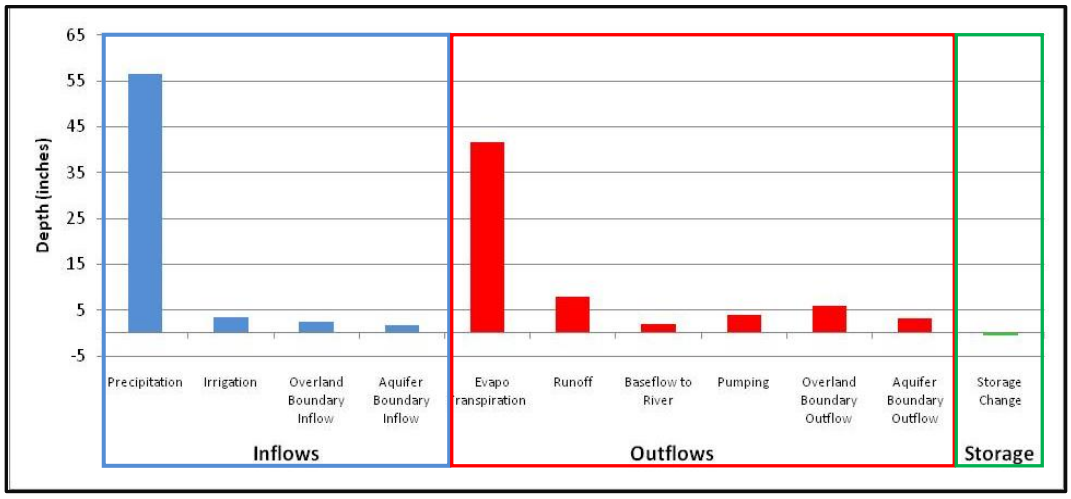


Figure 2-8. Average Water Year Budget – Cocohatchee-Corkscrew Watershed

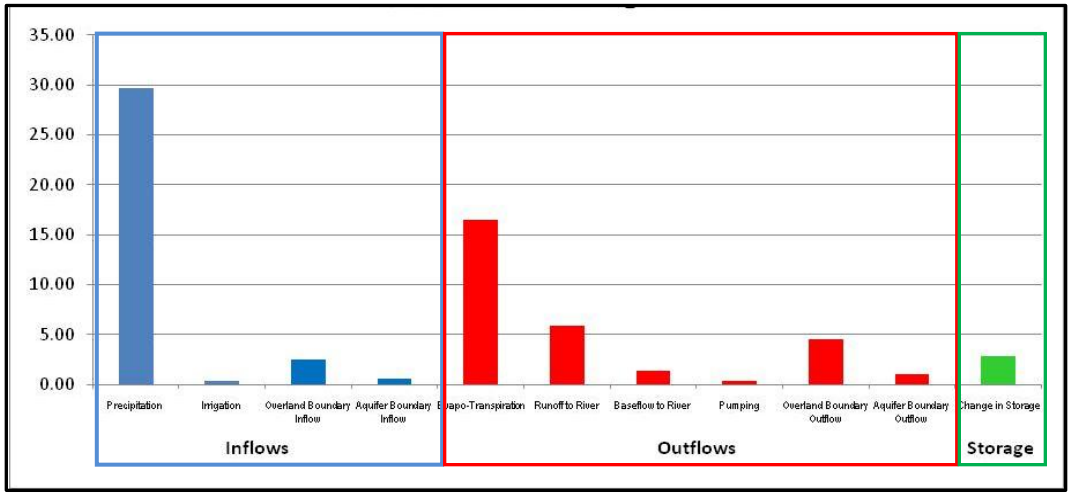


Figure 2-9. Average Wet Season Water Budget – Cocohatchee-Corkscrew Watershed

Table 2-2. Seasonal Water Budget for Cocohatchee-Corkscrew Watershed

Season	Inflows (inches)				Outflows (inches)						Storage (inches)
	Precipitation	Irrigation	Overland Boundary Inflow	Aquifer Boundary Inflow	Evapo-Transpiration	Runoff to River	Baseflow to River	Pumping	Overland Boundary Outflow	Aquifer Boundary Outflow	Storage Change
Wet 2002	23.14	0.34	0.25	0.59	15.99	2.46	1.01	0.43	0.64	0.81	2.88
Wet 2003	29.78	0.17	4.09	0.62	15.26	9.10	1.81	0.26	7.11	1.17	-0.67
Wet 2004	36.10	0.19	4.30	0.63	16.05	9.11	1.66	0.29	7.88	1.11	4.46
Wet 2005	33.54	0.11	4.72	0.62	17.36	9.14	1.91	0.22	8.61	1.25	-0.07
Wet 2006	29.79	0.55	1.35	0.67	17.11	4.89	1.33	0.65	2.76	0.98	4.33
Wet 2007	25.30	0.56	0.07	0.73	17.42	0.91	0.45	0.66	0.16	0.78	6.18
Average Wet	29.61	0.32	2.46	0.64	16.53	5.93	1.36	0.42	4.53	1.02	2.85
Dry 2003	33.32	2.31	0.56	0.97	24.43	2.80	1.09	2.51	1.08	1.72	3.37
Dry 2004	24.91	2.63	0.56	1.05	25.37	1.51	1.10	2.83	0.77	1.91	-4.40
Dry 2005	35.40	2.57	1.16	1.08	25.08	3.54	1.21	2.80	1.99	1.97	3.38
Dry 2006	19.83	3.62	1.26	1.10	25.69	1.18	1.06	3.85	1.82	1.94	-9.80
Dry 2007	15.15	5.03	0.25	1.13	24.08	-0.55	0.24	5.27	0.13	1.92	-9.52
Average Dry	25.72	3.23	0.76	1.07	24.93	1.70	0.94	3.45	1.16	1.89	-3.39

Table 2-3. Seasonal Water Budget for Golden Gate-Naples Bay Watershed

Season	Inflows (inches)				Outflows (inches)						Storage (inches)
	Precipitation	Irrigation	Overland Boundary Inflow	Aquifer Boundary Inflow	Evapo-Transpiration	Runoff to River	Baseflow to River	Pumping	Overland Boundary Outflow	Aquifer Boundary Outflow	Storage Change
Wet 2002	23.29	0.04	0.35	0.92	15.21	1.20	6.34	1.53	0.26	0.51	-0.47
Wet 2003	33.93	0.02	6.12	1.02	15.05	11.99	10.52	1.27	3.40	0.50	-1.76
Wet 2004	36.10	0.02	7.11	1.07	16.04	10.98	9.38	1.45	3.55	0.51	2.32
Wet 2005	37.47	0.01	7.82	1.25	17.08	13.32	10.74	1.56	4.12	0.59	-0.97
Wet 2006	34.29	0.06	2.39	1.05	16.36	6.69	9.23	1.37	1.34	0.59	2.13
Wet 2007	26.77	0.17	0.06	1.16	16.62	0.16	4.85	1.69	0.06	0.50	4.29
Average Wet	31.98	0.05	3.97	1.08	16.06	7.39	8.51	1.48	2.12	0.53	0.92
Dry 2003	32.81	0.89	0.75	1.83	21.24	1.52	5.01	3.70	0.35	0.84	3.59
Dry 2004	25.01	1.13	0.45	2.17	20.66	0.42	4.89	4.13	0.25	0.80	-2.40
Dry 2005	37.61	1.32	1.42	2.23	21.21	4.97	5.71	4.49	0.89	0.91	4.35
Dry 2006	19.86	1.79	1.58	2.37	19.43	0.94	5.02	4.93	0.92	0.95	-6.60
Dry 2007	14.35	2.55	0.12	2.20	19.00	-0.09	0.72	5.49	0.03	0.79	-6.71
Average Dry	25.93	1.54	0.86	2.16	20.31	1.55	4.27	4.55	0.49	0.86	-1.56

Table 2-4. Seasonal Water Budget for Rookery Bay Watershed

Season	Inflows (inches)				Outflows (inches)						Storage (inches)
	Precipitation	Irrigation	Overland Boundary Inflow	Aquifer Boundary Inflow	Evapo-Transpiration	Runoff to River	Baseflow to River	Pumping	Overland Boundary Outflow	Aquifer Boundary Outflow	Storage Change
Wet 2002	19.89	0.16	0.16	0.95	16.42	0.19	1.45	0.16	0.98	0.91	1.05
Wet 2003	33.15	0.02	0.92	0.80	16.13	9.52	3.38	0.02	4.66	1.48	-0.52
Wet 2004	30.46	0.09	0.67	1.02	16.94	4.76	3.23	0.09	2.51	1.31	3.19
Wet 2005	31.48	0.04	0.80	0.99	17.25	7.19	4.04	0.09	3.44	1.72	-0.69
Wet 2006	31.82	0.05	0.69	1.00	17.17	5.11	3.32	0.06	2.82	1.41	3.51
Wet 2007	26.51	0.17	0.22	1.15	17.41	0.43	1.15	0.17	1.00	1.01	6.83
Average Wet	28.88	0.09	0.58	0.99	16.89	4.53	2.76	0.10	2.57	1.31	2.23
Dry 2003	29.23	1.02	0.55	2.07	24.15	0.24	1.62	1.02	1.26	1.79	2.79
Dry 2004	23.84	0.84	0.56	2.17	25.13	0.03	2.19	0.84	0.88	2.07	-3.72
Dry 2005	35.71	1.08	0.82	2.39	24.10	3.22	2.15	1.13	2.62	2.17	4.56
Dry 2006	19.09	1.19	0.69	2.45	24.13	0.24	2.12	1.27	0.73	2.30	-7.40
Dry 2007	16.28	1.48	0.68	2.69	24.17	-0.10	0.89	1.48	0.58	1.79	-7.67
Average Dry	24.83	1.12	0.66	2.35	24.34	0.72	1.80	1.15	1.21	2.03	-2.29

Table 2-5. Seasonal Water Budget for Faka Union, Fakahatchee and Okaloacoochee-SR29 Watersheds

Season	Inflows (inches)				Outflows (inches)						Storage (inches)
	Precipitation	Irrigation	Overland Boundary Inflow	Aquifer Boundary Inflow	Evapo-Transpiration	Runoff to River	Baseflow to River	Pumping	Overland Boundary Outflow	Aquifer Boundary Outflow	Storage Change
Wet 2002	20.59	0.00	0.12	1.73	16.50	0.16	4.41	0.47	0.24	0.51	0.16
Wet 2003	29.37	0.00	6.57	1.81	15.98	8.31	8.66	0.43	3.07	1.06	0.31
Wet 2004	32.52	0.00	7.28	1.85	16.65	9.02	8.15	0.43	2.80	1.02	3.58
Wet 2005	33.19	0.00	9.45	1.69	17.17	12.32	11.02	0.55	3.70	1.30	-1.69
Wet 2006	32.17	0.00	4.21	1.73	17.05	7.05	8.07	0.59	2.36	1.02	2.01
Wet 2007	26.77	0.00	0.12	1.54	17.24	0.31	4.88	0.59	0.28	0.67	4.41
Average Wet	29.10	0.00	4.63	1.73	16.77	6.19	7.53	0.51	2.07	0.93	1.46
Dry 2003	27.44	0.08	0.08	3.86	23.70	0.00	3.31	1.14	0.24	0.98	2.05
Dry 2004	23.94	0.12	0.24	4.06	23.98	0.24	5.91	1.10	0.31	1.18	-4.37
Dry 2005	34.33	0.12	1.54	4.06	23.43	2.32	4.61	1.42	1.10	1.22	5.98
Dry 2006	19.88	0.16	0.59	4.21	23.19	0.39	4.92	1.57	0.24	1.14	-6.69
Dry 2007	19.13	0.20	0.04	3.90	23.39	-0.28	2.40	1.61	0.16	1.18	-5.20
Average Dry	24.94	0.13	0.50	4.02	23.54	0.54	4.23	1.37	0.41	1.14	-1.65

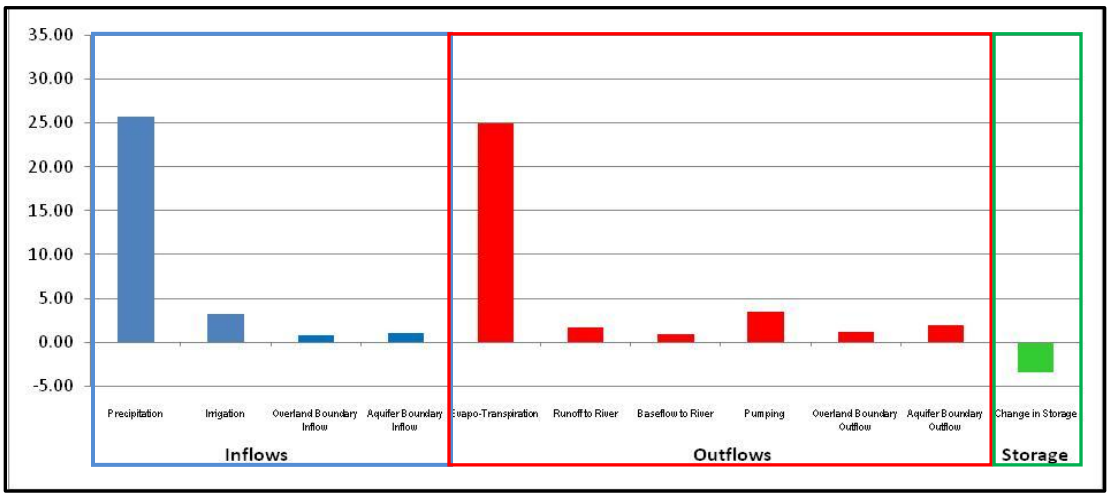


Figure 2-10. Average Dry Season Water Budget – Cocohatchee-Corkscrew Watershed

Runoff flow contributions from natural areas are small because the majority is stored in the Corkscrew Swamp. In addition, there is a large component of overland runoff flow that leaves the Cocohatchee-Corkscrew watershed and enters the Golden Gate–Naples Bay, Okaloacoochee-SR 29, Fakahatchee, and Faka Union watersheds during large rainfall events due to the little difference in elevation at the watershed ridges. In terms of baseflow, the amount relative to runoff is only half of that computed for the entire study area. This can be attributed to the low density of canals in the watershed.

Golden Gate-Naples Bay Watershed. The water budgets for the Golden Gate watershed are shown in **Figures 2-11 through 2-13** and in **Table 2-3**. The most important feature of this watershed is that baseflow is the primary source of water to the canal network. It often exceeds 70 percent of the canal flow during the dry season. This can be attributed to the density of canals throughout the drainage area. Reducing baseflow to the canal network could have a significant effect on the volume of water discharging to the Naples Bay Estuary.

Runoff exceeds 19 percent of rainfall and occurs primarily during the rainy season. As in the Cocohatchee–Corkscrew watershed, most of the runoff is from urban development close to the coast. The volume of water leaving the watershed via overland and aquifer flow is low and is directly influenced by the presence of the canal network that drains the Water Table Aquifer and directs water to the estuary systems.

Rookery Bay Watershed. The Rookery Bay watershed is diverse with urban development located west of the Henderson Creek Canal. The central portion of the watershed is mostly natural and consists of the Henderson Strand and portions of the Picayune Strand State Forest. The southeast portion of the watershed is agricultural. In general, the percentage of runoff relative to precipitation

(11 percent) is low compared to the other watersheds. The low runoff value is most likely associated to the lack of development in large parts of the watershed.

The seasonal water budget results shown in **Figures 2-14–16** and **Table 2-4** indicate that surface runoff makes up 60 percent of canal flow during the wet season. However, during the dry season, baseflow contributions often exceed 70 percent of canal flow. Wet season runoff occurs primarily from the urbanized and agricultural areas; while dry season baseflow contributions occur primarily in the Henderson Creek Canal.

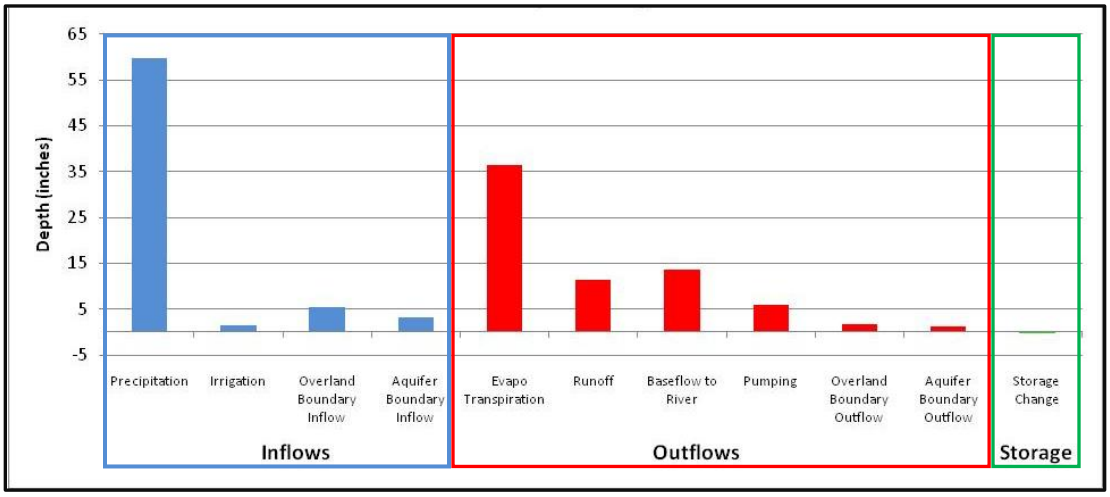


Figure 2-11. Average Water Year Budget–Golden Gate-Naples Bay Watershed

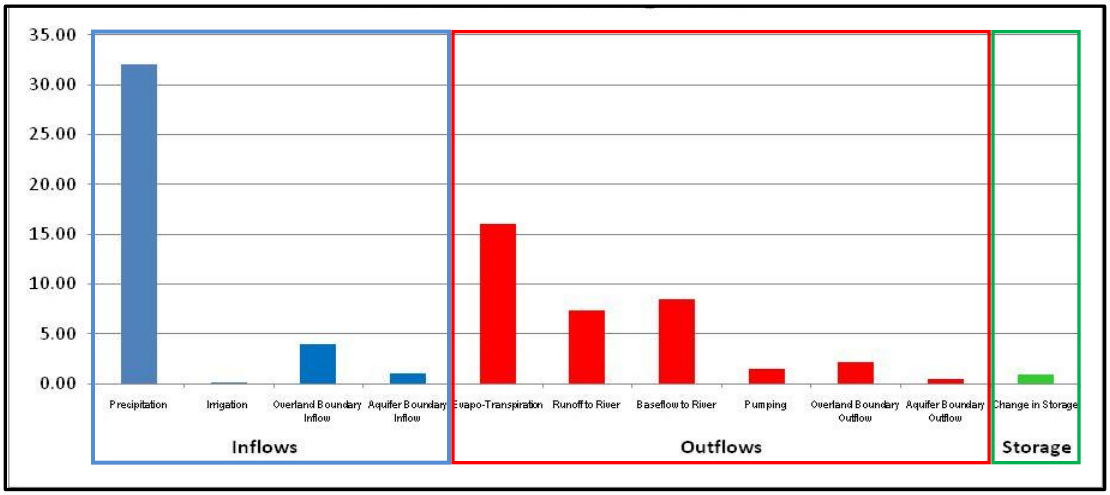


Figure 2-12. Average Wet Season Water Budget – Golden Gate-Naples Bay Watershed

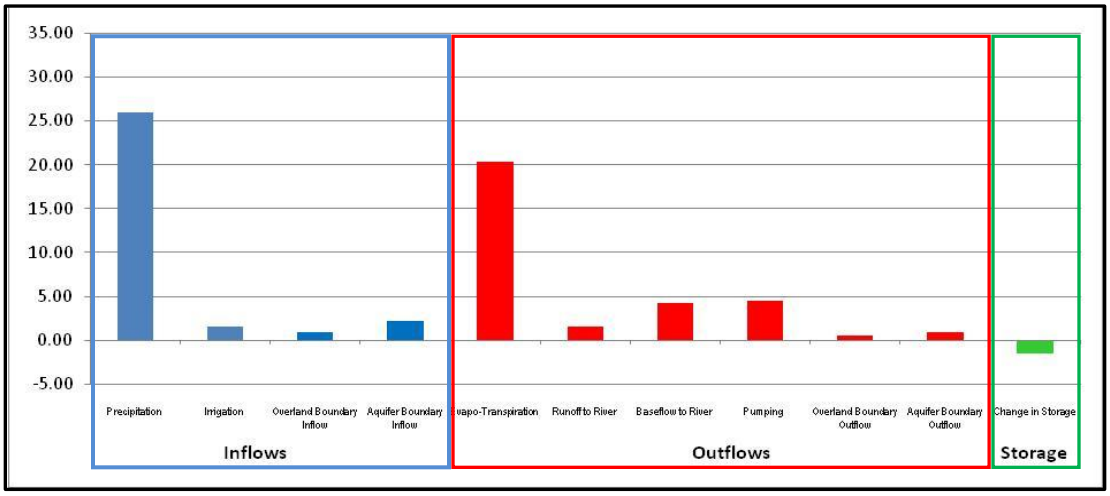


Figure 2-13. Average Dry Season Water Budget – Golden Gate-Naples Bay Watershed

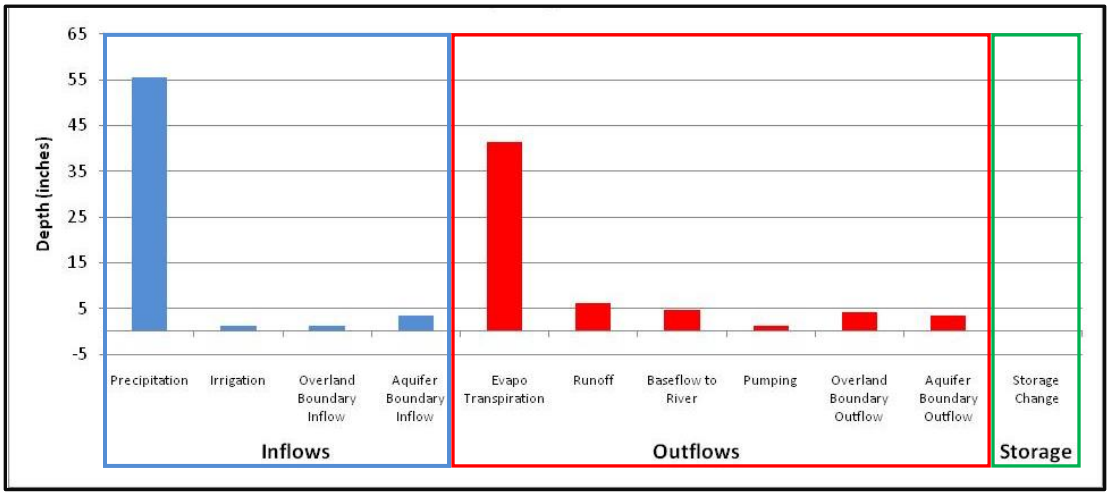


Figure 2-14. Average Annual Water Budget – Rookery Bay Watershed

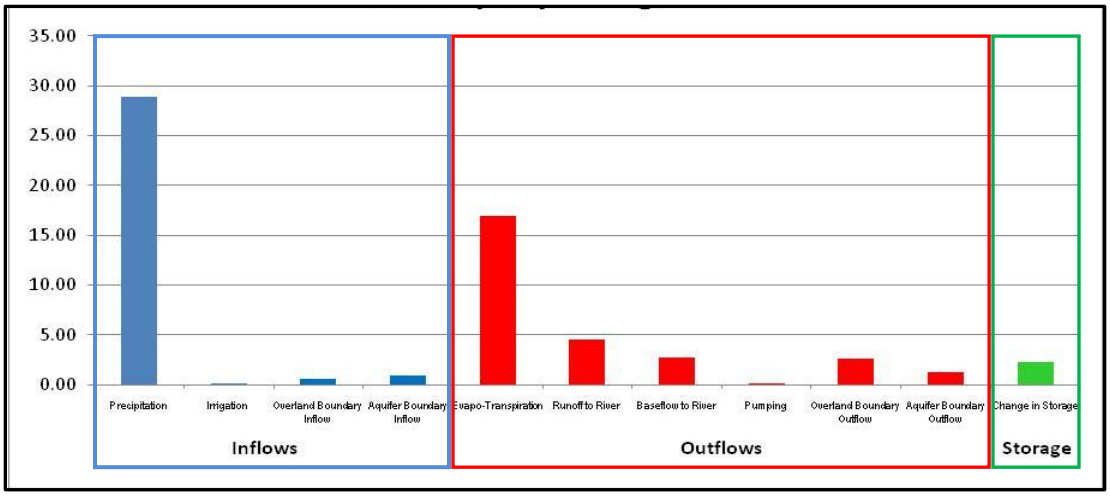


Figure 2-15. Average Wet Season Water Budget – Rookery Bay Watershed

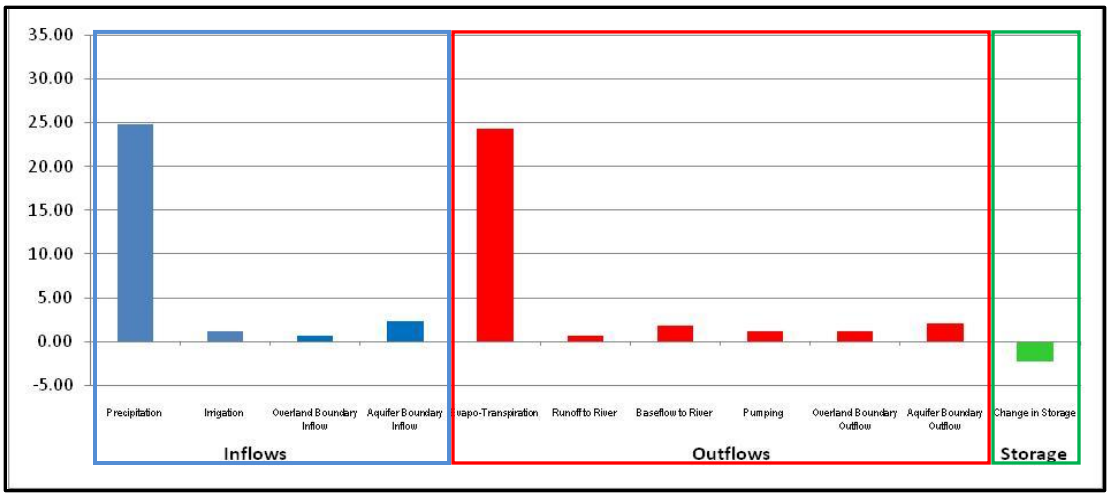


Figure 2-16. Average Dry Season Water Budget – Rookery Bay Watershed

Faka Union, Fakahatchee, and Okaloacoochee–SR29 Watersheds. The water year and seasonal water budgets for the Faka Union, Fakahatchee, and Okaloacoochee-SR29 watersheds are shown in **Figures 2-17–2-19** and in **Table 2-5.** There are a large percentage of agricultural lands in the northern portion of the Fakahatchee and Okaloacoochee-SR29 watersheds; whereas, the northern part of the Faka Union watershed includes rural residential areas. The remainder of the watershed consists of wetlands or other natural areas; however, portions of the Golden Gate Canal network drain large portions of the natural areas in the southern Faka Union watershed.

In the wet season, baseflow in these watersheds is equal to approximately 120 percent of runoff, but during the dry season, the volume of baseflow is more than 7.5 times that of runoff. The model results indicate that baseflow occurs primarily in the Faka Union watershed, although there are baseflow contributions to the State Road 29 Canal in the Okaloacoochee–SR29 watershed. It is Atkins opinion that the Picayune Strand Restoration Project will greatly reduce the volume of baseflow in these combined watersheds.

The water budget results indicate a slight loss in stored water over the model simulation period. The results suggest that this loss is most likely attributed to the high baseflow contributions to the canal network in the Faka Union watershed, although groundwater pumping for potable water supply and agricultural irrigation in the northern parts of the watershed may contribute to loss of water.

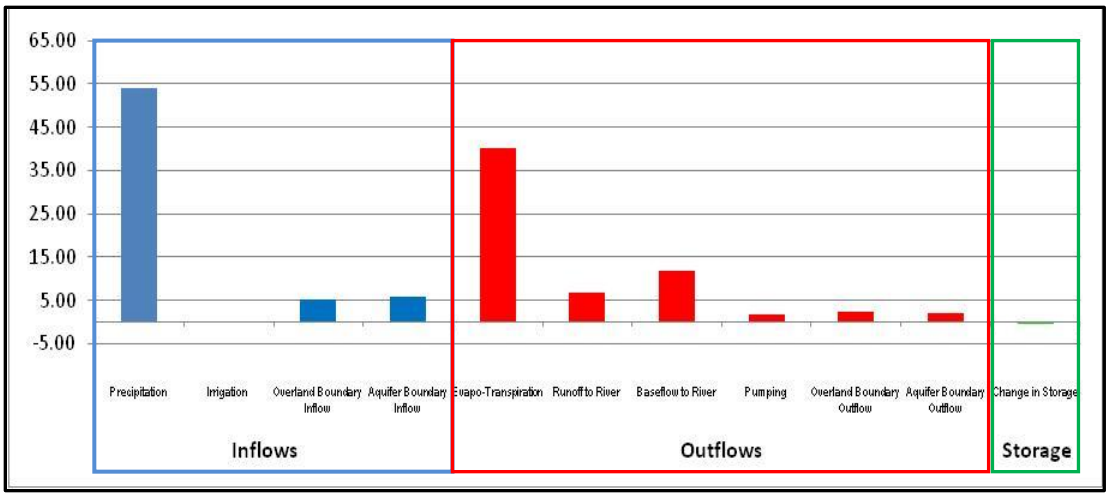


Figure 2-17. Average Water Year Budget – Faka Union, Fakahatchee, and Okaloacoochee-SR29 Watersheds

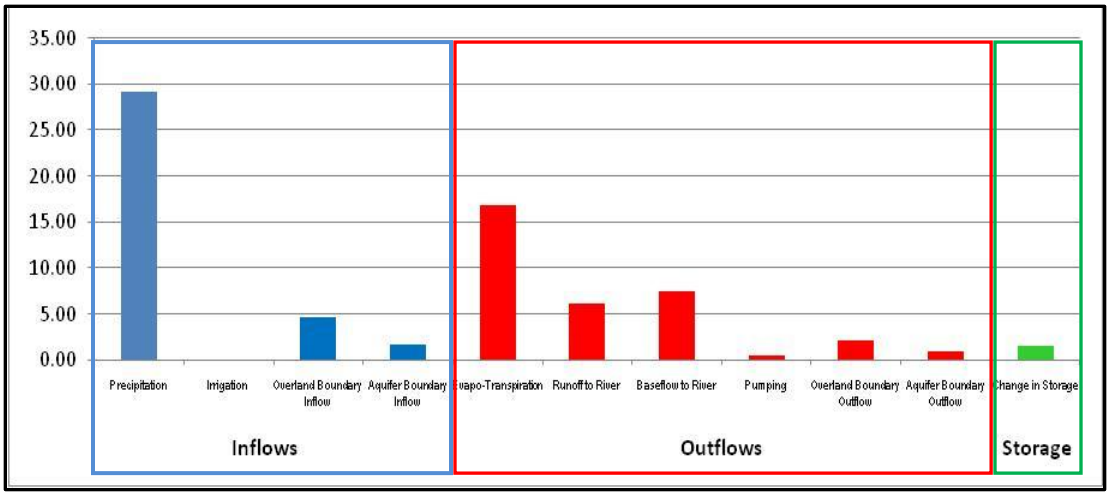


Figure 2-18. Average Wet Season Water Budget – Faka Union, Fakahatchee, and Okaloacoochee-SR29 Watersheds

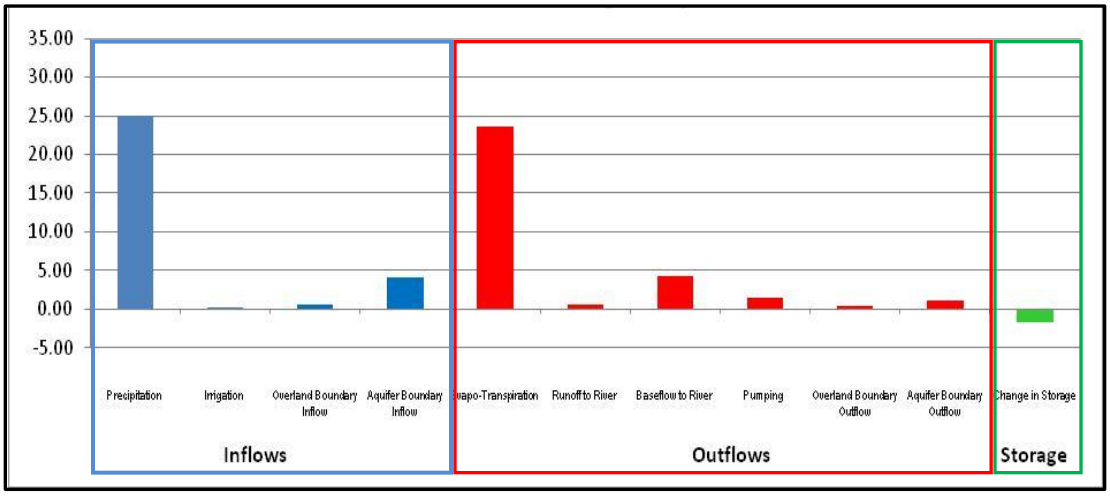


Figure 2-19. Average Dry Season Water Budget – Faka Union, Fakahatchee, and Okaloacoochee-SR29 Watersheds

2.1.5 Baseflow and Structure Operations

The water budget discussion indicated the relative importance of baseflow in the individual watersheds. **Figures 2-20 and 2-21** show the average baseflow contribution to the individual drainage features. The maps indicate that the wetland area in the Okaloacoochee Slough, Camp Keais Strand, and the Corkscrew Swamp provides groundwater recharge (negative baseflow) on a year round basis. The maps also indicate that significant baseflow contributions to the canal network occur especially in the Golden Gate and Faka Union watersheds. It is expected that completion of the Picayune Strand Restoration Project will greatly reduce the baseflow contributions in the Faka Union watershed; therefore, the remainder of this discussion will focus on baseflow and structure operations in the Golden Gate-Naples Bay Watershed.

A comparison of baseflow during the wet and dry seasons in the Golden Gate-Naples Bay Watershed indicates that substantially more baseflow occurs during the wet season than during the dry. The water budget analysis showed that 8.51 inches of baseflow occurs in the Golden Gate-Naples Bay Watershed during the wet season compared to 4.27 inches during the dry season.

Figure 2-22 and **Figure 2-23** show the average wet season and dry season baseflow contributions in the Golden Gate-Naples Bay Watershed. It is interesting to note that during the dry season, recharge (negative baseflow) is predicted to occur in several locations immediately upstream of operable gates, or near shallow potable water supply well fields. The greatest volume of dry season recharge occurs immediately north of the CR951-1 structure which includes a pump to divert water from the Golden Gate Main Canal into the CR951 Canal. The results shown in **Figure 2-23** suggest that water pumped into the CR951 Canal is returning to the Golden Gate Main Canal via baseflow. Groundwater recharge influenced by pumping for potable water supply is also observed in the dry season near the GG-4 structure.

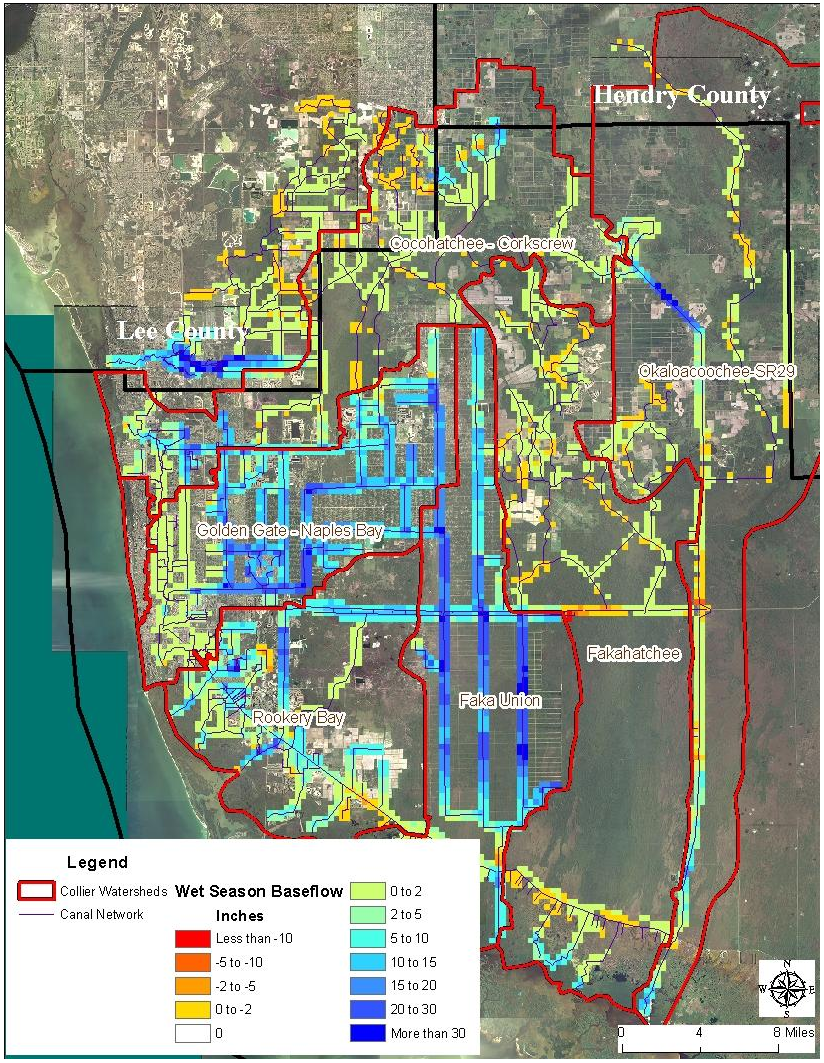


Figure 2-20. Average Wet Season Baseflow Contributions

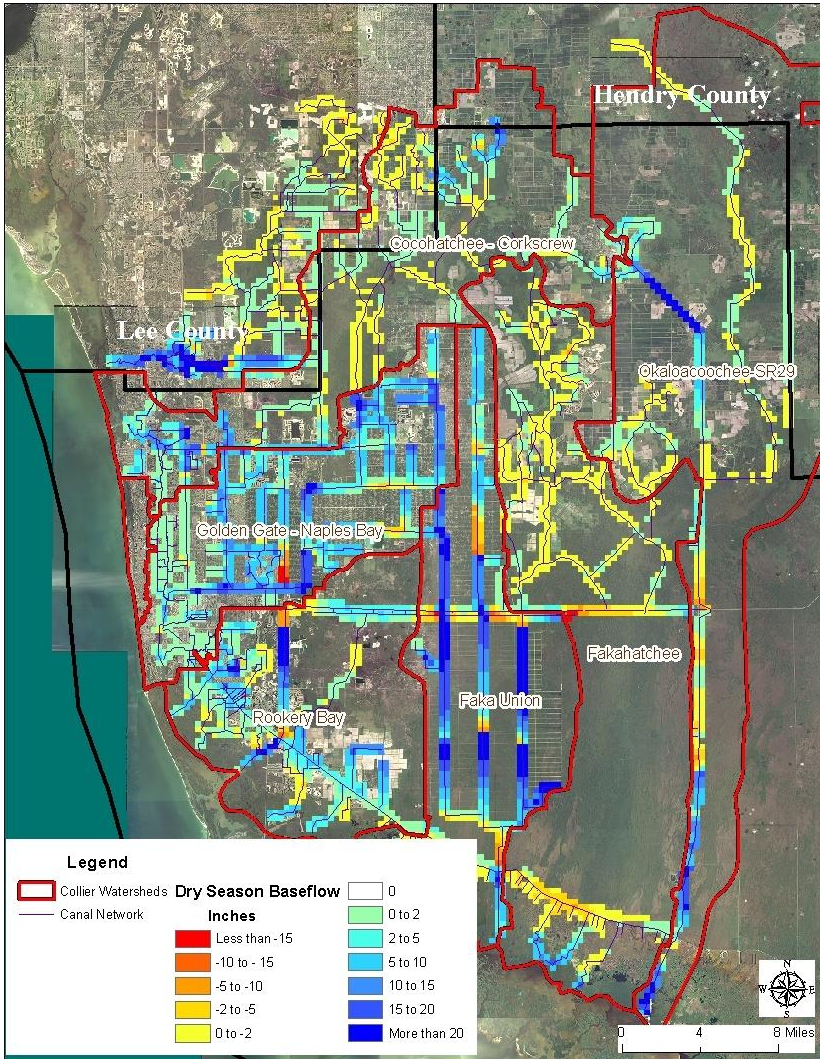


Figure 2-21. Average Dry Season Baseflow Contributions

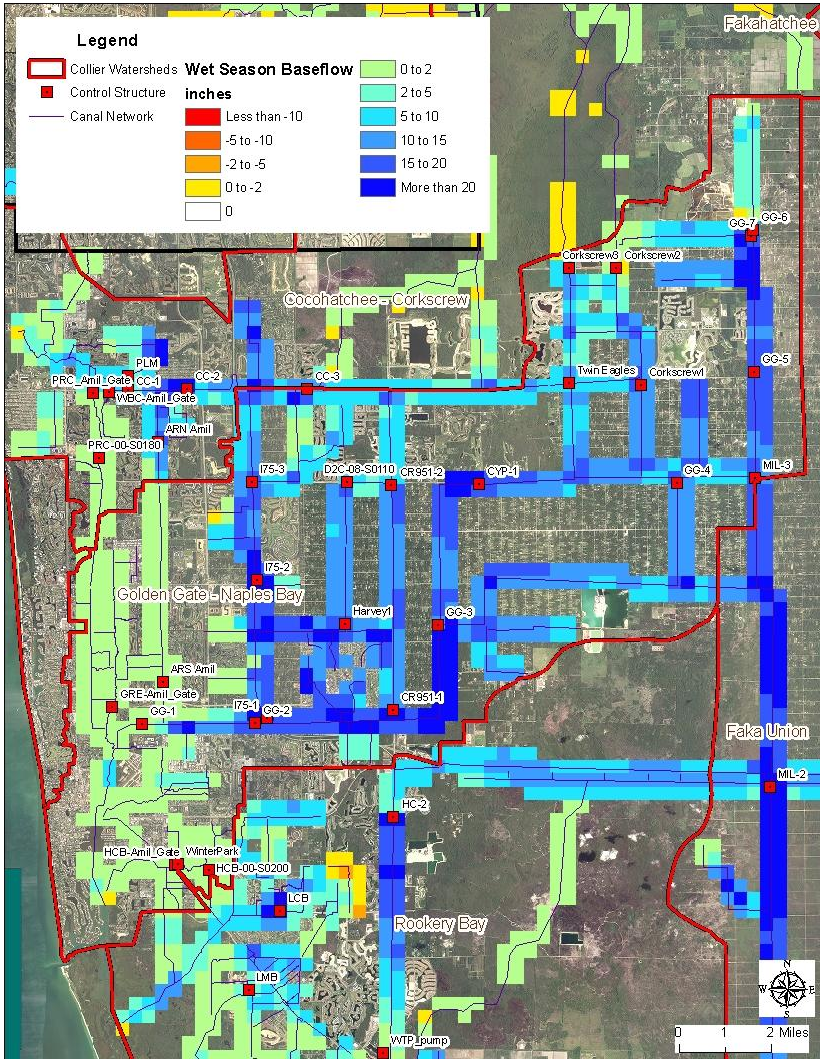


Figure 2-22. Average Wet Season Baseflow Contributions Golden Gate Watershed

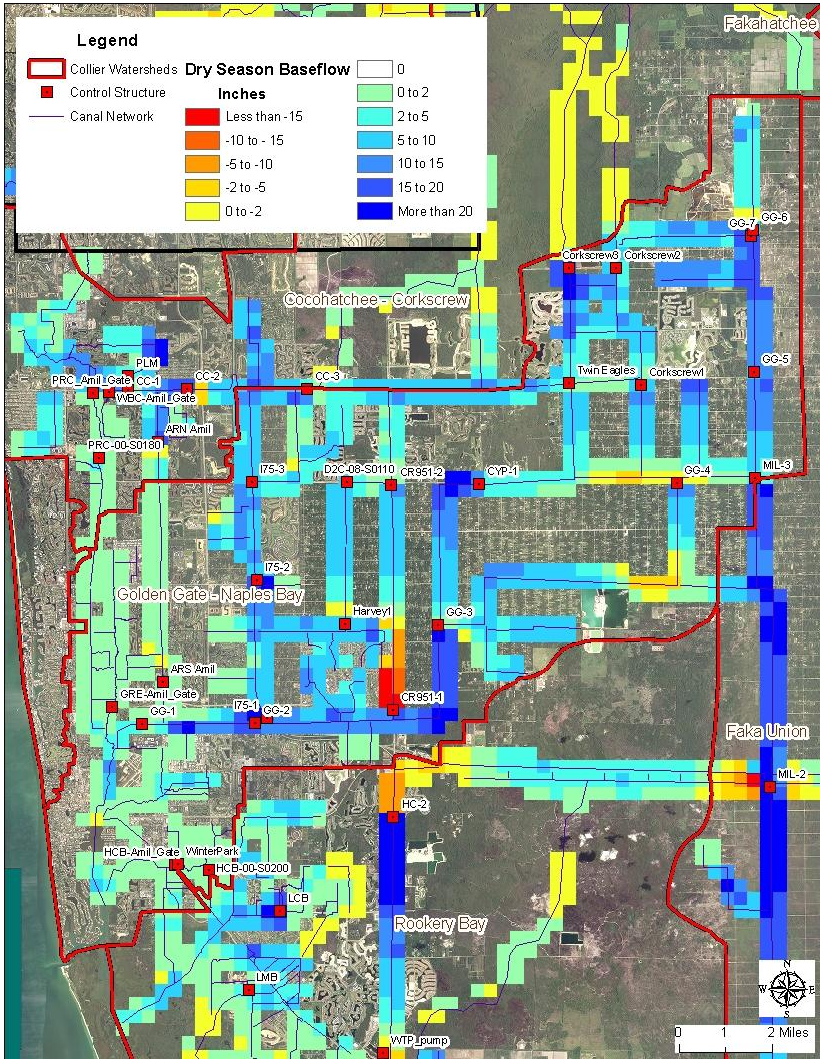


Figure 2-23. Average Dry Season Baseflow Contributions Golden Gate Watershed

The maps also show that the highest predicted baseflow values occur immediately downstream of the operable structures and that baseflow decreases along the canal toward the next downstream structure. This is most evident along the Cypress Canal segment between structures CYP-1 and GG-3. This pattern of baseflow along the length of a canal segment is the result of staging water at different elevations upstream of each structure.

It should be noted that the ECM was setup to replicate the standard operating rules defined by the SFWMD for each structure. These rules primarily rely upon the water levels upstream and downstream of the individual structures and are designed to stage water at different elevations for the wet and dry seasons and may contribute to the seasonal difference in baseflow. During the wet season, the structures are operated to stage the canals at an elevation that is approximately one foot (1 ft) lower than the dry season. The lower elevation, paired with higher groundwater elevations due to rainfall, leads to an increase in baseflow.

Figure 2-24 shows the typical relationship between baseflow and the difference in groundwater and canal water surface elevation in the Cypress Canal. The data clearly indicate that managing canal stage to match groundwater elevations is important to reducing the volume of baseflow entering the canal network. It is our understanding that the existing structures are physically limited in their ability to stage water at a higher elevation within the canal network. It is recommended that the design of new and replacement structures consider seasonal groundwater head elevation data. The ability to more closely match canal stage and the groundwater head elevation will have long-term benefits to reduce baseflow to the canal network.

2.1.6 Analysis of Canal Conveyance Capacity

Model simulation results using the SFWMD design storm events were conducted to assess the conveyance capacity of the existing canals. To evaluate canal capacity, the maximum predicted water surface elevation at each cross-section in the canal was compared to the top of bank elevation at those locations. The water level is defined as “Out of Bank” if the predicted elevation is higher than that at one or both of the canal banks.

An important simulation parameter is the establishment of the model’s initial conditions. For this analysis it was assumed that the water elevations in the canals prior to the beginning of the storm were those that occurred in September 4, 2004, after Hurricane Charley and prior to Hurricane Francis. That assumption is consistent with numerous recent H&H studies in Florida because it is representative of a historical period when large back-to-back precipitation events occurred.

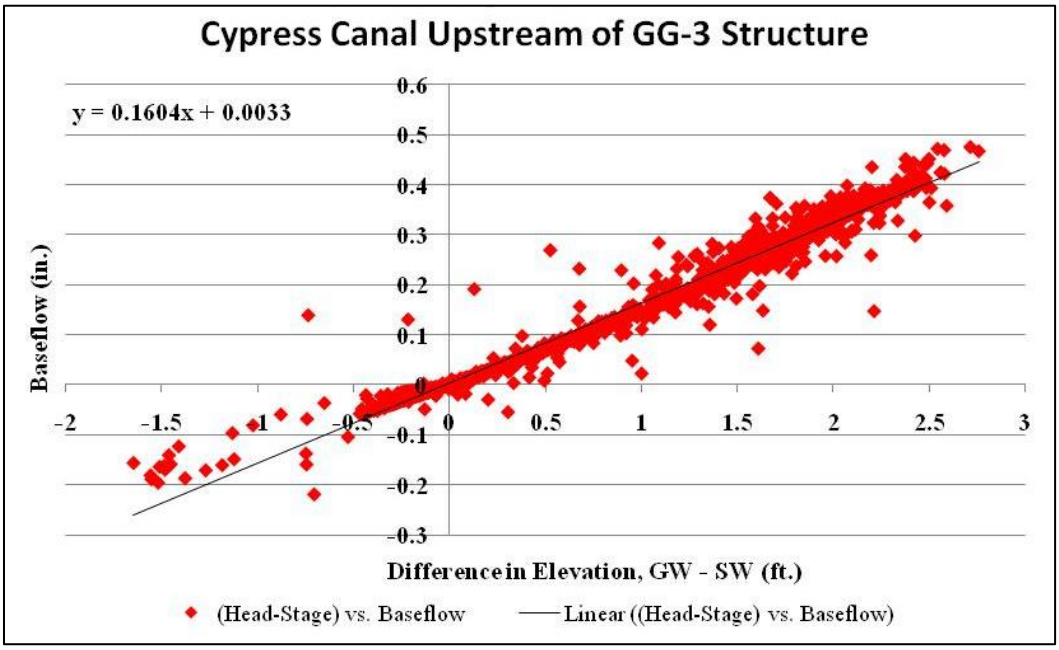


Figure 2-24. Relationship of Baseflow and (Head–Stage) Elevation Difference

The SFWMD has established emergency canal management protocols that require that the structures be opened and the water levels in the canal network be lowered prior to large storm events to provide additional canal conveyance to mitigate the risk of flooding. Therefore, for the design storm simulations, structure operations were modified to open all operable gates 72 hours prior to the storm event.

The next step was to determine the flow rate in the existing canal network just prior to the out of bank conditions. However, since flow conditions may change within a given canal due to inflows from other canals and structure operations, each canal was divided into smaller segments. The segments are defined by structure locations and junctions with other canals. For each segment, model results were reviewed to determine if out of bank conditions exist for each of the design storms. At the time step when out of bank conditions in the canal network occurred, the predicted flow was extracted from the model results.

Figure 2-25 shows the locations where overtopping is predicted to occur during the 5-year, 72-hour hour storm event. The results for the 10-, 25-, and 100-year storm events are very similar indicating that canal overtopping would occur at the low lying areas. Most of the overtopping occurs in wetland areas where inundation is expected to occur. However, the results also indicate areas along the Cocohatchee Canal and within the Golden Gate–Naples Bay and Rookery Bay watersheds that may be subject to flooding conditions due to limited canal conveyance capacity.

Table 2-6 specifies the predicted flow in each of the existing canal segments and identifies the smallest storm when out of bank conditions are predicted to occur. The results indicate that the canal networks

that provide drainage to many areas of Collier County are at risk of flooding during the 5-yr/72-hour return period storm event. The overall results show that future development would worsen an already difficult condition unless management strategies are established to mitigate flooding risks.

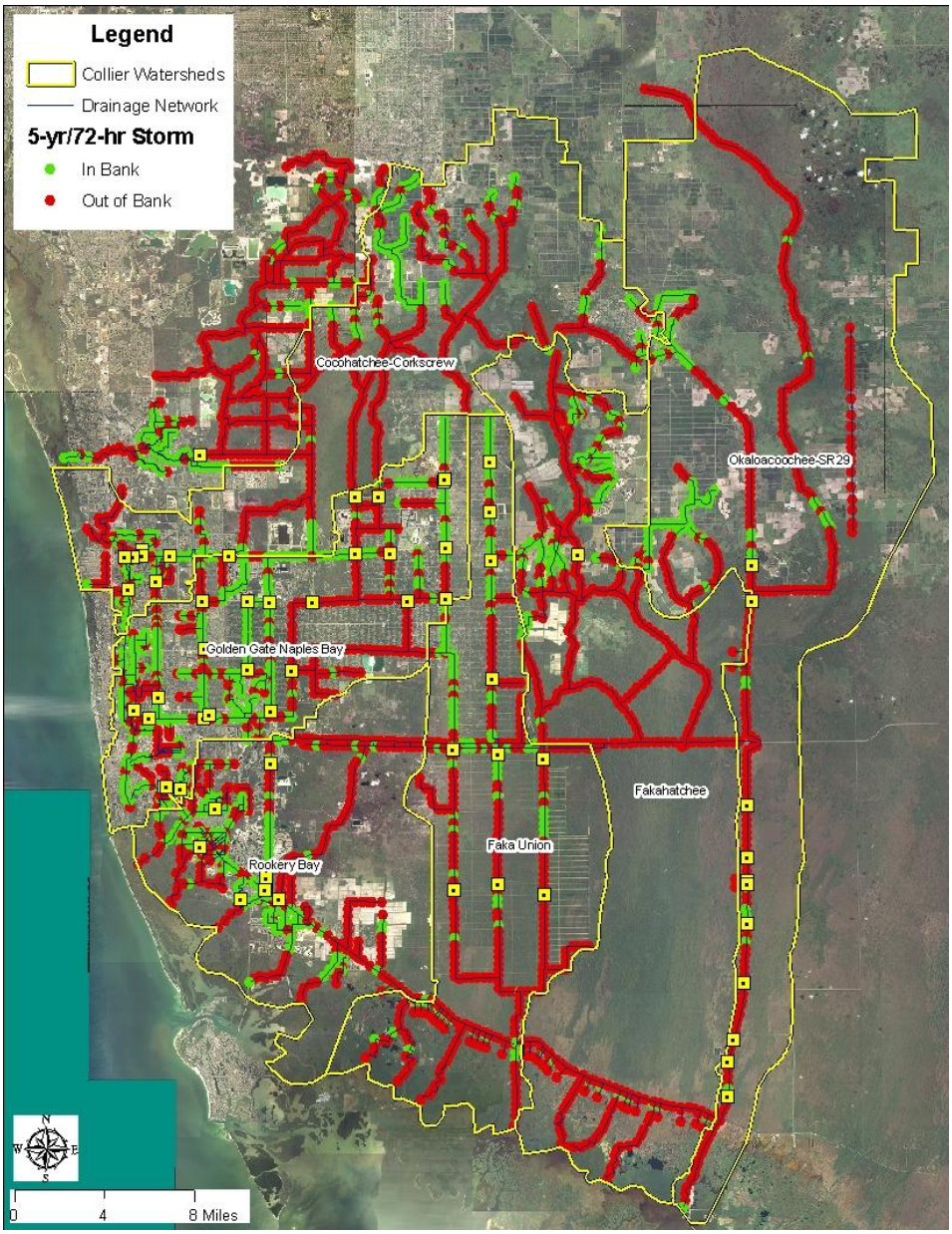


Figure 2-25. Bank Overtopping Locations for the 5-yr, 72-hr Storm Event

Table 2-6. Predicted Flow Just Prior to Canal Segment Failure

Storm Sub-Basin	Segment Name	Upstream End of Segment	Downstream End of Segment	Return Period Storm Causing Failure				Predicted 5-year Flow at Failure
				5-yr/ 72-hr	10-yr/ 72-hr	25-yr/ 72-hr	100-yr/ 72-hr	cfs
951 Canal Central	CR951	Control Structure CR951-2	Control Structure CR951-1	✓				496.34
951 Canal North	CR951	Junction with Cocohatchee Canal	Control Structure CR951-2	✓				123.42
Airport Road North Canal	Airport Road Canal-01	Junction with Airport Road Canal-02	Junction with AirportRdN	✓				21.75
Airport Road North Canal	AirportRdN	Control Structure ARN Amil	Junction with AirportRdS	✓				308.19
Airport Road North Canal	AirportRdN	Junction with Cocohatchee West	Control Structure ARN Amil	✓				323.77
Airport Road South Canal	AirportRdS	Junction with AirportRdN	Weir-Cross_Air1	✓				485.60
Airport Road South Canal	AirportRdS	Weir-Cross_Air1	Junction with AirportRdS	✓				695.89
Airport Road South Canal	AirportRdS	Junction with AirportRdS	Control Structure ARS_Amil	✓				681.51
Airport Road South Canal	AirportRdS	Control Structure ARS Amil	Junction with Golden Gate Main Canal	✓				1007.79
C-4	C-4_Canal-00	Weir C4C-00-S0170	Control Structure C4C-00-S0110_Eagle Creek Road	✓				326.70
Cocohatchee River Canal	Cocohatchee Canal-06	Upstream end of Branch	Junction with CocohatcheeWest	✓				355.22
Cocohatchee River Canal	CocohatcheeWest	Junction with Cocohatchee East	Junction with CocohatcheeWestN	✓				195.27
Cocohatchee River Canal	CocohatcheeWest	Junction with CR951	Control Structure CC-3	✓				268.11

Storm Sub-Basin	Segment Name	Upstream End of Segment	Downstream End of Segment	Return Period Storm Causing Failure				Predicted 5-year Flow at Failure
				5-yr/ 72-hr	10-yr/ 72-hr	25-yr/ 72-hr	100-yr/ 72-hr	cfs
Cocohatchee River Canal	CocohatcheeWest	Control Structure CC-3	Junction with I-75Can	✓				489.80
Cocohatchee River Canal	CocohatcheeWest	Junction with I-75 Canal	Control Structure CC-2	✓				1163.92
Cocohatchee River Canal	CocohatcheeWest	Control Structure CC-2	Junction with AirportRdN	✓				1298.25
Cocohatchee River Canal	CocohatcheeWest	Junction with AirportRdN	Control Structure CC-1	✓				1680.12
Cocohatchee River Canal	CocohatcheeWest	Control Structure CC-1	Junction with Palm River Canal	✓				1631.39
Corkscrew Canal	CocohatcheeEast	Junction with Corkscrew1	Control Structure Twin Eagles	✓				113.07
Corkscrew Canal	Cork2	Junction with CorkTribCan	Junction with Corkscrew Canal-01					
Corkscrew Canal	Corkscrew Canal-00	Upstream end of Branch	Junction with Corkscrew					
Corkscrew Canal	Corkscrew Canal-01	Junction with Cork2	Junction with Cocohatchee East	✓				203.43
Corkscrew Canal	CorkScrew Canal	Junction with Corkscrew	Control Structure Corkscrew2					
Corkscrew Canal	CorkScrew Canal	Control Structure Corkscrew2	Junction with Corkscrew Canal					
Corkscrew Canal	CorkScrew Canal	Junction with CorkTribCan	Junction with Cork2	✓				86.49
Corkscrew Canal	CorkScrew Canal	Junction with Cork2	Junction with Corkscrew Canal-02	✓				221.68
Corkscrew Canal	CorkScrew Canal	Junction with Corkscrew Canal-02	Control Structure Corkscrew1	✓				516.23
Corkscrew Canal	CorkScrew Canal	Control Structure Corkscrew1	Junction with Cypress Canal	✓				698.29

Storm Sub-Basin	Segment Name	Upstream End of Segment	Downstream End of Segment	Return Period Storm Causing Failure				Predicted 5-year Flow at Failure
				5-yr/ 72-hr	10-yr/ 72-hr	25-yr/ 72-hr	100-yr/ 72-hr	cfs
Corkscrew Canal	CorkTribCan	Control Structure Corkscrew3	Junction with CorkTribCanal	✓				
Corkscrew Canal	CorkTribCan	Junction with CorkscrewTribCan	Junction with Corkscrew Canal					
Cypress Canal	Curry Canal	Junction with CocohatcheeEast	Junction with Cypress Canal	✓				90.95
Cypress Canal	Cypress Canal	Junction with Golden Gate Main Canal	Junction with Corkscrew Canal	✓				623.32
Cypress Canal	Cypress Canal	Junction with Corkscrew Canal	Junction with Curry Canal	✓				47.22
Cypress Canal	Cypress Canal	Junction with Curry Canal	Control Structure CYP-1	✓				308.78
Cypress Canal	Cypress Canal	Control Structure CYP-1	Junction with Golden Gate Main Canal	✓				615.76
West Branch Cocohatchee	West Branch Cocohatchee River	Upstream end of Branch	Control Structure WBC-00-S0110	✓				50.03
Faka Union Canal	Faka Union Canal	Upstream end of Branch	Control Structure FU-7	✓				393.38
Faka Union Canal	Faka Union Canal	Control Structure FU-7	Control Structure FU-6	✓				806.48
Faka Union Canal	Faka Union Canal	Control Structure FU-6	Control Structure FU-5	✓				1208.51
Faka Union Canal	Faka Union Canal	Control Structure FU-5	Junction with Faka-Union Canal-04	✓				1159.90
Faka Union Canal	Faka Union Canal	Junction with Faka-Union_Canal-04	Control Structure FU-4	✓				1589.53
Faka Union Canal	Faka Union Canal	Control Structure FU-4	Control Structure FU-3	✓				1877.55
Gateway Triangle	GTB	Upstream end of Branch	Discharge to Naples Bay	✓				79.30

Storm Sub-Basin	Segment Name	Upstream End of Segment	Downstream End of Segment	Return Period Storm Causing Failure				Predicted 5-year Flow at Failure
				5-yr/ 72-hr	10-yr/ 72-hr	25-yr/ 72-hr	100-yr/ 72-hr	cfs
Gordon River Extension	Gordon River Extension_0	Upstream end of Branch	Junction with Gordon River Extention_0	✓				601.87
Gordon River Extension	Gordon River Extension_0	Junction with Gordon River Extention_0	Junction with Gordon River Extention_9	✓				183.27
Gordon River Extension	Gordon River Extension_9	Junction with Gordon River Extention_9	Control Structure GRE-00-S0100	✓				53.76
Gordon River Extension	Gordon River Extension_0	Control Structure GRE-00-S0100	Junction with Gordon River Extention_1	✓				748.28
Gordon River Extension	Gordon River Extension_0	Junction with Gordon River Extention_1	Junction with Golden Gate Main Canal	✓				123.65
Gordon River Extension	Gordon River Extension_1	Weir GRE-01-S0510	Weir GRE-01-S0480	✓				163.45
Gordon River Extension	Gordon River Extension_1	Weir GRE-01-S0480	Junction with Gordon River Extension__1	✓				63.00
Gordon River Extension	Gordon River Extension_1	Junction with Gordon River Extension_1	Junction with Gordon River Extension_3	✓				14.23
Gordon River Extension	Gordon River Extension_1	Junction with Gordon River Extension_3	Junction with Gordon River Extention_0	✓				0.68
Gordon River Extension	Gordon River Extension_0	Upstream end of Branch	Junction with Gordon River Extension_41	✓				25.80
Gordon River Extension	PRC Connection	Junction with Gordon River Extension_1	Junction with Pine Ridge Canal_00	✓				3.94
Green Canal	Green Canal	Upstream end of Branch	Junction with Sunshine Canal	✓				41.08
Green Canal	Green Canal	Junction with Sunshine Canal	Junction with Harvey Canal	✓				459.06
Green Canal	Harvey Canal	Weir Harvey1	Junction with Neptune Canal	✓				523.15

Storm Sub-Basin	Segment Name	Upstream End of Segment	Downstream End of Segment	Return Period Storm Causing Failure				Predicted 5-year Flow at Failure
				5-yr/ 72-hr	10-yr/ 72-hr	25-yr/ 72-hr	100-yr/ 72-hr	cfs
Green Canal	Harvey Canal	Junction with Neptune Canal	Junction with I-75 Canal	✓				175.59
Green Canal	Hunter Canal	Upstream end of Branch	Junction with Harvey Canal	✓				5.53
Green Canal	Sunshine Canal	Upstream end of Branch	Junction with Green Canal	✓				64.72
Haldeman Creek	Haldeman Creek-00	Junction with Lely Canal Branch-10	Control Structure HCB-00-S0200	✓				394.65
Haldeman Creek	Haldeman Creek-00	Control Structure HCB-00-S0200	Control Structure HCB-00-S0130	✓				466.59
Haldeman Creek	Haldeman Creek_01	Weir HCB-01-S0100	Junction with Lely Canal Branch-00_1	✓				9.83
Haldeman Creek	Haldeman Creek_01	Junction with Haldeman Creek-00	Weir ID HCB-01-S0100	✓				91.54
Haldeman Creek	Haldeman Creek_00	Control Structure HCB-00-S0130	Discharges to Naples Bay	✓				400.62
Haldeman Creek	Haldeman Creek_09	Upstream end of Branch	Junction with Haldeman Creek-00	✓				9.04
Harvey Canal	Harvey Canal-00	Control Structure D2C-08-S0110	Junction with Harvey Canal	✓				277.69
Harvey Canal	Harvey Canal	Junction with Harvey Canal	Control Structure Harvey1	✓				621.90
Henderson Creek	Henderson Creek Canal	Junction with I75-Block1	Control Structure HC-2	✓				240.68
Henderson Creek	Henderson Creek Canal	Control Structure HC-2	Control Structure HC-1	✓				491.32
I-75 Canal	I-75 Canal_06	Junction with CocohatcheeWest	Weir D2C-07-S0100	✓				74.47
I-75 Canal	I-75 Canal_06	Weir D2C-07-S0100	Junction with I-75Can	✓				157.00

Storm Sub-Basin	Segment Name	Upstream End of Segment	Downstream End of Segment	Return Period Storm Causing Failure				Predicted 5-year Flow at Failure
				5-yr/ 72-hr	10-yr/ 72-hr	25-yr/ 72-hr	100-yr/ 72-hr	cfs
I-75 Canal	I-75 Canal_04	Upstream end of Branch	Junction with I-75Can	✓				69.99
951 Canal North	I-75 Canal_08	Junction with CR951	Structure ID D2C-08-S0110	✓				145.35
I-75 Canal	I-75 Canal_09	Upstream end of Branch	Weir Discharge_to_I75Can					
I-75 Canal	I-75 Canal	Junction with CocohatcheeWest	Control Structure I75-3	✓				203.28
I-75 Canal	I-75 Canal	Control Structure I75-3	Junction with I-75 Canal_04	✓				481.11
I-75 Canal	I-75 Canal	Junction with I-75 Canal_04	Control Structure I75-2	✓				687.44
I-75 Canal	I-75 Canal	Control Structure I75-2	Junction with I-75 Canal_05	✓				991.97
I-75 Canal	I-75 Canal	Junction with I-75 Canal_05	Junction with I-75 Canal_03	✓				1472.26
I-75 Canal	I-75 Canal	Junction with I-75 Canal_03	Control Structure I75-1	✓				1056.90
Imperial Drainage Outlet	Imperial Drainage Outlet	Weir-like Feature in Canal	Junction with Cocohatchee West	✓				180.18
Island Walk (aka Harvey)	I-75 Canal_07	Upstream end of Branch	Inlet to Island Walk Pond System	✓				178.14
Island Walk (aka Harvey)	I-75 Canal_07	Inlet to Island Walk Pond System	Junction with I-75 Canal_06	✓				138.63
Lely Canal	Lely Canal Branch-00_1	Upstream end of Branch	Control Structure LCB-00-S0150	✓				150.25
Lely Canal	Lely Canal Branch-00_1	Control Structure LCB-00-S0150	Junction with Lely Canal Branch-01_1	✓				607.95
Lely Canal	Lely Canal Branch-00_1	Junction with Lely_Canal_Branch-01_1	Weir LCB-00-S0100	✓				1184.98

Storm Sub-Basin	Segment Name	Upstream End of Segment	Downstream End of Segment	Return Period Storm Causing Failure				Predicted 5-year Flow at Failure
				5-yr/ 72-hr	10-yr/ 72-hr	25-yr/ 72-hr	100-yr/ 72-hr	cfs
Lely Canal	Lely Canal Branch-01_1	Junction with Haldeman_Creek-00	Junction with Lely Canal Branch-00_1	✓				488.95
Lely Canal	Lely Canal Branch-01_2	Upstream end of Branch	Junction with Lely Canal Branch-09	✓				204.41
Lely Canal	Lely Canal Branch-01_2	Junction with Lely_Canal_Branch-09	Junction with Lely Canal Branch-10	✓				235.58
Lely Canal	Lely Canal Branch-02_1	Junction with Haldeman_Creek-00	Junction with Lely Canal Branch-00_1	✓				31.84
Lely Canal	Lely Canal Branch-09	Junction with Lely_Canal_Branch-01-2	Junction with Lely Canal Branch-10	✓				7.37
Lely Canal	Lely Canal Branch-10	Junction with Lely_Canal_Branch-09	Junction with Lely Canal Branch-01_1	✓				243.90
Lely Canal	Lely Canal Branch-11	Upstream end of Branch	Junction with Lely Canal Branch-00_1	✓				31.48
Lely Canal	Lely Canal Branch-15	Upstream end of Branch	Weir LCB-15-S0100	✓				165.21
Lely Manor Canal	C-4 Canal-01	Upstream end of Branch	Junction with C-4 Canal-02	✓				
Lely Manor Canal	C-4 Canal-02	Upstream end of Branch	Junction with C-4 Canal-03	✓				44.10
Lely Manor Canal	C-4 Canal-02	Junction with C-4_Canal-03	Junction with Lely Manor Canal-00	✓				3.65
Lely Manor Canal	Lely Manor Canal-00	Weir LMB-00-S0150	Junction with Lely Manor Canal-01-1	✓				147.09
Lely Manor Canal	Lely Manor Canal-00	Weir LMB-00-S0150	Junction with Lely Manor Canal-08	✓				13.68
Lely Manor Canal	Lely Manor Canal-01_2	Upstream end of Branch	Junction with Lely Manor Canal-03_1	✓				83.56

Storm Sub-Basin	Segment Name	Upstream End of Segment	Downstream End of Segment	Return Period Storm Causing Failure				Predicted 5-year Flow at Failure
				5-yr/ 72-hr	10-yr/ 72-hr	25-yr/ 72-hr	100-yr/ 72-hr	cfs
Lely Manor Canal	Lely Manor Canal-01_2	Junction with Lely Manor Canal-03_1	Junction with Lely Manor Canal-01-2	✓				288.83
Lely Manor Canal	Lely Manor Canal-03_1	Junction with Lely Manor Canal-08	Junction with Lely Manor Canal-01-2	✓				100.59
Lely Manor Canal	Lely Manor Canal-07_1A	Junction with Lely Manor Canal-08	Junction with Lely Manor Canal-11	✓				120.60
Lely Manor Canal	Lely Manor Canal-11	Upstream end of Branch	Junction with Lely Manor Canal-07_1A	✓				47.99
Lely Manor Canal	Lely Manor_Canal-11	Junction with Lely Manor Canal-07_1A	Junction with Lely Manor Canal-12_1	✓				24.95
Lely Manor Canal	Lely Manor Canal-12_1	Control Structure LMB-07-S0100	Discharges to Rookery Bay	✓				274.66
Lely Manor Canal	MCB-16	Upstream end of Branch	Junction with Lely Manor Canal-01-2	✓				4.02
Main Golden Gate Canal	C1 Connector Canal	Junction with Golden Gate Main Canal	Junction with Miller Canal	✓				48.67
Main Golden Gate Canal	Coronado Canal	Upstream end of Branch	Junction with Santa Barbara Canal	✓				19.55
Main Golden Gate Canal	Golden Gate Canal_09	Upstream end of Branch	Junction with Golden Gate Main Canal	✓				94.52
Main Golden Gate Canal	Golden Gate Canal _10	Upstream end of Branch	Junction with Golden Gate Canal_09	✓				145.65
Main Golden Gate Canal	Golden Gate Canal _12	Upstream end of Branch	Junction with Golden Gate Main Canal	✓				335.14
Main Golden Gate Canal	Golden Gate Canal _14	Upstream end of Branch	Weir MGG-14-S0100	✓				130.09
Main Golden Gate Canal	Golden Gate Canal _15	Upstream end of Branch	Junction with Golden Gate Main Canal	✓				62.82

Storm Sub-Basin	Segment Name	Upstream End of Segment	Downstream End of Segment	Return Period Storm Causing Failure				Predicted 5-year Flow at Failure
				5-yr/ 72-hr	10-yr/ 72-hr	25-yr/ 72-hr	100-yr/ 72-hr	cfs
Main Golden Gate Canal	Golden Gate Canal _16	Upstream end of Branch	Weir MGG-16-S0140	✓				112.68
Main Golden Gate Canal	Golden Gate Canal _16	Weir MGG-16-S0140	Junction with Golden Gate Main Canal	✓				61.82
Main Golden Gate Canal	Golden Gate Canal _18	Upstream end of Branch	Discharge to Naples Bay	✓				18.26
Main Golden Gate Canal	Golden Gate Branch	Upstream end of Branch	Control Structure GG-7	✓				414.44
Main Golden Gate Canal	Golden Gate Main Canal	Upstream end of Branch	Control Structure GG-6	✓				457.37
Main Golden Gate Canal	Golden Gate Main Canal	Control Structure GG-6	Junction with Golden Gate Canal_12	✓				1291.05
Main Golden Gate Canal	Golden Gate Main Canal	Junction with Golden Gate Canal_12	Control Structure GG-5	✓				1533.53
Main Golden Gate Canal	Golden Gate Main Canal	Control Structure GG-5	Junction with Miller Canal	✓				1827.24
Main Golden Gate Canal	Golden Gate Main Canal	Junction with Miller Can	Junction with Orange Tree Canal	✓				411.01
Main Golden Gate Canal	Golden Gate Main Canal	Junction with Orange Tree Canal	Control Structure GG-4	✓				788.53
Main Golden Gate Canal	Golden Gate Main Canal	Control Structure GG-4	Junction with C1-Connector	✓				936.60
Main Golden Gate Canal	Golden Gate Main Canal	Junction with C1-Connector	Junction with Golden Gate Canal_09	✓				845.06
Main Golden Gate Canal	Golden Gate Main Canal	Junction with Golden Gate Canal_09	Control Structure GG-3	✓				959.25
Main Golden Gate Canal	Golden Gate Main Canal	Control Structure GG-3	Junction with CR951	✓				504.22

Storm Sub-Basin	Segment Name	Upstream End of Segment	Downstream End of Segment	Return Period Storm Causing Failure				Predicted 5-year Flow at Failure
				5-yr/ 72-hr	10-yr/ 72-hr	25-yr/ 72-hr	100-yr/ 72-hr	cfs
Main Golden Gate Canal	Golden Gate Main Canal	Junction with CR951	Junction with Tropicana Canal	✓				670.27
Main Golden Gate Canal	Golden Gate Main Canal	Junction with Santa Barbara Canal	Junction with I-75Can	✓				1328.89
Main Golden Gate Canal	Golden Gate Main Canal	Junction with I-75Can	Control Structure GG-2	✓				3186.83
Main Golden Gate Canal	Golden Gate Main Canal	Control Structure GG-2	Junction with AirportRdS	✓				2480.48
Main Golden Gate Canal	Golden Gate Main Canal	Junction with AirportRdS	Control Structure GG-1	✓				4362.73
Main Golden Gate Canal	Golden Gate Main Canal	Control Structure GG-1	Discharges to Naples Bay	✓				3323.70
Main Golden Gate Canal	I-75_Canal_03	Upstream end of Branch	Junction with I-75Canal	✓				79.66
Main Golden Gate Canal	I75N-1	Weir I75N-Block1	Junction with Henderson Creek Canal	✓				41.64
Main Golden Gate Canal	Santa Barbara Canal	Junction with Coronado Canal	Junction with Tropicana Canal	✓				25.63
Main Golden Gate Canal	Tropicana Canal	Upstream end of Branch	Junction with Golden Gate Main Canal	✓				27.10
Miller Canal	Miller Canal	Control Structure MIL-3V notch	Junction with C1-Connector	✓				457.40
Miller Canal	Miller Canal	Junction with C1-Connector	Control Structure MIL-2	✓				823.19
Orange Tree Canal	Orange Tree Canal	Upstream end of Branch	Junction with Golden Gate Main Canal	✓				263.39
Palm River Canal	Palm River Canal	Junction with Imperial Drainage Outlet	Control Structure PLM-00-S0100	✓				197.39

Storm Sub-Basin	Segment Name	Upstream End of Segment	Downstream End of Segment	Return Period Storm Causing Failure				Predicted 5-year Flow at Failure
				5-yr/ 72-hr	10-yr/ 72-hr	25-yr/ 72-hr	100-yr/ 72-hr	cfs
Palm River Canal	Palm River Canal	Control Structure PLM-00-S0100	Junction with CocohatcheeWest	✓				195.35
Pine Ridge Canal	Pine Ridge Canal_00	Junction with PRC Connection	Control Structure PRC-00-S0180	✓				161.93
Pine Ridge Canal	Pine Ridge Canal_00	Control Structure PRC-00-S0180	Control Structure PRC-00-S0110	✓				316.93
Pine Ridge Canal	Pine Ridge Canal_00	Control Structure PRC-00-S0110	Junction with CocohatcheeWest	✓				13.69
Rock Creek	Rock Creek-00	Upstream end of Branch	Junction with Rock_Creek-01	✓				233.62
Rock Creek	Rock_Creek-00	Junction with Rock_Creek-01	Discharges to Naples Bay	✓				55.03
Rock Creek	Rock Creek-01	Upstream end of Branch	Junction with Rock_Creek-00	✓				152.73
Winter Park Outlet	Winter Park	Upstream end of Branch	Control Structure WP0-00-S0100	✓				95.47
Wiggins Pass Outlet	Wiggins Bay	Upstream end of Branch	Junction with CocohatcheeWest					
Upper Immokalee	Upper Immokalee Canal	Junction with Barron River Canal	Junction with SR29	✓				482.31
Baron River (North)	SR29	Junction with ImmokaleeS	Control Structure BRN-00-S0110	✓				166.20
Baron River (North)	SR29	Control Structure BRN-00-S0110	Control Structure BRC-00-C0345_Sunniland	✓				216.75

2.1.7 Conclusions

Several conclusions are drawn from the water budget analysis.

- Critical water budget processes are stormwater runoff and groundwater discharges to the canal network through baseflow.
- Annual and seasonal average stormwater runoff volumes are greatly influenced by the amount of precipitation. Relatively small variations in precipitation results in large changes in the volume of runoff.
- Baseflow contributions increase with canal density. Baseflow to the canal network in the Golden Gate and Faka Union watersheds make up approximately 55 percent of canal flow during the average year, and as much as 85 percent of canal flow during the dry season. Reducing baseflow would have a significant effect on the volume and timing of discharge to the estuary systems.
- The seasonal water budget analysis indicates a net balance in watershed storage over the simulation period. Annual losses in storage occur during the dry season and are associated with high baseflow contributions and with pumping from the Water Table and Lower Tamiami Aquifers to meet potable and irrigation water supply needs.
- Collier County and the SFWMD should consider seasonal groundwater elevations to establish updated seasonal controlled water levels in the canal network. Additional flexibility to raise the stage in the canals and reduce baseflow contributions should be considered when designing new or replacement control structures.
- Lowering the water surface in the canal network prior to large storm events is an important management tool to provide storage within the canal network and to mitigate flooding risks in Collier County.
- The existing conveyance capacity of the canal system is limited. Conditions would worsen in the future unless management actions are implemented to control for the impact of new development.

2.2 IN-STREAM SURFACE WATER QUALITY

This Chapter addresses Element 1, Task 1.2: In-Stream Water Quality.

2.2.1 Introduction and Objective

This section describes the water quality conditions of the Cocohatchee-Corkscrew, Golden Gate–Naples Bay, Rookery Bay, and the combined Faka Union, Okaloacoochee–SR29, Fakahatchee, watersheds. This effort focused on characterizing the water quality in Collier County's priority watersheds in the context of the Total Maximum Daily Load (TMDL) impairment conditions as described in the Florida Department of Environmental Protection's (FDEP) verified list of impaired waters.

The analysis conducted as part of this project included: 1) review of relevant reports from local, regional and state agencies related to water quality conditions, 2) review of relevant water quality data for Collier County's watersheds, 3) an assessment of locations where the water quality "impairment" may need to be further verified, 4) determination of the factor(s) likely to be responsible for impairment, 5) determination of factors likely to be responsible for phytoplankton growth, and 6) a conceptual overview of factor(s) that most strongly influence water quality in Collier County's priority watersheds.

The reports reviewed to identify impaired and potential waters of concern within Collier County included the water quality impairment analysis completed as part of the FDEP TMDL program implementation and the analysis of water quality conditions conducted by both the United States Army Corps of Engineers (USACE) as part of the Southwest Florida Feasibility Study (SWFFS) and more recently by Janicki Environmental, Inc. (JEI) at the request of Collier County. Results of analyses conducted as part of those studies are presented below.

2.2.2 The FDEP TMDL Impairment Analysis

For implementation of the statewide TMDL program, the FDEP divided the state into five groups. Each group is comprised of multiple basins and each basin is assigned a water body identification number (WBID). All water bodies within Collier County are in the Everglades West Coast Group 1 Basin. Per TMDL guidelines, every five years (cycle) each WBID is evaluated to determine whether available data indicate that water quality parameters exceed the limits defined by FDEP in the Impaired Waters Rule (IWR). After the compilation of all impaired WBIDs from Cycles 1 and 2, a total of fourteen impairments have been designated by FDEP in the freshwater portions of the study area. The freshwater WBIDs of concern in the study area are listed in **Table 2-7**. It must be noted that the FDEP analysis is based on available data. The County must continue working with the agency to identify the causes of the impairments and the corresponding courses of action.

The water quality impairment parameters include dissolved oxygen, nutrients, fecal coliform bacteria, iron, and un-ionized ammonia (**Figures 2-26 through 2-29**). The majority of impairments (9 of 14) are due to low dissolved oxygen concentrations, which was observed mostly in the Cocohatchee-Corkscrew watershed and also in the Golden Gate-Naples Bay and Okaloacooche-SR29 watersheds. Nutrients and un-ionized ammonia have been considered impairment parameters in WBID 3259W (Lake Trafford) within the Cocohatchee-Corkscrew watershed. Presently, large-scale restoration projects including sediment removal are underway to improve water quality in Lake Trafford. As such, the current water quality conditions may not reflect the impaired water quality status identified by FDEP. Lake Trafford will be re-evaluated during the next FDEP listing cycle. Only WBID 3278G (Fakahatchee Strand) was identified as impaired for fecal coliform concentrations. No water quality impairments were identified by the FDEP TMDL program in the freshwater portion of the Rookery Bay or Faka Union watersheds.

Table 2-7. List of FDEP Impaired Waters from Group 1 Cycles 1 and 2 for the freshwater discharge WBIDs of each watershed

WBID#	WBID Name	Impaired Parameter	Watershed
3259W	Lake Trafford	Dissolved Oxygen	Cocohatchee-Corkscrew
3259W	Lake Trafford	Nutrients	Cocohatchee-Corkscrew
3259W	Lake Trafford	Un-ionized Ammonia	Cocohatchee-Corkscrew
3278D	Cocohatchee Inland	Dissolved Oxygen	Cocohatchee-Corkscrew
3278F	Corkscrew Marsh	Dissolved Oxygen	Cocohatchee-Corkscrew
3278L	Immokalee Basin	Dissolved Oxygen	Cocohatchee-Corkscrew
3278K	Gordon River Extension	Dissolved Oxygen	Golden Gate–Naples Bay
3278S	North Golden Gate	Dissolved Oxygen	Golden Gate–Naples Bay
3278S	North Golden Gate	Iron	Golden Gate–Naples Bay
3278G	Fakahatchee Strand	Dissolved Oxygen	Fakahatchee
3278G	Fakahatchee Strand	Fecal Coliform	Fakahatchee
3261C	Barron River Canal	Iron	Okaloacooche-SR29
3278T	Okaloacoochee	Dissolved Oxygen	Okaloacooche-SR29
3278W	Silver Strand	Dissolved Oxygen	Okaloacooche-SR29

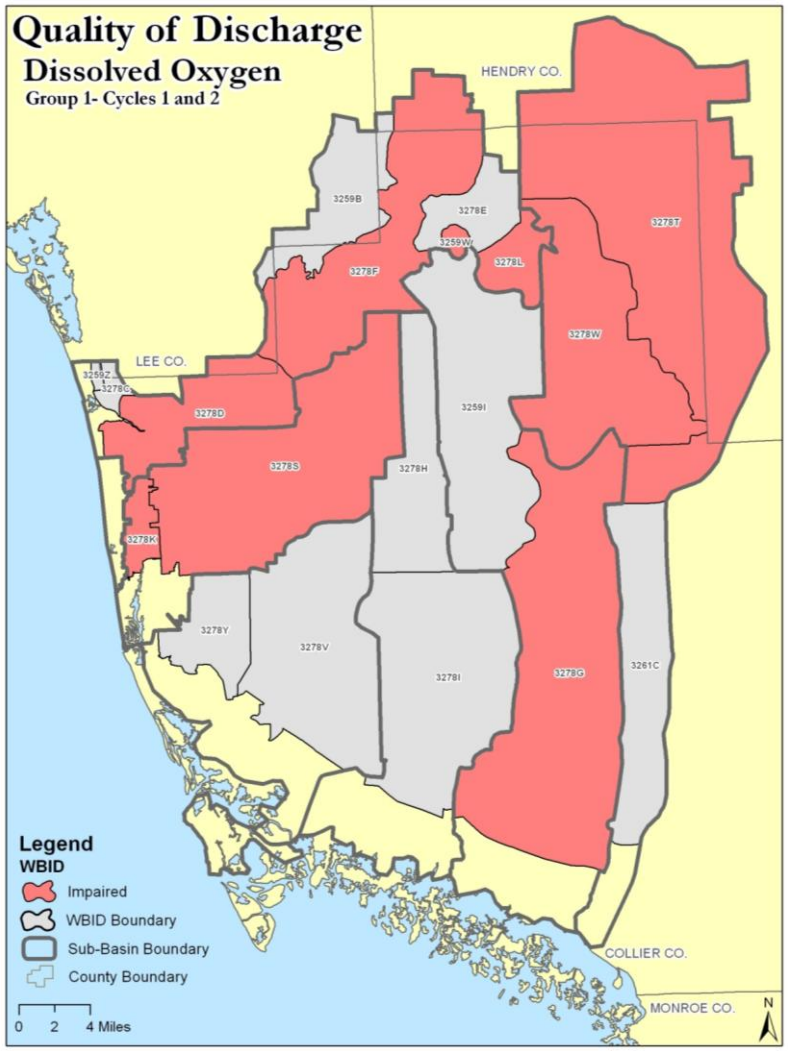


Figure 2-26. WBIDs within priority watersheds that were verified impaired for Dissolved Oxygen by FDEP

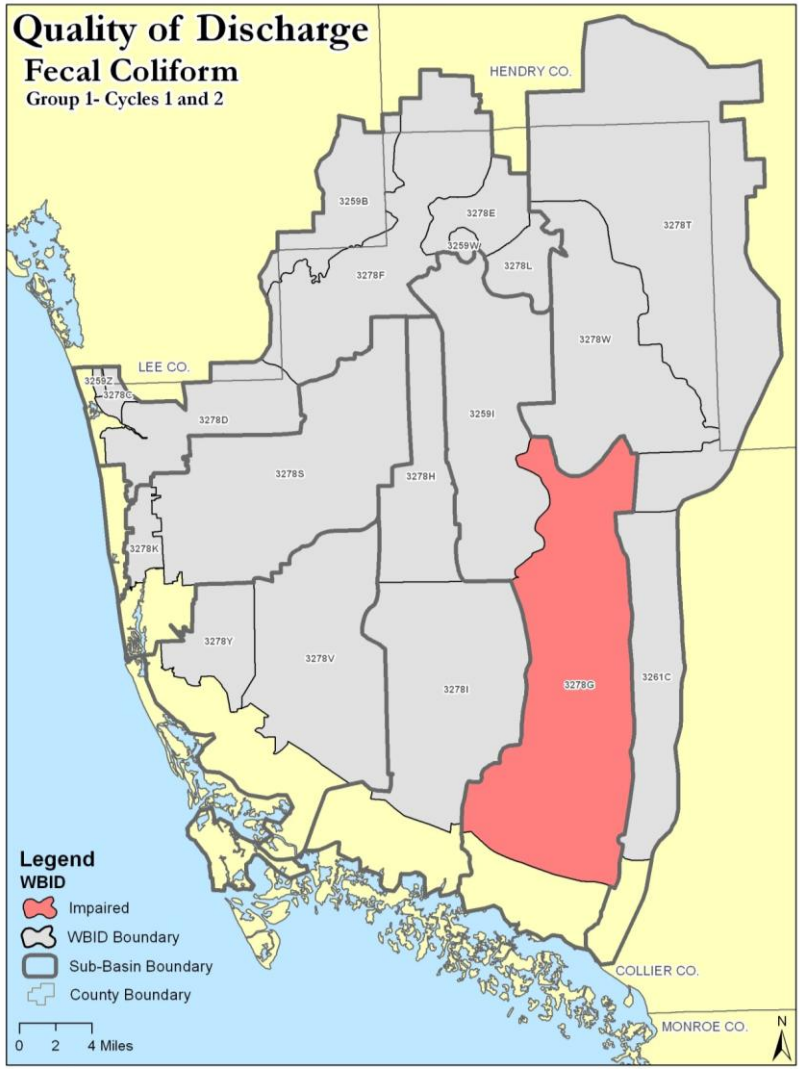


Figure 2-27. WBIDs within priority watersheds that were verified impaired for Fecal Coliform Bacteria by FDEP

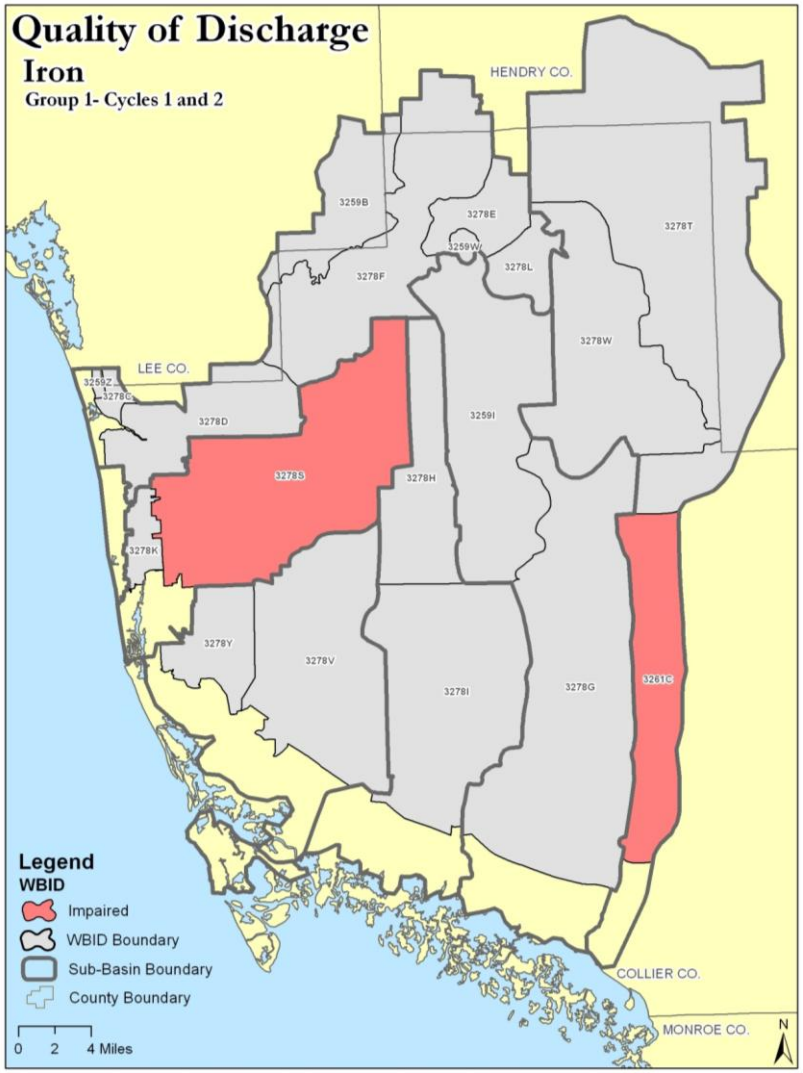


Figure 2-28. WBIDs within priority watersheds that were verified impaired for Iron by FDEP

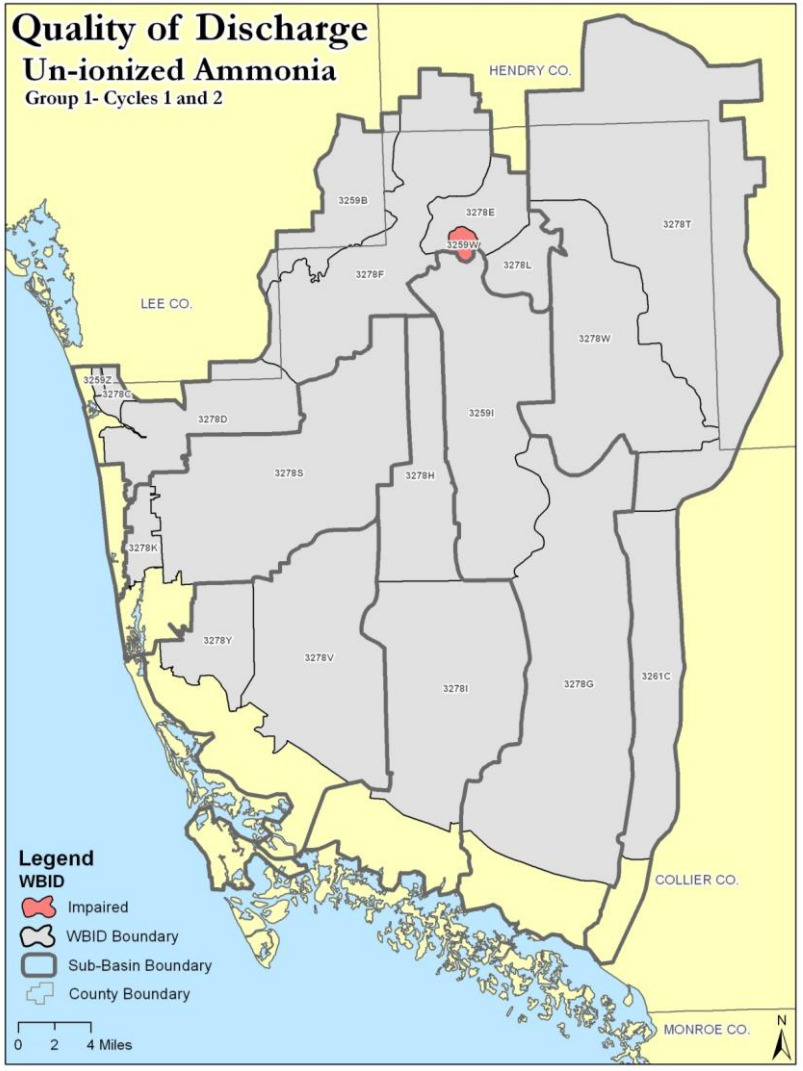


Figure 2-29. WBIDs within priority watersheds that were verified impaired for Nutrients and Un-ionized Ammonia by FDEP

2.2.3 Relevant Reports

The Southwest Florida Feasibility Study Water Quality Evaluation

The SWFFS water quality analysis was conducted in 2004 by Tetra Tech, Inc., and Janicki Environmental, Inc. The report was entitled "Compilation, Evaluation, and Archiving of Existing Water Quality Data for Southwest Florida" to the USACE. Task 7 of that report focused on the identification of waters of concern within the SWFFS area using a modification of the IWR. The boundaries of the watersheds reviewed for that report include the Collier County area included in the current study. WBID boundaries were not considered for their analysis.

The SWFFS identified a total of 318 parameter-specific waters of potential concern and 296 waters of verified concern. **Figures 2-30 through 2-34** show the location of potential waters of concern by parameter. Consistent with FDEP's evaluation, dissolved oxygen is the dominant parameter of concern. All of the priority watersheds in Collier County were identified as potential waters of concern for dissolved oxygen even those with limited urban development. Additionally, fecal coliform, un-ionized ammonia, and iron were reported as elevated in the majority of watersheds. Discrepancies were found between FDEP impairment analysis and SWFFS evaluation. Atkins believes the discrepancies are likely due to the variations in water quality databases, spatial scale of analysis (WBID vs. watershed) and the type of analysis (IWR vs. modifications to the IWR).

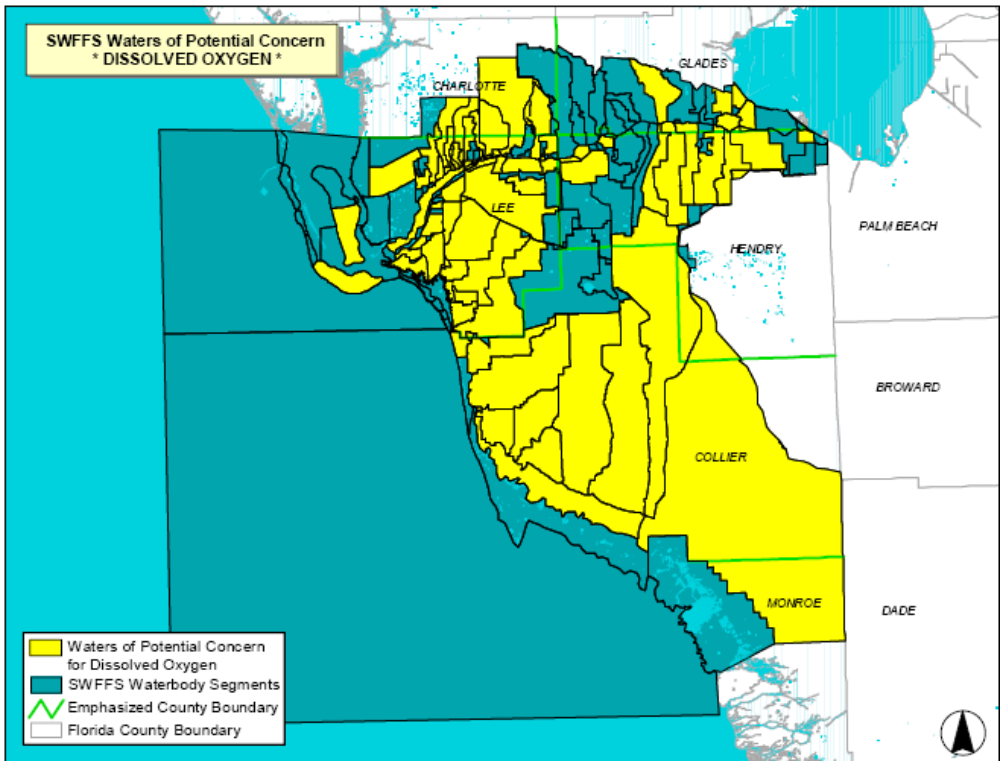


Figure 2-30. Potential Waters of Concern for Dissolved Oxygen as determined by Tetra Tech, Inc., and Janicki Environmental, Inc. (2004).

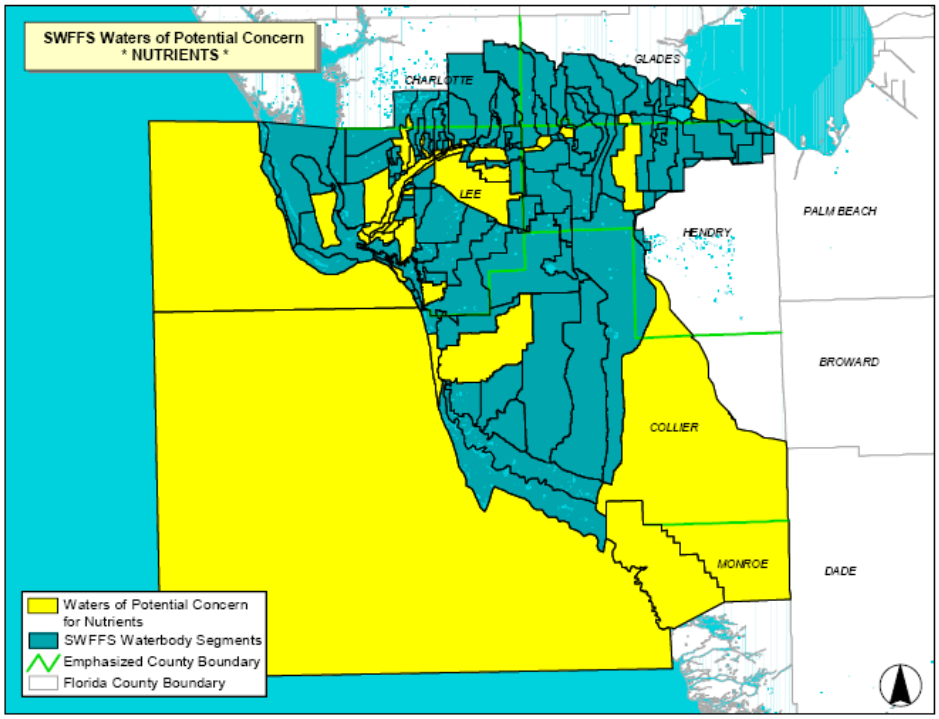


Figure 2-31. Waters of Potential Concern for Nutrients as determined by Tetra Tech, Inc., and Janicki Environmental, Inc. (2004).

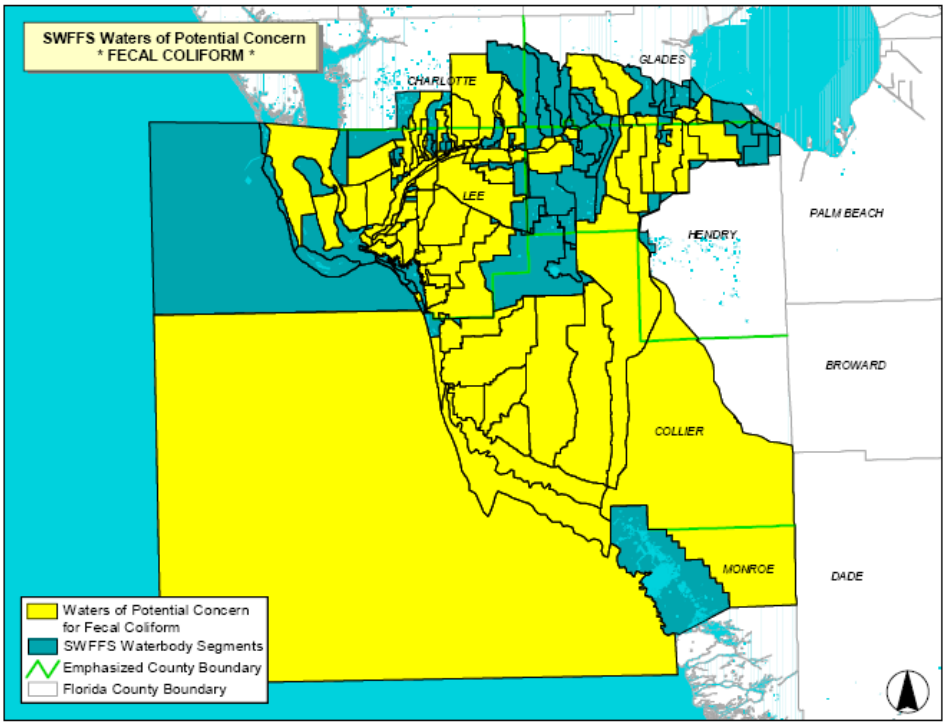


Figure 2-32. Potential Waters of Concern for Fecal Coliform as determined by Tetra Tech, Inc., and Janicki Environmental, Inc. (2004).

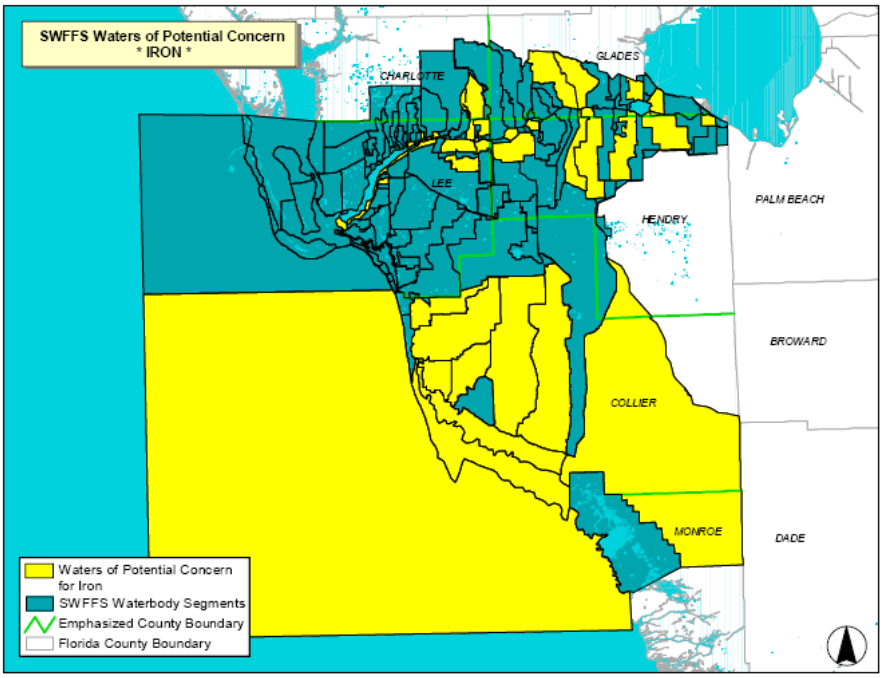


Figure 2-33. Potential Waters of Concern for Iron as determined by Tetra Tech, Inc., and Janicki Environmental, Inc. (2004).

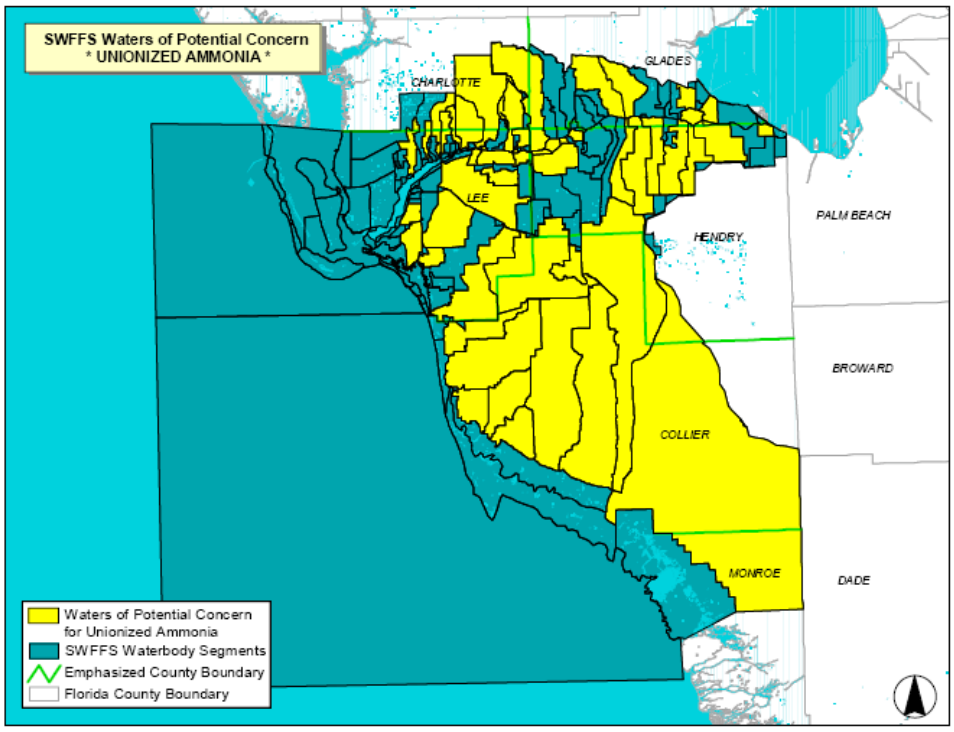


Figure 2-34. Potential Waters of Concern for Unionized Ammonia as determined by Tetra Tech, Inc., and Janicki Environmental, Inc. (2004).

The Collier County Surface Water Quality Annual Assessment and Trend Report (Janicki Environmental, Inc. 2010)

Collier County contracted Janicki Environmental, Inc. (JEI) to complete a review of water quality data from the County in the context of Florida's IWR (JEI 2010). The JEI review of annual chlorophyll *a* values six basins in the County indicated that all six exceeded the chlorophyll thresholds established by FDEP, compared with the single impairment (Lake Trafford) identified by FDEP for the watershed. The difference in results can be attributed to differences in classification of the water bodies (i.e. marine or freshwater systems) and the corresponding chlorophyll *a* threshold used to assign impairment. All the water bodies examined by JEI are considered freshwater systems by FDEP. JEI identified Barron River Canal, Camp Keais and Okaloacoochee Slough as freshwater basins, while Fakahatchee Strand, the Gordon River Extension, and Rookery Bay (Inland East) were identified as marine basins. Using the lower chlorophyll *a* threshold of 11 µg/L established for marine systems, the three basins designated as marine exceeded the chlorophyll threshold and were identified as potentially impaired by JEI. Exceedances were predominantly observed in 2007 and 2009 which was attributed to years of low rainfall (JEI 2010).

Table 2-8 lists the eight basins (and corresponding WBIDs) in Collier County identified as impaired or potentially impaired by FDEP, JEI, or Atkins. Lake Trafford is the only WBID identified as impaired for nutrients (chlorophyll *a)* by FDEP. Atkins identified two WBIDs (Cow Slough and Okaloacoochee Slough) which may be impaired in addition to the six potentially impaired WBIDs identified by JEI. The methods and results of the Atkins method are discussed in greater detail in further sections of this report.

Table 2-8. Impairment Status in Eight WBIDs in the Collier County Watersheds (Potential = Potentially Impaired)

WBID	WBID Name	Watershed	FDEP	Atkins	Janicki
3259W	Lake Trafford	Cocohatchee-Corkscrew	Impaired	Potential	Not Evaluated
3278E	Cow Slough	Cocohatchee-Corkscrew	Not Impaired	Potential	Not Evaluated
3259I	Camp Keais	Fakahatchee	Not Impaired	Not Impaired	Potential
3278G	Fakahatchee Strand	Fakahatchee	Not Impaired	Not Impaired	Potential
3278K	Gordon River Extension	Golden Gate Naples Bay	Not Impaired	Not Impaired	Potential
3261C	Barron River Canal	Okaloacoochee-SR29	Not Impaired	Not Impaired	Potential
3278T	Okaloacoochee Slough	Okaloacoochee-SR29	Not Impaired	Potential	Potential
3278V	Rookery Bay (Inland East Segment)	Rookery Bay	Not Impaired	Not Impaired	Potential

2.2.4 Stream Water Quality Analysis Method

The two methods used in this report to evaluate the potential waters of concern for each of the Collier County watersheds are described below:

- Watershed Analysis: A review of long-term water quality data was conducted to identify potential parameters of concern at the watershed level.
- Evaluation of WBID Impairment: A review of water quality data within each WBID was performed to compare results with FDEP impairment determinations.

The data used for the analyses included the IWR Run 39 data (supplied by FDEP), as well as data from Florida STORET, Collier County, City of Naples, and the Rookery Bay National Estuarine Research Reserve. This resulted in an updated and comprehensive database of water quality data. All analyses were conducted using the most recent 10-year time period (2000–2009) to minimize the effect of temporal variations. It should be noted that the majority of water quality data available was collected during this ten year period.

To eliminate potential errors due to duplicate data entry via multiple agencies uploading the same data, median values were calculated by station, date, and parameter. To allow for a direct comparison between lab parameters (i.e., nutrients) and field parameters (i.e., temperature, dissolved oxygen, samples were restricted to those collected from less than one meter depth. Since lab parameters are typically from surface grab samples, this ensures that comparisons between various parameters are from samples taken from the same general water depth.

Using GIS and the station descriptions, the locations of water quality stations were reviewed in order to identify locations where multiple stations were sampled. Data were merged when more than one water quality station was sampled at the same location and a unique merged station name was assigned to that location. **Appendix 4-B** lists all water quality stations and assigned merged station names. Each parameter in the database was screened to identify outliers or entry errors due to unit inconsistencies. Identified inconsistencies were reviewed and corrected. When Total Nitrogen (TN) species were not listed, TN was calculated as the sum of Total Kjeldahl Nitrogen (TKN) and Nitrate + Nitrite (NOx). To ensure consistency with IWR guidance, corrected chlorophyll *a* was preferentially used over uncorrected chlorophyll *a* for samples collected in 2006 and earlier. After 2006, IWR guidance from FDEP directs that only corrected chlorophyll *a* data should be used.

Watershed Analysis

This analysis was conducted using only data from the long-term water quality stations that were consistently sampled throughout the ten year time period 2000-2009. Summary statistics for all discharge water quality stations are found in **Appendix 4-C**. The use of long-term water quality stations accommodates variability in water quality due to irregular sampling and temporary monitoring efforts. The long-term data also provided a means of evaluating the watershed as a

whole, rather than characterizing it using short-term "snapshots" of water quality from individual sub-basins. **Figure 2-35** shows the long-term freshwater discharge water quality sampling stations used for analysis.

Summary data for each watershed were compared to the Criteria for Surface Water Quality Classifications (F.A.C. 62-302.530) for water quality parameters based on their water body classification. **Table 2-9** lists the regulatory class for each watershed. Class is defined as the associated designated use of the water body provided by FDEP. All freshwater bodies examined here are classified as class III freshwater (3F). **Table 2-11** lists the regulatory standards for a Class 3F water body for selected parameters. Regulatory standards have been vetted by the scientific community and provide a biologically relevant basis for comparison.

The FAC Chapter 62-303: "Identification of Impaired Surface Waters," provides a list of the minimum number of samples not meeting a water quality criterion for a range of sample sizes in order for the water to be included on the FDEP Verified list. The same criteria were used herein to classify a watershed as a "watershed of concern" when an appropriate regulatory standard was exceeded. In terms of chemical parameters, chlorophyll a, dissolved oxygen, iron, and fecal coliform are parameters used by FDEP to classify WBIDs as impaired water bodies. In contrast, color, total phosphorus, total nitrogen, and total suspended solids cannot be quantitatively assessed to identify impaired water bodies. Total nitrogen and total phosphorus are valuable parameters providing indicators of eutrophication. Both chlorophyll *a* and dissolved oxygen levels can be directly impacted by the nutrient loads. Color has the ability to affect chlorophyll *a* and dissolved oxygen concentrations. Additionally, total suspended solids provide an indication of sediment erosion, which occurs frequently in storm water run-off.

To further evaluate potential water quality impairments at the watershed level when no numeric state standards exist, such in the case of nutrients, data were compared to screening level standards, which can provide an indication of water quality concerns. Screening level standards are available for total nitrogen (TN) and total phosphorus (TP) based on the 70th percentile of all available data, a technique first used by Friedman and Hand (1989). Using IWR Run 39, a similar screening level was calculated by water body type for color and total suspended solids, in which the 70th percentile of all data available from 2000 to 2009 by water body type was calculated. **Table 2-12** lists the screening level standard for selected parameters by water body type (stream or lake).

As the focus of the watershed management plan is to protect, and if possible restore, the natural environment, the watershed analysis also considered the water quality characteristics of the natural systems. In addition, the analysis referred to the potential impact of groundwater discharges into the drainage system within each of the watersheds.

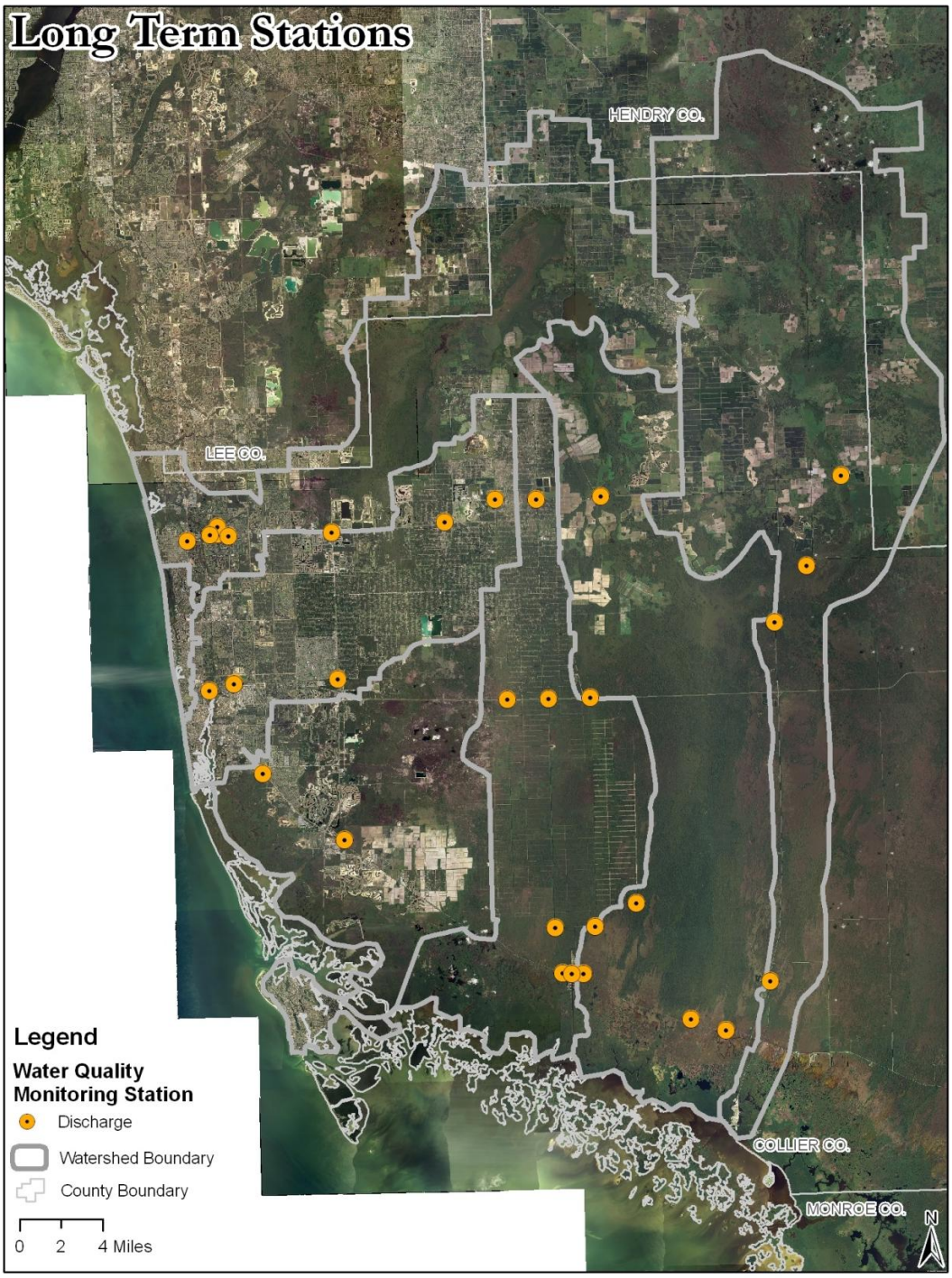


Figure 2-35. Long-term stations for watershed in-stream water quality analysis

Table 2-9. WBID name and corresponding watershed designation

WBID	Class*	Watershed	WBID Name
3259W	3F	Cocohatchee-Corkscrew	LAKE TRAFFORD
3259Z	3F	Cocohatchee-Corkscrew	LITTLE HICKORY BAY
3278D	3F	Cocohatchee-Corkscrew	COCOHATCHEE (INLAND SEGMENT)
3278C	3F	Cocohatchee-Corkscrew	COCOHATCHEE GOLF COURSE DISCHARGE
3278F	3F	Cocohatchee-Corkscrew	CORKSCREW MARSH
3278E	3F	Cocohatchee-Corkscrew	COW SLOUGH
3259B	3F	Cocohatchee-Corkscrew	DRAINAGE TO CORKSCREW
3278L	3F	Cocohatchee-Corkscrew	IMMOKALEE BASIN
3278H	3F	Faka Union	FAKA UNION (NORTH SEGMENT)
3278I	3F	Faka Union	FAKA UNION (SOUTH SEGMENT)
3278G	3F	Fakahatchee	FAKAHATCHEE STRAND
3259I	3F	Fakahatchee	CAMP KEAIS
3278K	3F	Golden Gate Naples Bay	GORDON RIVER EXTENSION
3278S	3F	Golden Gate Naples Bay	NORTH GOLDEN GATE
3261C	3F	Okaloacooche-SR29	BARRON RIVER CANAL
3278T	3F	Okaloacooche-SR29	OKALOACOOCHEE SLOUGH
3278W	3F	Okaloacooche-SR29	SILVER STRAND
3278V	3F	Rookery Bay	ROOKERY BAY (INLAND EAST SEGMENT)
3278Y	3F	Rookery Bay	ROOKERY BAY (INLAND WEST SEGMENT)

*3F: Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife (Predominantly Fresh Waters)

Table 2-10. List of Water Quality Parameters

Parameter	Unit	Parameter	Unit
Salinity	ppt	Conductivity	µmhos/cm
Total Nitrogen	mg/l	Nitrate-Nitrite	mg/l
Total Phosphorus	mg/l	Orthophosphate	mg/l
Total Kjeldahl Nitrogen	mg/l	Unionized Ammonia	mg/l
Chlorophyll a	µg/L	Fecal Coliform	#/100 mL
Color	PCU	Copper	µg/L
Total Suspended Solids	mg/l	Turbidity	NTU
Dissolved Oxygen	mg/l	Biochemical Oxygen Demand	mg/l
Iron	µg/L	Hardness	mg/l
Secchi Depth	m		

Table 2-11. List of regulatory standards for selected water quality parameters

Parameter	Classification*
	3F
Dissolved Oxygen (mg/l)	5
Iron (µg/L)	1000
Fecal Coliform (#/100 mL)	400
Chlorophyll a (µg/L)	20
Copper (µg/L)	e^(0.854[lnH]-1.702)
Un-ionized Ammonia (mg/l)	0.02

*3F: Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife (Predominantly Fresh Waters)

Evaluation of WBID Impairment

Using methods similar to IWR, Atkins analyzed the water quality data for each WBID in a watershed. As opposed to the watershed analysis that used data only for the long-term water quality stations, for this analysis it was decided that all data available for the period 2000–2009 would be used for consistency with FDEP's approach for impairment evaluation. Dissolved oxygen, iron, fecal coliform, un-ionized ammonia, and copper concentrations were compared to the appropriate state regulatory standard to determine impairment status (**Table 2-12**). It should be noted that a modification to the FDEP method for determining chlorophyll *a* impairments was used. Each chlorophyll *a* value was compared to the state regulatory standard and the percent exceedance was calculated. This approach is more conservative than the FDEP method by which an annual average is calculated using data from each yearly quarter for comparison with the regulatory standard. The results of Atkins analyses for each WBID within a watershed were compared to the FDEP impaired WBID list for those water bodies in the study area.

Table 2-12. List of screening levels for selected water quality parameters

Parameter	Lake	Stream
Color (PCU)	80	111.5
TSS (mg/l)	13	7
TN (mg/l)	1.7	1.6
TP (mg/l)	0.11	0.22

2.2.5 Results

This section presents the results of both the evaluation of watershed conditions and the review of impaired WBIDs for each of the priority watersheds. In general, using the methods described

previously, five parameters were identified as parameters of concern, color, dissolved oxygen, TN, iron, and fecal coliform. Chlorophyll *a*, total phosphorus, and total suspended solids concentrations were within range of the regulatory standards and screening levels for all six watersheds. While un-ionized ammonia was identified by FDEP as a parameter of concern for WBID 3259W (Lake Trafford), elevated levels of un-ionized ammonia were not observed in other locations in the Cocohatchee-Corkscrew watershed.

Table 2-13 lists the parameters and the number of watersheds for which that parameter is of concern. The majority of watersheds frequently had low dissolved oxygen concentrations (**Figure 2-36**). Two of the six watersheds showed elevated fecal coliform bacteria levels: Fakahatchee and Cocohatchee-Corkscrew (**Figure 2-37**). The Okaloacoochee/SR29 watershed had elevated total nitrogen concentrations (**Figure 2-38**). Only the Rookery Bay watershed was not identified as having elevated color (**Figure 2-39).** Data from a number of watersheds indicated elevated iron concentrations (**Figure 2-40**).

A more-detailed description of results by watershed and WBID is provided in the following sections.

Table 2-13. Total number of Watersheds of Concern identified for each parameter

Parameter	Watersheds of Concern
Chlorophyll a	0
Color	5
Dissolved Oxygen	6
Fecal coliform	2
Iron	2
Total Nitrogen	1
Total Phosphorus	0
Total Suspended Solids	0
Un-ionized Ammonia	0

2.2.5.1 Cocohatchee-Corkscrew Watershed

A description of the results of the watershed analysis and WBID impairment condition are presented here. The summary water quality statistics for the Cocohatchee-Corkscrew watershed are provided in **Table 2-14**. Based upon the evaluation of the long term stations within the watershed, three potential parameters of concern were identified: color, dissolved oxygen, and fecal coliform bacteria. Chlorophyll *a* and nutrients were not found to be elevated in the Cocohatchee-Corkscrew watershed.

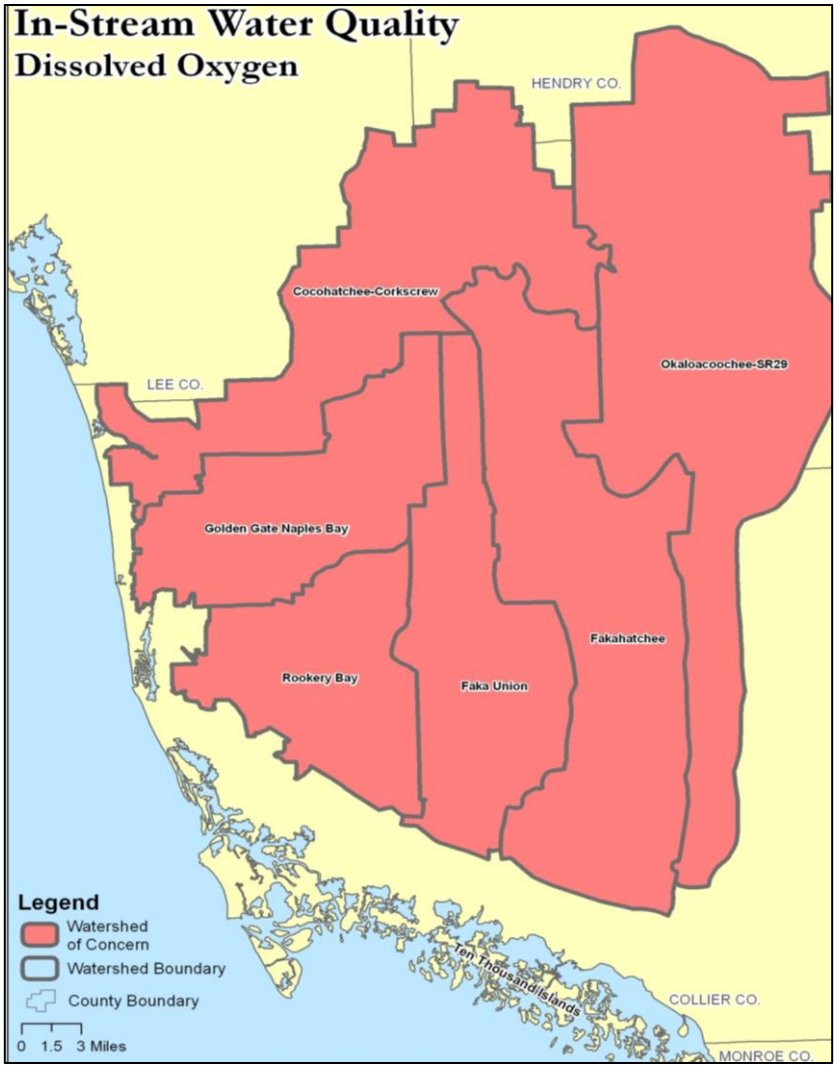


Figure 2-36. Watersheds of Concern for Dissolved Oxygen

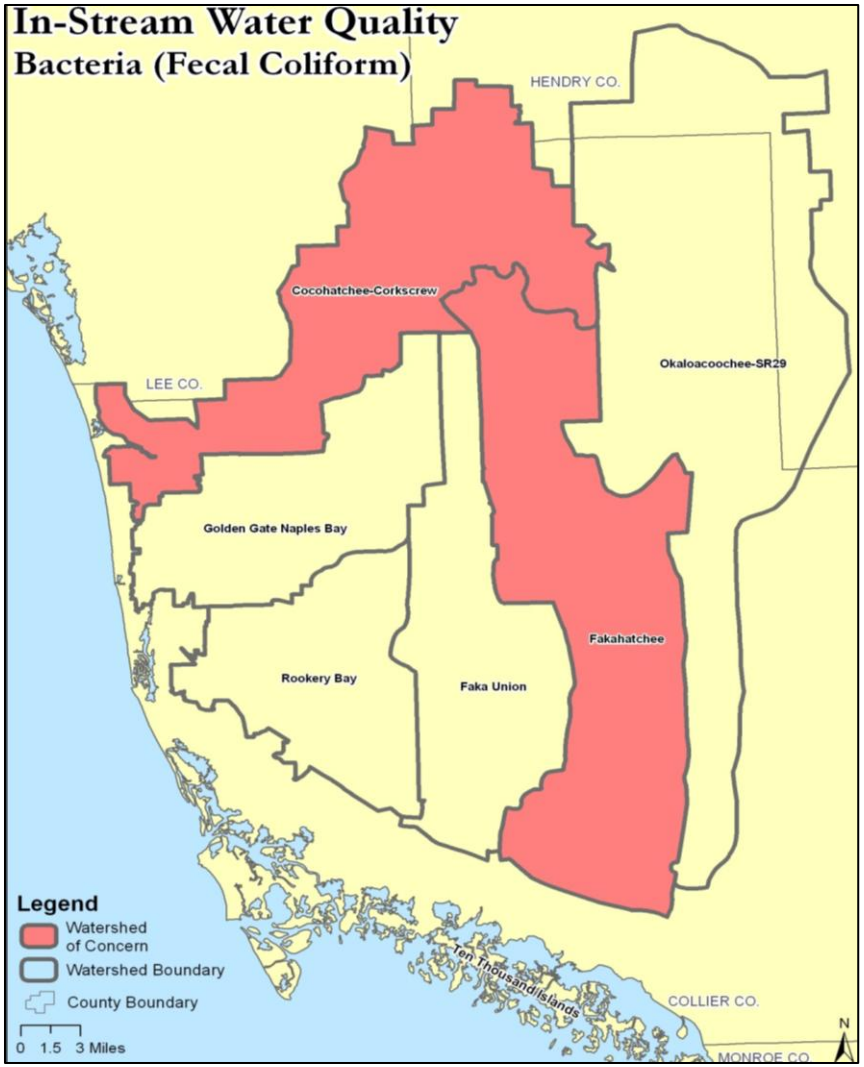


Figure 2-37. Watersheds of Concern for Fecal Coliform Bacteria

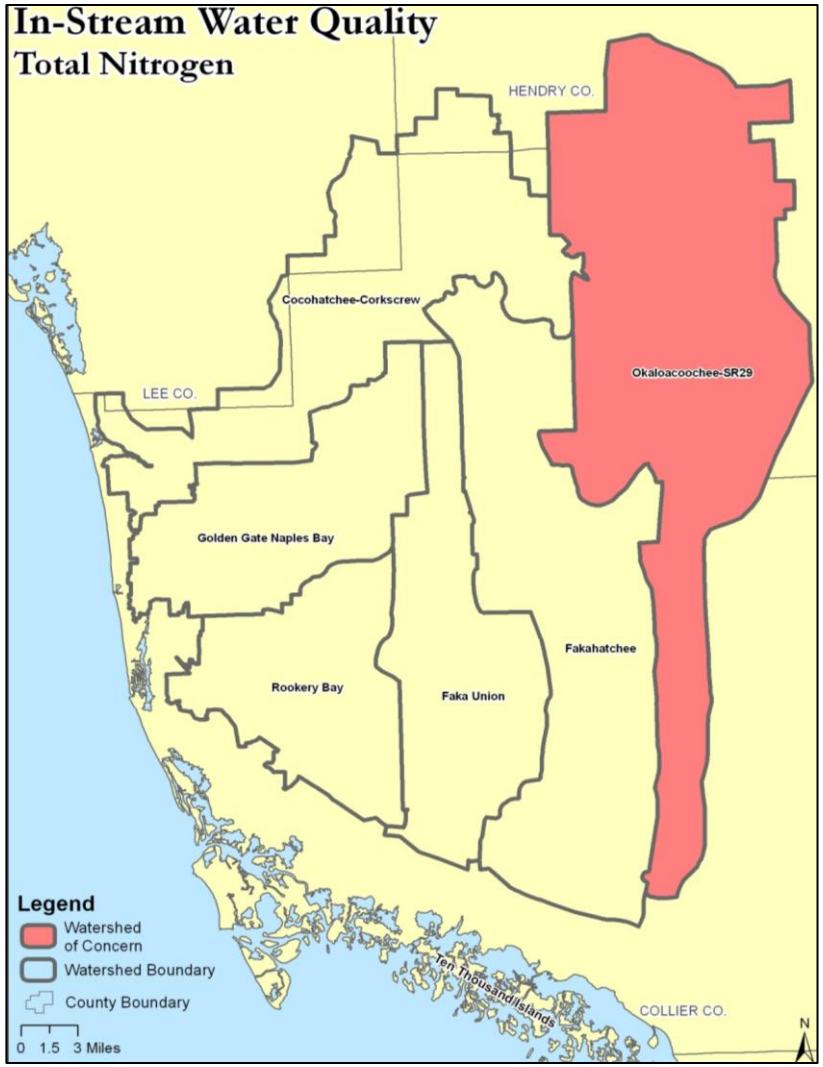


Figure 2-38. Watersheds of Concern for Total Nitrogen

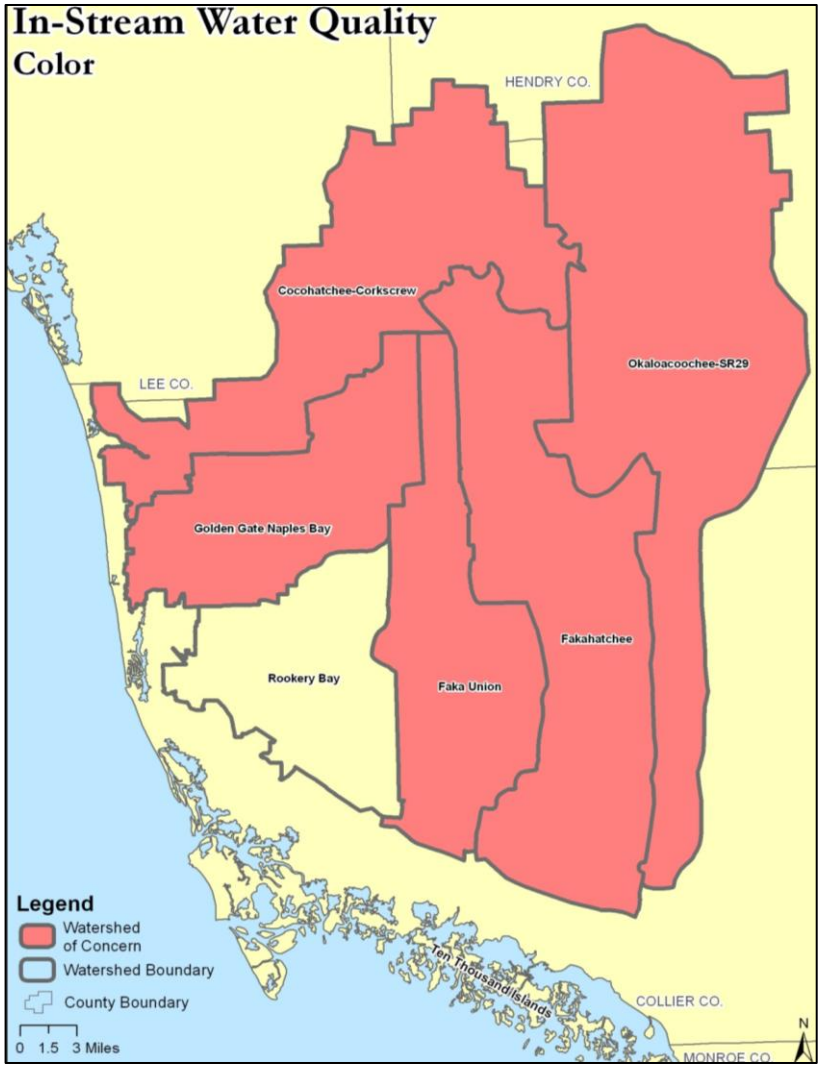


Figure 2-39. Watersheds of Concern for Color

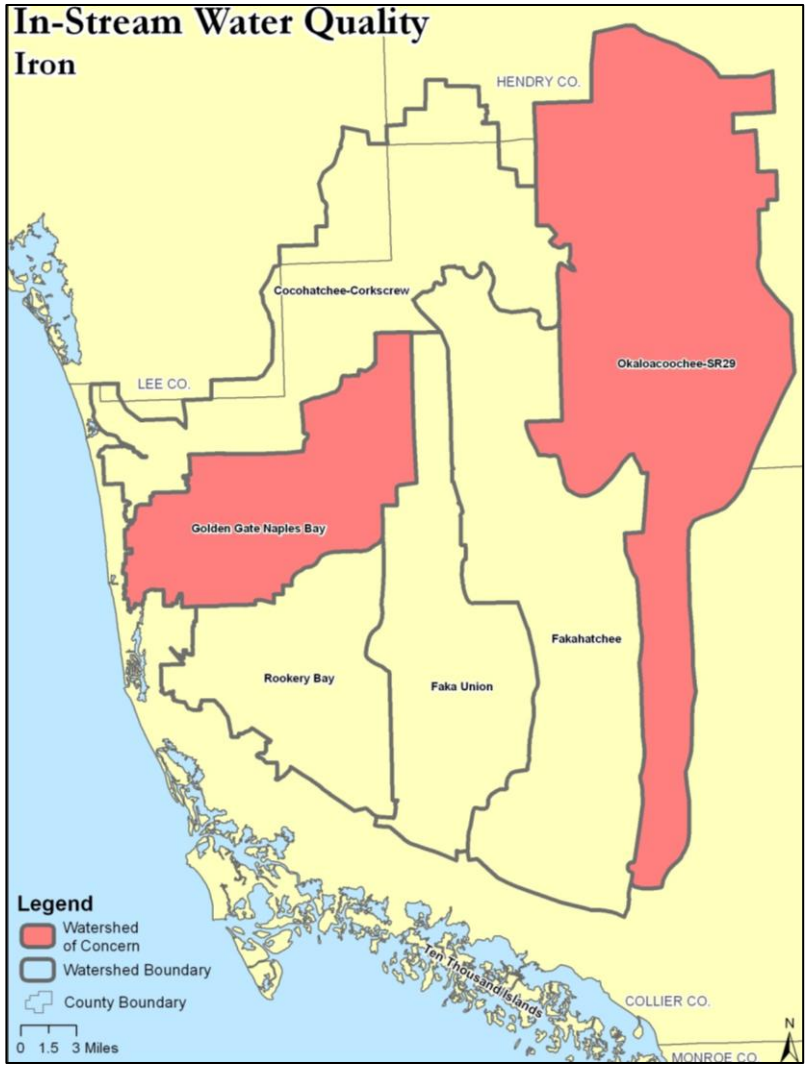


Figure 2-40. Watersheds of Concern for Iron

Table 2-14. Water Quality Summary Statistics for the Cocohatchee-Corkscrew Watershed indicating potential parameters of concern

Parameter	N	Min	Mean	Median	Max	Percent Exceed	Parameter of Concern
BOD, mg/l	125	1.6	2.4	2.0	6.8		
Chlorophyll-a, µg/L	449	3.0	9.1	4.3	246.3	9	N
Color, PCU	437	5	72	60	300	12	Y
Conductivity, umhos/cm	495	317	6718	1064	49624		
Copper, µg/L	153	0.30	5.28	2.25	178.00		
Dissolved Oxygen, mg/l	499	0.42	5.45	5.10	16.74	47	Y
Fecal Coliform, #/100 mL	442	1	259	88	4500	13	Y
Iron, µg/L	140	100.0	352.3	325.0	1100.0	1	N
Nitrate-Nitrite, mg/l	435	0.01	0.08	0.05	0.78		
Orthophosphate as P, mg/l	347	0.004	0.042	0.024	0.290		
Salinity, ppt	447	0.2	4.2	0.5	32.4		
Secchi Depth, m	471	0.10	1.16	1.10	2.50		
TKN, mg/l	394	0.05	0.86	0.83	4.30		
Total Nitrogen, mg/l	407	0.005	0.790	0.860	4.300	3	N
Total Phosphorus, mg/l	428	0.004	0.079	0.055	0.563	6	N
TSS, mg/l	365	1.3	4.5	2.0	102.0	8	N
Turbidity, NTU	276	0.4	2.4	1.8	24.0		
Unionized Ammonia, mg/l	266	0.0000	0.0013	0.0010	0.0082	0	N

Chlorophyll a and Nutrients

FDEP declared Lake Trafford (WBID 3259W) impaired for both chlorophyll *a* (nutrients) and un-ionized ammonia. However, elevated chlorophyll a and nutrient values were not observed on the watershed-scale. It is important to note that due to the poor water quality conditions observed in Lake Trafford by FDEP, Collier County, and the SFWMD, a large-scale restoration project has been implemented. Previous water quality conditions that existed during the timeframe used for the Lake Trafford TMDL report and that resulted in the identified impairment are complex. The Lake Trafford sediment removal project has been completed and observed water quality improvements have been documented (i.e., PBS&J 2009). Further water quality improvements are anticipated. Much of the data for Lake Trafford is from the period prior to implementation of the Lake Trafford sediment removal project and may not accurately represent post-project conditions. Atkins believes that the impairments indicated by FDEP (un-ionized ammonia and chlorophyll *a*) are likely not indicative of current water quality conditions in the Lake. The County should work with FDEP to re-evaluate Lake Trafford during the next assessment cycle.

Dissolved Oxygen

Dissolved oxygen concentrations in the Cocohatchee-Corkscrew watershed are consistently below the regulatory standard of 5.0 mg/L for freshwater water bodies. Wet and dry season median values amount to 4.3 and 2.1 mg/L, respectively. An evaluation of the cause for the low dissolved oxygen levels was completed to determine the factor(s) that may explain the depressed dissolved oxygen values. Three factors were identified: high nutrient concentrations, impact of wetland systems, and groundwater contributions to the drainage system. Boyer (2008) reported that "localized naturally low DO conditions are common due to stratification and inputs of large amounts of organic material from natural mangrove forests" (as cited in FDEP 2010).

The decomposition of detritus associated with color, and phytoplankton biomass associated with TN and TP, can affect levels of dissolved oxygen. Increased color and decreased dissolved oxygen values have also previously been documented from forested wetlands in Florida (PBSJ 2009). That study concluded that low dissolved oxygen concentrations due to high levels of color (aka. tannins) occurring in wetland systems can be an entirely natural phenomenon. It is possible that low dissolved oxygen concentrations are a function of natural seasonal fluctuations which occur in wetland environments. This is relevant because the majority of the Cocohatchee-Corkscrew watershed is comprised of natural areas (47%), which are located primarily in the headwater of the watershed associated with the Corkscrew Swamp.

In addition, low DO concentrations may result from elevated nutrient concentrations and can be indicative of anthropogenic pollution loads. Anthropogenic sources may include nutrients carried in stormwater runoff from urban and agricultural areas located in the watershed. Groundwater contributions may also be a factor affecting DO levels because groundwater concentrations are predicted to be less than 1.5 mg/L (Section 2.5).

Based on those considerations, it was important to conduct an analysis to statistically determine the most likely causative factor that explains the observed low dissolved oxygen concentrations in the watershed. Regression analyses were conducted between dissolved oxygen and TN, TP and color. For each regression the best-fit curve was selected when comparing exponential, linear, and power relationships.

Results shown in **Table 2-15** indicate that color is potentially a causative factor for the low dissolved oxygen discharge in the watershed. This finding indicates that low dissolved oxygen concentrations may be due to discharges from wetland systems in the Corkscrew Swamp. This applies to the Corkscrew marsh and potentially the area downstream from the marsh. However, even though color is the strongest predictor of dissolved oxygen in the Cocohatchee-Corkscrew watershed (compared to TN or TP) the low r^2 value of the DO vs. color relationship also illustrates that color alone cannot explain observed low DO values.

Table 2-15. Identification of causative factor in the Cocohatchee-Corkscrew watershed for low dissolved oxygen concentrations

Causative Factor	Method	p	r^2
Color	Exponential regression	0.000	0.08
TN	Power regression	0.008	0.02
TP	Power regression	0.000	0.07

In addition to wetland function, other factors are likely involved in the DO impairment. More than 50% of the watershed is developed for urban or agricultural uses. Runoff from these areas may contribute nutrients to the drainage network. Stormwater pollutant loading calculations are discussed in Sections 2.3 and 4.3 of this document. Those results indicate that water quality in the canal network in the area around Immokalee is likely impacted by urban and agricultural runoff. It is also possible that the canal network in the western portion of the watershed is affected by urban runoff. Additional monitoring is recommended to assess the nutrient contributions from these developed areas.

In terms of groundwater quality, there is no monitoring data for dissolved oxygen available in the watershed. However, an average DO concentration of 0.57 mg/L (Collier County, 2010) has been reported in groundwater measurements completed in the Gordon River Extension (WBID 3278K). Predicted DO concentrations in groundwater (described in Section 2.5) are less than 1.5 mg/L in the Cocohatchee – Corkscrew watershed. **Table 2-16** shows the water budget components for each of the WBIDs in the watershed per the hydrologic/hydraulic model results. That information indicates that baseflow represents almost 40 percent of the average annual canal flow in WBID 3278D and ranges between 30 percent in the wet season to 65 percent in the dry season. Therefore, groundwater contributions may have a significant effect on dissolved oxygen levels in the Cocohatchee Canal.

Table 2-16. Water budget contributions to the drainage network in the Cocohatchee-Corkscrew watershed

		Average Annual		Average Wet Season		Average Dry Season	
WBID	Name	Groundwater (inches)	Surface Runoff (inches)	Groundwater (inches)	Surface Runoff (inches)	Groundwater (inches)	Surface Runoff (inches)
3259B	Drainage to Corkscrew	1.00	4.75	0.76	4.41	0.24	0.34
3278D	Cocohatchee (Inland Segment)	5.84	9.26	3.53	8.05	2.32	1.21
3278E	Cow Slough	0.16	3.20	0.12	2.51	0.03	0.69
3278F	Corkscrew Marsh	0.70	8.67	0.40	6.34	0.30	2.33
3278L	Immokolee Basin	1.01	9.04	0.62	6.22	0.39	2.82

To further assess the low DO condition in the Cocohatchee-Corkscrew and the other watersheds in the study area, the measured DO concentrations at all stations were plotted based on day and month of occurrence in a calendar year, as shown in **Figure 2.41**. A monthly running average line

was also added to the plot. Results show that the oxygen concentration varies with temperature as expected for systems that are not influenced by algae or vegetation that exerts oxygen during the day due to photosynthetic activity. This result suggests that algae, caused by excessive nutrient concentrations, are apparently not the cause of the low DO levels.

It is recognized that the urbanized areas of the watershed discharge nutrients and organic material that may contribute to DO concentrations being below water quality standards. However, results of the analysis also suggest the possibility that DO levels are a result of natural influences. It is recommended that the County implement additional monitoring studies to further assess the causes of the low DO concentrations.

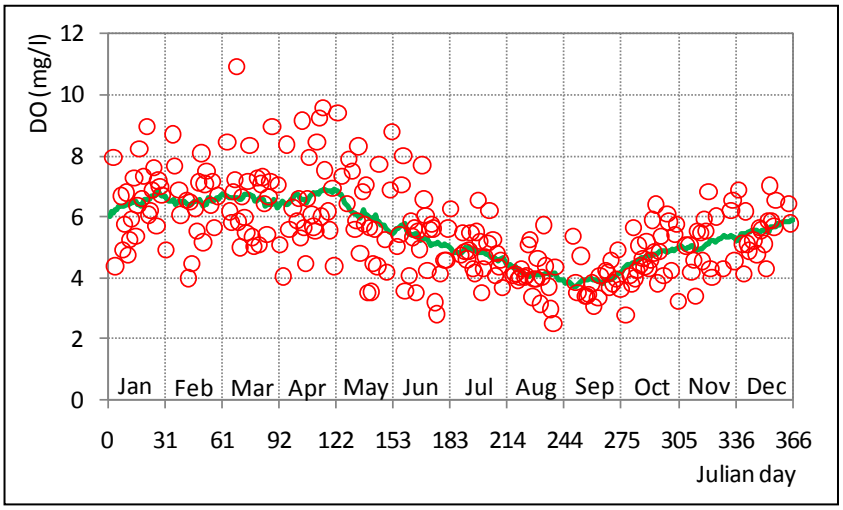


Figure 2-41. Measured Dissolved Oxygen Concentrations

Fecal Coliform Bacteria

The numeric criteria of fecal coliform bacteria concentrations for Class 3 waters as established by Rule 62-302, F.A.C., states that "*The Most Probable Number (MPN) shall not exceed a monthly average of 200, nor exceed 400 in 10% of the samples, nor exceed 800 on any one day.*"

No WBIDs were identified as verified impaired for bacteria as evaluated by FDEP. In contrast, the Cocohatchee-Corkscrew watershed reported 13% of the 442 values exceeded the 400 #/100 mL criteria established for Class 3 waters. As such, the watershed was classified as a "watershed of concern" for bacteria based on the analysis of the long-term sampling stations.

Though values exceed the regulatory standard for Class 3 waters, fecal coliform bacteria may not be an appropriate indicator for pathogenic diseases in sub-tropical climates. In subtropical environments such as South Florida, the specificity of the fecal coliform test is compromised by the more constant and warmer ambient water temperatures of sampled water bodies. The inability to specifically identify humans as a source of bacteria using traditional indicator bacteria testing protocols has been

noted by Fujioka (2001) and Fujioka et al. (1999) for various tropical locations. Further identification efforts are warranted to verify the source of impairment.

Evaluation of WBID Impairment

Using all of the available water quality data over the 10-year period for each WBID, Atkins evaluated the impairment status determined by FDEP in the watershed. **Table 2-17** shows the FDEP impairment as well as the results of the Atkins analysis. As shown all impairments were confirmed when compared to the State standards. Additionally, six potential impairments were identified in the Cow Slough, Corkscrew Marsh, Cocohatchee (Inland Segment) or the Drainage to Corkscrew water bodies that have not been identified by FDEP. As indicated previously, further site specific analyses may be necessary to determine whether the impairments and the potential impairments are caused by anthropogenic pollutant loads or are the reflection of natural conditions. It should be noted that the evaluation of the WBID impairment provided similar results to the long-term station watershed analysis.

Table 2-17. Impaired WBID comparison for Cocohatchee-Corkscrew watershed

WBID#	Water Segment Name	Impairment Parameter	PBSJ Analysis
3259W	Lake Trafford	Dissolved Oxygen	Confirm FDEP assessment
3259W	Lake Trafford	Nutrients	Confirm FDEP assessment
3259W	Lake Trafford	Un-ionized Ammonia	Confirm FDEP assessment
3278D	Cocohatchee Inland	Dissolved Oxygen	Confirm FDEP assessment
3278F	Corkscrew Marsh	Dissolved Oxygen	Confirm FDEP assessment
3278L	Immokalee Basin	Dissolved Oxygen	Confirm FDEP assessment
3278E	Cow Slough	Nutrients (Chlorophyll a)	Potential new impairment
3278E	Cow Slough	Dissolved Oxygen	Potential new impairment
3278F	Corkscrew Marsh	Fecal Coliform	Potential new impairment
3278D	Cocohatchee (Inland Segment)	Fecal Coliform	Potential new impairment
3259B	Drainage to Corkscrew	Dissolved Oxygen	Potential new impairment
3259B	Drainage to Corkscrew	Fecal Coliform	Potential new impairment

2.2.5.2 Golden Gate-Naples Bay Watershed

The results of the watershed analysis and WBID impairment condition in the Golden Gate-Naples Bay Watershed is presented here. The summary statistics for the Golden Gate-Naples Bay Watershed are provided in **Table 2-18**. Based upon the evaluation of the long term stations within the watershed, three parameters were identified as being of "potential concern"; dissolved oxygen, color, and iron. The canal network in the watershed was built to lower the water table and encourage development. Therefore, the majority of the watershed is comprised of urban

development (61%), which suggests that anthropogenic modifications in the watershed may have resulted in a decline in water quality conditions.

Table 2-18. Water Quality Summary Statistics for the Golden Gate-Naples Bay Watershed indicating potential parameters of concern

Parameter	N	Min	Mean	Median	Max	Percent Exceed	Parameter of Concern
BOD, mg/l	119	0.7	2.0	2.0	5.7		
Chlorophyll-a, µg/L	558	1.0	5.4	3.0	83.0	3	N
Color, PCU	553	5	93	80	800	26	Y
Conductivity, umhos/cm	558	184	2348	616	40222		
Copper, µg/L	151	0.15	1.24	1.00	4.90		
Dissolved Oxygen, mg/l	570	0.17	5.30	5.27	16.10	45	Y
Fecal Coliform, #/100 mL	502	1	128	32	5400	6	N
Iron, µg/L	153	100.0	554.6	500.0	1500.0	14	Y
Nitrate-Nitrite, mg/l	545	0.00	0.05	0.04	0.33		
Orthophosphate as P, mg/l	450	0.004	0.015	0.007	0.222		
Salinity, ppt	443	0.0	1.7	0.3	25.6		
Secchi Depth, m	535	0.00	1.20	1.10	6.00		
TKN, mg/l	510	0.04	0.81	0.75	3.30		
Total Nitrogen, mg/l	518	0.005	0.750	0.770	3.330	4	N
Total Phosphorus, mg/l	525	0.006	0.034	0.025	0.270	0	N
TSS, mg/l	478	2.0	3.7	2.0	94.0	5	N
Turbidity, NTU	394	0.2	2.3	1.9	19.5		
Unionized Ammonia, mg/l	478	0.0000	0.0008	0.0006	0.0099	0	N

Dissolved Oxygen

Similar to the analysis for the Cocohatchee watershed, an evaluation was completed to determine a likely causative factor for the depressed dissolved oxygen concentrations. Regressions analysis between dissolved oxygen and TN, TP, and color were conducted. For each regression the best-fit curve was selected when comparing exponential, linear, and power relationships. Results indicated that TP is the parameter that better explains statistically the low dissolved oxygen discharge in the watershed (**Table 2-19**). However, it explains only 29 percent of the condition. In addition TP mean and median concentrations are less than 15 percent of the nutrient screening levels for Florida streams. Therefore, other parameters are also likely affecting the DO condition.

Table 2-19. Identification of causative factor in the Golden Gates Naples Bay watershed for low dissolved oxygen values

Causative Factor	Method	P	r^2
Color	Power regression	0.0000	0.062
TN	Exponential regression	0.0005	0.024
TP	Power regression	0.0000	0.29

A potential causative factor for low dissolved oxygen values is groundwater contributions to the drainage network. Predicted groundwater concentrations of DO in the Golden Gate watershed are discussed in Section 2.5, The highest measured DO concentration in the watershed is less than 3.5 mg/L and the average DO concentration is less than 1.5 mg/L.

Table 2-20 shows the predicted flows in the watershed's drainage network, per the H&H model results. The table indicates that groundwater represents 43 and 24 percent of the average annual flow in the Golden Gate North canal and the Gordon River Extension, respectively. During the dry season, the groundwater contribution at those same locations increases to 52 and 32 percent, respectively. This data suggests that the groundwater flow to the canal network is significant and that the DO concentration in groundwater could be a factor that strongly influences DO concentrations in the canal network.

Table 2-20. Water budget contributions to the drainage network in the Golden Gate-Naples Bay Watershed

WBID	Name	Average Annual		Average Wet Season		Average Dry Season	
		Groundwater (inches)	Surface Water (inches)	Groundwater (inches)	Surface Water (inches)	Groundwater (inches)	Surface Water (inches)
3278S	Golden Gate North (1)	16.08	21.16	11.06	16.53	5.02	4.63
3278K	Gordon River Extension	1.09	6.67	0.54	5.48	0.55	1.19
(1) Indicates total flow in the canal in WBID area in inches, including diversions from other areas,							

Another factor that impacts DO concentrations is the discharge of nutrients and organic matter from urbanized areas. That is particularly important in the Golden Gate watershed, although as indicated for the Cocohatchee-Corkscrew watershed, the monthly concentrations curve shows that DO varies with temperature as expected for systems not influenced by algal activity. Further water quality analyses may be needed to assess the cause of the low DO levels.

Iron

Iron concentrations in the Golden Gate-Naples Bay watershed are sufficiently elevated to classify the watershed as of "potential concern". Fourteen percent of the 153 surface water samples show concentrations greater than the 1,000 µg/L Class 3 regulatory standard. Similarly, FDEP identified

WBID 3278S (North Golden Gate) as impaired for iron. Potential sources include iron dissolved in baseflow to the canal network, mine drainage, sewage treatment plant outfalls, or landfill leachate from industrial scrap yards.

Table 2-21 provides a summary of iron data collected within the Golden Gate-Naples Bay watershed. In WBID 3278K (Gordon River Extension), the average surface water concentration for iron is approximately 18 percent of the groundwater concentration. As indicated previously, the predicted average groundwater contribution is approximately 14 percent of inflows to the drainage network. This suggests that the measured surface water concentration may be directly related to the dilution of groundwater flowing into the drainage network.

In WBID 3278S (North Golden Gate), the average surface water concentration of iron is approximately 21 percent of the predicted groundwater concentration (Section 2.5). However, the predicted groundwater inflow to WBID 3278S comprises approximately 43 percent of the total inflow. The measured iron concentration in the surface water system is approximately half of what would be expected based on a relationship between the measured groundwater analytic data and the predicted inflow data. The data also suggests that surface water concentrations may be related to dilution of groundwater flowing into the drainage network. Additional studies should be conducted to further determine the impact of groundwater on iron concentration.

Table 2-21. Measured iron concentrations in the Golden Gate-Naples Bay Watershed

WBID	WBID Name	Measured Average Annual Concentration	
		Groundwater (µg/L)	Surface Water (µg/L)
3278S	North Golden Gate	2,805	604
3278K	Gordon River Extension	1,643	304

The iron impairment issue was also analyzed with a water quality model developed for the Golden Gate watershed. Model results confirm that groundwater is a large component of the surface water flow. During the year, the majority of the flow in numerous sections of the Golden Gate Main Canal network is from groundwater, and therefore has a high concentration of iron. **Figure 2-42** shows the average concentration of iron during April for the entire data analysis period. During the wet season, baseflow is approximately equal to stormwater runoff. However, during the dry season, baseflow contributes more than 70 percent of the surface water flow, indicating that the concentration of iron may be more pronounced during days when no stormwater runoff is present.

Evaluation of WBID Impairment

Using all of the water quality data for each WBID, Atkins confirmed the impairment status of all three FDEP impaired WBIDs (**Table 2-22**). An additional potentially impaired condition for fecal coliform in the Gordon River Extension was also identified. However, fecal coliform concentration was not identified as a parameter of concern at the watershed level using long-term station data. As mentioned previously, this is simply an evaluation of impairments based on a comparison of the measured data with State standards. Further source identification efforts are warranted.

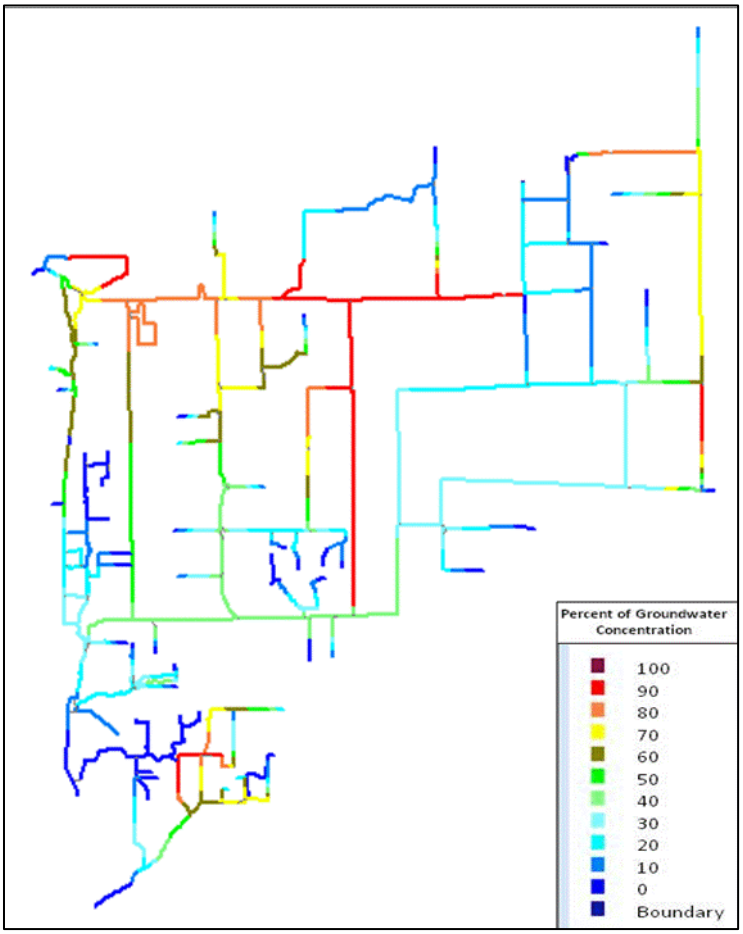


Figure 2-42. Percent of Iron Concentration in Canals Compared to Groundwater Concentration

Table 2-22. Impaired WBID comparison for Golden Gate-Naples Bay watershed

WBID#	Water Segment Name	Impairment Parameter	PBSJ Analysis
3278K	Gordon River Extension	Dissolved Oxygen	Confirms FDEP assessment
3278S	North Golden Gate	Dissolved Oxygen	Confirms FDEP assessment
3278S	North Golden Gate	Iron	Confirms FDEP assessment
3278K	Gordon River Extension	Fecal Coliform	Potential new impairment

2.2.5.3 Rookery Bay Watershed

The summary statistics for the Rookery Bay watershed WBID impairment analysis are provided in **Table 2-23**. Based upon the evaluation of the long term stations within the watershed, one parameter (dissolved oxygen) was identified as being of "potential concern", although none of the WBIDs that comprised the Rookery Bay watershed were identified by FDEP as impaired waters for dissolved oxygen. Consistently elevated chlorophyll a and nutrient values were not observed in the watershed. Similar to the Cocohatchee-Corkscrew watershed, the majority of the Rookery Bay watershed is comprised of natural areas (69%) predominantly in the northern and central portions.

Table 2-23. Water Quality Summary Statistics for the Rookery Bay Watershed indicating potential parameters of concern

Parameter	N	Min	Mean	Median	Max	Percent Exceed	Parameter of Concern
BOD, mg/l	35	0.8	2.1	2.0	4.7		
Chlorophyll-a, µg/L	147	3.0	5.2	3.2	24.6	2	N
Color, PCU	144	20	58	50	240	8	N
Conductivity, umhos/cm	143	182	1565	810	24400		
Copper, µg/L	50	0.30	3.33	1.00	54.00		
Dissolved Oxygen, mg/l	147	1.41	5.59	5.69	11.42	39	Y
Fecal Coliform, #/100 mL	131	1	107	40	2600	6	N
Iron, µg/L	45	0.1	249.3	220.0	770.0	0	N
Nitrate-Nitrite, mg/l	139	0.00	0.04	0.02	0.25		
Orthophosphate as P, mg/l	120	0.004	0.008	0.005	0.067		
Salinity, ppt	137	0.1	0.8	0.4	14.7		
Secchi Depth, m	138	0.20	1.01	1.00	1.80		
TKN, mg/l	129	0.24	0.70	0.63	4.30		
Total Nitrogen, mg/l	132	0.010	0.631	0.645	4.300	2	N
Total Phosphorus, mg/l	129	0.007	0.029	0.022	0.220	0	N
TSS, mg/l	122	2.0	3.6	2.0	56.0	6	N
Turbidity, NTU	88	0.4	1.6	1.4	7.5		
Unionized Ammonia, mg/l	124	0.0000	0.0009	0.0006	0.0088	0	N

Dissolved Oxygen

As in the other watersheds within Collier County, an evaluation of potential causative factor(s) was completed to identify the reasons for the potential dissolved oxygen concentrations below the regulatory standard of 5.0 mg/l for fresh water bodies. Based upon regressions between dissolved oxygen and TN, TP and color, a potential causative factor for the low dissolved oxygen

concentration in the watershed was identified as TP (**Table 2-24**). For each regression the best-fit curve was selected when comparing exponential, linear, and power relationships. While TP may be a causative factor, the low r^2 value (0.11) associated with the correlation between TP and dissolved oxygen concentrations suggests that multiple influences are contributing to dissolved oxygen fluctuations. The r^2 value can be interpreted as indicating that only 11 percent of the variation in levels of dissolved oxygen is explained by TP levels. In addition, the measured TP concentrations represent only about 10 percent of the screening level standard for Florida screens.

Table 2-24. Identification of causative factor in the Rookery Bay watershed for low dissolved oxygen values

Causative Factor	Method	p	r^2
Color	Power regression	0.0004	0.085
TN		>0.05	
TP	Power regression	0.0002	0.11

Factors influencing the depressed dissolved oxygen concentrations may include discharges from the forested landscape in the upstream portions of the watershed, groundwater contributions to the drainage network and anthropogenic pollutant loads.

As in the Cocohatchee watershed, a large percentage of the watershed consists of undeveloped wetland and forested landscapes within the Picayune Strand State Forest. It is likely that low dissolved oxygen concentrations in the upper portions of the watershed are a function of natural seasonal fluctuations which occur in these wetland environments.

In terms of groundwater, as shown in **Table 2-25,** computer model results indicate that the drainage network, particularly in the more developed western portion of the watershed, is strongly influenced by groundwater inflows. Approximately 68 percent of the total average annual flow and 85 percent of the dry season flow in the canal represents groundwater. There is little measured groundwater data for DO in the watershed; however, predicted groundwater concentrations of DO (Section 2.5) are less than 2.5 mg/L in the watershed. This information suggests that low DO levels in the canal network may be influenced by groundwater contributions. Groundwater monitoring within the watershed is recommended to verify the predicted groundwater concentrations.

Table 2-25. Water budget contributions to the drainage network in the Rookery Bay watershed

		Average Annual		Average Wet Season		Average Dry Season	
WBID	Name	Groundwater (inches)	Surface Water (inches)	Groundwater (inches)	Surface Water (inches)	Groundwater (inches)	Surface Water (inches)
3278V	Rookery Bay (Inland East)	3.34	6.09	2.15	5.48	1.19	0.61
3278Y	Rookery Bay (Inland West)	10.89	5.11	6.40	4.34	4.49	0.77

Anthropogenic impacts may be important particularly in the urban and agricultural areas of the watershed and their impact may be further assessed by local watershed assessments.

Evaluation of WBID Impairment

No impaired WBIDs have been identified by FDEP within the Rookery Bay watershed. However, Atkins identified two WBIDs with potential dissolved oxygen impairments (**Table 2-26**). As indicated previously, depressed dissolved oxygen concentrations may be influenced by natural conditions associated with the forested landscape in the upstream portions of the watershed. However, further studies are necessary to assess the cause of the impairment if in the future FDEP finds these areas impaired for DO.

Table 2-26. Impaired WBID comparison for Rookery Bay watershed

WBID#	Water Segment Name	Impairment Parameter	Atkins Analysis
3278V	Rookery Bay (Inland East Segment)	Dissolved Oxygen	Potential new impairment
3278Y	Rookery Bay (Inland West Segment)	Dissolved Oxygen	Potential new impairment

2.2.5.4 Faka Union Watershed

Summary statistics for the Faka-Union watershed WBID impairment analysis are provided in **Table 2-27**. Based upon the evaluation of the long term stations within the watershed, two parameters were identified as being of "potential concern"; color and dissolved oxygen. In terms of dissolved oxygen, concentrations were consistently below the regulatory standard of 5.0 mg/l for fresh water bodies.

An evaluation was completed to determine the causative factor likely responsible for the depressed dissolved oxygen concentrations. Regression analyses between dissolved oxygen and TN, TP and color indicated that the causative factor for the low dissolved oxygen discharge in the watershed may be color (**Table 2-28**). For each regression the best-fit curve was selected when comparing exponential, linear, and power relationships. As the vast majority (86%) of the Faka-Union watershed is comprised of natural areas, low dissolved oxygen concentrations in the watershed may be attributed to high color resulting from discharge from the adjacent natural landscape. However, the presence of areas where hydrologic processes have been altered (i.e., the Southern Golden Gate Estates drainage canals) suggests that further analysis are necessary to determine the actual cause of the observed low DO concentrations.

Table 2-27. Water Quality Summary Statistics for the Faka Union Watershed indicating potential parameters of concern

Parameter	N	Min	Mean	Median	Max	Percent Exceed	Parameter of Concern
BOD, mg/l	132	1.2	2.2	2.0	8.5		
Chlorophyll-a, µg/L	524	1.0	6.3	3.0	206.0	5	N
Color, PCU	509	5	62	50	240	12	Y
Conductivity, umhos/cm	528	211	2046	569	62047		
Copper, µg/L	166	0.15	1.37	1.00	17.70	0	N
Dissolved Oxygen, mg/l	542	1.02	6.02	5.96	14.54	37	Y
Fecal Coliform, #/100 mL	456	1	135	23	3850	8	N
Iron, µg/L	179	100.0	309.1	220.0	1390.0	2	N
Nitrate-Nitrite, mg/l	514	0.00	0.03	0.01	1.31		
Orthophosphate as P, mg/l	418	0.004	0.007	0.005	0.099		
Salinity, ppt	522	0.0	1.2	0.3	41.7		
Secchi Depth, m	319	0.30	1.19	1.20	2.50	34	Y
TKN, mg/l	463	0.04	0.60	0.52	4.90		
Total Nitrogen, mg/l	473	0.005	0.516	0.470	5.030	3	N
Total Phosphorus, mg/l	496	0.004	0.023	0.015	0.435	0	N
TSS, mg/l	441	2.0	3.1	2.0	62.0	6	N
Turbidity, NTU	331	0.1	1.8	1.3	7.1		
Unionized Ammonia, mg/l	449	0.0000	0.0006	0.0003	0.0127	0	N

Table 2-28. Identification of causative factor in the Faka Union watershed for low dissolved oxygen values

Causative Factor	Method	p	r^2
Color	Power regression	0.000	0.28
TN	Power regression	0.028	0.01
TP	Power regression	0.000	0.06

The impact of groundwater discharges into the drainage system was also evaluated based on results of the computer model. Model results shown in **Table 2-29** indicate that groundwater contributions are the primary source of inflows to the drainage network primarily during the dry season. In addition, measured and predicted groundwater concentrations of DO are less than 0.75 mg/L (Section 2.5). Groundwater contributions may also help explain the observed low dissolved oxygen concentrations.

Table 2-29. Water budget contributions to the drainage network in the Faka Union watershed

WBID	Name	Average Annual		Average Wet Season		Average Dry Season	
		Groundwater (inches)	Surface Water (inches)	Groundwater (inches)	Surface Water (inches)	Groundwater (inches)	Surface Water (inches)
3278H	Faka Union (North Segment)	11.71	7.81	7.70	6.91	4.00	0.90
3278I	Faka Union (South Segment)	14.67	3.94	9.41	3.66	5.26	0.28

Evaluation of WBID Impairment

No impaired WBIDs have been identified by FDEP within the Faka Union watershed. However, Atkins identified three potential impaired water bodies (**Table 2-30**). The Faka Union (South segment) had low dissolved oxygen values and elevated fecal coliform concentrations. Additionally, the north segment also was identified with low dissolved oxygen. If these impairments are verified by FDEP in the future, causative parameters and source identification work would be necessary.

Table 2-30. Impaired WBID comparison for Faka Union watershed

WBID#	Water Segment Name	Impairment Parameter	Atkins Analysis
3278I	Faka Union (South Segment)	Dissolved Oxygen	Potential new impairment
3278I	Faka Union (South Segment)	Fecal Coliform	Potential new impairment
3278H	Faka Union (North Segment)	Dissolved Oxygen	Potential new impairment

2.2.5.5 Fakahatchee Watershed

The vast majority of the Fakahatchee watershed is comprised of natural areas (85%). In fact, the Fakahatchee watershed has been identified by FDEP as a reference area due to the limited hydrologic impacts and absence of large-scale nutrient inputs. Therefore, water quality in this watershed is influenced by natural conditions.

The summary statistics for the Fakahatchee watershed are provided in **Table 2-31**. Based upon the evaluation of the long term stations within the watershed, three parameters were identified as being of "potential concern"; dissolved oxygen, fecal coliform and color. The Fakahatchee Strand (WBID 3278G) was declared verified impaired by FDEP for both dissolved oxygen and fecal coliform.

Table 2-31. Water Quality Summary Statistics for the Fakahatchee Watershed indicating potential waters of concern

Parameter	N	Min	Mean	Median	Max	Percent Exceed	Parameter of Concern
BOD, mg/l	107	1.5	2.3	2.0	9.8		
Chlorophyll-a, µg/l	435	3.0	9.3	3.0	404.5	9	N
Color, PCU	418	5	79	75	350	23	Y
Conductivity, umhos/cm	436	197	5599	604	72958		
Copper, µg/l	133	0.15	1.16	1.00	8.00		
Dissolved Oxygen, mg/l	448	0.24	3.80	3.34	12.77	75	Y
Fecal Coliform, #/100 mL	387	1	201	50	5450	12	Y
Iron, µg/l	147	0.1	213.8	150.0	1300.0	1	N
Nitrate-Nitrite, mg/l	428	0.00	0.02	0.01	0.22		
Orthophosphate as P, mg/l	351	0.004	0.020	0.006	0.368		
Salinity, ppt	441	0.0	3.4	0.3	50.3		
Secchi Depth, m	361	0.20	1.03	1.00	2.80		
TKN, mg/l	395	0.04	0.88	0.74	5.19		
Total Nitrogen, mg/l	393	0.005	0.716	0.650	5.320	7	N
Total Phosphorus, mg/l	407	0.004	0.047	0.020	1.180	3	N
TSS, mg/l	368	2.0	4.8	2.0	97.0	10	N
Turbidity, NTU	281	0.1	1.0	0.7	5.9		
Unionized Ammonia, mg/l	353	0.0000	0.0007	0.0003	0.0162	0	N

Dissolved Oxygen

Based upon the current regulatory criteria for the Fakahatchee watershed, dissolved oxygen levels were consistently below the regulatory threshold of 5.0 mg/l for fresh water bodies. An evaluation was completed to determine the causative factor likely responsible for the depressed dissolved oxygen concentrations. Based upon regressions between dissolved oxygen and TN, TP and color, the causative factor for the low dissolved oxygen discharge in the watershed was identified as color (**Table 2-32)**. For each regression the best-fit curve was selected when comparing exponential, linear, and power relationships. The identification of color as the primary causative factor further supports the explanation of the tendency for low dissolved oxygen values in this mostly undeveloped landscape.

In terms of groundwater impacts, the Fakahatchee watershed is a recharge area. Model results show a net annual loss to groundwater from the surface water system. Therefore, groundwater is unlikely to have an impact on DO concentrations in the surface drainage system.

Table 2-32. Identification of causative factor in the Fakahatchee watershed for low dissolved oxygen values

Causative Factor	Method	p	r^2
Color	Power regression	0.000	0.17
TN	Linear regression	0.033	0.01
TP	Power regression	0.000	0.06

Fecal Coliform Bacteria

Fecal Coliform bacteria were identified as a potential parameter of concern in the Fakahatchee watershed based on the analysis of the long-term sampling stations. Twelve percent of the 387 values exceeded the 400 #/100 mL criteria established for Class 3 waters. WBID 3278G (Fakahatchee Strand) was identified as verified impaired for bacteria as evaluated by FDEP. As was previously discussed, fecal coliform are used as an indicator of pathogenic organisms and are currently used to identify potential health threats. Further source identification efforts are warranted.

Evaluation of WBID Impairment

Using all of the water quality data for each WBID, Atkins confirmed the FDEP impairment status of WBID 3278G, Fakahatchee Strand (**Table 2-33**). WBID 3289I (Camp Keais) was also identified as potentially impaired for dissolved oxygen. The lower DO concentrations are likely influenced by the natural characteristics of the watershed. However, nutrient loading from agricultural areas in the northern portions of the watershed may also contribute to low DO concentrations. Monitoring is recommended to identify any potential contribution from agricultural areas.

Table 2-33. Impaired WBID comparison for Fakahatchee watershed

WBID#	Water Segment Name	FDEP Impaired Parameter	PBSJ Analysis
3278G	Fakahatchee Strand	Dissolved Oxygen	Confirm FDEP assessment
3278G	Fakahatchee Strand	Fecal Coliform	Confirm FDEP assessment
3259I	Camp Keais	Dissolved Oxygen	Potential new impairment

2.2.5.6 Okaloacoochee–SR29 Watershed

About 60 percent of the Okaloacooche-SR29 watershed is comprised of natural areas. However, agricultural development exists in the upper portions of the watershed. Therefore it is possible that some impairments represent natural conditions, whereas others may be caused by anthropogenic impacts.

The summary statistics for the Okaloacoochee/SR29 watershed are provided in **Table 2-34**. Based upon the evaluation of the long term stations within the watershed, four parameters were identified as being of "potential concern"; dissolved oxygen, iron, total nitrogen, and color. Iron and dissolved oxygen were found to be impairment parameters by FDEP in this watershed.

Dissolved Oxygen

FDEP determined that WBIDs 3278T (Okaloacoochee) and 3278W (Silver Strand) are impaired for dissolved oxygen. Based upon the current dissolved oxygen criteria for the Okaloacooche-SR29 watershed, dissolved oxygen levels were consistently below the regulatory standard of 5.0 mg/l for fresh water bodies. Similar to the analyses conducted for the other watersheds, an evaluation was completed to determine the potential causative factor for the depressed dissolved oxygen concentration. Regression analyses between dissolved oxygen and TN, TP and color indicated that the most likely causative factor for the low dissolved oxygen level in the watershed was color (**Table 2-35**). For each regression the best-fit curve was selected when comparing exponential, linear, and power relationships. The identification of color as the causative factor is statistically significant, but it has a very low r^2 value, suggesting other factors may be influencing dissolved oxygen levels. For example, the data indicate that the 16 percent exceedence of TN occurs primarily in the upper portion of the watershed, which includes significant agricultural development.

Predicted groundwater concentrations (Section 2.5) and baseflow contributions may also be a contributing factor to low dissolved oxygen levels. **Table 2-36** shows the groundwater and surface water components of total flows in the drainage system from the associated WBIDs. Computer model results indicate that average annual groundwater contribution in the Barron River and Silver Strand canal amount to 20 and 38 percent, respectively. During the dry season, groundwater accounts for 39 and 77 percent of the total flow, respectively. Therefore, groundwater may be a significant factor explaining the DO levels, particularly in the Silver Strand canal, which has been found impaired for this parameter. Further site-specific analyses may be necessary to assess this finding.

Table 2-34. Water Quality Summary Statistics for the Okaloacoochee/SR29 Watershed indicating potential waters of concern

Parameter	N	Min	Mean	Median	Max	Percent Exceed	Parameter of Concern
BOD, mg/l	38	1.6	2.3	2.0	5.1		
Chlorophyll-a, µg/L	266	1.0	6.5	3.0	69.4	11	N
Color, PCU	255	5	90	80	450	31	Y
Conductivity, umhos/cm	297	103	491	502	905		
Copper, µg/L	73	0.15	1.35	1.10	6.29		
Dissolved Oxygen, mg/l	299	0.12	2.57	2.36	8.60	91	Y
Fecal Coliform, #/100 mL	243	1	112	33	3050	5	N
Iron, µg/L	49	0.1	478.2	250.0	1910.0	18	Y
Nitrate-Nitrite, mg/l	295	0.00	0.02	0.01	0.37		
Orthophosphate as P, mg/l	254	0.002	0.019	0.010	0.312		
Salinity, ppt	154	0.0	0.2	0.2	0.5		
Secchi Depth, m	262	0.10	1.28	1.25	2.60		
TKN, mg/l	282	0.04	1.23	0.90	35.35		
Total Nitrogen, mg/l	280	0.005	1.124	0.811	35.353	16	Y
Total Phosphorus, mg/l	290	0.006	0.049	0.026	0.470	2	N
TSS, mg/l	238	2.0	4.6	4.0	174.0	5	N
Turbidity, NTU	210	0.2	1.4	0.7	20.0		
Unionized Ammonia, mg/l	267	0.0000	0.0018	0.0003	0.3241	1	N

Table 2-35. Identification of causative factor in the Okaloacooche-SR29 watershed for low dissolved oxygen values

Causative Factor	Method	p	r^2
Color	Exponential regression	0.0001	0.06
TN		>0.05	
TP		>0.05	

Table 2-36. Water budget contributions to the drainage system in the Okaloacoochee-SR29 watershed

WBID	Name	Average Annual		Average Wet Season		Average Dry Season	
		Ground–water (inches)	Surface Water (inches)	Ground–water (inches)	Surface Water (inches)	Ground–water (inches)	Surface Water (inches)
3261C	Barron River Canal	2.88	11.36	1.50	9.16	1.38	2.20
3278T	Okaloacoochee Slough	0.04	3.22	0.03	2.51	0.01	0.70
3278W	Silver Strand (1)	3.04	5.04	1.40	4.56	1.64	0.48
(1) Flows are expressed in inches over the WBID area							

Iron

FDEP identified WBID 3261C (Barron River Canal) as impaired for iron. The Okaloacooche-SR29 watershed iron concentrations were sufficiently elevated to classify the entire watershed as of "potential concern" in regards to elevated iron concentrations. Analytical data show that nine (9) of the 49 samples had total iron concentrations higher than the 1,000 µg/L Class 3 regulatory standard. **Table 2-37** shows iron concentration statistics in the Barron River WBID both in the Water Table aquifer and the drainage network. The data seem to indicate that groundwater contributions from the WBID itself are not causing the elevated iron concentrations in the surface water system. However, the table also shows that groundwater iron concentrations in the WBID representing the Silver Strand, which discharges into the Barron River, are 180 percent higher than the regulatory standard. As indicated previously, groundwater contributions in the Silver Strand WBID represent 38 percent of the average annual flow and 77 percent of the dry season flow. The elevated groundwater concentrations in WBID 3278W, paired with the high percentage of baseflow suggest that iron concentrations in the downstream canal may be due to groundwater contributions from upstream.

As described previously in this report, sources of iron may also be of anthropogenic nature. The County may elect to conduct further analyses in this watershed to confirm the sources of the elevated iron concentrations in the Barron River.

Evaluation of WBID Impairment

Per the evaluation of the water quality data for each WBID, Atkins confirmed the impairment status of all three FDEP impaired WBIDs. As shown in **Table 2-38,** three additional potential impairment locations were also identified. Dissolved oxygen and iron were both identified as parameters of concern in the watershed analysis. However, the copper and chlorophyll *a* impairments resulted from the analysis of data for each WBID.

Table 2-37. Measured Iron concentrations in the Okaloacoochee-SR29 watershed

WBID	Name	Average Iron Concentration (ug/L)		Maximum Iron Concentration (ug/L)	
		Water Table Aquifer	Drainage Network	Water Table Aquifer	Drainage Network
3278W	Silver Strand	1817	No data	5880	No data
3261C	Barron River	309	663.2	510	1910

Table 2-38. Impaired WBID comparison for Okaloacoochee/SR29 watershed

WBID#	Water Segment Name	FDEP Impaired Parameter	PBSJ Analysis
3261C	Barron River Canal	Iron	Confirm FDEP assessment
3278T	Okaloacoochee	Dissolved Oxygen	Confirm FDEP assessment
3278W	Silver Strand	Dissolved Oxygen	Confirm FDEP assessment
3278W	Silver Strand	Copper	Potential new impairment
3278T	Okaloacoochee	Chlorophyll a	Potential new impairment
3261C	Barron River Canal	Dissolved Oxygen	Potential new impairment

In regards to the potential copper impairments for WBID 3278W (Silver Strand), four water quality locations provide data within the water body. However, all of the copper data were collected at a single location (station 21FLSFWMIMKBRN). It is recommended that the additional water quality samples be collected at other stations within the WBID to assess the extent of the problem. It is possible that water samples collected near boardwalks and pilings that are constructed from pressure-treated lumber show localized effects of copper leaching. It is also possible that the problem is generic to the WBID, in which case, action should be taken to eliminate anthropogenic sources.

In terms of Chlorophyll *a*, a review of the data analyzed for Okaloacoochee WBID (3278T) showed that five water quality stations exist in the WBID. However, 76 of the 78 chlorophyll *a* data points came from one station (Okala858). A preliminary investigation indicates that TP may be the causative factor resulting in elevated phytoplankton production at this location. However, a more detailed evaluation of the data and additional sampling from other water quality stations is recommended.

2.2.6 Conclusions

The FDEP has identified multiple impairments of individual WBIDs for several water quality parameters in Collier County. Results of water quality analyses at the watershed level suggest that

DO is the main parameter of concern in the context of FDEP's TMDL program. The data analyses for individual WBIDS conducted as part of this project are consistent with the FDEP findings, although additional potential water quality impairments are possible within some WBIDS. Following is a summary of the project findings.

- No discrepancies were found between FDEPs and Atkins impaired WBID designation. However, Atkins identified 16 new potential impairments. The difference is likely due to the incorporation of additional data with the IWR Run 39 dataset as well as differences in the analysis period.
- The most widespread "impairments" or "parameters of concern" appear to be those for dissolved oxygen. Causative factors include anthropogenic pollution loads, natural surface water discharges from forested landscapes, and groundwater inflows.
- Anthropogenic loads of nutrients and organic material are often the cause of low dissolved oxygen concentrations in urbanized areas. Discharge of pollution loads is generally best achieved by source control.
- High levels of color appear to be related to influences of high-tannin water from the extensive forested landscapes in areas such as the Corkscrew Swamp and the Fakahatchee Strand. In turn, increased tannin-rich waters during the wet season appear to result in depressed levels of dissolved oxygen.
- Groundwater discharges are significant in several watersheds. These discharges contribute to the observed low DO concentration conditions, particularly during the dry season.
- With the exception of Lake Trafford, freshwater water bodies in Collier County are not characterized by consistently high levels of TN or TP. The water quality benefits that seem to be occurring in response to the dredging project for Lake Trafford should be considered prior to implementing any water quality "fixes", as water quality may already be improved sufficiently that further activities are not needed.
- While many of the freshwater water bodies within the watersheds of Collier County are designated as "impaired" for fecal coliform bacteria, these indicator organisms do not specifically identify humans as a source of contamination (Fujioka 2001, and Fujioka et al. 1999). Additional efforts aimed at source identification are appropriate.

2.3 SURFACE WATER POLLUTANT LOADING

An approach that has been used by federal and state regulatory agencies to quantify the amount of pollutants discharged into a water body is to estimate the average annual pollutant loads. Land use based pollutant loading can serve as a useful accounting method for determining the relative contribution of various land use types to total pollutant load. In addition, establishing baseline and existing condition pollutant loads allows for a relative comparison as a performance of current pollutant loading to that resulting once improvement projects are implemented. The calculation of pollution loads for the management plans considered strictly anthropogenic loads as the focus of watershed protection and restoration is the mitigation of anthropogenic impacts.

2.3.1 Methods

Pollution loads discharged to the Collier County receiving water bodies were estimated using a Pollutant Loading and Removal Model. The model computes the loads using a variation of what is referred to as the USEPA Simple Method.

$$L_I = (0.227)(R)(EMC)(A)$$

where:

L_I = Annual pollutant load (lb/yr)
R = Annual average runoff (in/yr)
EMC = Event mean concentration of a pollutant (mg/l)
A = Catchment area (acres)

Runoff volume was determined using flow data from the MIKE SHE / MIKE 11 hydrologic & hydraulic (H&H) existing conditions computer model. The EMC is the mean concentration of a chemical parameter expected in the stormwater runoff discharged from a particular land use category during a typical (average) storm event. The area was considered that of each grid cell in the model domain, which amounts to approximately 51.6 acres.

Anthropogenic pollutant loads were estimated for the pollutants listed in **Table 2-39**. These are the same pollutants identified as parameters of concern in the SWFFS.

Table 2-39. List of Evaluated Pollutants

Conventional Pollutants	Heavy Metals
Total Suspended Solids (TSS)	Copper (Cu)
Total Nitrogen (TN)	Zinc (Zn)
Total Phosphorus (TP)	Lead (Pb)
5-Day Biological Oxygen Demand (BOD_5)	

Iron is also a parameter of water quality concern in Collier County. However, pollutant loads were not calculated because EMCs for iron are usually not available. Anthropogenic iron pollution is either site specific or sources are of natural origin.

The pollution loads calculated as described above represent the loads generated in the watershed (gross pollutant load). The pollutant loads discharged into the County's drainage system are referred to as net loads and they consider the effects of runoff treatment provided by the existing Best Management Practices (BMPs). The method used to estimate the pollutant removal capacity of the BMPs is described later in the report. It should be noted that pollutant loads should be not be compared to in-stream water quality measurements, as the land use base loading does not account for fate, transport and degradation of pollutants, nor ambient in-stream conditions and processes. Comparisons to in-stream data should be done in combination with a water quality model that incorporates in-stream chemical processes.

Following are descriptions of the land use analysis performed for estimating pollutant loads, as well as a detailed description of the pollutant load calculation method.

2.3.1.1 Land Use Analysis

The land use distribution for this analysis was made consistent with both the H&H model and the SWFFS. Therefore, it represents 2007 land use conditions. The land use maps incorporated in the H&H model were converted to a GIS-compatible format. The land use within each cell (1,500 x 1,500 feet) within the model domain grid was set based on its dominant use. The land use categories are shown in **Table 2-40**.

2.3.1.2 Pollution Load Calculation Method

As indicated previously, pollutant load calculation is based on expected annual runoff volume, the stormwater event mean concentrations (EMC), and the area of each cell.

2.3.1.3 Expected Annual Runoff Volume

The H&H model results for the simulation period considered for the watershed analysis were used to generate water balance data for every model grid cell. Because the simulation period includes a variety of rainfall conditions, it is reasonable to assume that it provides a reasonable estimate of annual average runoff volume.

Table 2-40. Land Use Categories in the H&H Model

Land Use Code	MIKE SHE Land Use	Land Use Type
1	Citrus	Agriculture
2	Pasture	Agriculture
5	Truck Crops	Agriculture
6	Golf Course	Agriculture
7	Bare Ground	Natural
8	Mesic Flatwood	Natural
9	Mesic Hammock	Natural
12	Hydric Flatwood	Natural
13	Hydric Hammock	Natural
14	Wet Prairie	Natural
16	Marsh	Natural
17	Cypress	Natural
18	Swamp Forest	Natural
19	Mangrove	Natural
20	Water	Natural
41	Urban Low Density	Urban
42	Urban Medium Density	Urban
43	Urban High Density	Urban

The runoff volume discharged from each cell was determined based on the product of expected runoff depth and the area of each cell (2,250,000 ft^2). Runoff depth was calculated as:

Runoff Depth = Overland flow to canals and rivers + drainage from the unsaturated zone.

The overland flow to canals and rivers includes cell to river flow and cell to cell boundary flow. The drainage from the unsaturated zone includes water that was captured by stormwater management features and agricultural drains and eventually discharges to the canals and rivers.

Because the MIKE SHE / MIKE 11 model includes a larger number of components than the typical surface water hydrologic model, errors are introduced when determining the runoff depth from a single cell. These errors are due primarily to the regional nature of some of the modelling processes and their spatial variations. For example, in the event that a cell represents a low area and ponds water, a certain volume of rainfall would go to storage and the runoff estimate from the cell may show as negative. To reduce the effects of these spatial variations, the runoff volume from each cell was adjusted by a smoothing process that consisted of averaging the runoff using a 12-cell grid of neighbouring cells. This produced stable and satisfactory results for pollution load calculations.

2.3.1.4 Event Mean Concentrations (EMCs)

As indicated previously, the EMC is the mean concentration of a chemical parameter expected in the stormwater runoff discharged from a particular land use category during a typical (average) storm

event. For consistency with previous work, the EMCs used in this analysis were obtained from the SWFFS Water Quality Model Development report. Because the focus of this analysis is on anthropogenic loads, the EMCs associated with the natural areas were assumed to be zero (0). **Table 2-41** lists the EMCs by land use category and chemical parameter.

2.3.1.5 Pollution Load Estimates By H&H Model Grid Cell

As described previously, gross pollutant loads were estimated for each cell in the model domain. Those loads were then modified to reflect the pollution removal effect of Best Management Practices (BMPs), such as detention ponds that exist throughout the County. The net loads are pollution loads that enter the drainage network, and therefore discharge into the estuary systems.

The method used to assess the extent of BMPs in the project area considered that current stormwater regulations in Florida came into effect in 1984. Therefore, development occurring since the mid to late 1980s includes treatment facilities that meet current regulatory standards.

To account for the presence of BMPs, a land use map from the 1980s was compared to the current land use map to identify the areas developed during the period. The SFWMD publishes land use data every number of years and the 1988 land use data base was determined to be the most appropriate for the analysis, as it was assumed that it would take a few years for the regulations to affect development. **Figure 2-43** illustrates the extent of urban development for the periods before and after 1988. Development from the period after 1988 was assumed to discharge stormwater runoff treated to current regulatory standards.

As the most commonly used BMP in Collier County is wet detention, net pollutant load calculations considered the typical pollutant reduction efficiency at this type of facility. They are listed in **Table 2-42**.

Table 2-41. Event Mean Concentrations (EMCs) by Land Use and Chemical Parameter

Land Use Code	H&H Model Land Use	SWFFS Land Use Category	Pollutant EMC's for Loading Analysis (mg/l)						
			TN	TP	BOD	TSS	CU	PB	ZN
1	Citrus	Agricultural/Pasture/Golf Course	3.18	0.64	4	13	0.004	0.005	0.023
2	Pasture	Agricultural/Pasture/Golf Course	3.18	0.64	4	13	0.004	0.005	0.023
5	Truck Crops	Agricultural/Pasture/Golf Course	3.18	0.64	4	13	0.004	0.005	0.023
6	Golf Course	Agricultural/Pasture/Golf Course	3.18	0.64	4	13	0.004	0.005	0.023
7	Bare Ground	Forest/Rural/Open	1.16	0.05	1	11	0.001	0.001	0
8	Mesic Flatwood	Forest/Rural/Open	0	0	0	0	0	0	0
9	Mesic Hammock	Forest/Rural/Open	0	0	0	0	0	0	0
12	Hydric Flatwood	Forest/Rural/Open	0	0	0	0	0	0	0
13	Hydric Hammock	Forest/Rural/Open	0	0	0	0	0	0	0
14	Wet Prairie	Water/Wetlands	0	0	0	0	0	0	0
16	Marsh	Water/Wetlands	0	0	0	0	0	0	0
17	Cypress	Water/Wetlands	0	0	0	0	0	0	0
18	Swamp Forest	Water/Wetlands	0	0	0	0	0	0	0
19	Mangrove	Water/Wetlands	0	0	0	0	0	0	0
20	Water	Water/Wetlands	0	0	0	0	0	0	0
41	Urban Low Density	Low Density Residential	2.02	0.39	13	27	0.012	0.016	0.051
42	Urban Medium Density	Medium Density Residential	2.34	0.39	9	59	0.023	0.016	0.073
43	Urban High Density	Urban and Built Up	2.45	0.37	8	72	0.031	0.015	0.065

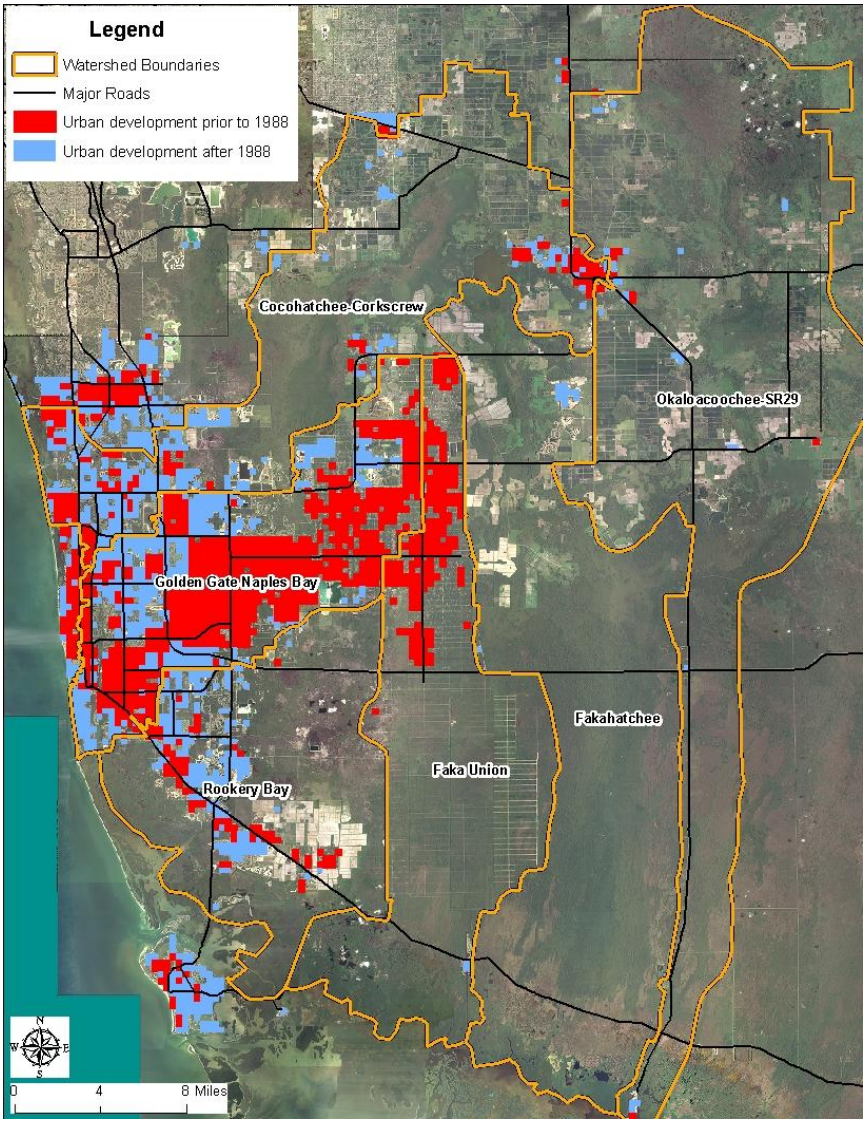


Figure 2-43, Areas of Development Before and After Current Stormwater Regulations Base Year for Analysis 1988

Table 2-42. Pollutant Removal Efficiency of Wet Detention Ponds

Chemical Parameter	Removal Efficiency (%)
Total Suspended Solids (TSS)	80
Total Nitrogen (TN)	30
Total Phosphorus (TP)	65
5-Day Biological Oxygen Demand (BOD-5)	80
Copper (Cu)	65
Lead (Pb)	80
Zinc (Zn)	80

2.3.2 Results

The estimated annual pollutant loads by cell were aggregated to reflect loads by WBID and watershed. They are shown in **Tables 2-43 through 2-49**. In addition, the tables show the load by unit area (lbs/acre/year) and the pollution load performance score to better reflect areas of concern. The scoring method is described in detail in section 4.3 of this volume. Results show that the WBIDs of most concern in terms of nutrient pollution loads are in the Cocohatchee–Corkscrew and the Golden Gate-Naples Bay Watersheds, particularly the coastal segment of Naples Bay and the Gordon River Extension. The Golden Gate-Naples Bay Watershed received the lowest average scores for the other pollutants because of the presence of areas of urban development with no treatment. It should be noted that the Lake Trafford WBID shows a pollution load of zero (0). That is because the WBID includes only the lake itself. The drainage area contributing to Lake Trafford includes WBIDs 3278E, Cow Slough, and 3278L, the Immokalee Basin.

Table 2-43. Total Suspended Solids Pollution Loads by WBID and Watershed

Watershed	WBID	WBID Name	Area (Acres)	Net Load (lbs/yr)	Net Load per Acre (lbs/ac/yr)	Performance Score
Cocohatchee - Corkscrew	3259A	COCOHATCHEE RIVER	3151	73414	23.3	8
	3259B	DRAINAGE TO CORKSCREW	21333	291250	13.7	9
	3259W	LAKE TRAFFORD	1395	0	0.0	10
	3259Z	LITTLE HICKORY BAY	620	25268	40.8	7
	3278C	COCOHATCHEE GOLF COURSE DISCHARGE	2066	47072	22.8	8
	3278D	COCOHATCHEE (INLAND SEGMENT)	25930	554807	21.4	9
	3278E	COW SLOUGH	11983	169129	14.1	9
	3278F	CORKSCREW MARSH	53461	431283	8.1	10
	3278L	IMMOKALEE BASIN	8368	215006	25.7	8
Total Watershed			128306	1807230	14.09	9
Golden Gate - Naples Bay	3278K	GORDON RIVER EXTENSION	5424	305600	56.3	5
	3278R	NAPLES BAY (COASTAL SEGMENT)	9246	1196629	129.4	0
	3278S	NORTH GOLDEN GATE	72624	1760485	24.2	8
Total Watershed			87293	3262713	37.38	7
Rookery Bay	3278U	ROOKERY BAY (COASTAL SEGMENT)	26033	144194	5.5	10
	3278V	ROOKERY BAY (INLAND EAST SEGMENT)	53719	444148	8.3	10
	3278Y	ROOKERY BAY (INLAND WEST SEGMENT)	14876	274768	18.5	9
Total Watershed			94628	863110	9.12	10
Faka Union - Fakahatchee - Okaloacoochee SR29	3278H	FAKA UNION (NORTH SEGMENT)	27221	214664	7.9	10
	3278I	FAKA UNION (SOUTH SEGMENT)	60227	1738	0.0	10
	3259I	CAMP KEAIS	55320	887706	16.0	9
	3278G	FAKAHATCHEE STRAND	94112	13370	0.1	10
	3261C	BARRON RIVER CANAL	33368	2622	0.1	10
	3278T	OKALOACOOCHEE SLOUGH	125413	1180126	9.4	10
	3278W	SILVER STRAND	54236	1537972	28.4	8
Total Watershed			449897	3838198	8.53	10

Table 2-44. Total Nitrogen Pollution Loads by WBID and Watershed

Watershed	WBID	WBID Name	Area (Acres)	Net Load (lbs/yr)	Net Load per Acre (lbs/ac/yr)	Performance Score
Cocohatchee - Corkscrew	3259A	COCOHATCHEE RIVER	3151	3973	1.26	8
	3259B	DRAINAGE TO CORKSCREW	21333	71326	3.34	3
	3259W	LAKE TRAFFORD	1395	0	0.00	10
	3259Z	LITTLE HICKORY BAY	620	1383	2.23	5
	3278C	COCOHATCHEE GOLF COURSE DISCHARGE	2066	4337	2.10	6
	3278D	COCOHATCHEE (INLAND SEGMENT)	25930	75503	2.91	4
	3278E	COW SLOUGH	11983	31528	2.63	5
	3278F	CORKSCREW MARSH	53461	100424	1.88	6
	3278L	IMMOKALEE BASIN	8368	32341	3.86	2
Total Watershed			128306	320814	2.50	5
Golden Gate - Naples Bay	3278K	GORDON RIVER EXTENSION	5424	20392	3.76	2
	3278R	NAPLES BAY (COASTAL SEGMENT)	9246	51998	5.62	0
	3278S	NORTH GOLDEN GATE	72624	167717	2.31	5
Total Watershed			87293	240107	2.75	4
Rookery Bay	3278U	ROOKERY BAY (COASTAL SEGMENT)	26033	17113	0.66	9
	3278V	ROOKERY BAY (INLAND EAST SEGMENT)	53719	94441	1.76	7
	3278Y	ROOKERY BAY (INLAND WEST SEGMENT)	14876	27643	1.86	6
Total Watershed			94628	139197	1.47	7
Faka Union - Fakahatchee - Okaloacoochee SR29	3278H	FAKA UNION (NORTH SEGMENT)	27221	26815	0.99	8
	3278I	FAKA UNION (SOUTH SEGMENT)	60227	130	0.00	10
	3259I	CAMP KEAIS	55320	215056	3.89	2
	3278G	FAKAHATCHEE STRAND	94112	3271	0.03	10
	3261C	BARRON RIVER CANAL	33368	312	0.01	10
	3278T	OKALOACOOCHEE SLOUGH	125413	287563	2.29	5
	3278W	SILVER STRAND	54236	370499	6.83	0
Total Watershed			449897	903646	2.01	6

Table 2-45. Total Phosphorus Pollution Loads by WBID and Watershed

Watershed	WBID	WBID Name	Area (Acres)	Net Load (lbs/yr)	Net Load per Acre (lbs/ac/yr)	Performance Score
Cocohatchee - Corkscrew	3259A	COCOHATCHEE RIVER	3151	520	0.17	8
	3259B	DRAINAGE TO CORKSCREW	21333	14225	0.67	1
	3259W	LAKE TRAFFORD	1395	0	0.00	10
	3259Z	LITTLE HICKORY BAY	620	204	0.33	6
	3278C	COCOHATCHEE GOLF COURSE DISCHARGE	2066	423	0.20	8
	3278D	COCOHATCHEE (INLAND SEGMENT)	25930	12003	0.46	4
	3278E	COW SLOUGH	11983	6083	0.51	4
	3278F	CORKSCREW MARSH	53461	19883	0.37	5
	3278L	IMMOKALEE BASIN	8368	6228	0.74	0
Total Watershed			128306	59569	0.46	4
Golden Gate - Naples Bay	3278K	GORDON RIVER EXTENSION	5424	3188	0.59	2
	3278R	NAPLES BAY (COASTAL SEGMENT)	9246	7628	0.83	0
	3278S	NORTH GOLDEN GATE	72624	26280	0.36	6
Total Watershed			87293	37096	0.42	5
Rookery Bay	3278U	ROOKERY BAY (COASTAL SEGMENT)	26033	3067	0.12	9
	3278V	ROOKERY BAY (INLAND EAST SEGMENT)	53719	18334	0.34	6
	3278Y	ROOKERY BAY (INLAND WEST SEGMENT)	14876	3652	0.25	7
Total Watershed			94628	25054	0.26	7
Faka Union - Fakahatchee - Okaloacoochee SR29	3278H	FAKA UNION (NORTH SEGMENT)	27221	3890	0.14	9
	3278I	FAKA UNION (SOUTH SEGMENT)	60227	25	0.00	10
	3259I	CAMP KEAIS	55320	42964	0.78	0
	3278G	FAKAHATCHEE STRAND	94112	658	0.01	10
	3261C	BARRON RIVER CANAL	33368	24	0.00	10
	3278T	OKALOACOOCHEE SLOUGH	125413	57779	0.46	4
	3278W	SILVER STRAND	54236	74376	1.37	0
Total Watershed			449897	179716	0.40	6

Table 2-46. Total BOD-5 Pollution Loads by WBID and Watershed

Watershed	WBID	WBID Name	Area (Acres)	Net Load (lbs/yr)	Net Load per Acre (lbs/ac/yr)	Performance Score
Cocohatchee - Corkscrew	3259A	COCOHATCHEE RIVER	3151	10674	3.4	8
	3259B	DRAINAGE TO CORKSCREW	21333	90438	4.2	8
	3259W	LAKE TRAFFORD	1395	0	0.0	10
	3259Z	LITTLE HICKORY BAY	620	4161	6.7	7
	3278C	COCOHATCHEE GOLF COURSE DISCHARGE	2066	6145	3.0	9
	3278D	COCOHATCHEE (INLAND SEGMENT)	25930	125610	4.8	8
	3278E	COW SLOUGH	11983	50622	4.2	8
	3278F	CORKSCREW MARSH	53461	140057	2.6	9
	3278L	IMMOKALEE BASIN	8368	47590	5.7	7
Total Watershed			128306	475295	3.70	8
Golden Gate - Naples Bay	3278K	GORDON RIVER EXTENSION	5424	48487	8.9	5
	3278R	NAPLES BAY (COASTAL SEGMENT)	9246	159348	17.2	0
	3278S	NORTH GOLDEN GATE	72624	587334	8.1	6
Total Watershed			87293	795169	9.11	5
Rookery Bay	3278U	ROOKERY BAY (COASTAL SEGMENT)	26033	29465	1.1	10
	3278V	ROOKERY BAY (INLAND EAST SEGMENT)	53719	130833	2.4	9
	3278Y	ROOKERY BAY (INLAND WEST SEGMENT)	14876	49438	3.3	9
Total Watershed			94628	209735	2.22	9
Faka Union - Fakahatchee - Okaloacoochee SR29	3278H	FAKA UNION (NORTH SEGMENT)	27221	101807	3.7	8
	3278I	FAKA UNION (SOUTH SEGMENT)	60227	837	0.0	10
	3259I	CAMP KEAIS	55320	270057	4.9	8
	3278G	FAKAHATCHEE STRAND	94112	4114	0.0	10
	3261C	BARRON RIVER CANAL	33368	291	0.0	10
	3278T	OKALOACOOCHEE SLOUGH	125413	362788	2.9	9
	3278W	SILVER STRAND	54236	467854	8.6	5
Total Watershed			449897	1207748	2.68	9

Table 2-47. Total Copper (Cu) Pollution Loads by WBID and Watershed

Watershed	WBID	WBID Name	Area (Acres)	Net Load (lbs/yr)	Net Load per Acre (lbs/ac/yr)	Performance Score
Cocohatchee - Corkscrew	3259A	COCOHATCHEE RIVER	3151	33	0.0	8
	3259B	DRAINAGE TO CORKSCREW	21333	92	0.0	8
	3259W	LAKE TRAFFORD	1395	0	0.0	10
	3259Z	LITTLE HICKORY BAY	620	11	0.0	7
	3278C	COCOHATCHEE GOLF COURSE DISCHARGE	2066	28	0.0	9
	3278D	COCOHATCHEE (INLAND SEGMENT)	25930	266	0.0	8
	3278E	COW SLOUGH	11983	62	0.0	8
	3278F	CORKSCREW MARSH	53461	142	0.0	9
	3278L	IMMOKALEE BASIN	8368	80	0.0	7
Total Watershed			128306	714	0.01	8
Golden Gate - Naples Bay	3278K	GORDON RIVER EXTENSION	5424	135	0.0	5
	3278R	NAPLES BAY (COASTAL SEGMENT)	9246	520	0.1	0
	3278S	NORTH GOLDEN GATE	72624	854	0.0	6
Total Watershed			87293	1510	0.02	5
Rookery Bay	3278U	ROOKERY BAY (COASTAL SEGMENT)	26033	61	0.0	10
	3278V	ROOKERY BAY (INLAND EAST SEGMENT)	53719	160	0.0	9
	3278Y	ROOKERY BAY (INLAND WEST SEGMENT)	14876	144	0.0	9
Total Watershed			94628	366	0.00	9
Faka Union - Fakahatchee - Okaloacoochee SR29	3278H	FAKA UNION (NORTH SEGMENT)	27221	112	0.0	8
	3278I	FAKA UNION (SOUTH SEGMENT)	60227	1	0.0	10
	3259I	CAMP KEAIS	55320	281	0.0	8
	3278G	FAKAHATCHEE STRAND	94112	4	0.0	10
	3261C	BARRON RIVER CANAL	33368	2	0.0	10
	3278T	OKALOACOOCHEE SLOUGH	125413	365	0.0	9
	3278W	SILVER STRAND	54236	480	0.0	5
Total Watershed			449897	1244	0.00	9

Table 2-48. Total Lead (Pb) Pollution Loads by WBID and Watershed

Watershed	WBID	WBID Name	Area (Acres)	Net Load (lbs/yr)	Net Load per Acre (lbs/ac/yr)	Performance Score
Cocohatchee - Corkscrew	3259A	COCOHATCHEE RIVER	3151	19	0.0	8
	3259B	DRAINAGE TO CORKSCREW	21333	113	0.0	9
	3259W	LAKE TRAFFORD	1395	0	0.0	10
	3259Z	LITTLE HICKORY BAY	620	7	0.0	7
	3278C	COCOHATCHEE GOLF COURSE DISCHARGE	2066	11	0.0	9
	3278D	COCOHATCHEE (INLAND SEGMENT)	25930	181	0.0	8
	3278E	COW SLOUGH	11983	66	0.0	9
	3278F	CORKSCREW MARSH	53461	175	0.0	9
	3278L	IMMOKALEE BASIN	8368	67	0.0	8
Total Watershed			128306	638	0.00	9
Golden Gate - Naples Bay	3278K	GORDON RIVER EXTENSION	5424	80	0.0	6
	3278R	NAPLES BAY (COASTAL SEGMENT)	9246	283	0.0	0
	3278S	NORTH GOLDEN GATE	72624	776	0.0	7
Total Watershed			87293	1139	0.01	6
Rookery Bay	3278U	ROOKERY BAY (COASTAL SEGMENT)	26033	43	0.0	10
	3278V	ROOKERY BAY (INLAND EAST SEGMENT)	53719	167	0.0	9
	3278Y	ROOKERY BAY (INLAND WEST SEGMENT)	14876	78	0.0	9
Total Watershed			94628	288	0.00	9
Faka Union - Fakahatchee - Okaloacoochee SR29	3278H	FAKA UNION (NORTH SEGMENT)	27221	125	0.0	9
	3278I	FAKA UNION (SOUTH SEGMENT)	60227	1	0.0	10
	3259I	CAMP KEAIS	55320	339	0.0	8
	3278G	FAKAHATCHEE STRAND	94112	5	0.0	10
	3261C	BARRON RIVER CANAL	33368	1	0.0	10
	3278T	OKALOACOOCHEE SLOUGH	125413	454	0.0	9
	3278W	SILVER STRAND	54236	587	0.0	7
Total Watershed			449897	1512	0.00	9

Table 2-49. Total Zinc (Zn) Pollution Loads by WBID and Watershed

Watershed	WBID	WBID Name	Area (Acres)	Net Load (lbs/yr)	Net Load per Acre (lbs/ac/yr)	Performance Score
Cocohatchee - Corkscrew	3259A	COCOHATCHEE RIVER	3151	86	0.0	9
	3259B	DRAINAGE TO CORKSCREW	21333	516	0.0	9
	3259W	LAKE TRAFFORD	1395	0	0.0	10
	3259Z	LITTLE HICKORY BAY	620	28	0.0	7
	3278C	COCOHATCHEE GOLF COURSE DISCHARGE	2066	49	0.0	9
	3278D	COCOHATCHEE (INLAND SEGMENT)	25930	766	0.0	8
	3278E	COW SLOUGH	11983	282	0.0	9
	3278F	CORKSCREW MARSH	53461	768	0.0	9
	3278L	IMMOKALEE BASIN	8368	303	0.0	8
Total Watershed			128306	2798	0.02	9
Golden Gate - Naples Bay	3278K	GORDON RIVER EXTENSION	5424	341	0.1	6
	3278R	NAPLES BAY (COASTAL SEGMENT)	9246	1231	0.1	1
	3278S	NORTH GOLDEN GATE	72624	2754	0.0	8
Total Watershed			87293	4325	0.05	7
Rookery Bay	3278U	ROOKERY BAY (COASTAL SEGMENT)	26033	186	0.0	10
	3278V	ROOKERY BAY (INLAND EAST SEGMENT)	53719	739	0.0	9
	3278Y	ROOKERY BAY (INLAND WEST SEGMENT)	14876	329	0.0	9
Total Watershed			94628	1254	0.01	9
Faka Union - Fakahatchee - Okaloacoochee SR29	3278H	FAKA UNION (NORTH SEGMENT)	27221	404	0.0	9
	3278I	FAKA UNION (SOUTH SEGMENT)	60227	3	0.0	10
	3259I	CAMP KEAIS	55320	1560	0.0	8
	3278G	FAKAHATCHEE STRAND	94112	24	0.0	10
	3261C	BARRON RIVER CANAL	33368	2	0.0	10
	3278T	OKALOACOOCHEE SLOUGH	125413	2085	0.0	9
	3278W	SILVER STRAND	54236	2697	0.0	7
Total Watershed			449897	6775	0.02	9

2.4 GROUND WATER QUANTITY

The purpose of this section is to present the results of the groundwater analyses completed using data extracted from the Collier County MIKE SHE/MIKE11 Existing Conditions Model (ECM). This section summarizes the predicted water budgets for each aquifer simulated by the ECM and discusses potential issues identified through the water budgeting process.

2.4.1 Ground Water Budgets

Three main aquifer systems have been identified in Collier County and Southwest Florida, the Surficial Aquifer System (SAS), the Intermediate Aquifer System (IAS), and the Floridan Aquifer System (FAS). Two aquifers are included in the SAS, the Water Table Aquifer and the Lower Tamiami Aquifer. A thin, semi-confining marl exists between the two aquifers (Weedman, 2002). The IAS also includes two aquifers, the Sandstone Aquifer and the Mid-Hawthorn Aquifer, which are separated by confining units. These two aquifer systems are simulated in the ECM. The Floridan Aquifer system is not represented in the ECM since it is isolated from the overlying aquifer and is not used as a source of drinking water. Atkins believes that the model is adequate to assess the conditions in Collier County; however, it is recognized that the groundwater calibration, primarily in the deeper aquifers, may be improved with additional effort. A detailed discussion of model limitations is presented in the Model Calibration Report.

The assessment of existing groundwater conditions involved detailed water budget calculations and spatial evaluations from ECM model results. Water budgets were set up to evaluate the lateral flow of water across model boundaries and internal basin delineation boundaries, and the vertical flow of water or exchange between aquifers.

The water budget analysis was conducted to understand the distribution of aquifer inflows and outflows. Data was extracted from the model result files using the water budget tool included in the software. The model results were then post processed to create water budgets for the entire model study area as well as for each of the watersheds, Cocohatchee-Corkscrew (CC), Golden Gate Naples Bay (GGNB), Rookery Bay (RB), and the combined Faka Union, Fakahatchee, and Okaloacoochee-SR29 (Eastern) watersheds.

Aquifer specific water budgets were generated for the model simulation period of January 1, 2002 through October 31, 2007. Budgets were developed for different time periods based on the availability of model simulation data. The time periods included:

- **Annual**: The annual water budget represents average conditions during each water year from 2003 to 2007. The budget represents the period from November 1–October 31. For example, the 2003 water year is the period from November 1, 2002–October 31, 2003.
- **Wet Season**: The wet season is defined as July 1–October 31. Wet season water budgets were developed for the years 2002–2007. This period includes all the wet seasons incorporated in the model simulation period.

- **Dry Season**: The dry season is defined as the period from November 1–June 30. For example, the 2003 dry season represents the period from November 2002–June 2003. Dry season water budgets were developed for the years 2003–2007.

Figure 2-44 is a schematic of the overall water budget components. As shown, the primary sources of inflow to a watershed are precipitation and applied irrigation. This water accumulates on the ground surface as basin storage, runs off as overland flow or infiltrates into the ground. Overland flow can be evaporated, discharged into the canal, or flow across watershed boundaries. Water budgets related to surface water runoff and baseflow are discussed in Technical Memorandum 1.1: Surface Water Quantity.

Water that infiltrates into the soils can be taken up by plants or percolate into the Water Table aquifer. This water can then be removed by plant uptake, lateral flows across the watershed boundary, pumping activities to meet potable water and irrigation needs, or by percolation to underlying aquifers. Any residual water is stored in the aquifer. Similar processes occur in each of the deeper aquifers.

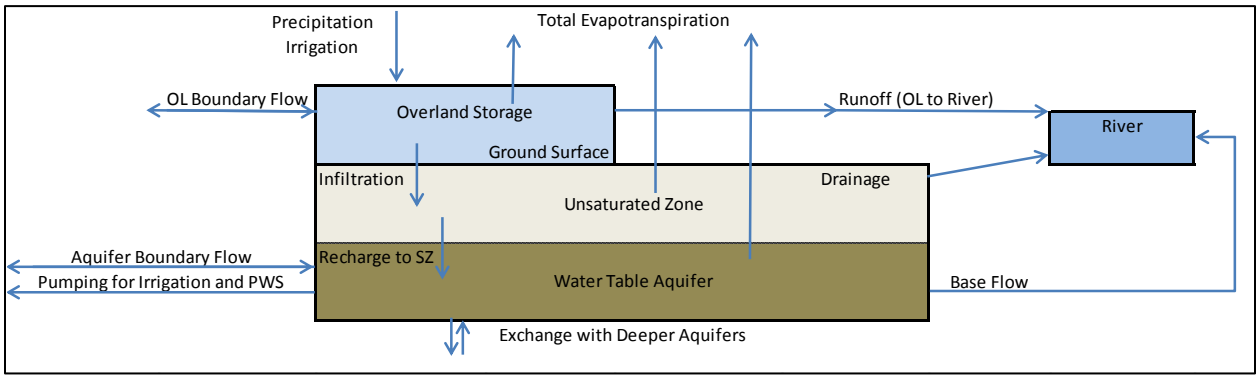


Figure 2-44. Components of Water Table Aquifer Budget

This section describes the results of the groundwater budget analysis in terms of annual average, wet season, and dry season. In addition, annual and seasonal groundwater budgets were developed for each watershed.

Groundwater Budget Analysis for the Water Table Aquifer

Table 2-50 and Figure 2-45 show the annual water year budget components for the study area. Tables 2-51 through 2-54 show the groundwater budgets for each watershed. Results indicate that approximately 93 percent of the water percolating downward from the unsaturated zone is lost due to evapotranspiration, baseflow, and pumping. The timing and volume of water percolating downward from the unsaturated zone is directly correlated to the timing of rainfall events. As an example, in the dry season of 2005, more than 10 inches of water infiltrated into the Water Table Aquifer. This volume exceeds most of the average wet season infiltration volumes and was caused by more than 18 inches of rainfall that occurred in June 2005.

Table 2-50. Water Table Aquifer, Annual Water Year and Seasonal Budgets for the Study Area

Period	Inflows (inches)				Outflows (inches)					Change in Storage (inches)
	Infiltration from Unsaturated Zone	Recharge from Canal Network	From Lower Tamiami	Boundary Inflow	Evapo-transpiration	Baseflow	To Lower Tamiami	Pumping	Boundary Outflow	
Average Water Year										
2003	16.69	0.31	8.23	0.16	10.39	4.21	7.99	0.28	0.83	1.69
2004	16.22	0.31	8.11	0.28	10.87	4.25	8.58	0.35	0.79	0.12
2005	18.58	0.35	7.99	0.31	10.94	4.84	9.21	0.35	0.75	1.18
2006	13.31	0.31	7.60	0.31	10.08	4.09	8.98	0.51	0.63	-2.72
2007	9.84	0.43	6.34	0.51	7.32	2.09	7.72	0.71	0.39	-1.06
Average	14.93	0.35	7.65	0.31	9.92	3.90	8.50	0.44	0.68	-0.16
Average Wet Season										
2002	6.50	0.04	2.48	0.08	3.50	1.54	2.60	0.04	0.20	1.14
2003	7.40	0.04	3.46	0.04	4.72	2.72	3.46	0.04	0.35	-0.28
2004	10.39	0.04	3.31	0.08	4.41	2.52	3.54	0.04	0.31	3.07
2005	8.62	0.04	3.43	0.08	4.80	3.03	3.94	0.00	0.35	0.04
2006	10.04	0.04	2.99	0.12	4.13	2.40	3.58	0.08	0.20	2.80
2007	9.37	0.08	2.48	0.20	2.87	1.34	2.99	0.08	0.12	4.72
Average	8.72	0.05	3.02	0.10	4.07	2.26	3.35	0.05	0.26	1.92
Average Dry Season										
2003	9.29	0.28	4.76	0.08	5.75	1.54	4.53	0.28	0.47	1.89
2004	5.83	0.28	4.80	0.16	6.50	1.77	5.00	0.31	0.47	-2.99
2005	10.35	0.31	4.61	0.24	6.18	1.81	5.31	0.35	0.39	1.46
2006	3.31	0.28	4.61	0.20	5.94	1.69	5.39	0.43	0.43	-5.51
2007	0.51	0.35	3.86	0.31	4.45	0.79	4.72	0.59	0.28	-5.79
Average	5.86	0.30	4.53	0.20	5.76	1.52	4.99	0.39	0.41	-2.19

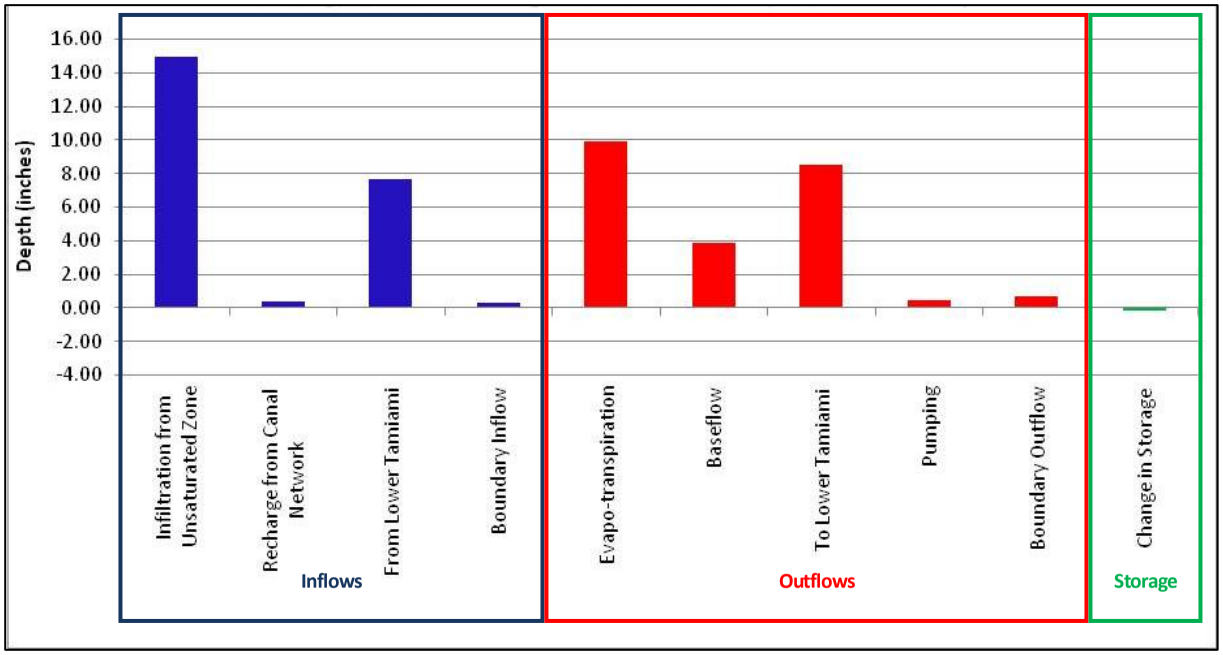


Figure 2-45. Water Table Aquifer, Average Annual Water Year Budget for the Study Area

Table 2-51. Water Table Aquifer, Annual Water Year and Seasonal Budgets for the Cocohatchee-Corkscrew Watershed

Period	Inflows (inches)				Outflows (inches)					Change in Storage (inches)
	Infiltration from Unsaturated Zone	Recharge from Canal Network	From Lower Tamiami	Boundary Inflow	Evapo-transpiration	Baseflow	To Lower Tamiami	Pumping	Boundary Outflow	
Annual Water Year Average										
2003	17.01	0.12	3.31	0.55	8.43	2.60	6.54	0.67	0.98	1.81
2004	16.46	0.16	3.50	0.63	9.17	2.52	7.05	0.83	0.98	0.16
2005	19.06	0.16	3.74	0.67	9.88	2.83	7.36	0.79	1.06	1.69
2006	12.64	0.20	3.03	0.67	7.95	2.20	7.40	1.22	0.91	-3.23
2007	8.74	0.20	1.77	0.59	3.74	0.75	6.73	1.57	0.79	-2.32
Average	14.78	0.17	3.07	0.62	7.83	2.18	7.02	1.02	0.94	-0.38
Wet Season Average										
2002	7.05	0.04	1.06	0.20	2.83	0.91	1.85	0.12	0.28	2.36
2003	6.89	0.04	1.77	0.24	4.49	1.57	2.52	0.04	0.43	-0.12
2004	10.00	0.04	1.73	0.28	4.45	1.50	2.52	0.08	0.39	3.15
2005	7.95	0.04	1.89	0.28	4.96	1.69	2.68	0.04	0.43	0.39
2006	9.29	0.04	1.38	0.31	3.70	1.18	2.40	0.16	0.31	3.27
2007	7.87	0.04	0.87	0.28	1.81	0.39	1.89	0.16	0.28	4.53
Average	8.18	0.04	1.45	0.26	3.71	1.21	2.31	0.10	0.35	2.26
Dry Season Average										
2003	10.20	0.08	1.54	0.31	3.98	1.02	4.02	0.63	0.59	1.93
2004	6.46	0.12	1.77	0.35	4.72	1.06	4.53	0.75	0.63	-2.99
2005	11.06	0.12	1.89	0.39	4.92	1.18	4.69	0.75	0.63	1.34
2006	3.31	0.16	1.65	0.35	4.25	1.02	5.00	1.06	0.59	-6.50
2007	0.87	0.16	0.91	0.35	1.93	0.35	4.84	1.50	0.51	-6.85
Average	6.38	0.13	1.55	0.35	3.96	0.93	4.61	0.94	0.59	-2.61

Table 2-52. Water Table Aquifer, Annual Water Year and Seasonal Budgets for the Golden Gate-Naples Bay Watershed

Period	Inflows (inches)				Outflows (inches)					Change in Storage (inches)
	Infiltration from Unsaturated Zone	Recharge from Canal Network	From Lower Tamiami	Boundary Inflow	Evapo-transpiration	Baseflow	To Lower Tamiami	Pumping	Boundary Outflow	
Annual Water Year Average										
2003	23.27	0.79	2.28	0.94	3.70	15.94	6.14	0.75	0.35	0.47
2004	21.61	0.71	2.40	1.06	3.62	14.53	6.34	0.94	0.39	0.00
2005	26.02	0.87	2.36	1.02	4.25	16.97	6.42	1.10	0.43	1.10
2006	20.51	0.71	2.40	0.98	3.35	14.49	6.42	1.38	0.43	-1.46
2007	11.22	1.30	1.65	0.91	1.57	6.69	5.51	1.93	0.35	-0.94
Average	20.53	0.87	2.22	0.98	3.30	13.72	6.17	1.22	0.39	-0.17
Wet Season Average										
2002	9.02	0.04	0.87	0.31	1.30	6.14	2.36	0.08	0.12	0.28
2003	13.15	0.04	1.14	0.39	2.32	10.28	2.40	0.04	0.12	-0.39
2004	13.46	0.04	1.06	0.39	2.24	9.21	2.40	0.08	0.16	0.87
2005	14.09	0.04	1.14	0.39	2.52	10.55	2.48	0.08	0.16	-0.08
2006	13.39	0.04	1.10	0.35	2.01	9.02	2.44	0.12	0.20	1.14
2007	9.45	0.20	0.75	0.35	0.87	4.92	2.17	0.16	0.12	2.48
Average	12.09	0.07	1.01	0.37	1.88	8.35	2.38	0.09	0.14	0.72
Dry Season Average										
2003	10.12	0.75	1.14	0.55	1.38	5.63	3.78	0.67	0.24	0.87
2004	8.11	0.67	1.34	0.67	1.38	5.31	3.94	0.87	0.20	-0.87
2005	11.93	0.83	1.22	0.63	1.73	6.42	3.94	1.10	0.28	1.18
2006	7.13	0.67	1.26	0.59	1.38	5.47	3.98	1.26	0.24	-2.60
2007	1.77	1.14	0.91	0.55	0.71	1.77	3.35	1.77	0.20	-3.39
Average	7.81	0.81	1.17	0.60	1.31	4.92	3.80	1.13	0.23	-0.96

Table 2-53. Water Table Aquifer, Annual Water Year and Seasonal Budgets for the Rookery Bay Watershed

Period	Inflows (inches)				Outflows (inches)					Change in Storage (inches)
	Infiltration from Unsaturated Zone	Recharge from Canal Network	From Lower Tamiami	Boundary Inflow	Evapo-transpiration	Baseflow	To Lower Tamiami	Pumping	Boundary Outflow	
Annual Water Year Average										
2003	16.42	0.28	7.09	0.47	8.98	4.21	8.78	0.12	1.18	0.94
2004	15.91	0.28	7.32	0.35	9.61	4.49	8.74	0.12	1.18	-0.24
2005	19.80	0.31	8.11	0.51	10.16	5.20	10.28	0.12	1.22	1.73
2006	14.76	0.31	7.28	0.35	9.61	4.53	9.06	0.16	1.22	-1.85
2007	9.17	0.43	5.55	0.51	6.77	1.85	6.14	0.20	0.91	-0.20
Average	15.21	0.32	7.07	0.44	9.02	4.06	8.60	0.14	1.14	0.08
Wet Season Average										
2002	5.59	0.08	2.01	0.28	3.07	1.22	2.68	0.04	0.28	0.71
2003	8.78	0.12	3.78	0.24	5.12	2.87	4.92	0.00	0.39	-0.43
2004	10.08	0.08	3.54	0.20	4.57	2.72	4.45	0.00	0.39	1.77
2005	10.04	0.08	4.09	0.24	5.24	3.43	5.39	0.00	0.47	-0.08
2006	10.63	0.08	3.46	0.24	4.76	2.80	4.57	0.00	0.43	1.85
2007	8.07	0.16	2.44	0.28	3.03	1.10	3.27	0.04	0.28	3.27
Average	8.86	0.10	3.22	0.24	4.30	2.36	4.21	0.01	0.37	1.18
Dry Season Average										
2003	7.64	0.20	3.31	0.20	3.86	1.34	3.86	0.12	0.79	1.38
2004	5.87	0.20	3.78	0.16	5.04	1.77	4.29	0.12	0.79	-2.01
2005	9.80	0.24	4.02	0.24	4.92	1.81	4.88	0.12	0.75	1.81
2006	4.13	0.24	3.82	0.12	4.84	1.77	4.49	0.16	0.79	-3.70
2007	1.10	0.28	3.11	0.24	3.70	0.79	2.87	0.20	0.63	-3.46
Average	5.71	0.23	3.61	0.19	4.47	1.50	4.08	0.14	0.75	-1.20

Table 2-54. Water Table Aquifer, Annual Water Year and Seasonal Budgets for the Eastern Watersheds

Period	Inflows (inches)				Outflows (inches)					Change in Storage (inches)
	Infiltration from Unsaturated Zone	Recharge from Canal Network	From Lower Tamiami	Boundary Inflow	Evapo-transpiration	Baseflow	To Lower Tamiami	Pumping	Boundary Outflow	
Annual Water Year Average										
2003	15.20	0.31	11.34	0.12	13.11	2.68	8.27	0.12	0.83	1.97
2004	15.12	0.31	11.30	0.28	13.58	2.99	9.25	0.12	0.83	0.20
2005	16.89	0.31	11.02	0.28	13.31	3.31	9.69	0.12	0.79	1.34
2006	11.42	0.31	10.63	0.31	12.68	2.76	9.33	0.20	0.63	-2.91
2007	10.24	0.39	9.25	0.47	10.20	1.65	8.35	0.24	0.43	-0.55
Average	13.77	0.33	10.71	0.29	12.57	2.68	8.98	0.16	0.70	0.01
Wet Season Average										
2002	5.79	0.08	3.39	0.04	4.29	0.91	2.95	0.04	0.24	0.87
2003	6.18	0.04	4.49	0.04	5.24	1.73	3.70	0.00	0.35	-0.28
2004	9.84	0.04	4.37	0.08	4.88	1.65	3.86	0.00	0.35	3.62
2005	7.32	0.04	4.49	0.08	5.28	2.17	4.21	0.00	0.35	-0.08
2006	9.13	0.04	4.02	0.12	4.76	1.57	3.74	0.04	0.20	3.07
2007	10.08	0.08	3.54	0.16	3.74	0.98	3.50	0.04	0.16	5.43
Average	8.06	0.05	4.05	0.09	4.70	1.50	3.66	0.02	0.28	2.11
Dry Season Average										
2003	9.02	0.31	6.85	0.08	7.87	0.94	4.57	0.12	0.51	2.24
2004	5.24	0.28	6.97	0.16	8.70	1.34	5.39	0.12	0.51	-3.46
2005	9.57	0.31	6.54	0.20	8.03	1.14	5.47	0.12	0.43	1.42
2006	2.28	0.31	6.61	0.16	7.95	1.14	5.59	0.16	0.47	-5.94
2007	0.16	0.31	5.71	0.28	6.46	0.67	4.84	0.20	0.28	-5.98
Average	5.25	0.31	6.54	0.17	7.80	1.05	5.17	0.14	0.44	-2.35

In the Water Table Aquifer, approximately 24 percent of the water infiltrating from the unsaturated zone is lost baseflow on average in the study area. However, in the Golden Gate-Naples Bay Watershed, the percentage of baseflow exceeds 60 percent as is shown in Table 2-52. The high percentage of baseflow losses is directly related to the canal density in the Golden Gate-Naples Bay Watershed and is discussed in more detail in Technical Memorandum 1.1: Surface Water Quantity. The other watersheds have a lower density of canals and as a result, the percentage of baseflow losses is much lower.

Results also indicate that there is a great deal of interaction between the Water Table and Lower Tamiami aquifers. On average approximately 7.65 inches of water moves upward from the Lower Tamiami aquifer into the Water Table Aquifer annually, and 8.50 inches moves downward. The net result is that approximately six (6) percent of the water entering the aquifer from the unsaturated zone percolates downward to recharge the Lower Tamiami Aquifer.

The seasonal annual water year results for the Water Table Aquifer indicate that percolation from the water table to the Lower Tamiami aquifer amounts to approximately four (4) percent of the water entering the unsaturated zone during the wet season and eight (8) percent during the dry season. This process is controlled by the characteristics of the confining unit that restricts downward movement. The result is that the storage in the Water Table aquifer increases by an average of 1.92 inches during the wet season.

During the dry season, the opposite occurs. With less rainfall, the amount of water percolating from the Water Table Aquifer to the Lower Tamiami Aquifer exceeds the amount that infiltrates into the Water Table Aquifer from the overlying soils. This activity, coupled with pumping for irrigation and water supply needs results in an average net loss of Water Table aquifer storage of approximately 2.19 inches during the dry season.

Computer model results also show that an average of 0.44 inch of water is pumped from the Water Table Aquifer annually. The majority of the pumping occurs during the dry season when demand to meet irrigation needs increase.

The results of the water budget analysis for each watershed indicate that the highest percentage of annual average percolation to the Lower Tamiami Aquifer occurs in the Cocohatchee-Corkscrew Watershed (Table 2-51). In this watershed, more than 25 percent of the water infiltrating into the aquifer from the unsaturated zone percolates into the Lower Tamiami Aquifer. In the Golden Gate–Naples Bay and Rookery Bay watersheds (Tables 2-52 and 2-53), the percentage of water percolating to the Lower Tamiami Aquifer is 19 and 10 percent, respectively.

The annual water budget results for the Faka Union, Fakahatchee, and Okaloacoochee–SR29 (Eastern) watersheds, shown in Table 2-54, indicate that there is a net gain in water migrating upward into the Water Table Aquifer System from the Lower Tamiami Aquifer. This appears to be the result of high levels of evapotranspiration from the natural areas in the watersheds. This is

most evident in the dry season when evapotranspiration is approximately equal to the volume of water infiltrating into the aquifer from the unsaturated zone.

The groundwater budget for the Water Table Aquifer indicates that there is a net annual loss of stored water of approximately 0.16 inch across the study area. However, that watershed scale budgets show that the net loss only occurs in the Cocohatchee–Corkscrew and Golden Gate-Naples Bay Watersheds. In the Cocohatchee–Corkscrew watershed, the predicted average net loss of storage in the Water Table Aquifer is most likely associated with groundwater pumping and movement of water across watershed boundaries. In the Golden Gate-Naples Bay Watershed, the annual net loss is storage is related to baseflow losses to the canal network and groundwater pumping for potable water supply.

Groundwater Budget Analysis for the Lower Tamiami Aquifer

Table 2-55 shows the annual water year and seasonal water budget results for the Lower Tamiami Aquifer across the study area. Figure 2-46 shows the average annual water year water budget for the Lower Tamiami Aquifer. In addition to an annual average inflow from the Water Table Aquifer of 0.84 inch, the results indicate that the Lower Tamiami Aquifer also receives a net annual inflow from the underlying Sandstone Aquifer of 1.5 inches. This net inflow from the over- and underlying aquifers appears to be driven by the annual pumping activities conducted to meet potable water and irrigation demand. As expected, the majority of the inflow occurs during the dry season when pumping demand is at its peak.

The water budgets for the Lower Tamiami Aquifer include losses due to baseflow. This loss is associated with the canal networks that cut into this aquifer system. The watershed budgets indicate that baseflow to the canals from the Lower Tamiami Aquifer is low in the Cocohatchee-Corkscrew Watershed. The amount of baseflow increases in each watershed moving to the south and east, with the most baseflow occurring in the Rookery Bay and Eastern Watersheds. This pattern indicates that the Water Table Aquifer is less thin in the southern parts of the county.

In the Cocohatchee-Corkscrew watershed (Table 2-56), the water budget results indicate a net loss of water (1.9 inches) to the Sandstone Aquifer suggesting that this watershed is a primary source of recharge to the underlying aquifer system. On the other hand, the Golden Gate-Naples Bay (Table 2-57) and Rookery Bay (Table 2-58) watersheds have net gains from the Sandstone Aquifer of 0.14, and 0.78 inch, respectively. This net gain is likely the result of additional hydraulic head differences resulting from pumping activities.

Table 2-55. Lower Tamiami Aquifer, Annual Water Year and Seasonal Budgets for the Study Area

Period	Inflows (inches)				Outflows (inches)					Change in Storage (inches)
	Percolation from Water Table	From Sandstone	Recharge from Canal Network	Boundary Inflow	Baseflow	Percolation To Sandstone	To Water Table	Pumping	Boundary Outflow	
Annual Water Year Average										
2003	7.99	2.87	0.08	3.07	0.79	1.18	8.23	1.65	2.09	0.04
2004	8.58	2.91	0.08	2.64	0.91	1.18	8.11	1.85	2.17	0.00
2005	9.21	2.76	0.08	2.48	0.91	1.26	7.99	1.81	2.56	0.00
2006	8.98	2.87	0.08	2.60	0.83	1.38	7.60	2.44	2.24	-0.04
2007	7.72	2.64	0.08	2.48	0.55	1.57	6.34	2.87	1.57	-0.04
Average	8.50	2.81	0.08	2.65	0.80	1.31	7.65	2.13	2.13	-0.01
Wet Season Average										
2002	2.60	1.02	0.00	0.75	0.31	0.24	2.48	0.47	0.67	0.16
2003	3.46	1.02	0.04	0.98	0.39	0.31	3.46	0.31	0.98	0.04
2004	3.54	1.02	0.04	0.87	0.39	0.31	3.31	0.28	1.06	0.12
2005	3.94	0.98	0.00	0.79	0.47	0.35	3.43	0.28	1.22	0.00
2006	3.58	0.98	0.00	0.83	0.39	0.31	2.99	0.51	0.98	0.20
2007	2.99	0.87	0.04	0.79	0.28	0.28	2.48	0.43	0.59	0.55
Average	3.35	0.98	0.02	0.83	0.37	0.30	3.02	0.38	0.92	0.18
Dry Season Average										
2003	4.53	1.85	0.04	2.09	0.39	0.87	4.76	1.34	1.10	0.00
2004	5.00	1.89	0.04	1.77	0.51	0.87	4.80	1.57	1.10	-0.12
2005	5.31	1.77	0.08	1.69	0.43	0.91	4.61	1.54	1.34	0.00
2006	5.39	1.85	0.04	1.77	0.43	1.06	4.61	1.97	1.26	-0.24
2007	4.72	1.73	0.04	1.69	0.28	1.30	3.86	2.44	0.94	-0.59
Average	4.99	1.82	0.05	1.80	0.41	1.00	4.53	1.77	1.15	-0.19

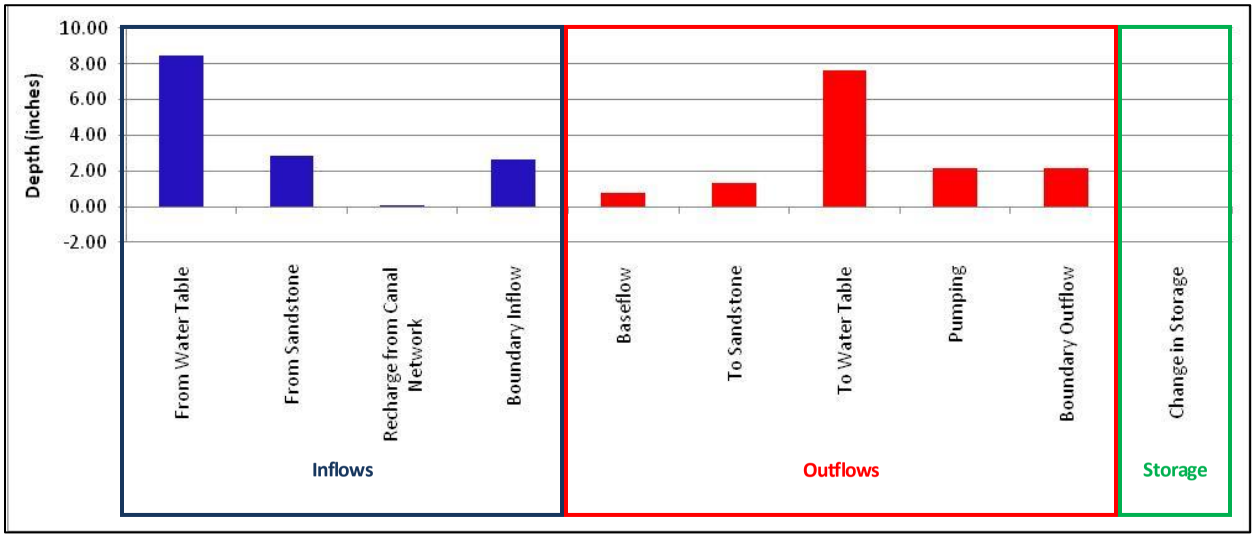


Figure 2-46. Lower Tamiami Aquifer, Average Annual Water Year Budget for the Study Area

Table 2-56. Lower Tamiami Aquifer, Annual Water Year and Seasonal Budgets for the Cocohatchee-Corkscrew Watershed

Period	Inflows (inches)				Outflows (inches)					Change in Storage (inches)
	Percolation from Water Table	From Sandstone	Recharge from Canal Network	Boundary Inflow	Baseflow	Percolation To Sandstone	To Water Table	Pumping	Boundary Outflow	
Annual Water Year Average										
2003	6.54	0.28	0.00	0.71	0.08	1.81	3.31	0.87	1.46	0.00
2004	7.05	0.31	0.00	0.75	0.08	1.93	3.50	1.02	1.54	0.00
2005	7.36	0.31	0.00	0.75	0.08	1.97	3.74	1.02	1.61	0.00
2006	7.40	0.28	0.00	0.83	0.08	2.44	3.03	1.57	1.42	0.00
2007	6.73	0.20	0.00	0.91	0.00	2.87	1.77	2.13	1.18	-0.12
Average	7.02	0.28	0.00	0.79	0.06	2.20	3.07	1.32	1.44	-0.02
Wet Season Average										
2002	1.85	0.12	0.00	0.24	0.04	0.35	1.06	0.16	0.39	0.20
2003	2.52	0.16	0.00	0.28	0.04	0.39	1.77	0.08	0.63	0.04
2004	2.52	0.16	0.00	0.28	0.04	0.39	1.73	0.08	0.59	0.08
2005	2.68	0.16	0.00	0.28	0.04	0.39	1.89	0.12	0.67	0.00
2006	2.40	0.12	0.00	0.28	0.04	0.51	1.38	0.20	0.51	0.16
2007	1.89	0.08	0.00	0.35	0.00	0.43	0.87	0.24	0.39	0.39
Average	2.31	0.13	0.00	0.28	0.03	0.41	1.45	0.14	0.53	0.14
Dry Season Average										
2003	4.02	0.12	0.00	0.43	0.04	1.42	1.54	0.79	0.83	0.00
2004	4.53	0.16	0.00	0.47	0.04	1.54	1.77	0.94	0.94	-0.08
2005	4.69	0.16	0.00	0.47	0.04	1.57	1.89	0.94	0.94	0.00
2006	5.00	0.16	0.00	0.51	0.04	1.93	1.65	1.34	0.91	-0.16
2007	4.84	0.12	0.00	0.55	0.00	2.44	0.91	1.85	0.83	-0.51
Average	4.61	0.14	0.00	0.49	0.03	1.78	1.55	1.17	0.89	-0.15

Table 2-57. Lower Tamiami Aquifer, Annual Water Year and Seasonal Budgets for the Golden Gate-Naples Bay Watershed

Period	Inflows (inches)				Outflows (inches)					Change in Storage (inches)
	Percolation from Water Table	From Sandstone	Recharge from Canal Network	Boundary Inflow	Baseflow	Percolation To Sandstone	To Water Table	Pumping	Boundary Outflow	
Annual Water Year Average										
2003	6.14	0.43	0.00	1.61	0.91	0.16	2.28	4.09	0.71	0.00
2004	6.34	0.51	0.00	1.81	0.87	0.16	2.40	4.53	0.71	0.00
2005	6.42	0.39	0.00	1.69	0.87	0.43	2.36	4.13	0.75	0.00
2006	6.42	0.43	0.00	1.73	0.83	0.43	2.40	4.13	0.83	0.00
2007	5.51	0.47	0.04	1.73	0.35	0.35	1.65	4.65	0.75	0.00
Average	6.17	0.45	0.01	1.72	0.76	0.31	2.22	4.31	0.75	0.00
Wet Season Average										
2002	2.36	0.16	0.00	0.55	0.35	0.08	0.87	1.42	0.28	0.04
2003	2.40	0.16	0.00	0.59	0.51	0.08	1.14	1.18	0.24	0.00
2004	2.40	0.16	0.00	0.59	0.43	0.08	1.06	1.34	0.24	0.04
2005	2.48	0.16	0.00	0.59	0.51	0.20	1.14	1.14	0.28	0.00
2006	2.44	0.16	0.00	0.55	0.43	0.08	1.10	1.14	0.31	0.04
2007	2.17	0.12	0.00	0.55	0.20	0.20	0.75	1.18	0.28	0.24
Average	2.38	0.15	0.00	0.57	0.41	0.12	1.01	1.23	0.27	0.06
Dry Season Average										
2003	3.78	0.28	0.00	1.02	0.39	0.12	1.14	2.91	0.47	0.00
2004	3.94	0.31	0.00	1.22	0.43	0.12	1.34	3.19	0.43	-0.04
2005	3.94	0.28	0.00	1.10	0.35	0.24	1.22	2.99	0.51	0.00
2006	3.98	0.28	0.00	1.18	0.35	0.31	1.26	2.99	0.51	-0.08
2007	3.35	0.35	0.04	1.18	0.16	0.16	0.91	3.46	0.47	-0.24
Average	3.80	0.30	0.01	1.14	0.34	0.19	1.17	3.11	0.48	-0.07

Table 2-58. Lower Tamiami Aquifer, Annual Water Year and Seasonal Budgets for the Rookery Bay Watershed

Period	Inflows (inches)				Outflows (inches)					Change in Storage (inches)
	Percolation from Water Table	From Sandstone	Recharge from Canal Network	Boundary Inflow	Baseflow	Percolation To Sandstone	To Water Table	Pumping	Boundary Outflow	
Annual Water Year Average										
2003	8.78	0.75	0.08	1.61	1.18	0.04	7.09	0.91	2.01	0.04
2004	8.74	1.02	0.08	1.61	1.30	0.04	7.32	0.79	2.05	0.00
2005	10.28	0.94	0.08	1.57	1.38	0.24	8.11	0.98	2.20	0.00
2006	9.06	0.94	0.08	1.77	1.26	0.20	7.28	1.06	2.05	0.00
2007	6.14	0.87	0.12	2.24	0.75	0.12	5.55	1.42	1.54	0.00
Average	8.60	0.91	0.09	1.76	1.17	0.13	7.07	1.03	1.97	0.01
Wet Season Average										
2002	2.68	0.28	0.04	0.39	0.35	0.00	2.01	0.12	0.63	0.28
2003	4.92	0.28	0.00	0.28	0.59	0.04	3.78	0.00	1.06	0.00
2004	4.45	0.39	0.00	0.39	0.63	0.00	3.54	0.08	0.87	0.12
2005	5.39	0.35	0.00	0.28	0.71	0.12	4.09	0.04	1.06	0.00
2006	4.57	0.35	0.00	0.35	0.63	0.04	3.46	0.04	0.91	0.24
2007	3.27	0.24	0.04	0.55	0.28	0.08	2.44	0.16	0.59	0.59
Average	4.21	0.31	0.01	0.37	0.53	0.05	3.22	0.07	0.85	0.20
Dry Season Average										
2003	3.86	0.47	0.08	1.34	0.55	0.00	3.31	0.91	0.94	0.04
2004	4.29	0.67	0.08	1.22	0.71	0.00	3.78	0.75	1.18	-0.12
2005	4.88	0.63	0.08	1.30	0.67	0.12	4.02	0.94	1.14	0.00
2006	4.49	0.59	0.08	1.46	0.67	0.16	3.82	1.02	1.14	-0.24
2007	2.87	0.63	0.08	1.69	0.47	0.04	3.11	1.30	0.94	-0.59
Average	4.08	0.60	0.08	1.40	0.61	0.06	3.61	0.98	1.07	-0.18

Table 2-59. Lower Tamiami Aquifer, Annual Water Year and Seasonal Budgets for the Eastern Watersheds

Period	Inflows (inches)				Outflows (inches)					Change in Storage (inches)
	Percolation from Water Table	From Sandstone	Recharge from Canal Network	Boundary Inflow	Baseflow	Percolation To Sandstone	To Water Table	Pumping	Boundary Outflow	
Annual Water Year Average										
2003	8.27	4.84	0.12	4.96	1.06	1.26	11.34	1.54	2.95	0.08
2004	9.25	4.84	0.12	4.53	1.22	1.18	11.30	1.77	3.23	0.00
2005	9.69	4.61	0.16	4.37	1.22	1.26	11.02	1.81	3.46	0.00
2006	9.33	4.80	0.08	4.53	1.14	1.26	10.63	2.83	2.91	-0.08
2007	8.35	4.41	0.12	4.09	0.83	1.38	9.25	3.31	2.28	-0.04
Average	8.98	4.70	0.12	4.50	1.09	1.27	10.71	2.25	2.97	-0.01
Wet Season Average										
2002	2.95	1.69	0.04	1.22	0.47	0.28	3.39	0.43	1.10	0.20
2003	3.70	1.69	0.04	1.69	0.51	0.39	4.49	0.24	1.42	0.04
2004	3.86	1.65	0.04	1.50	0.47	0.39	4.37	0.16	1.50	0.20
2005	4.21	1.65	0.04	1.54	0.63	0.43	4.49	0.20	1.69	0.00
2006	3.74	1.65	0.00	1.50	0.51	0.31	4.02	0.55	1.22	0.28
2007	3.50	1.50	0.04	1.34	0.39	0.28	3.54	0.43	0.98	0.75
Average	3.66	1.64	0.03	1.46	0.50	0.35	4.05	0.33	1.32	0.24
Dry Season Average										
2003	4.57	3.15	0.08	3.27	0.55	0.87	6.85	1.30	1.50	0.04
2004	5.39	3.19	0.08	3.03	0.71	0.79	6.97	1.61	1.73	-0.20
2005	5.47	2.95	0.12	2.87	0.59	0.83	6.54	1.61	1.81	0.00
2006	5.59	3.15	0.08	3.03	0.63	0.94	6.61	2.28	1.69	-0.31
2007	4.84	2.91	0.08	2.76	0.39	1.10	5.71	2.87	1.30	-0.79
Average	5.17	3.07	0.09	2.99	0.57	0.91	6.54	1.94	1.61	-0.25

In the Eastern watersheds, there is also a net loss of water to the Water Table Aquifer (Table 2-59). Hydraulic head differences in these watersheds results from the combination of evapotranspiration and irrigation pumping activities affecting the Water Table Aquifer.

Groundwater Budget Analysis for the Sandstone Aquifer

The average water year and seasonal water budgets for the study area within the Sandstone Aquifer are shown in Table 2-60. Figure 2-47 shows the annual water year budget for the Sandstone Aquifer. The results indicate that there is no change in storage on an annual basis meaning that the seasonal inflows and outflows are in equilibrium. The results indicate that there is a net loss of 1.5 inches water to the overlying Lower Tamiami Aquifer, and a net gain of 0.3 inch in water from the underlying Mid-Hawthorn Aquifer. In addition, there is a net annual loss of 0.76 inch of water due primarily to dry season pumping activities. Boundary inflows make up for the losses resulting in a no net change in aquifer storage.

The Sandstone aquifer system in the Cocohatchee-Corkscrew watershed (Table 2-61) has a net inflow of water from the Lower Tamiami aquifer of 1.93 inches annually, and a net loss to the Mid-Hawthorn Aquifer of 0.05 inch annually. In each of the other watersheds (Tables 2-62 through 2-64), there is a net loss of groundwater to the overlying Lower Tamiami Aquifer and a net gain from the underlying Mid-Hawthorn Aquifer. The inflows from the Mid-Hawthorn are less than one (1) inch annually, which is an indication of little interaction between the Sandstone and Mid-Hawthorn aquifer systems.

Table 2-60. Sandstone Aquifer, Annual Water Year and Seasonal Budgets for the Study Area

Period	Inflows (inches)			Outflow (inches)				Change in Storage (inches)
	Percolation from Lower Tamiami	From Mid-Hawthorne	Boundary Inflow	Percolation to Mid-Hawthorne	To Lower Tamiami	Pumping	Boundary Outflow	
Annual Water Year Average								
2003	1.18	0.28	2.36	0.08	2.87	0.55	0.28	0.00
2004	1.18	0.43	2.20	0.08	2.91	0.59	0.24	0.00
2005	1.26	0.43	2.01	0.12	2.76	0.51	0.28	0.00
2006	1.38	0.43	2.24	0.12	2.87	0.91	0.20	0.00
2007	1.57	0.39	2.17	0.08	2.64	1.26	0.20	0.00
Average	1.31	0.39	2.20	0.09	2.81	0.76	0.24	0.00
Wet Season Average								
2002	0.24	0.08	0.83	0.04	1.02	0.08	0.04	0.00
2003	0.31	0.08	0.75	0.04	1.02	0.04	0.04	0.00
2004	0.31	0.16	0.71	0.04	1.02	0.04	0.08	0.00
2005	0.35	0.12	0.67	0.04	0.98	0.04	0.08	0.00
2006	0.31	0.12	0.75	0.04	0.98	0.12	0.04	0.00
2007	0.28	0.08	0.75	0.04	0.87	0.12	0.04	0.00
Average	0.30	0.10	0.74	0.04	0.98	0.07	0.05	0.00
Dry Season Average								
2003	0.87	0.20	1.61	0.04	1.85	0.51	0.24	0.00
2004	0.87	0.28	1.50	0.04	1.89	0.51	0.16	0.00
2005	0.91	0.28	1.34	0.08	1.77	0.51	0.20	0.00
2006	1.06	0.28	1.50	0.08	1.85	0.79	0.12	0.00
2007	1.30	0.31	1.42	0.04	1.73	1.10	0.16	0.00
Average	1.00	0.27	1.47	0.06	1.82	0.69	0.17	0.00

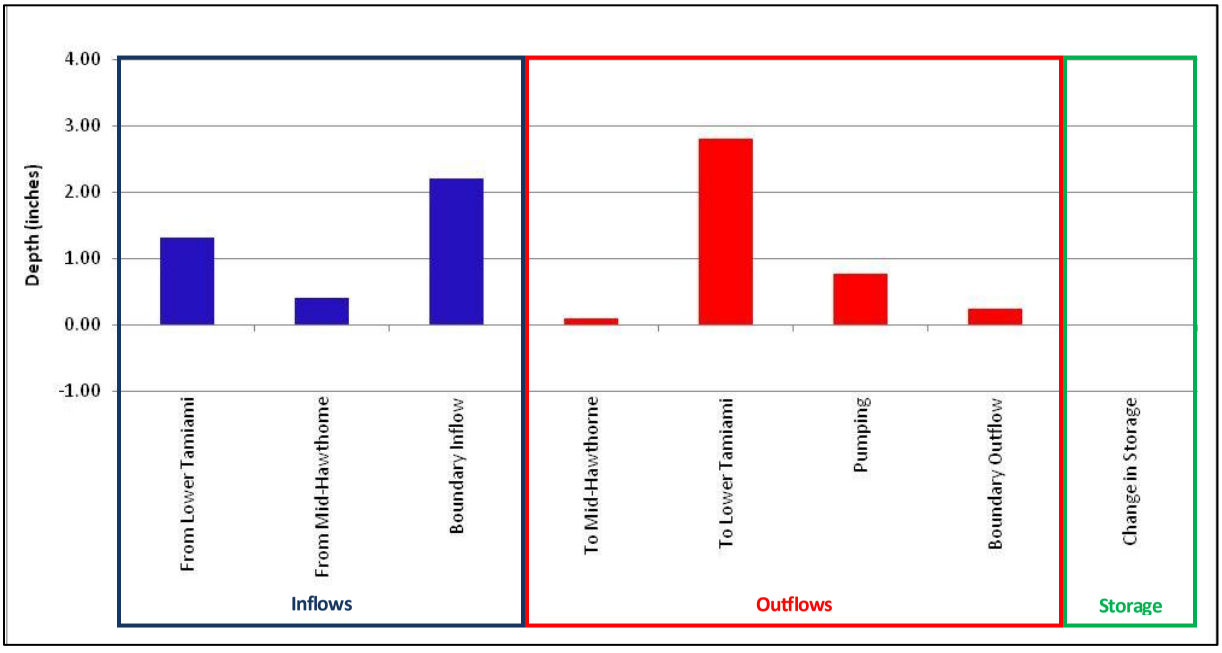


Figure 2-47. Sandstone Aquifer, Average Annual Water Year Budget for the Study Area

Table 2-61. Sandstone Aquifer, Annual Water Year and Seasonal Budgets for the Cocohatchee-Corkscrew Watershed

Period	Inflows (inches)			Outflow (inches)				Change in Storage (inches)
	Percolation from Lower Tamiami	From Mid-Hawthorne	Boundary Inflow	Percolation to Mid-Hawthorne	To Lower Tamiami	Pumping	Boundary Outflow	
Annual Water Year Average								
2003	1.81	0.08	0.28	0.12	0.28	1.26	0.47	0.00
2004	1.93	0.08	0.24	0.12	0.31	1.30	0.55	0.00
2005	1.97	0.08	0.24	0.12	0.31	1.22	0.59	0.00
2006	2.44	0.08	0.28	0.08	0.28	1.77	0.59	0.00
2007	2.87	0.08	0.35	0.20	0.20	2.28	0.63	0.00
Average	2.20	0.08	0.28	0.13	0.28	1.57	0.57	0.00
Wet Season Average								
2002	0.35	0.00	0.12	0.04	0.12	0.20	0.12	0.00
2003	0.39	0.04	0.08	0.04	0.16	0.12	0.16	0.00
2004	0.39	0.04	0.08	0.04	0.16	0.16	0.16	0.00
2005	0.39	0.04	0.08	0.04	0.16	0.12	0.20	0.00
2006	0.51	0.00	0.08	0.04	0.12	0.31	0.16	0.00
2007	0.43	0.04	0.12	0.04	0.08	0.28	0.12	0.04
Average	0.41	0.03	0.09	0.04	0.13	0.20	0.15	0.01
Dry Season Average								
2003	1.42	0.04	0.20	0.08	0.12	1.10	0.31	0.00
2004	1.54	0.08	0.16	0.08	0.16	1.14	0.39	0.00
2005	1.57	0.08	0.16	0.08	0.16	1.10	0.43	0.00
2006	1.93	0.08	0.20	0.12	0.16	1.46	0.43	0.00
2007	2.44	0.08	0.24	0.16	0.12	2.01	0.51	-0.04
Average	1.78	0.07	0.19	0.10	0.14	1.36	0.42	-0.01

Table 2-62. Sandstone Aquifer, Annual Water Year and Seasonal Budgets for the Golden Gate-Naples Bay Watershed

Period	Inflows (inches)			Outflow (inches)				Change in Storage (inches)
	Percolation from Lower Tamiami	From Mid-Hawthorne	Boundary Inflow	Percolation to Mid-Hawthorne	To Lower Tamiami	Pumping	Boundary Outflow	
Annual Water Year Average								
2003	0.16	0.24	0.08	0.04	0.43	0.00	0.04	0.00
2004	0.16	0.31	0.08	0.00	0.51	0.00	0.04	0.00
2005	0.43	0.24	0.08	0.28	0.39	0.00	0.04	0.00
2006	0.43	0.24	0.08	0.24	0.43	0.00	0.08	0.00
2007	0.35	0.28	0.08	0.16	0.47	0.00	0.08	0.00
Average	0.31	0.26	0.08	0.14	0.45	0.00	0.06	0.00
Wet Season Average								
2002	0.08	0.08	0.04	0.00	0.16	0.00	0.00	0.00
2003	0.08	0.08	0.04	0.00	0.16	0.00	0.00	0.00
2004	0.08	0.12	0.04	0.00	0.16	0.00	0.00	0.00
2005	0.20	0.08	0.04	0.12	0.16	0.00	0.00	0.00
2006	0.08	0.08	0.04	0.04	0.16	0.00	0.00	0.00
2007	0.20	0.08	0.04	0.12	0.12	0.00	0.00	0.00
Average	0.12	0.09	0.04	0.05	0.15	0.00	0.00	0.00
Dry Season Average								
2003	0.12	0.16	0.04	0.00	0.28	0.00	0.04	0.00
2004	0.12	0.20	0.04	0.00	0.31	0.00	0.04	0.00
2005	0.24	0.16	0.04	0.16	0.28	0.00	0.04	0.00
2006	0.31	0.16	0.04	0.20	0.28	0.00	0.04	0.00
2007	0.16	0.20	0.04	0.04	0.35	0.00	0.04	0.00
Average	0.19	0.17	0.04	0.08	0.30	0.00	0.04	0.00

Table 2-63. Sandstone Aquifer, Annual Water Year and Seasonal Budgets for the Rookery Bay Watershed

Period	Inflows (inches)			Outflow (inches)				Change in Storage (inches)
	Percolation from Lower Tamiami	From Mid-Hawthorne	Boundary Inflow	Percolation to Mid-Hawthorne	To Lower Tamiami	Pumping	Boundary Outflow	
Annual Water Year Average								
2003	0.04	0.51	0.24	0.00	0.75	0.00	0.04	0.00
2004	0.04	0.87	0.20	0.00	1.02	0.00	0.04	0.00
2005	0.24	0.79	0.16	0.20	0.94	0.00	0.04	0.00
2006	0.20	0.79	0.16	0.16	0.94	0.00	0.04	0.00
2007	0.12	0.75	0.12	0.08	0.87	0.00	0.04	0.00
Average	0.13	0.74	0.17	0.09	0.91	0.00	0.04	0.00
Wet Season Average								
2002	0.00	0.20	0.08	0.00	0.28	0.00	0.00	0.00
2003	0.04	0.16	0.08	0.00	0.28	0.00	0.00	0.00
2004	0.00	0.28	0.08	0.00	0.39	0.00	0.00	0.00
2005	0.12	0.24	0.08	0.08	0.35	0.00	0.00	0.00
2006	0.04	0.28	0.08	0.00	0.35	0.00	0.00	0.00
2007	0.08	0.16	0.08	0.08	0.24	0.00	0.00	0.00
Average	0.05	0.22	0.08	0.03	0.31	0.00	0.00	0.00
Dry Season Average								
2003	0.00	0.35	0.12	0.00	0.47	0.00	0.00	0.00
2004	0.00	0.55	0.08	0.00	0.67	0.00	0.00	0.00
2005	0.12	0.55	0.08	0.08	0.63	0.00	0.00	0.00
2006	0.16	0.51	0.08	0.16	0.59	0.00	0.04	0.00
2007	0.04	0.59	0.04	0.04	0.63	0.00	0.04	0.00
Average	0.06	0.51	0.08	0.06	0.60	0.00	0.02	0.00

Table 2-64. Sandstone Aquifer, Annual Water Year and Seasonal Budgets for the Eastern Watersheds

Period	Inflows (inches)			Outflow (inches)				Change in Storage (inches)
	Percolation from Lower Tamiami	From Mid-Hawthorne	Boundary Inflow	Percolation to Mid-Hawthorne	To Lower Tamiami	Pumping	Boundary Outflow	
Annual Water Year Average								
2003	1.26	0.28	4.13	0.08	4.84	0.35	0.39	0.00
2004	1.18	0.43	3.86	0.04	4.84	0.35	0.31	0.00
2005	1.26	0.47	3.62	0.04	4.61	0.31	0.35	0.00
2006	1.26	0.47	3.94	0.04	4.80	0.63	0.24	0.00
2007	1.38	0.43	3.78	0.04	4.41	0.87	0.24	0.00
Average	1.27	0.42	3.87	0.05	4.70	0.50	0.31	0.00
Wet Season Average								
2002	0.28	0.08	1.46	0.04	1.69	0.04	0.04	0.00
2003	0.39	0.08	1.34	0.04	1.69	0.00	0.08	0.00
2004	0.39	0.16	1.26	0.04	1.65	0.00	0.12	0.00
2005	0.43	0.16	1.22	0.04	1.65	0.00	0.12	0.00
2006	0.31	0.16	1.34	0.00	1.65	0.08	0.04	0.00
2007	0.28	0.08	1.26	0.04	1.50	0.04	0.04	0.00
Average	0.35	0.12	1.31	0.03	1.64	0.03	0.07	0.00
Dry Season Average								
2003	0.87	0.20	2.83	0.04	3.15	0.31	0.35	0.00
2004	0.79	0.31	2.64	0.04	3.19	0.31	0.20	0.00
2005	0.83	0.31	2.40	0.04	2.95	0.31	0.24	0.00
2006	0.94	0.31	2.60	0.04	3.15	0.55	0.16	0.00
2007	1.10	0.35	2.52	0.04	2.91	0.83	0.20	0.00
Average	0.91	0.30	2.60	0.04	3.07	0.46	0.23	0.00

Groundwater Budget Analysis for the Mid-Hawthorn Aquifer

The Mid-Hawthorn has little interaction with the overlying aquifer systems. The annual water year water budgets for the study area and each of the watersheds are shown in Tables 2-65 through 2-69. Figure 2-48 shows the annual average water budget for the Mid-Hawthorn Aquifer. The results indicate that less than 0.3 inch of water moves between the Sandstone in Mid-Hawthorn Aquifers across the study area.

The aquifer also experiences limited pumping withdrawals for potable water supply. The majority of the pumping occurs in the Golden Gate-Naples Bay Watershed at the Collier County wellfield. Smaller pumping withdrawals occur in the Rookery Bay and Cocohatchee-Corkscrew watersheds.

Table 2-65. Mid-Hawthorn Aquifer, Annual Water Year and Seasonal Budgets for the Study Area

Period	Inflows (inches)		Outflows (inches)			Change in Storage (inches)
	Percolation from Sandstone	Boundary Inflow	To Sandstone	Pumping	Boundary Outflow	
Annual Water Year Average						
2003	0.08	0.28	0.28	0.04	0.04	0.00
2004	0.08	0.47	0.43	0.08	0.04	0.00
2005	0.12	0.47	0.43	0.12	0.04	0.00
2006	0.12	0.47	0.43	0.12	0.04	0.00
2007	0.08	0.43	0.39	0.12	0.00	0.00
Average	0.09	0.43	0.39	0.09	0.03	0.00
Wet Season Average						
2002	0.04	0.08	0.08	0.00	0.00	0.00
2003	0.04	0.08	0.08	0.00	0.00	0.00
2004	0.04	0.16	0.16	0.00	0.00	0.00
2005	0.04	0.16	0.12	0.04	0.00	0.00
2006	0.04	0.16	0.12	0.04	0.00	0.00
2007	0.04	0.12	0.08	0.04	0.00	0.00
Average	0.04	0.12	0.10	0.02	0.00	0.00
Dry Season Average						
2003	0.04	0.20	0.20	0.04	0.00	0.00
2004	0.04	0.31	0.28	0.04	0.00	0.00
2005	0.08	0.31	0.28	0.08	0.00	0.00
2006	0.08	0.31	0.28	0.12	0.00	0.00
2007	0.04	0.31	0.31	0.08	0.00	0.00
Average	0.06	0.29	0.27	0.07	0.00	0.00

Table 2-66. Mid-Hawthorn Aquifer, Annual Water Year and Seasonal Budgets for the Cocohatchee-Corkscrew Watershed

Period	Inflows (inches)		Outflows (inches)			Change in Storage (inches)
	Percolation from Sandstone	Boundary Inflow	To Sandstone	Pumping	Boundary Outflow	
Annual Water Year Average						
2003	0.12	0.12	0.08	0.04	0.16	0.00
2004	0.12	0.16	0.08	0.04	0.16	0.00
2005	0.12	0.16	0.08	0.04	0.16	0.00
2006	0.16	0.16	0.08	0.08	0.16	0.00
2007	0.20	0.16	0.08	0.08	0.16	0.00
Average	0.14	0.15	0.08	0.06	0.16	0.00
Wet Season Average						
2002	0.04	0.04	0.00	0.00	0.04	0.00
2003	0.04	0.04	0.04	0.00	0.04	0.00
2004	0.04	0.04	0.04	0.00	0.04	0.00
2005	0.04	0.04	0.04	0.00	0.08	0.00
2006	0.04	0.04	0.00	0.00	0.04	0.00
2007	0.04	0.04	0.04	0.00	0.04	0.00
Average	0.04	0.04	0.03	0.00	0.05	0.00
Dry Season Average						
2003	0.08	0.08	0.04	0.04	0.08	0.00
2004	0.08	0.12	0.08	0.04	0.08	0.00
2005	0.08	0.12	0.08	0.04	0.08	0.00
2006	0.12	0.12	0.08	0.04	0.12	0.00
2007	0.16	0.12	0.08	0.08	0.12	0.00
Average	0.10	0.11	0.07	0.05	0.09	0.00

Table 2-67. Mid-Hawthorn Aquifer, Annual Water Year and Seasonal Budgets for the Golden Gate-Naples Bay Watershed

Period	Inflows (inches)		Outflows (inches)			Change in Storage (inches)
	Percolation from Sandstone	Boundary Inflow	To Sandstone	Pumping	Boundary Outflow	
Annual Water Year Average						
2003	0.04	0.28	0.24	0.00	0.08	0.00
2004	0.00	0.39	0.31	0.00	0.08	0.00
2005	0.28	0.75	0.24	0.67	0.16	0.00
2006	0.24	0.71	0.24	0.59	0.12	0.00
2007	0.16	0.59	0.28	0.39	0.12	0.00
Average	0.14	0.54	0.26	0.33	0.11	0.00
Wet Season Average						
2002	0.00	0.08	0.08	0.00	0.04	0.00
2003	0.00	0.08	0.08	0.00	0.00	0.00
2004	0.00	0.12	0.12	0.00	0.04	0.00
2005	0.12	0.28	0.08	0.31	0.04	0.00
2006	0.04	0.16	0.08	0.04	0.04	0.00
2007	0.12	0.24	0.08	0.24	0.04	0.00
Average	0.05	0.16	0.09	0.10	0.03	0.00
Dry Season Average						
2003	0.00	0.20	0.16	0.00	0.04	0.00
2004	0.00	0.24	0.20	0.00	0.04	0.00
2005	0.16	0.47	0.16	0.35	0.08	0.00
2006	0.20	0.55	0.16	0.51	0.12	0.00
2007	0.04	0.35	0.20	0.16	0.08	0.00
Average	0.08	0.36	0.17	0.20	0.07	0.00

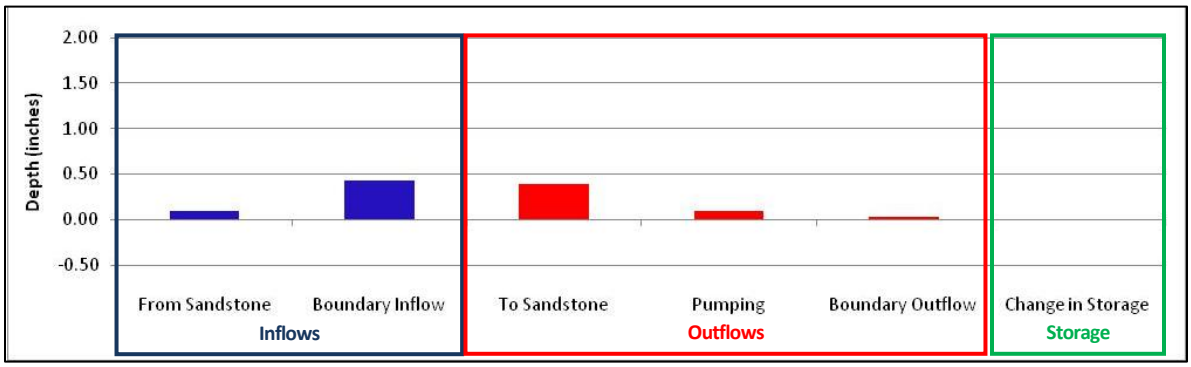
Table 2-68. Mid-Hawthorn Aquifer, Annual Water Year and Seasonal Budgets for the Rookery Bay Watershed

Period	Inflows (inches)		Outflows (inches)			Change in Storage (inches)
	Percolation from Sandstone	Boundary Inflow	To Sandstone	Pumping	Boundary Outflow	
Annual Water Year Average						
2003	0.00	0.59	0.51	0.00	0.08	0.00
2004	0.00	1.02	0.87	0.00	0.16	0.00
2005	0.20	1.18	0.79	0.12	0.47	0.00
2006	0.16	1.18	0.79	0.08	0.43	0.00
2007	0.08	0.98	0.75	0.00	0.35	0.00
Average	0.09	0.99	0.74	0.04	0.30	0.00
Wet Season Average						
2002	0.00	0.20	0.20	0.00	0.00	0.00
2003	0.00	0.20	0.16	0.00	0.00	0.00
2004	0.00	0.35	0.28	0.00	0.04	0.00
2005	0.08	0.39	0.24	0.04	0.20	0.00
2006	0.00	0.35	0.28	0.00	0.08	0.00
2007	0.08	0.24	0.16	0.00	0.16	0.00
Average	0.03	0.29	0.22	0.01	0.08	0.00
Dry Season Average						
2003	0.00	0.39	0.35	0.00	0.04	0.00
2004	0.00	0.67	0.55	0.00	0.12	0.00
2005	0.08	0.79	0.55	0.04	0.28	0.00
2006	0.16	0.83	0.51	0.08	0.35	0.00
2007	0.04	0.75	0.59	0.00	0.20	-0.04
Average	0.06	0.69	0.51	0.02	0.20	-0.01

Table 2-69. Mid-Hawthorn Aquifer, Annual Water Year and Seasonal Budgets for the Eastern Watersheds

Period	Inflows (inches)		Outflows (inches)			Change in Storage (inches)
	Percolation from Sandstone	Boundary Inflow	To Sandstone	Pumping	Boundary Outflow	
Annual Water Year Average						
2003	0.08	0.28	0.28	0.00	0.08	0.00
2004	0.04	0.47	0.43	0.00	0.08	0.00
2005	0.04	0.51	0.47	0.00	0.08	0.00
2006	0.04	0.51	0.47	0.00	0.08	0.00
2007	0.04	0.43	0.43	0.00	0.08	0.00
Average	0.05	0.44	0.42	0.00	0.08	0.00
Wet Season Average						
2002	0.04	0.08	0.08	0.00	0.04	0.00
2003	0.04	0.08	0.08	0.00	0.04	0.00
2004	0.04	0.16	0.16	0.00	0.04	0.00
2005	0.04	0.16	0.16	0.00	0.04	0.00
2006	0.00	0.16	0.16	0.00	0.04	0.00
2007	0.04	0.12	0.08	0.00	0.04	0.00
Average	0.03	0.12	0.12	0.00	0.04	0.00
Dry Season Average						
2003	0.04	0.20	0.20	0.00	0.04	0.00
2004	0.04	0.31	0.31	0.00	0.04	0.00
2005	0.04	0.35	0.31	0.00	0.04	0.00
2006	0.04	0.35	0.31	0.00	0.04	0.00
2007	0.04	0.35	0.35	0.00	0.04	0.00
Average	0.04	0.31	0.30	0.00	0.04	0.00

Figure 2-48. Mid-Hawthorn Aquifer, Average Annual Water Budget for the Study Area



Boundary inflows into the Mid-Hawthorn Aquifer match the losses due to transference to the Sandstone Aquifer and pumping. The result is a no net change in aquifer storage. This is also evident in each of the watershed specific budgets shown in Tables 2-66 through 2-69.

2.4.2 Water Uses

This section discusses groundwater withdrawals from each aquifer. Comparisons were made to the boundary inflows and aquifer exchanges to evaluate the general effects of pumping activities.

Potable Water Supply

Groundwater is the primary source of potable water in Collier County. Municipal water supply systems were represented in the ECM as individual wells that withdraw water from specific aquifers. The pumping rates for each well were defined using reported time series of groundwater withdrawal or established based on permitted pumping rates. The distribution of the municipal water supply wells in the ECM is shown in Figure 2-49. The figure also shows the extent of the wellhead protection areas. The majority of water supply wells are located in the Golden Gate-Naples Bay, Rookery Bay, and Faka Union watersheds. Figure 2-50 shows the extent of the County area served by the public water supply system. Table 2-70 shows the annual volume of water pumped for potable water supply in each watershed. The majority of municipal water supply is withdrawn from the Lower Tamiami Aquifer.

Most of the municipal water supply wells are located in the Golden Gate-Naples Bay Watershed and are screened in the Lower Tamiami Aquifer. As a result, the volume of water pumped from these municipal wells far exceeds the volumes pumped in the other watersheds or from the other aquifers. The water pumped from the public wells in the Golden Gate-Naples Bay Watershed is used to meet water supply needs throughout the county and is not limited to usage within the watershed.

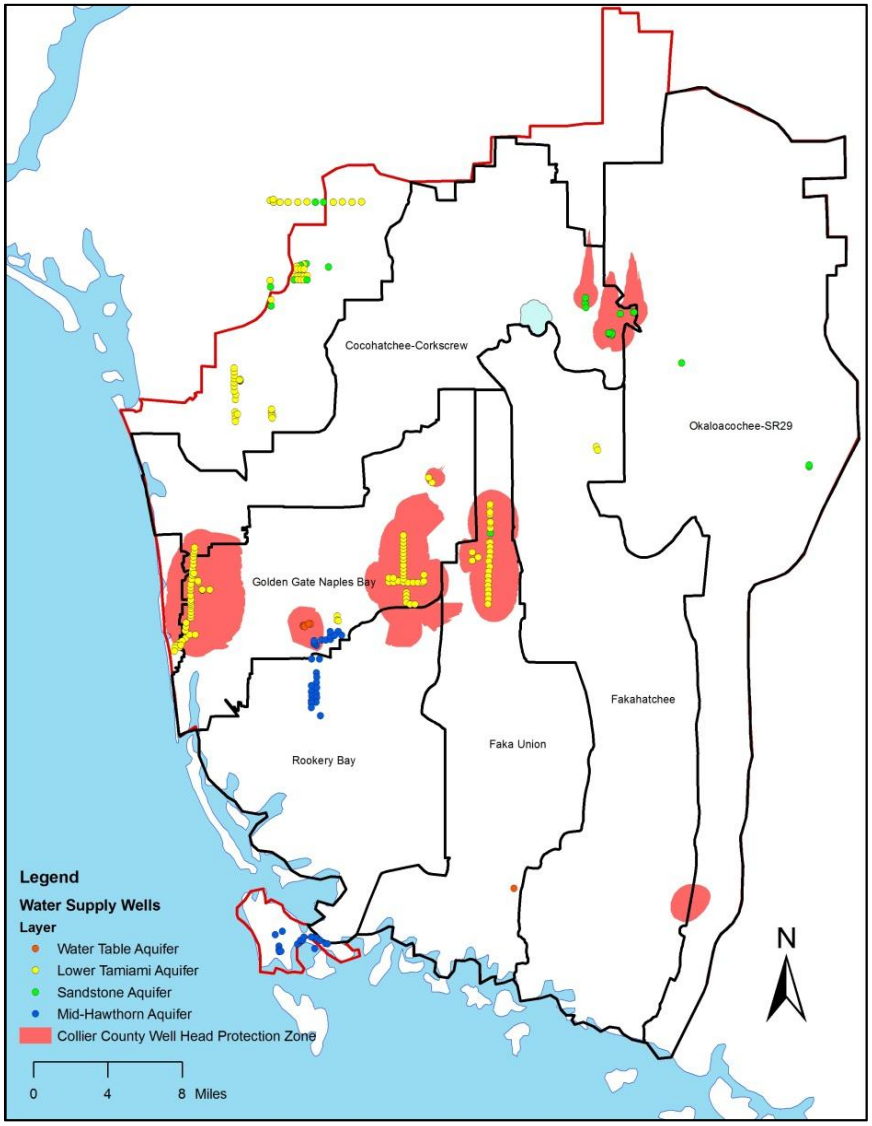


Figure 2-49. Municipal Water Supply Wells and Well Head Protection Zones

Onsite Private Wells

Throughout suburban areas in the county, private wells are used to provide water for domestic consumption and landscape irrigation. Currently there is no database identifying the location and number of the domestic self supply wells within Collier County. For modeling purposes, it was assumed that urban areas outside of water service areas use private wells. Figure 2-50 shows the areas in the County that were assumed to be served by private water wells.

Due to the lack of data, domestic self supply wells are not represented as individual wells in the model. The urban areas served by private wells were represented within the irrigation component of the model. This is reasonable because water used for domestic self supply is returned to the Water Table Aquifer through septic systems or as irrigation. It is assumed that the model applies an

equal maximum pumping rate for domestic water supply for each cell within the defined area. It was further assumed that the private wells pump water from the Water Table Aquifer; however, it is noted that in some urban areas of the county, the Water Table Aquifer is very thin and these domestic self-supply wells are screened in the Lower Tamiami Aquifer.

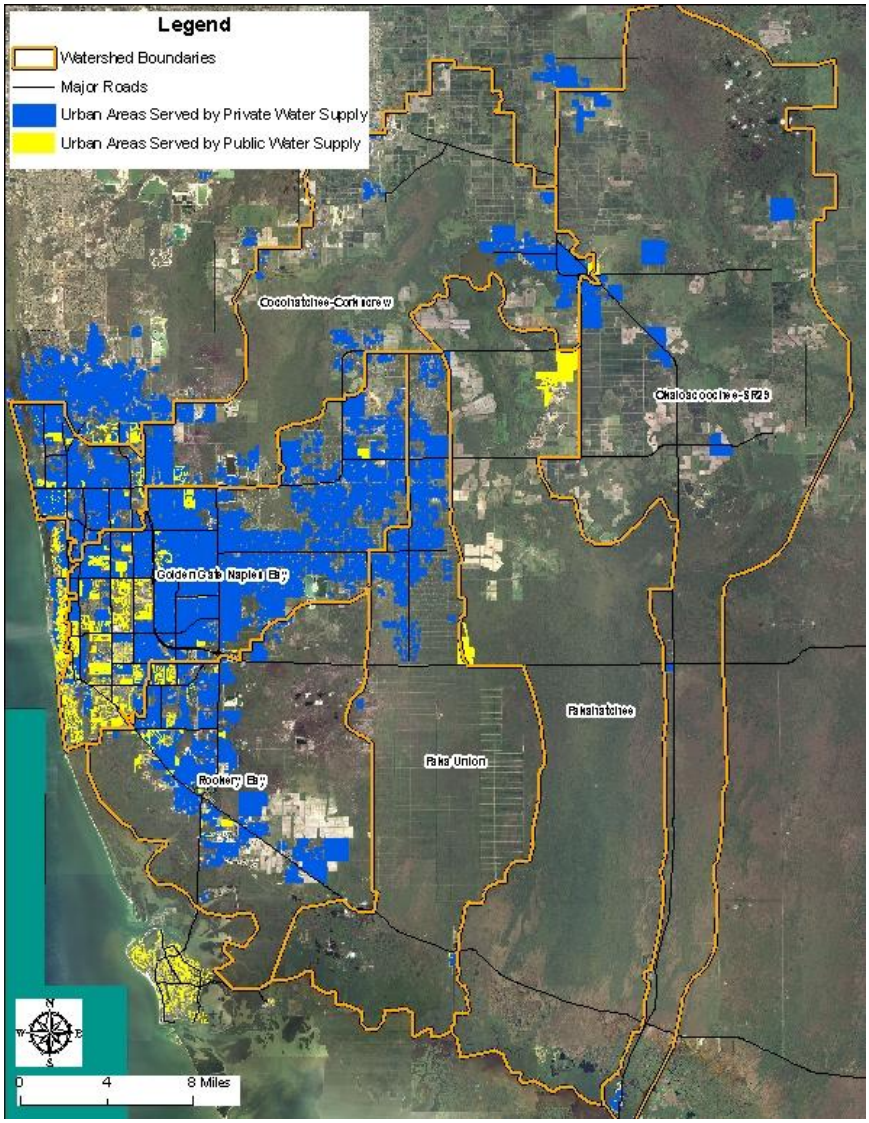


Figure 2-50. Urban Water Supply Distribution

Table 2-70 shows the predicted volume of water pumped by private wells annually in each watershed. The results indicate that demand from private wells exceeds demand from municipal wells only in Rookery Bay watershed where most of municipal water users are supplied from wells in other watersheds. Rookery Bay is also the only watershed where domestic self supply is taken primarily from the Lower Tamiami Aquifer.

Table 2-70. Annual and Seasonal Water Pumping Rates for Public Water Supply and Domestic Self Supply

Period	Cocohatchee Corkscrew				Golden Gate			
	Water Table	Lower Tamiami	Sandstone	Mid-Hawthorne	Water Table	Lower Tamiami	Sandstone	Mid-Hawthorne
	Domestic Self Supply (inches)							
Average Wet Season	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Average Dry Season	0.12	0.00	0.00	0.00	0.61	0.07	0.00	0.00
Average Water Year	0.14	0.00	0.00	0.00	0.63	0.07	0.00	0.00
	Public Water Supply (inches)							
Average Wet Season	0.00	0.02	0.09	0.00	0.07	1.22	0.00	0.12
Average Dry Season	0.00	0.03	0.19	0.00	0.13	2.68	0.00	0.19
Average Water Year	0.00	0.05	0.28	0.00	0.20	3.90	0.00	0.31
Period	Rookery Bay				Faka Union, Fakahatchee, Okaloacoochee			
	Water Table	Lower Tamiami	Sandstone	Mid-Hawthorne	Water Table	Lower Tamiami	Sandstone	Mid-Hawthorne
	Domestic Self Supply (inches)							
Average Wet Season	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Average Dry Season	0.02	0.04	0.00	0.00	0.03	0.00	0.00	0.00
Average Water Year	0.02	0.04	0.00	0.00	0.03	0.00	0.00	0.00
	Public Water Supply (inches)							
Average Wet Season	0.00	0.00	0.00	0.01	0.00	0.11	0.01	0.00
Average Dry Season	0.00	0.00	0.00	0.02	0.00	0.26	0.02	0.00
Average Water Year	0.00	0.00	0.00	0.04	0.00	0.37	0.02	0.00

Agricultural and Golf Course Irrigation

Agricultural and Golf Course irrigation is a significant amount of total water demand in Collier County. These areas are represented in the irrigation component of the model and pumping rates and well withdrawal information was defined by data obtained from permitted withdrawal information.

Figure 2-51 shows the distribution of irrigated agricultural lands and golf courses in the study area. This figure shows that the majority of the citrus areas are located in the Cocohatchee-Corkscrew and Okaloacoochee-SR29 watersheds. Truck or row crops are produced mostly in the northern portion of the Faka Union watershed and in the southeastern portion of the Rookery Bay watershed. The majority of the golf courses are located in the more urbanized areas near the coast in the Cocohatchee–Corkscrew, Golden Gate–Naples Bay, and Rookery Bay watersheds.

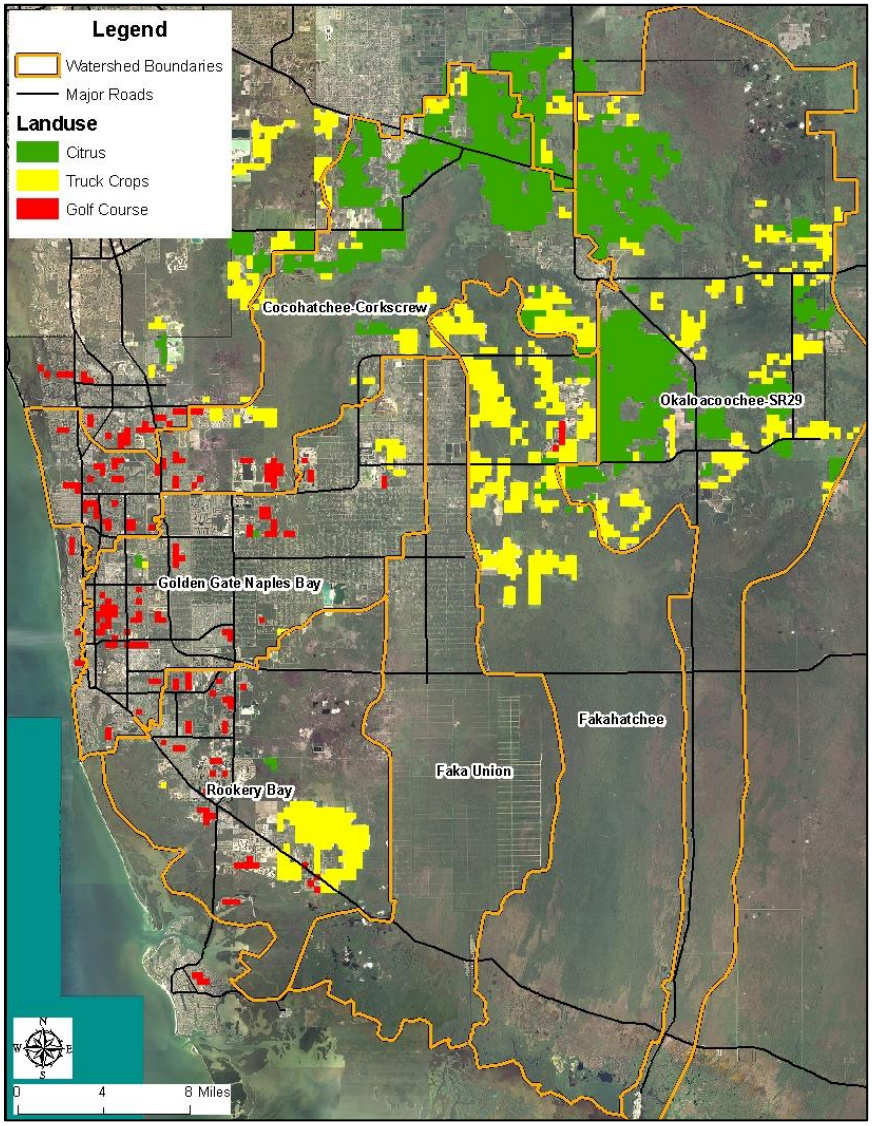


Figure 2-51. Agricultural and Golf Course Irrigated Areas

Table 2-71 shows predicted volumes of water applied to meet irrigation requirements in each watershed. For comparative purposes, the reported volumes for each specific land use classification were averaged across the entire area of the watershed. As an example, in the Cocohatchee–Corkscrew watershed, 8.9 inches of irrigation was applied to citrus during an average water year. This was average across the watershed to obtain the total of 1.5 inches reported in Table 2-71.

Table 2-71. Annual and Seasonal Water Pumping Rates for Agricultural and Golf Course Irrigation Needs

Period	Cocohatchee Corkscrew				Golden Gate			
	Surficial	Lower Tamiami	Sandstone	Mid-Hawthorne	Surficial	Lower Tamiami	Sandstone	Mid-Hawthorne
	Golf Courses (inches)							
Average Wet Season	0.002	0.003	0.000	0.000	0.007	0.003	0.000	0.000
Average Dry Season	0.026	0.030	0.000	0.000	0.129	0.068	0.000	0.000
Average Water Year	0.028	0.032	0.000	0.000	0.136	0.071	0.000	0.000
	Citrus (inches)							
Average Wet Season	0.008	0.014	0.057	0.003	0.000	0.000	0.000	0.000
Average Dry Season	0.180	0.409	0.792	0.038	0.004	0.001	0.000	0.000
Average Water Year	0.188	0.422	0.849	0.041	0.004	0.001	0.000	0.000
	Truck Crops (inches)							
Average Wet Season	0.030	0.061	0.020	0.000	0.000	0.005	0.000	0.000
Average Dry Season	0.148	0.268	0.093	0.000	0.000	0.023	0.000	0.000
Average Water Year	0.178	0.329	0.113	0.000	0.001	0.028	0.000	0.000
Period	Rookery Bay				Faka Union, Fakahatchee, Okaloacoochee			
	Surficial	Lower Tamiami	Sandstone	Mid-Hawthorne	Surficial	Lower Tamiami	Sandstone	Mid-Hawthorne
	Golf Courses (inches)							
Average Wet Season	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Average Dry Season	0.016	0.028	0.000	0.000	0.000	0.007	0.000	0.000
Average Water Year	0.018	0.028	0.000	0.000	0.000	0.007	0.000	0.000
	Citrus (inches)							
Average Wet Season	0.000	0.000	0.000	0.000	0.000	0.002	0.007	0.000
Average Dry Season	0.000	0.006	0.000	0.000	0.006	0.134	0.233	0.000
Average Water Year	0.000	0.006	0.000	0.000	0.007	0.136	0.239	0.000
	Truck Crops (inches)							
Average Wet Season	0.007	0.051	0.000	0.000	0.007	0.102	0.003	0.000
Average Dry Season	0.055	0.520	0.000	0.000	0.041	0.506	0.012	0.000
Average Water Year	0.062	0.571	0.000	0.000	0.048	0.608	0.015	0.000

In the Cocohatchee-Corkscrew watershed, the total volume of water applied to meet irrigation demand (2.18 inches) slightly exceeds the demand for potable water supply (0.47 inch). Sixty-nine percent of the irrigation water is applied to citrus and 28 percent is applied to truck crops. Less than three (3) percent of irrigation water is applied to golf courses.

In the Golden Gate-Naples Bay watershed, total irrigation demand for groundwater at golf courses and in agricultural areas is predicted to be 0.24 inch annually compared to slightly more than 5 inches of demand to meet potable water supply needs. Irrigation at golf courses consists of 86 percent of the irrigation demand in the watershed.

Pumping for potable water supply needs is also less than the irrigation demand in the Rookery Bay watershed. The pumped volumes are 0.10 and 0.68 inch, respectively. Of the irrigation demand, truck crops utilize 92 percent of water used during the average water year.

Demand for irrigation supply exceeds potable water demand in the Faka Union, Fakahatchee, and Okaloacoochee-SR29 watersheds. Potable water usage averages 0.42 inches in the typical water year, while irrigation usage is predicted to equal 1.06 inches across the watersheds. More than 60 percent of the irrigation water was applied to truck crops; another 35 percent of the irrigation water was applied to citrus.

2.4.3 Aquifer Hydraulic Heads/Elevations

The following sections present information describing the average water year and average seasonal groundwater head (measured by elevation of water levels) in each aquifer. The model-predicted hydraulic heads will be used to identify areas of potential concern in terms of groundwater withdrawals. The hydraulic heads will also be used as the basis for determining a performance measure to assess impacts of proposed projects.

Water Table Aquifer

Figures 2-52 through 2-54 show the predicted average annual and average seasonal hydraulic heads in the Water Table Aquifer. The gradient of the average annual groundwater surface is approximately 0.8 feet per mile (0.016 percent) and trends from the northeastern part of the county, north of Immokalee, to the southwest. The water surface gradient generally follows the topographic slope of approximately 1.0 foot per mile (0.020 percent).

The seasonal average groundwater surface elevation maps for the Water Table Aquifer shown in Figures 2-53 and 2-54 show a shift in the isohyetal lines. This is most evident near the coast in Faka Union watershed where the 5- and 10-foot contour lines shift as much as five (5) miles further inland. In the Faka Union watershed, this shift may be attributed to the presence of the canal network and the high volume of baseflow in this watershed. As shown in Table 2-54, baseflow from the Water Table Aquifer in the eastern watersheds is more than 2.5 inches annually. The majority of that baseflow occurs in the Faka Union watershed. In the Cocohatchee–Corkscrew, Golden Gate–Naples Bay, and Rookery Bay watersheds, the isohyetal line shift is strongly influenced by increased groundwater pumping during the dry season and may be indicative of potential risks to water supply due to salt water intrusion.

There is an area of the Water Table Aquifer, north of Immokalee, where the water table is predicted to exceed 30 feet in elevation, This average annual groundwater elevation is not observed in the underlying Lower Tamiami Aquifer, except during the wet season (see Figure 2-57). This suggests that the aquitard in this location is less permeable than in other areas, and creates a perched water table.

Figure 2-55 shows the predicted annual fluctuation in the Water Table Aquifer. For this evaluation, fluctuation is defined as the difference between the average water year maximum groundwater head and the average water year minimum groundwater head and represents the change in

groundwater head from wet season to dry season. Darker areas indicate greater fluctuation in the groundwater surface. These large fluctuations are attributed to groundwater pumping to meet potable water supply and irrigation demand during the dry season. The areas with greater differences in elevation are also influenced by the horizontal conductivity of the aquifers and the connectivity to other aquifers. Figure 2-55 also indicates that there are large differences in groundwater head near the boundary of the study area. These results are most likely due to differences in the established boundary conditions defined in the models.

Lower Tamiami Aquifer

The average annual, average seasonal, and annual fluctuation in groundwater surface elations for the Lower Tamiami Aquifer are shown in Figures 2-56 through 2-58. During the wet season, there is an area of higher potentiometric elevations north of Immokalee that is not observed in the average annual and average dry season maps. The results also indicate similar shifts in the 5- and 10-foot isohyets as was seen in the Water Table Aquifer system.

In the Faka Union, watershed, the shift is less than three (3) miles compared to the five (5) miles observed in the Water Table aquifer. The difference is due to less interaction with the canal network. Baseflow from the Lower Tamiami Aquifer is predicted to be approximately 1.25 inches annually (Table 2-59). This is less than half of what was predicted for the Water Table Aquifer.

The shift of the isohyetal lines near the coast in the Cocohatchee–Corkscrew, Golden Gate–Naples Bay, and Rookery Bay watershed are also similar to that observed in the Water Table Aquifer. This indicates that there is high connectivity between the aquifers.

The annual fluctuation in head elevation for the Lower Tamiami Aquifer, shown in Figure 2-59, indicates that there is a great demand placed on this aquifer during the dry season in the Fakahatchee and Okaloacoochee-SR29 watersheds. This is supported by the information presented in Table 2-59, which reports agricultural irrigation exceeds 1.29 inches from the Lower Tamiami Aquifer during the dry season. This volume is averaged over the watershed and approaches nine (9) inches of water applied directly to agricultural lands.

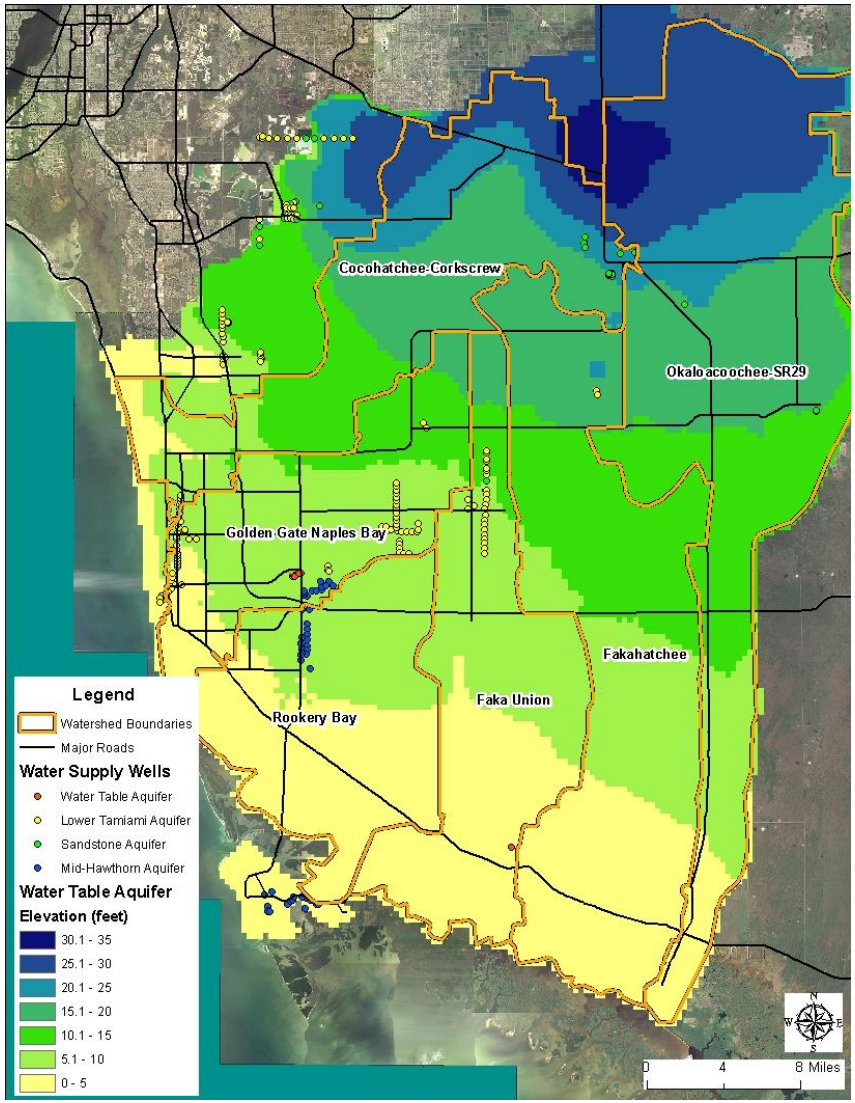


Figure 2-52. Water Table Aquifer Average Annual Elevation

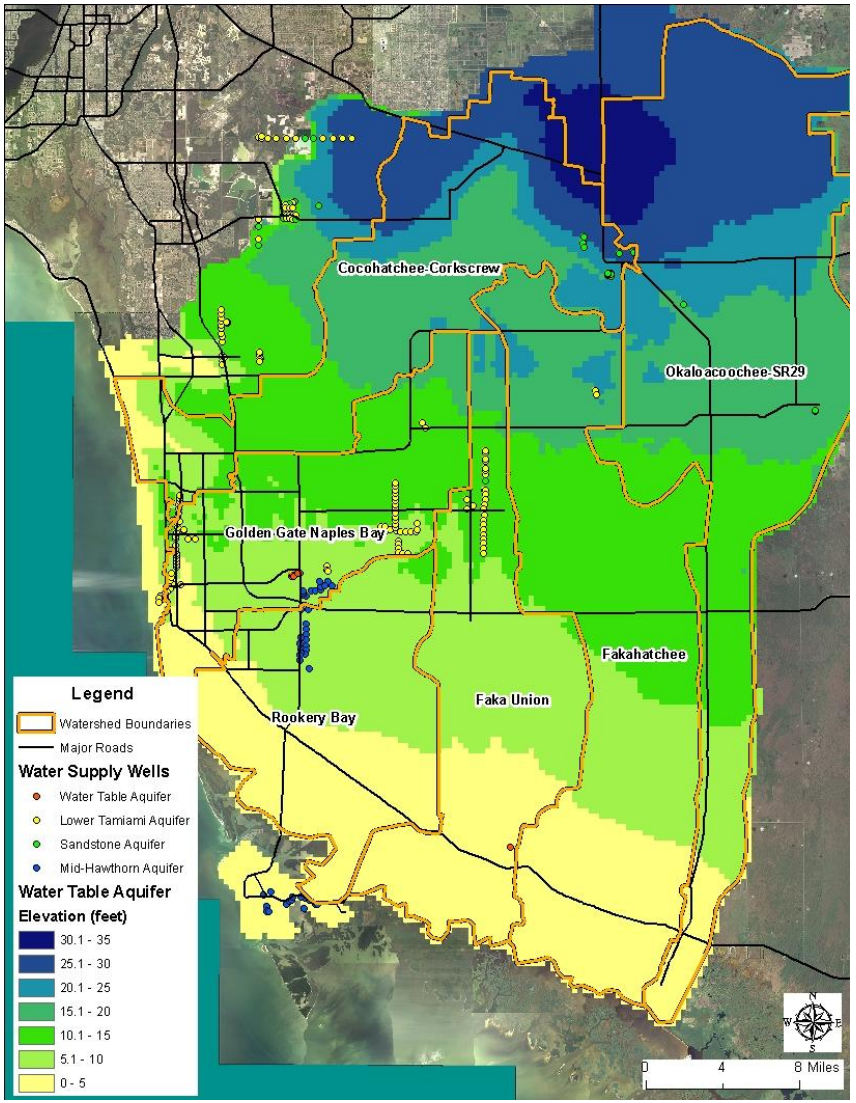


Figure 2-53. Water Table Aquifer Average Wet Season Elevation

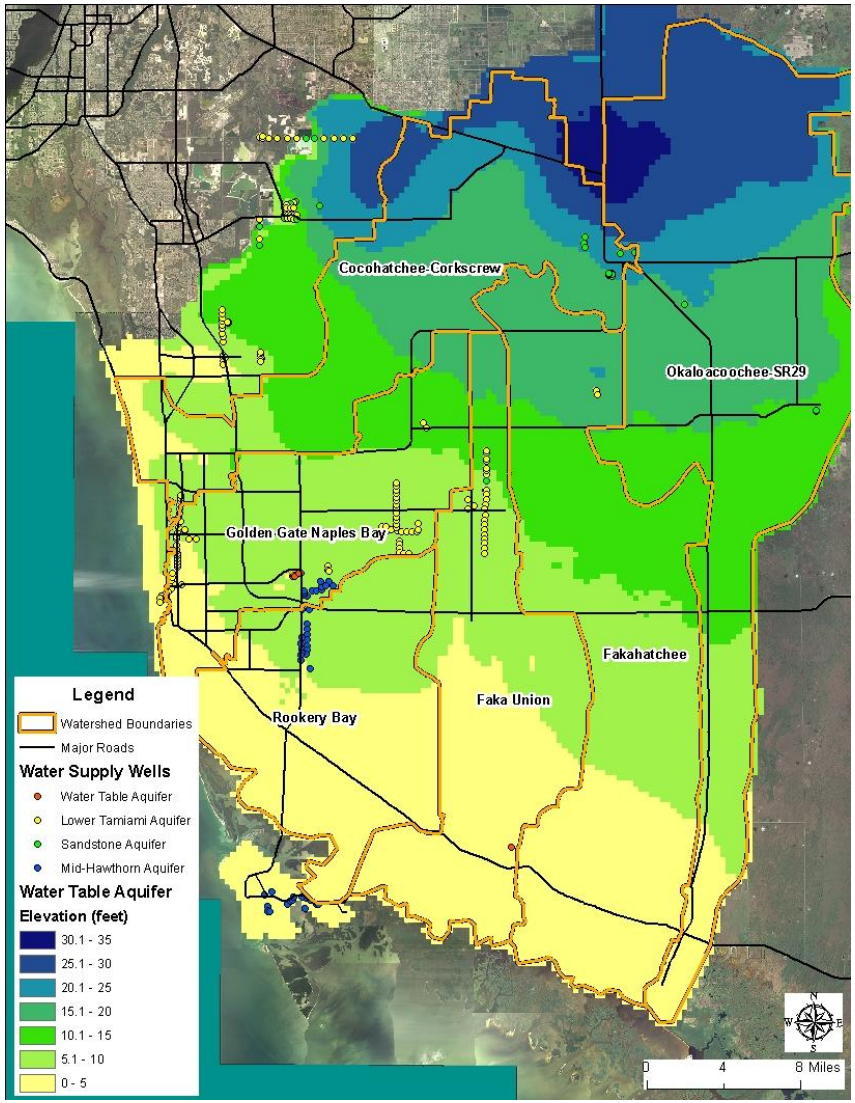


Figure 2-54. Water Table Aquifer Average Dry Season Elevation

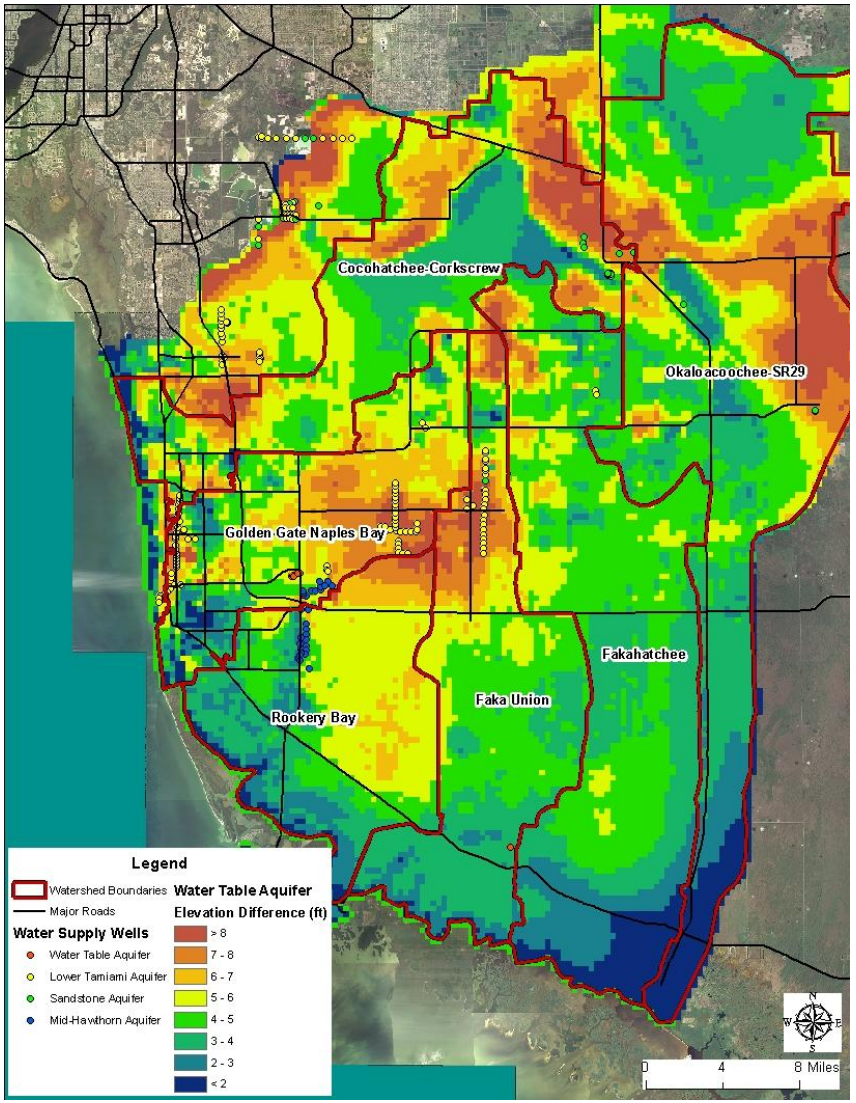


Figure 2-55. Water Table Aquifer Average Annual Groundwater Fluctuation

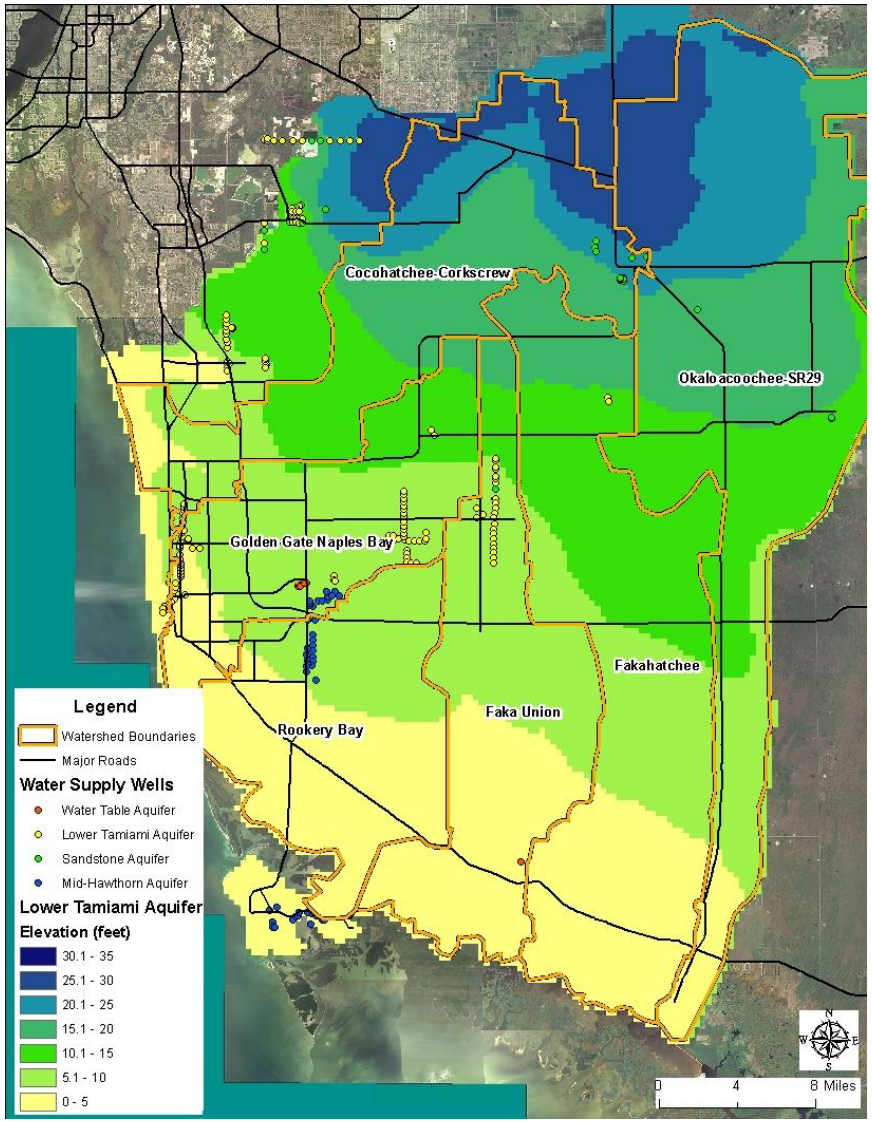


Figure 2-56. Lower Tamiami Aquifer Average Annual Elevation

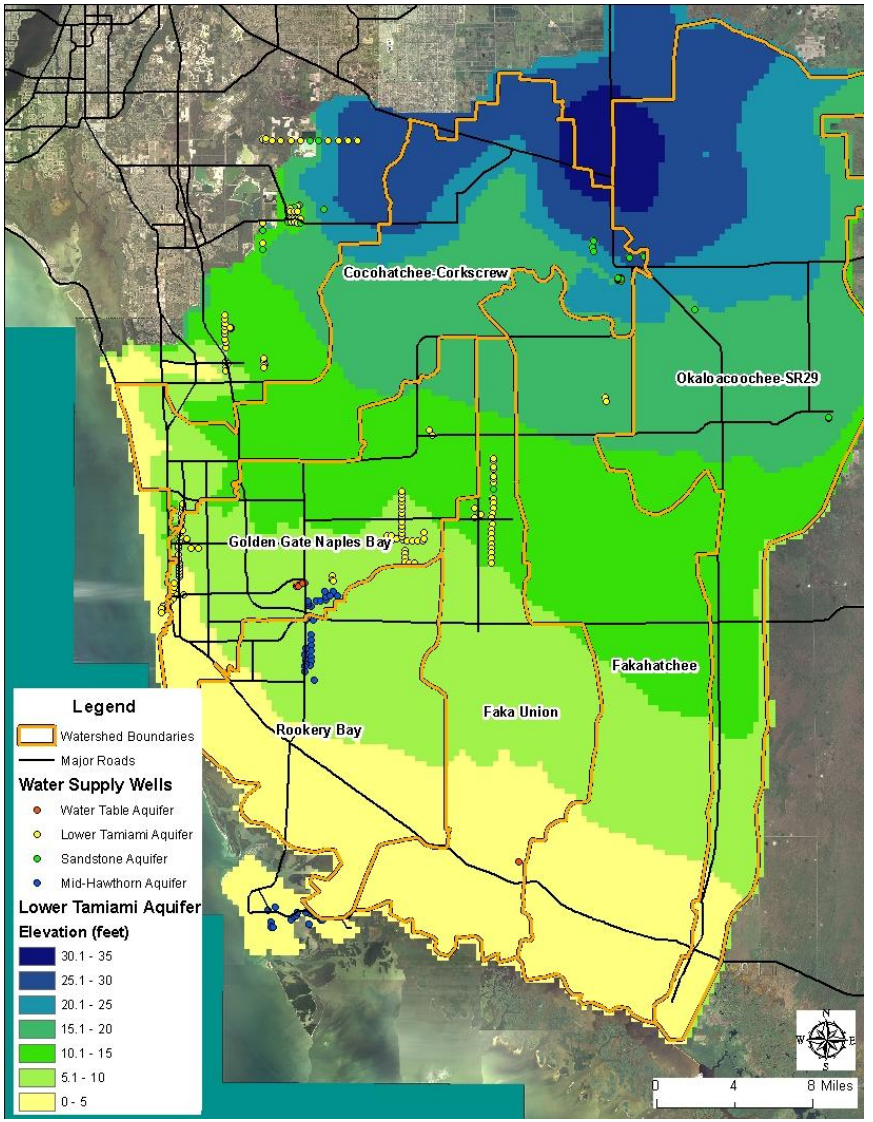


Figure 2-57. Lower Tamiami Aquifer Average Wet Season Elevation

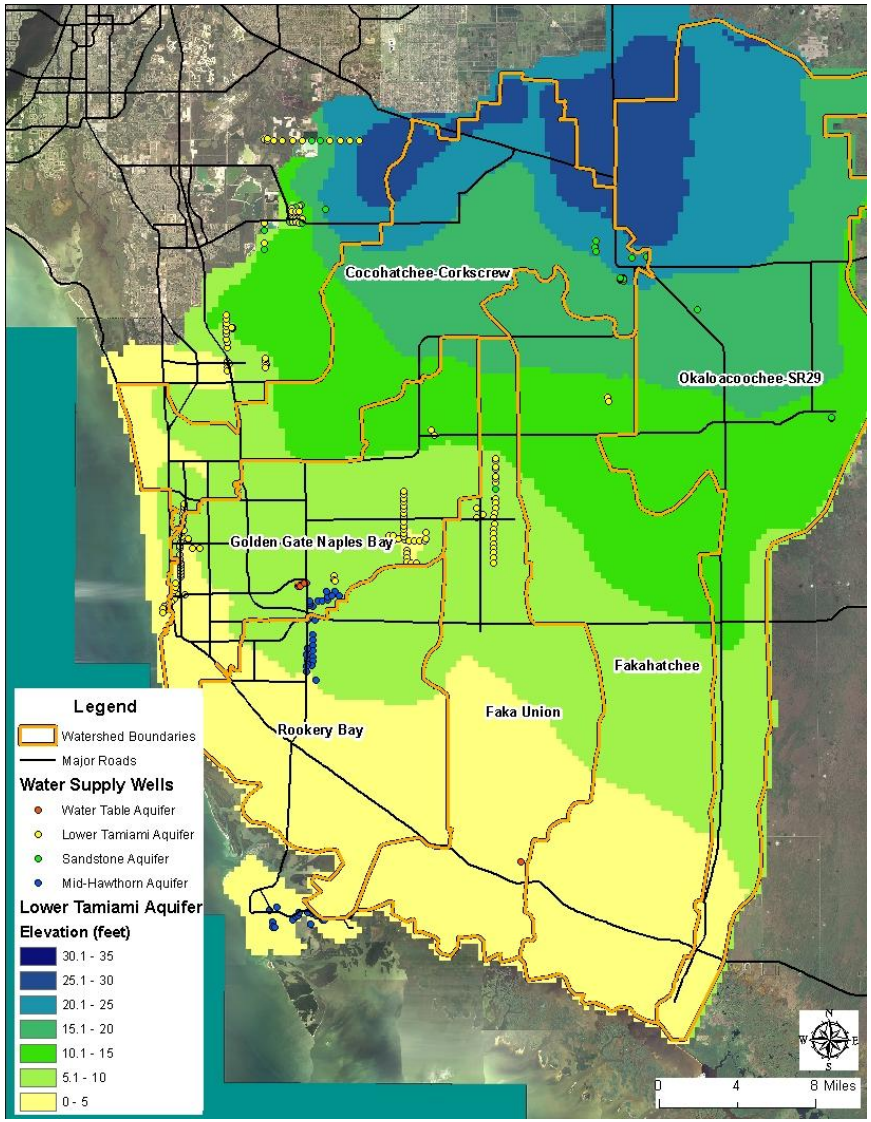


Figure 2-58. Lower Tamiami Aquifer Average Dry Season Elevation

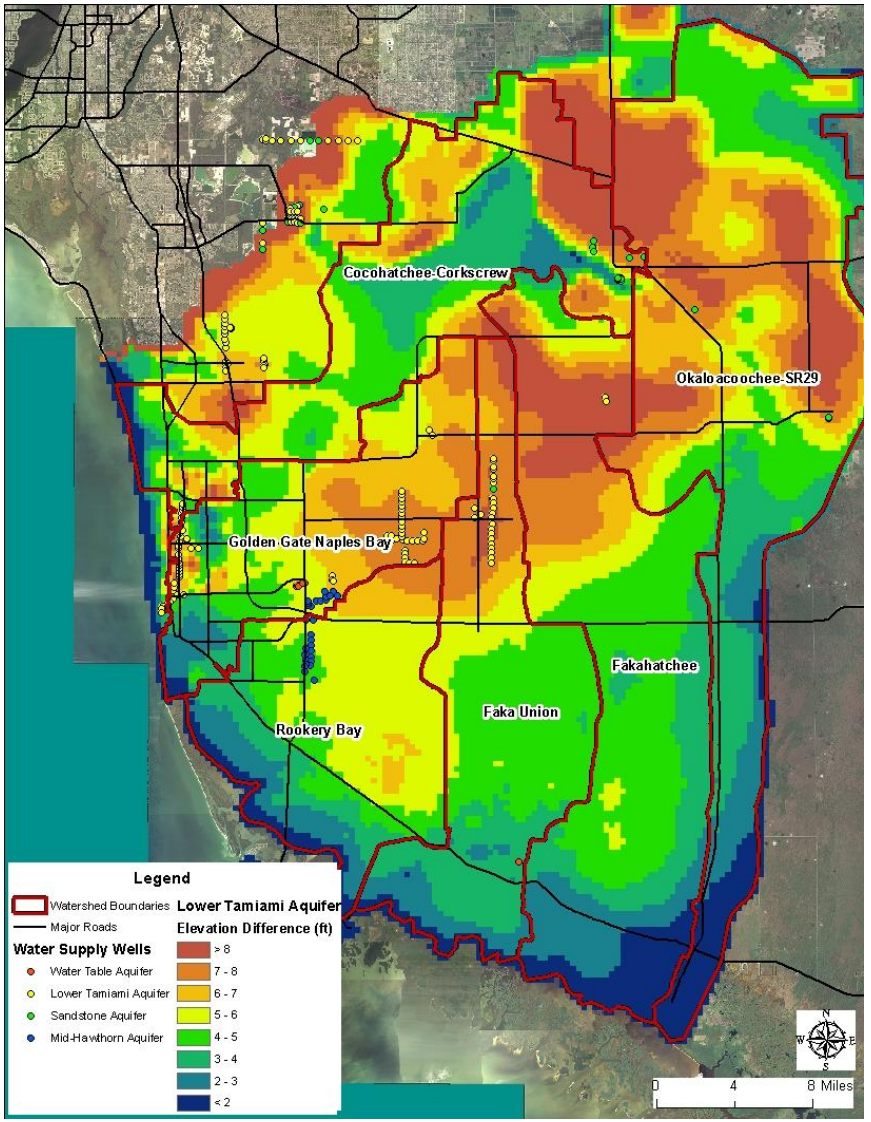


Figure 2-59. Lower Tamiami Aquifer Average Annual Groundwater Fluctuation

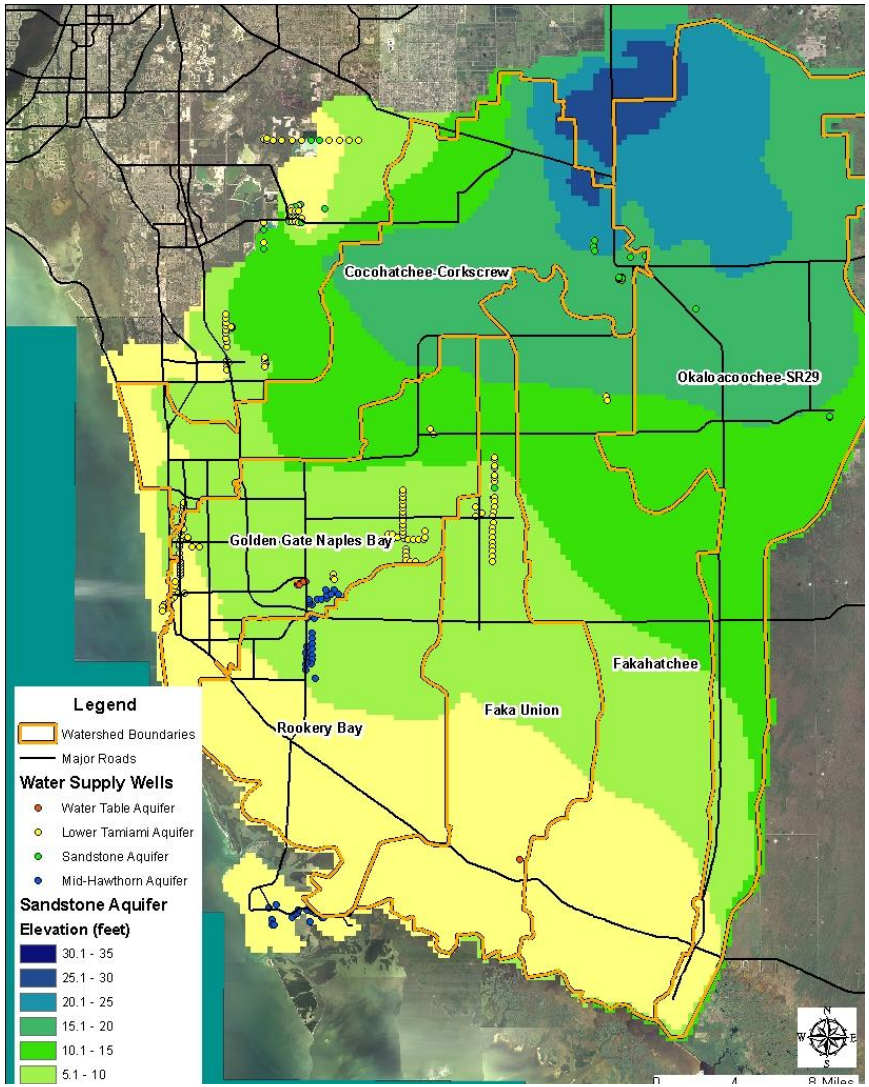


Figure 2-60. Sandstone Aquifer Average Annual Elevation

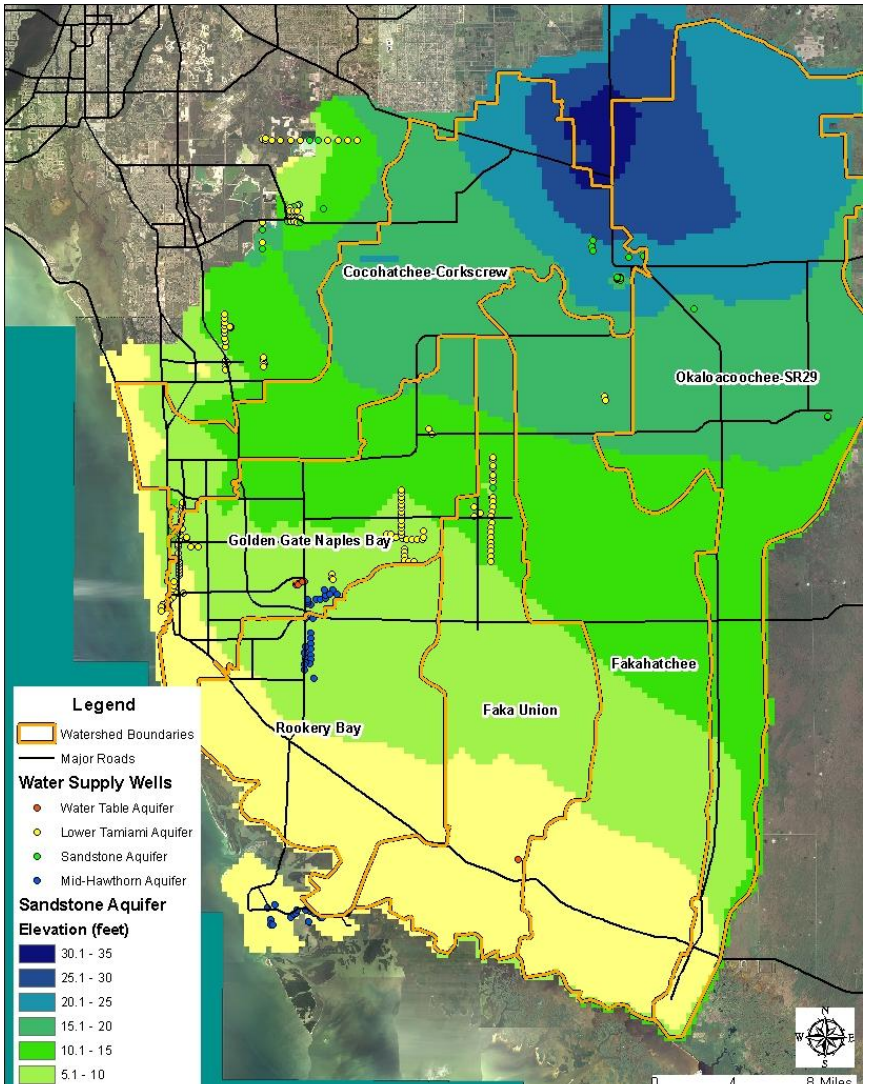


Figure 2-61. Sandstone Aquifer Average Wet Season Elevation

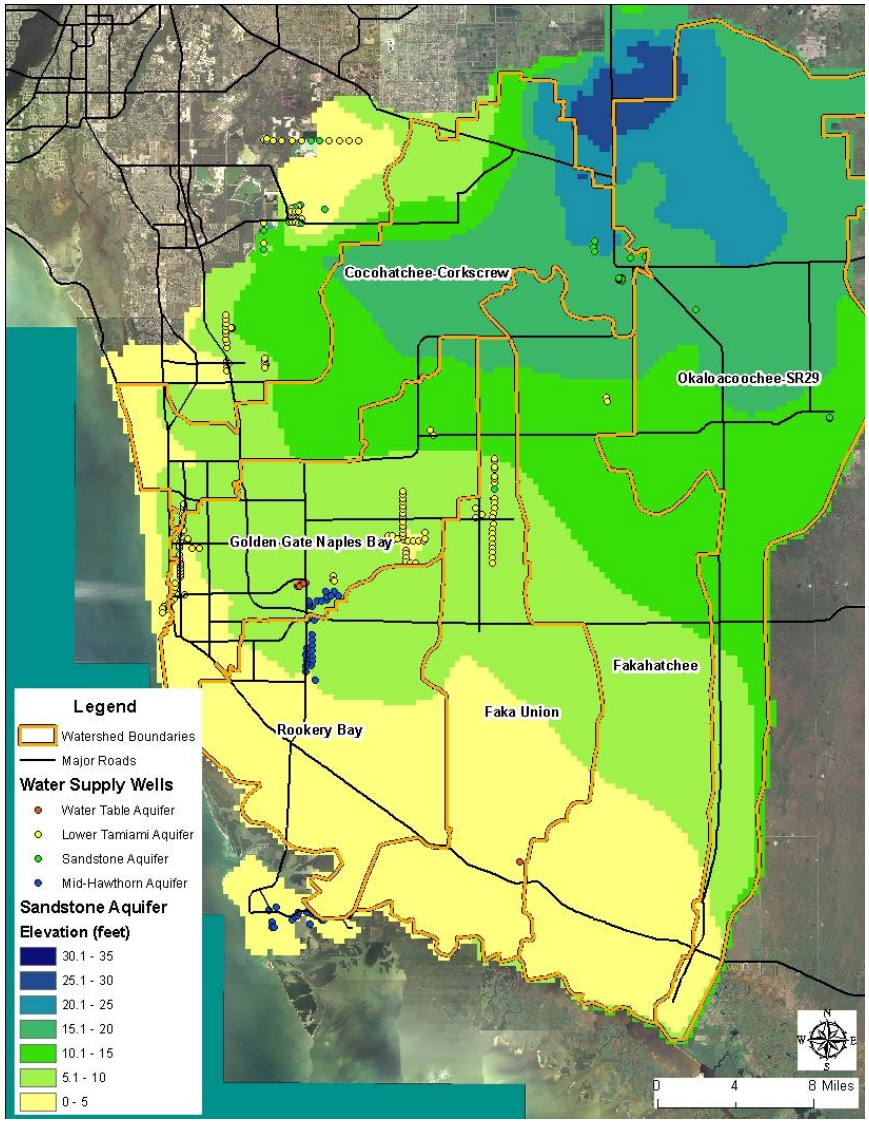


Figure 2-62. Sandstone Aquifer Average Dry Season Elevation

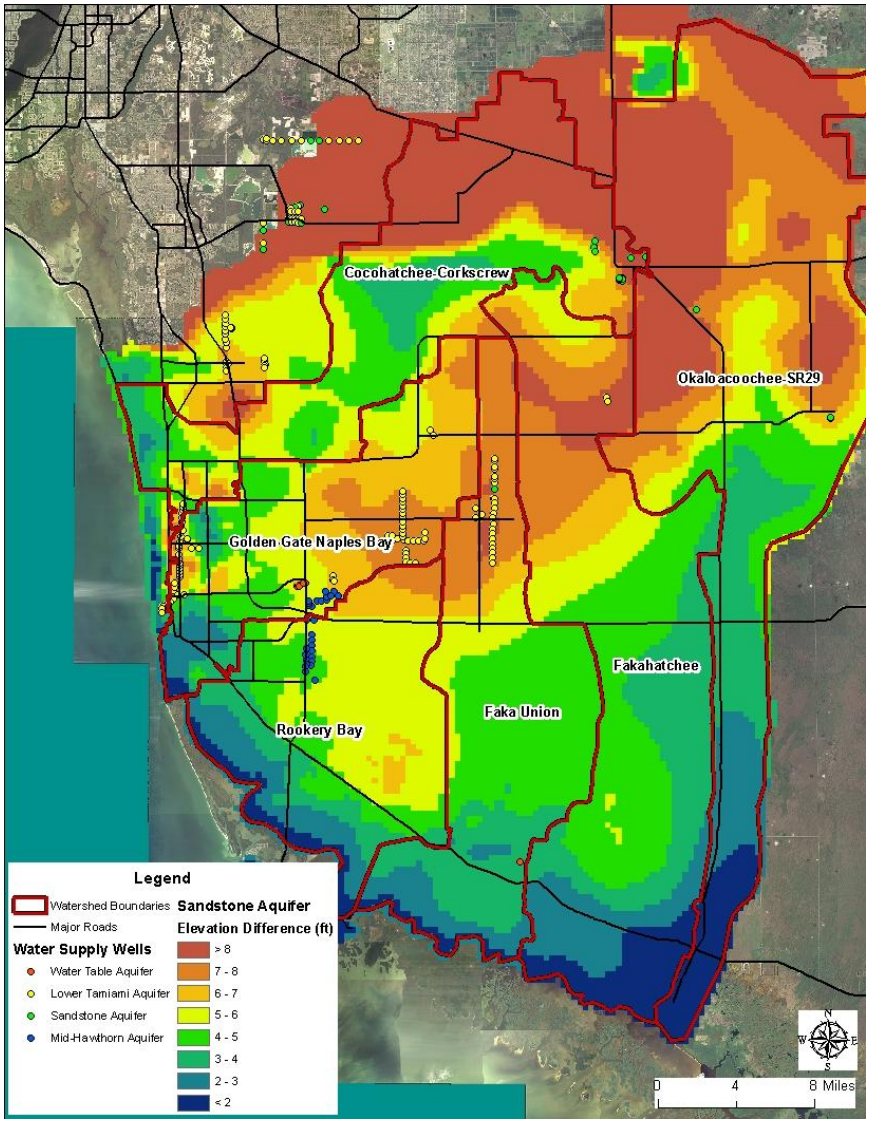


Figure 2-63. Sandstone Aquifer Average Annual Groundwater Fluctuation

Sandstone Aquifer

Figures 2-60 through 2-62 show the average annual and seasonal groundwater surface elevations for the Sandstone aquifer. As was observed in the Lower Tamiami Aquifer, there is an area of increased groundwater surface elevation north of Immokalee where the groundwater surface exceeds 30 feet in elevation. Similar elevations were not observed in the average annual and average dry season maps. The results also indicate similar shifts in the 5- and 10-foot isohyets as was seen in the Lower Tamiami Aquifer system.

In all of the watersheds, the shift in the isohyetal lines from the wet season (Figure 2-61) to the dry season (Figure 2-62) is almost identical to those observed in the Lower Tamiami Aquifer. This similarity indicates that there is high connectivity between the aquifers. The water budget discussion (Table 2-55) indicated that the Lower Tamiami Aquifer receives large volumes of inflow from the underlying Sandstone Aquifer, which supports the results of the mapped groundwater elevations.

Figure 2-63 shows the annual fluctuation in head elevation for the Sandstone Aquifer. As with the Lower Tamiami Aquifer, the figure indicates that there is great demand placed on this aquifer during the dry season. The Lee County wellfield draws from the Sandstone Aquifer and is the likely cause of the drawdown observed in the northern portion of the Cocohatchee-Corkscrew watershed. However, there is little pumping directly from the Sandstone Aquifer in the Faka Union and Okaloacoochee-SR29 watersheds as is shown in Table 2-64. This suggests that water is migrating from the Sandstone Aquifer into the Lower Tamiami Aquifer to meet irrigation demands. This is supported by the information presented in Table 2-59. More than 3 inches of groundwater migrates from the Sandstone to the Lower Tamiami Aquifer during the average dry season.

Mid-Hawthorn Aquifer

The Mid-Hawthorn Aquifer exhibits a noticeable depression in the potentiometric surface around the well field that straddles the boundary between the Golden Gate and Rookery Bay watersheds. This is seen in Figures 2-64 through 2-66. This well field draws from the Mid-Hawthorn Aquifer and is the likely source of drawdown. The wet season and dry season elevation maps indicate that the area influence by pumping shifts several miles to the north and east. This pattern of drawdown was not observed in the Sandstone Aquifer; indicating that there is little interaction between the Mid-Hawthorn Aquifer and the overlying Sandstone Aquifer.

Figure 2-67 shows extensive drawdown near the Collier County wellfield. The area of drawdown in the northern portion of the Cocohatchee-Corkscrew watershed is most likely a function of boundary conditions defined in the model. There are no known wells that draw from the Mid-Hawthorn Aquifer in that area.

2.4.4 Model Sensitivity to Increased Potable Water Supply Demand

In order to evaluate the sensitivity of the groundwater system to an increase in potable water supply demand, model sensitivity tests were conducted assuming a 10 percent increase in potable water demand. It was assumed that such an increase is realistic without having to develop new wellfields. The ECM pumping time series for all potable water supply pumping wells were modified to reflect the increased withdrawal rate.

It is expected that agricultural demand will decrease as development continues in the county. It is further expected that future development, and redevelopment of areas currently using private wells and septic systems, will be required to utilize municipal water and sewer systems. Therefore, no change was made to pumping rates for irrigation or domestic self supply wells.

A first model sensitivity test consisted of comparing the average annual minimum water level in each aquifer predicted by the ECM against the average annual minimum water level in each aquifer as predicted by the model with increased pumping. The results are shown in maps that define the change in drawdown resulting from the increased pumping in each aquifer. **Figures 2-68 through 2-71** show the increased drawdown in each aquifer.

A second sensitivity test considered the effect of increased pumping during a prolonged dry season. The dry season of 2007, which began on November 1, 2006 and continued through June 2007, followed a wet season with little rainfall. This average groundwater elevation calculated for the dry season 2007 was used to evaluate the effect of increased pumping during prolonged drought conditions. **Figures 2-72 through 2-75** show the extent of the increased drawdown during the extended dry period.

The area near where Immokalee Road turns to the north indicates a predicted difference in water surface elevation for the Water Table Aquifer that exceeds 0.5 feet during the driest dry season, although no potable water supply wells exist at this location. This result appears to be related to an unstable structure operation in the Cocohatchee Canal that occurs only during the driest dry season with the increased pumping.

In each of the aquifer systems, the extent of the predicted area influenced by pumping increases during extended drought conditions. The results show that the area of influence extends from the City of Naples wellfield into the northern portions of the Fakahatchee watershed and that individual areas of influence have merged into a single area of influence that encompasses almost the entire area of the Golden Gate-Naples Bay Watershed.

The results indicate that the availability of groundwater is limited to meet long-term water supply needs for Collier County. Increased pumping is predicted to increase the risk of salt water intrusion and potentially affect availability of water for domestic self supply from the Water Table and Lower Tamiami aquifer systems.

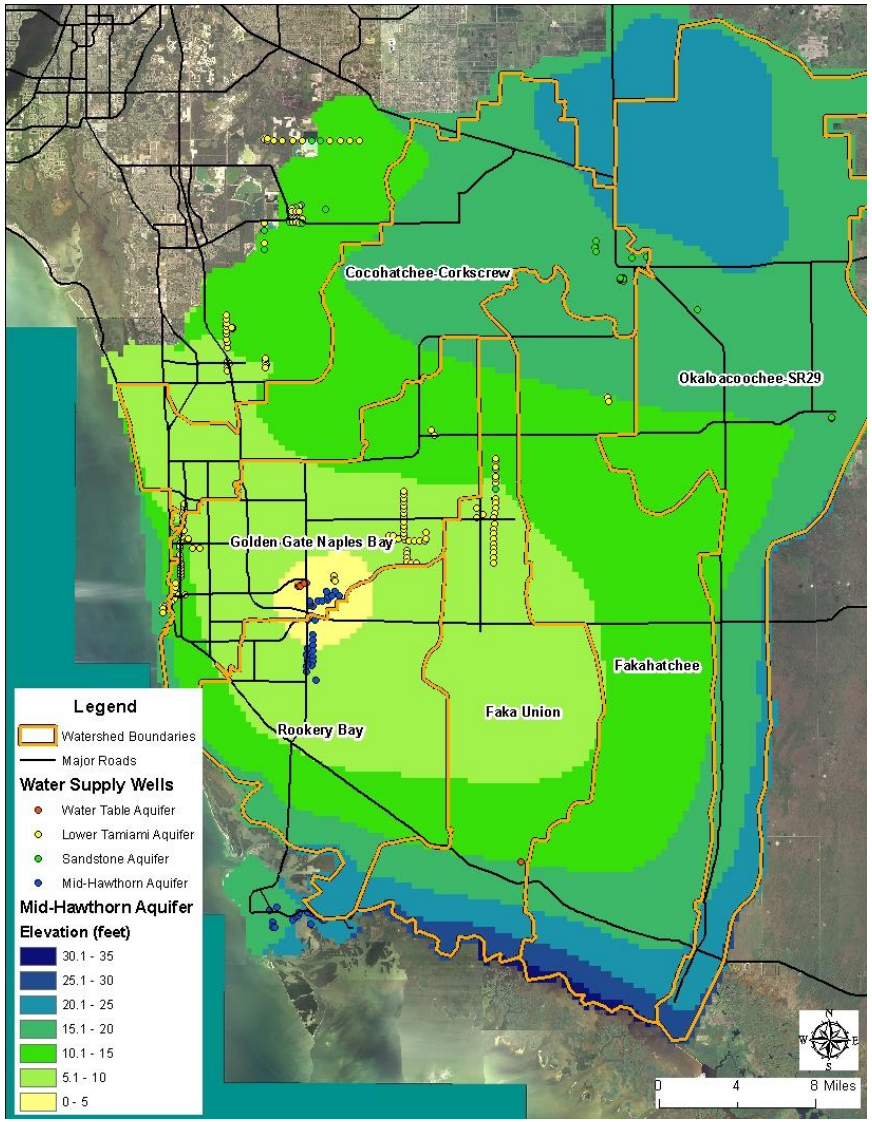


Figure 2-64. Mid-Hawthorn Aquifer Average Annual Elevation

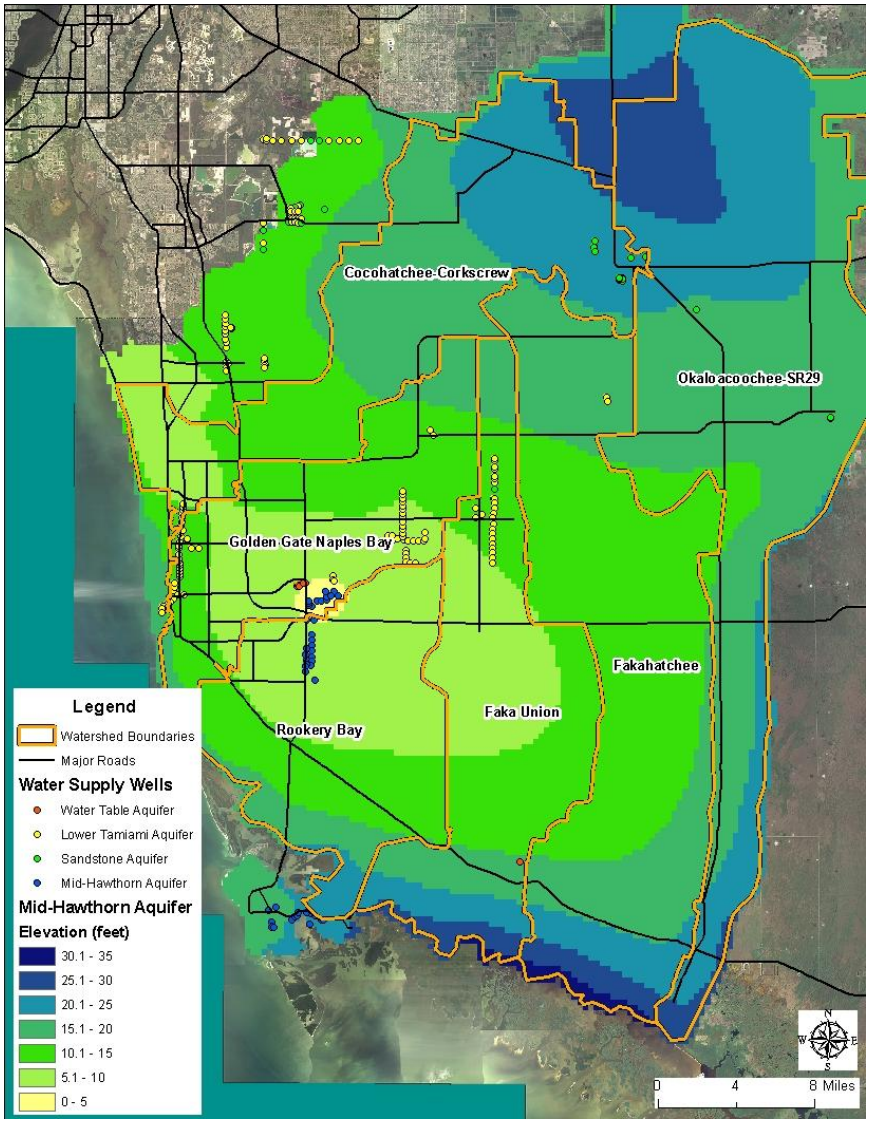


Figure 2-65. Mid-Hawthorn Aquifer Average Wet Season Elevation

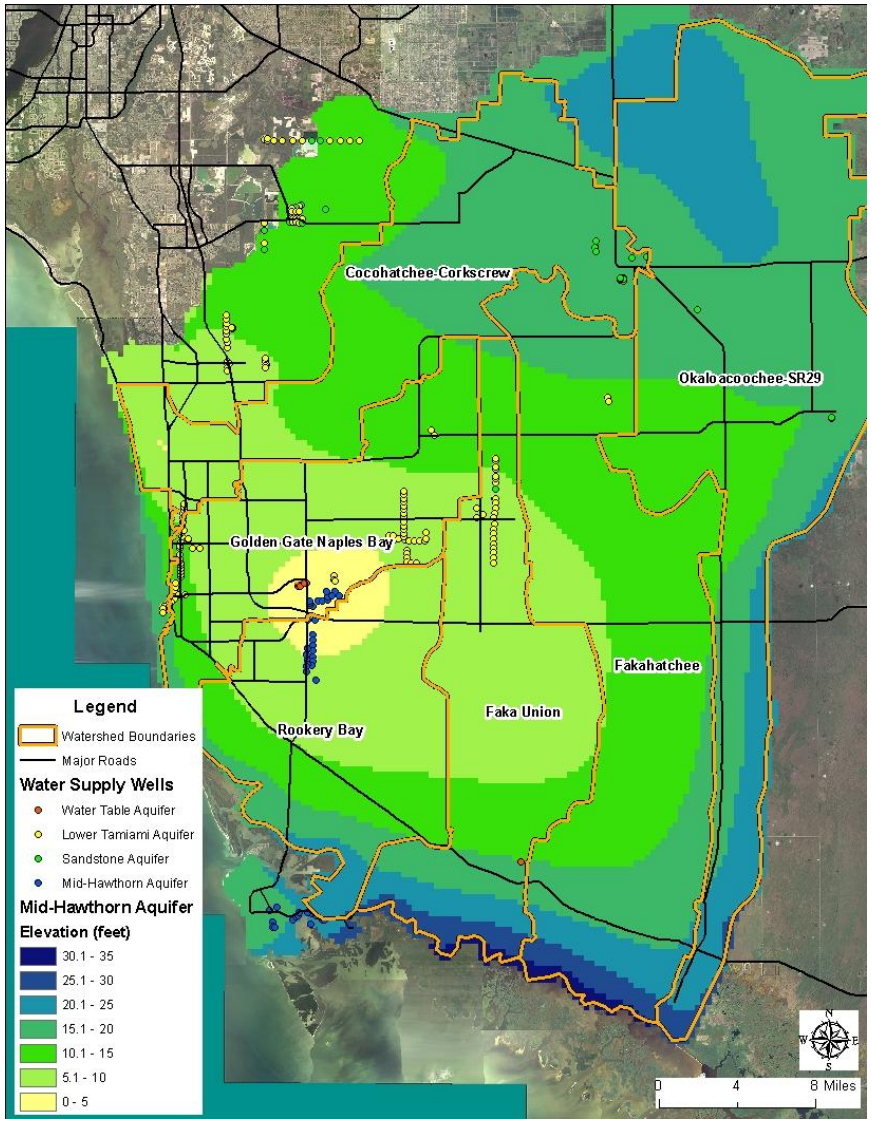


Figure 2-66. Mid-Hawthorn Aquifer Average Dry Season Elevation

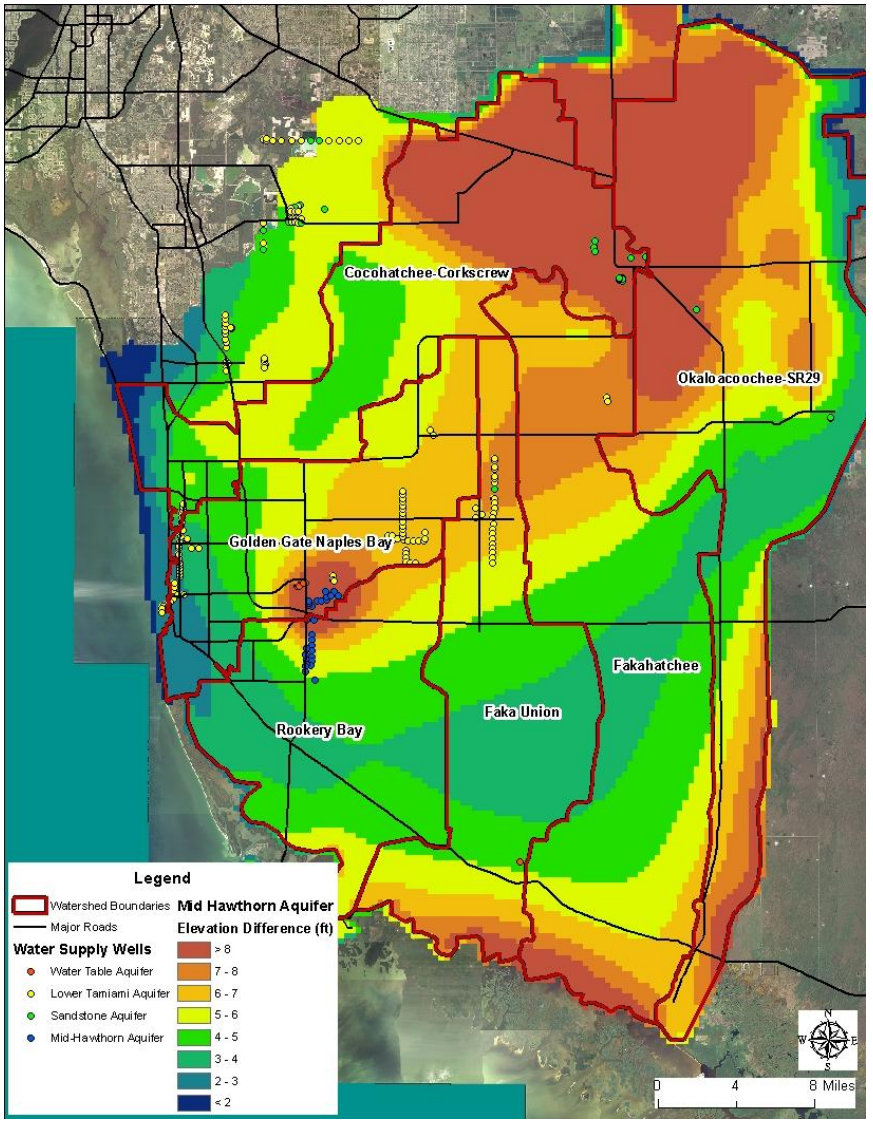


Figure 2-67. Mid-Hawthorn Aquifer Average Annual Groundwater Fluctuation

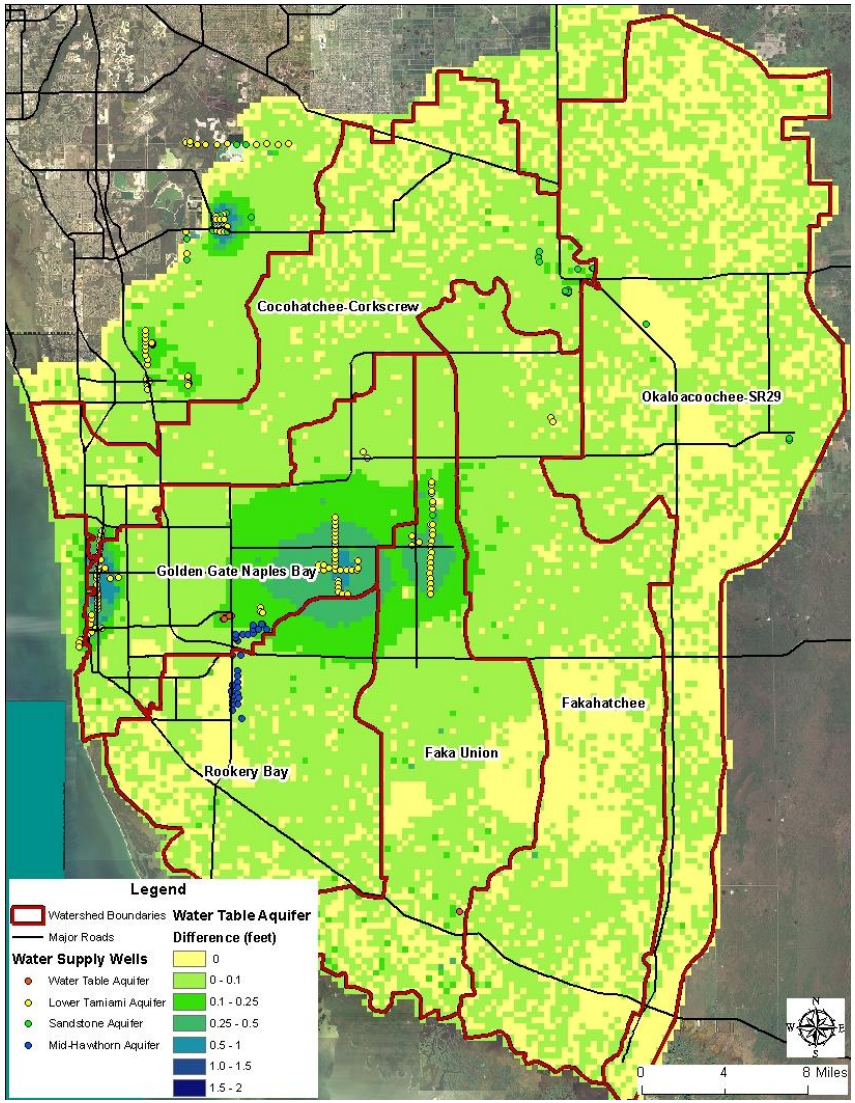


Figure 2-68. Water Table Aquifer Average Increase in Drawdown With 10% Increase in Groundwater Withdrawal

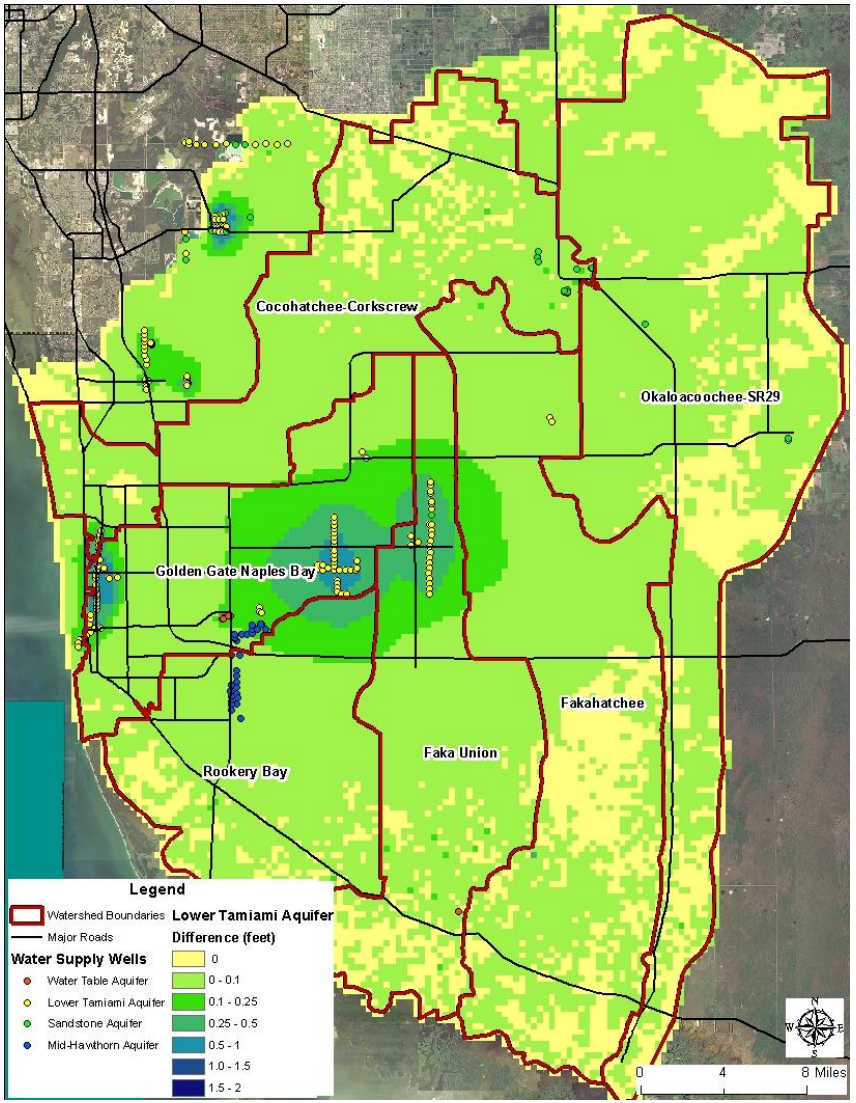


Figure 2-69. Lower Tamiami Aquifer Average Increase in Drawdown With 10% Increase in Groundwater Withdrawal

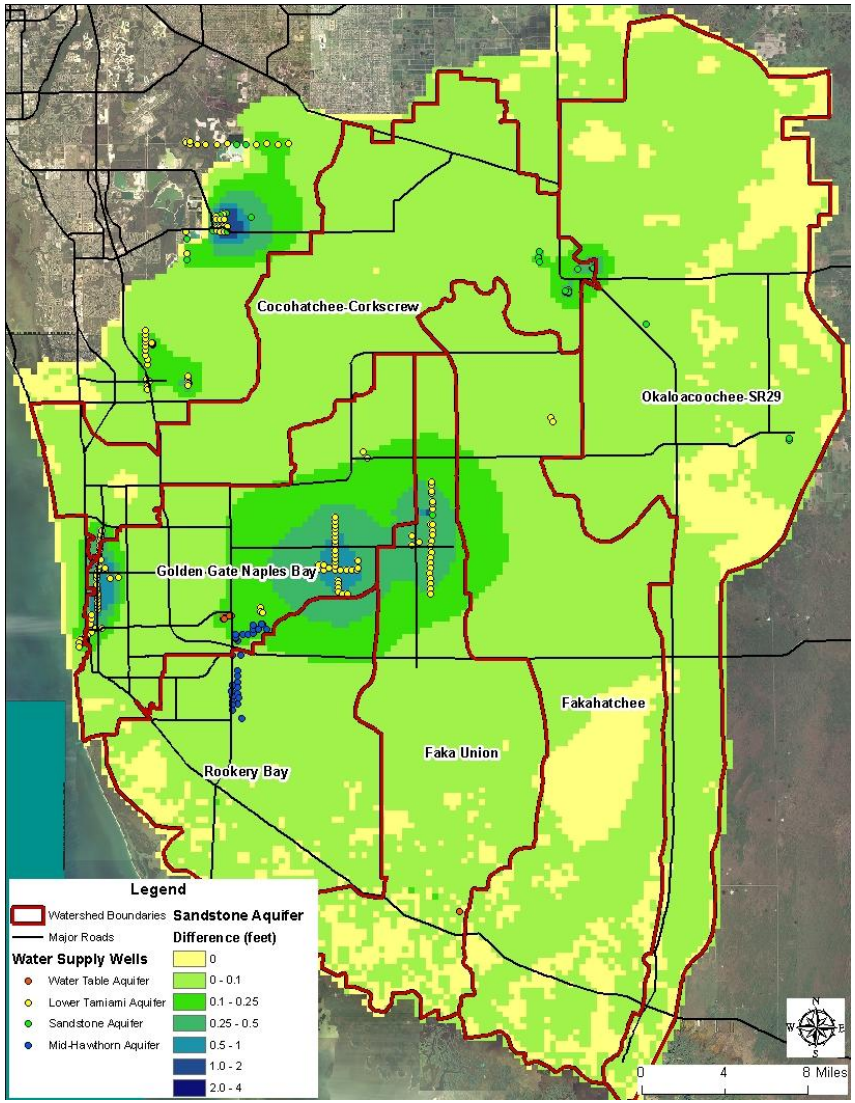


Figure 2-70. Sandstone Aquifer Average Increase in Drawdown With 10% Increase in Groundwater Withdrawal

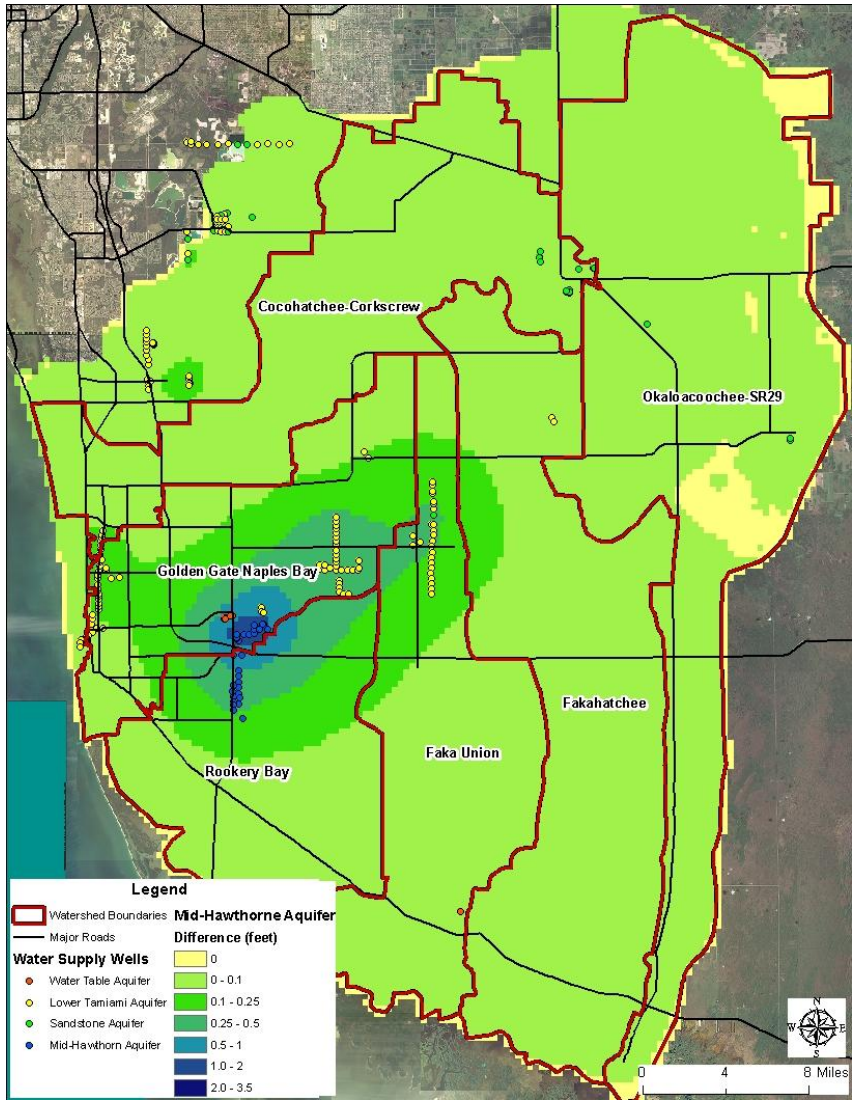


Figure 2-71. Mid-Hawthorn Aquifer Average Increase in Drawdown With 10% Increase in Groundwater Withdrawal

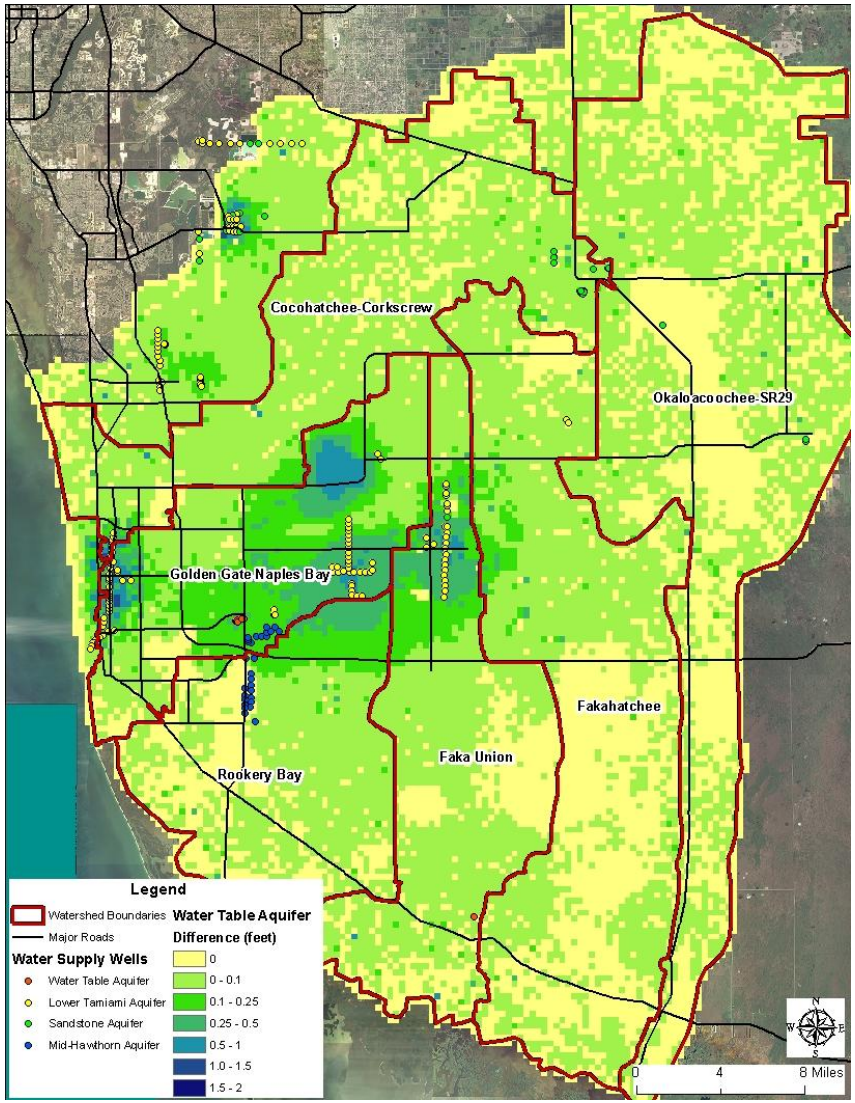


Figure 2-72. Water Table Aquifer Driest Dry Season Increase in Drawdown With 10% Increase in Groundwater Withdrawal

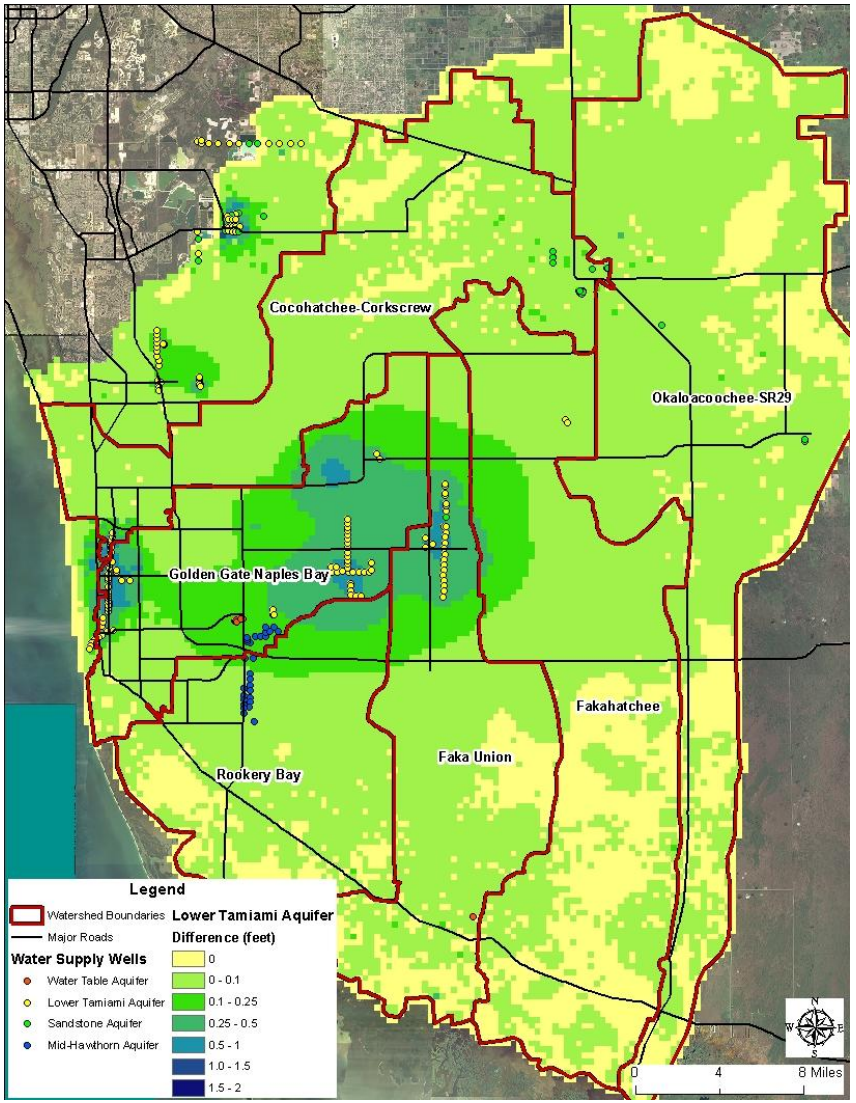


Figure 2-73. Lower Tamiami Aquifer Driest Dry Season Increase in Drawdown With 10% Increase in Groundwater Withdrawal

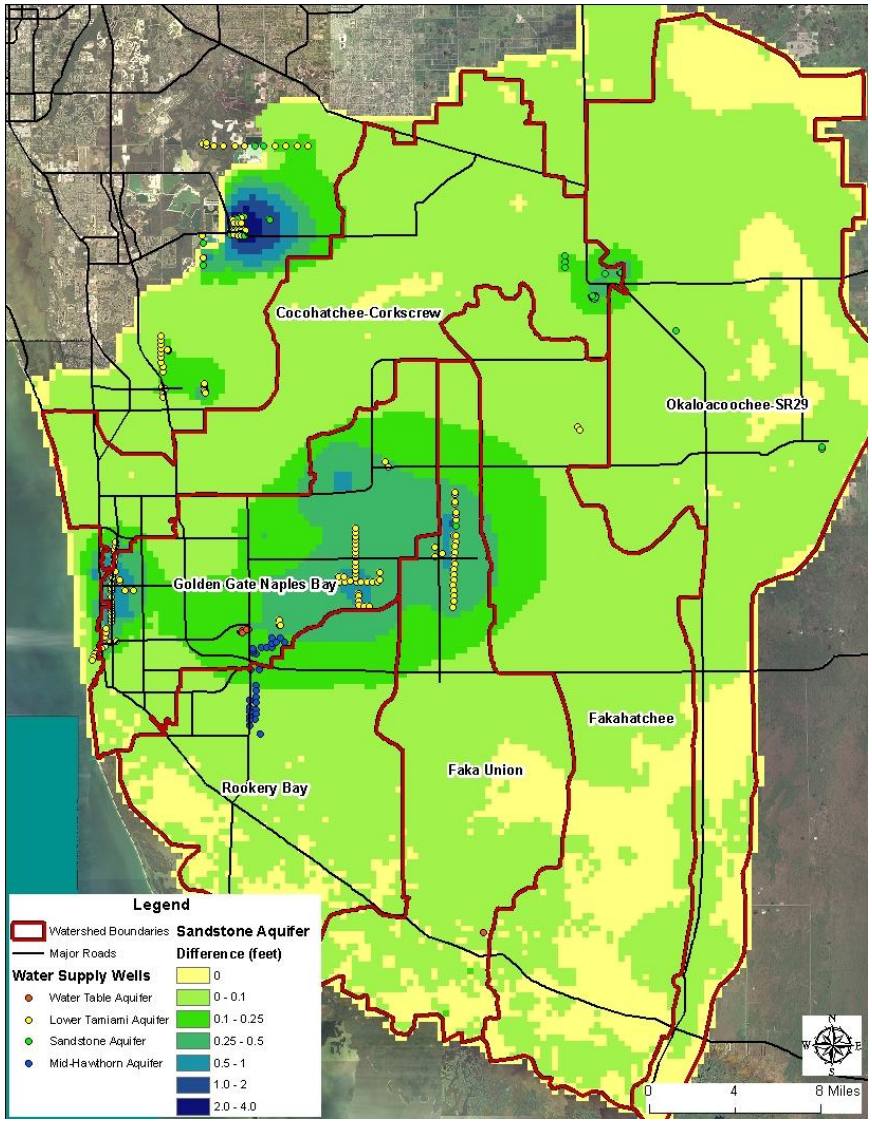


Figure 2-74. Sandstone Aquifer Driest Dry Season Increase in Drawdown With 10% Increase in Groundwater Withdrawal

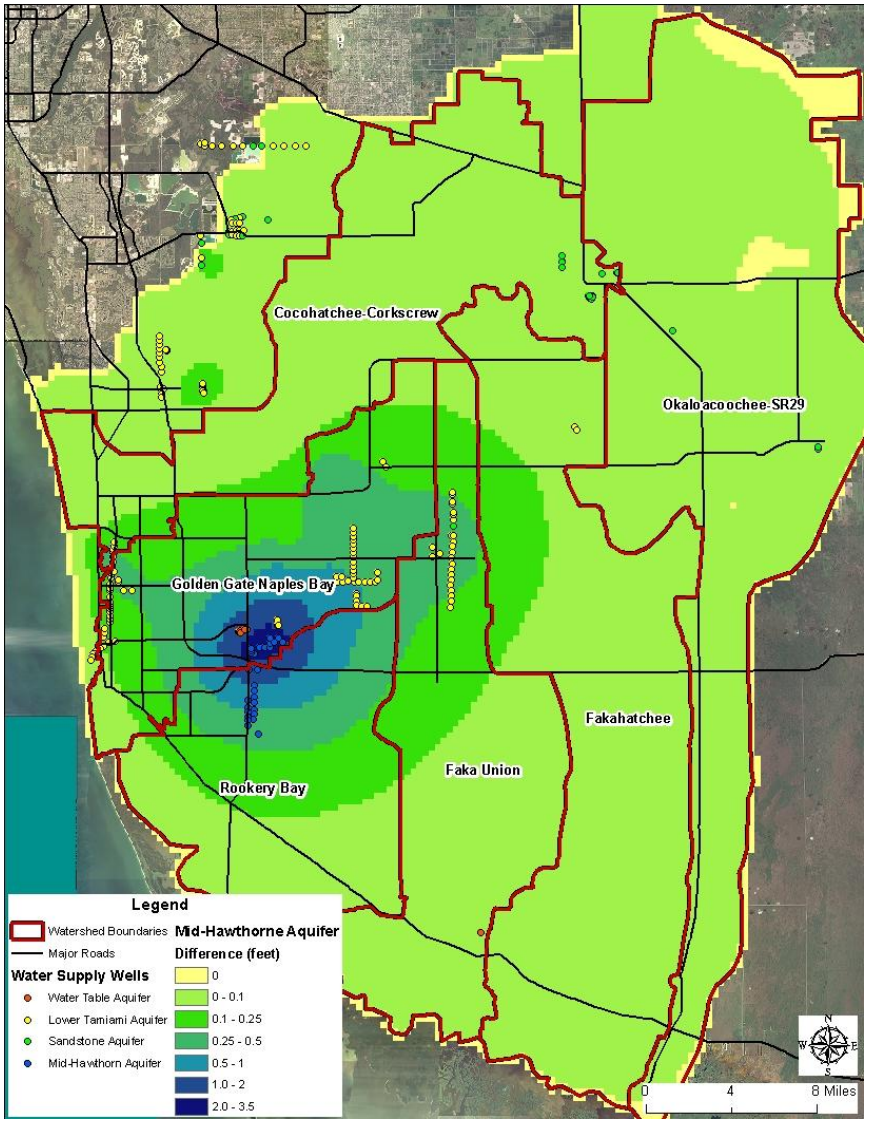


Figure 2-75. Mid-Hawthorn Aquifer Driest Dry Season Increase in Drawdown With 10% Increase in Groundwater Withdrawal

2.4.5 Conclusions

The groundwater system of Collier County is an integral part of the highly integrated hydrologic system of southwest Florida. The groundwater systems in Collier County act as regional reservoirs and exhibit seasonal variations in water storage. The use of groundwater to meet potable water supply and irrigation demand places extensive pressure on the aquifer systems to meet current and future needs. Several conclusions were drawn from this analysis.

- The water budget completed for the Water Table Aquifer indicates that wet season recharge may be insufficient to match dry season losses in the Cocohatchee-Corkscrew and Golden Gate-Naples Bay Watersheds. Losses are directly influenced by baseflow losses to the canal network and to pumping to meet water supply and irrigation demand.
- Conditions in the canal network influence groundwater elevations and contribute to long term changes in the water table elevation. Changes in structural operations in the Golden Gate Canal network will likely help mitigate groundwater losses and increase water availability.
- The water budget analysis indicates that current wet season recharge rates within the lower aquifers tend to match the current dry season withdrawals. However, additional pumping may lead to an annual loss of stored water within each aquifer.
- The groundwater performance measure evaluation indicated that locations with relatively low scores tend to correspond to areas with high groundwater demand to meet potable water supply and irrigation needs. Projects and policies that encourage additional recharge and reduce demand on the shallow aquifer systems would most likely lead to improved scores in these areas.
- Sensitivity tests related to groundwater pumping indicate that the availability of groundwater is limited to meet long-term water supply needs for Collier County and may increase the risk of salt water intrusion and potentially affect availability of water for domestic self supply from the Water Table and Lower Tamiami aquifer systems.

2.4.6 Performance Scores for Aquifer Conditions

The continued use of groundwater resources in Collier County has resulted in groundwater levels that fluctuate seasonally in response to the demand for withdrawals. During the wet season, sufficient rainfall and recharge typically result in higher aquifer storage and hydraulic heads. However, during the dry season, limited rainfall leads to additional groundwater pumping to meet seasonal population needs and increased demand for irrigation purposes.

In order to assess the relative yield or quantity of available water within each aquifer, the ECM-predicted hydraulic heads were compared to those obtained from the Natural Systems Model (NSM) that was developed for the SWFFS. The NSM was an approximation of the predevelopment

hydrologic and hydrogeologic conditions of the region. The NSM did not include the Mid-Hawthorn Aquifer and so comparisons were completed for the Water Table, Lower Tamiami, and Sandstone aquifers.

The SFWMD has defined the Minimum Aquifer Level (MAL) for confined aquifers to be the structural top of each aquifer. The lower limit of the performance measure was therefore designated as the physical top of the aquifer unit. The upper limit of the Water Table Aquifer is defined by the simulated NSM results. For the water table, the lower limit was defined as the bottom of the aquifer.

A performance measure score (0 to 10) was calculated for the top three aquifers and each cell in the model grid. The NSM does not include the Mid-Hawthorn Aquifer so no performance score was been calculated for the Mid-Hawthorn. The score was defined as follows:

Score = ((ECM Head Elevation – Structural Top of Aquifer) /
(NSM Head Elevation – Structural Top of Aquifer)) x 10

Figure 2-76 illustrates a theoretical aquifer condition representing performance scores for a confined aquifer system.

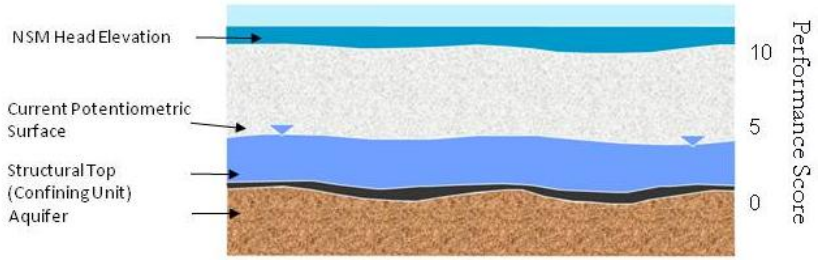


Figure 2-76. Theoretical Condition for Confined Aquifer Performance Score

Figures 2-77 through 2-79 show the difference between the average annual groundwater surface elevation for the NSM and ECM models for the Water Table, Lower Tamiami, and Sandstone aquifer systems. The results show that the most drawdown occurs near municipal wells fields and in areas where there is demand for irrigation or domestic self supply. These figures also indicate that boundary conditions can contribute to significant differences in predicted groundwater elevations. Negative values indicate that the ECM groundwater elevation is lower than the NSM groundwater elevation.

Aquifer performance measure scores were calculated for each aquifer on a cell-by-cell basis within the model area. The scores for each aquifer were then averaged within WBIDs and watersheds. Table 2-72 lists each WBID and the performance score for each aquifer. These scores are based on the average dry season water level for the ECM and the NSM. The relatively high performance scores averaged over WBID and watershed areas do not provide the resolution to evaluate local

effects of groundwater drawdown. Figures 2-80 through 2-82 show the distribution of grid level performance scores within each watershed.

Figure 2-80 shows the cell by cell performance score in the Water Table Aquifer. The areas in green indicate high performance or relatively little change in dry season conditions from the NSM. Areas in red indicate locations where water demand to meet agricultural and potable water supply needs results in low performance scores relative to historic groundwater levels. Areas that score poorly tend to correspond to well field locations. This is most apparent in the Rookery Bay and Golden Gate watersheds.

Other areas that correspond to well field locations include the area near Immokalee and in the northern portion of the Faka Union watershed. Another area that scores poorly is in the Okaloacoochee watershed and corresponds with agricultural areas with significant irrigation demands. Projects and policies that encourage additional recharge and reduce demand on the shallow aquifer systems would most likely lead to improved scores in these areas.

A final area that scores poorly is in the southern Faka Union watershed. This poor score is likely attributable to the canal network that has effectively drained this historic wetland area. Similar results are observed in portions of the Golden Gate-Naples Bay Watershed. The high level of baseflow in these areas influences the groundwater elevation and contributes to lower water table elevations. Changes in structure operations could have a positive influence on groundwater elevation and availability in the watershed.

The results for the Lower Tamiami Aquifer (Figure 2-81) show that poor scores that correspond with similar locations in the Water Table Aquifer. This can be attributed to the significant interaction between the aquifer systems coupled with the high water demand.

Areas in red along the model boundaries in both the Water Table and Lower Tamiami Aquifers are likely not real and caused by the differences in defined boundary conditions between the ECM and NSM.

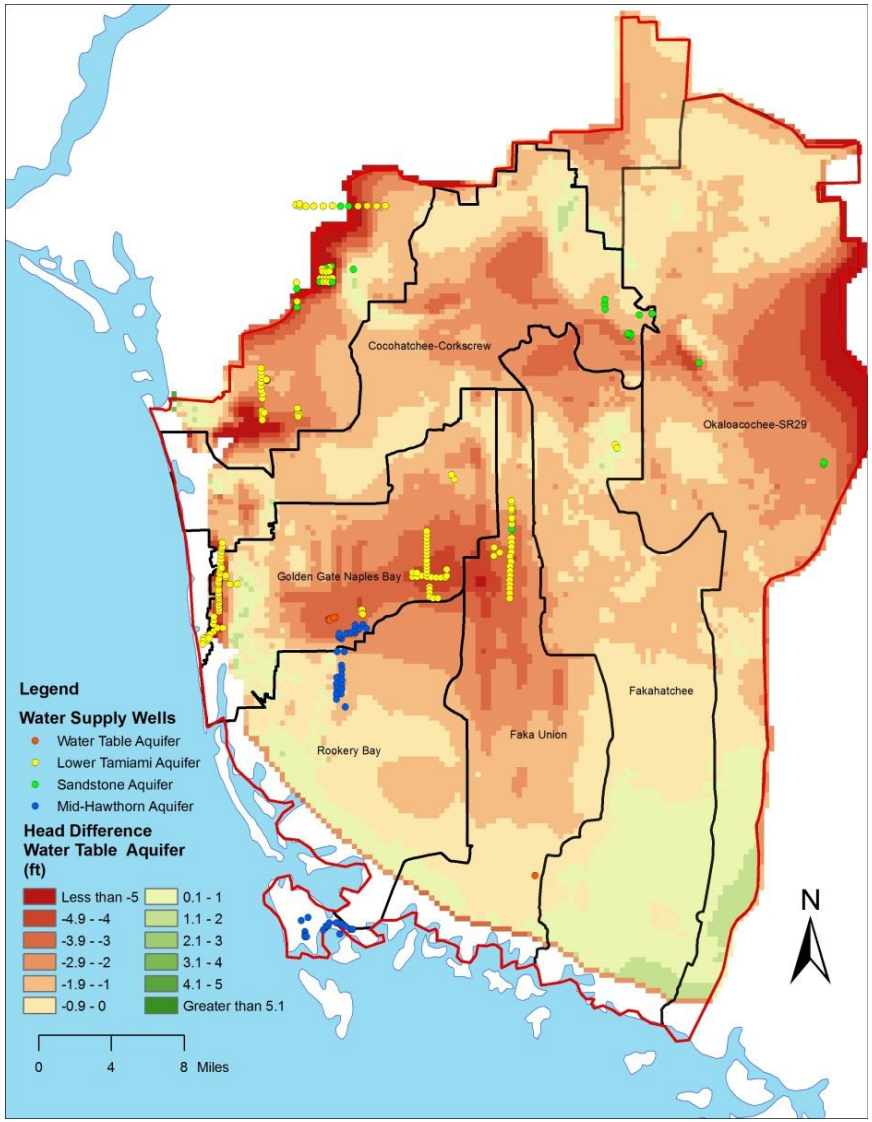


Figure 2-77. Water Table Aquifer, Average Annual Elevation Difference ECM–NSM

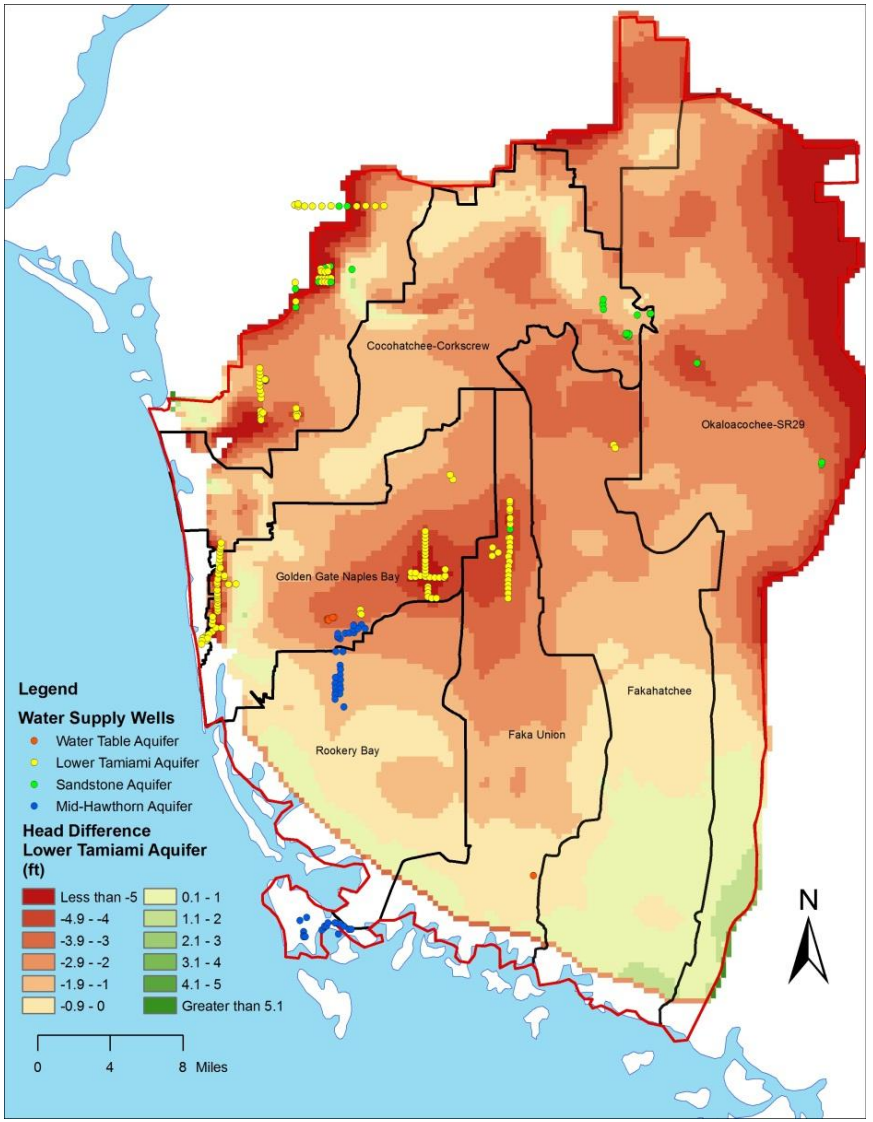


Figure 2-78. Lower Tamiami Aquifer, Average Annual Elevation Difference ECM–NSM

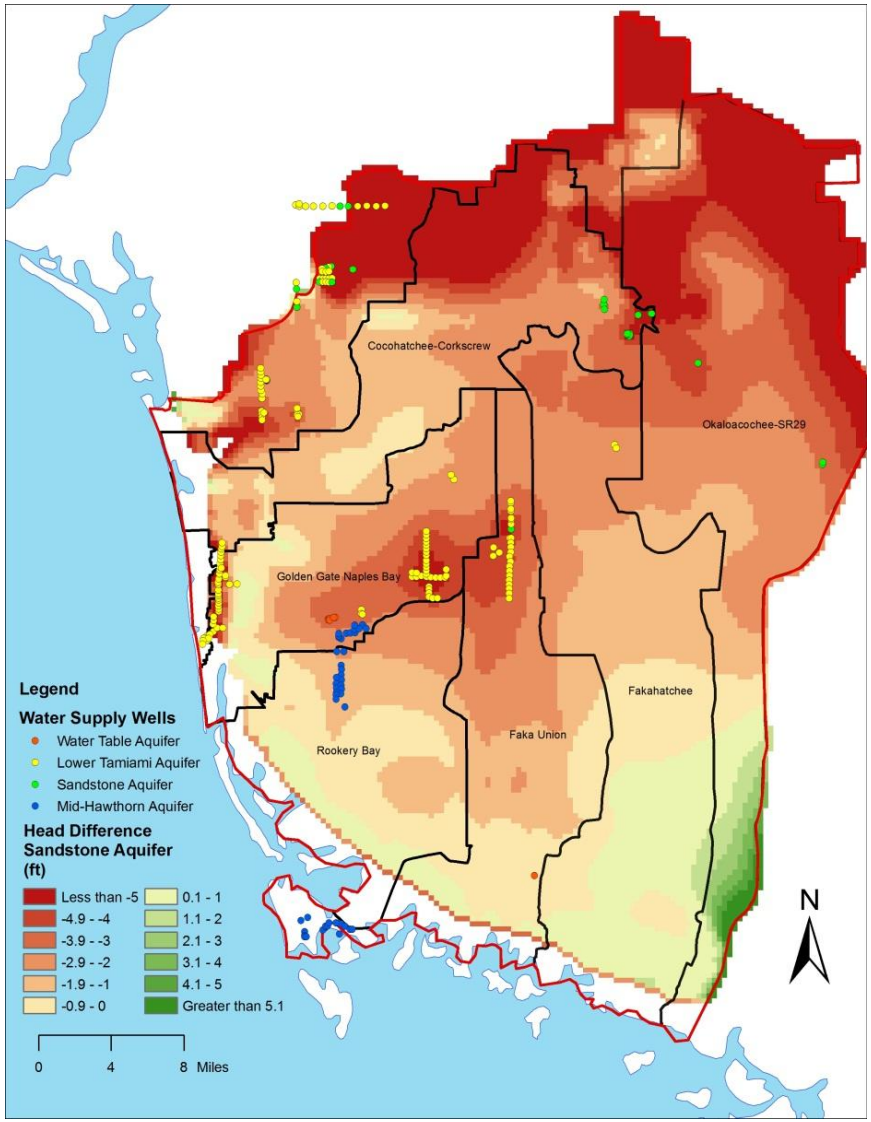


Figure 2-79. Sandstone Aquifer, Average Annual Elevation Difference ECM–NSM

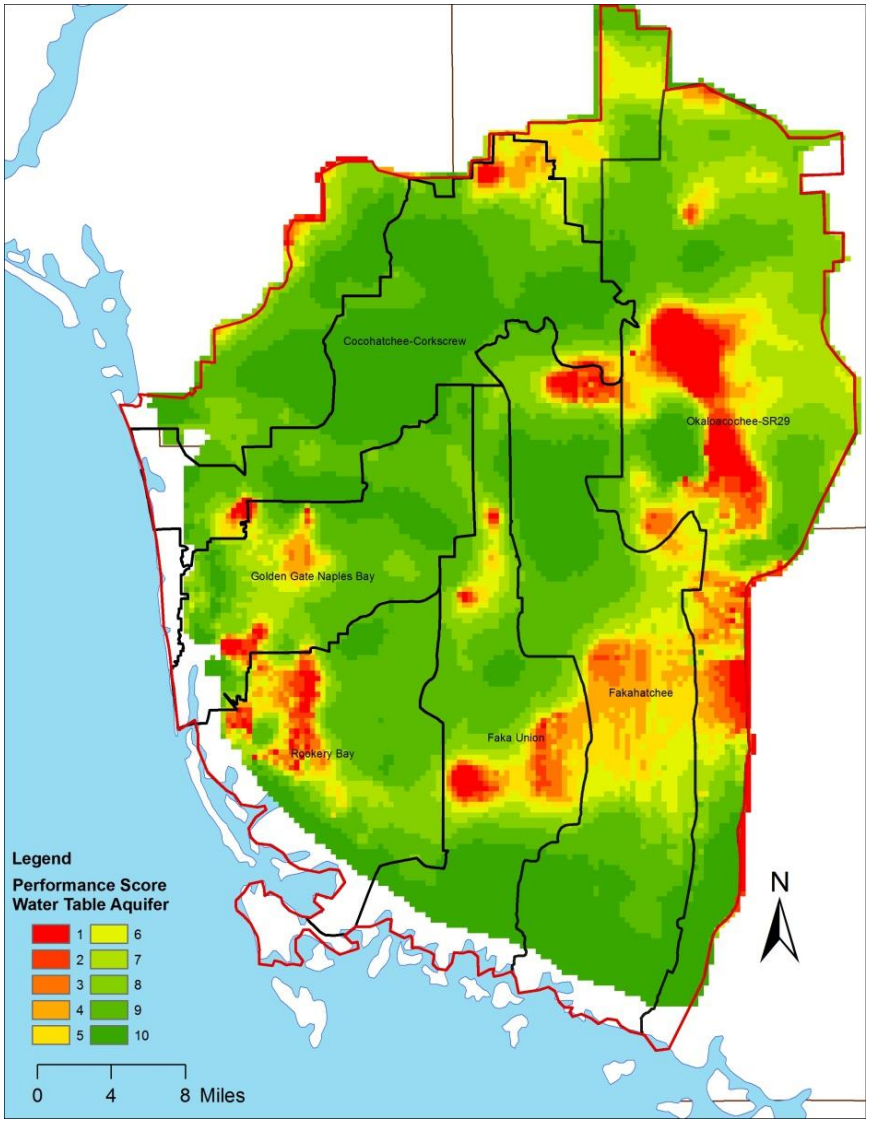


Figure 2-80. Water Table Aquifer, Average Dry Season Performance Score

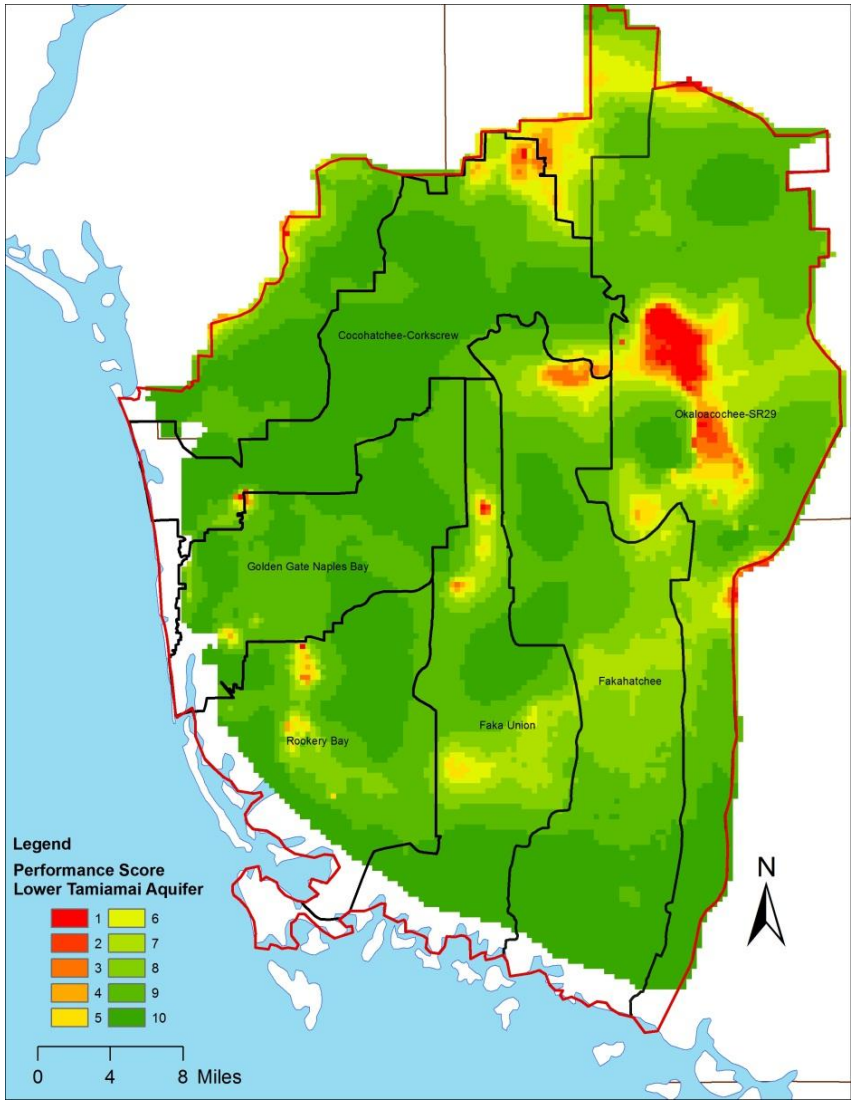


Figure 2-81. Lower Tamiami Aquifer, Average Dry Season Performance Score

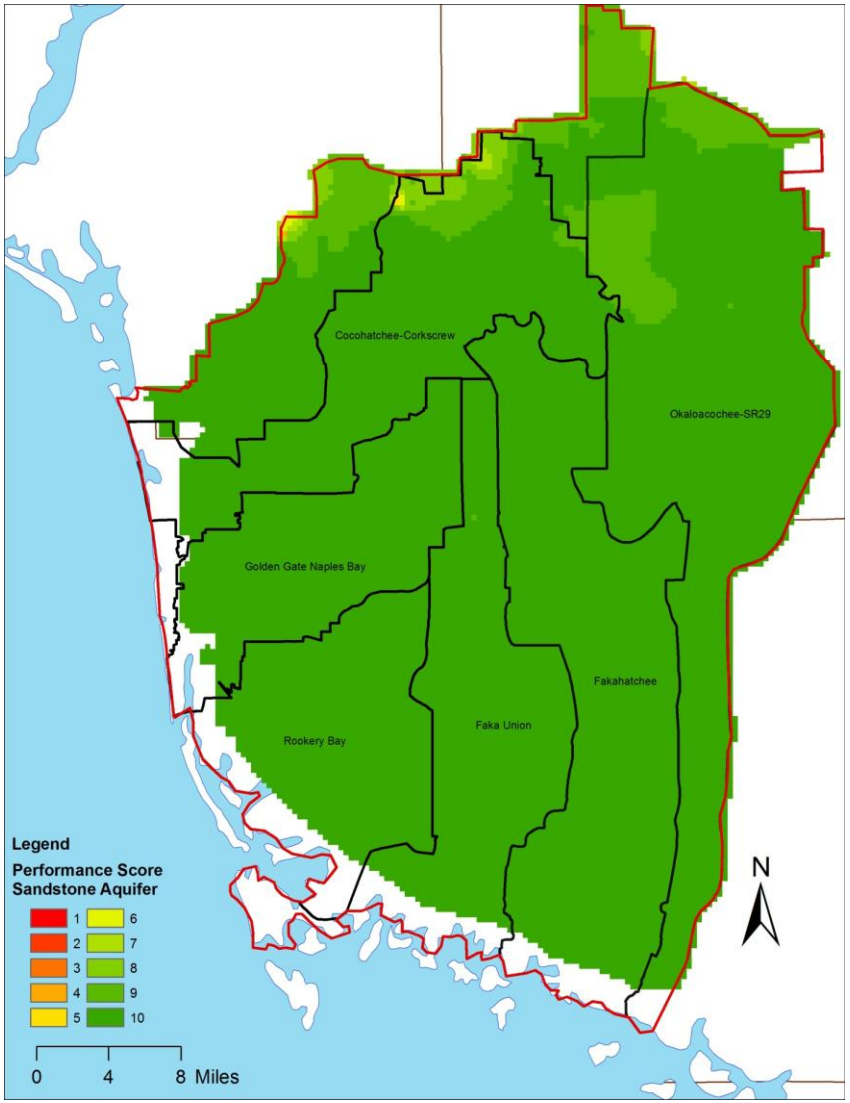


Figure 2-82. Sandstone Aquifer, Average Dry Season Performance Score

Table 2-72. Performance scores for each aquifer by WBID

Watershed	WBID	WBID Name	Water Table Aquifer	Lower Tamiami Aquifer	Sandstone Aquifer
Cocohatchee-Corkscrew	3278D	COCOHATCHEE (INLAND SEGMENT)	9.3	9.6	9.9
	3278C	COCOHATCHEE GOLF COURSE DISCHARGE	9.1	9.6	9.7
	3278F	CORKSCREW MARSH	9.4	9.4	9.6
	3278E	COW SLOUGH	9.5	9.4	9.5
	3259B	DRAINAGE TO CORKSCREW	9.5	9.6	9.5
	3278L	IMMOKALEE BASIN	9.1	9.2	9.5
	3259W	LAKE TRAFFORD	9.4	9.4	9.7
	3259Z	LITTLE HICKORY BAY	8.9	9.6	9.7
	Weighted Average		9.4	9.5	9.6
Golden Gate - Naples Bay	3278K	GORDON RIVER EXTENSION	9.3	9.5	9.8
	3278R	NAPLES BAY (COASTAL SEGMENT)	9.6	9.6	10.0
	3278S	NORTH GOLDEN GATE	8.9	9.3	9.8
	Weighted Average		9.0	9.3	9.8
Rookery Bay	3278U	ROOKERY BAY (COASTAL SEGMENT)	9.6	9.8	10.0
	3278V	ROOKERY BAY (INLAND EAST SEGMENT)	9.0	9.2	9.9
	3278Y	ROOKERY BAY (INLAND WEST SEGMENT)	7.2	9.1	9.9
	Weighted Average		8.7	9.3	9.9
Fakaunion	3278H	FAKA UNION (NORTH SEGMENT)	8.5	8.8	9.7
	3278I	FAKA UNION (SOUTH SEGMENT)	8.4	8.9	9.8
	Weighted Average		8.5	8.9	9.8
Fakahatchee	3259I	CAMP KEAIS	9.3	9.2	9.8
	3278G	FAKAHATCHEE STRAND	8.7	9.0	9.9
	Weighted Average		8.9	9.1	9.8
Okaloacochee-SR29	3261C	BARRON RIVER CANAL	8.4	8.8	10.0
	3278T	OKALOACOOCHEE SLOUGH	8.5	8.9	9.3
	3278W	SILVER STRAND	8.4	8.6	9.5
	Weighted Average		8.4	8.8	9.5

2.5 GROUND WATER QUALITY

2.5.1 Introduction and Objective

This Chapter addresses Element 1, Task 2.3: Groundwater Quality and Element 1, Task 2.4: Groundwater Pollutant Loading. The objective of this task is twofold, characterization of the groundwater quality conditions of the Cocohatchee-Corkscrew, Golden Gate–Naples Bay, Rookery Bay, Faka Union, Okaloacoochee–SR29, and Fakahatchee watersheds (**Figure 2-83**), and estimation of pollutant loads discharged from the Water Table and Tamiami aquifers into the surface water system in these watersheds.

This effort focused on characterizing the groundwater quality in the context of the water body impairment analysis, as discussed in the Chapter for Element 1, Task 1.2: In-Stream Water Quality.

The topics addressed in this document include the following: 1) data collection, 2) description of the applied analysis method, 3) groundwater concentrations of pollutants of concern, and 4) estimated groundwater pollutant loads. In addition, this document describes results of a preliminary analysis conducted to assess the potential impacts of septic tanks on the groundwater system.

2.5.2 Methods

Water quality in the County's drainage network is affected by groundwater quality. Data collection efforts, as well as the overall analysis, focused on the groundwater quality conditions in the Water Table and Lower Tamiami aquifer systems. The other aquifers are confined and have no known interaction with the surface water drainage system.

The groundwater quality data used for the analyses included data from Florida STORET, the South Florida Water Management District (SFWMD) DBYHDRO, the United States Geologic Survey (USGS), and Collier County. This resulted in an updated and comprehensive database of groundwater quality data. A total of 163 monitoring wells were identified within the model study area. Of those wells, 136 are located within the Water Table and Lower Tamiami aquifer systems.

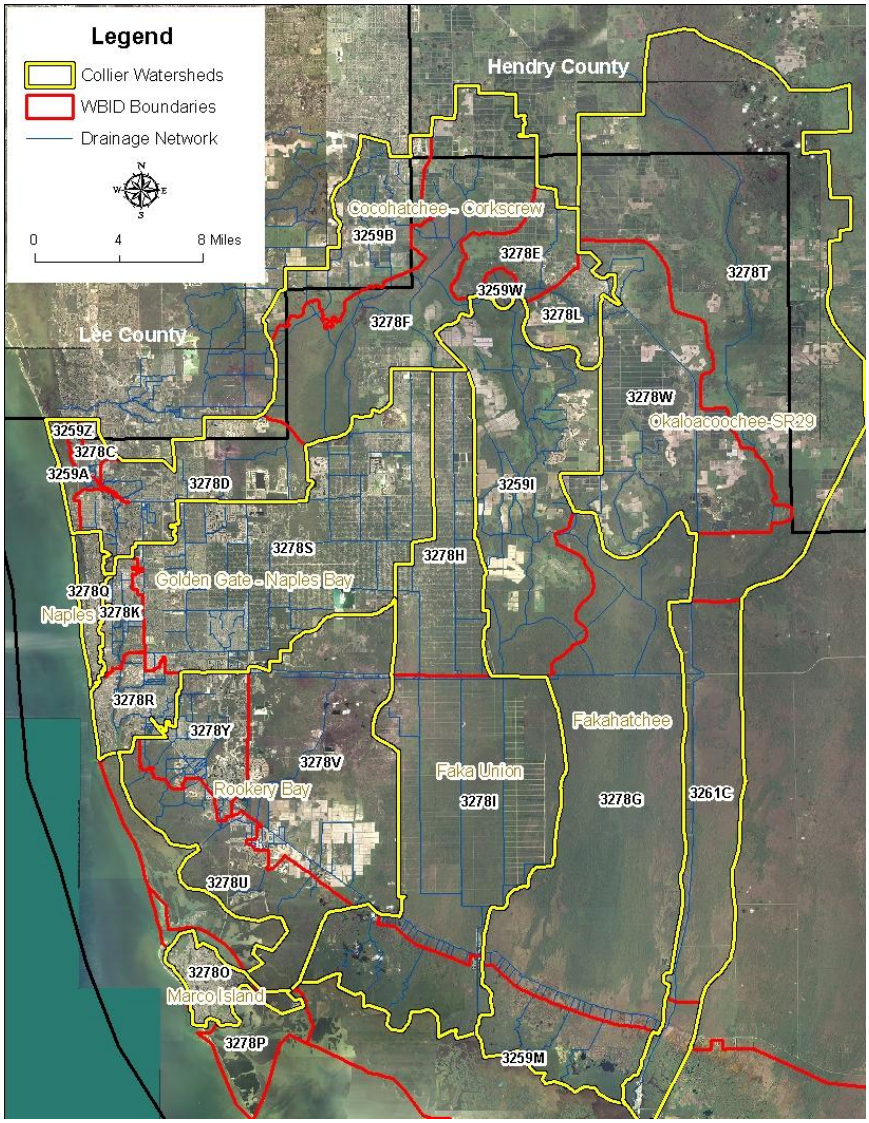


Figure 2-83. Collier County Watersheds

In terms of water quality parameters, the analysis focused on Dissolved Oxygen (DO), Total Nitrogen (TN), Total Phosphorus (TP), Copper (Cu), and Iron (Fe). It should be noted, that the DO data collected in the southern Golden Gate Estates area of the Faka Union watershed, as reported in DBHYDRO, was revised to correct for an apparent data entry error. Review of the data collection sheets indicated that the data was initially collected in units of percent saturation; however, the data was incorrectly reported in DBHYDRO as mg/L (Rhonda Watkins, personal communication). Therefore, the DO values incorrectly reported in DBHYDRO were converted to the correct units of mg/L using a methodology proposed by the University of Wisconsin (2006).

The analysis included calculation of groundwater quality concentrations of the parameters of interest throughout the study area, and subsequent estimates of pollutant loads discharged from

the local aquifers into the surface water network that eventually would reach the receiving estuaries. Following is a brief description of the method applied for determining both concentrations and pollutant loads.

2.5.3 Results

Chemical Concentration Data Analysis and Kriging Interpolation. As indicated previously, data for 136 monitoring wells in the Water Table and Lower Tamiami aquifer systems were identified within the model study area. Because groundwater systems, as opposed to surface water, are regional in nature, the Kriging interpolation method was applied to create regional groundwater concentration maps for each constituent. For each well where data was available, median concentrations were calculated and groundwater concentration was predicted for each cell within the hydrologic/hydraulic model domain. This made the groundwater quality analysis consistent with the surface water modeling approach.

The results of the Kriging analysis for Dissolved Oxygen (DO), Total Nitrogen (TN), Total Phosphorus (TP), Copper, and Iron are shown in **Figures 2-84 through 2-88**. Each of the figures is colored such that orange, red, and brown represent areas where the predicted concentration of the constituent exceeds the corresponding surface water standard or screening levels described in the Chapter for Element 1, Task 1.2: In-Stream Water Quality. Each of these figures also includes the locations of wells included in the analysis for each specific parameter. Following is a description of the results by constituent.

2.5.3.1 Dissolved Oxygen Concentration

Dissolved oxygen concentration is not a parameter commonly monitored in groundwater. Therefore, the available data is limited. The majority of the data comes from wells located in the Gordon River and the Picayune Strand areas. No data are available for the Cocohatchee-Corkscrew, Fakahatchee, and Okaloacoochee–SR29 watersheds, or the eastern portion of the Golden Gate watershed. The data evaluation predicted that dissolved oxygen concentrations do not vary significantly across the study area and are less than 3.5 mg/L. Adamski (2001) states that DO concentrations in ground water generally decrease over time as the oxygen reacts with minerals and organic material; therefore, it is assumed that the results are appropriate to provide a preliminary assessment of groundwater quality. Additional groundwater monitoring for dissolved oxygen should be completed to verify this assumption.

The location of the wells and the results of the Kriging interpolation analysis are shown in **Figure 2-84.** Results indicate that predicted concentrations throughout the study area are less than the in-stream water quality standard of 5.0 mg/L. The highest concentrations are associated with two wells located adjacent to I-75 and the Golden Gate Main Canal. In 1994, a single measurement of DO was made in each well and the reported concentrations were between 2.5 and 3.0 mg/L. These data appear to be outdated and the wells should be re-sampled to verify the accuracy of the reported values.

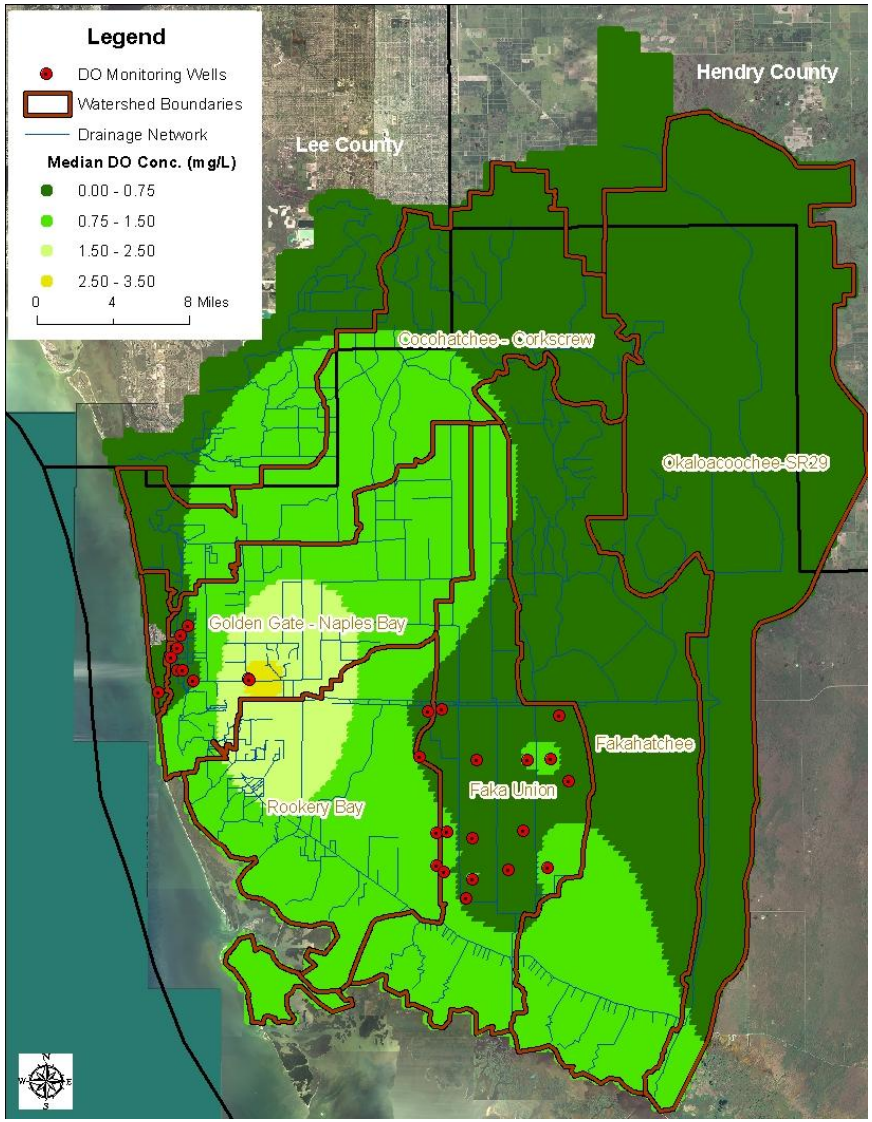


Figure 2-84. Estimated Dissolved Oxygen concentrations

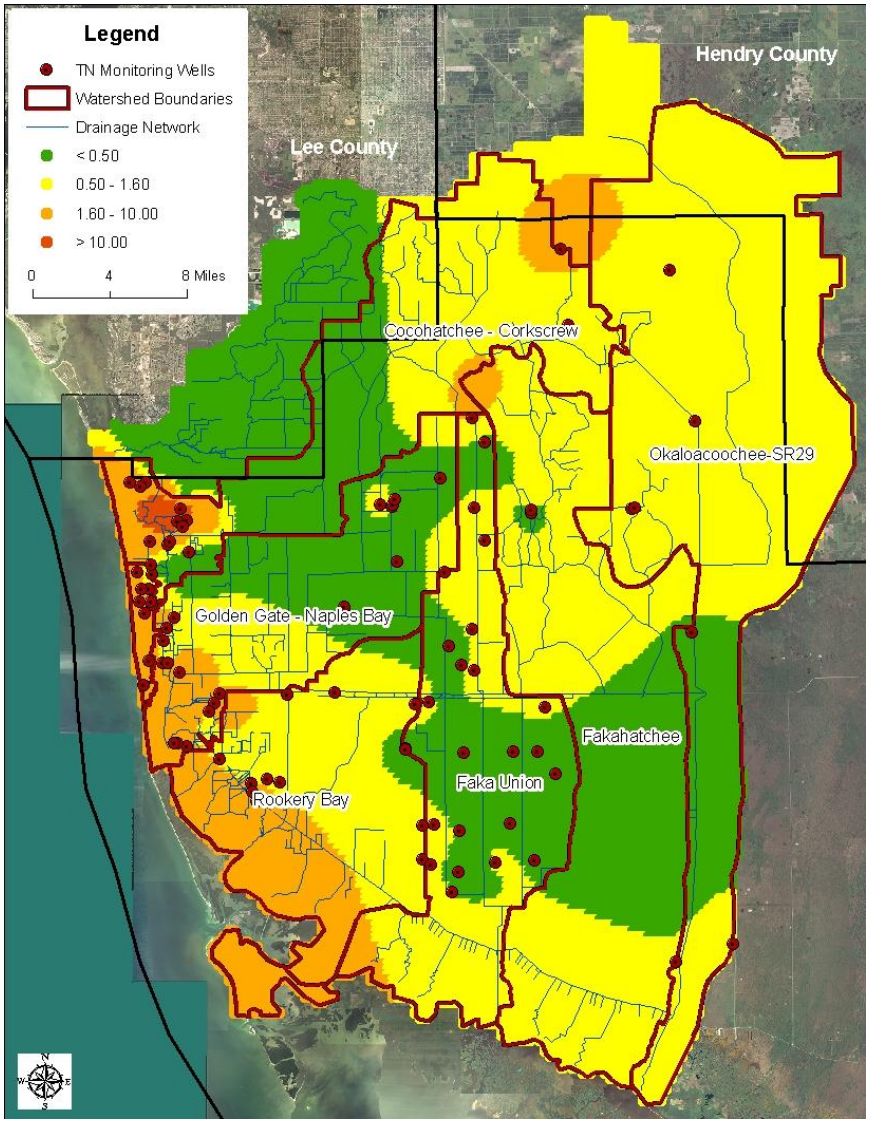


Figure 2-85. Estimated Total Nitrogen concentrations

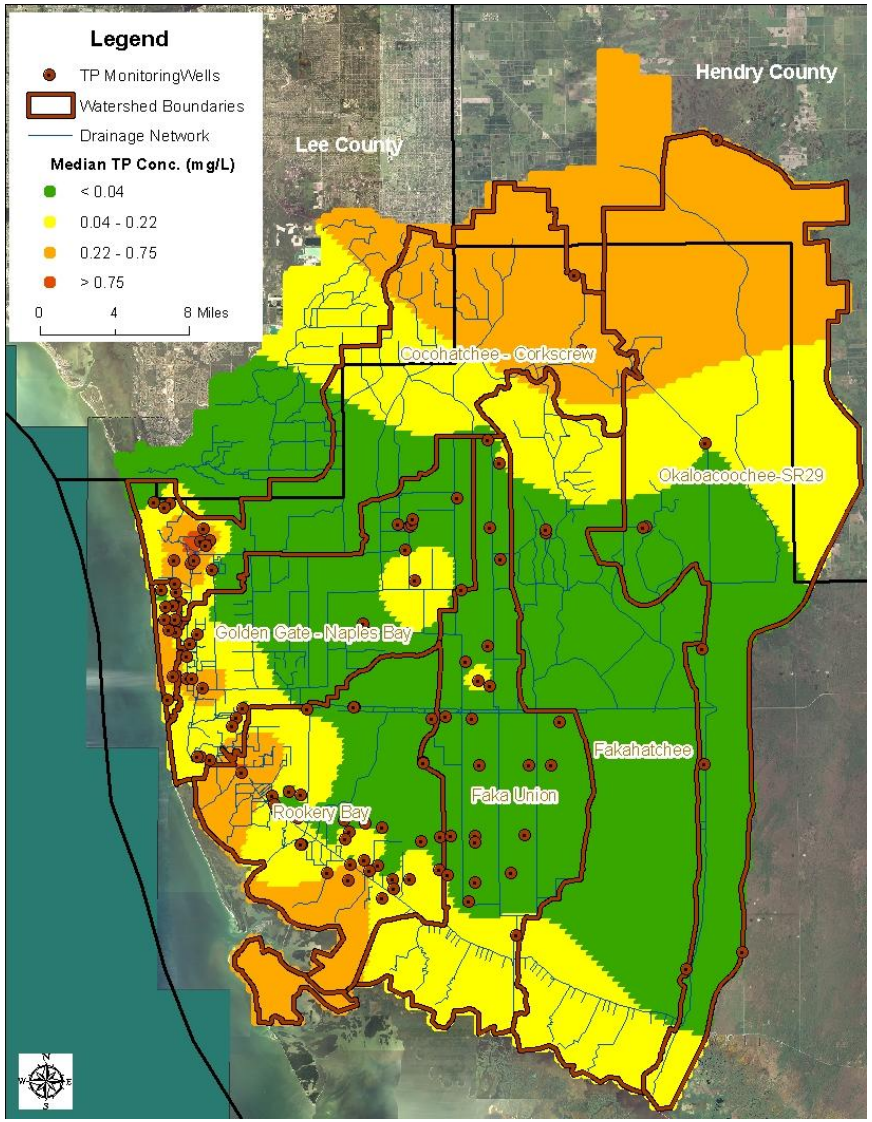


Figure 2-86. Estimated Total Phosphorus concentrations

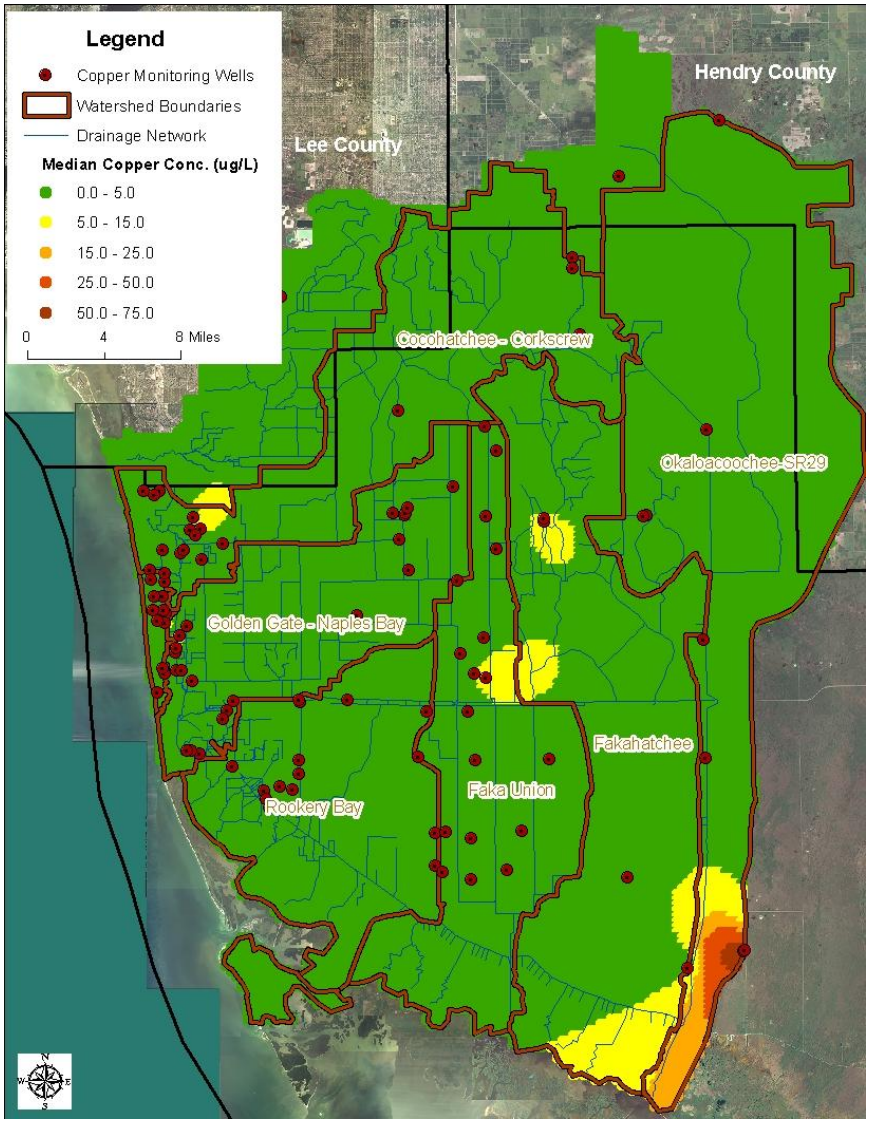


Figure 2-87. Estimated Copper concentrations

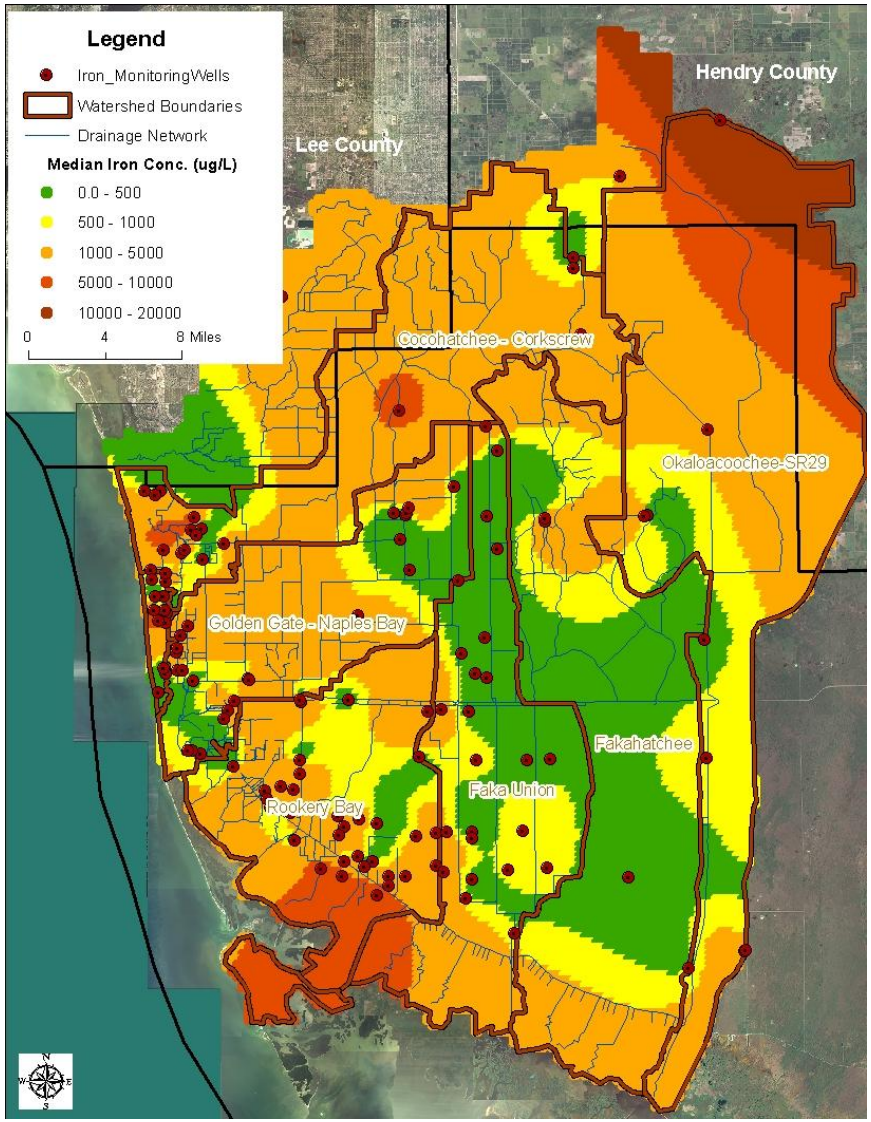


Figure 2-88. Estimated Iron concentrations

All other samples, measured in the Gordon River and Southern Golden Gate Estates area have reported concentrations between 0.5 mg/L and 1.5 mg/L. These data were collected between 2007 and 2009.

The water budget (Section 2.4) and groundwater quality analyses suggest that the low DO concentrations in the groundwater, coupled with the significant amount of base flow predicted in the main drainage canals contribute to the low measured DO concentrations in the canal network.

2.5.3.2 Total Nitrogen Concentration

Total nitrogen concentration data is available at 94 wells located throughout the study area. Well locations and Kriging interpolation results are shown in **Figure 2-85.**

A potential problem identified for this analysis was that a total of 47 wells exist along the coast from the Cocohatchee canal to Henderson Creek, but 38 of these wells are associated with the County's reuse monitoring program. It was considered possible that the reuse data may be biasing the results. To assess this condition, the measured TN concentrations at the reuse wells were compared to those at wells not associated with reuse. Results indicated that there is not a significant difference in measured concentrations for the majority of the wells, except for the area influenced by reuse monitoring wells CCN4 and CCN5, which are located near the coast north of the Cocohatchee Canal (**Figure 2-89**), and well CCS2 located near Rock Creek between Radio Road and Davis Blvd (**Figure 2-90**). These three wells are screened into the Water Table aquifer and concentrations amount to 21.52 mg/L, 31.96 mg/L, and 8.14 mg/L, respectively.

The fact that the areas of influence of wells CCN4, CCN5, and CCS2 are well defined by the Kriging interpolation and there is not a significant difference in concentrations between the other reuse wells and the non-reuse wells, it was considered that the analysis is providing adequate results. It is noted that the three wells showing high concentrations are located at golf courses irrigated by reuse water and it is unclear if groundwater concentrations are directly related to golf course land management practices or are influenced by other factors, including activities in the surrounding land uses.

Overall the analysis showed that areas with predicted TN groundwater concentrations that exceed the in-stream water quality screening levels are located primarily in the western portion of the County. FDEP's screening criteria for streams uses the 75th percentile of values in STORET. It amounts to 1.6 mg/L TN. FDEP has also developed a TMDL TN target of 0.74 mg/L for Hendry Creek in Lee County that is being used in this analysis as an alternative screening criterion.

Figure 2-89. Total Nitrogen (TN) Monitoring Wells
in the Western Cocohatchee Watershed

Figure 2-90. Total Nitrogen Monitoring Wells in the
Western Golden Gate-Naples Bay Watershed

In addition to the area influenced by wells CCN4, CCN5, results of the analysis show that groundwater concentrations in the Cocohatchee- Corkscrew watershed exceed the TN criteria in

the area represented by WBIDs 3259A, 3259Z, 3278C, and the most western portion of WBID 3278D. These areas are located along the coast. Although none of these WBIDs have been found impaired for nutrients, they may be considered at risk due to the potential groundwater discharges. As shown in **Figure 2.85,** the rest of the watershed shows predicted groundwater TN concentrations less than the in stream screening level of 1.6 mg/L, except for a single well located near Immokalee, which has a mean reported concentration of 1.7 mg/L.

In the Golden Gate-Naples Bay Watershed, WBIDs 3278R (coastal segment of Naples Bay) and 3278K (Gordon River Extension) have predicted groundwater TN concentrations that exceed the screening criteria. As in the Cocohatchee-Corkscrew watershed, these WBIDs have not been found impaired for nutrients in the canal network. However, the baseflow contributions to the canal network (Section 2.4) are predicted to exceed 50 percent of the canal flow suggesting there is a risk of future nutrient impairment due to the potential groundwater discharges.

In Rookery Bay, Kriging interpolation analysis indicates that groundwater concentrations of TN along the coastal portion of the watershed (WBID 3278U) exceed the in-stream water quality screening level of 1.6 mg/L. This would appear to support the identified TMDL impairment for nutrients. However, it should be noted that monitoring wells with TN data in this area are all located in the Lely area. In the eastern portion of the watershed predicted concentrations result from the extrapolation of concentrations observed in two wells. The location of these wells, CCS16 and CCS17 are shown in **Figure 2-91**. Additional sampling is necessary in this area to verify the extrapolated results.

Groundwater TN concentration data in the Faka Union, Fakahatchee, and Okaloacoochee-SR29 watersheds includes data from the wells in Picayune Strand. TN concentrations at these locations were calculated by adding the reported Total Kjeldahl Nitrogen and Nitrate–Nitrite results. Nine of the other 14 sampling stations are located in the northern part of the Faka Union at single family residences. The average predicted concentration of TN is less than the in stream water quality screening level in the majority of the watershed area. The highest reported mean concentration in these watersheds was 2.96 mg/L in a sample taken from the well located in the headwaters of the Faka Union watershed. It is unclear what might be contributing to the elevated TN concentration in this well.

The Okaloacoochee-SR29 watershed was designated as a watershed of concern for TN; however, the lack of data makes it is difficult to accurately assess the potential contributions of TN from groundwater. Additional groundwater monitoring should be completed to evaluate the contribution of TN to the surface water drainage network.

Figure 2-91. Total Nitrogen Monitoring Wells in Rookery Bay Watershed

Table 2-73 shows the predicted TN median concentration in the groundwater by WBID. These were calculated by averaging the total load by grid cell. A total of six (6) WBIDs have predicted concentrations that equal or exceed the in stream screening level of 1.6 mg/L and all except five exceed the Hendry Creek TMDL screening value of 0.74 mg/L.

2.5.3.3 Total Phosphorus

TP concentration data is available at 117 wells located throughout the study area. Results of the Kriging interpolation analysis are shown in **Figure 2-86**. Similar to the TN analysis, the interpolated values were compared to the FDEP's screening criteria for streams (0.22 mg/L) and Hendry Creek TMDL (0.04 mg/L). However, as with TN, a potential identified problem is that 80 percent of the wells located along the coast from the Cocohatchee canal to Henderson Creek are associated with the County's reuse monitoring program. Since the reuse data may bias the results, the measured TP concentrations at the reuse wells were compared to those at wells not associated with reuse. Results indicated that there is not a significant difference in measured concentrations for the majority of the wells. Unfortunately, as opposed to the TN analysis, the reuse wells showing higher TP concentrations do not define specific problem areas, but are present at various locations along the coast.

Table 2-73. Groundwater Concentrations Predicted by Kriging Interpolation Analysis for Critical Parameters per WBID

WBID	Watershed	Name	Dissolved Oxygen	Total Nitrogen	Total Phosphorus	Copper	Iron
			mg/L			ug/L	
3259A	Cocohatchee - Corkscrew	COCOHATCHEE RIVER	0.56	6.22	0.10	0.99	2425
3259B		DRAINAGE TO CORKSCREW	0.72	0.59	0.22	1.90	3050
3259W		LAKE TRAFFORD	0.70	1.43	0.31	0.91	2136
3259Z		LITTLE HICKORY BAY	0.59	2.78	0.01	0.52	251
3278C		COCOHATCHEE GOLF COURSE DISCHARGE	0.63	5.05	0.11	0.74	1133
3278D		COCOHATCHEE (INLAND SEGMENT)	0.95	2.30	0.12	2.38	1514
3278E		COW SLOUGH	0.67	1.45	0.42	1.15	1667
3278F		CORKSCREW MARSH	0.76	0.96	0.23	1.40	2951
3278L		IMMOKALEE BASIN	0.66	1.14	0.29	0.95	1807
3278K	Golden Gate - Naples Bay	GORDON RIVER EXTENSION	0.61	1.60	0.15	1.84	1445
3278R		NAPLES BAY (COASTAL SEGMENT)	1.18	3.08	0.14	1.03	740
3278S		NORTH GOLDEN GATE	1.35	0.50	0.03	1.26	1552
3278U	Rookery Bay	ROOKERY BAY (COASTAL SEGMENT)	1.24	2.44	0.25	0.91	4180
3278V		ROOKERY BAY (INLAND EAST SEGMENT)	1.21	0.91	0.04	1.38	1527
3278Y		ROOKERY BAY (INLAND WEST SEGMENT)	1.82	1.49	0.24	0.62	1476
3259I	Fakahatchee	CAMP KEAIS	0.66	0.81	0.06	2.93	901
3278G		FAKAHATCHEE STRAND	0.68	0.48	0.02	2.56	474
3278H	Faka Union	FAKA UNION (NORTH SEGMENT)	0.73	0.61	0.02	1.96	348
3278I		FAKA UNION (SOUTH SEGMENT)	0.67	0.42	0.02	0.86	721
3261C	Okaloacoochee - SR29	BARRON RIVER CANAL	0.66	0.45	0.02	8.87	700
3278T		OKALOACOOCHEE SLOUGH	0.60	1.11	0.26	2.01	6222
3278W		SILVER STRAND	0.61	0.87	0.10	2.14	1332

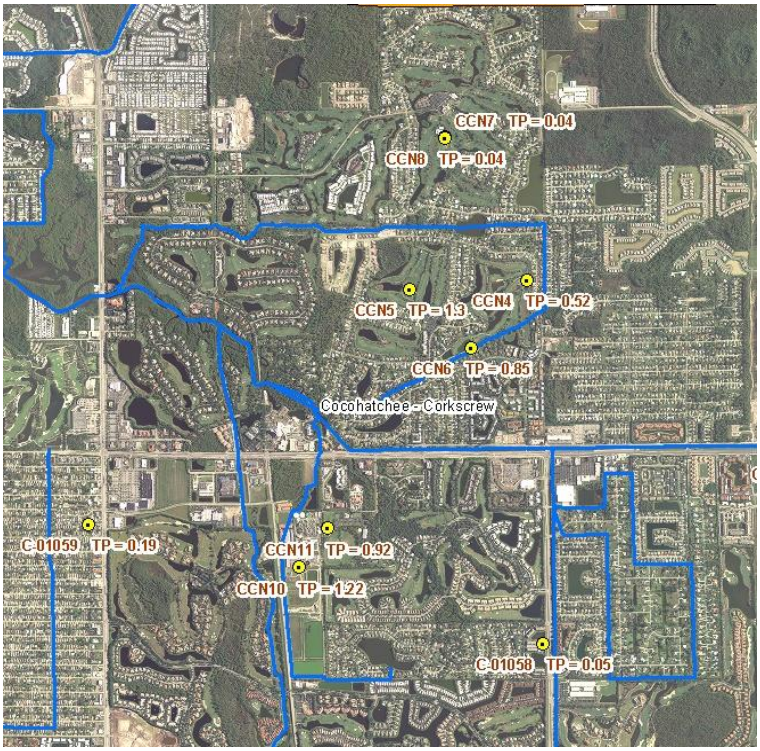


Figure 2-92. Total Phosphorus Median Concentrations
in the Western Cocohatchee-Corkscrew Watershed

One of the wells showing high TP concentrations is CCN5, which is located north of the Cocohatchee Canal (**Figure 2-92**). This well also shows high TN concentrations. A total of six samples were collected at this well from October 2006 through April 2009. The measured values range from a low of 0.171 mg/L in August 2007 to a maximum of 2.5 mg/L in April 2008. The measured values prior to September 2007 are all less than 0.22 mg/L, but are all higher than 2.20 mg/L after March 2008. This suggests that the increased concentrations may be associated with a change in land management practices, potentially including application of reuse water.

Other examples of wells with TP concentrations exceeding the screening criteria are CCN10, MW-9, and CCS20. Well CCN10 is located adjacent to a wastewater treatment facility, well MW-9 is located on a golf course adjacent to the Golden Gate Main Canal south of Golden Gate Parkway and west of Airport Pulling Road, and well CCS20 is located in the Lely Golf Estates near the Tamiami Trail.

As indicated above, the area of influence of some of the reuse wells showing high TP concentrations is not very well defined. However, there is not a clear criterion to select only a certain number of wells for the analysis without biasing the results. Therefore, it was decided that the best approach is to include all wells in the Kriging interpolation and recognize that the results probably err on the side of higher-than-actual concentrations.

Overall, results indicate that the areas where the predicted concentrations exceed the in stream water quality screening levels are located along the coast, as well on the northeastern portion of the study area. It is noted that the predicted concentration in northeast Collier County are based on sample results from only three wells. One of these wells is located in the City of Immokalee, one is located in an agricultural area near Immokalee, and the third is located near Keri Rd close to the study area boundary. There is insufficient data to determine whether land use activities contribute to the measured concentrations. However, no stream water quality impairments for TP have been identified in that area.

In the Cocohatchee-Corkscrew and Golden Gate-Naples Bay Watersheds the high TP concentrations along the coast seem to be the result of interpolation of the high concentrations at some of the reuse wells. In the Rookery Bay watershed the highest reported median TP concentrations are 0.71 mg/L and 0.76 mg/L in wells CCS20 and 021-67, respectively. These values far exceed the screening criteria. Well CCS20 is located in the Lely Golf Estates near the Tamiami Trail. TP concentrations exceed 1.0 mg/L in three (3) of the seven (7) collected samples. The data from well 021-67, which is located south of the Tamiami Trail in the agricultural lands east of Collier Blvd, was collected in 1997-1998. At this location, TP concentrations exceed 0.65 mg/L in three (3) of four (4) samples.

Finally, in the Faka Union, Fakahatchee and Okaloacoochee-SR 29 watersheds the highest reported mean concentration of 0.44 mg/L for TP was measured in well HE-852 located in Hendry County at the northern boundary of the Okaloacoochee-SR 29 watershed. The data from well HE-852 was collected in 1989 and 1990. All other monitoring wells in these watersheds have a median concentration of 0.07 mg/L or less.

A summary of the results indicates that the relatively high groundwater TP concentrations are not currently determining surface water quality conditions in terms of nutrients because only one WBID (3278U–Rookery Bay Coastal Segment) has been identified as impaired for nutrients. However, the relatively high groundwater TP concentrations in the groundwater at some of the reuse wells may indicate a risk of groundwater pollution loads. As shown in **Table 2-73**, the median TP concentration in five (5) of the WBIDs exceeds the stream screening criteria of 0.22 mg/L, whereas the Hendry Creek criteria of 0.04 mg/L is exceeded in 12 out of the 15 WBIDs in the Cocohatchee-Corkscrew, Golden Gate–Naples Bay, and Rookery Bay watersheds. Most of the WBIDs in the undeveloped areas of the County meet the 0.04 mg/L screening criteria.

2.5.3.4 Copper

The predicted results for copper (**Figure 2-87**) indicate that only one area is of concern for copper in groundwater. Well C-00495, which monitors the Lower Tamiami aquifer system, is located near the SR29 canal and has a median copper concentration in excess of 90 µg/L and a maximum concentration of 213 µg/L. As a comparison, the in-stream standard for copper in WBID 3261C is calculated to be 22.69 µg/L based on the average hardness value from the groundwater samples. Collier County is investigating potential sources of metals in the area around this well (Rhonda

Watkins, personal communication). There is no known activity in the area that would contribute to elevated copper concentrations. It is noted that no exceedance of water quality standards for copper has been reported in the SR29 canal.

2.5.3.5 Iron

The results of the Kriging interpolation analysis for iron concentrations in groundwater are shown in **Figure 2-88**. Results indicate that the groundwater concentration of iron in most of the study area exceed the in-stream water quality standard of 1,000 ug/L. As shown in **Table 2-73**, the calculated median concentration exceeds the in stream water quality standard in 68 percent (15 of 22) of the WBIDs. These results suggest that identified surface water iron impairments may be attributed to groundwater inflows.

In the Cocohatchee-Corkscrew watershed, all but one of the WBIDs exceed the screening criteria. Well C-492, located adjacent to the Corkscrew Swamp in the central portion of the watershed reported the highest mean concentration of iron. The reported median concentration is 8,100 µg/L.

In the Golden Gate-Naples Bay Watershed, reported mean concentrations of iron in the Water Table and Lower Tamiami aquifers range from 50 µg/L, in the north Golden Gate Estates to 5,060 µg/L near the Gordon River. Concentrations in two of the three WBIDs exceed the State water quality standard.

In the Rookery Bay watershed, the Kriging analysis indicated that groundwater iron concentrations exceed 5,000 µg/L in some parts of the watershed and median predicted concentrations exceed 1,400 µg/L. These concentrations are higher than those in the Cocohatchee–Corkscrew and Golden Gate–Naples Bay. However, there are limited groundwater contributions to overland flow in the Rookery Bay watershed, which may explain why there are no identified impairments for iron in the stream network.

2.6 GROUNDWATER POLLUTANT LOADING

2.6.1 Methods

Pollutant loads associated with groundwater discharges from the Water Table and Lower Tamiami aquifers to the surface water system were calculated based on a) water flows obtained for each cell from the H&H model simulation domain, and b) pollutant concentrations determined from the Kriging analysis described herein. Pollutant loads were calculated for TN, TP and copper. The analysis was limited to the parameters of concern that are also part of the NPDES list of pollutants included in the calculation of surface water loads. The pollutant load was assumed to be zero (0) in WBIDs where surface runoff in the drainage network is lost to the surface aquifers. Pollutant loads by cell were also aggregated to determine the load by WBID. Iron is not one of the NPDES parameters and no comparisons are possible with surface water loadings because event mean concentration data is not available.

2.6.2 Results

Table 2-74 shows the total estimated annual groundwater pollutant load by WBID and watershed. For comparison purposes, the table also shows the calculated surface water pollutant loads, as described in the corresponding chapter. The largest total predicted TN groundwater load in lbs / year is found in WBID 3278S (Northern Golden Gate). Naples Bay is listed as impaired for DO with the likely cause identified as nutrients. It is likely that baseflow in the canal network, which results from groundwater discharging into the surface water system, contributes to the low DO concentrations in the estuary; however nutrients entering the groundwater system and discharging to the canal network may also contribute to the impairment.

Results also show that in terms of nutrients, 74 and 88 percent of the total TN and TP load in the study area comes from surface water sources, respectively. However, Rookery Bay is the only watershed where the predicted groundwater load of TN is basically the same as the predicted surface water load and groundwater represents about 40 percent of the TP load. In other watersheds, the TN load from groundwater is less than 30 percent. As Rookery Bay is the only estuary found impaired for nutrients, results suggest that the control of nutrients entering the groundwater would be important to address the impairment condition.

Copper pollution seems to be originating primarily in the surface water system, which account for 76 percent of the total load.

It should be noted that as total pollution loads are determined by the extent of the watershed and the anticipated baseflow entering the surface water system, total loads do not provide a good representation of actual WBID conditions. A better indicator is the load per unit area. **Table 2-75** shows the pollutant load by WBID per unit area (acres). It also shows the mean unit area pollutant

load by watershed. Rookery Bay shows by far the largest nutrient load / acre / year. Approximately 60 percent of the TN load per acre appears to be of groundwater origin.

Assessment of Pollution Loads from Septic Tanks. Septic tanks are common in parts of Collier County that are not served by sewer. They are also potential sources of nutrients discharges into the receiving water bodies by way of percolation into the Water Table aquifer. The objective of this analysis was to evaluate the potential effect of septic tanks on the groundwater concentrations of TN and TP. This was done by first estimating the number of septic tanks in each cell within the model domain and subsequently conducting a correlation analysis between septic tank density and constituent concentration in the groundwater.

The actual density of septic systems is unknown in most parts of the county. The Florida Department of Health (FDoH) is in the process of developing a comprehensive inventory of septic tanks in Florida; however, that inventory is not complete. In the interim, the FDoH has developed a GIS based shapefile that predicts the probability of a septic tank existing in any area within the State. This map was modified as part of this project to estimate the existing density of septic tanks within each grid cell that makes up the existing conditions H&H model (ECM). The process consisted of the following steps.

- The FDoH data was modified to represent only the probability of existing septic systems in Collier and Lee counties. If a polygon was located within an area currently served by sanitary sewer, the probability of a septic tank was set to zero (0). It is possible that some septic systems exist in sewered areas, but this decision eliminates the potential influence of outside sources when comparing septic system density and groundwater concentrations.
- The probability value was then converted to predicted number of septic tanks per parcel and summed within the area of a grid cell. **Figure 2-93** shows the predicted location and density of septic tanks per grid cell in Collier County.

Figures 2-94 and 2-95 are scatter diagrams of predicted septic tank density versus predicted concentrations of TN and TP. Concentrations were as determined from the Kriging interpolation analysis described previously. For illustration purposes, the line of best fit to the data was also included, along with the corresponding coefficient of determination.

Results of this analysis indicate that there is little correlation between TN and TP and septic tank density. Therefore, it can be concluded that septic tanks appear not to be a major countywide problem. Of course localized problems may exist.

Table 2-74. Predicted Pollution Loads from the Groundwater and Surface Water Systems

WBID	Watershed	Name	Groundwater Pollutant Load			Surface Water Pollutant Load		
			TN	TP	Cu	TN	TP	Cu
			lbs/yr	lbs/yr	lbs/yr	lbs/yr	lbs/yr	lbs/yr
3259A	Cocohatchee - Corkscrew	COCOHATCHEE RIVER	6,489	109	1	4,614	661	38
3259B		DRAINAGE TO CORKSCREW	3,152	1,202	10	83,815	16,768	110
3259W		LAKE TRAFFORD	0	0	0	0	0	0
3259Z		LITTLE HICKORY BAY	0	0	0	1,605	268	11
3278C		COCOHATCHEE GOLF COURSE DISCHARGE	2,623	58	0	4,807	614	39
3278D		COCOHATCHEE (INLAND SEGMENT)	82,284	4,291	85	77,840	13,398	253
3278E		COW SLOUGH	716	208	1	31,052	6,049	61
3278F		CORKSCREW MARSH	8,572	2,040	13	99,729	19,880	141
3278L		IMMOKALEE BASIN	2,551	656	2	31,806	6,148	82
Subtotal			**106,387**	**8,564**	**112**	**335,267**	**63,786**	**734**
3278K	Golden Gate - Naples Bay	GORDON RIVER EXTENSION	2,574	243	3	21,885	3,482	132
3278R		NAPLES BAY (COASTAL SEGMENT)	13,397	609	4	52,523	8,001	526
3278S		NORTH GOLDEN GATE	135,931	7,396	339	166,652	28,165	838
Subtotal			**151,901**	**8,247**	**346**	**241,060**	**39,648**	**1,497**
3278U	Rookery Bay	ROOKERY BAY (COASTAL SEGMENT)	46,964	4,760	17	23,551	4,315	77
3278V		ROOKERY BAY (INLAND EAST SEGMENT)	40,289	1,662	61	94,760	18,550	160
3278Y		ROOKERY BAY (INLAND WEST SEGMENT)	60,045	9,798	25	28,130	4,151	145
Subtotal			**147,298**	**16,220**	**104**	**146,442**	**27,015**	**382**
3259I	Fakahatchee	CAMP KEAIS	0	0	0	231,302	46,134	300
3278G		FAKAHATCHEE STRAND	0	0	0	5,532	1,113	7
3278H	Faka Union	FAKA UNION (NORTH SEGMENT)	48,412	1,705	155	36,092	6,312	2
3278I		FAKA UNION (SOUTH SEGMENT)	88,616	4,120	179	129	25	4
3261C	Okaloacoochee-SR29	BARRON RIVER CANAL	6,234	264	122	311	34	2
3278T		OKALOACOOCHEE SLOUGH	1,587	380	3	291,256	58,543	9
3278W		SILVER STRAND	33,443	3,690	82	379,120	76,110	541
Subtotal			**178,292**	**10,160**	**541**	**943,743**	**188,271**	**866**
Total	**All Watersheds**		**583,878**	**43,191**	**1,103**	**1,666,512**	**318,720**	**3,479**

Table 2-75. Predicted Pollution Loads by Unit Area from the Groundwater and Surface Water Systems

WBID	Watershed	Name	Groundwater Pollutant Load			Surface Water Pollutant Load		
			TN	TP	Cu	TN	TP	Cu
			lbs/ac/yr	lbs/ac/yr	lbs/ac/yr	lbs/ac/yr	lbs/ac/yr	lbs/ac/yr
3259A	Cocohatchee - Corkscrew	COCOHATCHEE RIVER	2.166	0.036	0.000	1.540	0.221	0.013
3259B		DRAINAGE TO CORKSCREW	0.147	0.056	0.000	3.910	0.782	0.005
3259W		LAKE TRAFFORD	0.000	0.000	0.000	0.000	0.000	0.000
3259Z		LITTLE HICKORY BAY	0.000	0.000	0.000	2.390	0.400	0.016
3278C		COCOHATCHEE GOLF COURSE DISCHARGE	1.238	0.028	0.000	2.270	0.290	0.018
3278D		COCOHATCHEE (INLAND SEGMENT)	3.192	0.166	0.003	3.020	0.520	0.010
3278E		COW SLOUGH	0.061	0.018	0.000	2.660	0.518	0.005
3278F		CORKSCREW MARSH	0.162	0.038	0.000	1.880	0.375	0.003
3278L		IMMOKALEE BASIN	0.287	0.074	0.000	3.580	0.692	0.009
Average			**0.831**	**0.067**	**0.001**	**2.618**	**0.498**	**0.006**
3278K	Golden Gate - Naples Bay	GORDON RIVER EXTENSION	0.484	0.046	0.001	4.114	0.655	0.025
3278R		NAPLES BAY (COASTAL SEGMENT)	1.457	0.066	0.000	5.713	0.870	0.057
3278S		NORTH GOLDEN GATE	1.853	0.101	0.005	2.272	0.384	0.011
Average			**1.729**	**0.094**	**0.004**	**2.744**	**0.451**	**0.017**
3278U	Rookery Bay	ROOKERY BAY (COASTAL SEGMENT)	1.699	0.172	0.001	0.852	0.156	0.003
3278V		ROOKERY BAY (INLAND EAST SEGMENT)	0.743	0.031	0.001	1.747	0.342	0.003
3278Y		ROOKERY BAY (INLAND WEST SEGMENT)	3.954	0.645	0.002	1.852	0.273	0.010
Average			**1.518**	**0.167**	**0.001**	**1.509**	**0.278**	**0.004**
3259I	Fakahatchee	CAMP KEAIS	0.000	0.000	0.000	4.154	0.829	0.005
3278G		FAKAHATCHEE STRAND	0.000	0.000	0.000	0.058	0.012	0.000
3278H	Faka Union	FAKA UNION (NORTH SEGMENT)	1.755	0.062	0.006	1.309	0.229	0.000
3278I		FAKA UNION (SOUTH SEGMENT)	1.505	0.070	0.003	0.002	0.000	0.000
3261C	Okaloacoochee-SR29	BARRON RIVER CANAL	0.195	0.008	0.004	0.010	0.001	0.000
3278T		OKALOACOOCHEE SLOUGH	0.013	0.003	0.000	2.372	0.477	0.000
3278W		SILVER STRAND	0.618	0.068	0.002	7.004	1.406	0.010
Average			**0.400**	**0.023**	**0.001**	**2.118**	**0.423**	**0.002**
Average	**All Watersheds**		**0.770**	**0.057**	**0.002**	**2.197**	**0.420**	**0.005**

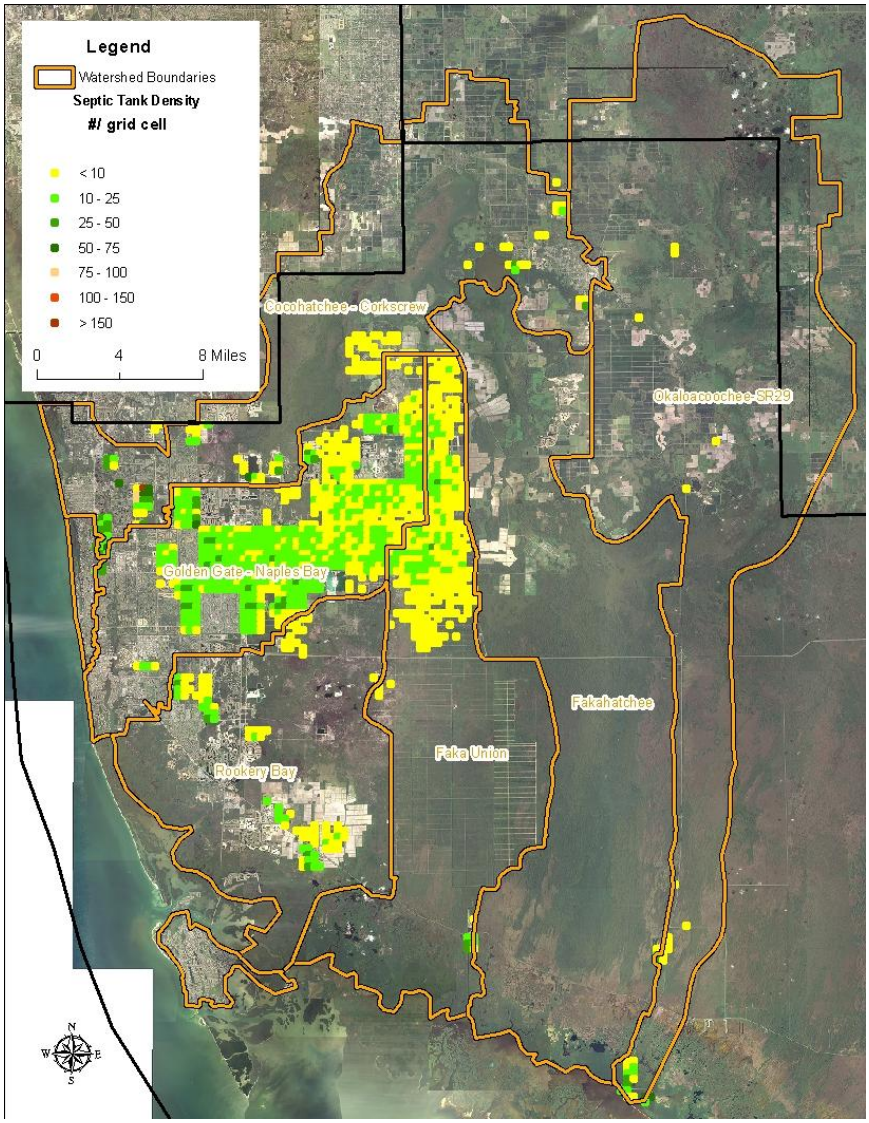


Figure 2-93. Estimated Septic Tank Density in Collier County

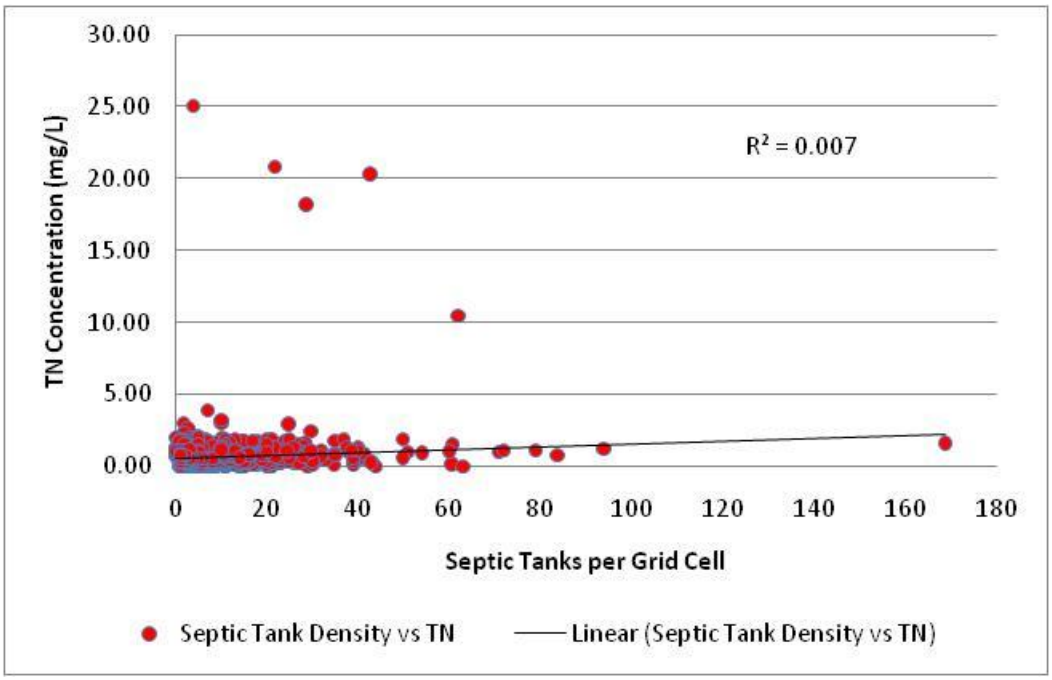


Figure 2-94. Scatter Diagram of Septic Tank Density vs. TN Concentration

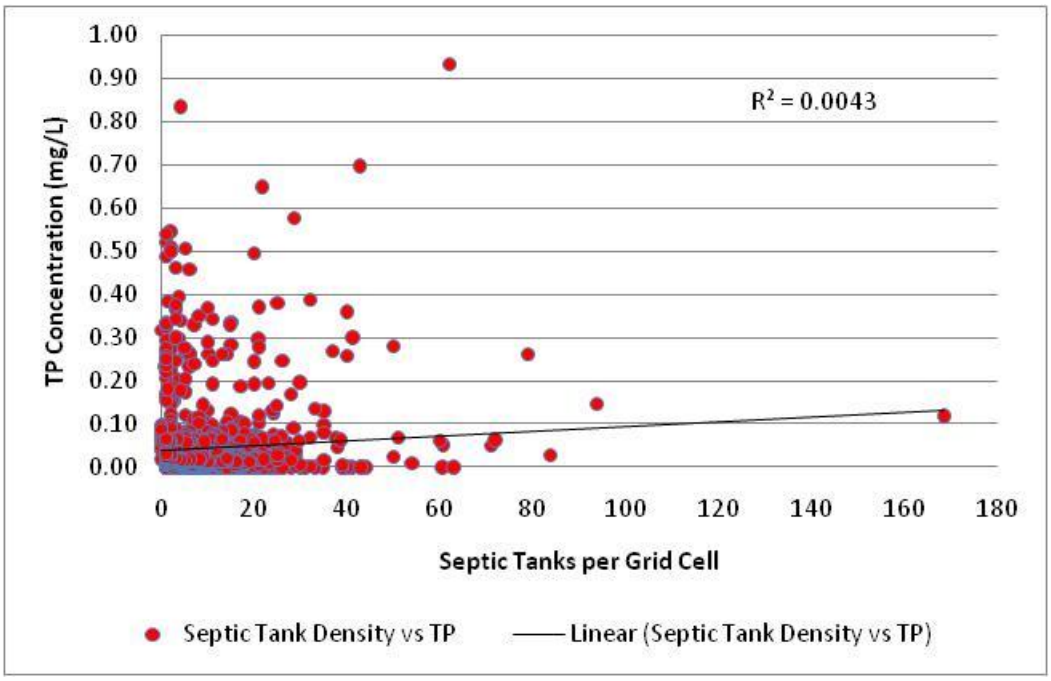


Figure 2-95. Scatter Diagram of Septic Tank Density vs. TP Concentration

2.6.3 Conclusions

The following conclusions can be drawn from the analysis:

- Dissolved oxygen concentration data is not commonly reported. Data for the Water Table and Tamiami aquifers was available only in the Gordon River and Picayune Strand. The collected data and the Kriging interpolation analysis indicate that dissolved oxygen concentrations in groundwater are less than 1.5 mg/L throughout most of Collier County. Groundwater inflows likely contribute to identified DO impairments in the canal network.
- A potential problem identified for this analysis was that many of the wells whose data was used to predict TN and TP loads are associated with the County's reuse monitoring program. It was considered possible that the reuse data may be biasing the results. To assess this condition, measured concentrations at the reuse wells were compared to those at wells not associated with reuse. Results indicated that there is not a significant difference in measured concentrations for the majority of the wells
- Results indicate that TN concentrations in groundwater exceed the corresponding screening criteria for surface water in a significant portion of the study area. TP concentrations exceed the criteria along the coast and in the northern portion of the area. The limited data available suggests that land practices in the immediate vicinity of the wells may contribute to the elevated groundwater concentrations. Additional sampling data that provides a better overview of existing conditions is necessary.
- Copper concentrations in groundwater are generally very low across Collier County suggesting that copper impairments in the canal network can be attributed to surface runoff. One well, located at the edge of the Big Cypress Preserve, shows elevated copper concentrations. Additional on-site assessments should be completed to identify the source of copper at this location.
- Iron concentrations in groundwater are elevated relative to the Class 3 surface water standard in many WBIDs within the study area. The areas of elevated iron concentrations in groundwater correspond with the locations of identified impairment in the canal network. Therefore, it is possible that groundwater inflows are a significant source of iron in the surface water system.
- Pollution load calculations indicate that groundwater is a potential contributor to the nutrient impairment in the Rookery Bay watershed. It is possible that human activities contribute to predicted nutrient concentrations in groundwater. Additional studies should be conducted to identify sources and verify groundwater contributions to the canal network.
- There is little correlation between TN and TP and septic tank density. While septic tanks may not be a countywide problem, localized problems may exist and should be resolved.

2.7 NATURAL SYSTEMS: REFERENCE PERIOD COMPARISON

The existing areal extent and functional quality of native wetland and upland communities in the three primary watersheds are presented in this section.

2.7.1 Introduction and Objective

This chapter addresses Element 1, Task 3.1. Under this task, pre-development and current conditions were compared and losses and conversions of native plant communities in Collier County watersheds over the past 50–60 years were estimated via a change analysis of land use cover data. The 1942 Collier County soils map provided additional data to characterize pre-development characteristics in the watersheds. The vegetation and soils data are reported and analyzed for the first three watersheds individually and the other three watersheds collectively.

Results of an analysis of changes in areal extent of natural communities and the causes of those changes are reported here and used to evaluate current watershed functions for Element 1 Task 3.2 (Functional Assessment). The pre-development data serve as the reference period, or baseline index against which to evaluate current vegetation data in determining resource protective function. This section of the chapter also presents a summary of soils characteristics from the 1942 soils survey data layer published in 2006, discovered in the course of preparing this section. These soils data do not appear to have been evaluated as part of the SWFFS and Natural Systems Model (NSM), but may be useful in calibrating other historical data collected through those and other efforts. The 1942 soils data is not directly comparable to current soils data due to changes in soils taxonomy, so was not evaluated to determine changes in soils or vegetation over time as part of this memorandum or the memorandum regarding functional assessment.

2.7.2 Methods

Vegetation changes were quantified as the change in number of acres in each vegetation community for each watershed, and further examined to determine losses due to conversion to specific types of development (i.e. change analysis). Changes were quantified from a simple comparison of pre-development and current vegetation data. Land use conversions were quantified using a GIS digital overlay process that generates a matrix of "from/to" changes in land use and cover (e.g. cypress swamp to urban).

Pre-development and current vegetation classifications vary among classification systems. Therefore, a "crosswalk" of natural communities was developed to compare pre- development and current conditions. The crosswalk was derived from the three sources:

- Pre-Development Vegetation Map (PDVM; Duever, 2004), which groups vegetation into 15 broad communities.

- Florida Land Use, Cover, and Forms Classification System (FLUCCS) maps in Collier County include over 300 land use and cover codes.
- Land use designations used in the MIKE SHE analysis for the Watershed Model Update include up to 23 land use/cover codes.

MIKE SHE-FLUCCS vegetation groupings were conducted as part of this project using a SWFFS-FLUCCS crosswalk table (http://crocdoc.ifas.ufl.edu/crosswalk/) and supplemented where necessary based on professional judgment of Atkins scientific staff. Eight additional MIKE SHE land use classes were further aggregated into four developed land uses (agriculture, golf course, pasture/bare ground, urban) since differences in these four developed land uses are of no consequence to the resource protective assessment.

Consequently, the 2004/2007 FLUCCS data were grouped into the 15 corresponding resource protective community descriptions used in the PDVM or one of the 8 additional agricultural and development land use/land cover types commonly used in the MIKE SHE model. Using the crosswalk, 19 "change analysis vegetation classes" or "crosswalk vegetation/ land cover classes" were designated and are listed in **Table 2-76**. These vegetation/ land cover classes were subsequently applied to pre-development and current mapping and data used to quantify the changes in vegetation from pre-development to current (2007) conditions and are referred to as "vegetation/land cover" changes in comparisons of pre-development vegetation with current land use/land cover in maps and tables.

Soils data from the 1942 survey (36 soil names) do not correspond to soil taxonomic classification standards developed circa 1950 (finalized in 1975 as the U.S. Department of Agriculture (USDA) and Soil Conservation Service (SCS) Soil Taxonomy). Neither is the extent of soils in the 1942 data directly comparable to the pre-development vegetation map, due in part to the difficulty of

Table 2-76. Land Use/Model Code/FLUCCS Crosswalk Vegetation Classes

PDVM and/or MIKE SHE Land Use Type	FLUCCS Code	Crosswalk Vegetation/ Land Cover
Citrus	221, 222, 223	Agriculture
Pasture	190, 191, 192, 193, 194, 211, 212, 213, 251, 260, 261, 8115, 832	Pasture/Bare Ground
Sugar Cane & Sod	2156, 242	Agriculture
Truck (Row) Crops	214, 215, 216	Agriculture
Golf Course	180, 182	Golf Course
Bare Ground	161, 162, 163, 164, 181, 231, 740, 743, 744, 835	Pasture/Bare Ground
Mesic Flatwood	310, 320, 321, 323, 330, 410, 411, 442	Mesic Flatwood
Mesic Hammock	420, 422, 427, 4271, 434, 437	Mesic Hammock
Xeric Flatwood	4120, 4130	Xeric Flatwood
Xeric Hammock	322	Xeric Hammock
Hydric Flatwood	624, 625, 626	Hydric Flatwood
Hydric Hammock	424, 428, 6111, 618	Hydric Hammock
Wet Prairie	643	Wet Prairie
Freshwater Marsh	6172, 641, 6411, 6412, 644,	Freshwater Marsh
Cypress	620, 621 (except 6211), 6215, 6216	Cypress
Dwarf/Scrub Cypress	6211	Dwarf/Scrub Cypress
Swamp Forest	615, 617, 6191, 630	Swamp Forest
Mangrove	612	Mangrove
Open Water	166, 184, 254, 511, 512, 520, 525, 530, 541, 543, 560, 572, 651, 836	Open Water
Tidal Marsh	642	Tidal Marsh
Beach	710,720	Beach
Urban Low Density	110, 111, 112, 113, 118, 119, 148, 185, 240, 241, 243, 250	Urban
Urban Medium Density	120, 121, 122, 123, 129, 176, 834	Urban
Urban High Density	130, 131, 132, 133, 134, 135, 139, 140, 1411, 1423, 146, 149, 154, 155, 156, 170, 171, 183, 187, 252, 810, 8110, 8113, 814, 820, 831, 833	Urban

associating soils with particular pre-development vegetation communities, and in part due to soils classification by runoff characteristics (i.e. the speed at which water flows across the soil surface as opposed to seeping into the soil) in the earlier data set rather than seasonal water table (the primary indicator of hydric soils). The soils data nonetheless provide a seamless GIS data layer of 1942 soils in Collier County and may be useful in the calibration of other historical data sets. Soils runoff characteristics (1942) are presented for each watershed and summarized in a narrative.

2.7.3 Data Sources

Several sources of data were for defining, analyzing and comparing reference conditions and current conditions. The primary source of vegetation reference conditions was the PDVM GIS layer developed by Mike Duever and the Natural Systems Group (NSG) at SFWMD. Existing vegetation characteristics were determined from a 2004 GIS data layer developed by SFWMD, and updated by Atkins for 2007. 1940s soils characteristics were identified from a data layer developed by the United States Geological Survey. These three data sources are described below.

Duever, M. 2004. Southwest Florida Pre-Development Vegetation Map. South Florida Water Management District.

The Pre-Development Vegetation Map (PDVM) is an ArcView data coverage representing pre-development vegetation communities in the five-county region (including Collier County) addressed by the SWFFS. The PDVM was developed over a period of two years using several GIS data sources, including 1940s soils (lands outside of Everglades National Park and Big Cypress National Preserve) and 1990s vegetation maps (lands within ENP and BCNP), as well as best professional judgment of pre-development vegetation by the author and NSG where necessary due to data gaps and altered conditions. The PDVM identifies 15 pre-development plant communities based on their hydrological characteristics (depth and duration of inundation). One of the NSG's guiding principles in developing this data layer was to provide sufficient detail for the development of a hydrological model with a resolution of 20 acres or larger. Changes in vegetation from the pre-development period to present conditions are attributed to a variety of causes, including conversion to agricultural or residential land uses, altered hydrologic and/or fire regimes, or invasion by exotic plants. Potential errors in the PDVM may occur due to different degrees of familiarity of those working on the map with the various geographic areas in southwest Florida, and the imprecise nature of soil–plant community relationships. The PDVM is widely recognized as a reasonably accurate source of seamless GIS coverage of pre-development vegetation communities (e.g., Zahina et al, 2007) in the SWFFS area.

South Florida Water Management District Land Cover/Land Use 2004-05 Mapping Project

GIS data from this SFWMD project was utilized to characterize existing land use and land cover conditions, with classification codes based on the Florida Land Use, Cover, and FLUCCS; Department of Transportation, State Topographic Bureau, Thematic Mapping Section; January 1999 Edition.

Atkins reviewed the 2007 aerial photography to identify areas that had changed to urban land uses between 2004 and 2007. This information was used to update the land use distribution to better represent the 2007 land use and land cover conditions. The majority of the changes occurred due to development of the Town of Ave Maria and nearby areas.

Jones, J.W. 2006. Creation of GIS-Compatible, Historic Detailed Soil Data Sets for Collier and Miami-Dade Counties of Florida. United States Geological Survey (Table 2-77).

This publication describes a GIS data layer developed by USGS in 2006 for which a single GIS data file was created for Collier County from eight individual 1942 soils maps (presumably from aerial photographs prior to 1942) and published in 1954 by the USDA/SCS, in cooperation with the Florida Agricultural Experiment Station. The USGS developed the data layer using a multi-step process that included scanning paper copies of surveys, geo-rectification, and selection of appropriate uniform colors and line types.

Table 2-77. 1942 Collier County Soil Names, Relief and Surface Runoff Characteristics (Data Source from Jones/USGS, 2006)

Soil Name	**First_RELI** (Relief)	**First_SURF** (Surface Runoff)
Arzell fine sand	Level to nearly or slightly depressional	Very shallow or ponded
Blanton fine sand	Level to gently undulating	Slow to medium
Broward Ochopee complex	Level nearly level or gently undulating	Slow
Coastal beach	Gently sloping	Medium
Copeland fine sand	Level or nearly level	Very slow
Copeland fine sand–Low phase	Level depressions	Very slow or ponded
Lakewood fine sand	Hummocky (dunes) to level	Very slow due to rapid infiltration
Mangrove swamp	Level below high tide	Water covered at high tide

2.7.4 Results

Results of the watershed assessment are reported below for each of the three primary watersheds, followed by an aggregated summary of the three remaining watersheds.

2.7.4.1 Cocohatchee-Corkscrew Watershed

The Cocohatchee-Corkscrew Watershed has experienced a loss of nearly 85 percent of pre-development upland communities and just over 30 percent of freshwater wetlands. The greatest loss of a natural upland community was due to conversion of natural uplands to agricultural land uses, while urban development accounted for the greatest loss of pre-development wetlands.

The Cocohatchee-Corkscrew PDVM included 13 of the 15 identified vegetation communities. Scrub cypress and tidal marsh were not present on the PDVM, presumably because the data used by SWFFS were not sufficient to determine whether or where these communities were historically present in the Cocohatchee-Corkscrew watershed. The 2007 land use and land cover map includes these thirteen PDVM communities, as well as tidal marsh and four agricultural/development cover types. Changes are mapped in **Figure 2-96** and listed in **Table 2-78**.

Table 2-78. Cocohatchee-Corkscrew Watershed Vegetation/ Land Cover Changes from Pre-Development vs. 2007

Cocohatchee–Corkscrew Vegetation/ Land Cover	Pre-Development Vegetation/ Land Cover		2007 Vegetation/Land Cover	
	Acres	Percent of Total	Acres	Percent of Total
Agriculture	-	-	29,512	23
Freshwater Marsh	13,372	10	20,652	16
Urban	-	-	17,084	13
Cypress	11,334	9	12,931	10
Pasture & Bare Ground	-	-	11,869	9
Hydric Flatwood	25,911	20	7,969	6
Swamp Forest	12,167	9	7,353	6
Mesic Flatwood	46,501	36	7,094	6
Water	2,439	2	5,577	4
Golf Course	-	-	3,603	3
Mesic Hammock	1,463	1	1,109	1
Wet Prairie	5,969	5	1,101	1
Mangrove	1,731	1	1,056	1
Hydric Hammock	3,042	2	990	1
Tidal Marsh	-	-	195	0
Xeric Hammock	4,090	3	86	0
Beach	231	0	68	0
Xeric Flatwood	10	0	10	0
Total	128,260	100	128,260	100

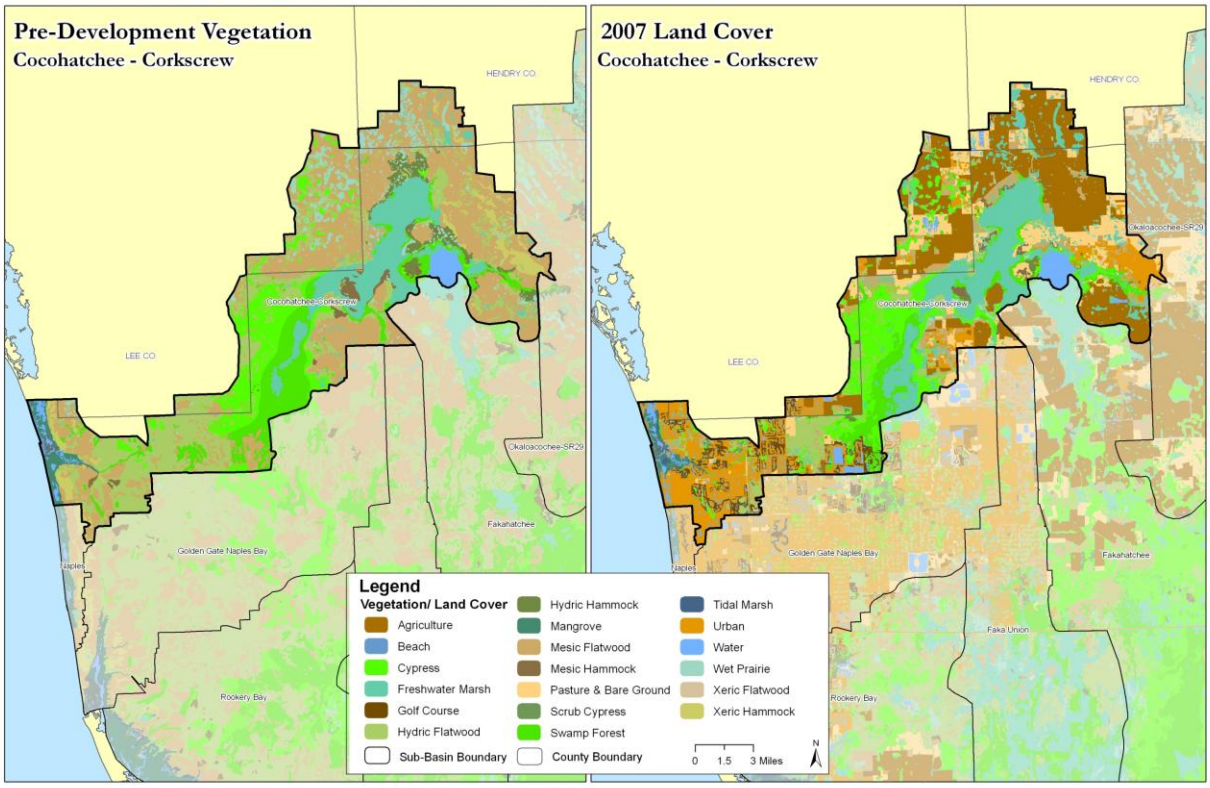


Figure 2-96. Cocohatchee-Corkscrew Watershed, Vegetation/Land Cover Changes from Pre-Development vs. 2007
(GIS Source Data from SFWMD)

Under pre-development conditions, the watershed (128,670 acres) included approximately 72,000 acres freshwater wetlands (56 percent), 52,000 acres undeveloped uplands (41 percent), and 4,400 acres (4 percent) open water and tidal systems. By 2007, over 62,000 acres (48 percent) of this watershed had been converted to agricultural and urban-related development. Approximately 44,000 acres (84 percent) of native uplands and 21,000 acres (29 percent) of freshwater wetlands (freshwater marsh, cypress, hydric flatwoods, swamp forest, wet prairie, hydric hammock) had been lost, while the acres of open water increased by over 3,000 acres. There were estimated increases in the extent of freshwater marsh and cypress of 7,300 acres and 1,600 acres, respectively. However, these apparent increases may have resulted from the inherent difficulties in determining which specific vegetation community is associated with a pre-development soil type, particular where, for instance, a given hydric soil is common to more than one type of freshwater wetland. For this reason, aggregation of the data among similar cover types would be more accurate than for an individual vegetation community. The Cocohatchee-Corkscrew watershed in 2007 included 8,300 acres of undeveloped uplands (16 percent of the pre-development acres) and 51,000 acres of freshwater wetlands (71 percent of the pre-development acres).

The net conversions (change in number of acres) of pre-development vegetation to the four development land use and land cover classes are summarized in **Table 2-79**. By far, the greatest conversion of natural lands to a developed land use is mesic flatwood to agriculture (approximately 22,000 acres), representing approximately 33 percent of the conversion of natural lands that occurred during this time period. The wetland community with the greatest loss during this time period was hydric flatwoods (nearly 18,000 acres lost; 69 percent of the pre-development total), due to conversions to urban development (5,700 acres; 31 percent of the loss), agriculture (4,000 acres; 23 percent of the loss), pasture and bare ground (2,500 acres; 14 percent of the loss), and golf course (2,000 acres; 11 percent of the loss).

The 1940s soils data, based on runoff characteristics listed in the USGS data (an attribute labeled as "First SURF" in the USGS spatial data), are mapped in **Figure 2-97** for soils data in the Cocohatchee-Corkscrew Watershed and Collier County (approximately 75 percent of the watershed). Of the 97,550 acres in this watershed within Collier County, approximately 41,000 acres in the USGS data are soils with runoff characteristics described as medium, medium/slow, slow, or slow due to rapid infiltration, which are most likely to occur in uplands. Another 37,000 acres are soils with runoff characteristics described as very slow/ponded or very shallow/ponded, which are most likely to occur in wetlands. Approximately 1,700 acres are categorized as covered at high tide (most likely representing tidal communities such as mangrove, tidal marsh and beach). About 2,500 acres are open water. The remaining 16,000 acres are categorized as very slow runoff, a description that may be characteristic of either wetlands or uplands (e.g., flatwoods) in Collier County.

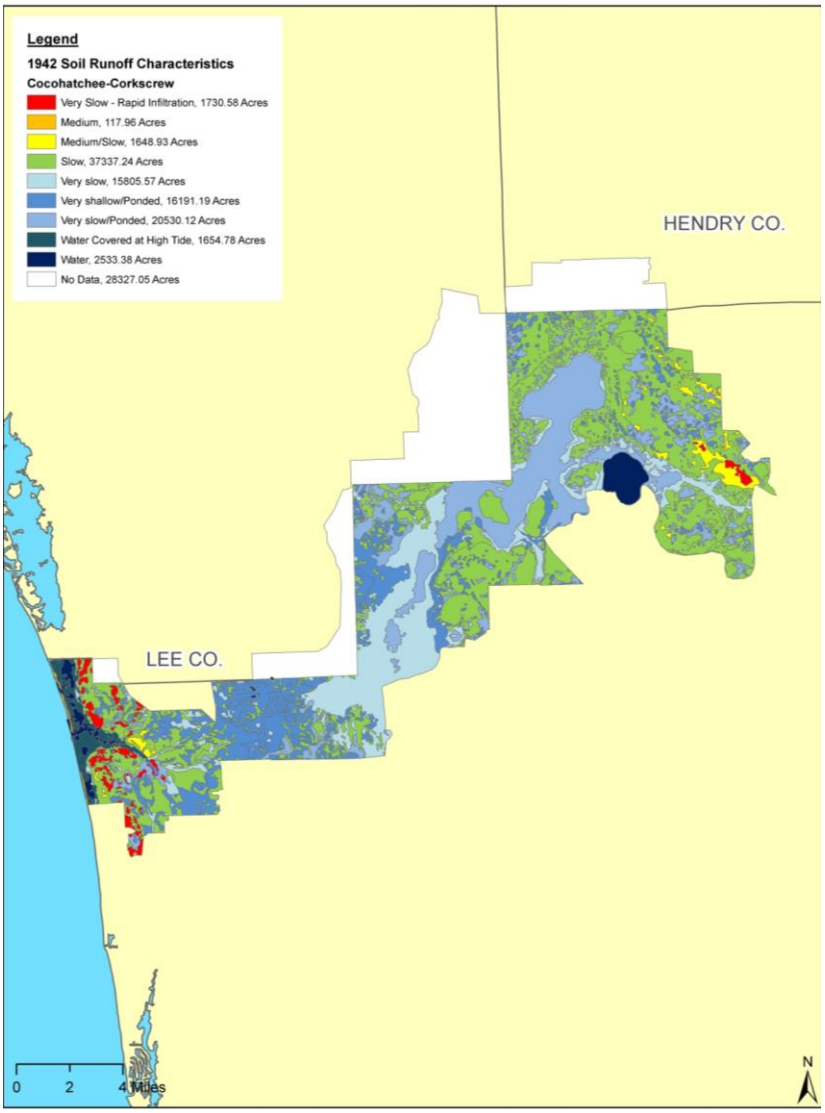


Figure 2-97. Cocohatchee-Corkscrew Watershed 1942 Soils Runoff Characteristics (Source Data from USGS)

Table 2-79. Cocohatchee-Corkscrew Watershed Vegetation/ Land Cover Conversions from Pre-Development to 2007 (Acres)

Pre-Development Vegetation/ Land Cover	Agriculture	Golf Course	Pasture & Bare Ground	Urban
Beach	0	0	0	39
Cypress	820	83	135	244
Freshwater Marsh	165	6	86	89
Hydric Flatwood	4,221	1,999	2,466	5,731
Hydric Hammock	715	0	561	191
Mangrove	0	2	0	432
Mesic Flatwood	21,562	1,149	7,188	7,504
Mesic Hammock	17	53	196	84
Scrub Cypress	0	0	0	0
Swamp Forest	8	215	34	394
Tidal Marsh	0	0	0	0
Water	0.00	0.04	1.3	52
Wet Prairie	1,054	8	726	166
Xeric Flatwood	0	0	0	7
Xeric Hammock	949	88	476	2,152

2.7.4.2 Golden Gate-Naples Bay Watershed

The Golden Gate-Naples Bay watershed had the greatest loss of pre-development vegetation communities of any of the watersheds analyzed for this study, with a loss of almost 70 percent of wetland acreage and over 80 percent of uplands. Urban development accounted for most of the loss. The PDVM for this watershed included eleven vegetation communities; xeric hammock, hydric hammock, scrub cypress and tidal marsh were not represented in the PDVM. The current land use map includes the same eleven PDVM vegetation communities, plus four agricultural/development land uses. **Figure 2-98** and **Table 2-80** present and summarize the pre-development and 2007 land use and land covers. The change analysis summarized below uses the current boundaries overlaid on the PDVM and current FLUCCS coverages, rather than the smaller historical watershed. This approach allows for direct comparison of land use and land cover acreages between the two time periods.

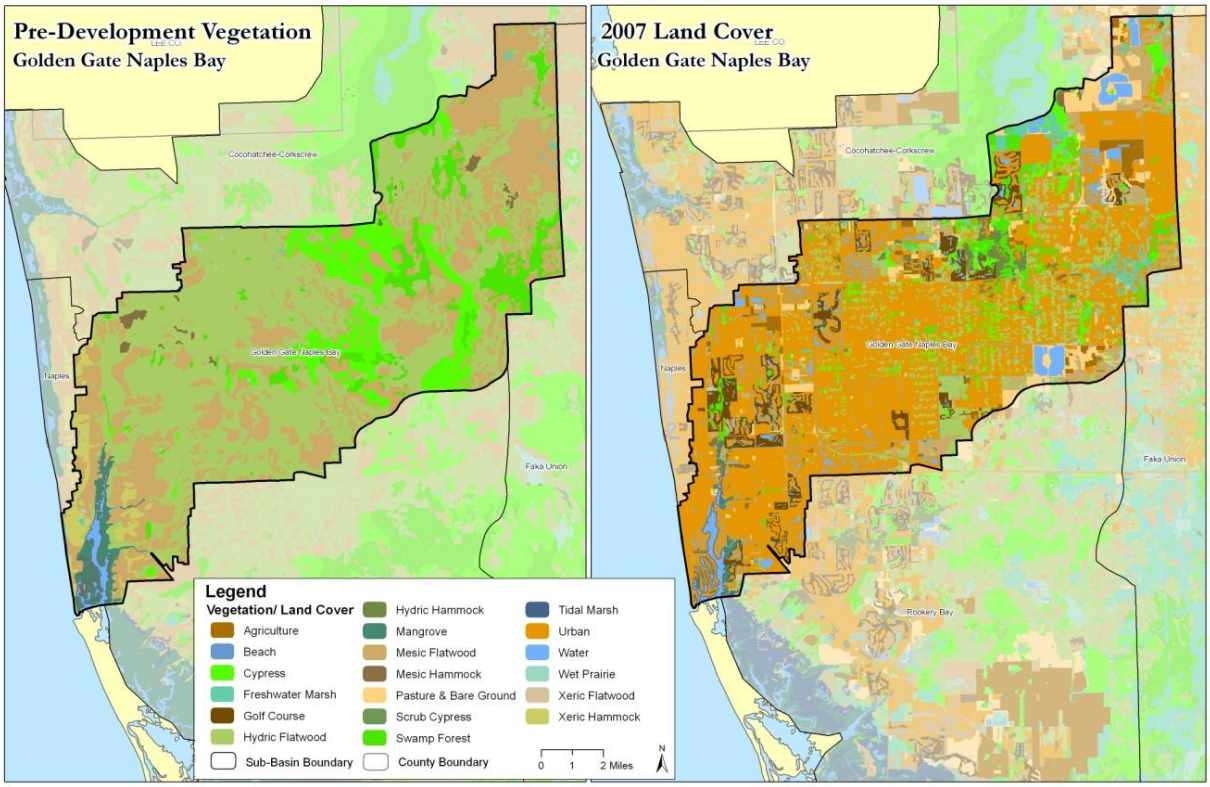


Figure 2-98. Golden Gate-Naples Bay Watershed, Vegetation/ Land Cover Changes from Pre-Development vs. 2007
(GIS Source Data from SFWMD)

Table 2-80. Golden Gate-Naples Bay Watershed Vegetation/Land Cover Changes from Pre-Development vs. 2007

Vegetation/Land Cover	Pre-Development Vegetation/ Land Cover		2007 Vegetation/ Land Cover	
	Acres	Percent of Total	Acres	Percent of Total
Urban	-	-	49,257	56
Hydric Flatwood	40,893	47	7,776	9
Water	777	1	5,986	7
Mesic Flatwood	27,545	31	4,545	5
Golf Course	-	-	4,216	5
Pasture & Bare Ground	-	-	3,941	5
Swamp Forest	5,279	6	2,922	3
Cypress	8,289	9	2,858	3
Freshwater Marsh	167	0	2,027	2
Agriculture	-	-	1,557	2
Hydric Hammock	-	-	1,254	1
Mesic Hammock	530	1	442	1
Mangrove	1,675	2	420	0
Wet Prairie	151	0	237	0
Beach	59	0	32	0
Xeric Flatwood	2,152	2	29	0
Tidal Marsh	-	-	20	0
Total	87,517	100	87,517	100

In the pre-development condition, this watershed (87,517 acres) was composed of approximately 55,000 acres freshwater wetlands (63 percent), 30,000 acres undeveloped uplands (35 percent), and 2,500 acres (3 percent) other natural land cover (open water and tidal systems). By 2007, 59,000 acres of this watershed (67 percent) had been converted to development. Nearly 37,000 acres of freshwater wetlands and over 25,000 acres of undeveloped uplands were lost by conversion to other land uses, while the acreage of open water increased by approximately 5,200 acres. There were also apparent increases in acreage in freshwater marsh (1,900-acre increase) and hydric hammock (1,300-acre increase). However, as with the other watersheds, these increases may in fact be due to the difficulty of correlating specific pre-development vegetation communities with soil data rather than actual changes in these communities; aggregate data for similar vegetation types is more accurate. The Golden Gate-Naples Bay watershed in 2007 retained just

over 17,000 acres of wetlands (31 percent of the pre-development amount) and 25,000 acres of undeveloped uplands (17 percent of the pre-development amount).

The net conversion of each pre-development community type to the four categories of development is summarized in **Table 2-81**. Unlike the Cocohatchee-Corkscrew watershed, the largest conversion of lands in the Golden Gate-Naples Bay watershed occurred due to urban development, which replaced over 24,000 acres of mesic flatwoods, nearly 17,000 acres of hydric flatwoods, approximately 2,000 acres of xeric flatwoods, and 1,700 acres of swamp forest communities. The second highest conversion of natural lands occurred due to golf course development, which replaced over 2,500 acres of hydric flatwoods and almost 1,200 acres of mesic flatwoods.

Table 2-81. Golden Gate-Naples Bay Watershed Land Use and Land Cover Conversions from Pre-Development to 2007 (Acres)

Pre-Development Vegetation/ Land Cover	Agriculture	Golf Course	Pasture & Bare Ground	Urban
Beach	0	0	0	28
Cypress	161	383	514	3,124
Freshwater Marsh	1	0	5	81
Hydric Flatwood	634	2,514	1,511	24,348
Hydric Hammock	0	0	0	0
Mangrove	0	28	37	885
Mesic Flatwood	694	1,174	1,807	16,657
Mesic Hammock	18	15	46	298
Scrub Cypress	0	0	0	0
Swamp Forest	48	64	15	1,732
Tidal Marsh	0	0	0	0
Water	0	0	1	33
Wet Prairie	0	8	0	54
Xeric Flatwood	0	0	0	0
Xeric Hammock	0	30	6	2,017

Soils runoff characteristics are mapped **in Figure 2-99** for the Golden Gate-Naples Bay watershed. The USGS soils data cover all but 55 acres of this watershed. Of the 87,403 acres within the 1942 soils coverage, just over 27,000 acres are soils with runoff characterized as medium, medium/slow, slow or slow due to rapid infiltration, characteristic of uplands. Another 43,000 acres of soils had runoff characteristics described as very slow/ponded or very shallow/ponded, characteristic of wetlands. About 1,400 acres are categorized as covered at high tide, characteristic of estuarine tidal systems; and 900 acres are open water. The remaining 15,000 acres of soils had a runoff

characteristic described as very slow runoff, which can occur in wetlands and uplands (e.g., flatwoods) in Collier County.

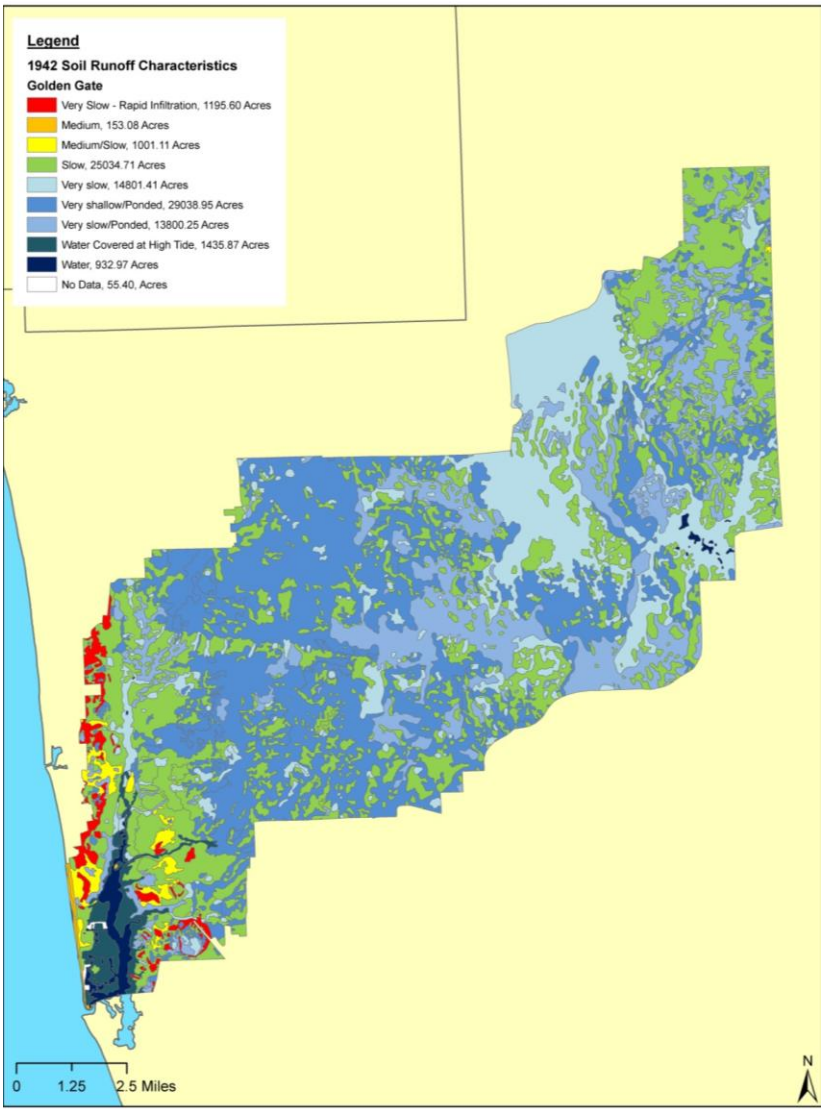


Figure 2-99. Golden Gate-Naples Bay Watershed 1942 Soils Runoff Characteristics (Source Data from USGS)

2.7.4.3 Rookery Bay Watershed

The Rookery Bay Watershed exhibited the smallest loss of pre-development vegetation communities among the three priority watersheds, with a loss of approximately 30 percent of wetlands and less than 50 percent of uplands. The largest conversion of pre-development natural lands occurred due to urban development. The Rookery Bay PDVM included twelve vegetation/land cover classes: xeric hammock, hydric hammock, and tidal marsh were not represented in the PDVM for this watershed. The current vegetation/land cover map includes the same twelve classes, plus hydric hammock and four agricultural/development cover classes. Pre-development and 2007

vegetation/land cover classes in the watershed are mapped in **Figure 2-100** and listed in **Table 2-82**.

Table 2-82. Rookery Bay Watershed Vegetation/ Land Cover Changes from Pre-Development vs. 2007

Vegetation/ Land Cover Class	Pre-Development Vegetation/ Land Cover		2007 Vegetation/ Land Cover	
	Acres	Percent of Total	Acres	Percent of Total
Hydric Flatwood	35,041	37	19,576	21
Urban	-	-	12,029	13
Mangrove	15,805	17	10,634	11
Cypress	9,562	10	9,422	10
Mesic Flatwood	13,575	14	7,703	8
Agriculture	-	-	6,753	7
Freshwater Marsh	183	0	6,062	6
Tidal Marsh	2,328	2	5,209	5
Water	1,792	2	4,323	5
Pasture & Bare Ground	-	-	3,664	4
Swamp Forest	13,789	14	3,330	3
Golf Course	-	-	2,838	3
Hydric Hammock	-	-	1,531	2
Wet Prairie	325	0	1,366	1
Mesic Hammock	2,202	2	707	1
Xeric Hammock	521	1	71	0
Scrub Cypress	97	0	-	-
Total	95,218	100	95,218	100

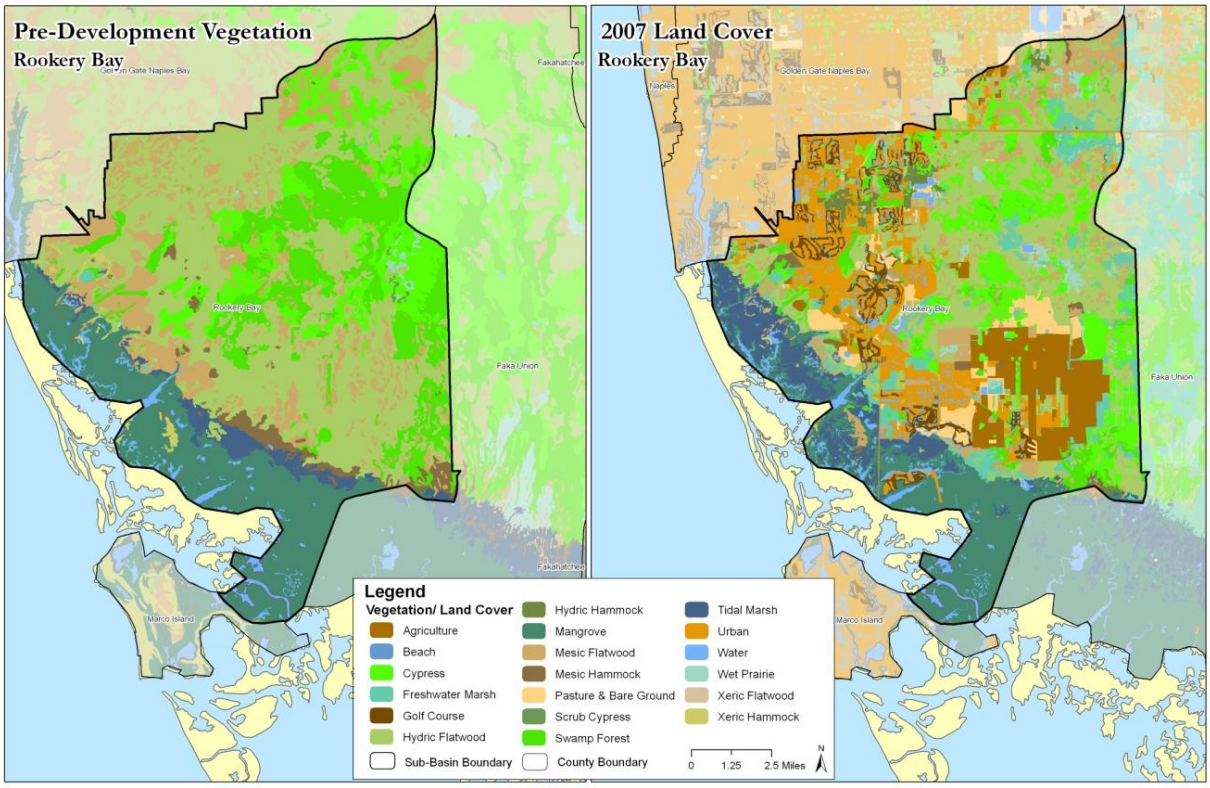


Figure 2-100. Rookery Bay Watershed, Vegetation/ Land Cover Changes from Pre-Development vs. 2007 (GIS Source Data from SFWMD)

Under the pre-development condition, this watershed (95,122 acres) included approximately 59,000 acres of freshwater wetlands (62 percent), 16,300 acres of undeveloped uplands (17 percent), 18,000 acres tidal systems (19 percent) and 1,800 acres open water (2 percent). By 2007, just over 25,000 acres (less than 27 percent) of this watershed had been converted to one of the four development-related land uses. There were 18,000 acres of freshwater wetlands, 8,000 acres of undeveloped uplands, and nearly 2,300 acres of tidal systems lost via conversion to other land uses, while acres of open water increased by over 2,500 acres. The cover of several natural resource protective communities appeared to increase during this time period, including freshwater marsh (by almost 6,000 acres), wet prairie (by over 1,000 acres), and tidal marsh (by nearly 3,000 acres). However, as mentioned previously, the data are more accurate when aggregated for similar ecosystems (e.g. freshwater wetlands) than for individual vegetation communities, due to the difficulty in determining specific pre-development vegetation from soils that occur in multiple similar systems. The Rookery Bay watershed in 2007 still included approximately 42,000 acres of wetlands (70 percent of the pre-development amount), 8,500 acres of undeveloped uplands (52 percent of the pre-development amount), and 16,000 acres of tidal systems (87 percent of the pre-development amount).

The net conversion of each pre-development community type to the four categories of development is summarized in **Table 2-83**. Similar to the Golden Gate-Naples Bay watershed, the largest conversion of lands in the Rookery Bay watershed occurred due to urban development, which replaced approximately 7,000 acres of hydric flatwoods and 3,000 acres of mesic flatwoods. The second highest conversion of natural lands occurred due to agriculture, which replaced nearly 5,000 acres of hydric flatwoods and 1,700 acres of mesic flatwoods. Not included in this analysis of loss to development is an apparent shift from a mangrove-dominated coastal estuary zone to one dominated by tidal marshes, as the acreage of mangroves decreased by nearly 5,000 acres, and tidal marshes increased by almost 3,000 acres. This may represent an actual shift due to a natural or artificially-induced successional/disturbance cycle (see Lewis and Streever, 2000), or be attributable to the difficulty in determining which of these two communities were associated with a soil type common to both for the PDVM.

The 1940s soils map, based on soil runoff characteristics (First_SUR) in the USGS data, is shown in **Figure 2-101** below. The USGS soils data covers all but 4 acres of this watershed. In this coverage, approximately 19,000 acres are soils characterized as medium, medium/slow, slow, or slow runoff due to rapid infiltration, typical of uplands in Collier County. Another 46,000 acres are soils with runoff characteristics described as very slow/ponded or very shallow/ponded, typical of freshwater wetlands. Almost 11,000 acres are categorized as covered at high tide, typical of tidal systems. About 1,700 acres are open water. The remaining 17,000 acres are soils described as having very slow runoff, which may occur in wetlands or uplands (e.g., flatwoods) in Collier County.

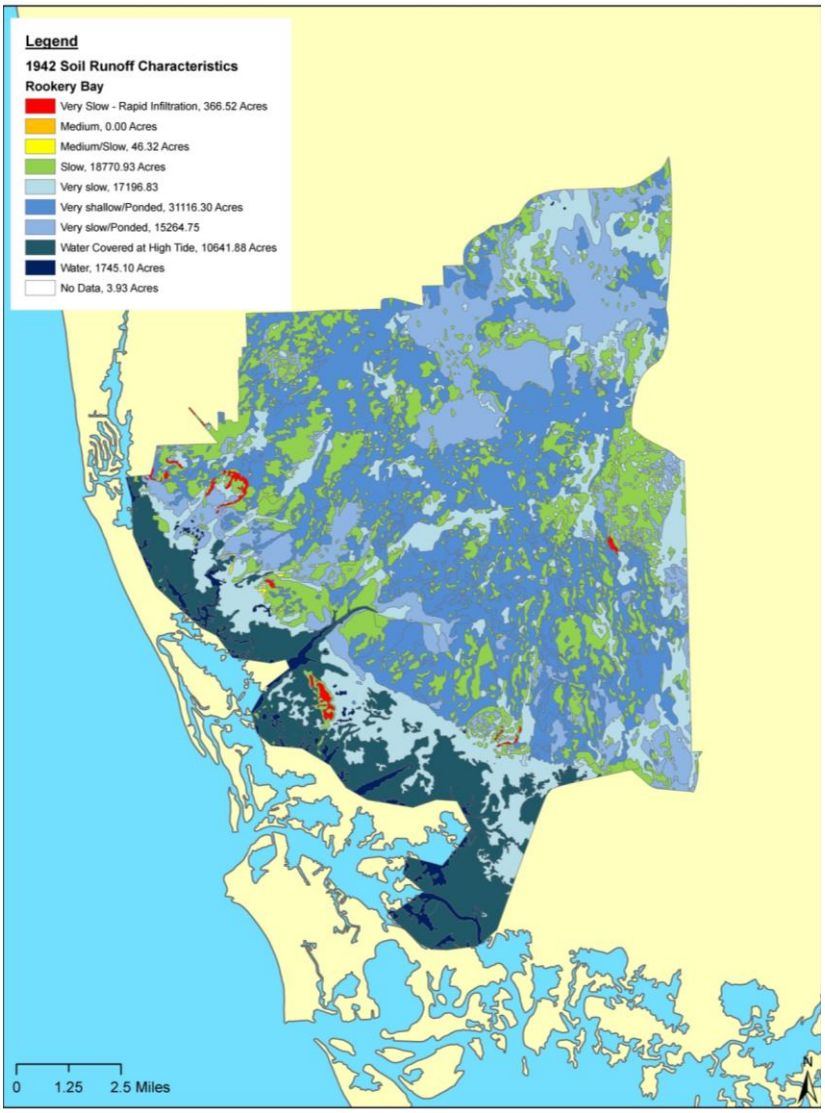


Figure 2-101. Rookery Bay Watershed 1942 Soils Runoff Characteristics (Source Data from USGS)

Table 2-83. Rookery Bay Watershed Vegetation/ Land Cover Conversions from Pre-Development to 2007 (Acres)

Pre-Development Vegetation/ Land Cover	Agriculture	Golf Course	Pasture & Bare Ground	Urban
Beach	0	0	0	0
Cypress	274	173	589	911
Freshwater Marsh	1	0	0	1
Hydric Flatwood	4665	1606	1797	6924
Hydric Hammock	0	0	0	0
Mangrove	0	168	14	221
Mesic Flatwood	1731	508	918	3235
Mesic Hammock	33	272	231	191
Scrub Cypress	0	0	0	0
Swamp Forest	44	72	54	358
Tidal Marsh	0	32	50	99
Water	0	3	0	3
Wet Prairie	0	3	11	11
Xeric Flatwood	0	0	0	0
Xeric Hammock	4	0	1	74

2.7.4.4 Faka Union, Okaloacoochee/SR 29, and Fakahatchee Watersheds

The Faka Union, Okaloacoochee/SR 29, and Fakahatchee watersheds were analyzed as an aggregate, rather than individually, due to lower priority assigned to them (re: anticipated development, etc.) compared with the three priority watersheds analyzed above. These watersheds retain the highest percentage of pre-development wetlands (nearly 85 percent), but only 30 percent of the pre-development uplands. The largest losses occurred via conversion to agricultural land uses.

The pre-development vegetation/land cover map for these watersheds included 14 cover types; only xeric hammock was not represented in the PDVM. The current land use and land cover map includes the same fourteen, plus hydric hammock, and the four agricultural/development cover types. **Table 2-84** summarizes the pre-development and 2007 land use and land covers.

In the pre-development condition, this trio of watersheds (507,369 acres) was composed of approximately 335,000 acres freshwater wetlands (66 percent), 115,000 acres undeveloped uplands (23 percent), 54,000 acres tidal systems (11 percent) and 3,500 acres open water (1 percent). Similar to Rookery Bay watershed, as of 2007, just 135,000 acres of these watersheds

Table 2-84. Faka Union, Okaloacoochee/SR 29, Fakahatchee Watersheds
Vegetation/Land Cover Changes from Pre-Development vs. 2007
(GIS Source Data from SFWMD)

Faka Union, Okaloacoochee/SR 29, Fakahatchee Watersheds				
Vegetation/ Land Cover	Pre-Development Vegetation/ Land Cover		2007 Vegetation/ Land Cover	
	Acres	Percent of Total	Acres	Percent of Total
Freshwater Marsh	38,749	8	117,994	23
Cypress	39,302	8	63,101	12
Swamp Forest	106,601	21	61,437	12
Agriculture	-	-	59,028	12
Pasture & Bare Ground	-	-	52,347	10
Mangrove	43,579	9	33,885	7
Mesic Flatwood	107,183	21	28,293	6
Hydric Flatwood	67,832	13	26,568	5
Urban	-	-	22,626	4
Tidal Marsh	10,315	2	13,172	3
Wet Prairie	58,693	12	11,973	2
Water	3,541	1	8,097	2
Mesic Hammock	4,639	1	6,554	1
Hydric Hammock	10,662	2	1,593	0
Golf Course	-	-	527	0
Beach	262	0	152	0
Xeric Hammock	3,289	1	21	0
Scrub Cypress	12,720	3	-	-
	507,369	100	507,369	100

(27 percent) had been converted to development. In addition, 52,000 acres of freshwater wetlands, 80,000 acres of undeveloped uplands, and 7,000 acres of tidal systems were lost by conversion to development-related land uses, while the acreage of open water increased by almost 5,000 acres. As in other watersheds, the extent of several natural systems appeared to increase during this time period, including freshwater marsh (by 79,000 acres), cypress (by 24,000 acres), mesic hammock (by 2,000 acres) and tidal marsh (by 3,000 acres). It is likely that these reflect difficulties in determining specific pre-development resource protective communities from soil surveys, rather than actual changes. The accuracy of analysis of vegetation therefore increases with aggregation among similar vegetation communities. These watersheds in 2007 still included 283,000 acres of freshwater wetlands (84 percent of the pre-development amount), 35,000 acres of undeveloped

uplands (just 30 percent of the pre-development amount), and 47,000 acres of tidal systems (87 percent of the pre-development amount).

The net conversion of each pre-development community type to the four categories of development is summarized in **Table 2-85**. The largest conversion of lands in this set of watersheds occurred due to agriculture, which replaced more than 38,000 acres of mesic flatwoods and slightly less than 16,000 acres of hydric flatwoods. The second highest conversion of natural lands occurred due to conversion to pasture, which replaced 26,000 acres of mesic flatwoods, 12,000 acres of hydric flatwoods, and 5,000 acres of wet prairie.

Table 2-85. Faka Union, Okaloacoochee/SR 29, Fakahatchee Watersheds
Land Use and Land Cover Conversions from Pre-Development to 2007
(Acres)

Pre-Development Vegetation/ Land Cover	Agriculture	Pasture & Bare Ground	Urban
Beach	0	0	0
Cypress	433	876	1,367
Freshwater Marsh	525	2,247	87
Hydric Flatwood	15,923	12,162	4,359
Hydric Hammock	34	4,440	133
Mangrove	0	21	201
Mesic Flatwood	38,200	26,495	7,407
Mesic Hammock	1,050	872	58
Scrub Cypress	0	3	48
Swamp Forest	227	550	814
Tidal Marsh	0	8	95
Water	2	0	10
Wet Prairie	2,539	4,582	315
Xeric Flatwood	0	0	0
Xeric Hammock	90	14	125

The 1940s soils map, based on soil runoff characteristics in the USGS data, is shown in **Figure 2-102**. The USGS soils data does not cover 42,831 acres of these watersheds located in Hendry County. In this coverage, approximately 108,147 acres have soils with runoff characteristics described as medium, medium/slow, slow or slow due to rapid infiltration. Another 168,455 acres are soils with runoff characterized as very slow/ponded or very shallow/ponded and may be assumed to occur in wetlands. 14,759 acres of soils were described as covered at high tide; and 3,398 acres were open water. The remaining 151,440 acres have soils with a runoff characteristic described as very slow runoff.

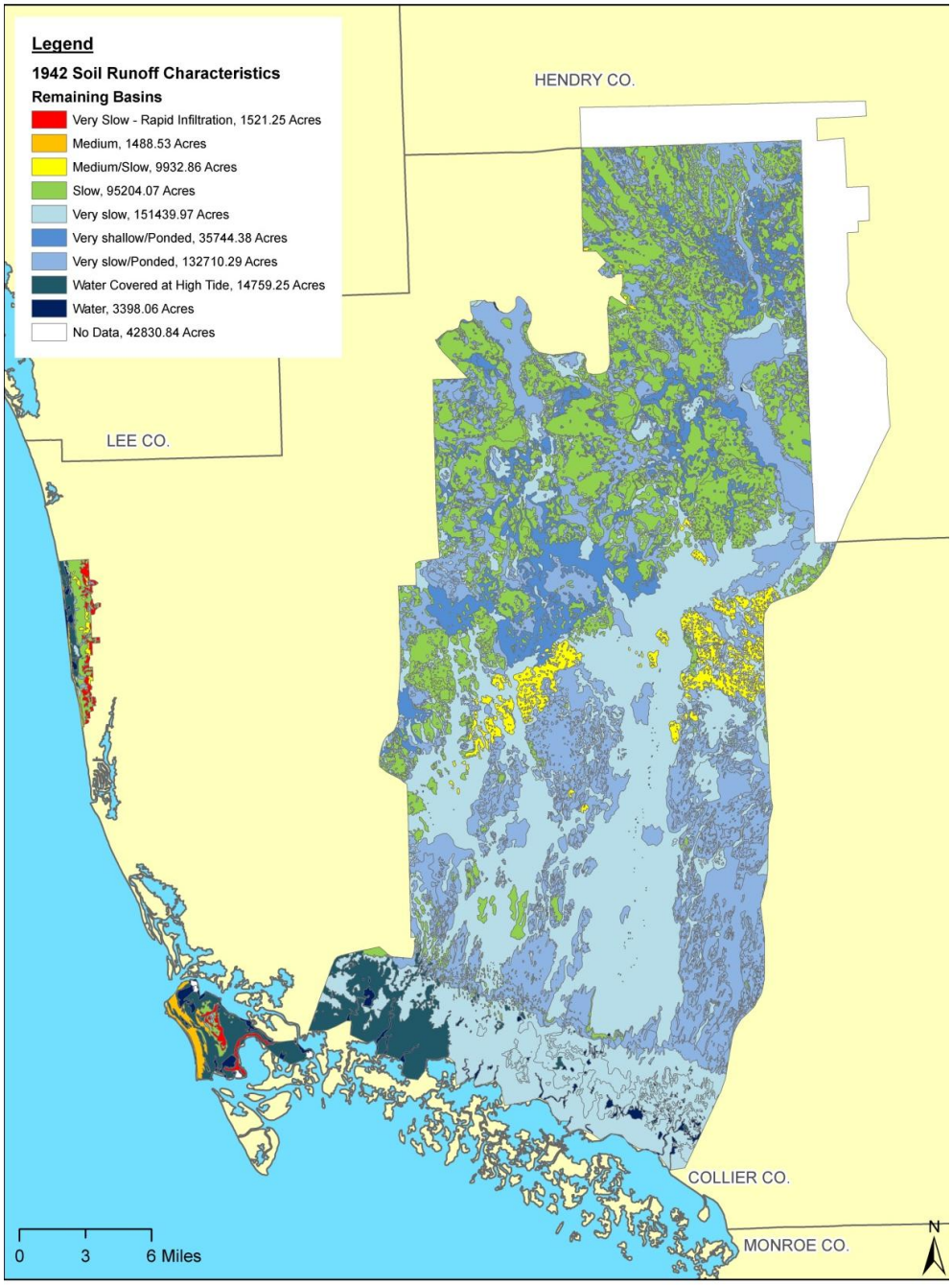


Figure 2-102. Faka Union, Okaloacoochee/SR 29, Fakahatchee Watersheds 1942 Soils (Source Data from USGS)

2.7.5 Conclusions

Vegetation and land cover changes from pre-development to current (2007) conditions were evaluated for the Cocohatchee-Corkscrew, Golden Gate-Naples Bay, Rookery Bay, Faka Union, Okaloacoochee/SR 29, and Fakahatchee watersheds. (**Figure 2-103**, **Tables 2-86 and 2-87)**. PDVM vegetation communities included approximately 520,000 acres (64 percent of the total area) of freshwater wetlands, 214,000 acres (26 percent of the total area) of uplands, 76,000 acres (9 percent of the total area) of estuarine tidal systems, and 8,500 acres (1 percent of the total area) of natural open water. By 2007, pre-development acres of freshwater wetlands had declined by 128,000 acres (25 percent) across these watersheds. The extent of native uplands had declined by 157,000 acres (73 percent) and estuarine tidal wetlands had declined by more than 11,000 acres (15 percent).

Declines were greatest for hydric and mesic flatwoods (70 percent loss) and increases were greatest for urban development (12 percent), agriculture (12 percent), and pasture/bare ground (9 percent). The largest conversion of one land cover/land use class to another was from mesic flatwoods to agricultural land use (over 62,000 acres), followed by conversion of hydric flatwoods to urban land use (over 37,000 acres).

The conversion of natural wetlands and uplands summarized in this memorandum represent a loss of nearly 273,000 acres (426 square miles) of wildlife habitat, natural water storage, filtration, and open recreational space in these six watersheds. Of the three primary watersheds, the greatest percentage loss has occurred due to urban development within the Golden Gate-Naples Bay watershed, with almost 60 percent of the watershed now categorized as urban. In contrast, just 23 percent of the lands within Rookery Bay watershed are categorized as any type of development. Of the 273,000 acres of natural lands converted to other land uses throughout these six basins, agriculture accounts for approximately 97,000 acres (12 percent of the watersheds' area).

Assessment of potential restoration opportunities includes recognition of limitations (e.g., land converted to urban development has far less restoration potential than agricultural lands or degraded natural areas), as well as opportunities (e.g., restoration of highly degraded areas may provide greater value, particularly if located contiguous with natural areas). The related analysis of wetland and upland functional values provides a more in-depth qualitative assessment, including the effect of the loss of natural lands and identification of areas with the greatest opportunity for recovery.

The results of this change analysis provide the basis for assessing the functional value of the natural systems in the watershed, evaluating the potential for restoration, and a comparison with performance measures, as further analyzed in the technical memorandum for Element 1, Task 3.2 (Functional Assessment).

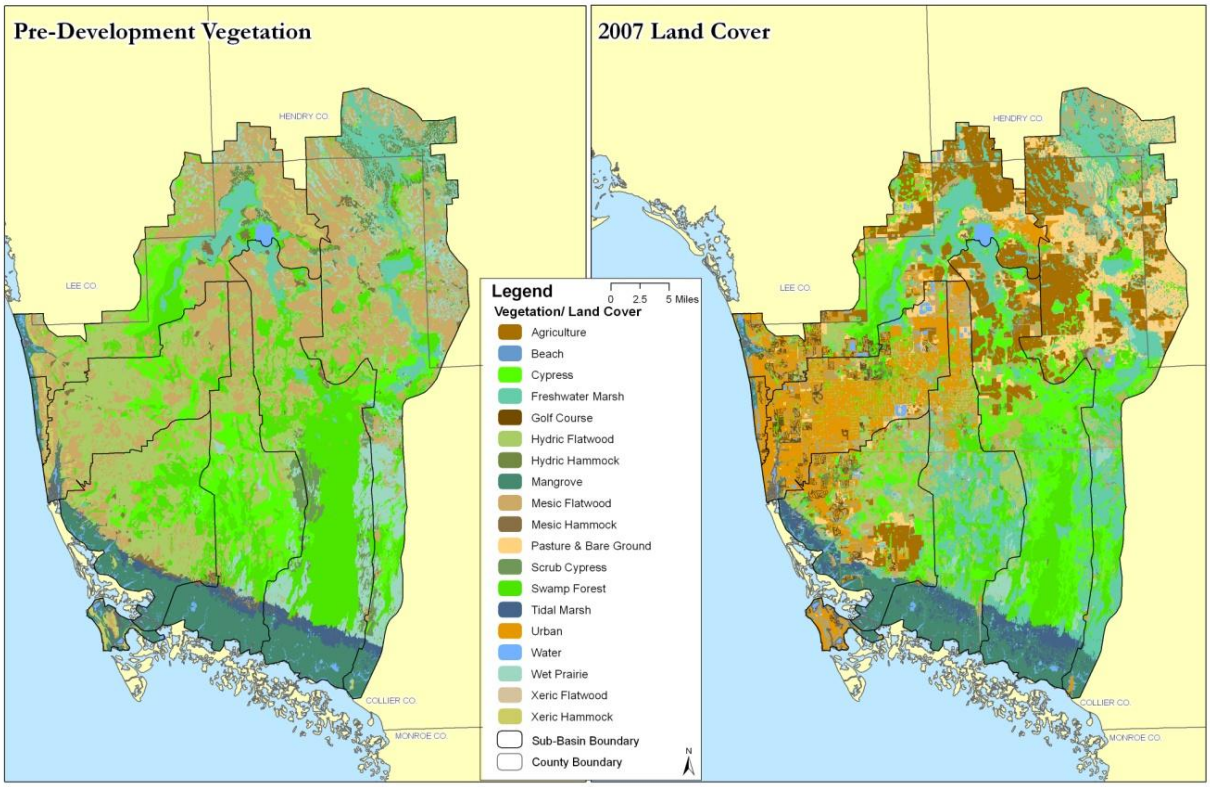


Figure 2-103. Model-Wide Overview, Land Use and Land Cover Changes from Pre-Development vs. 2007 (GIS Source Data from SFWMD)

Table 2-86. Collier County Watersheds Land Use and Land Cover
Changes from Pre-Development vs. 2007

Cocohatchee-Corkscrew, Golden Gate-Naples Bay, Rookery Bay, Faka Union, Okaloacoochee/SR 29, and Fakahatchee Watersheds				
Vegetation/ Land Cover Class	Pre-Development Vegetation/ Land Cover		2007 Vegetation/ Land Cover	
	Acres	Percent of Total	Acres	Percent of Total
Agriculture	0	0%	96,849	12%
Beach	552	0%	251	0%
Cypress	68,487	8%	88,312	11%
Freshwater Marsh	52,471	6%	146,734	18%
Golf Course	0	0%	11,184	1%
Hydric Flatwood	169,677	21%	61,888	8%
Hydric Hammock	13,704	2%	5,367	1%
Mangrove	62,790	8%	45,995	6%
Mesic Flatwood	194,804	24%	47,635	6%
Mesic Hammock	8,833	1%	8,812	1%
Pasture & Bare Ground	0	0%	71,821	9%
Scrub Cypress	12,817	2%	0	0%
Swamp Forest	137,836	17%	75,042	9%
Tidal Marsh	12,643	2%	18,596	2%
Urban	0	0%	100,996	12%
Water	8,549	1%	23,983	3%
Wet Prairie	65,138	8%	14,678	2%
Xeric Flatwood	2,162	0%	40	0%
Xeric Hammock	7,901	1%	178	0%
Total	818,364	100%	818,364	100%

Table 2-87. Collier County Watersheds Land Use and Land Cover Conversions from Pre-Development to 2007 (Acres)

Pre-Development Vegetation/ Land Cover	Agriculture	Golf Course	Pasture/Bare Ground	Urban
Beach	0	0	0	66
Cypress	1,688	1,514	2,604	4,279
Freshwater Marsh	691	2,254	178	170
Hydric Flatwood	25,443	18,282	10,132	37,003
Hydric Hammock	749	4,440	694	191
Mangrove	0	219	251	1,539
Mesic Flatwood	62,187	29,326	17,320	27,396
Mesic Hammock	1,118	1,212	531	573
Scrub Cypress	0	3	48	0
Swamp Forest	328	901	917	2,484
Tidal Marsh	0	40	146	99
Water	2	3	12	88
Wet Prairie	3,593	4,601	1,052	231
Xeric Flatwood	0	0	0	7
Xeric Hammock	1,044	132	608	4,243
Total	96,843	62,928	34,492	78,370

2.8 NATURAL SYSTEMS: FUNCTIONAL ASSESSMENT

2.8.1 Introduction and Objective

This Chapter addresses Element 1, Task 3.2 *Functional Assessment*. The primary objective of this task was to develop and apply a method to assess the County's natural systems under existing conditions throughout the study area. The method is a landscape-level functional assessment of native wetland and upland communities. The assessment also provides the basis for the application of performance measures that are used to evaluate the potential impact of proposed restoration projects. Because the functional assessment is intended to target areas for resource protection and restoration, the analysis addressed only the non-urban portions of the watersheds, which are more likely to provide opportunities for restoration.

The functional assessment considered vegetation conditions, hydrologic conditions, and locations of the natural features. A scoring procedure was used to assess conditions compared to a reference time period.

In addition to the functional assessment analysis, this task also included two additional analyses that help estimate the resource protective capacity for additional water storage on undeveloped (non-urban) lands, and coverage (acres) of non-native invasive vegetation. These analyses, though not used directly for the functional assessment, provide information that may be used to further assess watershed conditions.

Results of the functional assessment were used first as a criterion to identify areas within each watershed where projects are most likely to improve or restore the functional value of the natural system. Also, development of the functional assessment is tied closely to the development of performance measures, which is the methodology used to assess the potential impact of proposed restoration actions.

2.8.2 Methods

The Uniform Mitigation Assessment Method (UMAM, Chapter 62-345 Florida Administrative Code) is widely accepted as a means of resource protection assessment. UMAM provided the template from which to develop the functional assessment for this project. Modifications were necessary to implement the functional assessment at the watershed level, rather than the site-specific level for which UMAM was designed. The overall concepts and design, however, are consistent with the development of UMAM.

Similar to UMAM, the optimal condition for this functional assessment is defined in terms of the landscape position, vegetation, and hydrology of the resource protective community in a targeted

reference condition. Scores are assigned based on the degree of change between the existing condition of the natural communities and a reference condition.

This assessment relies exclusively on available GIS data to determine functional values at a watershed (and regional) level scale. The results presented herein should therefore be evaluated as a watershed-level assessment and cannot be used as a substitute for on-site analysis typically required for permitting purposes. Consistent with the level of detail incorporated in the hydrologic/hydraulic MIKE-SHE computer model developed as part of this project, the functional assessment methodology is applied using 1500 X 1500 foot cells whose land use characteristics are designated by the predominant land cover in each cell. For example, if a 1500 X 1500 foot cell is characterized by 80 percent cypress swamp, the entire cell is designated as cypress swamp.

An initial element of the functional assessment was establishing the reference conditions, similar to the Part I "frame of reference" prescribed in UMAM. Based on discussions with Collier County staff, other agencies, and not-for-profit conservation organizations, it was agreed that the data set which best defines the reference condition for this project area is the Pre Development Vegetation Model (PDVM). The PDVM is a 5-county map (including Collier County) with 15 vegetation associations defined by common vegetation composition and hydrological characteristics in the locations anticipated prior to development.

The functional assessment developed for this project included three (3) independent indices (scores), each of which includes a specific method for evaluating the current condition of a cell in comparison to its reference condition. The methods used to assign these indices (listed below) are presented in the following sections.

- Vegetation Score
- Hydrological Score
- Landscape Suitability Index (LSI)

2.8.2.1 Vegetation Scores

The vegetation score provides a means of comparing the resource protective functions of a cell (consisting of vegetation stratum (e.g., forested vs. herbaceous) and type of ecosystem (e.g., upland vs. wetland)) with the PDVM community that historically occupied the cell. UMAM provides a means of evaluating the set of characteristics to provide a parameter known as Community Structure. The change in vegetation characteristics is calculated by comparing 2007 FLUCCS data with the PDVM data. The land cover change analyses completed under Element 1 Task 3.1 (Reference Period Comparison) are incorporated into the vegetation scoring method for this project. The vegetation scoring method is described in greater detail below under Vegetation.

Vegetation scores generally represent the functional value of a cell in the landscape based on the degree to which the current cell retains natural vegetation (the PDVM conditions). A cell that has

experienced a large change from pre-development vegetation (i.e., to a developed land use) would be characterized by low scores, while little or no change in vegetation cover (i.e., same as pre-development, or shift to another natural vegetation classification) would be characterized by a higher score. The vegetation scoring method is summarized in the following bullets and in **Table 2-88**. Vegetation scores are displayed in **Figure 2-104** and listed in **Table 2-91**.

- Polygons with existing FLUCCS designation that indicate the same dominant vegetation or natural water body as the PDVM (e.g., hydric flatwoods under pre-development and existing conditions) received a score of 10.
- Polygons that retained the same dominant stratum and ecosystem type (e.g., freshwater forested wetland to freshwater forested wetland) also received a score of 10.
- Polygons that shifted from one dominant stratum to another but retained the same ecosystem type (e.g., freshwater forested wetland to herbaceous freshwater wetland) received a score of 8.
- A shift from mesic to hydric flatwoods or vice-versa received a score of 8.
- Polygons in which vegetation shifted between natural ecosystem types and strata (e.g., herbaceous freshwater wetland to forested native upland or natural water body) received a score of 8.
- Polygons that were converted to an artificial water body received a score of 6.
- A natural system that was converted to a developed land use class was scored as listed in **Table 2-88**.

Table 2-88. Vegetation Score for Developed Lands

Model Land Use Type	MIKE SHE Model Code	FLUCCS Code	Vegetation Score
Citrus	1	221, 222, 223	4
Pasture	2	211, 212, 213, 251, 260, 261, 832	6
Pasture	2	190,192, 193 (urban abandoned)	1
Sugar Cane & Sod	3	2156, 242	4
Truck (Row) Crops	5	214, 215, 216	4
Golf Course	6	180, 182	1
Bare Ground	7	161, 162, 163, 164, 181, 231, 740, 743, 744, 8113, 8115, 835	0
Urban Low Density	41	110, 111, 112, 113, 119, 148, 185, 240, 241, 243, 250	1
Rural Residential Low Density	41	118	3
Urban Medium Density	42	120, 121, 122, 123, 129, 176, 834	1
Urban High Density	43	130, 131, 132, 133, 134, 135, 139, 140, 1411, 1423, 146, 149, 154, 155, 156, 170, 171, 183, 184, 187, 252, 810, 811, 814, 820, 831, 833	0

2.8.2.2 Hydrology Scores

The hydrology score is used to characterize the effects of depth and duration (hydroperiod) of inundation. Like the vegetation scoring, the hydrologic scoring method developed for this project assigns values by comparing existing modeled hydrology and PDVM conditions. Areas for which existing hydrological conditions are in the normal range of the pre-development conditions are designated with higher scores, while areas dryer (i.e. shorter duration or depth of inundation) than PDVM conditions are assigned lower scores.

Similar to the approach used for assessing the vegetation functional value, hydrology scoring represents the functional value of a parcel of land based on the degree to which the parcel retains the same hydrological characteristics as its pre-development reference condition. Pre-development hydrological conditions are estimated based on the typical range of depth and duration (hydroperiod) of inundation of the vegetation community present on the PDVM per **Table 2-89**. Current average depth and hydroperiod were determined from the MIKE SHE - MIKE 11 model developed for this project for 1500 x 1500 feet sized cells. For example:

- No change from pre-development would result in a score of 10.
- Total loss of hydrology (e.g., a cell dominated by a pre-development wetland or open water body but which now experiences no inundation) would result in a score of 0.

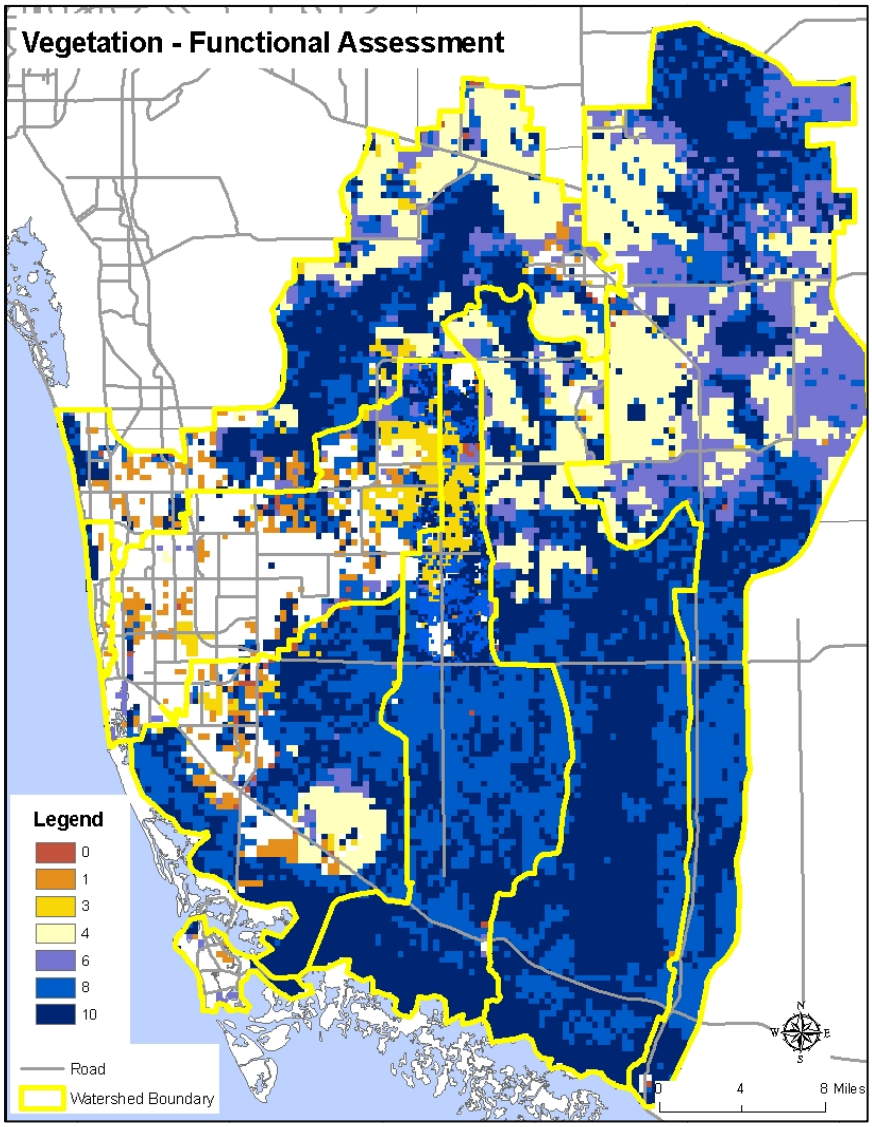


Figure 2-104. Vegetation Functional Assessment Values

The hydrology score for a cell was calculated as the average of the depth and duration scores of the current and reference (PDVM) conditions, adjusted to a scale of 0 to 10. For instance, a site with a reference (PDVM) average hydroperiod of 6 months and an average inundation of 12 inches, but which currently is inundated for only 2 months at an average depth of 4 inches has a quantifiable change of 1/3 ((6/12 + 2/4)/2 = 1/3). Therefore, the hydrology score for the cell is 3.3.

Table 2-89. Hydrologic Regimes of Major Southwest Florida Plant Communities

Plant Community	Duration (months)	Seasonal Water Depth (inches)	
		Wet	Dry (1,10)*
Xeric Flatwood	0	≤-24	-60, -90
Xeric Hammock			
Mesic Flatwood	≤1	≤2	-46, -76
Mesic Hammock			
Hydric Flatwood	1–2	2–6	-30, -60
Hydric Hammock			
Wet Prairie	2–6	6–12	-24, -54
Dwarf Cypress			
Freshwater Marsh	6–10	12–24	-6, -46
Cypress	6–8	12–18	-16, -46
Swamp Forest	8–10	18–24	-6, -36
Open Water	>10	≥24	< 24, -6
Tidal Marsh	Tidal	Tidal	Tidal
Mangrove			
Beach			

* 1 = average year low water; 10 = 1 in 10 year drought, July 2002

The reference condition for hydrology scoring depends on whether the existing vegetation community remains in the same vegetation/hydrology class as in the PDVM, per **Table 2-89** (Mike Duever, personal communication).

The hydrology scoring allows for a single score to be developed for each cell. The hydrology score also serves as a performance measure for proposed project evaluations: it differentiates between the hydrologic "lift" associated with projects that could enhance a particular wetland type without altering the vegetation (e.g., hydric flatwoods that will become wetter through project implementation) versus projects that would likely change current vegetation to achieve the PDVM vegetation community (e.g. wet prairie that would be rehydrated to achieve pre-development freshwater marsh hydrology).

If the vegetation community currently characterizing a cell is different than it was in the PDVM, the hydrological reference condition is the minimum depth and hydroperiod typical of the PDVM plant community. In cells where the current vegetation class is the same as the PDVM, the hydrology

reference condition is the maximum depth and hydroperiod typical of the plant community. These calculations are summarized below.

- If PDVM vegetation = FLUCCS vegetation, then Score = (Model Hydro/Max PDVM Hydro)*10
- If PDVM vegetation is not equal to FLUCCS vegetation, then Score = (Model Hydro/Min PDVM Hydro)*10
- Tidal marshes and mangroves = 8.
- Combined Hydrology Score = (depth score + duration score)/2
- Recognizing that a score of 10 represents target conditions, all scores greater than 10 were set to 10.

where*:*

- "Model Hydro" is a cell's average depth or hydroperiod in the MIKE SHE/MIKE 11 model;
- "Max PDVM Hydro" or "Min PDVM Hydro" is the top or bottom value, respectively, of the typical average range of depth or hydroperiod for a vegetation community, as estimated in **Table 2-89**.

Due to a wide range of hydroperiod and depth of inundation for mangroves and salt marshes, no specific hydroperiod conditions were established for these systems in **Table 2-89,** but a hydrology score of 8 was globally assigned. Results of the hydrology scoring are mapped in **Figure 2-105** and listed in **Table 2-91**.

2.8.2.3 Landscape Suitability Index (LSI)

The LSI, unlike the hydrology and vegetation scores, is a measure of the effects of adjacent lands on a site (cell) rather than conditions within the site itself. The LSI represents the degree to which adjacent lands provide or inhibit resource protective connectivity, buffers, and corridors. Higher scores characterize areas surrounded by natural lands or lands conducive to wildlife passage, while lower LSI scores are typical of areas surrounded by land uses that function as barriers. For instance, even a natural preserve area would receive a low LSI score if surrounded by commercial land uses, while a parcel with otherwise poor conditions could receive a high LSI score if surrounded by pasture or natural areas. The LSI is based on peer-reviewed work published by researchers at the University of Florida during the development of UMAM (Bardi et al. 2011, Reiss et al. 2009; Brown and Vivas. 2005).

Initially, each 1500 X 1500 foot cell was assigned a dominant vegetation FLUCCS code. Each FLUCCS code was then assigned an LSI score representing the degree to which that land use supports the resource protective functions of adjacent lands, per **Table 2-90**. In some instances, this required interpretation to determine which land use/land cover description in **Table 2-90** best matches a FLUCCS code.

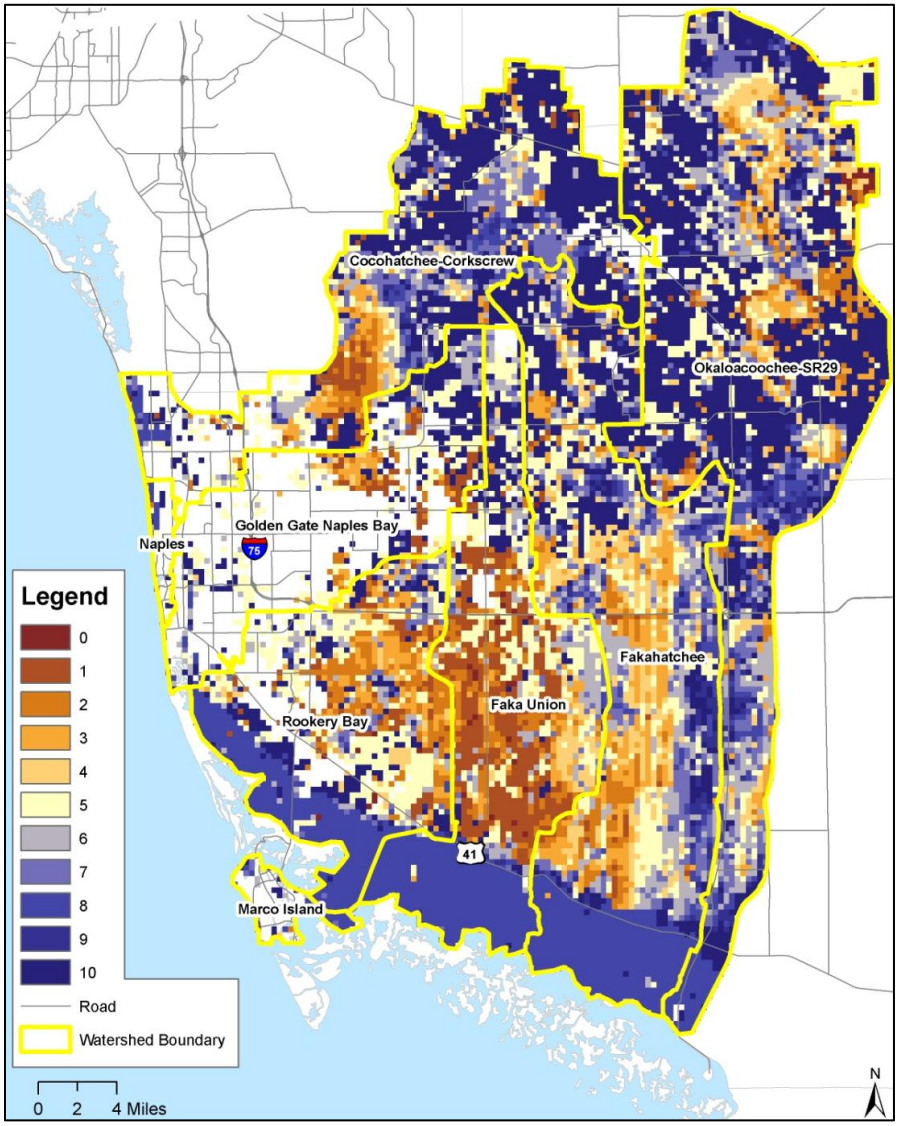


Figure 2-105. Hydrology Functional Assessment Values

Table 2-90. LSIs for Land Use/Land Cover Classes in Florida

Land Use/Land Cover Class	LSI
Natural System	10.00
Natural Open water	10.00
Pine Plantation	9.36
Recreational / Open Space (Low-intensity)	9.08
Woodland Pasture (with livestock)	8.87
Pasture (without livestock)	8.03
Low Intensity Pasture (with livestock)	7.32
Citrus	7.02
High Intensity Pasture (with livestock)	6.96
Row crops	6.07
Single Family Residential (Low-density)	3.57
Recreational / Open Space (High-intensity)	3.42
High Intensity Agriculture (Dairy farm)	3.33
Single Family Residential (Med-density)	2.81
Single Family Residential (High-density)	2.72
Mobile Home (Medium density)	2.56
Highway (2 lane)	2.43
Low Intensity Commercial	2.22
Institutional	2.14
Highway (4 lane)	1.91
Mobile Home (High density)	1.90
Industrial	1.87
Multi-family Residential (Low rise)	1.49
High Intensity Commercial	0.91
Multi-family Residential (High rise)	0.90
Central Business District (Average 2 stories)	0.64
Central Business District (Average 4 stories)	0.00

The LSI for each cell was calculated as the average LSI score of the eight adjoining cells. LSIs are mapped in **Figure 2-106** and summarized in **Table 2-91**. Due to the focus on identifying and evaluating potential projects, no LSI scores were generated for cells dominated by urban land uses.

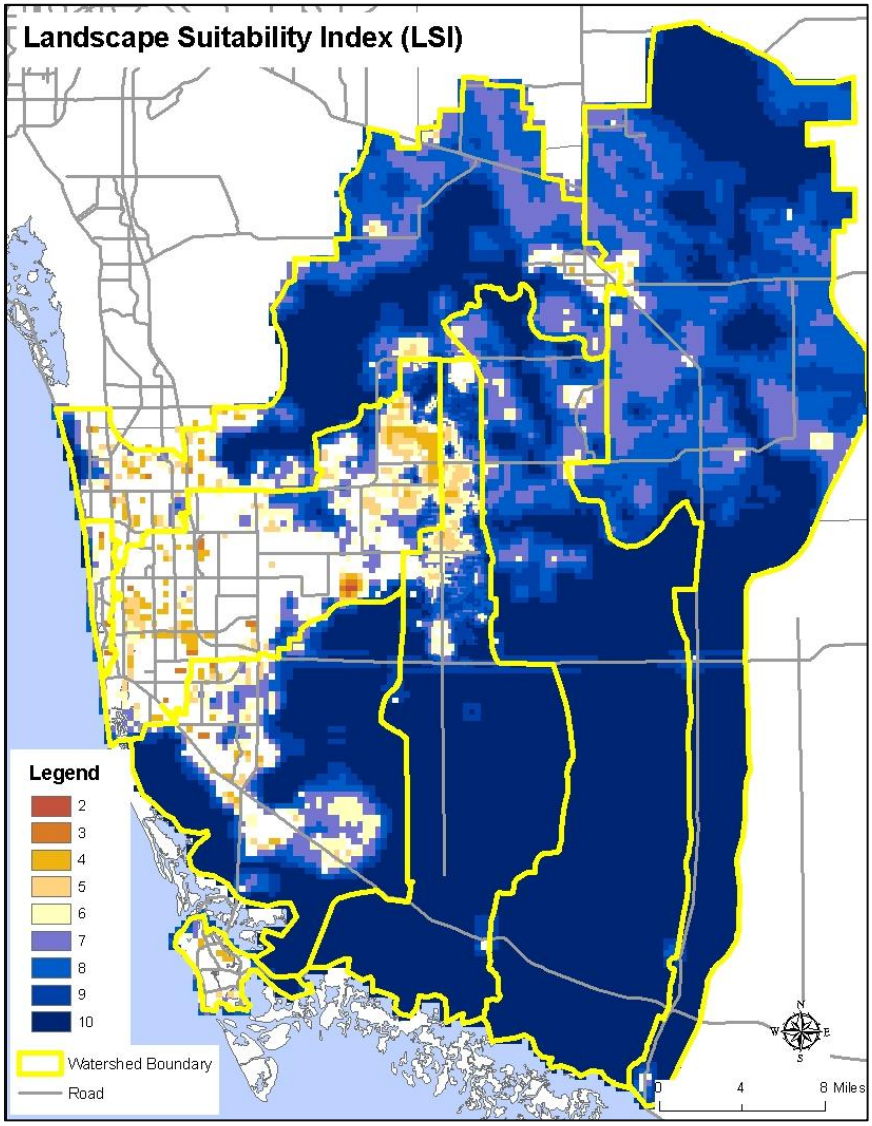


Figure 2-106. LSI Functional Assessment Values

2.8.3 Results

Watersheds with higher functional values reflect less development and urbanization impacts in the watershed. As expected, the highest resource protective values, as measured by the individual functional assessment scores for vegetation, hydrology and LSI, were found in the eastern Faka Union/Okaloacoochee SR29/Fakahatchee watersheds, followed by the Rookery Bay and Cocohatchee-Corkscrew watersheds (**Table 2-91**). The lowest functional values occurred in the Golden Gate-Naples watershed. Individual vegetation, hydrology and LSI scores are listed by watershed in **Tables 2-92 through 2-94.** Scores are also shown in **Figures 2-104 through 2-106.**

Table 2-91. Average Functional Values, by Parameter and Watershed, in Non-urban Areas of Collier County Watersheds

Watershed	Acres	Average Vegetation Score	Average Hydro Score	Average LSI Score
Cocohatchee-Corkscrew	111,250	7	7	8
Golden Gate-Naples	36,627	5	6	6
Rookery Bay	83,105	8	6	9
Faka Union/ Okaloacoochee SR29/ Fakahatchee	431,414	9	6	9

Water bodies in the state of Florida are each assigned a unique Water Body Identification number (WBID). WBID units include drainage basins, lakes, lake drainage areas, springs, rivers and streams, segments of rivers and streams, coastal, bay and estuarine waters in Florida. The WBIDs identify polygons that roughly delineate the drainage basins surrounding the water body and are used in FDEP's Total Maximum Daily Load (TMDL) program as well as other applications. Some water bodies in the watersheds examined are identified as impaired, pursuant to FDEP's Impaired Waters Rule (IWR), as approved by EPA. Functional values were calculated herein by WBID as well as watershed, so that projects offering opportunities for improved resource protective value can also be examined in the context of their impairment condition. **Tables 2-95 through 2-97** list corresponding functional scores by watershed and WBID.

2.8.3.1 Cocohatchee-Corkscrew Watershed

The functional assessment of the non-urban portions of the Cocohatchee-Corkscrew Watershed (**Figures 2-104 through 2-106**) reveals two distinct trends: the central part of the watershed just east of Corkscrew Swamp system maintains a high functional value for all three parameters, while the northern and eastern portions dominated by non-pasture agricultural lands retain relatively high hydrology and LSI scores and moderate vegetation scores. The LSI remains high (seven or greater) throughout the non-urban portion of the watershed due to natural and agricultural land uses. Vegetation and hydrology scores are somewhat lower due to conversion to agricultural uses.

Table 2-92. Detailed Vegetation Scores by Watershed

Vegetation Score	Cocohatchee-Corkscrew		Golden Gate/Naples Bay		Rookery Bay		Faka Union/SR29/Fakahatchee	
	Area (acres)	Percent of Watershed	Area (acres)	Percent of Watershed	Area (acres)	Percent of Watershed	Area (acres)	Percent of Watershed
0	563	0.44	579	0.66	1,229	1.29	821	0.20
1	4,954	3.86	7,594	8.68	4,937	5.18	1,061	0.26
3	2,306	1.80	8,299	9.48	2,266	2.38	8,461	2.11
4	33,165	25.87	979	1.12	7,260	7.62	68,427	17.03
6	11,395	8.89	3,203	3.66	1,920	2.02	56,759	14.12
8	19,795	15.44	8,159	9.32	32,344	33.97	119,205	29.66
10	39,072	30.47	7,815	8.93	33,148	34.81	138,017	34.34
N/A - Urban	16,965	13.23	50,882	58.14	12,112	12.72	9,122	2.27
Total:	**128,215**	**100.00**	**87,509**	**100.00**	**95,218**	**100.00**	**401,873**	**100.00**

Table 2-93a. Detailed Hydroperiod Scores by Watershed

Hydroperiod Score	Cocohatchee-Corkscrew		Golden Gate/Naples Bay		Rookery Bay		Faka Union/SR29/Fakahatchee	
	Area (acres)	Percent of Watershed	Area (acres)	Percent of Watershed	Area (acres)	Percent of Watershed	Area (acres)	Percent of Watershed
1	98	0.08	0	0.00	620	0.65	2,251	0.46
2	1,092	0.85	2,318	2.65	1,983	2.08	15,353	3.11
3	2,772	2.16	1,672	1.91	3,600	3.78	15,596	3.16
4	3,429	2.67	1,603	1.83	8,894	9.34	20,807	4.21
5	4,696	3.66	1,061	1.21	7,891	8.29	27,381	5.54
6	3,933	3.07	1,876	2.14	1,898	1.99	30,950	6.26
7	2,463	1.92	491	0.56	1,431	1.50	28,320	5.73
8	4,524	3.53	638	0.73	18,043	18.95	65,386	13.23
9	3,718	2.90	301	0.34	1,601	1.68	15,982	3.23
10	84,525	65.92	26,667	30.47	37,144	39.01	264,503	53.52
N/A - Urban	16,965	13.23	50,882	58.14	12,112	12.72	7,684	1.55
Total:	**128,215**	**100.00**	**87,509**	**100.00**	**95,218**	**100.00**	**494,212**	**100.00**

Table 2-93b. Water Depth Scores by Watershed

Water Depth Score	Cocohatchee-Corkscrew		Golden Gate/Naples Bay		Rookery Bay		Faka Union/SR29/Fakahatchee	
	Area (acres)	Percent of Watershed	Area (acres)	Percent of Watershed	Area (acres)	Percent of Watershed	Area (acres)	Percent of Watershed
0	15,690	12.24	13,187	15.07	21,964	23.07	75,097	17.97
1	12,378	9.65	4,606	5.26	18,731	19.67	59,940	14.34
2	7,221	5.63	2,577	2.94	5,381	5.65	54,066	12.94
3	7,278	5.68	1,669	1.91	2,659	2.79	43,078	10.31
4	6,578	5.13	550	0.63	1,829	1.92	29,872	7.15
5	7,031	5.48	416	0.48	1,037	1.09	18,827	4.51
6	3,314	2.59	323	0.37	1,161	1.22	11,855	2.84
7	2,083	1.62	246	0.28	302	0.32	8,909	2.13
8	2,802	2.19	483	0.55	17,921	18.82	52,849	12.65
9	743	0.58	155	0.18	207	0.22	4,879	1.17
10	46,131	35.98	12,415	14.19	11,912	12.51	127,156	30.43
N/A - Urban	16,965	13.23	50,882	58.14	12,112	12.72	6,469	1.55
Total:	**128,215**	**100.00**	**87,509**	**100.00**	**95,218**	**100.00**	**417,901**	**100.00**

Table 2-93c. Combined Hydrology Scores by Watershed

Combined Hydrology Score	Cocohatchee-Corkscrew		Golden Gate/Naples Bay		Rookery Bay		Faka Union/SR29/Fakahatchee	
	Area (acres)	Percent of Watershed	Area (acres)	Percent of Watershed	Area (acres)	Percent of Watershed	Area (acres)	Percent of Watershed
0	98	0.08	0	0.00	413	0.43	2,251	0.46
1	3,765	2.94	3,783	4.32	4,789	5.03	28,854	5.88
2	5,069	3.95	2,245	2.57	10,030	10.53	27,060	5.51
3	5,791	4.52	1,997	2.28	8,113	8.52	34,722	7.08
4	3,663	2.86	1,004	1.15	3,002	3.15	34,905	7.11
5	15,700	12.25	9,761	11.15	17,467	18.34	68,205	13.90
6	10,790	8.42	3,404	3.89	5,851	6.14	53,131	10.83
7	11,398	8.89	1,018	1.16	3,061	3.21	33,574	6.84
8	6,838	5.33	939	1.07	19,490	20.47	66,896	13.63
9	2,100	1.64	268	0.31	671	0.71	10,871	2.22
10	46,037	35.91	12,209	13.95	10,219	10.73	126,061	25.69
N/A - Urban	16,965	13.23	50,882	58.14	12,112	12.72	6,469	1.32
Total:	**128,215**	**100.00**	**87,509**	**100.00**	**95,218**	**99.57**	**490,747**	**100.00**

Table 2-94. LSI Scores by Watershed

LSI Score	Cocohatchee-Corkscrew		Golden Gate/Naples Bay		Rookery Bay		Faka Union/SR29/Fakahatchee	
	Area (acres)	Percent of Watershed	Area (acres)	Percent of Watershed	Area (acres)	Percent of Watershed	Area (acres)	Percent of Watershed
2	0	0.00	103	0.12	0	0.00	0	0.00
3	258	0.20	732	0.84	155	0.16	0	0.00
4	1,664	1.30	4,605	5.26	930	0.98	250	0.05
5	2,067	1.61	5,916	6.76	1,623	1.70	2,964	0.60
6	4,943	3.86	7,403	8.46	6,119	6.43	6,475	1.31
7	23,987	18.71	8,426	9.63	9,369	9.84	41,479	8.39
8	28,443	22.18	5,399	6.17	6,755	7.09	79,878	16.16
9	16,547	12.91	3,331	3.81	10,678	11.21	66,977	13.55
10	33,341	26.00	713	0.81	47,477	49.86	288,504	58.38
N/A - Urban	16,965	13.23	50,882	58.14	12,112	12.72	7,684	1.55
Total:	**128,215**	**100.00**	**87,509**	**100.00**	**95,218**	**100.00**	**494,212**	**100.00**

Table 2-95. Vegetation Functional Assessment Values by Watershed and WBID

Veg. Score	Cocohatchee-Corkscrew																		Golden Gate-Naples					
	3259A		3259B		3259W		3259Z		3278C		3278D		3278E		3278F		3278L		3278K		3278R		3278S	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
0	43	1	44	0	0	0	0	0	63	3	103	0	0	0	207	0	103	1	33	1	19	0	527	1
1	16	1	0	0	0	0	52	8	52	2	4,008	16	753	6	0	0	73	1	1,154	21	401	4	6,039	8
3	0	0	923	4	7	0	0	0	16	1	231	1	200	2	878	2	52	1	103	2	41	0	8,154	11
4	0	0	9,623	45	0	0	0	0	0	0	833	3	3,099	26	15,544	29	4,066	47	0	0	0	0	979	1
6	109	4	4,440	21	0	0	0	0	0	0	847	3	3,162	27	2,123	4	714	8	0	0	723	8	2,480	3
8	413	13	3,934	18	94	6	22	3	475	22	2,804	11	1,985	17	8,868	17	1,200	14	258	5	229	2	7,672	11
10	1,787	58	2,500	12	1,388	93	16	2	110	5	6,000	23	1,582	13	24,984	47	703	8	203	4	455	5	7,157	10
Urban	720	23	112	1	0	0	545	86	1,438	67	11,012	43	996	8	309	1	1,832	21	3,660	68	7,446	80	39,776	55
Acres	3,088		21,576		1,490		635		2,155		25,837		11,777		52,914		8,745		5,412		9,313		72,784	

Veg. Score	Rookery Bay						Faka Union/Okaloacoochee SR 29/Fakahatchee															
	3278U		3278V		3278Y		3259I		3259M		3261C		3278G		3278H		3278I		3278T		3278W	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
0	45	0	814	2	371	2	103	0	52	0	0	0	18	0	310	1	137	0	0	0	155	0
1	1,724	7	1,024	2	2,189	15	59	0	0	0	0	0	52	0	744	3	0	0	52	0	155	0
3	139	1	1,074	2	1,054	7	636	1	0	0	0	0	14	0	7,103	26	6	0	300	0	399	1
4	314	1	6,895	13	51	0	19,823	36	0	0	0	0	343	0	123	0	0	0	24,254	19	24,227	45
6	52	0	1,662	3	207	1	4,331	8	52	0	110	0	148	0	639	2	93	0	35,745	28	15,789	29
8	8,953	34	21,410	40	1,981	13	10,896	20	8,611	20	22,450	67	26,550	28	7,483	27	37,680	63	25,539	20	6,071	11
10	13,074	50	17,947	33	2,128	14	19,266	35	34,726	79	10,447	31	67,371	71	7,295	27	21,463	36	38,875	31	5,834	11
Urban	1,872	7	3,166	6	7,075	47	591	1	497	1	358	1	0	0	3,752	14	69	0	1,215	1	1,201	2
Acres	26,171		53,991		15,055		55,706		43,938		33,365		94,494		27,449		59,450		125,980		53,830	

Table 2-96. Hydrology Functional Assessment Values by Watershed and WBID

Hydro Score	Cocohatchee-Corkscrew																		Golden Gate - Naples					
	3259A		3259B		3259W		3259Z		3278C		3278D		3278E		3278F		3278L		3278K		3278R		3278S	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
0	46	1	0	0	0	0	0	0	0	0	0	0	0	0	52	0	0	0	0	0	0	0	0	0
1	4	0	103	0	0	0	0	0	52	2	1,669	6	50	0	1,784	3	103	1	0	0	27	0	3,756	5
2	0	0	269	1	0	0	0	0	0	0	1,774	7	72	1	2,894	5	59	1	0	0	0	0	2,245	3
3	0	0	614	3	0	0	0	0	0	0	1,686	7	275	2	3,106	6	109	1	0	0	0	0	1,997	3
4	0	0	237	1	0	0	0	0	7	0	611	2	352	3	2,382	5	73	1	52	1	0	0	952	1
5	202	7	3,261	15	1	0	0	0	64	3	3,606	14	1,039	9	6,664	13	864	10	677	13	241	3	8,843	12
6	258	8	2,348	11	108	7	0	0	0	0	1,758	7	428	4	5,672	11	218	2	177	3	516	6	2,711	4
7	267	9	1,584	7	1,218	82	0	0	0	0	310	1	885	8	6,756	13	378	4	52	1	127	1	840	1
8	1,398	45	813	4	33	2	37	6	52	2	231	1	741	6	3,327	6	207	2	136	3	437	5	366	1
9	52	2	371	2	48	3	0	0	0	0	207	1	146	1	1,271	2	5	0	0	0	0	0	268	0
10	141	5	11,864	55	82	6	52	8	542	25	2,973	12	6,791	58	18,694	35	4,897	56	659	12	519	6	11,031	15
Urban	720	23	112	1	0	0	545	86	1,438	67	11,012	43	996	8	309	1	1,832	21	3,660	68	7,446	80	39,776	55
Acres	3,088		21,576		1,490		635		2,155		25,837		11,777		52,914		8,745		5,412		9,313		72,784	

Hydro Score	Rookery Bay						Faka Union/Okaloacoochee SR 29/Fakahatchee															
	3278U		3278V		3278Y		3259I		3259M		3261C		3278G		3278H		3278I		3278T		3278W	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
0	109	0	304	1	0	0	52	0	0	0	0	0	0	0	166	1	867	1	1,114	1	52	0
1	62	0	4,365	8	362	2	293	1	0	0	52	0	1,528	2	3,648	13	20,199	34	2,304	2	831	2
2	110	0	9,547	18	373	2	1,797	3	0	0	956	3	6,724	7	1,770	6	8,587	14	6,434	5	792	1
3	38	0	7,809	14	266	2	4,093	7	96	0	1,727	5	13,367	14	375	1	4,155	7	9,304	7	1,604	3
4	127	0	2,563	5	312	2	5,444	10	0	0	2,030	6	12,206	13	335	1	3,798	6	10,021	8	1,071	2
5	1,099	4	12,748	24	3,619	24	10,284	18	211	0	2,788	8	12,575	13	6,638	24	10,103	17	16,978	13	8,627	16
6	871	3	4,047	7	932	6	5,159	9	280	1	8,637	26	14,486	15	3,240	12	5,439	9	13,425	11	2,464	5
7	657	3	2,197	4	207	1	3,946	7	288	1	6,313	19	10,694	11	1,044	4	1,789	3	7,823	6	1,677	3
8	18,169	69	1,076	2	245	2	2,191	4	40,160	91	3,489	10	11,411	12	166	1	2,676	5	5,255	4	1,548	3
9	52	0	568	1	52	0	889	2	214	0	1,911	6	3,877	4	146	1	310	1	2,753	2	771	1
10	3,005	11	5,601	10	1,613	11	20,968	38	2,191	5	5,106	15	7,627	8	6,168	22	1,458	2	49,353	39	33,191	62
Urban	1,872	7	3,166	6	7,075	47	591	1	497	1	358	1	0	0	3,752	14	69	0	1,215	1	1,201	2
Acres	26,171		53,991		15,055		55,706		43,938		33,365		94,494		27,449		59,450		125,980		53,830	

Table 2-97. LSI Functional Values by Watershed and WBID

LSI Score	Cocohatchee-Corkscrew																		Golden Gate-Naples					
	3259A		3259B		3259W		3259Z		3278C		3278D		3278E		3278F		3278L		3278K		3278R		3278S	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	103	0
3	0	0	0	0	0	0	51	8	1	0	207	1	0	0	0	0	0	0	61	1	155	2	517	1
4	0	0	0	0	0	0	1	0	51	2	1,509	6	8	0	0	0	95	1	599	11	207	2	3,799	5
5	18	1	95	0	0	0	0	0	209	10	1,449	6	52	0	163	0	80	1	756	14	299	3	4,861	7
6	43	1	891	4	0	0	0	0	229	11	2,041	8	283	2	965	2	491	6	335	6	401	4	6,667	9
7	506	16	5,964	28	0	0	37	6	177	8	2,664	10	3,430	29	8,180	15	3,027	35	0	0	481	5	7,945	11
8	504	16	9,250	43	7	0	0	0	17	1	1,941	8	2,812	24	11,885	22	2,027	23	0	0	196	2	5,203	7
9	732	24	3,970	18	64	4	0	0	32	1	1,902	7	2,693	23	6,031	11	1,121	13	0	0	129	1	3,202	4
10	563	18	1,294	6	1,419	95	0	0	0	0	3,112	12	1,502	13	25,380	48	71	1	0	0	0	0	712	1
Urban	720	23	112	1	0	0	545	86	1,438	67	11,012	43	996	8	309	1	1,832	21	3,660	68	7,446	80	39,776	55
Acres	3,088		21,576		1,490		635		2,155		25,837		11,777		52,914		8,745		5,412		9,313		72,784	

LSI Score	Rookery Bay						Faka Union/Okaloacoochee SR 29/Fakahatchee															
	3278U		3278V		3278Y		3259I		3259M		3261C		3278G		3278H		3278I		3278T		3278W	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	155	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	116	0	78	0	736	5	0	0	0	0	0	0	0	0	250	1	0	0	0	0	0	0
5	231	1	422	1	969	6	78	0	0	0	0	0	0	0	2,708	10	0	0	0	0	178	0
6	431	2	3,822	7	1,867	12	1,644	3	0	0	0	0	0	0	3,197	12	0	0	591	0	1,043	2
7	1,359	5	6,011	11	2,000	13	9,789	18	52	0	38	0	13	0	4,160	15	0	0	12,257	10	15,171	28
8	2,093	8	3,933	7	728	5	13,991	25	428	1	261	1	430	0	6,407	23	14	0	36,921	29	21,427	40
9	2,535	10	7,533	14	610	4	13,433	24	969	2	1,455	4	2,712	3	4,967	18	3,271	6	29,406	23	10,764	20
10	17,534	67	29,027	54	916	6	16,180	29	41,991	96	31,253	94	91,340	97	2,007	7	56,096	94	45,591	36	4,046	8
Urban	1,872	7	3,166	6	7,075	47	591	1	497	1	358	1	0	0	3,752	14	69	0	1,215	1	1,201	2
Acres	26,171		53,991		15,055		55,706		43,938		33,365		94,494		27,449		59,450		125,980		53,830	

The distribution of vegetation scores (**Figure 2-104**) reflects conversion of natural landscape cover outside the Corkscrew Swamp. Just over 30 percent (over 36,000 acres) of this watershed has a vegetation score of 4 or less, resulting primarily from the loss of most of the mesic and hydric flatwoods (as documented under the Reference Period Comparison). WBID 3278F (Corkscrew Marsh) retains the highest vegetation scores, with nearly 65 percent (just under 34,000 acres) of total area of that WBID scoring 8 or higher. Just 5 percent of WBID 3259Z (Little Hickory Bay) is comprised of non-urban land with a vegetation score of 8 or higher (**Table 2-92**), and over 15 percent of WBID 3278D (Cocohatchee–Inland Slough) has a vegetation score of 3 or lower.

Hydrology scores in the Cocohatchee-Corkscrew Watershed reflect existing conditions similar to PDVM depth and duration throughout much of the agricultural lands, and dryer-than-PDVM conditions in the vicinity of Corkscrew Swamp. For example over 55 percent (nearly 5,000 acres) of WBID 3278L (Immokalee Basin) has a hydrology score of 10, while only 35 percent (just under 5,000 acres) of WBID 3278F scores that high (**Table 2-93**). The lowest hydrology scores occur in WBID 3278D, with nearly 65 percent (over 9,000 acres) of the non-urban portion of that WBID comprised of lands scoring 5 or less.

LSI scores (**Table 2-94**) reflect natural lands surrounding Corkscrew Marsh, Lake Trafford, and coastal mangroves. Nearly 80 percent (nearly 80,000 acres) of the non-urban portion of Cocohatchee-Corkscrew Watershed has an LSI of 8 or greater. The largest portion of this high-LSI area (over 40,000 acres) occurs in WBID 3278F (Corkscrew Marsh). The lowest-scoring area, WBID 3278L (Immokalee Basin), is dominated by agricultural lands with moderately-high LSI values, with over 3500 acres (approximately 40 percent) scoring 6 or 7, and most of the rest scoring higher.

Reviewing the results, the greatest opportunities for improvement of resource protective value occur within WBIDs 3278D and 3278F. These portions of the watershed contain over 10,000 acres with a hydrology score of 4 or lower, indicating significant potential for improvement due to hydrological restoration. WBID 3278F, with a relatively higher extent of compatible land uses based on LSI and vegetation scores, presents greater potential opportunity for resource protective benefits from hydrological restoration.

The western portion of this watershed was not evaluated for restoration potential, due to the prevalence of urban lands that restrict the feasibility of resource protective benefits from hydrological restoration projects.

2.8.3.2 Golden Gate-Naples Bay Watershed

Nearly 60 percent (over 50,000 acres) of the Golden Gate-Naples Bay watershed is urban land not suitable for resource protection (**Tables 2-92 through 2-94**). The analysis of current condition and restoration projects is focused on the remaining non-urban portion of this watershed. Overall, even the non-urban areas have relatively low resource protective value, with an average vegetation score of 5 and hydrology and LSI scores of 6 (**Table 2-91**).

The area with the highest functional value is WBID 3278S (Northern Golden Gate Estates). Reflecting the relatively less-developed land uses in this portion of the watershed, just over 20 percent of this WBID (approximately 15,000 acres) has vegetation scores of 8 or higher, 15 percent (11,000 acres) has a hydrology score of 10, and just over 25 percent (approximately 19,500 acres) has an LSI score between 5 and 7.

Overall, this watershed presents relatively few opportunities for large-scale improvement in resource protective value. Urban and suburban development throughout the watershed limits the degree to which restoration projects would improve functional values beyond the footprint of the project itself. In relation to other portions of the watershed, the eastern portion of WBID 3278S (Northern Golden Gate Estates) presents the greatest opportunity for resource protective restoration. The relatively less-developed land uses in this portion of the watershed may allow restoration projects to improve resource protective values on a wider scale.

2.8.3.3 Rookery Bay Watershed

The functional values calculated for this watershed are low in the portions of the watershed surrounding Belle Meade and Tamiami Trail, but functional values are relatively higher when compared with Cocohatchee-Corkscrew and Golden Gate watersheds. The watershed-wide average LSI score in Rookery Bay Watershed is nine (9) and the average vegetation score is eight (8) (**Table 2-91**). This is primarily because less than 30 percent of the watershed has been converted to urban or agricultural uses (refer to Reference Period Comparison). Within the watershed, the Belle Meade area scores the lowest, with low to moderate scores in all three parameters.

Vegetation score distribution (**Figure 2-104** and **Table 2-92**) reflects the relatively high proportion of undeveloped lands in this watershed other than the Belle Meade area and Tamiami Trail corridor. Over 65 percent (65,000 acres) of this watershed has a vegetation score of eight (8) or higher. Among WBIDs (**Table 2-92**), 3278Y (Rookery Bay—Inland West Slough) has the lowest vegetation score, with almost 25 percent (approximately 3,500 acres), scoring three (3) or lower. The highest-scoring area is WBID 3278U (Rookery Bay–Coastal Slough), with vegetation scores of eight (8) or higher for almost 85 percent (22,000 acres) of this WBID.

The overall hydrology scores (**Figure 2-105** and **Table 2-93**) indicate existing dryer conditions throughout the watershed in comparison to PDVM conditions. Comparing the PDVM to current FLUCCS data shown in the Technical Memorandum for Task 3.1 (Reference Period Comparison), large portions of the watershed once supported swamp forest but are now dominated by shorter-hydroperiod hydric flatwoods. As a result of this shift, over 40 percent (over 21,500 acres) of WBID 3278V (Rookery Bay–Inland East Slough) has a hydrology score of three (3) or lower.

LSI scores in the Rookery Bay Watershed (**Figure 2-106** and **Table 2-94**) reflect moderate resource protective value in the Belle Meade agricultural area, but otherwise high values throughout the watershed. The non-urban portion of WBID 3278Y includes approximately 5,000

acres of lands (30 percent of the WBID) with a moderate LSI score (between 5 and 7), and WBID 3278V contains approximately 10,200 acres (just under 20 percent) in that same scoring range. At the high end, over 75 percent (approximately 20,000 acres) of WBID 3278U have an LSI score of nine (9) or higher.

The large extent of undeveloped and agricultural lands in this watershed provides opportunities for restoration, while the functional values indicate opportunities for improvements via hydrological restoration throughout these lands.

2.8.3.4 Faka Union, Okaloacoochee/SR 29, and Fakahatchee Watersheds

These watersheds, individually and as a whole, retain relatively high functional value, with average Vegetation and LSI scores of nine (9), and hydrological score average of six (6) (**Table 2-91**). The mapped scores (**Figures 2-104 through 2-106**) indicate higher vegetation and LSI scores south of I-75 than north, and the opposite trend among the hydrology scores (i.e., higher hydrology scores in the north than in the south).

Vegetation scores (**Figures 2-104 and Table 2-92**) reflect the prevalence of agricultural lands in the northern portion of these watersheds, with highest scores in the preserved natural lands in the southern and eastern portions of the watersheds. WBID 3259M (Ten Thousand Islands [TTI]) has the highest vegetation score, with nearly 100 percent of this WBID scoring eight (8) or higher. WBID 3278H (Faka Union–North Segment) has the lowest vegetation value, with 30 percent (approximately 8,100 acres) of this WBID scoring three (3) or lower. The overall average vegetation score of nine (9) throughout these watersheds, however, indicates significant resource protective value including near the agricultural lands.

The modest hydrological scores throughout these watersheds (**Figure 2-105** and **Table 2-93**) reflect the effects of regional drainage canals, with the highest scores occurring in the northern and eastern portions of the Okaloacoochee-SR 29 Watershed and the lowest scores in the Faka Union Watershed. No primary drainage canals serve the northern Okaloacoochee-SR 29 Watershed, while the Faka Union is currently drained by several. Over 33,000 acres (over 60 percent) of WBID 3278W (Silver Strand) have a hydrology score of 10, in contrast to WBID 3278I (Faka Union–South Segment), of which nearly 30,000 acres (over 50 percent) have a hydrological score of two (2) or less.

Over 70 percent (325,000 acres) of the land in these watersheds has an LSI value of nine (9) or higher. The relatively lowest-LSI value WBID is 3278H (Faka Union North Segment), with just under 40 percent of that WBID having an LSI between five (5) and seven (7). These modest scores reflect low-density rural development north of Alligator Alley in the eastern portion of Golden Gate Estates. Each of the other WBIDs have LSI scores of 8 or higher for at least 65 percent of their area.

Based on the scores for these three watersheds, the greatest opportunity for measurable improvement in functional value would occur through hydrological restoration. The ongoing restoration of Picayune Strand, as an example, is well-positioned to deliver hydrological and resource protective benefits to the Faka Union Watershed.

2.8.4 Resource Protective Capacity for Additional Water Storage

The potential for hydrological storage provides information useful for evaluating watershed conditions and restoration opportunities. Restoration of an area that is currently an upland but was previously a wetland, for instance, would require development of storage capacity to a depth and duration typical of the pre-development wetland. Storing water in restored wetlands could also cleanse and attenuate freshwater flows to downstream estuaries, depending on the location and morphology of those wetlands. This section describes both the method and results of calculating potential water storage.

Hydrological storage capacity and coverage of non-native invasive species are summarized in **Figures 2-107 and 2-108** and **Tables 2-98 and 2-99**.

2.8.4.1 Methods

The difference between the existing depth and duration of inundation (based on FLUCCS vegetation type) and the pre-development depth and duration of inundation (based on PDVM vegetation type) may be considered as the resource protective capacity for additional water storage. Adding water beyond this amount would potentially exceed the hydrological tolerance of the pre-development vegetation community and result in a transition to a different type of wetland or open water system that was not previously present on that site. For example, adding too much water for too much time to a current upland site that was a wet prairie could result in creation of a deepwater marsh or unvegetated pond rather than restoration of the pre-development wet prairie. In Atkins' opinion, this scenario would be ecologically and logistically difficult to justify or accomplish.

For the purposes of this project, the change in depth of inundation is estimated in inches based on comparisons between the typical water levels of existing vegetation and PDVM vegetation. **Table 2-99** lists data used to calculate the available resource protective capacity for additional storage. The formula used is:

$$\text{Capacity for Additional Storage} = WSWL_{PDVM} - WSWL_{2007}$$

where:

WSWL is the long-range average wet season water level typical for the type of vegetative community.

Similarly, the change in duration of inundation between PDVM and current FLUCCS vegetation is calculated in months, based on the hydroperiod per **Table 2-90**.

2.8.4.2 Results

Due to the close relationship between vegetation community and hydrology, the results of the calculations for depth and duration of inundation are displayed and summarized together. **Table 2-100** summarizes the results of the calculations for each watershed.

A comparison of the hydrological characteristics of pre-development and 2007 vegetation communities (**Figure 2-107**) suggests areas for potential additional wet season water storage (**Figure 2-108**). Overall, approximately 44,000 acres of undeveloped lands (including over 10,000 acres in Rookery Bay watershed) have capacity for additional wet season storage of at least 0.5 feet up to over 2.5 feet (**Table 2-98**).

The largest opportunity for storage, based strictly on the difference in hydrological characteristics between pre-development and 2007 vegetation communities, is the portion of the Rookery Bay watershed north of Belle Meade. Restoration of hydrology in these areas could lead to large-scale improvements in both functional value and hydrological storage. Not included in this assessment is the potential benefit to downstream estuaries as a result of attenuating freshwater flows. To the extent that improved storage in northern Belle Meade would restore healthier salinity regimes in downstream estuaries, this would further contribute to the resource protective value of such projects.

Table 2-98. Resource Protective Capacity for Additional Storage

PDVM	Existing (2007) FLUCCS	Additional Storage Capacity
Open Water	Freshwater marsh, cypress, or swamp forest	≥ 1 foot
Open Water	Wet prairie, dwarf/scrub cypress	≥ 1.5 feet
Open Water	Hydric flatwood, hydric hammock	≥ 2 feet
Open Water	Mesic flatwood, mesic hammock	≥ 2.5 feet
Open Water	Xeric flatwood, xeric hammock	≥ 4 feet
Any	Developed	0
Freshwater Marsh, Cypress, or Swamp Forest	Wet prairie, dwarf cypress	0.5-1 foot
Freshwater Marsh, Cypress, or Swamp Forest	Hydric flatwood, hydric hammock	1-1.5 feet
Freshwater Marsh, Cypress, or Swamp Forest	Mesic flatwood, mesic hammock	1-2 feet
Freshwater Marsh, Cypress, or Swamp Forest	Xeric flatwood, xeric hammock	≥ 3 feet
Any natural system	Same system	0

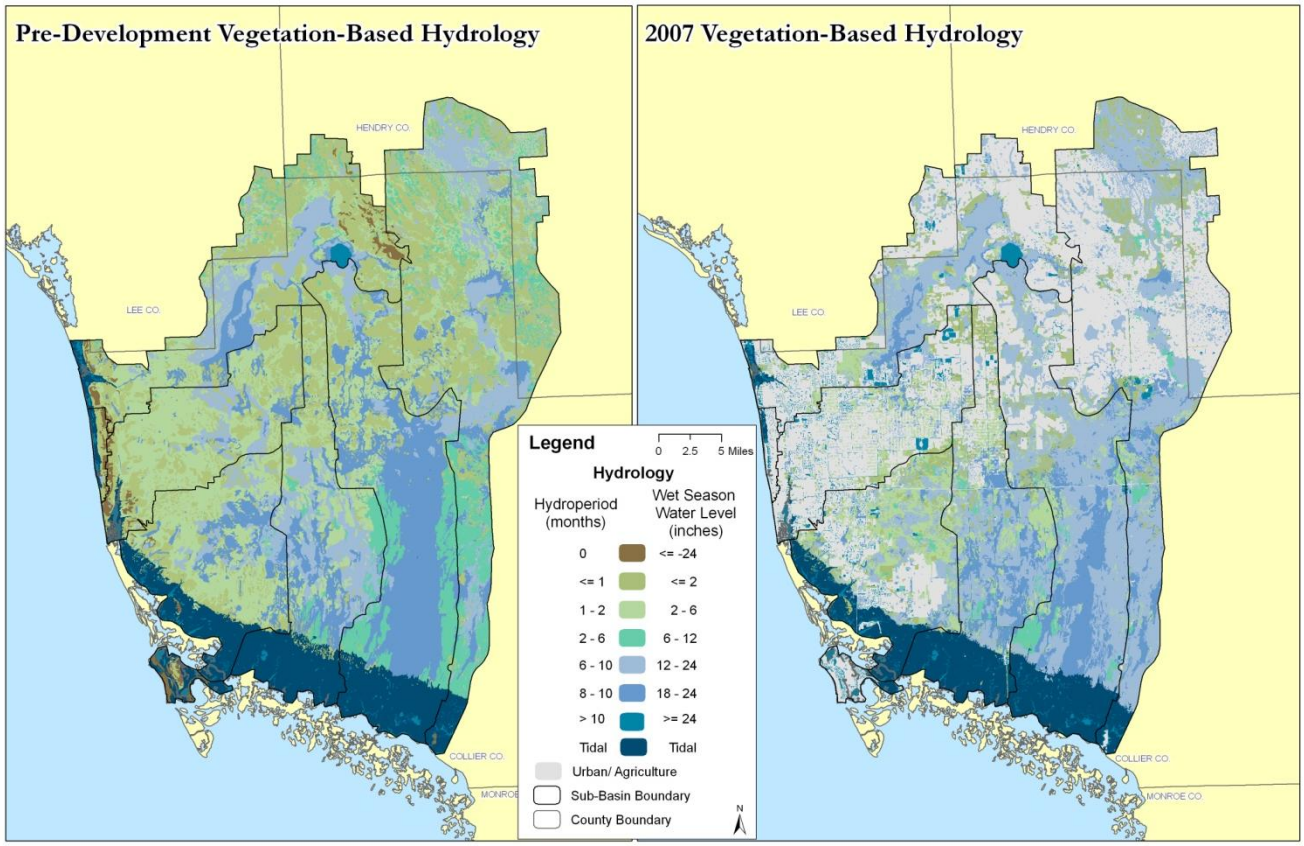


Figure 2-107. Hydrology of Pre-Development and 2007 Vegetation

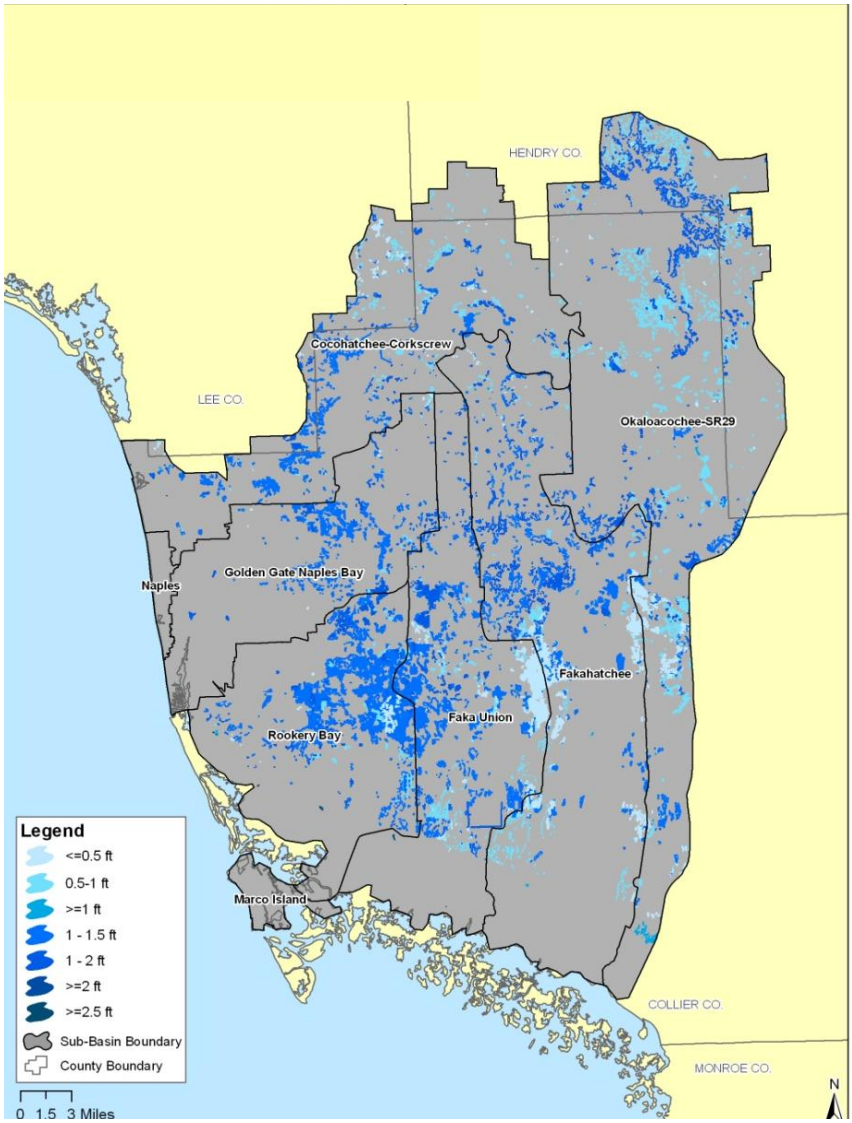


Figure 2-108. Resource Protective Systems' Wet Season Water Storage Potential

Table 2-99. Resource Protective Capacity for Additional Water Storage in Watersheds

Potential Additional Storage	Additional Acres, by Watershed				Total (acres)
	Cocohatchee Corkscrew	Golden Gate Naples Bay	Rookery Bay	Faka Union/ Okaloacoochee SR 29/ Fakahatchee	
0.5–1 foot	277	75	694	2,042	3,087
0.5-1 feet	285	7	42	1,919	2,254
0.5–1 feet	571	14	84	3,839	4,508
1–1.5 feet	2,071	2,026	7,673	8,612	20,381
1–2 feet	677	472	1,611	3,935	6,695
<=0.5 f00t	292	21	219	6,304	6,837
>=1 foot	7	2	5	80	94
>=2 feet	1	0	0	0	1
>=2.5 feet	0	1	5	3	10
n/a (urban)	50,200	55,029	21,619	74,047	209,030

2.8.5 Non-Native Invasive Vegetation

The presence of non-native invasive vegetation can significantly degrade wildlife habitat functions, as documented by many studies, including studies specific to southwestern Florida (e.g., Myers 1975). This section describes the extent of non-native vegetation in the study area.

2.8.5.1 Methods

Due to the potentially significant impact of non-native invasive species at a watershed level, several data sources, government agencies, and non-profit organizations were consulted to determine the availability of comprehensive, County-wide, accurate GIS coverages of non-native exotic vegetation. However, no GIS data layers were found that provide a sufficiently comprehensive and accurate coverage of the six watersheds to incorporate these into the functional assessment method. The two best sources of identified data are the Florida Natural Areas Inventory (FNAI) Florida Invasive Plants Geodatabase (FLInv) for public lands and the Early Detection and Distribution Mapping System (EDDMapS) for private lands. Due to the limited extent of both of these data layers, non-native invasive vegetation was not included in the calculation of watershed-wide functional values. Instead, data from these two sources are mapped and discussed separately from the functional assessment, as well as suggestions for obtaining additional GIS data for this purpose.

2.8.5.2 Results

The data presented in **Table 2-100** and **Figures 2-109 and 2-110** represent the most up-to-date and accurate GIS sources available at this time. Due to the lack of comprehensive non-native invasive species data on private lands, the most suitable use of these GIS data sources is to evaluate the effects of non-native invasive species on publicly managed lands, in combination with the other factors described earlier in this Chapter.

The public lands with the greatest extent of non-native invasive species on these maps are the Belle Meade and western Corkscrew Swamp areas. Comparing the non-native invasive species maps to the functional assessment and hydrological storage data for these two areas, the greatest opportunity for multi-function improvement on public lands occurs in northern Belle Meade. Projects in this area would achieve improvements in overall functional value (particularly if coupled with restoration of adjacent private lands), large potential improvements in hydrological storage, and improvements in natural vegetation communities.

A more thorough analysis and comparison that incorporates non-native invasive species coverage is only possible with the development of additional GIS data layers for private lands. The primary options include remote sensing via multi-spectral imagery coupled with unsupervised classification and a more detailed mapping via hyperspectral imagery, LiDAR, and supervised classification based on existing known non-native invasive vegetation data points. Multispectral imagery and unsupervised classifications can be expected to achieve overall accuracy of 60 to 70 percent. A more detailed and accurate mapping of non-native invasive vegetation can be accomplished using hyperspectral imagery, LiDAR and supervised classifications.

Table 2-100. Acres of Non-native Invasive Species on Publicly Managed Lands

Watershed	Brazilian Pepper	Cogon Grass	Downy Rose-Myrtle	Melaleuca	Old World Climbing Fern
Cocohatchee-Corkscrew	16,052	3,041	3,747	13,246	11,942
Golden Gate-Naples Bay	985		37	828	829
Rookery Bay	1,674	1	166	8,438	421
Faka Union, Okaloacoochee-SR29, Fakahatchee	6,415	271	0	206	106
Total Area	25,125	3,313	3,950	22,719	13,298

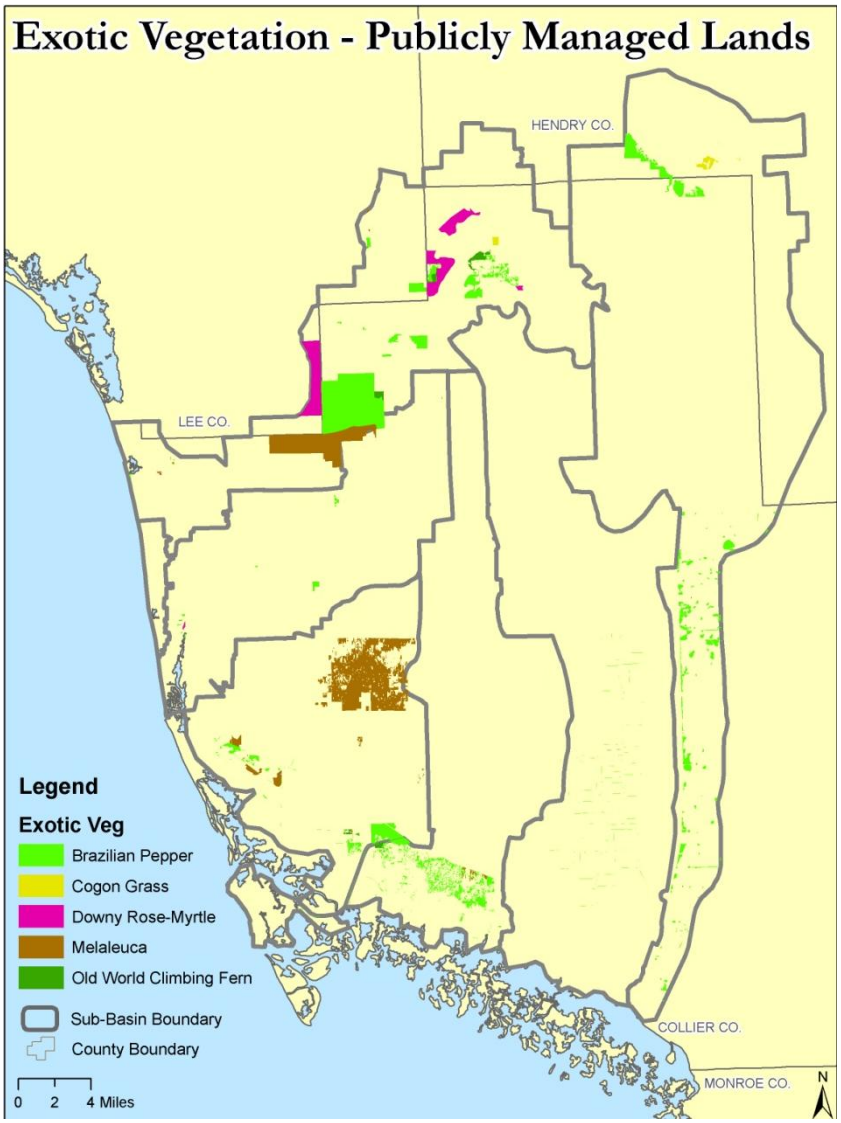


Figure 2-109. Non-native invasive Species on Public Lands
(Source: FNAI)

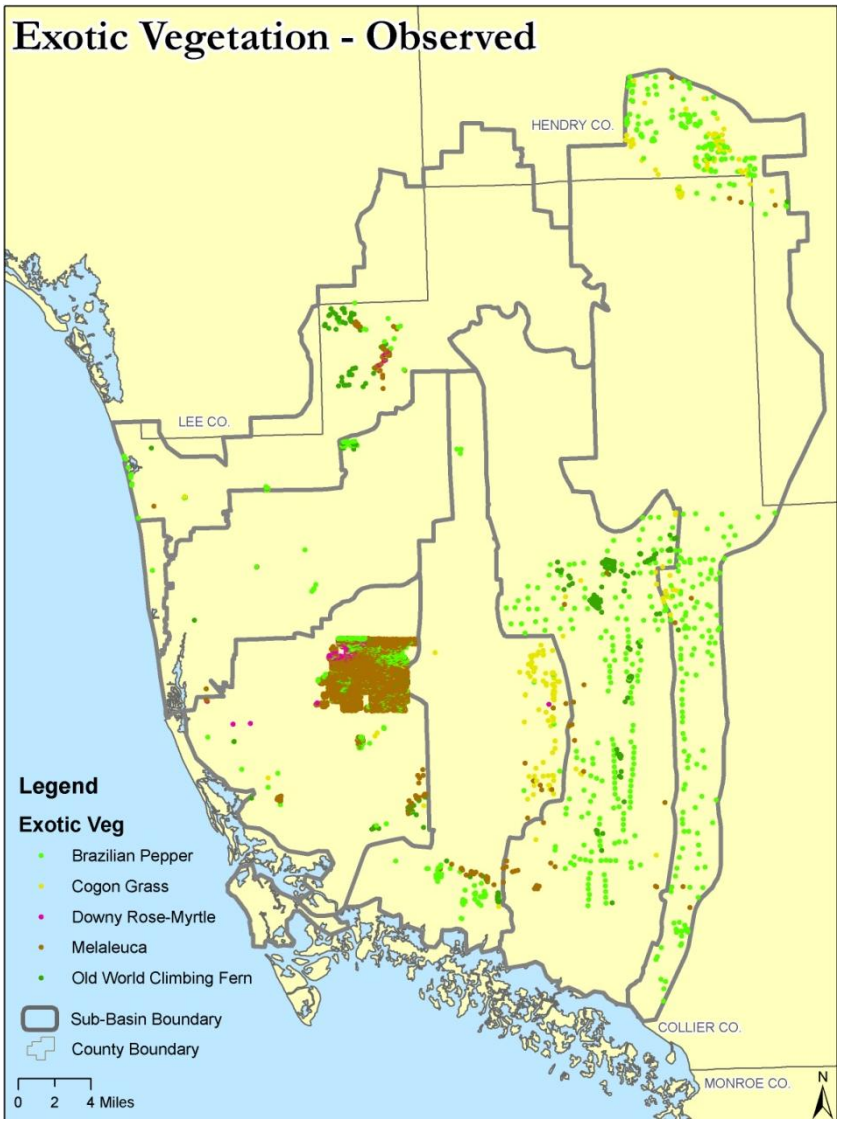


Figure 2-110. Non-native invasive Species Observation—Point Data (Source: EDDMapS)

2.8.6 Resource Protective Lands

The results of the functional assessment indicate declining resource protective scores in the Golden Gate-Naples Bay Watershed, as well as the western Cocohatchee-Corkscrew Watershed, and Belle Meade portion of Rookery Bay watershed. In these watersheds, the relatively lower functional value has resulted from conversions of natural lands to agricultural or other developed land uses. Reduced resource protective values in the Faka Union watershed, in contrast, are primarily related to impacts to the regional historical drainage patterns.

Resource protective and supportive lands were identified in the watersheds via consideration of LSI and vegetation scores. The hydrology score was not included in this analysis, due to focus on natural and passive land use management rather than identification of hydrological restoration projects. Three groups of LSI and vegetation scoring ranges designated, reflecting their degree of compatibility with preserved lands. All three categories support resource protective functions and are listed below.

- Natural areas with the highest resource protective value are those showing an LSI score of 10 and a vegetation score of 8 or higher. These areas are labeled "Resource Protective Lands" on **Figure 2-111** and **Figure 2-112**.
- Additional supportive agricultural lands, with a vegetation score of 6 to less than 8 and LSI score of 8 to less than 10, indicate pasture and similar passive land uses. These lands are identified as "Resource Supportive Lands" in **Figure 2-112**.
- Other agricultural lands, with a vegetation score of 4 to less than 6 and LSI score of 6 to less than 8, are identified as "Agricultural Supportive Lands" in **Figure 2-112.**

Collier County and the SFWMD have put in place programs to help preserve areas of high resource protective value. The functional assessment analysis conducted as part of this study provides a means of identifying lands in the three categories listed above, resource protective lands, resource supportive lands, and agricultural supportive lands that may not be included in the County's or the SFWMD's preserved/Sending lands and supportive agricultural lands programs. The process consisted of comparing the extent of currently protected areas through the County or State programs with the extent of each of the protective/supportive lands identified herein. **Figures 2-111 and 2-112** also show the areas under the Preserved and Sending lands programs.

Results of this analysis indicate that, although much of the preserved lands are in areas where the vegetation and relative location provide high-value resource protective functions, areas in and adjacent to the preserved lands also contain supportive land uses. Continued or improved management of passive land uses in these areas provides opportunities for additional resource protective improvement. Recommendations that would help contribute to the protection of the identified protective/supportive lands in Collier County. Recommendations are described in Volume 3.

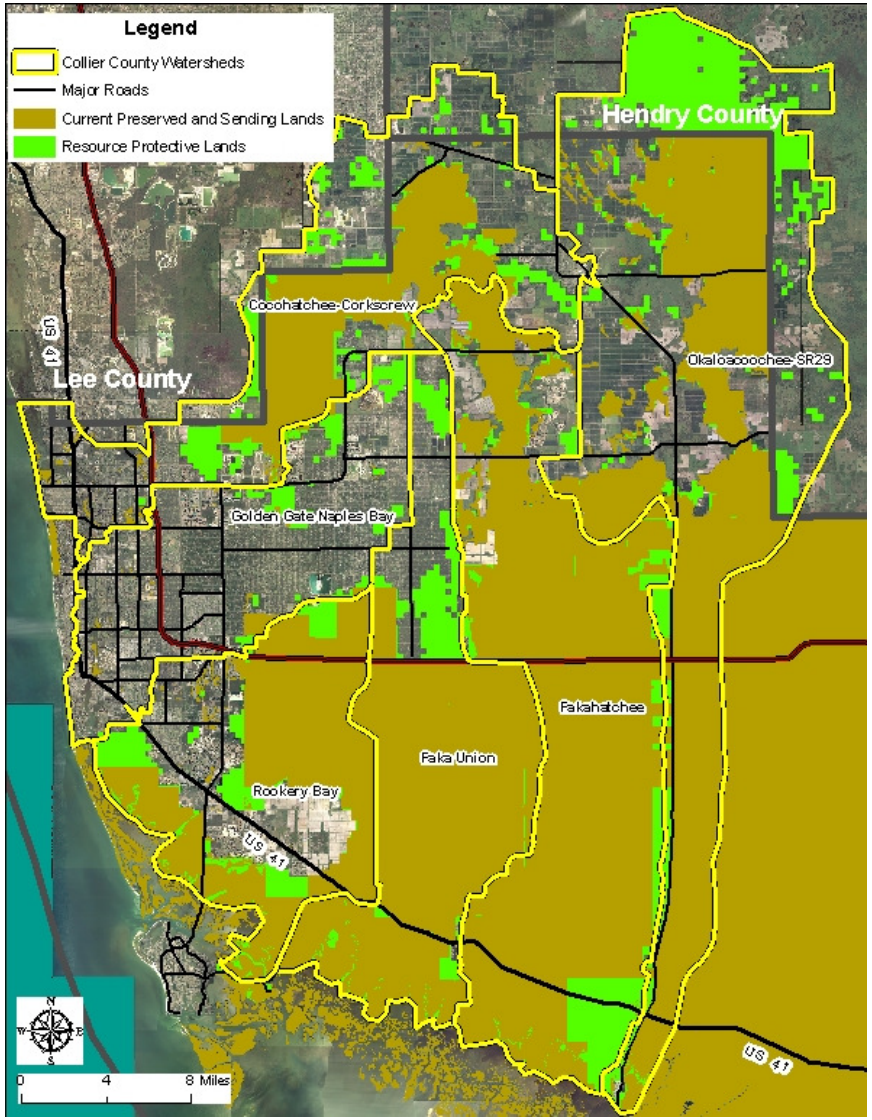


Figure 2-111. Resource Protective Lands (Based on Vegetation and LSI Scores)

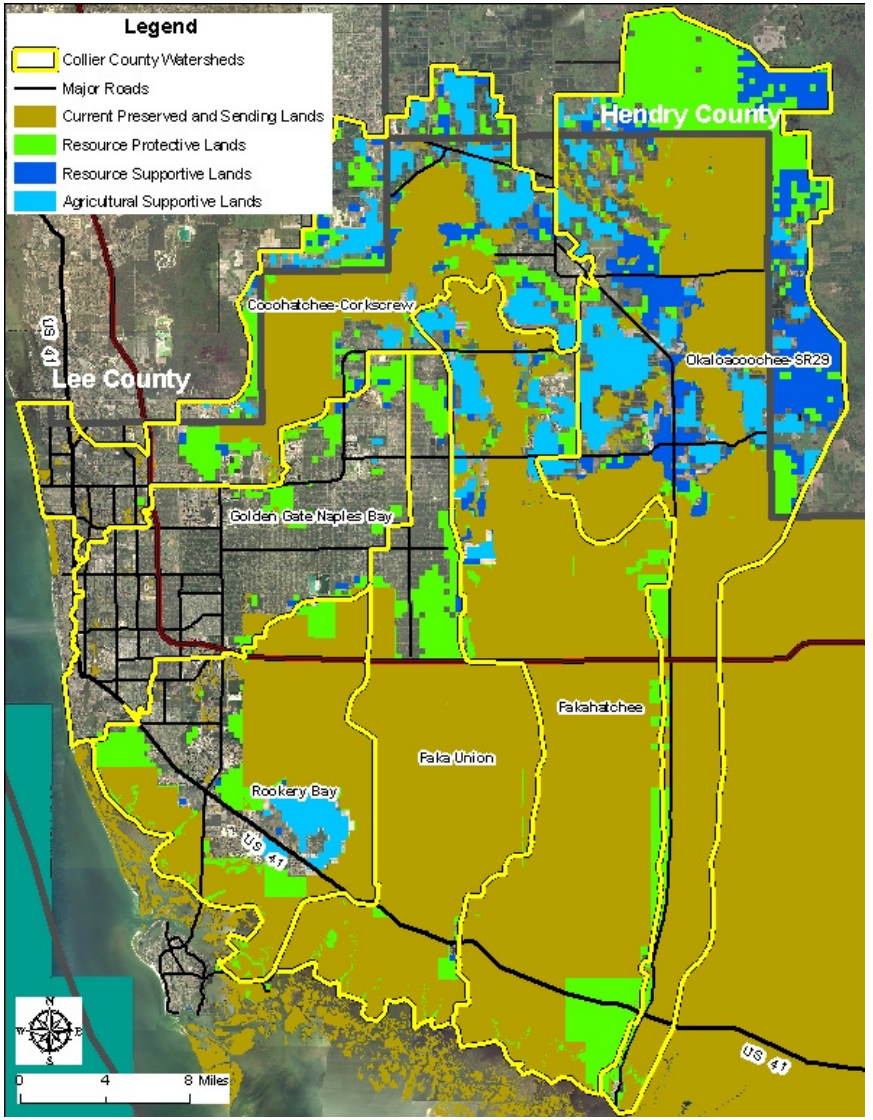
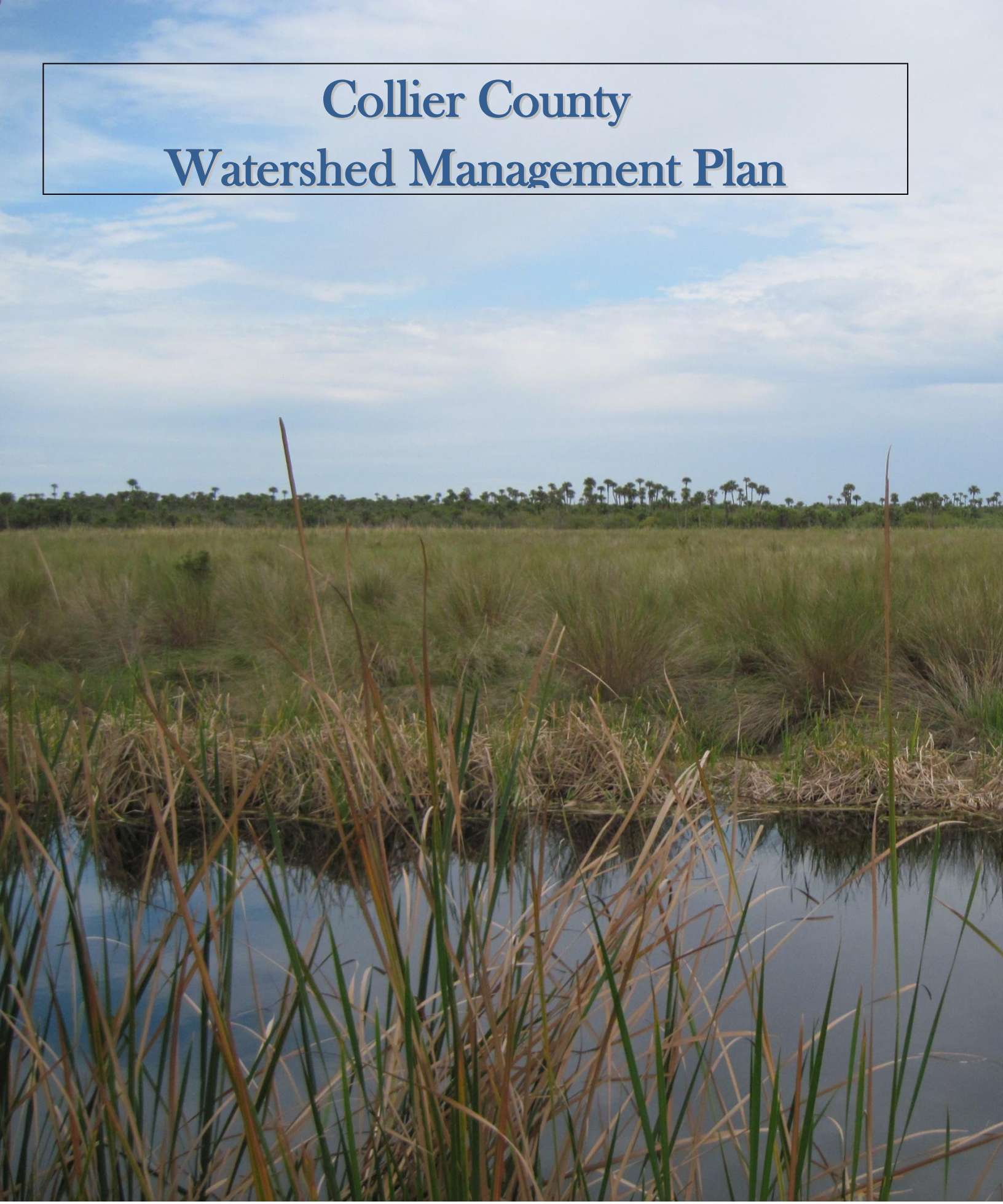


Figure 2-112. Resource Protective Lands and Resource Supportive Lands (Based on Vegetation and LSI Scores)

Collier County
Watershed Management Plan



Collier County

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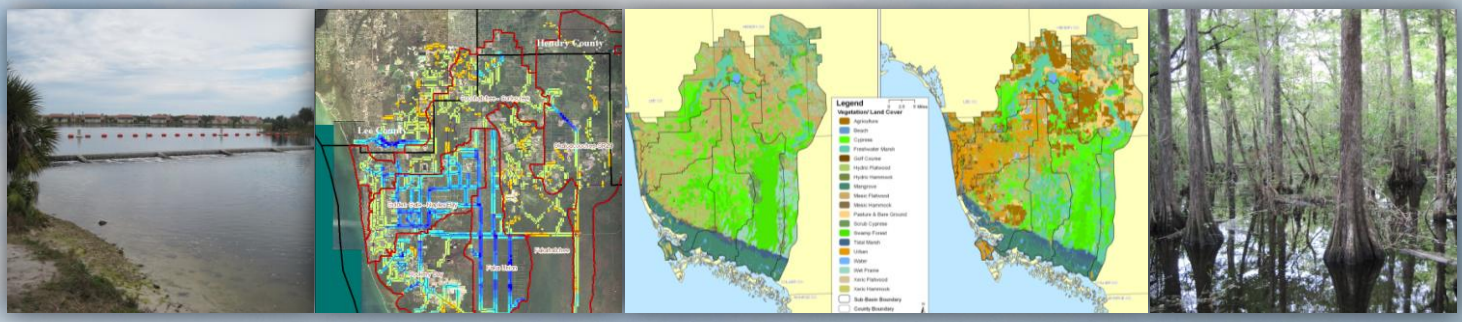
Collier County
Watershed Management Plan



Final Report
Volume 4B
Technical Report
Assessment of Existing Conditions and Performance Measures

Collier County

Prepared by ATKINS

November 2011

Document No. 110082
Job No. 100013237

FINAL REPORT

COLLIER COUNTY WATERSHED MANAGEMENT PLAN COLLIER COUNTY, FLORIDA

VOLUME 3: RECOMMENDED NON-STRUCTURAL INITIATIVES

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November 2011

Contents of Volume 4

Volume 4 is a compilation of the individual technical memoranda completed to describe results of the existing conditions analysis in the watersheds and estuaries of Collier County, as well as the performance measures utilized to assess the benefit of proposed structural projects. The technical memoranda are presented as individual chapters and sections in this document and address the following items in the project's scope of work:

- Literature Review
- Element 1: Assessment of Existing Conditions – Watersheds
- Element 2: Assessment of Existing Conditions – Estuaries
- Element 3: Development of Performance Measures

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Acronyms and Abbreviations

ACSC	Area of Critical State Concern
ACSC-ST	Area of Critical State Concern – Special Treatment
BCB	Big Cypress Basin
BCC	Board of County Commissioners
BCE	Black, Crow, and Eidsness
BCNP	Big Cypress National Preserve
BMAP	Basin Management Action Plan
BMP	Best Management Practices
BOD-5	5-Day Biochemical Oxygen Demand
CC	Cocohatchee-Corkscrew Watershed
CCME	Conservation Coastal Management Element
CCPC	Collier County Planning Commission
CCWMP	Collier County Watershed Management Plan
CDU	Community Development Unit
CERP	Comprehensive Everglades Restoration Plan
cfs	Cubic feet per second
CN	Curve Number
Cu	Copper
DCIA	Directly Connected Impervious Area
DEM	Digital Elevation Model
DO	Dissolved Oxygen
EAC	Environmental Advisory Council
ECM	Existing Conditions Model
EDDMapS	Early Detection and Distribution Mapping System
EMC	Event Mean Concentration
ENP	Everglades National Park
EPA	Environmental Protection Agency
ERD	Environmental Research and Design
ERP	Environmental Resource Permit
ERU	Equivalent Residential Unit
ET	Evapotranspiration
F.A.C.	Florida Administrative Code
FAS	Floridan Aquifer System
FCM	Future Conditions Model
FDEP	Florida Department of Environmental Protection
FDoH	Florida Department of Health
FLInv	Florida Invasive Plants Geodatabase
FLUCCS	Florida Land Use, Land Cover Classification System
FLUE	Future Land Use Element
FLUM	Future Land Use Map

FNAI	Florida Natural Areas Inventory
FPLOS	Flood Protection Level of Service
FRESP	Florida Ranchlands Environmental Services Project
FUFHOK	Faka Union, Fakahatchee, and Okaloacoochee-SR29 Watersheds
FWRI	Fish and Wildlife Research Institute
GGAMP	Golden Gate Area Master Plan
GGNB	Golden Gate-Naples Bay Watershed
GIS	Geographic Information Systems
GMP	Growth Management Plan
H&H	Hydraulic and Hydrologic
HOA	Homeowners Association
IAS	Intermediate Aquifer System
IWR	Impaired Waters Rule
JEI	Janicki Environmental Inc.
LASIP	Lely Area Stormwater Improvement Plan
LDC	Land Development Code
LID	Low Impact Development
LSI	Landscape Suitability Index
MAL	Minimum Aquifer Level
mg/l	milligrams/liter
MPN	Most Probable Number
MSL	Mean Sea Level
MSTU	Municipal Services Taxing Unit
NAVD	North American Vertical Datum
NEXRAD	High Resolution Radar
NGGE	Northern Golden Gates Estates
NGGEFRA	North Golden Gate Estates Flowway Restoration Area
NGGEFRP	North Golden Gate Estates Flowway Restoration Program
NGVD	National Geodetic Vertical Datum
NOx	Nitrate + Nitrite
NSG	Natural Systems Group
NSM	Natural Systems Model
OFW	Outstanding Florida Water
OL	Overland
Pb	Lead
PBS&J	Post Buckley Schuh and Jernigan
PCU	Platinum Cobalt Units
PDVM	Pre-Development Vegetation Map
PIR	Project Implementation Report
PSRP	Picayune Strand Restoration Project
PUD	Planned Unit Development
RB	Rookery Bay Watershed

RFMU	Rural Fringe Mixed Use
RIDS	Regional Irrigation Distribution System
RLSA	Rural Lands Stewardship Area
ROMA	Regional Offsite Mitigation Area
RSF	Residential Single Family
RWCA	Recyclable Water Containment Areas
SAS	Surficial Aquifer System
SCS	Soil Conservation Service
SFWMD	South Florida Water Management District
SGGE	Southern Golden Gate Estates
SOW	Scope of Work
S.R.	State Road
ST	Special Treatment
SWFFS	Southwest Florida Feasibility Study
SWIM	Surface Water Improvement and Management
SZ	Saturated Zone
TDR	Transfer of Development Rights
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TKN	Total Kjeldahl Nitrogen
TM	Technical Memorandum
TP	Total Phosphorus
TSS	Total Suspended Solids
TTI	Ten Thousand Islands
ug/l	micrograms/liter
UMAM	Uniform Mitigation Assessment Method
URF	Urban Residential Fringe
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USGS	United States Geologic Survey
UZ	Unsaturated Zone
WBID	Water body Identification Number
WMD	Water Management District
WMPs	Watershed Management Plans
Zn	Zinc

INTRODUCTION

Collier County is developing Watershed Management Plans (WMPs) with the purpose of protecting the County's estuarine and wetland systems, consistent with Florida Statute (Subsection 163.3177 (5)(d)). Under the statute, a Conservation Element that addresses "the conservation, use, and protection of natural resources in the area, including air, water, water recharge areas, wetlands, water wells, estuarine marshes, soils, beaches, shores, flood plains, rivers, bays, lakes, harbors, forests, fisheries and wildlife, marine habitat, minerals, and other natural and environmental resources" is required as part of Local Government Comprehensive Plans.

This volume of the CCWMP provides a historical perspective and summary of previously completed studies. This volume also presents a detailed assessment of existing conditions in Collier County and performance measures that were used to evaluate the projects described in Volume 2.

DOCUMENT ORGANIZATION

This volume of the WMP describes the link between water quality, water quantity, and natural systems issues in Collier County watersheds and estuaries. This volume is presented in four (4) chapters, consistent with the work elements outlined in the County's Scope of Work.

Chapter 1: Literature Review and Preliminary Assessment Based on Review of Previously Developed Models. This section provides a historical perspective on water resource issues in Collier County. This chapter also describes other models previously applied for in BCB and compares model results in order to lay the groundwater necessary to fully understand the evaluation of existing conditions

Chapter 2: Assessment of Existing Conditions – Watersheds. Surface water, ground water, and natural systems conditions in the Cocohatchee-Corkscrew, Golden Gate, and Rookery Bay watersheds, and the rural Faka Union/Okaloacoochee/Fakahatchee basins combined are presented and assessed against performance measures to evaluate historical habitat loss.

Chapter 3: Assessment of Existing Conditions – Estuaries. Freshwater inflows, water quality of inflows and receiving waters, and coastal habitat conditions in Wiggins Pass, Naples Bay, Rookery Bay, and Ten Thousand Islands estuaries will be characterized and evaluated in terms of performance measures developed for the estuaries.

Chapter 4: Development of Performance Measures. Performance measures used for assessing watershed and estuary conditions are described in this chapter.

Chapter 5: References.

3.0 ASSESSMENT OF EXISTING CONDITIONS: ESTUARIES

3.1 VOLUME AND TIMING OF FRESHWATER INFLOWS/FRESHWATER

Historic fresh water flow patterns in Collier County have changed over the years due to increased development. The changes in flow have impacted the environmental integrity of many of the County's estuaries due to changes in salinity patterns (Browder et al. 1998, Shirley et al. 2005). In addition, the changes in flow patterns have resulted in the introduction into some estuaries of large quantities of organic-rich sediment from accelerated rates of freshwater inflow (Locker 2005). In fact, much of the scientific literature conducted in the TTI estuary has focused primarily on the issue of altered hydrology and the need for a more natural pattern of freshwater inflow (e.g., Browder et al. 1988, Shirley et al. 2005).

As watershed restoration activities must consider the restoration of historic flows, it was necessary as part of this project to assess existing conditions in the volume and timing of fresh water discharges to each estuary system from the contributing watersheds by comparing them to a baseline, which in this case is represented by the predevelopment condition.

The method consisted of comparing the results of the MIKE SHE MIKE 11 ECM to those of the NSM to define the monthly water surplus or deficit that should be targeted for restoration purposes. The ECM is the model updated specifically for this project to support preparation of the County's Watershed Management Plans, whereas the NSM, or pre-development model, was developed as part of the USACE SWFFS. A full description of the NSM can be found in the report titled "Final Report, Natural Systems Model (NSM) Scenario Southwest Florida Feasibility Study" (SDI, 2007).

As part of the watershed management planning process, it is necessary to establish basis for comparing existing conditions to both the natural system and a master plan conditions. That was achieved through the use of a performance measure, which is a quantitative indicator of the characteristics of the system under a given condition. A numerical scoring method was identified to reflect existing and proposed system conditions in terms of volume and timing of fresh water discharges into the receiving estuaries. This chapter includes a description of the scoring method and results.

3.1.1 Description of the Hydrologic / Hydraulic Models

As indicated above, model results from the Natural Systems MIKE SHE model (NSM) were compared to the Existing Conditions MIKE SHE model (ECM). The ECM represents the 2007 land use condition in Collier County and was calibrated against measured flow and stage data in the canal network, as well as measured groundwater head elevation data. The simulation period for this model is 2002–October 2007. The primary drainage system and most of the secondary drainage system is explicitly represented in the model input.

The NSM was developed as part of the USCOE SWFFS by modifying the original SFWMD Big Cypress basin (BCB) model in terms of land use and conveyance systems to represent pre-development conditions. The NSM simulation period extended from 1976 to 1986.

It should be noted that the ECM and NSM computer models provide an estimate of the simulated conditions. However, comparisons must consider differences in model characteristics including:

a) The ECM model domain includes the area within Collier County west of, and including, the Okaloacoochee-S.R. 29 basins, and all the way to the coastline. The NSM encompasses the entire SWFFS area, including the Caloosahatchee and Estero River Basins.

b) The ECM includes all the entire main conveyance system, as well as the main secondary canals. In the Collier County portion of the NSM, flow to the estuarine systems is predicted as overland flow. Natural drainage systems such as the Gordon River and Henderson Creek are not explicitly represented.

c) The ECM and NSM simulation periods are not the same. As indicated above, the ECM was used to conduct simulations from 2002–October 2007, whereas the NSM simulation period extended from 1976 to 1986.

d) The input data, particularly the topographic data source, for the ECM and NSM are not the same and differences in terrain elevations are noticeable.

In spite of the model differences, it was determined that the comparisons between the two models provide valid information to setup flow restoration targets because a) flow estimates for comparison were obtained at specific locations within each watershed, which minimized the effect of differences in the extent of the model domain, and b) both models included simulation periods that on the average can be considered representative of hydrologic conditions.

To further validate the model comparisons results, it was considered necessary to compare them to those from an alternative method. As such, they were compared to those from the salinity analysis described in a technical memorandum previously prepared as part of this project. Results of those comparisons are also described later in this report.

3.1.2 Flow Estimation Methods

This section describes the method used to calculate the total water discharged to each estuary system from the NSM and the ECM.

3.1.2.1 Natural Systems Model (NSM) Flow Estimates

The NSM uses overland flow to predict the movement of water across the ground surface and into the estuaries. In order to extract overland flow results from specific locations in the model, a tool was developed to extract the required information. This tool, called FlowthruLine, was used to extract a time series of flow data from one set of cells to an adjacent set of cells along a line.

Figures 3-1 through 3-4 show the locations of the "Flow through" lines specified for each watershed. These lines are generally drawn along the US 41 corridor and it is assumed that all water that flows across this line will enter the downstream estuary.

The tool was applied to each of the six watersheds. The calculated times series of flow for each watershed was then converted to daily discharge volume and summed by month for the period of the simulation (1976–1986). The monthly values generated for each year were then averaged to estimate the period of record average monthly flow volume from each watershed. The flows from the Faka Union, Fakahatchee, and Okaloacoochee-SR29 watersheds were combined to estimate total flows into the TTI estuary.

3.1.2.2 Existing Conditions Model (ECM) Flow Estimates

The ECM utilizes both channel and overland flow to predict total watershed discharge. However, in Collier County US 41 generally restricts overland flow before it can reach the estuaries and flow is routed through a series of culverts, bridges, or control structures. Therefore, only flows in the conveyance system were used in the calculations.

Discharge to the estuaries was measured by extracting time series of flow data from specified locations in the MIKE 11 river network. These locations are also shown in **Figures 3-1 through 3-4**. The flow data from each station were converted from discharge rate (cubic feet per second) to discharge volume (inches) for each time step. Flow data was extracted every three hours for the duration of the simulation. As indicated previously, the simulation covers the period from January 1, 2002–October 31, 2007.

The following steps were used to calculate the seasonal fresh water discharges for each watershed.

- The individual times series of discharge for each watershed were summed to estimate the total volume to the estuary for each time step.
- The volumes for each time step were then summed by month and by year. The results for the Faka Union, Fakahatchee, and Okaloacoochee-SR29 watersheds were consolidated to represent the total flow to the TTI Estuary. This resulted in a table of monthly volume by year for the period of the simulation. An example calculated for the Wiggins Pass Estuary is shown in Table 3-1.
- The monthly values generated for each year were then averaged to estimate a period of simulation average monthly water volume discharged from each watershed.
- The monthly average values were then consolidated by season to arrive at predicted wet season and dry season discharges into each of the receiving estuaries.

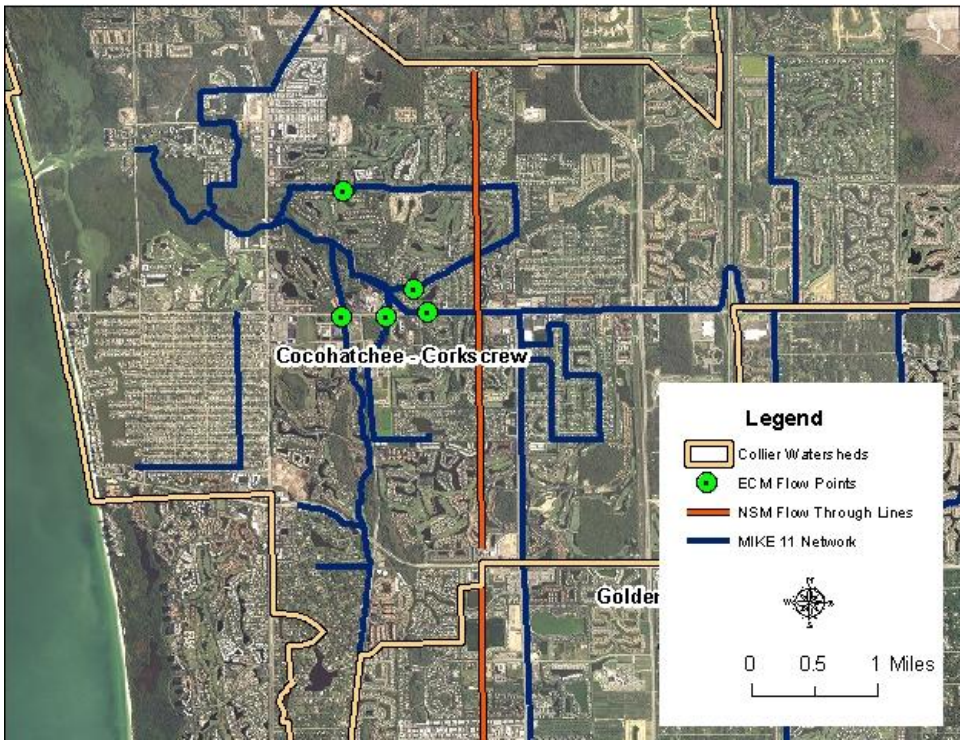

Figure 3-1
NSM Flow Through Line and ECM Flow Data Points,
Cocohatchee–Corkscrew Watershed

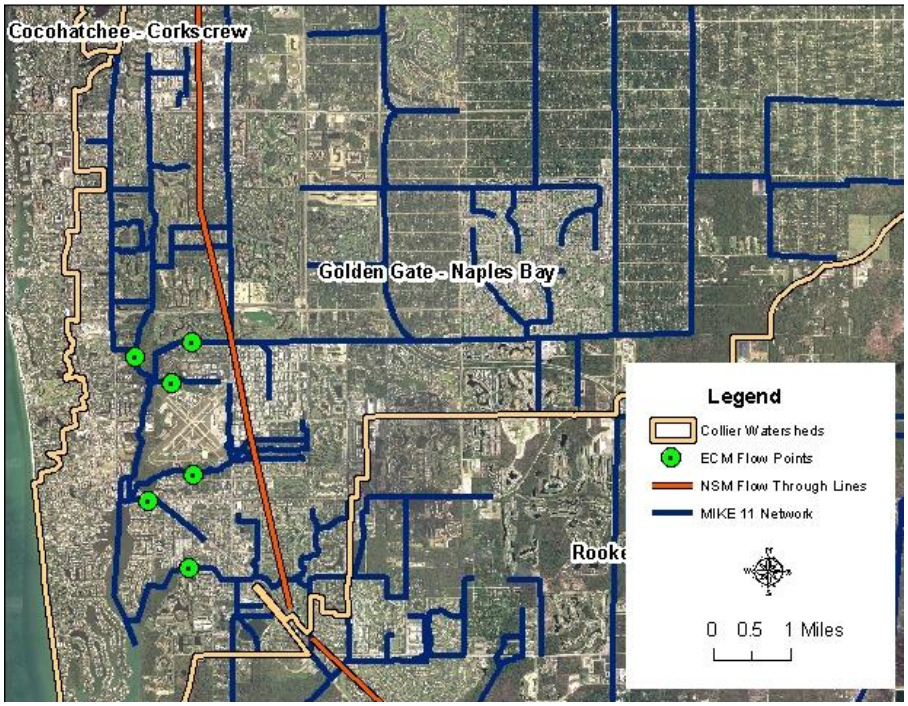

Figure 3-2
NSM Flow Through Line and ECM Flow Data Points,
Golden Gate-Naples Bay Watershed

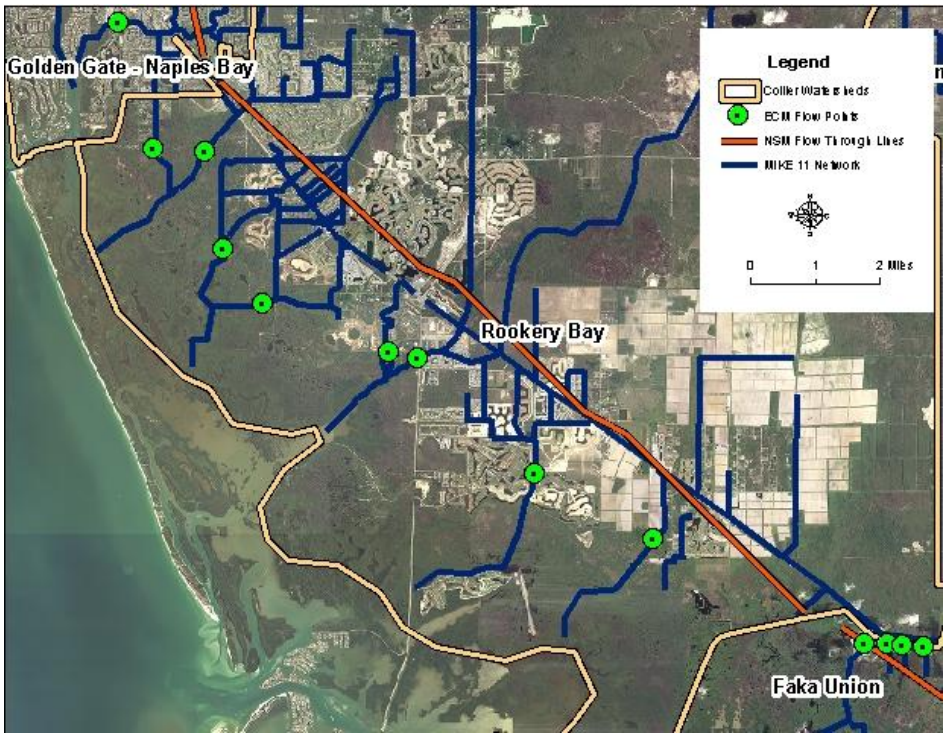

Figure 3-3
NSM Flow Through Line and ECM Flow Data Points, Rookery Bay Watershed

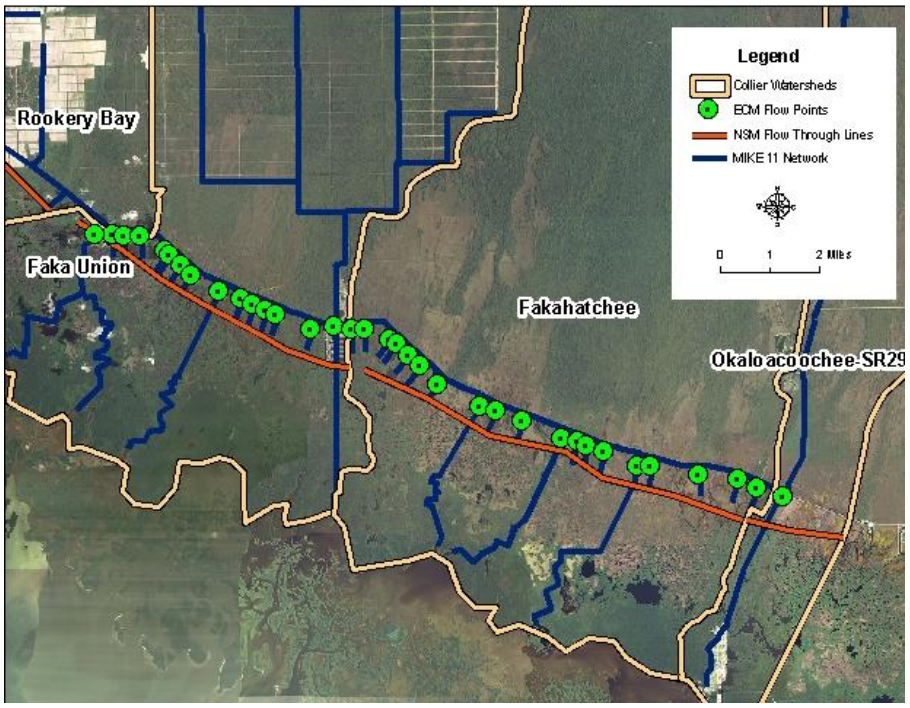

Figure 3-4
NSM Flow Through Line and ECM Flow Data Points, Faka Union, Fakahatchee and Okaloacoochee-SR29 Watersheds

Table 3-1
Calculated ECM Fresh Water Discharge to the Wiggins Bay Estuary
from the Cocohatchee-Corkscrew Watershed

Discharge to Wiggins Bay Estuary (inches)							
Month	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**Average Month**
January	0.02	0.17	0.10	0.05	0.12	0.03	0.08
February	0.01	0.10	0.11	0.04	0.08	0.02	0.06
March	0.01	0.06	0.12	0.11	0.07	0.01	0.06
April	0.01	0.04	0.07	0.07	0.02	0.01	0.03
May	0.01	0.03	0.06	0.05	0.01	0.01	0.03
June	0.03	0.65	0.03	1.12	-0.10	0.01	0.29
July	0.10	0.66	0.12	1.59	0.20	0.01	0.44
August	0.09	1.44	2.21	1.04	0.61	0.01	0.90
September	0.54	1.75	1.72	0.50	1.52	0.06	1.02
October	0.22	0.73	0.45	1.36	0.20	0.13	0.51
November	0.13	0.21	0.07	0.48	0.04		0.19
December	0.15	0.15	0.06	0.21	0.03		0.12
Annual Total	1.32	5.98	5.11	6.61	2.79		3.73

3.1.3 Fresh Water Discharge Comparison

For each of the four estuaries in Collier County, the predicted fresh water discharges from the NSM was compared to those predicted from the ECM. This was completed by subtracting the average monthly flows over the simulation period. Below is a description of the results for each of the estuaries.

3.1.3.1 Wiggins Pass Estuary

As shown in **Figure 3-5**, results indicate that the total fresh water discharges into Wiggins Pass have increased from pre-development conditions, particularly in the wet season. In addition, flow increases start earlier in the year and continue longer than in the NSM conditions. The difference in total fresh water volume discharged in the wet season (July–October) was expected, as were the comparable discharges for most of the dry season.

The relative large discharge increase in June was unexpected and suggests a change in the timing of flows to the estuary. This increase may also be attributable to the rainfall volume difference in the simulation periods for each model for the month of June. The surplus flow in November and December are likely associated with groundwater recharge to the canal system and delayed runoff from above average rainfall in 2003 and 2005.

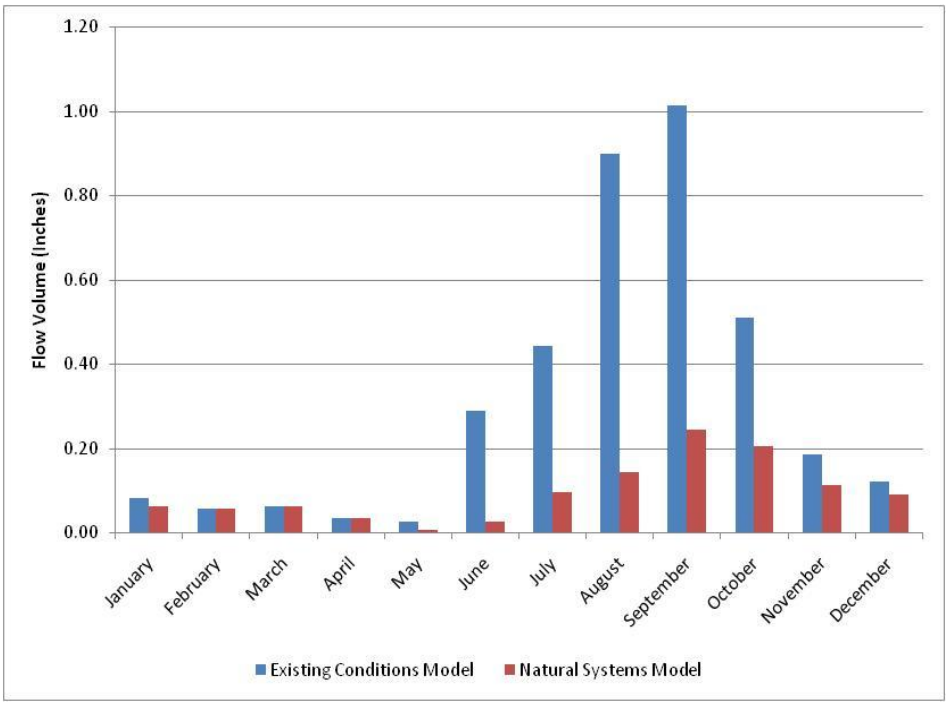

Figure 3-5
Comparison of the NSM vs. ECM Average Monthly Discharge,
Cocohatchee-Corkscrew Watershed to Wiggins Pass Estuary

3.1.3.2 Naples Bay Estuary

Figure 3-6 shows a comparison of the period of simulation average monthly volume of fresh water discharge to the Naples Bay Estuary from the Golden Gate-Naples Bay Watershed. The results indicate an increase in the magnitude of water volume released to the estuary, primarily in the wet season. The results do not indicate a significant change in the timing of discharges. These results were expected and are consistent with previous studies (Black, Crow, and Eidsness, 1974; SFWMD, 2007). The increased discharges are attributed to construction of the Golden Gate Main Canal that resulted in effectively increasing the extent of the watershed's drainage area from approximately 50 square miles to approximately 135 square miles.

3.1.3.3 Rookery Bay Estuary

The period of simulation average monthly comparison results for the NSM vs. ECM predicted fresh water discharges into the Rookery Bay estuary is shown in **Figure 3-7**. These results show a flow deficit during the months of October through May, and a flow surplus during the months of June through September. The total average annual predicted volume discharged to the estuary is very similar for both models, indicating that the primary challenge in this estuary is related to the timing of discharges.

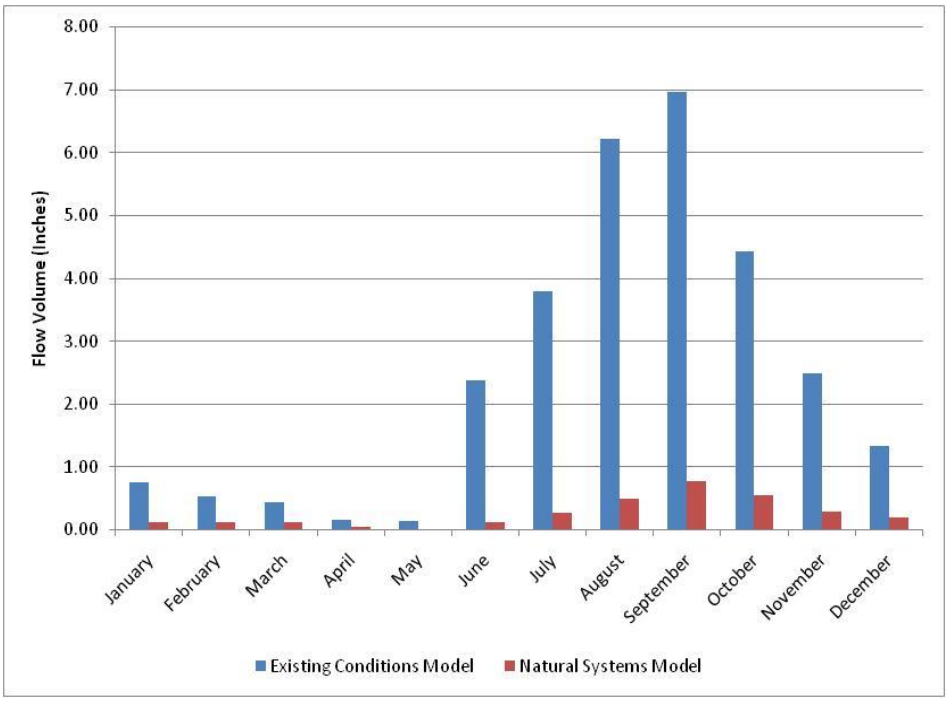

Figure 3-6
Comparison of the NSM vs. ECM Average Monthly Discharge,
Golden Gate-Naples Bay Watershed to Naples Bay Estuary

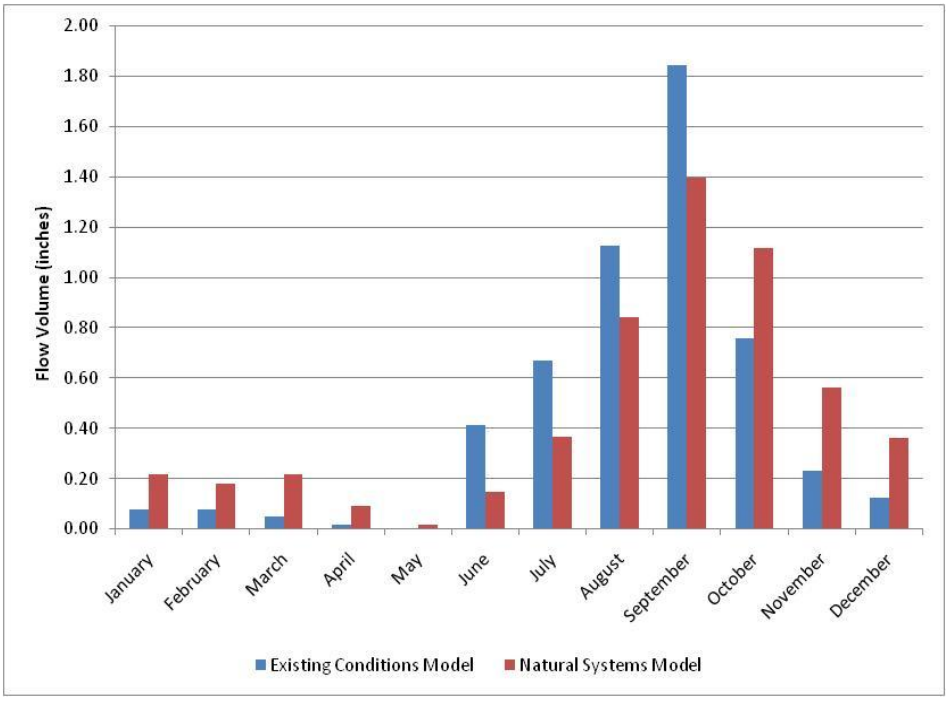

Figure 3-7
Comparison of the NSM vs. ECM Average Monthly Discharge,
Rookery Bay Watershed to the Rookery Bay Estuary

3.1.3.4 Ten Thousand Islands Estuary

The TTI Estuary receives fresh water discharge from three watersheds; Faka Union, Fakahatchee, and Okaloacoochee-SR29. Control structures are used to manage discharge from the Faka Union and SR29 canals into the estuary system. The results in **Figure 3-8** indicate that excess fresh water discharge to the estuary occurs primarily during the wet season. The volume of wet season excess discharge is approximately 10 inches. The data suggests that the wet season excess flow contribution comes primarily from the Faka Union watershed that is drained by Miller, Faka Union and Merritt Canals.

The southern portion of the Faka Union watershed is the location of the Picayune Strand Restoration Project. This project will remove the road system and install ditch blocks throughout the canal network. The project is expected to provide wet season storage, restore wetlands, and decrease the volume of discharge to the estuary, which is consistent with estuary restoration goals.

Predicted dry season discharges from the watersheds are essentially equal for the ECM and NSM during the months of January through May. Excess flows in November and December are likely the result of delayed runoff during 2003 and 2005. The average runoff volume is 1.97 inches in November 2003 and November 2005. The average runoff volume is 0.70 in the other years of the ECM simulation, which compares favorably with the average NSM November discharge of 0.6 inch.

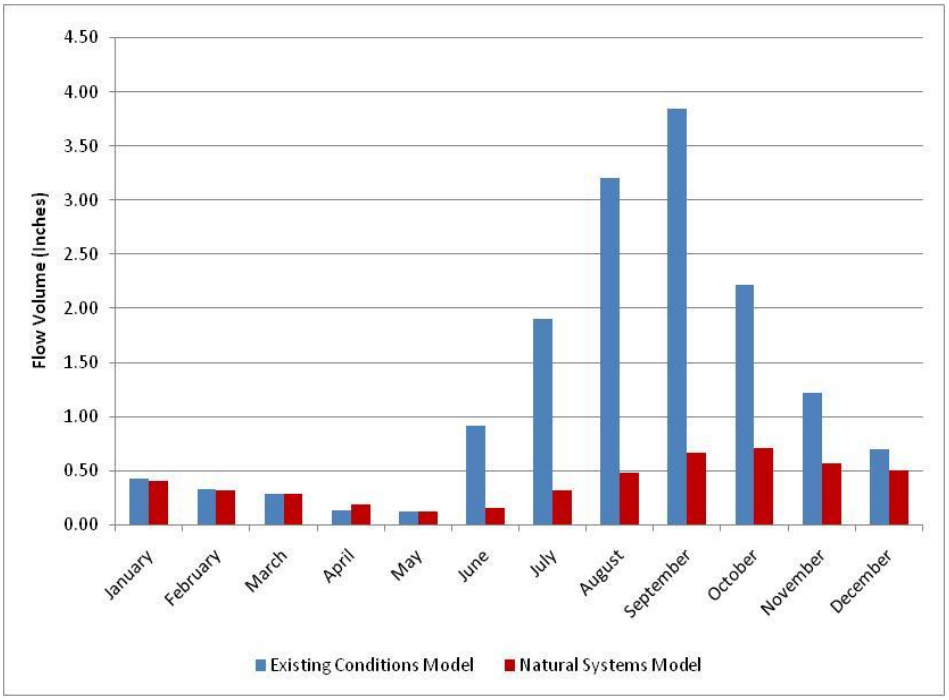

Figure 3-8
Comparison of the NSM vs. ECM Average Monthly Discharge, Faka Union, Fakahatchee and Okaloacoochee Watersheds to the Ten Thousand Islands Estuary

3.1.3.5 Seasonal Discharge Comparison Summary

Figure 3-9 shows the seasonal fresh water deficit or surplus estimated by subtracting NSM predicted discharges from ECM predicted discharges. As shown, pre-development water discharges during the wet season have increased for all estuaries due to the construction of drainage canals as well as the increased impervious areas associated with urban development. During the dry season, discharges have increased to all estuaries, except Rookery Bay, which has experienced a fresh water flow reduction because of the re-routing of watershed discharges into the Golden Gate Canal.

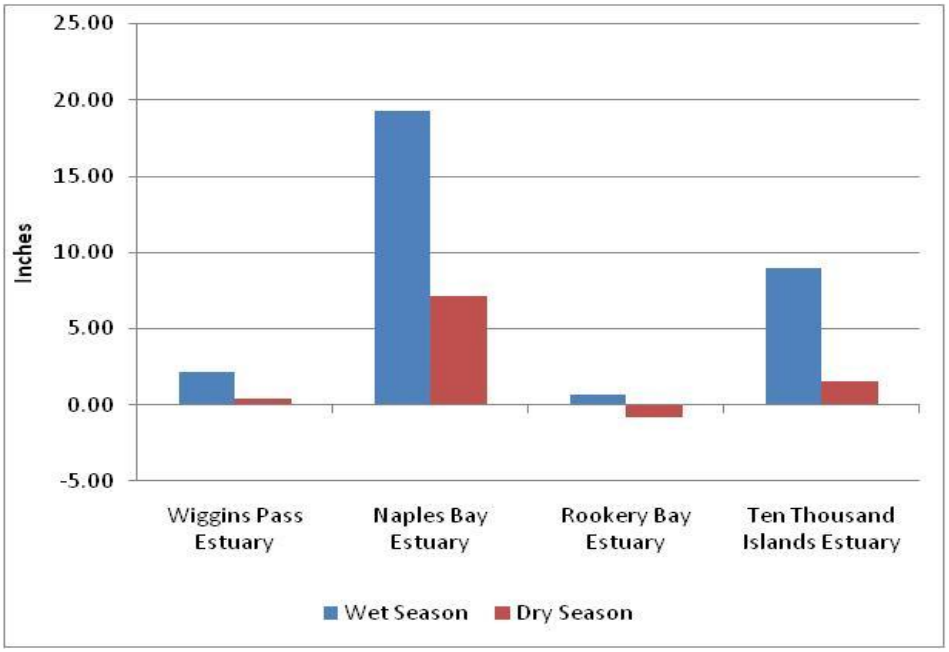

Figure 3-9
Seasonal Fresh Water Surplus and Deficit by Estuary

3.1.4 Results Validation with Salinity Analysis

The salinity:flow analysis method is described in detail in the Technical Memorandum submitted for Phase 1, Element 4, Task 2. The analytical method was applied to areas drained by the four primary canals listed below that discharge to the County estuaries. The location of those canals is shown in **Figure 3-10**.

- The Cocohatchee Canal that discharges to the Wiggins Pass Estuary,
- The Golden Gate Main Canal that discharges to the Naples Bay Estuary,
- The Henderson Creek Canal that discharges to the Rookery Bay Estuary, and
- The Faka Union Canal that discharges to the TTI Estuary

The analysis included the following steps:

- Obtain estimates of salinity at an estuarine area that can be considered unaffected by changes in fresh water discharge patterns due to development. This salinity value was assumed to be the target representing restored conditions at other locations.
- Based on available salinity and flow data, develop salinity:flow relationships representing conditions at the four estuaries of concern for this study, Wiggins Pass, Naples Bay, Rookery Bay, and TTI. The location of the salinity and flow stations used in the analysis are also shown in **Figure 3-10**.
- Estimate the flow deficit or surplus at each of the monitoring stations that is required to reach the salinity target.

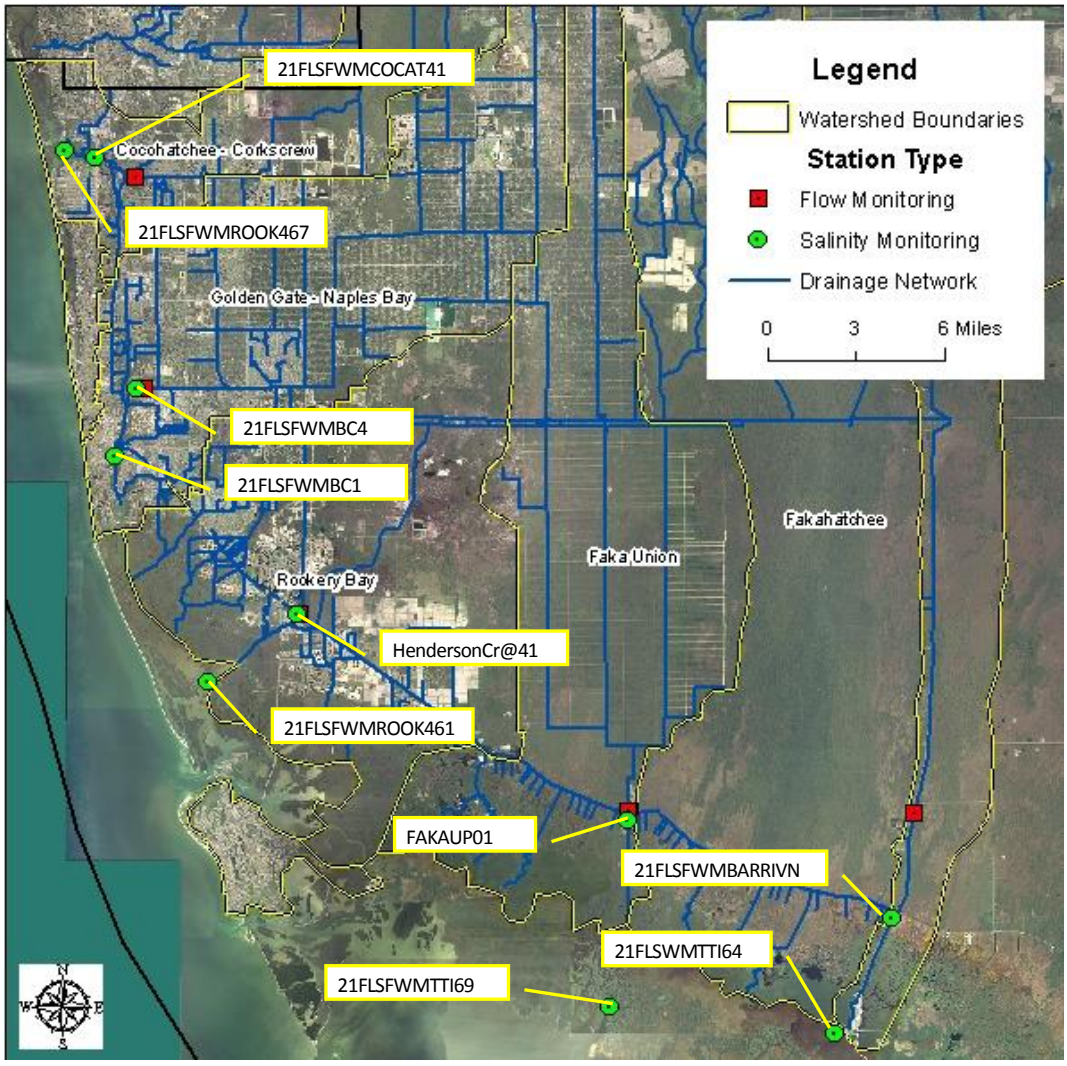

Figure 3-10
Monitoring Stations Considered in the Salinity:Flow Analysis

It must be noted that flow estimates in the salinity analysis are based solely on a single point of discharge to each estuary. In some watersheds, such as Rookery Bay, additional fresh water flows enter the estuaries through other canals that are not monitored for flow or salinity and could not be included in the analysis.

Figure 3-11 shows results of the model comparison and salinity analysis methods for the wet and dry seasons, respectively. During the wet season, the predicted excess flow to the Wiggins Pass and Naples Bay estuaries are very similar in both methods. This indicates that wet season flows to the estuary are dominated by discharge from the Cocohatchee and Golden Gate Main Canals to the Wiggins Pass and Naples Bay estuaries; respectively.

Both methods also predict similar discharge to the TTI Estuary during the wet season. The salinity analysis uses only measured flows from the Faka Union watershed. The similarity of the ECM vs. NSM results suggest that the excess wet season flow to the TTI estuary is dominated by discharges from the largely impacted Faka Union watershed and not from the Fakahatchee and Okaloacoochee/SR 29 watersheds, which have been impacted by development to a much small degree.

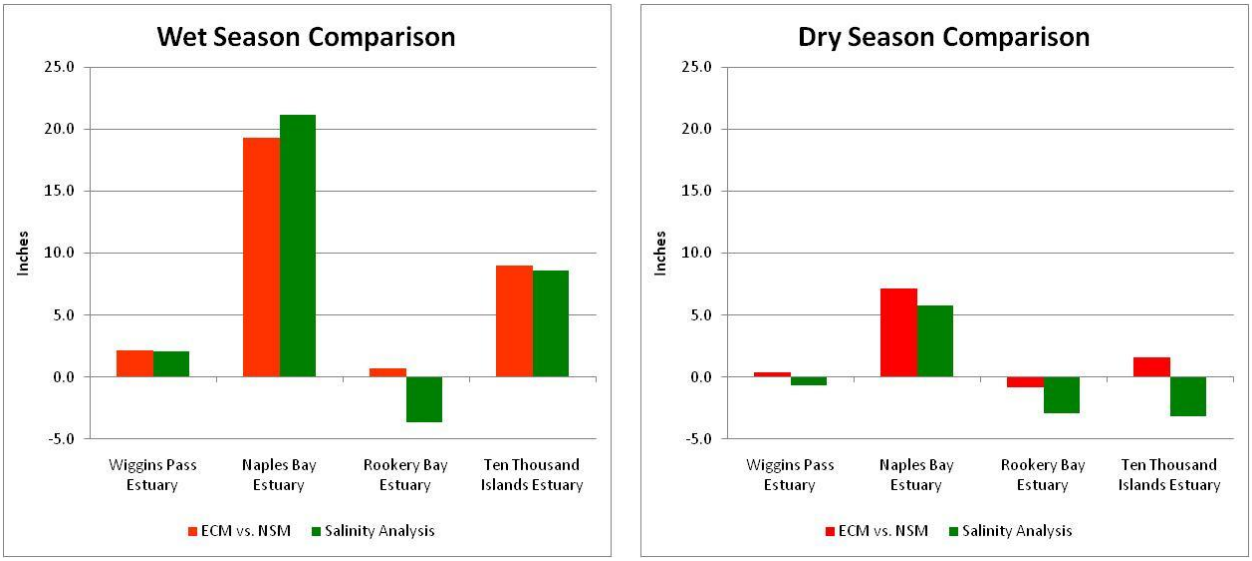

Figure 3-11
Results of the Model Comparison and Salinity Analysis Methods

For the Rookery Bay estuary, the Salinity Analysis indicates a wet season deficit from the Henderson Creek Canal to the estuary. The ECM vs. NSM comparison indicates a wet season surplus. The difference is that the Salinity Analysis only considers flows from the Henderson Creek Canal that drains approximately 40 percent of the watershed. The ECM vs. NSM analysis considers flows from the entire watershed and includes the urbanized Lely Area in the western portion of the watershed and the agricultural areas in the southeastern portion of the watershed.

During the dry season, the Salinity Analysis indicates that there is a flow deficit from the primary canals to the Wiggins Pass, Rookery Bay, and TTI estuaries. This is expected since the most downstream control structures in the Cocohatchee, Henderson Creek, and Faka Union Canals often prevent flow from occurring during the dry season. In the ECM vs. NSM results, a flow surplus, or a smaller flow deficit, can be attributed to the flow contributions from the secondary and uncontrolled releases to the estuary systems.

In the Naples Bay Estuary, the dry season results indicate a surplus using both calculation methods. This indicates that the Golden Gate Main Canal remains the primary source of discharge to the estuary; however, it is likely that flows from the smaller tributaries make up a larger percentage of the total flow to the estuary during the dry season.

3.1.5 Conclusions on the Application of the Analysis Methods

The following conclusions can be drawn from the results of this analysis:

In spite of the limitations of both methods applied to define fresh water discharge targets for the Collier County estuaries, the runoff surplus or deficit results are comparable. This validates the use of the ECM to evaluate potential proposed projects that will be incorporated in the Watershed Management Plans.

The primary environmental protection issue associated with the Wiggins Pass, Naples Bay, and TTI estuaries is excess runoff during the wet season.

For the Rookery Bay Estuary, the primary issue appears to be the timing of flow to the estuary. The system receives too much water during the wet season and too little water during the dry season.

3.2 QUALITY OF DISCHARGE

This Chapter addresses Element 2, Task 2: Quality of Discharge. The objective of this task is to characterize the water quality of fresh water discharges delivered to the following four estuaries in Collier County:

- Wiggins Pass
- Naples Bay
- Rookery Bay
- TTI

Six watersheds were evaluated that discharge fresh water to these four estuaries (**Figure 3-12**). The Wiggins Pass estuary receives runoff from the Cocohatchee-Corkscrew watershed. The Golden Gate-Naples Bay and Rookery Bay watersheds discharge into Naples Bay and Rookery Bay estuaries, respectively. Three watersheds make up the drainage area to the TTI estuary: Faka Union, Fakahatchee, and Okaloacoochee-SR29.

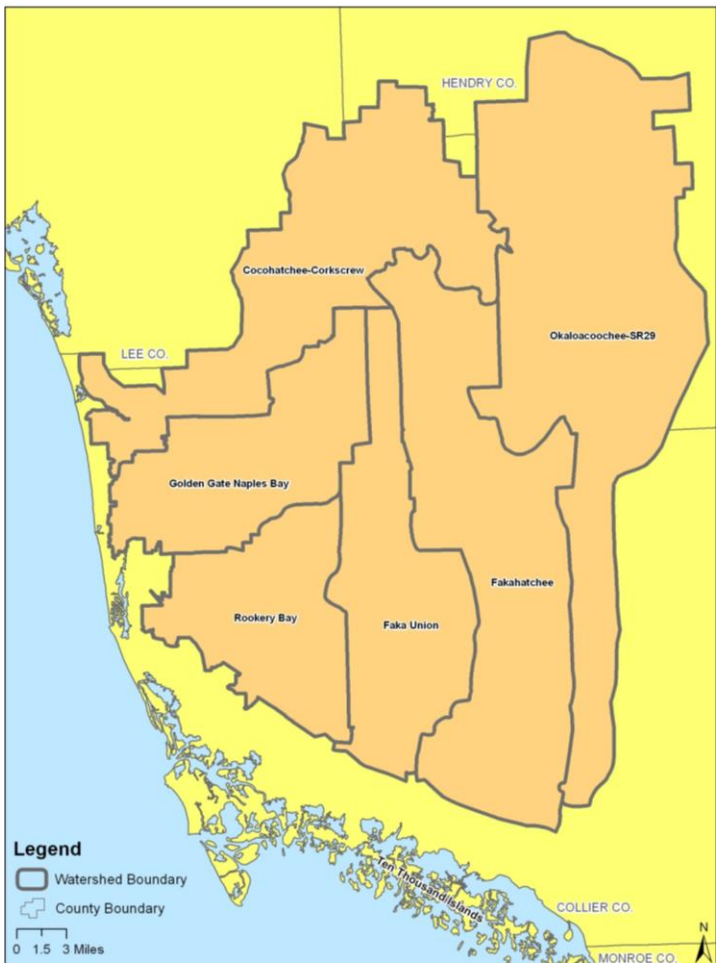

Figure 3-12. Collier County Watersheds

3.2.1 Water Quality Data

To accurately characterize the water quality of the discharge waters from priority watersheds in Collier County, in addition to the review of the available reports, Atkins analyzed available water quality data for Cocohatchee-Corkscrew, Golden Gate–Naples Bay, Rookery Bay, Faka Union, Okaloacoochee–SR29, and Fakahatchee watersheds. The data used for the analyses included the IWR Run 39 data (supplied by FDEP), as well as data from Florida STORET, Collier County, City of Naples, and the Rookery Bay National Estuarine Research Reserve. This resulted in an updated and comprehensive database of water quality data.

All available water quality data were subject to a quality assurance / quality control procedure. It should be noted that the analyses were conducted using data from the most recent ten year time period (2000 to 2009) to minimize the effect of temporal variations. Also, it was determined that the majority of water quality data available was collected during this ten year period.

As all water quality stations retrieved from the IWR database or Florida STORET were previously assigned to a WBID by FDEP, water quality station data provided by Collier County, City of Naples, or Rookery Bay National Estuarine Research Reserve were assigned to a WBID and watershed based on location coordinates.

3.2.2 Analysis Method

To focus on the assessment of watershed discharges in the receiving estuaries, only the most downstream water quality stations in each watershed were included in the analysis. **Table 3-2** lists the stations by watershed. As described later in more detail, the data was analyzed for the TMDL planning and verified periods. Data from all stations were used for the verified period analysis, whereas the planning period analysis included all stations except 21FLNAPLGORDJOE and Gord60, both in the Golden Gate / Naples watershed.

An important factor considered in the analysis was that many of the sampling stations are subject to tidal effects, especially during the dry season, Effects extend as far inland as the Tamiami Trail. This situation creates two data analysis problems: a) data does not reflect watershed conditions because the discharges are diluted by estuarine waters, and b) the chemistry of the discharges fluctuates from freshwater to marine conditions.

Table 3-2. Sampling Stations by Watershed

Watershed	Sampling Station
Cocohatchee–Corkscrew	28030036
Golden Gate / Naples Bay	21FLNAPLGORDJOE
	HC@Bayshore
	BC2
	Gord60
Rookery Bay	21FLSWMLELY
	HendersonCrk at US41
Faka Union	21FLSFWMFAKA
	FAKAUPOI
Fakahatchee	21FLSFWMBC21
	21FLSFWMBC19
	21FLSFWMBC18
Okaloacoochee-SR 29	BARRIVN

To control for this situation, water quality data from the selected stations was queried so that data analysis was restricted to those times when specific conductance (µmhos / cm at 25°C) was below 4,700 (equivalent to FDEP's threshold for marine waters of 1,500 mg chloride / liter). Samples representing the "freshwater" condition were thus considered representative of the surface water quality discharging into the estuaries.

The subsequent analysis method included the following steps:

1. The water quality data sets were compared to existing water quality criteria for the impairment parameters associated with each estuary.
2. The mean, minimum, maximum and percent exceedances of such criteria were quantified and displayed for each station within each watershed.
3. A review of data from the Planning Period was conducted, with data restricted to between January 1995 and December 2004.
    a. For inclusion on the Planning List, impairments for dissolved oxygen and metals concentrations would have to occur in at least 10 percent of samples, with an 80 percent confidence level using a binomial distribution.
        i. For samples of 10 to 15, this requires 3 exceedances.
        ii. For samples from 16 to 23, this requires 4 exceedances.
        iii. For samples from 24 to 31, this requires 5 exceedances
        iv. For samples from 32 to 39, this requires 6 exceedances
        v. For samples from 40 to 47, this requires 7 exceedances.

4. A review of data from the Verified Period was conducted, with data restricted to between January 2000 and June 30, 2007.
    a. For inclusion on the Verified List, impairments for dissolved oxygen and metals would have to occur in at least 10 percent of samples, with a 90 percent confidence level using a binomial distribution.
        i. For samples of 20 to 25, this requires 5 exceedances.
        ii. For samples from 26 to 32, this requires 6 exceedances.
        iii. For samples from 33 to 40, this requires 7 exceedances
        iv. For samples from 41 to 47, this requires 8 exceedances
        v. For samples from 48 to 55, this requires 9 exceedances.
5. For nutrient concentrations, discharge data were compared to two separate potential criteria.
    a. FDEP's screening criteria for streams uses the 75th percentile of values in STORET. These values are 1.6 mg total nitrogen (TN) / liter and 0.22 mg total phosphorus (TP) / liter
    b. FDEP's Hendry Creek TMDL used target TN and TP values of 0.74 and 0.04 mg / liter, respectively.

3.2.3 Analysis Results

This section presents the results and discussion of the water quality characterization of the watershed discharges into each of the estuary systems in Collier County based on the identified sampling stations. **Tables 3-3 through 3-10** show data statistics, as well as percent exceedance of the water quality/ screening criteria for dissolved oxygen, total phosphorus, total nitrogen, and fecal coliform concentration associated with the TMDL planning and verified periods. Following are descriptions of the results by watershed and estuary.

3.2.3.1 Wiggins Pass

Wiggins Pass is the receiving water for the Cocohatchee-Corkscrew watershed. It is located within WBID 3259A (Cocohatchee River) and is presently listed as impaired for three water quality parameters; dissolved oxygen, fecal coliforms and iron. As shown in **Tables 3-3 through 3-10**, the data available at Station 28030036 is very limited. Therefore, definite statistical conclusions are not possible, but general conclusions have been derived for this analysis for each impairment parameter.

Table 3-3. Data Analysis–Dissolved Oxygen Concentration, Planning Period (January 1995–December 2004)

Watershed	Station	Sample Size	Mean	Min.	Max.	Percent exceedance (< 5 mg / L)
Cocohatchee–Corkscrew	28030036	2	6.00	4.70	7.30	50
Golden Gate / Naples Bay	BC2	28	4.05	2.74	5.56	80
	HC@Bayshore	14	3.82	2.34	5.40	86
Rookery Bay	21FLSWMLEY	42	4.98	1.41	8.37	52
	HendersonCrk@41	13	6.13	4.73	0.28	15
Faka Union	21FLSFWMFAKA	48	6.46	2.92	9.83	25
	FAKAUPOI	29	6.12	3.60	8.92	24
Fakahatchee	21FLSFWMBC21	34	4.41	0.84	8.80	71
	21FLSFWMBC19	34	2.82	0.24	7.98	88
	21FLSFWMBC18	37	3.02	0.60	8.06	86
Okaloacoochee-SR 29	BARRIVN	28	4.24	2.72	7.87	82

Table 3-4. Data Analysis–Dissolved Oxygen Concentration, Verified period (January 2000–June 30, 2007)

Watershed	Station	Sample Size	Mean	Min.	Max.	Percent exceedance (< 5 mg / L)
Cocohatchee–Corkscrew	28030036	1	3.36	3.36	3.36	100
Golden Gate / Naples Bay	21FLNAPLGORDJOE	1	3.90	3.90	3.90	100
	HC@Bayshore	19	3.80	2.34	5.40	89
	BC2	15	3.89	2.74	5.56	87
	Gord60	2	4.31	4.20	4.41	100
Rookery Bay	21FLSWMLELY	59	4.77	1.41	8.37	54
	HendersonCrk@41	19	5.87	3.64	9.28	21
Faka Union	21FLSFWMFAKA	64	6.53	2.92	10.39	27
	FAKAUPOI	35	6.01	3.60	8.92	29
Fakahatchee	21FLSFWMBC21	42	4.20	0.84	8.80	74
	21FLSFWMBC19	44	2.85	0.24	7.98	84
	21FLSFWMBC18	48	3.05	0.30	8.06	85
Okaloacoochee-SR 29	BARRIVN	36	4.12	2.38	7.87	83

Table 3-5. Data Analysis–Total Phosphorus, Planning Period
(January 1995–December 2004)

Watershed	Station	Sample Size	Mean	Min.	Max.	Percent exceedance (> 0.04 mg/L)[1]	Percent exceedance (>0.22 mg/L)[2]
Cocohatchee–Corkscrew	28030036	2	0.05	0.03	0.07	50	0
Golden Gate / Naples Bay	HC@Bayshore	15	0.06	0.04	0.08	93	0
	BC2	10	0.06	0.03	0.09	80	0
Rookery Bay	21FLSWMLELY	39	0.03	0.01	0.09	13	0
	HendersonCrk@41	10	0.01	0.01	0.03	0	0
Faka Union	21FLSFWMFAKA	44	0.01	0.00	0.03	0	0
	FAKAUPOI	23	0.03	0.00	0.34	9	0
Fakahatchee	21FLSFWMBC21	30	0.01	0.00	0.04	0	0
	21FLSFWMBC19	31	0.02	0.01	0.06	6	0
	21FLSFWMBC18	32	0.01	0.00	0.04	3	0
Okaloacoochee-SR 29	BARRIVN	26	0.02	0.01	0.05	4	0

1 Hendry Creek TMDL Criteria

2 Florida Streams Screening Criteria

Table 3-6. Data Analysis–Total Phosphorus, Verified period
(January 2000–June 30, 2007)

Watershed	Station	Sample Size	Mean	Min.	Max.	Percent exceedance (> 0.04 mg/L)[1]	Percent exceedance (>0.22 mg/L)[2]
Cocohatchee–Corkscrew	28030036	1	0.07	0.07	0.07	100	0
Golden Gate / Naples Bay	21FLNAPLGORDJOE	1	0.04	0.04	0.04	0	0
	HC@Bayshore	18	0.06	0.04	0.11	89	0
	BC2	13	0.05	0.03	0.09	85	0
	Gord60	2	0.04	0.03	0.06	50	0
Rookery Bay	21FLSWMLELY	51	0.03	0.01	0.09	18	0
	HendersonCrk@41	16	0.02	0.01	0.05	6	0
Faka Union	21FLSFWMFAKA	56	0.01	0.00	0.03	0	0
	FAKAUPOI	28	0.01	0.00	0.06	4	0
Fakahatchee	21FLSFWMBC21	36	0.01	0.00	0.06	3	0
	21FLSFWMBC19	38	0.02	0.00	0.06	5	0
	21FLSFWMBC18	39	0.01	0.00	0.04	3	0
Okaloacoochee-SR 29	BARRIVN	32	0.02	0.01	0.05	3	0

1 Hendry Creek TMDL Criteria

2 Florida Streams Screening Criteria

Table 3-7. Data Analysis–Total Nitrogen, Planning period
(January 1995–December 2004)

Watershed	Station	Sample Size	Mean	Min.	Max.	Percent exceedance (> 0.74 mg/L)[1]	Percent exceedance (>1.6 mg/L)[2]
Cocohatchee–Corkscrew	28030036	2	1.26	0.75	1.78	100	50
Golden Gate / Naples Bay	HC@Bayshore	13	1.05	0.04	5.98	46	8
	BC2	9	0.86	0.27	1.08	78	0
Rookery Bay	21FLSWMLELY	40	1.68	0.01	4.30	35	2
	HendersonCrk@41	11	0.78	0.58	1.02	55	0
Faka Union	21FLSFWMFAKA	44	0.38	0.01	1.22	5	0
	FAKAUPOI	27	0.36	0.01	0.71	0	0
Fakahatchee	21FLSFWMBC21	32	0.80	0.01	2.70	56	3
	21FLSFWMBC19	32	0.82	0.01	1.50	56	0
	21FLSFWMBC18	36	0.62	0.01	1.30	31	0
Okaloacoochee-SR 29	BARRIVN	26	0.57	0.02	1.02	15	0

1 Hendry Creek TMDL Criteria

2 Florida Streams Screening Criteria

Table 3-8. Data Analysis–Total Nitrogen, Verified period
(January 2000–June 30, 2007)

Watershed	Station	Sample Size	Mean	Min.	Max.	Percent exceedance (> 0.74 mg/L)[1]	Percent exceedance (>1.6 mg/L)[2]
Cocohatchee–Corkscrew	28030036	1	1.00	1.00	1.00	100	0
Golden Gate / Naples Bay	21FLNAPLGORDJOE	1	1.03	1.03	1.03	100	0
	HC@Bayshore	17	0.93	0.03	5.98	47	6
	BC2	13	0.70	0.04	1.08	54	0
	Gord60	2	1.23	1.11	1.34	100	0
Rookery Bay	21FLSWMLELY	52	0.65	0.01	4.30	33	2
	HendersonCrk@41	16	0.63	0.06	1.02	38	0
Faka Union	21FLSFWMFAKA	55	0.36	0.01	1.22	4	0
	FAKAUPOI	31	0.32	0.01	0.71	0	0
Fakahatchee	21FLSFWMBC21	38	0.72	0.01	2.70	50	3
	21FLSFWMBC19	40	0.78	0.01	1.64	52	2
	21FLSFWMBC18	43	0.59	0.01	1.65	28	2
Okaloacoochee-SR 29	BARRIVN	32	0.49	0.01	1.02	12	0

1 Hendry Creek TMDL Criteria

2 Florida Streams Screening Criteria

Table 3-9. Data Analysis–Fecal Coliform, Planning period
(January 2000–June 30, 2007)

Watershed	Station	Sample Size	Mean	Min.	Max.	Percent exceedance (> 43/100 mL)
Cocohatchee–Corkscrew	28030036	2	140.00	10.00	270.00	50
Golden Gate / Naples Bay	HC@Bayshore	15	829.00	142.00	3,627.00	100
	BC2	9	573.33	70.00	3,200.00	10
Rookery Bay	21FLSWMLELY	40	191.78	11.00	2,600.00	65
	HendersonCrk@41	11	172.82	17.00	440.00	73
Faka Union	21FLSFWMFAKA	45	104.98	1.00	560.00	51
	FAKAUPOI	25	27.36	1.00	340.00	12
Fakahatchee	21FLSFWMBC21	32	421.41	6.00	5,300.00	47
	21FLSFWMBC19	33	324.48	3.00	1,386.00	73
	21FLSFWMBC18	36	289.69	9.00	5,450.00	61
Okaloacoochee-SR 29	BARRIVN	28	371.00	33.00	2,300.00	93

Table 3-10. Data Analysis–Fecal Coliform, Verified period
(January 2000–June 30, 2007)

Watershed	Station	Sample Size	Mean	Min.	Max.	Percent exceedance (> 43/100 mL)
Cocohatchee–Corkscrew	28030036	1	200.00	20.00	200.00	100
Golden Gate / Naples Bay	21FLNAPLGORDJOE	1	1.00	1.00	1.00	0
	HC@Bayshore	18	856.83	61.00	3,627.00	100
	BC2	14	402.86	40.00	3,200.00	93
	Gord60	2	76.00	72.00	80.00	100
Rookery Bay	21FLSWMLELY	52	159.96	11.00	2,600.00	63
	HendersonCrk@41	16	186.81	17.00	576.00	75
Faka Union	21FLSFWMFAKA	47	101.38	1.00	560.00	49
	FAKAUPOI	27	25.96	1.00	340.00	11
Fakahatchee	21FLSFWMBC21	37	369.41	6.00	5,300.00	46
	21FLSFWMBC19	42	282.86	3.00	1,386.00	69
	21FLSFWMBC18	41	277.12	9.00	5,450.00	59
Okaloacoochee-SR 29	BARRIVN	36	321.86	20.00	2,300.00	89

Dissolved Oxygen

Data collected in Wiggins Pass itself has indicated that low dissolved oxygen levels appear to be evident in the estuary's upstream portions of Wiggins Pass. This supports the notion that watershed discharges may affect that portion of the estuary. The limited data available shows that the dissolved oxygen concentration in the watershed discharge does not meet the 4 mg/L standard for the estuary. The cause of the depleted oxygen level may be attributed to excessive nutrient concentrations. The available data shows that the measured concentration of TN in the two discharge samples exceeds the Hendry Creek TMDL target for both the planning and verified periods. However, only one of the samples exceeds the screening criteria for Florida streams. The available data also shows that TP exceeds the Hendry Creek TMDL target in one of the samples, but never exceeds the Florida streams criteria.

Another potential cause of low dissolved oxygen concentrations in the watershed discharge is the groundwater contribution to the canal flow. As described for the stream water quality analysis, the annual average groundwater contribution from WBID 3278D - Cocohatchee (Inland Segment), to flow in the Cocohatchee Canal is about 40 percent of the total contributions and increases to 65 percent during the dry season.

The results of the analysis suggest that groundwater discharges may have a larger impact on dissolved oxygen levels than nutrient concentrations in the Wiggins Pass estuary. However, more data coupled with in-stream water quality modeling are necessary to determine the cause of the low dissolved oxygen levels in the estuary.

Fecal Coliform

One of the two samples analyzed for the planning period evaluation exceeds the water quality criteria for the estuary. So does the only sample that is included in the verified period analysis. Therefore it can be concluded that there is the possibility that the estuary is affected by watershed discharges of fecal coliform bacteria. Bacteria source evaluations are necessary to confirm the condition.

Iron

No data for iron is available at the sampling stations considered for data analysis. Although sources have not been confirmed, it is possible that groundwater discharges through the canal system as described for dissolved oxygen is an important cause of the elevated iron levels. Other human activities such as mine drainage, sewage treatment plant outfalls, or landfill leachate from industrial scrap yards (e.g., junkyards for cars) are also potential sources of the elevated iron levels in this case.

3.2.3.2 Naples Bay Estuary

Naples Bay is located within WBID 3278R (Naples Bay-Coastal Segment) and is presently listed as impaired for four parameters; dissolved oxygen, fecal coliforms, copper and iron. Naples Bay is the receiving water for the Golden Gate-Naples Bay and Gordon River Extension watersheds.

Dissolved Oxygen

Data available at the two stations analyzed for planning period conditions and the four stations with data available for the verified period analysis show that the dissolved oxygen concentration in the watershed discharges do not meet the estuary water quality standard. As indicated for Wiggins Pass, the cause of the depleted oxygen levels could be attributed to excessive nutrient concentrations. The analytical data indicates that neither TN nor TP concentrations in the watershed discharges exceed the Florida stream screening standards; however in most cases they exceed the Hendry Creek TMDL target for both the planning and verified periods. In summary, from the available data it is not clear if TN and TP discharges from the watershed are causing the lower dissolved oxygen levels. More data collection and analysis may be required to determine the effect of discharged nutrients on the estuary.

Another potential cause of low dissolved oxygen concentrations may be the discharge of groundwater to the dredged canal network. Low dissolved oxygen levels appear to be most evident in the upstream portions of the estuary that are most affected by watershed discharges. As described for the stream water quality analysis, measured DO concentrations in groundwater are less than 3.0 mg/L and the annual average baseflow contribution to the flow in the Golden Gate Canal is about 55 percent of the total flow and increases to more than 70 percent during the dry season. This information suggests that watershed discharges may have a larger impact on dissolved oxygen levels in the estuary than nutrient loading in the upper reaches of the estuary. More data is required to determine the cause of low measured DO levels in the estuary.

Fecal Coliform

The data analyzed indicate that fecal coliform concentrations exceed the standard at most discharge locations. Therefore it can be concluded that there is the possibility that the estuary is affected by watershed discharges of fecal coliform bacteria. However, significant more bacteria source evaluations are necessary to confirm this condition.

Iron and Copper

No sources of iron contribution to the canal network have been identified. Based on the predicted groundwater concentrations for iron in the Golden Gate – Naples Bay watershed and the level of baseflow contributions to the drainage network, it is possible that groundwater discharges to the canal system are an important cause of the elevated iron levels. Other potential sources include

human activities such as mine drainage, sewage treatment plant outfalls, or landfill leachate from industrial scrap yards (e.g., junkyards for cars).

Data for copper at the discharge stations were not analyzed, but discharges of copper into the estuary could be from anthropogenic sources, such as its use as an algaecide to prevent algae growth. High measured concentrations could also result from site characteristics of the sampling locations, such as effects of leaching from boardwalks and pilings that are constructed from pressure-treated lumber.

3.2.3.3 Rookery Bay Estuary

Rookery Bay is the receiving water for the Rookery Bay watershed. The estuary is located within WBID 3278U (Rookery Bay-Coastal Segment) and, similar to the other previously described two estuaries, is presently listed impaired for dissolved oxygen and fecal coliforms. However, this estuary is also listed impaired for nutrients, which are potential causes for the low dissolved oxygen concentrations.

Dissolved Oxygen and Nutrients

Data available at the two stations analyzed for planning period conditions and the four stations with data available for the verified period analysis show that the dissolved oxygen concentration in the discharges do not meet the estuary water quality standard. Causes of the depleted oxygen level could be attributed to excessive nutrient concentrations, as well as groundwater inflows. In spite of the estuary being listed for nutrient impairment, data at the watershed discharge point indicate that TN and TP concentrations are below the Florida screening criteria for streams for both the planning and verified period analysis. In addition, total phosphorus exceeds the Hendry Creek TMDL criterion less than 20 percent of the time. The exceedance of the Hendry Canal standard for total nitrogen ranges between 35 and 55 percent for the planning period and 33 and 38 percent for the verified period.

As mentioned previously, another cause of low dissolved oxygen concentrations may be the discharge of groundwater. The groundwater quality analysis predicts that DO concentrations are less than 2.0 mg/L in the Rookery Bay watershed and the stream water quantity analysis showed that the annual average groundwater contribution to the estuary is about 45 percent of the total flow and increases to approximately 70 percent during the dry season. This information suggests that the groundwater contribution is likely an important factor effecting DO concentrations in the estuary.

It is also possible that nitrogen runoff is contributing to the lower dissolved oxygen concentration in the estuary, although the measured concentrations are generally low. Additional monitoring is required to assess the causes of the DO impairment in the Rookery Bay estuary.

Fecal Coliform

The estuary fecal coliform water quality criterion at the watershed discharge point is exceeded between approximately 60 and 75 percent of the time. Therefore it is likely that the estuary is affected by watershed discharges. Additional bacteria source evaluations are necessary to confirm this condition.

3.2.3.4 Ten Thousand Islands Estuary

The TTI is the receiving water for the Faka Union, Fakahatchee, and Okaloacoochee/SR29 watersheds. It is located within WBID 3259M (TTI) and is presently not listed as impaired for any parameter. The watersheds largely remain in undeveloped conditions.

No detailed water quality evaluation of the discharge characteristics was conducted. However, per the data provided in Tables 3-3 through 3-10, the percent of time dissolved oxygen concentrations in the watershed discharges are below the standard range from 24 to 85 percent during the planning and verified periods. This is likely the result of discharges from the wetland systems present in the watersheds coupled with groundwater contributions to the total flow in the canals. Total phosphorus and total nitrogen concentrations are below the screening criteria for Florida streams, but nitrogen levels exceed the Hendry Creek criteria in the Fakahatchee watershed. Fecal coliform data also shows values above the estuarine criterion around 60 percent of the time.

3.2.4 Conclusions

The Collier County estuaries are impaired primarily for dissolved oxygen and fecal coliforms. Rookery Bay is also impaired for nutrients. Data show that the watershed discharges do not meet the water quality standards for dissolved oxygen and fecal coliforms either. Therefore, it is likely that the watershed conditions are impacting the receiving estuaries. However, causative parameters for the observed low oxygen levels are not clear. Nutrient concentrations in the discharges are commonly below the screening criteria for Florida streams and only exceed the TMDL target established for Hendry Creek. Fecal coliforms are indicators of pathogenic organisms and are used to identify potential health threats. However, as described in other technical memos, fecal coliform bacteria may not be an appropriate indicator for pathogenic diseases in sub-tropical climates. Further source identification efforts are warranted.

Other parameters of impairment concern are iron and copper. Iron appears to be caused by the groundwater discharges through the canal network, although other sources are possible. High copper concentrations may be the result of anthropogenic impacts such as the use of copper sulfate as an algaecide to prevent algae growth in ponds or for leaching from boardwalks and pilings that are constructed from pressure-treated lumber.

3.3 QUALITY OF RECEIVING WATERS

This Chapter will address Element 2, Task 3: Quality of Receiving Waters. The objective of this task is to characterize the water quality conditions in the receiving waters of the four primary estuaries in Collier County:

- Wiggins Pass
- Naples Bay
- Rookery Bay
- Ten Thousand Islands (TTI)

Six watersheds were identified as the headwaters to the four estuaries of interest for this project (**Figure 3-13**). The Wiggins Pass estuary is located at the outfall from the Cocohatchee-Corkscrew watershed. Naples Bay estuary receives discharge from the Golden Gate-Naples Bay watershed and Gordon River Extension, while the Rookery Bay watershed discharges into the Rookery Bay estuary. The TTI estuary is the receiving water body for three main watersheds: Faka Union, Fakahatchee, and Okaloacoochee-SR29.

This section focused on the downstream, estuarine portions of the above-listed watersheds in Collier County. These estuaries are influenced by the quantity, timing, and quality of inflow from their associated watersheds. Characterization of the quality of water within the watersheds was the focus of the technical memorandum prepared for Phase 2, Element 2, Task 2.

The main impact to the Collier County estuaries has resulted from changes in historic fresh water flow patterns over the years due to increased development. These hydrologic changes have adversely impacted the environmental integrity of many of the estuaries, mostly in terms of widely varying salinity patterns (Browder et al. 1998, Shirley et al. 2005). Specifically about TTI, much of the scientific literature focused on the issue of altered hydrology and the need for a more natural pattern of freshwater inflow (e.g., Browder et al. 1988, Shirley et al. 2005).

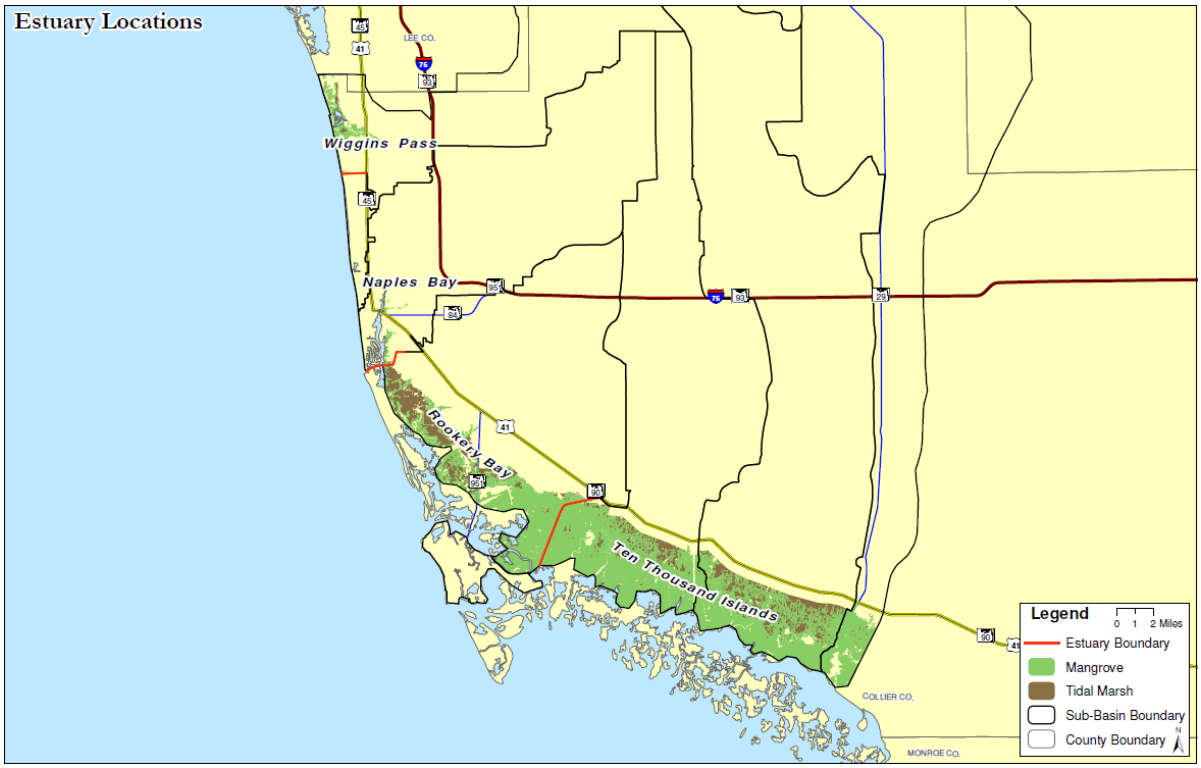

Figure 3-13. Collier County Estuaries and Major Features

3.3.1 Methods

In order to accurately characterize the receiving waters of the Collier County estuaries, Atkins completed a review of the existing impaired water bodies as defined by Florida Department of Environmental Protection (FDEP) and compared these results to available water quality data within the estuarine portion of each watershed: Cocohatchee-Corkscrew, Golden Gate–Naples Bay, Rookery Bay, Faka Union, Okaloacoochee–SR29, and Fakahatchee. A discussion of the analysis conducted is presented below.

3.3.1.1 FDEP Impaired WBIDs

For implementation of the statewide TMDL program, the FDEP has divided the state into five groups. Each group is comprised of multiple basins. All water bodies within Collier County are located within the Everglades West Coast Group 1 Basin. Per TMDL guidelines, every five years each WBID is evaluated to determine whether available water quality parameters exceed the limits defined by FDEP in the IWR. The verified impaired list of WBIDs for each group and cycle is available on the FDEP website. After the compilation of all impaired WBIDs from Cycle 1 and 2, a total of ten impairments have been designated by FDEP for the four WBIDs representing the estuaries. Those WBIDs are listed in **Table 3-11**.

Table 3-11. WBID Name and corresponding estuarine receiving water

WBID#	WBID Name	Receiving Water
3259A	Cocohatchee River	Wiggins Pass
3278R	Naples Bay (Coastal Segment)	Naples Bay
3278U	Rookery Bay (Coastal Segment)	Rookery Bay
3259M	Ten Thousand Islands	Ten Thousand Islands

3.3.1.2 Water Quality Analysis

As was done for characterizing the quality of water discharging into the estuaries, the IWR Run 39 dataset was supplemented with data from Florida STORET, Collier County, City of Naples, and the Rookery Bay National Estuarine Research Reserve to create a comprehensive water quality database. To eliminate potential errors due to apparent data duplications for water quality stations (possibly due to multiple agencies uploading the same data, a single agency loading the data more than once with slight variations like rounding errors, etc.), median values were calculated by station, date, and parameter. For field parameters such as water temperature and dissolved oxygen, all data with water depths greater than one meter were analyzed no further. Daily median values were calculated for water quality stations in which datasondes collected data at 15-minute intervals. This ensured that any comparisons of field parameters to lab parameters (i.e., nutrients) were from samples taken at the same water depth.

Using GIS and the station descriptions, the location of water quality stations were reviewed in order to identify locations where multiple stations were sampled. Data were merged when more than one water quality station was sampled at a location and a unique merged station name was assigned to that location. **Appendix 4-B** lists all water quality stations and assigned merged station names. Each parameter in the database was screened to identify outliers or entry errors due to unit inconsistencies. Identified inconsistencies were reviewed and corrected. When Total Nitrogen (TN) species were not listed, TN was calculated through the addition of Total Kjeldahl Nitrogen (TKN) and Nitrate + Nitrite (NOx). For chlorophyll *a* data consistent with IWR, corrected chlorophyll *a* was preferentially used over uncorrected chlorophyll *a* when available for samples collected in 2006 and earlier. After 2006, only corrected chlorophyll *a* data were used. All statistical analysis was completed using the most recent ten year time period (2000 to 2009) to characterize each watershed.

All water quality stations retrieved from the IWR database or Florida STORET were previously assigned to a WBID by FDEP. Water quality station data provided by Collier County, City of Naples, or Rookery Bay National Estuarine Research Reserve were assigned to a WBID based on location coordinates (**Figure 3-14**). A list of the parameters analyzed for each station and receiving water is provided in **Table 3-12**.

Table 3-12. List of Water Quality Parameters

Parameter	Unit	Parameter	Unit
Salinity	ppt	Conductivity	µmhos/cm
Total Nitrogen	mg/l	Nitrate-Nitrite	mg/l
Total Phosphorus	mg/l	Orthophosphate	mg/l
Total Kjeldahl Nitrogen (TKN)	mg/l	Un-ionized Ammonia	mg/l
Chlorophyll a	µg/L	Fecal Coliform	#/100 mL
Color	PCU	Copper	µg/L
Total Suspended Solids (TSS)	mg/l	Turbidity	NTU
Dissolved Oxygen (DO)	mg/l	Biochemical Oxygen Demand (BOD)	mg/l
Iron	µg/L	Hardness	mg/l
Secchi Depth	m		

Summary data for each estuary were compared to the Criteria for Surface Water Quality Classifications (F.A.C. 62-302.530) for water quality parameters based on water body classification. All of the receiving waters are Class II water bodies, i.e. their designated use is shellfish propagation and harvesting. In addition, FDEP's anti-degradation policy (62-302.300 FAC) allows for protection of water quality above the minimum required for a classification and Class II water bodies, i.e. "water quality sufficient for the protection and propagation of fish, shellfish, and wildlife, as well as for recreation in and on the water, is an interim goal to be sought whenever attainable." **Table 3-13** lists the regulatory standards for a Class 2 water body for the selected parameters previously identified by the FDEP TMDL program as verified parameter. Regulatory standards have been vetted by the scientific community and provide a biologically relevant basis for comparison.

To further evaluate potential water quality impairments for chemical parameters for which no numeric water quality standard currently exist, the data were compared to screening level standards, which can provide an indication of potential water quality concerns but do not necessarily constitute an impairment problem. Screening level standards are available for TN and TP based on the 70th percentile of all available data, as in Friedman and Hand (1989). Using IWR Run 39, a similar screening level was calculated by water body type for color, total suspended solids, and Secchi depth, in which the 70th percentile of all data available from 2000 to 2009 by water body type was calculated. **Table 3-14** shows the screening level standard for selected parameters by water body type (estuary).

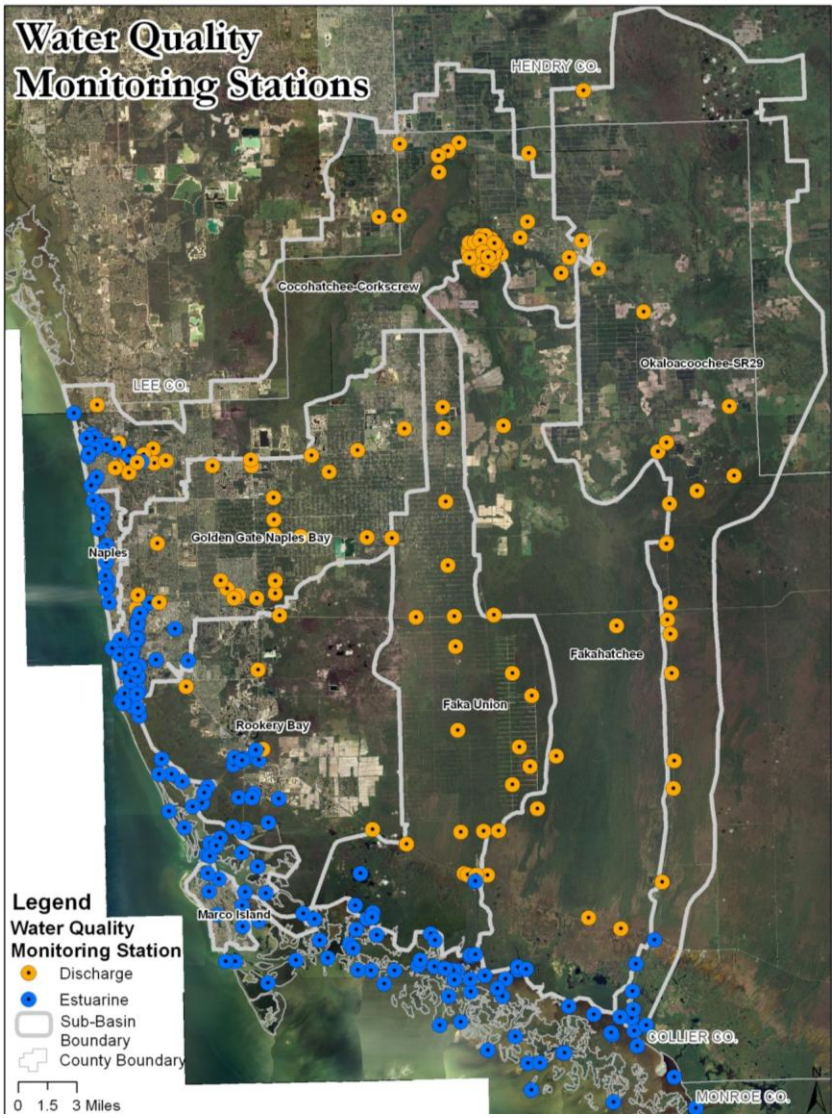

Figure 3-14. Water quality monitoring station location map

Table 3-13. List of regulatory standards for selected water quality parameters

Parameter	Class 2
Dissolved Oxygen (mg/l)	4
Fecal Coliform (#/100 mL)	43
Chlorophyll a (µg/L)	11
Iron (µg/L)	300
Copper (µg/L)	3.7

Table 3-14. List of screening levels for selected water quality parameters

Parameter	Estuary
Color (PCU)	40
SD (m)	1.38
TSS (mg/l)	17
TN (mg/l)	1
TP (mg/l)	0.19

Another screening tool that was used to assess nutrient concentrations in the Collier County estuaries was the Hendry Creek TMDL (located on the Everglades West Coast in northern Estero Bay; this is the only estuarine WBID with a nutrient TMDL in the EWC group), which addresses dissolved oxygen impairments, established TN and TP targets using an estuarine reference site, Estero Bay Wetlands (FDEP, 2008). The TN and TP targets were calculated based on the unique characteristics of the Estero Bay Wetlands to develop an empirical relationship between nutrients (especially TN) and dissolved oxygen. Similarly, the TMDLs developed for the Gordon and Imperial Rivers were established based on assumptions specific to those particular watersheds. These TN and TP targets could be used as a screening tool but should not be accepted as representative of the potential response found in watersheds other than those themselves.

3.3.1.3 Impaired WBID Comparison

Using methods similar to FDEP IWR, Atkins analyzed the water quality data for each WBID All analyses were conducted using the most recent ten year time period (2000 to 2009) to minimize the effect of temporal variations. Also, it was determined that the majority of water quality data available was collected during this ten year period. All data collected for each WBID during that period were used to evaluate the parameters previously declared "verified impaired" by FDEP. Dissolved oxygen, iron, fecal coliforms, nutrients (chlorophyll *a*), and copper concentrations were compared to the appropriate state regulatory standard (**Table 3-13**) to determine impairment status. A modification to the FDEP method for determining chlorophyll *a* impairments was utilized because it provides a more realistic assessment of the frequency of exceedances. Each chlorophyll *a* value was compared to the state regulatory standard and the percent exceedance was calculated. In contrast, FDEP calculates an annual average using data from each quarter for comparison with the regulatory standard. The results of Atkins WBID analysis were compared to the FDEP impaired WBID list for those water bodies in the study area.

Results of the impairment analysis was also compared to the work conducted by Janicki Environmental, Inc as part of a review of the County's water quality data in the context of Florida's Impaired Water Rule (Janicki Environmental, Inc. 2010). A preliminary review of annual chlorophyll *a* values for each WBID indicated one basin which exceeded the threshold (Cocohatchee River). Annual chlorophyll *a* values exceeded the 11 µg/L threshold in one year only (2001).

Results of the FDEP impairment status for nutrients were compared to the two other methods (Atkins and Janicki) to identify potentially impaired WBIDs **(Table 3-15)**. Rookery Bay (Coastal Segment) is the only WBID identified as impaired for nutrients by FDEP. Atkins identified two additional WBIDs which may be impaired. Janicki Environmental identified one potentially impaired segment, but that conclusion is not supported by the current analysis.

Table 3-15. Comparison of methods to identify WBIDs potentially impaired for nutrients

WBID	WBID Name	Watershed	FDEP	Atkins	Janicki
3278U	Rookery Bay (Coastal Segment)	Rookery Bay	Impaired	Potential	
3278R	Naples Bay (Coastal Segment)	Golden Gate Naples Bay		Potential	
3259A	Cocohatchee River	Cocohatchee-Corkscrew			Potential
3278Q	Naples			Potential	

3.3.1.4 Critical Parameters

Four critical parameters were further evaluated for the estuaries to identify those estuaries of concern: chlorophyll *a*, dissolved oxygen, transparency (Secchi depth), and bacteria. In addition, parameters of concern for individual estuaries such as iron and copper were evaluated.

Potential areas of concern within the estuaries by water quality station were identified for each of the critical parameters. Water quality stations data were used if the sample size was greater than or equal to 12 to preclude the use of data with irregular sampling frequency over short time periods. Data from each of the water quality stations were categorized based on the percent of data values that exceeded the appropriate regulatory standard or screening level. Stations which have data with less than 10 percent of the total samples greater than the regulatory standard were shaded green. Data from stations with values that exceed the appropriate regulatory standard or screening level in 10-49 percent of the total samples were shaded yellow. Stations with values that exceed the appropriate regulatory standard or screening level in 50 percent or more of the total samples were shaded red.

Several factors can be responsible for elevated chlorophyll *a* or depressed dissolved oxygen values, including nutrient loading and/or low flushing rates within an estuary. Additionally, Boyer (2008) reported that "localized naturally low DO conditions are common due to stratification and inputs of large amounts of organic material from natural mangrove forests" (as cited in FDEP 2010). In regards to transparency, sediment loading or resuspension, algal blooms and/or elevated color values can cause a decline in Secchi depth values. Bacterial loads can be attributed to either human, pets or wildlife from point or non-point discharges. Iron discharges can be the results of natural groundwater discharges or could result from anthropogenic pollution, same as copper.

3.3.2 Results and Discussion

This section presents the results and a discussion of the FDEP impaired WBIDs, a water quality characterization for each estuary, and an evaluation of critical water quality parameters. The water quality characterization results and discussion are discussed separately for Wiggins Pass, Naples Bay, Rookery Bay, and the TTI estuaries.

The impairments identified by FDEP in the estuaries include dissolved oxygen, fecal coliform, iron, nutrients, and copper (**Figures 3-15 to 3-19).** Three (Wiggins Pass, Naples Bay and Rookery Bay) of the four estuarine receiving waters are verified impaired for both dissolved oxygen and fecal coliform bacteria by FDEP. Only the TTI is presently not listed as impaired for any water quality parameters. It is the only estuary in which average dissolved oxygen concentrations have remained above the regulatory standard of 4.0 mg/L for marine waters and fecal coliform concentrations have remained below 43 #/100 mL for a Class 2 water bodies. Rookery Bay was shown to be the only receiving water to have elevated chlorophyll *a* concentrations attributed to nutrient loads. Naples Bay is presently verified impaired for copper (>3.7 µg/L) and iron (>300 µg/L). The Wiggins Pass estuary has also been verified impaired for iron.

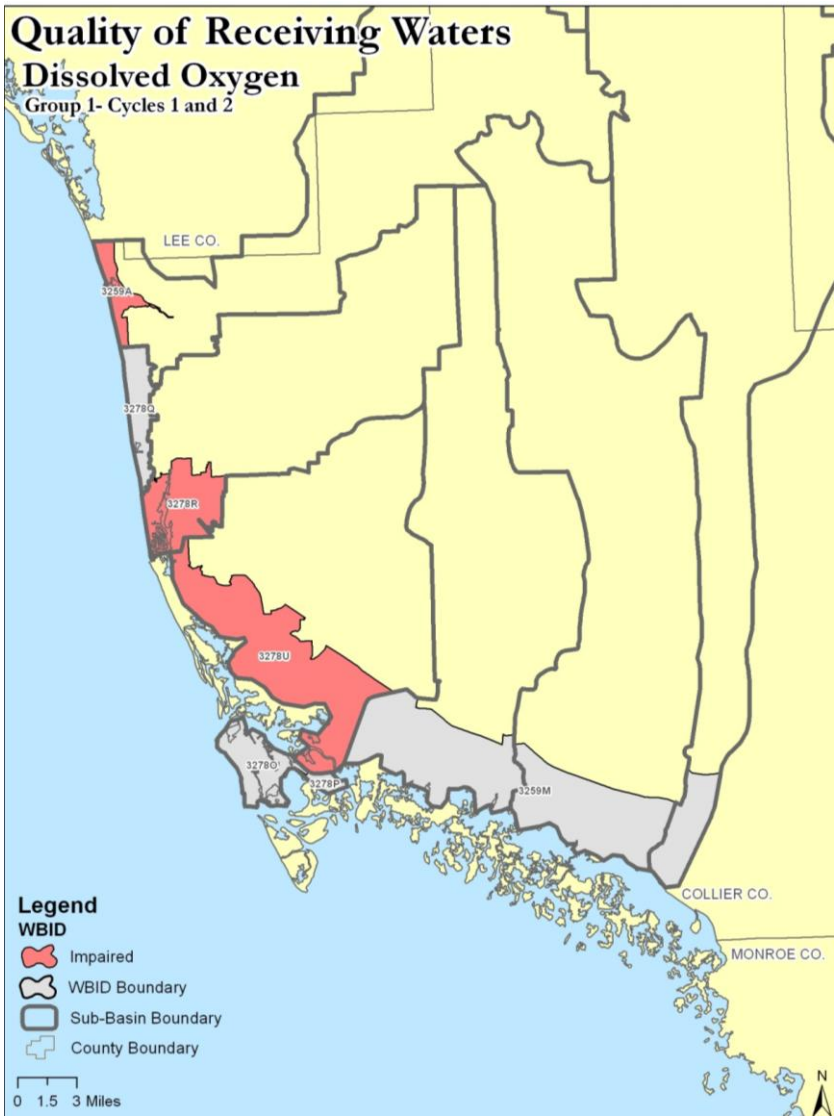

Figure 3-15. WBIDS verified impaired for Dissolved Oxygen in the estuarine receiving waters of the study area by FDEP

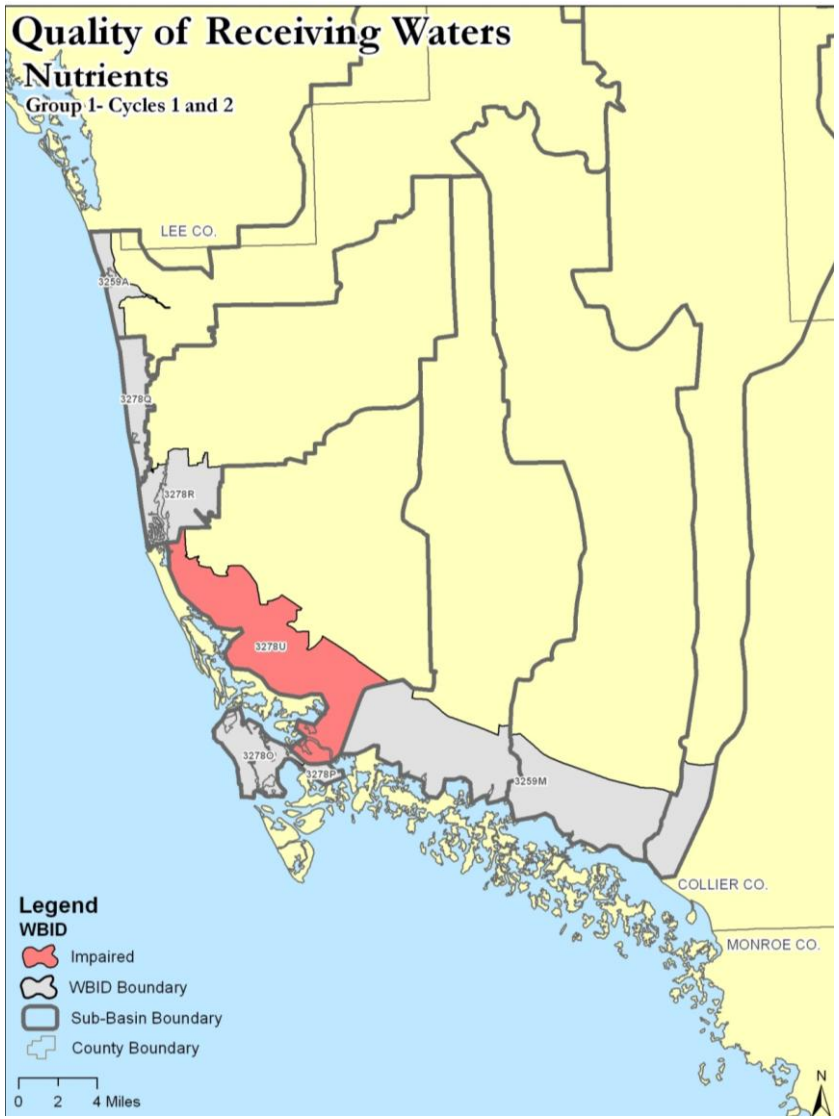

Figure 3-16. WBIDS verified impaired for Nutrients in the estuarine receiving waters of the study area by FDEP

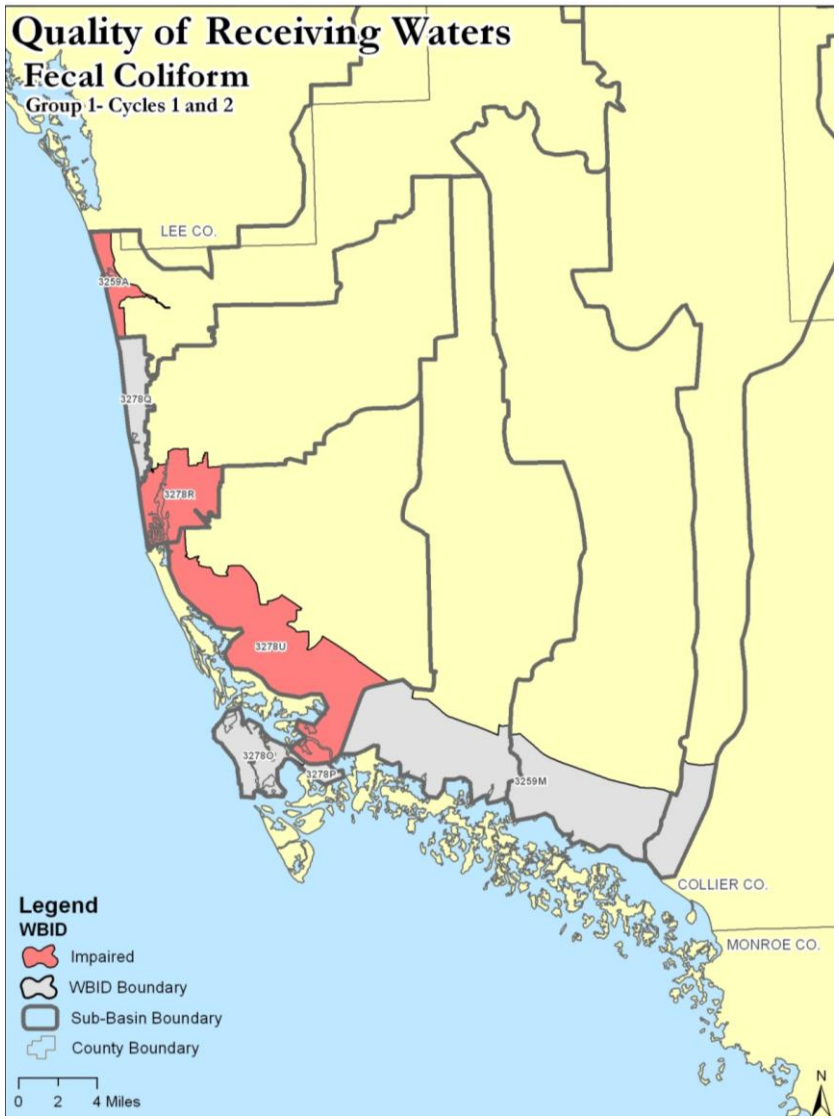

Figure 3-17. WBIDS verified impaired for Fecal Coliform in the estuarine receiving waters of the study area by FDEP

Figure 3-18. WBIDS verified impaired for Copper in the estuarine receiving waters of the study area by FDEP

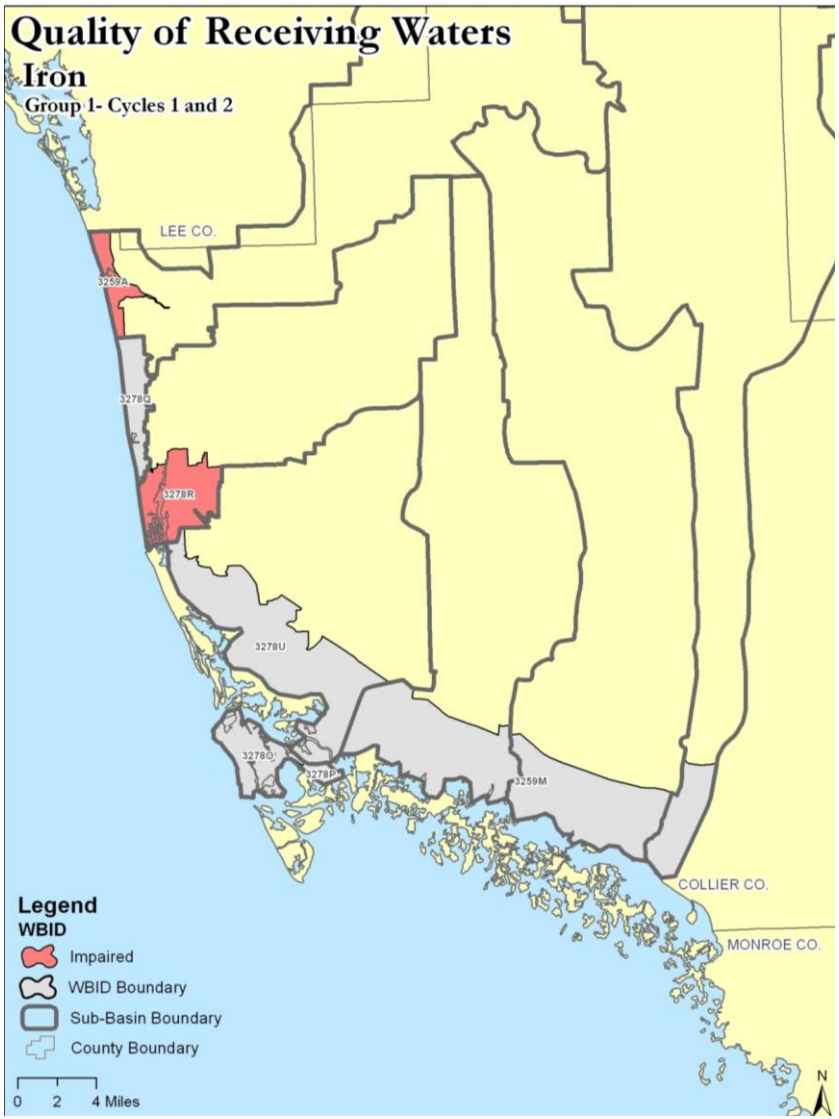

Figure 3-19. WBIDS verified impaired for Iron in the estuarine receiving waters of the study area by FDEP

Summary statistics for each water quality parameter, by station and watershed, were calculated for the four estuarine receiving water bodies. Four critical water quality parameters were identified to evaluate the estuarine water quality condition:

- chlorophyll-*a*
- dissolved oxygen
- transparency and
- Fecal coliform bacteria

The maps shows as **Figures 3-20 though 3-23** show water quality conditions by sampling station for each of the parameters. Secchi depth was used as the measure of transparency in the water body.

3.3.2.1 Wiggins Pass Estuary

Wiggins Pass is located within WBID 3259A (Cocohatchee River) and is presently listed as impaired for three water quality parameters; dissolved oxygen, fecal coliforms and iron. Wiggins Pass is the receiving water for the Cocohatchee-Corkscrew watershed. A total of eighteen water quality stations contain data for the parameters reviewed from 2000 to 2009 (**Table 3-16**). Summary statistics by station are available in **Appendix 4-D**. The water quality summary statistics for Wiggins Pass are presented in **Table 3-17.**

Table 3-16. List of stations with water quality data from 2000 to 2009 in Wiggins Pass (WBID 3259A)

Name	Name
21FLFTM 28030071FTM	28030036
21FLFTM EVRGWC0024FTM	BFBSP
21FLFTM EVRGWC0026FTM	COCEOF31
21FLFTM EVRGWC0041FTM	COCOR1
21FLFTM EVRGWC0042FTM	COCOR2
21FLFTM EVRGWC0081FTM	COCORVW
21FLSFWMROOK467	Canal@99thAve
28030009	Coco @ Collier Reserve
TURKBAY	Coco at SR 865

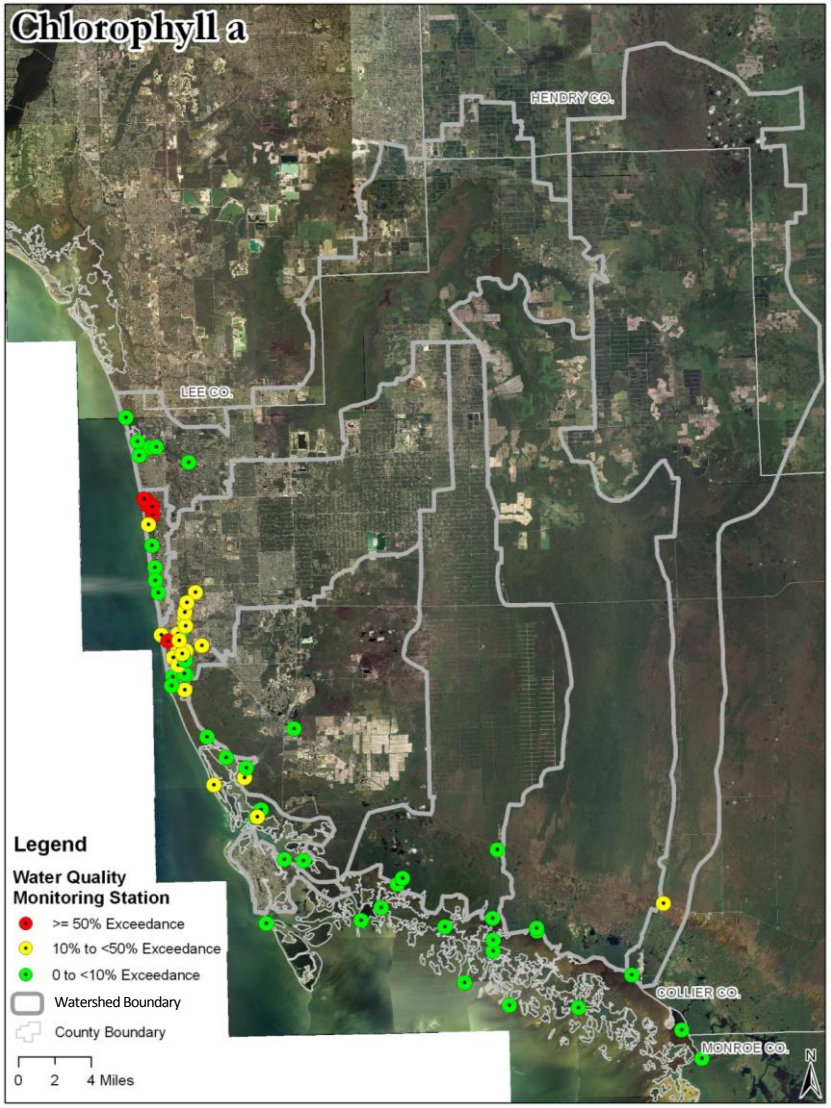

Figure 3-20. Chlorophyll *a* potential areas of concern by water quality station

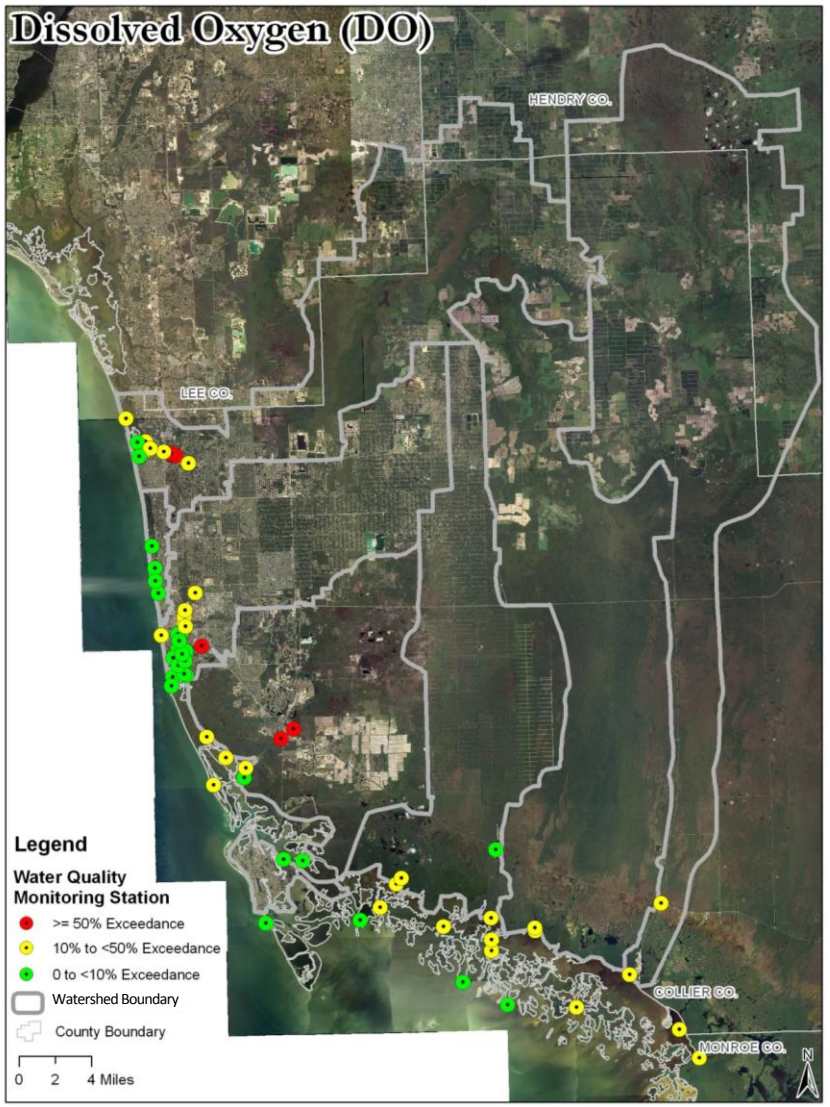

Figure 3-21. Dissolved Oxygen potential areas of concern by water quality station

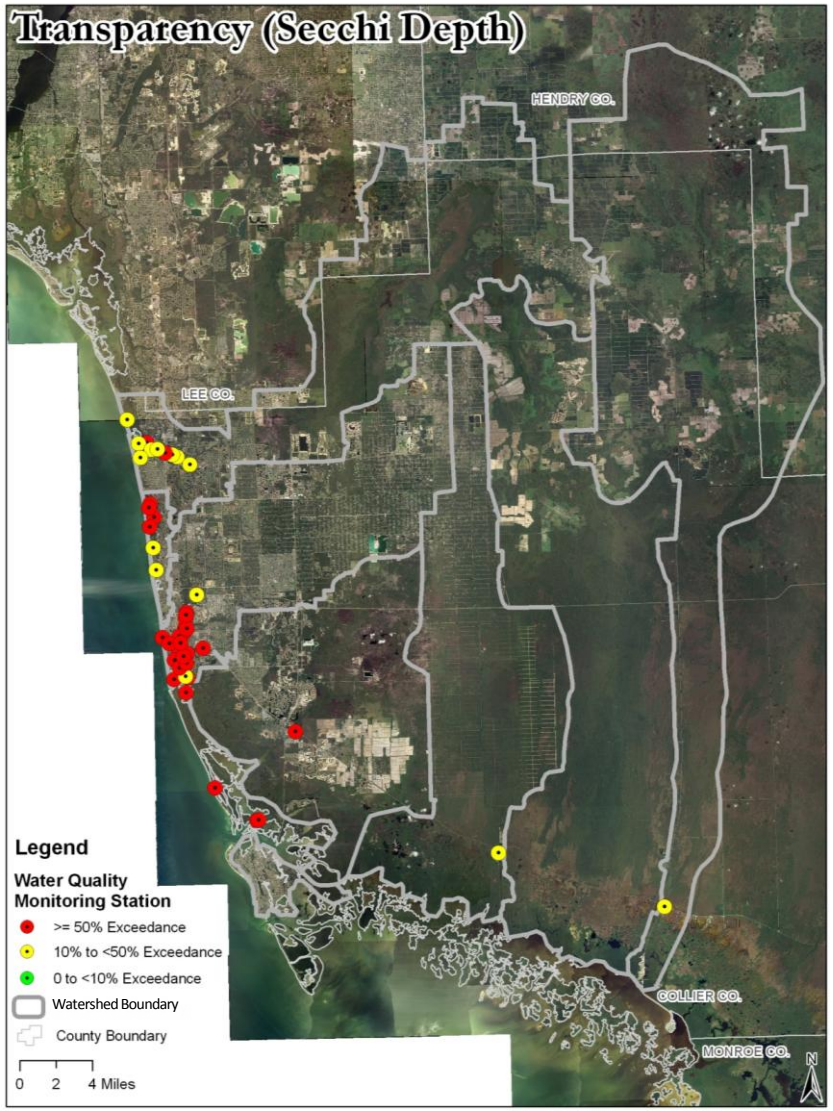

Figure 3-22. Transparency (Secchi Depth) potential areas of concern by water quality station

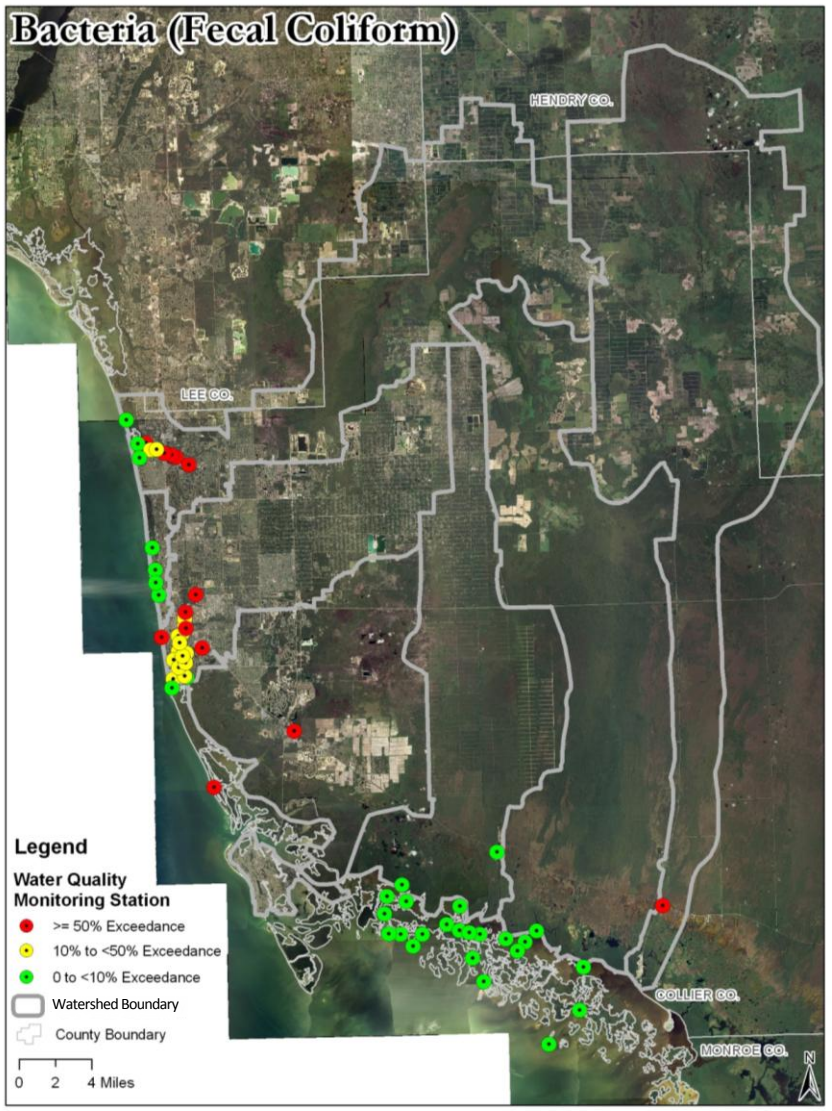

Figure 3-23. Bacteria (Fecal Coliform) potential areas of concern by water quality station

Table 3-17. Water quality summary statistics from 2000 to 2009 in Wiggins Pass (WBID 3259A)

Parameter	N	Min	Mean	Median	Max	Percent Exceed
BOD, mg/l	108	1.0	2.2	2.0	8.1	-
Chlorophyll-*a*, ug/l	209	1.0	4.5	3.0	70.0	6
Color, PCU	149	5	51	50	200	8
Conductivity, umhos/cm	282	305	28135	33990	57059	-
Copper, ug/l	75	0.51	1.95	1.65	7.60	4
DO, mg/l	340	0.1	5.1	4.9	19.4	29
Fecal Coliform, #/100 mL	260	1	187	62	5700	57
Iron, ug/l	72	35	290	239	840	40
Nitrate-Nitrite, mg/l	213	0.002	0.508	0.027	99	-
Orthophosphate as P, mg/l	122	0.004	0.018	0.012	0.140	-
Salinity, ppt	167	0.0	22.3	29.0	66.9	-
Secchi Depth, m	268	0.10	0.92	1.00	3.50	45
TKN, mg/l	150	0.08	0.74	0.78	2.00	-
Total Nitrogen, mg/l	181	0.05	0.72	0.74	2.09	1
Total Phosphorus, mg/l	210	0.004	0.046	0.036	0.310	0
TSS, mg/l	90	2.0	10.1	7.5	62.0	50
Turbidity, NTU	210	0.1	3.5	2.8	18.1	
Unionized Ammonia, mg/l	34	0.0001	0.0008	0.0008	0.0022	

Impaired WBID comparison

Using all of the water quality data for each WBID, Atkins confirmed the impairment status determined by FDEP for parameters identified in the Wiggins Pass Estuary (WBID 3259A) (**Table 3-18**).

Table 3-18. Impaired WBID comparison for Wiggins Pass estuary

WBID#	Water Segment Name	FDEP Impaired Parameter	PBSJ Analysis
3259A	Cocohatchee River	Dissolved Oxygen	Confirm FDEP assessment
3259A	Cocohatchee River	Fecal Coliform	Confirm FDEP assessment
3259A	Cocohatchee River	Iron	Confirm FDEP assessment

Chlorophyll a

Overall, chlorophyll *a* concentrations exceeded the regulatory 11 µg/L standard in 6 percent of the collected samples. The median chlorophyll *a* concentration was 3 µg/L with the maximum measuring 70 µg/L. These concentrations are within the allowable range for a marine water body and have remained consistently below the regulatory standard throughout the estuary (**Figure 3-20**).

Dissolved Oxygen

Dissolved oxygen values were less than 4.0 mg/L in 29 percent of the samples. The median DO concentration was 4.9 mg/L with a minimum value of 0.1 mg/L. Low dissolved oxygen levels appear to be evident in the upstream portions of Wiggins Pass, where stations were below 4 mg/L in more than 50 percent of samples reviewed. Depressed dissolved oxygen continued mid-estuary but less consistently with stations reporting values below the standard in 10-49 percent of samples (**Figure 3-21**). From this analysis it was confirmed that Wiggins Pass is impaired for dissolved oxygen (**Table 3-18**), although those stations with the most interaction with the Gulf of Mexico consistently met regulatory standards for dissolved oxygen.

The DO impairment could be attributed to decomposition of organic material from the adjacent wetlands and upstream landscapes (McCormick, 1997); however, elevated color and high total suspended solid concentrations were not observed in the downstream portion of these watersheds.

A causative factor for the low DO concentration could also be the presence of high concentrations of TN and TP. The median TN and TP concentrations in Wiggins Pass (0.74 and 0.05 mg/L, respectively) are lower than the screening levels per **Table 3-18**. In addition, although the TN concentration is slightly higher than the Estero Bay Wetland TN target (0.60 mg/L), the median TP concentration is below the 0.05 mg/L TP target from the Hendry Creek TMDL.

Based on the findings described above, further analyses may be necessary to identify the cause of the low dissolved oxygen concentrations.

Transparency (Secchi Depth)

Forty-five percent of the Secchi depth measurements were below the calculated screening level of 1.38 m indicating low visibility. The median Secchi depth was 1.00 m with a minimum of 0.10 m. No water quality station had consistent Secchi depth values greater than the screening level (**Figure 3-22**). Low Secchi depth values indicate poor light penetration which could lead to degradation of seagrass communities and other photosynthetic biota. Atkins believes that that the measured Secchi depth values may be low due to the limited flushing characteristics of the estuary and potentially the resuspension of bottom material.

Fecal Coliform Bacteria

Wiggins Pass is impaired by FDEP for fecal coliforms (**Table 3-18**). Fecal coliform concentrations in Wiggins Pass exceed the 43 #/100 mL regulatory standard for Class II waters in 57 percent of the samples. The median bacteria concentration was 62 #/100 mL and a maximum value of 5,700 #/100 mL. The water quality stations within the upper estuary exceeded 43 #/100 mL in >=50 percent of all samples reviewed (**Figure 3-23**). The frequency of elevated values decreases with proximity to the Gulf of Mexico. The decrease in frequency of elevated bacterial concentration is

possibly due to the high inactivation ("die-off") rate of both fecal coliforms and *E. coli* in saline waters (Anderson et al. 2005).

Though values exceed the regulatory standard, it should be considered that fecal coliform bacteria may not be an appropriate indicator for pathogenic diseases in sub-tropical environments such as South Florida where the specificity of the fecal coliform test is compromised by the more constant and warmer ambient water temperatures. The inability to specifically identify humans as a source of bacteria using traditional indicator testing protocols has been noted by Fujioka (2001) and Fujioka et al. (1999) for various tropical locations. Source identification studies are recommended to determine whether anthropogenic factors cause of the elevated bacteria concentrations. This is particularly important because uses of the Collier County estuaries are shellfish propagation and harvesting and monitoring for the presence of bacteria is important for public health concerns.

Iron

Computer model simulations indicate that groundwater represents almost 40 percent of the average annual flow in the Cocohatchee Canal and range between 30 percent in the wet season to65 percent in the dry season. Therefore, groundwater contributions to Wiggins Pass are significant and could be the cause for the elevated iron concentrations. However, because iron may also be of anthropogenic origin, more detailed source-identification studies may be warranted.

3.3.2.2 Naples Bay Estuary

Naples Bay is located within WBID 3278R (Naples Bay-Coastal Segment) and is presently listed as impaired for four parameters; dissolved oxygen, fecal coliforms, copper and iron. Naples Bay is the receiving water for the Golden Gate-Naples Bay watershed and Gordon River Extension A total of forty water quality stations are available which contain data for the parameters reviewed for the period 2000 to 2009 (**Table 3-19**). Summary statistics by station are available in **Appendix 4-D**. The water quality summary statistics for Naples Bay are presented in **Table 3-20.**

Table 3-19. List of stations with water quality data from 2000 to 2009 in Naples Bay (WBID 3278R)

Name	Name	Name
21FLBRA 3259G-B	21FLSFWMBC4	21FLNAPLNBAYBV
21FLBRA 3259G-C	AQS8-1	21FLNAPLNBAYCC
21FLBRA 3259G-D	BC2	21FLNAPLNBAYLLO
21FLBRA 3259G-E	Bay20	21FLNAPLNBAYNL
21FLFMRINTK200120	COL8	21FLSFWMBC1
21FLFTM 28030069FTM	COL9	ROOK464
21FLFTM28030031	ESBAY	Haldeman Bay
21FLGW14160	GORD10	JayceePark
21FLGW21751	GORD30	NaplesBay22
21FLGW22543	GORD31	NaplesBay24
21FLNAPLGORDJOE	GORD70	NaplesBay41
21FLNAPLGORDPK	Gord60	NaplesBay50
21FLNAPLNBAY13	Gord80	HC@Bayshore
21FLNAPLNBAY29		

Table 3-20. Water quality summary statistics from 2000 to 2009 in Naples Bay (WBID 3278R)

Parameter	N	Min	Mean	Median	Max	Percent Exceed
BOD, mg/l	500	0.3	2.1	2.0	12.0	-
Chlorophyll-*a*, ug/l	842	0.9	6.6	3.7	110.0	14
Color, PCU	719	5	45	40	200	41
Conductivity, umhos/cm	729	449	34163	42751	57220	-
Copper, ug/l	513	0.15	3.43	2.90	25.30	30
DO, mg/l	714	0.6	5.6	5.7	14.0	16
Fecal Coliform, #/100 mL	682	1	148	29	4700	43
Iron, ug/l	306	29	419	390	2530	65
Nitrate-Nitrite, mg/l	712	0.00	0.05	0.04	0.26	-
Orthophosphate as P, mg/l	596	0.004	0.021	0.018	0.081	-
Salinity, ppt	660	0.2	22.7	27.9	38.2	-
Secchi Depth, m	746	0.15	1.13	1.10	3.90	78
TKN, mg/l	683	0.04	0.60	0.60	5.90	-
Total Nitrogen, mg/l	766	0.01	0.63	0.63	17.00	10
Total Phosphorus, mg/l	823	0.004	0.046	0.040	0.310	0
TSS, mg/l	577	2.0	10.4	6.0	270.0	14
Turbidity, NTU	618	0.1	2.7	2.1	63.0	-
Unionized Ammonia, mg/l	0	-	-	-	-	-

Impaired WBID comparison

The current analysis confirmed the impairment status determined by FDEP for parameters identified in the Naples Bay Estuary WBID 3278R (**Table 3-21**).

Table 3-21. Impaired WBID comparison for Naples Bay estuary

WBID#	Water Segment Name	FDEP Impaired Parameter	Atkins Analysis
3278R	Naples Bay Coastal	Copper	Confirm FDEP assessment
3278R	Naples Bay Coastal	Dissolved Oxygen	Confirm FDEP assessment
3278R	Naples Bay Coastal	Fecal Coliform	Confirm FDEP assessment
3278R	Naples Bay Coastal	Iron	Confirm FDEP assessment

Chlorophyll a

Overall, chlorophyll *a* concentrations exceeded the 11 µg/L standard in 14 percent of the collected samples. The median chlorophyll *a* concentration was 3.7 µg/L, with the maximum measured value equal to 110 µg/L. The chlorophyll *a* data do not show evidence of excess phytoplankton production in Naples Bay (**Figure 3-20**).

Dissolved Oxygen

Naples Bay is impaired for dissolved oxygen by FDEP (Table 2-21). Concentrations in the Atkins data set were less than 4.0 mg/L in 16 percent of the samples. The median DO concentration was 5.7 mg/L with a minimum value of 0.6 mg/L. Low dissolved oxygen levels appear to be evident in the upstream portions Naples Bay where stations were below 4 mg/L in more than 50 percent of samples reviewed. Depressed dissolved oxygen levels continued mid-estuary but less consistently with stations reporting values below the standard in 10-49 percent of samples (**Figure 3-21**). Those stations with the most interaction with the Gulf of Mexico consistently met regulatory standards for dissolved oxygen.

TN and TP are potential causative parameters for low DO level. The median TN and TP concentrations in Naples Bay are lower than the screening criteria and lower than the targets established to address the DO impairment in Hendry Creek using the Estero Bay Wetlands (FDEP 2008). Therefore nutrient concentrations are likely not the cause for the DO impairment.

Another potential cause for the low DO levels could be related to the elevated total suspended solids (TSS) concentrations measured in the estuary. The measured results exceed water quality criteria 14% of the time. TSS may contribute to decreased DO concentrations if sufficient organic material is available for decomposition. The stratification caused by stormwater discharges and limited circulation in dead end canals may also contribute to depressed DO concentrations. More detailed evaluations are necessary to assess the cause of the DO impairment.

Transparency (Secchi Depth)

Transparency in the Naples Bay estuary appears to be the lowest of the Collier County estuaries. Seventy-eight percent of the Secchi depth measurements were below the calculated screening level of 1.38 m. The median Secchi depth was 1.10 m with a minimum of 0.15 m. No water quality station had consistent Secchi depth values greater than the screening level (**Figure 3-22**). As previously mentioned, Atkins believes that total suspended solid loads may be a concern for the Naples Bay estuary. High suspended solids loads may result in reduced water clarity and decreased Secchi depth values.

Fecal Coliform Bacteria

Naples Bay estuary was declared impaired by FDEP for fecal coliform concentrations. They exceed the regulatory standard of 43 #/100 mL in 53 percent of the samples (**Figure 3-23**). The median bacteria concentration was 29 #/100 mL and the maximum value was 4,700 #/100 mL. The majority of consistent exceedances occurred in the upper portion of each estuary. The frequency of elevated values decreases with proximity to the Gulf of Mexico. As with the other estuaries, the decrease in frequency of elevated bacteria concentrations is possibly due to the high inactivation ("die-off") rate of both fecal coliforms and *E. coli* in saline waters (Anderson et al. 2005).

Impairment for fecal coliform bacteria may not necessarily mean that there is an anthropogenic impact (Fujioka 2001, Fujioka et al. 1999). Bacterial loads from the watershed would provide a source of contamination to the estuary. However, none of the WBIDs discharging into Naples Bay have been declared impaired for fecal coliforms. Historically, elevated bacterial concentrations in Naples Bay may have been attributed to discharge from stormwater pipes (Staats, 1999).

Given the uncertainty as of the nature of the impairment, further source identification efforts are warranted.

Iron and Copper

Computer model simulations indicate that groundwater represents 43 and 24 percent of the average annual flow in the Golden Gate North canal and the Gordon River Extension, respectively. During the dry season, the groundwater contribution at those same locations increases to 52 and 32 percent, respectively. Therefore, groundwater contributions to Naples Bay are significant and could be the cause for the elevated iron concentrations. However, because iron may also be of anthropogenic origin, more detailed source-identification studies may be warranted.

Discharges of copper into the estuary could be from anthropogenic sources, such as its use as an algaecide to prevent algae growth. High measured concentrations could also result from the effects of copper leaching from boardwalks and pilings that are constructed from pressure-treated lumber. Detailed site-specific studies are also warranted.

3.3.2.3 Rookery Bay Estuary

Rookery Bay is located within WBID 3278U (Rookery Bay-Coastal Segment) and is presently listed as impaired for three parameters; dissolved oxygen, fecal coliforms, and nutrients. Rookery Bay is the receiving water for the Rookery Bay watershed. A total of thirty-nine water quality stations contain data for the parameters reviewed for the sampling period 2000 to 2009 (**Table 3-22**). Summary statistics by station are available in **Appendix 4-D**. The water quality summary statistics for Rookery Bay are presented in **Table 3-23.**

Table 3-22. List of stations with water quality data from 2000 to 2009 in Rookery Bay (WBID 3278U)

Name	Name	Name
21FLFMRINTK200121	21FLFTM EVRGWC0061FTM	HendersonCreek
21FLFMRINTK200122	21FLFTM EVRGWC0062FTM	HendersonCrk@41
21FLFMRINTK200123	21FLFTM EVRGWC0063FTM	JohnsonBay1
21FLFMRINTK200124	21FLGW13733	JohnsonBay2
21FLFMRINTK200129	21FLGW15163	JohnsonBay3
21FLFTM EVRGWC0027FTM	21FLSFWMHALDCRK	NTK200125
21FLFTM EVRGWC0028FTM	21FLSFWMROOK461	NTK200126
21FLFTM EVRGWC0029FTM	21FLSFWMROOK462	NTK200130
21FLFTM EVRGWC0030FTM	21FLSFWMROOK463	PORTAUPR5
21FLFTM EVRGWC0031FTM	BigMarcoRiver	ROOK458
21FLFTM EVRGWC0059FTM	COL10	ROOK459
21FLFTM EVRGWC0060FTM	DollarBay15	ROOK460
TarponBay1	UH	TarponBay

Impaired WBID Comparison

Using water quality data for each WBID, Atkins confirmed the impairment status determined by FDEP for two parameters identified in the Rookery Bay Estuary (WBID 3278U), dissolved oxygen and fecal coliforms (**Table 3-24**). The evaluation of chlorophyll *a* data indicated that values were not elevated frequently enough to classify the water body as impaired. The discrepancy in impairment classification could be due to the modified technique used to evaluate chlorophyll a, the data used or time period examined. However, Atkins also identified Rookery Bay estuary as potentially impaired for copper and iron.

Table 3-23. Water quality summary statistics from 2000 to 2009 in Rookery Bay (WBID 3278U)

Parameter	N	Min	Mean	Median	Max	Percent Exceed
BOD, mg/l	66	0.8	2.2	2.0	5.8	-
Chlorophyll-a, ug/l	691	0.8	5.9	4.3	74.0	10
Color, PCU	192	15	71	60	277	83
Conductivity, umhos/cm	521	125	29777	36345	60964	-
Copper, ug/l	84	0.25	5.94	1.71	51.00	38
DO, mg/l	771	0.6	4.9	4.8	20.6	31
Fecal Coliform, #/100 mL	166	1	136	80	1143	62
Iron, ug/l	79	16	340	240	1440	43
Nitrate-Nitrite, mg/l	453	0.0003	0.0170	0.0094	0.1440	-
Orthophosphate as P, mg/l	315	0.002	0.012	0.008	0.126	-
Salinity, ppt	779	0.1	24.3	27.7	41.4	-
Secchi Depth, m	267	0.15	1.06	1.04	2.59	82
TKN, mg/l	167	0.19	0.83	0.75	2.90	-
Total Nitrogen, mg/l	418	0.01	0.50	0.39	2.91	11
Total Phosphorus, mg/l	542	0.002	0.043	0.038	0.206	0
TSS, mg/l	127	2.0	5.5	2.0	70.0	6
Turbidity, NTU	670	-1.0	5.1	4.1	70.5	-
Unionized Ammonia, mg/l	0	-	-	-	-	-

Table 3-24. Impaired WBID comparison for Rookery Bay estuary

WBID#	Water Segment Name	FDEP Impaired Parameter	PBSJ Analysis
3278U	Rookery Bay Coastal	Dissolved Oxygen	Confirm FDEP assessment
3278U	Rookery Bay Coastal	Fecal Coliform	Confirm FDEP assessment
3278U	Rookery Bay Coastal	Nutrients (Chlorophyll a)	Not confirmed
3278U	Rookery Bay Coastal	Copper	Potential Impairment
3278U	Rookery Bay Coastal	Iron	Potential Impairment

Chlorophyll a

Overall, chlorophyll a concentrations exceeded the 11 µg/L regulatory standard in 10 percent of the collected samples (**Figure 3-20**) and no impairment was identified. . The median chlorophyll a concentration was 4.3 µg/L, with a maximum reported value of 74 µg/L. Some of these stations are landlocked or strongly affected by stormwater treatment systems. In those cases, they may have poor water quality but are not representative of the open waters of Rookery Bay or a significant source of nutrients to the estuary.

Dissolved Oxygen

As indicated previously, the estuary was declared impaired for low dissolved oxygen values by FDEP. The Atkins data set showed that dissolved oxygen concentrations were less than 4.0 mg/L in 31 percent of the samples. The median DO concentration was 4.8 mg/L, with a minimum reported value of 0.6 mg/L. Low dissolved oxygen levels appear to be evident in the upstream portions of Rookery Bay where stations were below 4 mg/L in more than 50 percent of samples reviewed (**Figure 3-21**). Depressed dissolved oxygen continued in the northern section of the estuary but less consistently with stations reporting values below the standard in 10-49 percent of samples. Those stations with the most interaction with the Gulf of Mexico consistently met regulatory standards for dissolved oxygen.

As DO concentrations may be affected by nutrient concentrations, TN and TP concentrations were compared to screening levels. The median TN and TP concentrations in Rookery Bay were found to be below the established screening values for Florida as well as those established for Hendry Creek using the Estero Bay Wetlands (FDEP 2008). The results of the comparative analysis suggest that nutrients do not appear to be the cause for the depressed DO levels.

Atkins believes that another cause for the low DO levels could be the stratification caused by stormwater discharges from the watershed. Given the uncertainty regarding the cause of the DO impairment, more detailed evaluations are necessary.

Transparency (Secchi Depth)

Eighty-two percent of the Secchi depth measurements were below the calculated screening level of 1.38 m. The median Secchi depth was 1.04 m with a minimum of 0.15 m. No water quality station had consistent Secchi depth values greater than the screening level (**Figure 3-22**). It is unclear what is causing the low secchi depth values. Atkins believes that the low values may be due to the low flushing characteristics of the estuary and resuspension of bottom material deposited in the discharge canals. In Addition, mangrove forests are abundant in Rookery Bay which may result in increased color which would be expected to diminish Secchi disk depths.

Fecal Coliform Bacteria

Rookery Bay is designated impaired by FDEP for elevated fecal coliform levels. For this analysis, the median bacteria concentration was 80 #/100 mL, with a maximum value of 1,143 #/100 mL. Sixty-two percent of all samples were greater than the regulatory standard of 43 #/100 mL for Class II water bodies. Both water quality stations examined within this estuary exceeded 43 #/100 mL in >=50 percent of all samples reviewed (**Figure 3-23**).

Bacterial loads from the watershed could be a source of the elevated concentration of fecal coliforms in the estuary. However, low bacterial loads are expected from the watershed (see TM

3.1: Quality of Discharge). As impairment for fecal coliform bacteria may not necessarily mean that it is caused by an anthropogenic impact (Fujioka 2001, Fujioka et al. 1999), source identification studies are warranted.

3.3.2.4 Ten Thousand Islands Estuary

The TTI is the receiving water for the Faka-Union, Fakahatchee, and Okaloacoochee/SR29 watersheds, which largely remain in undeveloped conditions. It is located within WBID 3259M (TTI) and is presently not listed as impaired for any parameter. The watershed largely remains in undeveloped conditions; therefore, no significant human activities affect the estuary system. A total of sixty-three water quality stations are available for the parameters reviewed from 2000 to 2009 (**Table 3-25**). Summary statistics by station are available in **Appendix 4-D**. The water quality summary statistics for TTI estuary are presented in **Table 3-26.**

Impaired WBID Comparison

No WBIDs were declared impaired by FDEP in the Ten Thousand Island estuary. Results of the analysis conducted herein for the critical water quality parameters are described below.

Chlorophyll a

Overall, chlorophyll *a* concentrations exceeded the 11 µg/L standard in 3 percent of the collected samples. The median chlorophyll a concentration was 3.0 µg/L with a maximum reported value of 47.5 µg/L. Only one station in the eastern portion of the estuary near the Tamiami Trail indicated values in exceedance of the standard in 10 to 49 percent of the samples (**Figure 3-20**). In general, chlorophyll a concentrations have remained consistently below the regulatory standard throughout the estuary.

Table 3-25. List of stations with water quality data from 2000 to 2009 in Ten Thousand Islands (WBID 3259M)

Name	Name	Name
187_Fakahatchee	21FLSFWMTTI53	SEAS007_Ferguson
21FLA 66011SEAS	21FLSFWMTTI65	SEAS010_IndianKey
21FLA 66038SEAS	21FLSFWMTTI67	SEAS028_Turtle
21FLFMRISTK200201	21FLSFWMTTI68	SEAS029_SnagShoal
21FLFMRISTK200205	21FLSFWMTTI69	SEAS034_DismalKey
21FLFMRISTK200208	21FLSFWMTTI70	SEAS035_SantinaBay
21FLFMRISTK200210	21FLSFWMTTI72	SEAS036_Pumpkin
21FLFMRISTK200211	21FLSFWMTTI74	SEAS037_Santina
21FLFMRISTK200212	21FLSFWMTTI75	SEAS111_Fakahatchee
21FLFMRISTK200214	21FLSFWMTTI76	SEAS112_Fakahatchee
21FLFMRISTK200216	BARRIVN	SEAS113_Fakahatchee
21FLFTM EVRGWC0001FTM	BL_Kwater	SEAS114_Fakahatchee
21FLFTM EVRGWC0002FTM	BRMouth	SEAS281_FishHawk
21FLFTM EVRGWC0003FTM	Bridge030122	SEAS299_Blackwater
21FLFTM EVRGWC0004FTM	COL14	SEAS300_Blackwater
21FLGW13734	COL15	SEAS301_ShellKey
21FLGW15173	COL16	SEAS302_SnagShoal
21FLSFWMROOK451	FAKAUPOI	SEAS303_Buttonwood
21FLSFWMTTI51	FU	SEAS401_FakaUnion
Fa-Aunion	STK200206	SEAS771_FakaUnion
FakahatcheeBay	PumpkinBay	Seas077

Table 3-26. Water quality summary statistics from 2000 to 2009 in the Ten Thousand Islands (WBID 3259M)

Parameter	N	Min	Mean	Median	Max	Percent Exceed
BOD, mg/l	52	0.6	1.9	2.0	8.3	-
Chlorophyll-a, ug/l	1113	0.5	4.0	3.0	47.5	3
Color, PCU	167	10	60	50	200	68
Conductivity, umhos/cm	9150	306	43007	48013	64190	-
Copper, ug/l	63	0.26	1.33	1.00	5.13	5
DO, mg/l	7593	0.2	5.0	5.0	20.3	24
Fecal Coliform, #/100 mL	431	1	56	1	2300	17
Iron, ug/l	66	65	233	180	980	15
Nitrate-Nitrite, mg/l	918	0.0005	0.0162	0.0108	0.1100	-
Orthophosphate as P, mg/l	319	0.002	0.012	0.009	0.054	-
Salinity, ppt	10132	0.2	28.1	31.4	43.4	-
Secchi Depth, m	190	0.20	1.52	1.55	2.90	41
TKN, mg/l	152	0.04	0.63	0.58	2.26	-
Total Nitrogen, mg/l	769	0.01	0.43	0.38	2.27	5
Total Phosphorus, mg/l	926	0.001	0.144	0.033	99	0
TSS, mg/l	130	2.0	6.9	2.0	113.0	8
Turbidity, NTU	9735	0.3	9.4	8.0	249.0	-
Unionized Ammonia, mg/l	0	-	-	-	-	-

Dissolved Oxygen

Dissolved oxygen concentrations were less than 4.0 mg/L in 24 percent of the samples. The median DO concentration was 5.0 mg/L with a minimum value of 0.2 mg/L. Low dissolved oxygen levels appear to be evident in the mid-estuary with stations reporting values below the standard in 10-49 percent of samples (**Figure 3-21**). While FDEP has not declared the WBID impaired for dissolved oxygen, the analysis completed by Atkins indicates that during the time period examined dissolved oxygen is a parameter of potential concern for the estuary. The elevated color and total suspended solids discharged from the contributing watersheds are likely responsible for the depressed dissolved oxygen values. However, as discussed in technical memorandum 1.2: In-stream water quality, low dissolved oxygen concentrations in this region are likely due to natural conditions (Diaz, 2011) associated with the extensive forested wetlands found in the adjacent watershed.

Transparency (Secchi Depth)

Forty-one percent of the Secchi depth measurements were below the calculated screening level of 1.38 m. The median Secchi depth was 1.55 m with a minimum of 0.2 m. Although limited data were available, those stations with sufficient data show values less than 1.38 m in 10-49 percent of all samples (**Figure 3-22**). Total suspended solid and color loads from the adjacent watersheds contribute to the reduced water clarity in the TTI estuary.

Fecal Coliform Bacteria

Fecal coliform concentrations exceed the regulatory standard of 43 #/100 mL in 17 percent of the samples. The median bacteria concentration was 1 #/100 mL with a maximum value of 2,300 #/100 mL. While FDEP has not declared the WBID impaired for fecal coliforms, the analysis completed by Atkins indicates that one water quality station in the eastern portion of the estuary exceeded 43 #/100 mL in >=50 percent of all samples reviewed (**Figure 3-23**). The remainders of the water quality stations were consistently below the regulatory standard. If the fecal coliform concentration results in water quality impairment in the future, additional water quality sampling to identify the potential bacteria sources to the estuary would be warranted. In addition, impairment for fecal coliform bacteria may not necessarily mean that there is an anthropogenic impact as the cause (Fujioka 2001, Fujioka et al. 1999).

3.3.3 Conclusions

Water quality impairments identified by FDEP were generally confirmed by results of analyses completed for the estuaries water quality evaluation. Only one discrepancy was identified in a comparison of the FDEP and Atkins derived impaired WBIDs. FDEP verified Rookery Bay estuary (WBID 3278U) as impaired for chlorophyll a; however, Atkins did not reach the same conclusion. The discrepancy is likely due to the modified method utilized by Atkins as well as the data set and time period analyzed. A more extensive review of this impairment is recommended.

Recommendations were developed based on the results of this evaluation to address dissolved oxygen and chlorophyll *a* impairments and source identification for fecal coliforms in some cases. It is recommended that Collier County work with FDEP to determine whether the impairment for dissolved oxygen in Wiggins Pass, Naples Bay and Rookery Bay is naturally occurring due to wetland influences, or due to groundwater contributions from the extensive canal system, or whether low dissolved oxygen levels are due to anthropogenic pollutant loads. While these three estuaries have been declared verified impaired by FDEP for dissolved oxygen, it is important to note that many of the "reference sites" used by FDEP to establish background levels of nitrogen and phosphorus also "fail" FDEP's default dissolved oxygen standard. In addition, levels of the potentially causative nutrients TN and TP are only infrequently above relevant screening criteria. In Atkins' opinion, it is likely that factors other than nutrient enrichment alone influence concentrations of chlorophyll *a* and levels of dissolved oxygen.

Site specific alternative criteria might be a useful tool to address chlorophyll *a* and dissolved oxygen impairment conditions if it is proven that the problem is not caused by anthropogenic pollutant loads.

Additionally, Collier County should work with FDEP to develop a directed sampling effort focusing on identifying potential sources (including non-anthropogenic ones) of fecal coliform bacteria in Wiggins Pass, Naples Bay, and Rookery Bay, perhaps as part of FDEP's TMDL and/or Basin Management Action Plan (BMAP) programs. Further assessments are needed to determine whether or not levels of iron and copper are indicative of anthropogenic influences in Collier County's estuaries. Given the extent of groundwater contributions to the estuaries, iron concentrations may reflect groundwater sources rather than anthropogenic contamination.

3.4 COASTAL HABITATS

The loss of natural functions in Wiggins Pass, Naples Bay, Rookery Bay, and the Ten Thousand Islands estuaries (**Figure 3-24)** that has occurred over time due to hydrologic alterations is addressed in this section of the CCWMP. Specifically, the historical (i.e. natural) timing and volume of freshwater discharges to these four estuaries have been altered due to excess freshwater deliveries to the systems. The result of these alterations includes the reduced areal extent (acres) of oyster bars, seagrass beds, mangrove forests and salt marshes in the estuaries. This section specifically addresses Element 2, Task 4 in the CCWMP SOW.

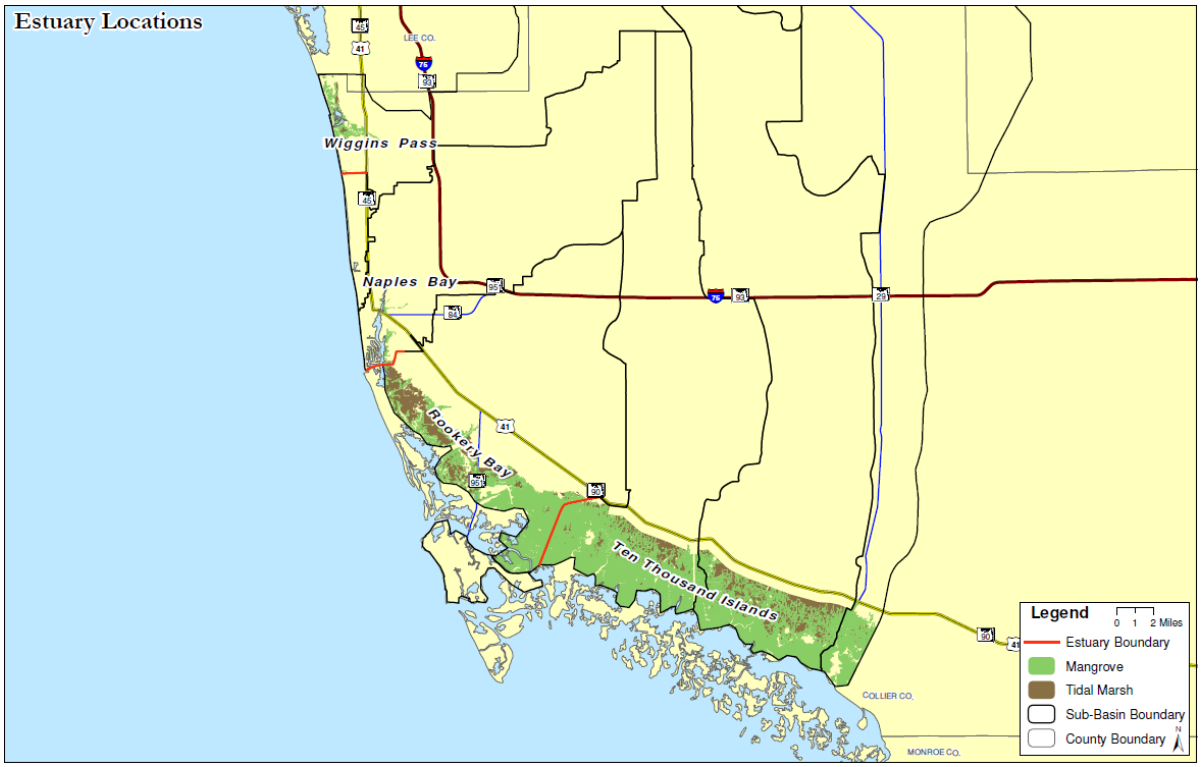

Figure 3-24. Estuary Locations

3.4.1 Introduction and Objective

Estuaries provide many ecosystem functions, including shoreline stabilization, nutrient recycling, and habitat for a diverse assemblage of plants and animals. Within Collier County, coastal ecosystems have been impacted by altered timing and volumes of freshwater inflow (e.g., Browder et al. 1988, Shirley et al. 1997, Shirley et al. 2005, Popowski 2006, etc.) and direct physical destruction (Shirley et al. 1997). A less frequently mentioned impact is degradation due to nutrient enrichment, a topic discussed by Shirley et al. (1997).

Many of the large-scale hydrologic alterations in Collier County began in the early 1950s. Dredge-and-fill became the established method to meet the post-World War II demand for housing. Canals

were used to create waterfront property, increase access for boating, and provided fill material needed for buildable lots (Antonini et al 2002). Increased impermeable surfaces due to coastal development have subsequently increased freshwater inputs from the watershed. Changes to the timing and volume of freshwater discharges to the estuaries have been dramatic when compared with historical conditions, the primary problem being the delivery of too much fresh water during the wet season and too little during the dry season (e.g., Browder et al. 1988, Shirley et al. 1997). As a result, the historical areal extents of oyster bars and seagrass beds have been reduced by salinity alterations, increased shading due to decreased water clarity, and increased sediment deposition in communities. The tidal mangrove habitat has also been directly affected by coastal development and hydrologic alterations to the salinity regime (Doyle et al 2003, Popowski 2006).

3.4.2 Methods

Several GIS databases were queried, and relevant data compiled, to quantify the changes, if any, in the spatial extent of oyster bars, seagrass beds, mangrove forests, and salt marshes in Wiggins Pass, Naples Bay, Rookery Bay, and the TTI estuaries. GIS databases searched included those from the SWFWMD (i.e., Duever 2004 and others) and the Florida Freshwater Fish and Wildlife Conservation Commission. The data available differed among the four estuaries examined.

Wiggins Pass GIS data were available for 1999 for oysters, seagrass data were found for 2006, tidal marsh data were available for pre-development and current (2007) time periods, and mangrove data were available for both pre-development and 2007 time periods.

In Naples Bay, GIS data were acquired for both oysters and seagrass for the years 1953 and 2005. Data on both tidal marshes and mangrove forests were available for both pre-development and 2007 time periods.

For Rookery Bay, GIS data were available for both tidal marshes and mangrove forests for both pre-development and 2007 time periods. No GIS data on the spatial extent of oysters and seagrasses were found, although reports in which locations of oyster reefs and seagrass beds that had been encountered were found, although these sources were insufficient for a GIS-based analysis of spatial trends.

In the TTI, GIS data for both tidal marshes and mangrove forests for both pre-development and 2007 time periods were found. As in Rookery Bay, no GIS data were found that would allow for a detailed assessment of the changes (if any) in the spatial extent of oysters and seagrasses, although reports were found that referenced locations at which oyster reefs and seagrass beds had been encountered.

The report *Seagrass Status and Trends in the Northern Gulf of Mexico* (Handley et al. 2007) identifies the coastal waters of Collier County as the only region on both east and west coasts of Florida without seagrass acreage estimates. In general, the lack of GIS data for seagrasses and oysters in

much of Collier County may be due to the reduced water clarity in many coastal waters, making delineation of features from aerial photography a difficult task to accomplish.

Trend analysis in the estuaries depends on the availability of an accurate assessment of the spatial extent of various landscape features at the earliest time possible. For Collier County, the previously described PDVMs developed by Duever (2004) allow for a comparison of more recent landscapes with a "pre-development" condition. However, that pre-development conditions mapping effort did not include the islands south and west of the mainland of Collier County, particularly in the region of the TTI. Therefore, GIS comparisons are limited to those regions along the mainland portion of Collier County. While this is unfortunate, most of the alterations in natural system features over time have occurred along the mainland shoreline in response to coastal development, not on the offshore islands of the TTI estuary, with the exception of the large-scale development of Marco Island.

3.4.3 Results and Discussion

This section presents the results of the GIS-based land cover analysis conducted as part of this project for each of the four estuaries, Wiggins Pass, Naples Bay, Rookery Bay and the TTI.

3.4.3.1 Wiggins Pass

Wiggins Pass was first officially dredged in 1952, and dredging continues in the inlet and along the inland waterway south of Bonita Beach and north of Naples Park. Coastal development surrounding Wiggins pass began in the early 1950s and included creation of residential canals that subsequently altered natural sheet flow of stormwater runoff into the estuary. As shown in **Figure 3-25,** the area adjacent to Wiggins pass has shifted from a mangrove dominated system to both tidal marsh and mangroves and an overall decrease in the mangrove community has occurred due to direct loss due to coastal development.

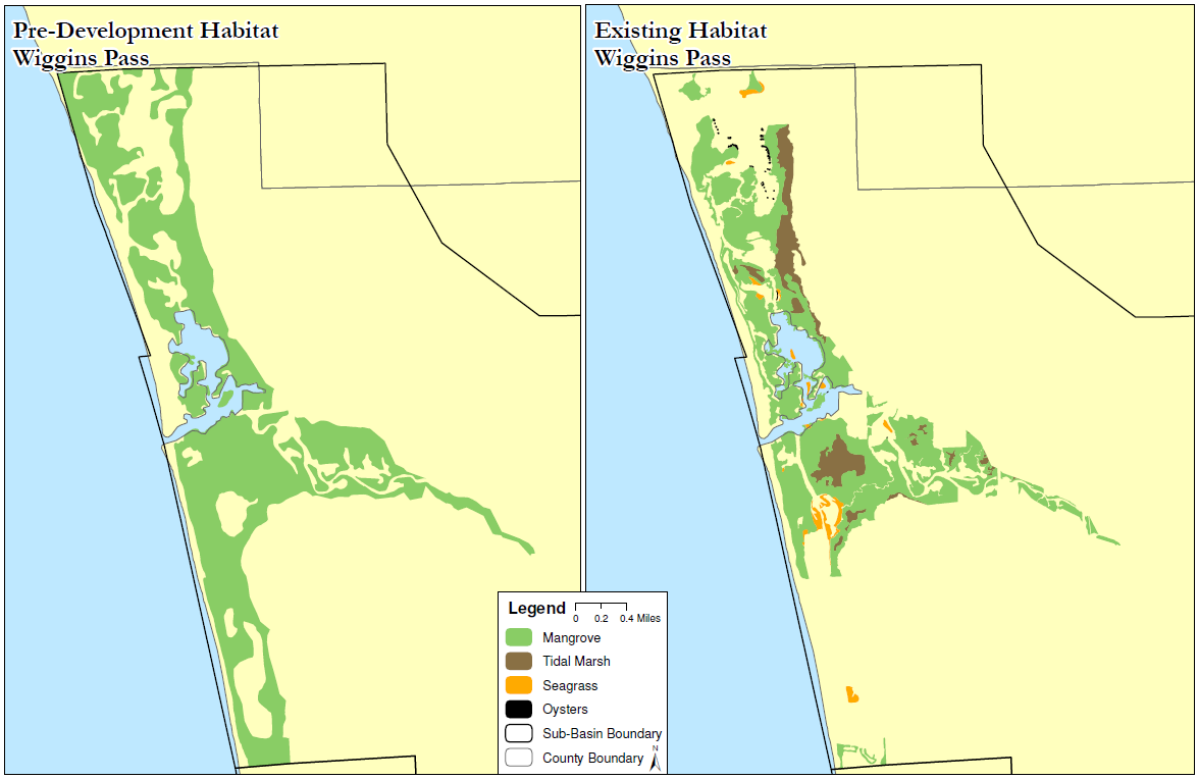

Figure 3-25. Wiggins Pass Estuarine Communities
(GIS data from SFWMD and the FWRI)

Areal extent (acres) of mangroves in the Wiggins Pass estuary boundaries decreased from 1,660 in pre-development times (Duever 2004) to 999 acres in 2007, a decline of approximately 40 percent (**Table 3-27)**. Tidal marsh habitat was not mapped for pre-development conditions in the Wiggins Pass estuary boundaries, but it accounted for 183 acres in 2007 (**Table 3-27)**. Due to natural succession shifts between mangroves and salt marshes (Lewis and Streever, 2000); analysis was focused on examining the combined acreage of the two communities, rather than each one separately. With this approach, a decrease from 1,660 acres in pre-development years to 1,182 in 2007, a decline of 29 percent, occurred in mangroves and tidal marshes in the Wiggins Pass estuary.

Table 3-27
Wiggins Pass Estuarine Communities Changes (Acres)

Community	Pre-Development	Current	Acres Lost	Percent Loss
Oyster (1999)	No Data	5	NA*	NA
Seagrass (2006)	No Data	39	NA	NA
Tidal Marsh (Pre-Dev vs. 2007)	0	183	477	29
Mangrove (Pre-Dev vs. 2007)	1,660	999		
NA=not applicable due to missing data				

No GIS data sources of oyster resources were located other than a 1999 coverage obtained from the Fish and Wildlife Research Institute (FWRI). **Figure 3-25** depicts several small patches of oysters in the northern portion of Wiggins Bay in 1999. **Figure 3-25** also shows the location of seagrasses from a data layer compiled in 2006 by the FWRI. These limited oyster and seagrass data provide a potential baseline of information for identifying future changes in estuarine conditions.

3.4.3.2 Naples Bay

Historic maps and records indicate that Naples Bay was a shallow estuarine system with mangrove islands surrounded by oysters and seagrass beds (Antonini et al. 2002, Schmid et al. 2006). Historically, extensive oyster bars occurred along the shorelines and at the mouth of Naples Bay's many tidal creeks. Seagrass beds were also noted in the historical record (Schmid et al 2006).

Dredging activities conducted to create the system of residential development dramatically altered the tidal flushing patterns and the overall function of the bay (Schmid et al 2006). The length of shoreline associated with Naples Bay increased by nearly 50 percent between 1927 and 1965, followed by an additional increase of 11 percent between 1965 and 1978. The increase in shoreline length is directly related to the construction of residential canal systems. In addition, Schmid et al. (2006) documented a 91 percent loss in seagrass habitat and 82 percent loss in oyster habitat since the 1950s.

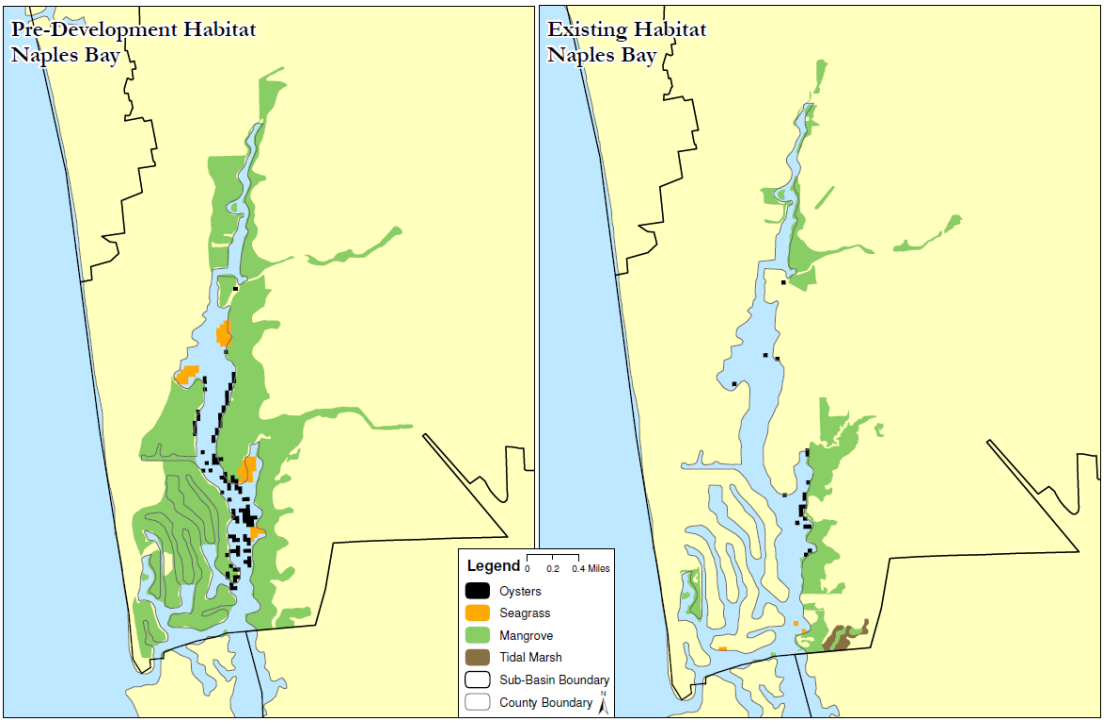

Figure 3-26. Naples Bay Habitat Changes
(GIS data from SFWMD and the FWRI)

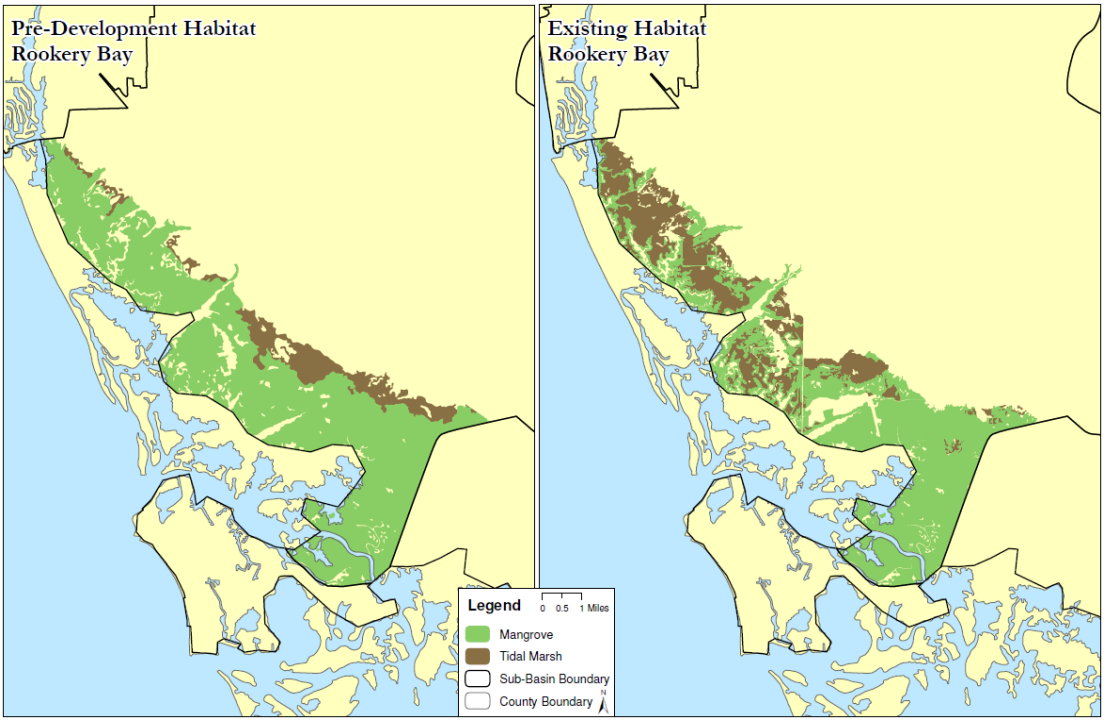

Figure 3-27. Rookery Bay Mangroves and Salt Marshes
(GIS data from SFWMD)

The loss of oyster coverage is mapped in **Figure 3-26** and illustrates past widespread distribution of oysters in 1953, now restricted to scattered locations along the eastern shoreline south of Haldeman Creek. **Figure 3-26** also shows the decrease in natural shoreline vegetation, particularly the mangrove fringe. Schmidt et al. (2006) reported that 70 percent of the fringing mangrove shoreline of Naples Bay has been converted to residential developments. This is consistent with the GIS analysis results listed in **Table 3-28**, in which a 76 percent decline in combined mangrove and tidal marsh acreage was estimated between the pre-development and 2007 time periods (1,549 and 367 acres, respectively) in the Naples Bay estuary.

Table 3-28. Naples Bay Estuarine Community Changes (Acres)

Community	Pre-Development	Current	Acres Lost	Percent Loss
Seagrass (1953 vs. 2005)	51	2	48	95
Oyster (1953 vs. 2005)	68	12	55	82
Tidal Marsh (Pre-Dev vs. 2007)	0	20	1,182	76
Mangrove (Pre-Dev vs. 2007)	1,549	347		

3.4.3.3 Rookery Bay

The Rookery Bay watershed has also been altered by channel creation, and present estuarine salinity regimes are more strongly influenced by canal management than by tides or rainfall

(Shirley et al 2004). Resulting alterations to freshwater inflows have been identified as the most important threat to the natural biodiversity of this area (Shirley et al., 2004).

Based on the rates of vertical accretion in the mangrove communities in Rookery Bay, mangrove forest elevations have kept pace with sea level rise over approximately the past 70 years (Cahoon and Lynch 1997). This finding supports the importance of mangroves as a means of stabilizing shorelines and preventing erosion in coastal regions. **Figure 3-27** illustrates the transition of the mangrove community into salt marsh in some locations, a finding at odds with the pattern described by Popowski (2006). This transition could be the result of natural cycles of succession, or the "transition" could be a mapping artifact associated with delineating the boundaries of tidal marshes in the pre-development vegetation data layers (i.e. Duever 2004).

Overall, Rookery Bay has had a decrease in acres of mangrove and salt marsh habitat of within its estuary boundaries, from 17,866 acres in pre-development times to 15,697 in 2007, a decline of 12 percent (**Table 3-29**).

Table 3-29. Rookery Bay Estuarine Community Changes (Acres)

Community	Pre-Development	Current	Acres Lost	Percent Loss
Tidal Marsh (Pre-Dev vs. 2007)	2,131	5,122	2,170	12
Mangrove (Pre-Dev vs. 2007)	15,735	10,575		

3.4.3.4 Ten Thousand Islands

The spatial and temporal variation in salinities in the Ten Thousand Island estuary has been significantly and adversely affected by upstream water management practices (Browder et al. 1988, Shirley et al. 1997, Shirley et al. 2005, Popowski 2006). Two major examples of large-scale hydrologic alteration are the Tamiami Trail Canal, which intercepts inflows from the north and passes them through a fixed number of bridges and box culverts underneath Tamiami Trail (Popowski, 2006) and the Golden Gate Estates canal system, which discharges more than 10 times the volume of freshwater into Naples Bay during the wet season than prior to construction of the canal network (Section 3.1).

The TTI estuary consists of mangrove islands, oyster beds, and shallow lagoons (Wanless et al 1994). As depicted in **Figure 3-28**, the TTI mangrove system appears to have been slightly reduced in areal extent, but has also undergone an apparent transition into tidal marsh habitat when comparing the PDVM data to 2007 data. This finding is in contrast to the pattern of an increase in mangrove coverage, at the expense of tidal marsh, cited by Popowski (2006). As described previously, a shift from mangrove to salt marsh, or vice versa, could be due to natural succession, or it could be an artifact associated with the difficulty of accurately locating GIS based features in the pre-development vegetation data layer used for this analysis.

As with the other estuaries examined, the status and trends of the areal extent (acres) of salt marsh and mangroves (combined) was examined. These data (**Table 3-30**) indicate a decrease in combined salt marsh and mangrove extent from 40,405 acres in pre-development times to 38,490 acres in 2007, a decline of 5 percent (**Table 3-30**). North of Tamiami Trail, a more substantial loss in mangrove and salt marsh extent was identified — a 13 percent reduction from pre-development to current conditions.

Table 3-30. Ten Thousand Islands Estuarine Community Changes (Acres)

Community	Pre-Development	Current	Acres Lost	Percent Loss
Tidal Marsh (Pre-Dev vs. 2007)	2,711	7,737	1,916	5
Mangrove (Pre-Dev vs. 2007)	37,694	30,753		

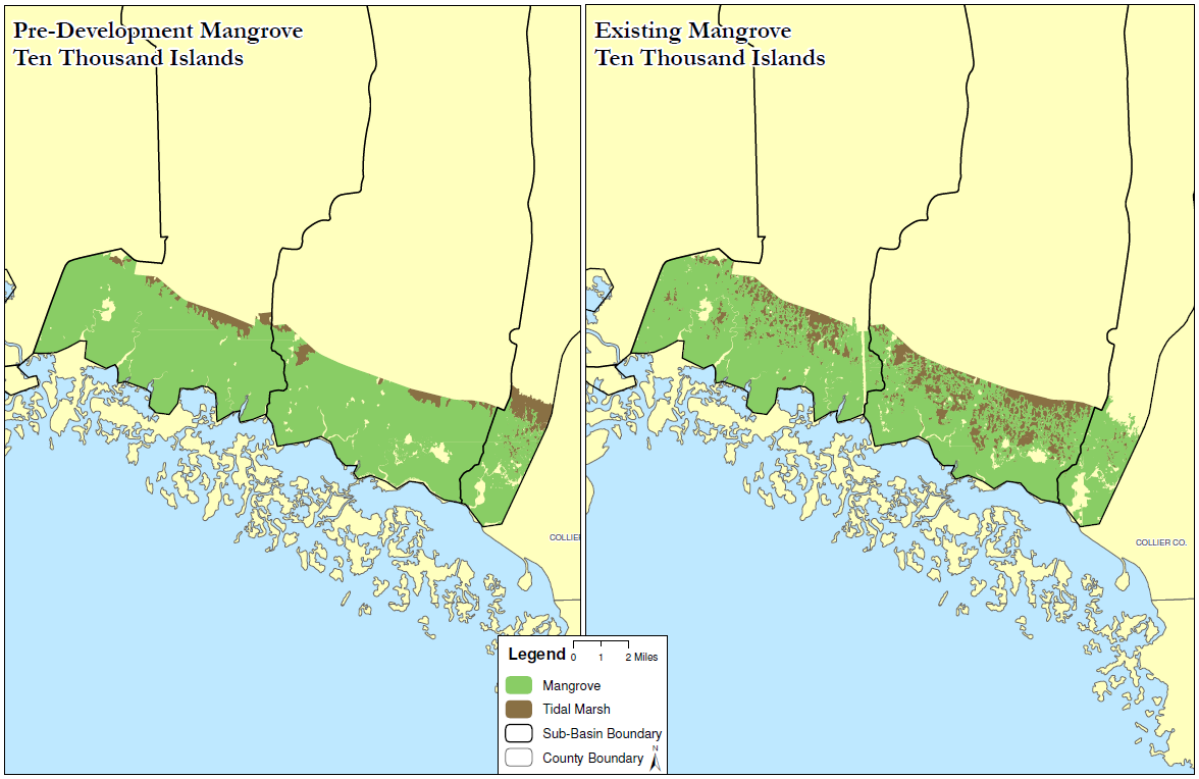

Figure 3-28. Ten Thousand Islands Mangroves and Tidal Marshes
(GIS data from SFWMD)

3.4.4 Conclusions

The extent of coastal habitats along the Collier County's coast line increases from north to south, commensurate with the decrease in coastal development. In Wiggins Pass, the most northern estuary, acres of salt marsh and mangroves have declined by 29 percent when compared with pre-

development conditions. To the south, in Naples Bay, the extent of salt marsh and mangroves has declined by approximately 76 percent. In contrast, salt marshes and mangroves in the less developed estuaries of Rookery Bay declined by 12 and 5 percent, respectively, from pre-development to current conditions. Less development along the coastal reaches of the Rookery Bay estuary reflects the protection of this area through various land acquisition activities (e.g., the 110,000 acre Rookery Bay National Estuarine Research Reserve).

Documenting changes over time in the extent of oyster reefs and seagrass beds is more difficult due to the limited availability of data. The coastal waters of Collier County are mostly unique for the absence of any seagrass bed delineations and/or quantification compared with other coastal Florida waters (Handley et al. 2007). These data were available only for Wiggins Pass and Naples Bay, and historical data were available only found for Naples Bay. In Naples Bay, the areal extent of oyster reefs has declined by 82 percent from the 1950s, with seagrass coverage down by 95 percent. In Wiggins Pass, oysters and seagrass meadows are not wide-spread features of these estuaries, yet it is not known if their declines over time have been as substantial as that found in Naples Bay. Using side-scan sonar, Locker (2005) found substantial meadows of seagrass, mostly *Halophila decipiens*, in Fakahatchee Bay, but little evidence of anything other than small isolated patches of seagrass within Faka Union Bay. Locker (2005) also recorded "…anthropogenic mud layer blankets much of the bay due to flushing of organic-rich fines from the Faka Union Canal due to high-velocity freshwater inflows."

Based on this information, estuarine habitats in Collier County coastal areas have been impacted by alterations in the timing and quantity of freshwater inflows as well as direct physical impacts of increased development and shoreline disturbance/loss in the more urbanized estuaries (e.g., Wiggins Pass and Naples Bay. For Wiggins Pass and Naples Bay, re-creating more natural freshwater inflows may not be sufficient for restoring historical estuarine functions (i.e. habitats), since oyster reefs and seagrass meadows have been displaced by coastal development. In contrast, much of the historical extent of tidal marshes and mangroves remains intact in Rookery Bay and the TTI. Therefore, restoration of historical freshwater inflows for the less-developed Rookery Bay and TTI estuaries may provide a more effective management action to address the loss of coastal habitats in Collier County.

4.0 DEVELOPMENT OF PERFORMANCE MEASURES

Performance measures were developed for freshwater discharge to estuaries, pollutant loads, aquifer recharge, and natural systems using the same approach of comparing pre-development with existing conditions to establish a performance score against which to evaluate the success of proposed projects.

Performance measures are tools based on a set of indicators used in project planning to predict (or evaluate) the degree to which proposed alternative plans are likely to meet restoration objectives and to assess the success of implemented plans in meeting restoration objectives (CERP 2006). Most performance measures for the Everglades restoration projects were developed through conceptual models that identified key stressors and attributes of the natural system. Attributes are biological and resource protective indicators in the natural system that respond to effects of stressors. Performance measures for other water-related needs of the system, such as water supply and flood control to meet urban and agricultural needs, are derived from state and federal laws.

The intent of the performance measures developed for the CCWMP was to maintain consistency with this concept, as developed by the CERP program. Therefore, performance measures for freshwater discharge to the estuaries, aquifer recharge/yield, and natural systems were developed based on the concepts outlined below.

- The performance measure must address indicators that represent attributes or stressors of natural or human systems that (the proposed project or management action) is expected to affect
- The performance targets, e.g. improved water quality, must reflect the desired restoration condition, which is the maximum level of restoration possible given the existing development conditions
- The performance measure must provide an understanding of system-wide responses relative to how project implementation will meet improvement and/or restoration goals, while not being so unwieldy and costly that system-wide modeling and monitoring programs cannot be sustained over many years

The approach to developing the performance measures was based on “restoring” the system as close as possible to the original condition, within the constraints of existing development, and given the constraints of funding.

The maximum level of restoration, then, would be pre-development conditions. The NSM was used to provide the pre-development, or baseline condition. The County’s ECM was used to characterize existing conditions. The difference between the two gives the total restoration possible, without restraints of existing development and cost and provides a means of evaluating the improvement, or “lift” anticipated as a result of implementing a project.

Performance measures for each of the components examined, i.e. freshwater discharge, aquifer recharge, pollutant load, and natural systems, were developed using this approach. Development of individual performance measures are presented in the following sections.

4.1 NATURAL SYSTEMS WATER BUDGETS AND SEASONAL WATER LEVELS

Functional assessment scores, or performance measures, were calculated for the watersheds in Collier County. Average scores are lower for the Golden Gate-Naples Bay watershed due to extensive canals systems and development and suggest that hydrologic restoration may provide the greatest opportunity for measurable improvement in functional value in the County.

4.1.1 Introduction

The performance measure development the natural systems component of the CCWMP was accomplished as part of the *Functional Assessment*. Under this task, pre-development and current conditions were compared and losses and conversions of native plant communities in Collier County watersheds over the past 50–60 years were estimated via a change analysis of land use cover data. The 1942 Collier County soils map provided additional data to characterize pre-development characteristics in the watersheds. The vegetation and soils data are reported and analyzed for the first three watersheds individually and the other three watersheds collectively.

4.1.2 Methods

Results of an analysis of changes in areal extent of natural communities and the causes of those changes are reported here and used to evaluate current watershed functions for Element 1 Task 3.2 (Functional Assessment). The pre-development data serve as the reference period, or baseline index against which to evaluate current vegetation data in determining resource protective function. Performance measures were established prior to the development of proposed project alternatives and will be used to:

- Evaluate how well proposed alternatives meet specific project objectives.
- Examine the applicability and feasibility of specific alternative analyses.
- Address the issues identified in the assessment of existing conditions, including surface water, ground water, and natural systems.

Similar to performance measures developed for freshwater discharges and groundwater, performance scores were calculated that provide a baseline conditions against which the success of proposed projects can be measured.

Vegetation scores represent the resource protective function, or value, of the landscape based on the degree to which the pre-development vegetation persists under existing conditions. The difference in scores between pre-development and existing provides the baseline against which to

evaluate the result of a project, such as removing a control structure or filling a canal. If the anticipated improvement, or "lift" score from the proposed project is greater than the performance score, one can conclude that the project will have a net benefit on the system. Hydrology and landscape (LSI) scores are developed similarly.

Dramatic conversions from pre-development wet prairie vegetation to a developed urban land use, for example, would be assigned low scores, while little or no change in vegetation cover (i.e. no change from pre-development, or shift to another natural vegetation classification) would be scored higher.

4.1.3 Results

Performance measures developed for this CCWMP are simply the hydrology and LSI scores developed for the functional assessment. The LSI and hydrology scores were developed as a means of characterizing existing baseline data (in numerical form) for natural conditions and, therefore, provide the conditions against which proposed projects can be measured. The vegetation score is not as applicable for evaluating the results of hydrological restoration projects because proposed projects will not focus on active vegetation management (although shifts in vegetation are expected to occur over time, commensurate with changes in hydrology).

The performance measures developed, i.e. the LSI and hydrology scores (refer to Element 1, Task 3 for further detail on development of scores), are suitable for small-scale site-level assessments (i.e., for projects that have little or no affect on the score of a 1500 X 1500 foot cell) or as modeled performance measures for larger-scale projects. The functional value of proposed projects will be assessed using the UMAM functional value calculation below.

Functional Value = [(Anticipated Score – Existing Score)/Maximum Score] X Number of Acres,

where:

Performance Measure = Functional Value
Anticipated Score = anticipated hydrology index or LSI
Existing Score = Hydrology score OR LSI based on existing conditions
Maximum Score = 10
Number of Acres = Acres of site being evaluated

As an example, consider a 500-acre proposed project area with a current hydrology score of 6. Rehydration of the site by filling a drainage ditch to the elevation of the surrounding area is reasonably expected to increase the hydrology score to 8. The hydrologic functional value of this proposed project would be 100 ((8-6)/10) X 500 acres). Likewise, LSI functional values would improve within, and adjacent to, projects that include restoration to more-natural conditions,

conservation easements, transfers of development rights, or other similar means of improving the degree of resource protective support to adjacent areas.

4.1.4 Conclusions

Functional assessment scores, or performance measures, are presented in Table 4.1 for the watersheds in Collier County. Average scores are lower in the Golden Gate-Naples Bay watershed due to extensive canals systems and development and indicate that hydrologic restoration may provide the greatest opportunity for measurable improvement in functional value in Collier County.

Table 4-1. Functional Assessment Score for Watersheds in Collier County

Average Functional Values of Non-Urban Lands, by Watershed				
Watershed	**Non-Urban Acres**	**Average Vegetation Score**	**Average Hydrology Score**	**Average LSI Score**
Cocohatchee-Corkscrew	111,250	7	7	8
Golden Gate-Naples	36,627	5	6	6
Rookery Bay	83,105	8	6	9
Faka Union/ Okaloacoochee SR29/ Fakahatchee	431,414	9	6	9

4.2 FRESHWATER DISCHARGE TO ESTUARIES

4.2.1 Development of Performance Measures

This section summarizes the method that was used to assign a Discharge to Estuary score for each watershed based on a comparison to the pre-development condition. As indicated previously, the scoring method is defined as the Performance Measure and is used to assign a score to the characteristics of the system under existing conditions. It will also be used to benefits of alternative improvement projects that are being proposed for each watershed.

4.2.1.1 Scoring Methods

Scoring is based by comparing the timing and volume of discharge from the NSM developed by for the Southwest Florida Feasibility Study (SDI, 2007) to the ECM and each alternative scenario. As described previously, average monthly discharge volumes from the NSM and ECM models were used to define the baseline distribution and total volume of flow from each watershed. The alternative scenarios will be scored in the same fashion as the ECM.

The scoring process consisted of the following steps.

1. The monthly discharge from each watershed from the NSM model is considered the baseline condition. The NSM volume of flow for each month is assigned a score of 10.
2. Each monthly discharge from the ECM is assigned a score from one (1) to 10. The monthly score is calculated by dividing the NSM volume by the ECM volume and multiplying by 10.
3. In the event that the NSM volume is larger than the ECM volume, the monthly score is calculated by dividing the ECM volume by the NSM volume and multiplying by 10.
4. The average of the monthly scores determines the watershed score relative to the NSM.

4.2.1.2 Example

The following example illustrates the scoring process. It was applied to the Golden Gate-Naples Bay Watershed using data extracted from the ECM. The data is shown in **Table 4-2**.

Step 1. Calculate the absolute difference between the ECM volume and the NSM volume. The result of this calculation is shown in Column 4.

Step 2 Calculate the score for each month. For the month of January, the score would equal to two (2) based on the following equation:

Calculated Score = (NSM volume/ECM volume) x 10)

The calculated score is rounded to the nearest whole number.

Step 3 Average the monthly scores to determine the watershed score for the annual and seasonal conditions relative to the NSM.

Table 4-2
Golden Gate-Naples Bay Watershed Scoring Summary

	Monthly Average NSM Volume (inches)	Monthly Average ECM Volume (inches)	Flow Deficit/Surplus (inches)	Calculated Score
January	0.12	0.76	0.64	2
February	0.12	0.53	0.41	2
March	0.13	0.44	0.31	3
April	0.06	0.15	0.09	4
May	0.02	0.14	0.12	1
June	0.13	2.38	2.25	1
July	0.27	3.80	3.54	1
August	0.50	6.22	5.72	1
September	0.78	6.97	6.19	1
October	0.55	4.43	3.88	1
November	0.30	2.49	2.19	1
December	0.20	1.33	1.13	1
			Annual Score	1.6
			Dry Season Score:	1.9
			Wet Season Score:	1.0

4.2.1.3 Existing Conditions Scores for the Watersheds

Tables 4-3 through 4-5 provide the scoring matrices showing the score for each of the other watersheds. Of the four watersheds, the Golden Gate-Naples Bay Watershed received the lowest annual score of 1.6. The score is indicative of the flow surplus discharging into Naples Bay from the Golden Gate canal network.

The scores for the Rookery Bay watershed indicate that the primary impairment occurs during the dry season due to freshwater deficits. This is likely due to the reduced size of the watershed caused by construction of the Golden Gate Main Canal. The model results indicate that the observed wet season surplus is due to stormwater runoff from the Lely area and from the agricultural lands in the southeast portion of the watershed.

In the Cocohatchee-Corkscrew, and Eastern (Faka Union, Fakahatchee, and Okaloacoochee-SR 29) watersheds, the scoring results indicate that the operational controls that are used to manage dry season flows are reasonably effective at matching pre-development flow conditions. This contributes to the higher monthly scores observed during the dry season. However, the wet season scores are low for all watersheds. This provides an indication of the effect of development on the natural drainage system.

Table 4-3
Cocohatchee–Corkscrew Watershed Scoring Summary

	Monthly Average NSM Volume (inches)	Monthly Average ECM Volume (inches)	Flow Deficit/Surplus (inches)	Calculated Score
January	0.06	0.08	0.02	8
February	0.06	0.06	0.00	10
March	0.06	0.06	0.00	10
April	0.03	0.03	0.00	10
May	0.01	0.03	0.02	3
June	0.03	0.29	0.26	1
July	0.10	0.44	0.35	2
August	0.14	0.90	0.76	2
September	0.24	1.02	0.77	2
October	0.21	0.51	0.31	4
November	0.11	0.19	0.08	6
December	0.09	0.12	0.03	7
			Annual Score	5.4
			Dry Season Score:	6.9
			Wet Season Score:	2.5

Table 4-4
Rookery Bay Watershed Scoring Summary

	Monthly Average NSM Volume (inches)	Monthly Average ECM Volume (inches)	Flow Deficit/Surplus (inches)	Calculated Score
January	0.22	0.08	-0.14	4
February	0.18	0.08	-0.10	4
March	0.22	0.05	-0.16	2
April	0.09	0.02	-0.08	2
May	0.01	0.00	-0.01	2
June	0.15	0.41	0.26	4
July	0.37	0.67	0.30	5
August	0.84	1.13	0.28	7
September	1.40	1.84	0.45	8
October	1.12	0.76	-0.36	7
November	0.56	0.23	-0.33	4
December	0.36	0.12	-0.24	3
			Annual Score	4.3
			Dry Season Score:	3.1
			Wet Season Score:	6.8

Table 4-5
Faka Union, Fakahatchee, and Okaloacoochee–SR 29 Watershed Scoring Summary

	Monthly Average NSM Volume (inches)	Monthly Average ECM Volume (inches)	Flow Deficit/Surplus (inches)	Calculated Score
January	0.40	0.43	0.02	9
February	0.31	0.33	0.02	9
March	0.29	0.29	0.00	10
April	0.19	0.14	-0.05	7
May	0.12	0.12	0.00	10
June	0.16	0.91	0.75	2
July	0.32	1.90	1.59	2
August	0.48	3.20	2.72	1
September	0.67	3.85	3.18	2
October	0.71	2.22	1.51	3
November	0.56	1.21	0.65	5
December	0.50	0.69	0.20	7
			Annual Score	5.6
			Dry Season Score:	7.4
			Wet Season Score:	2.0

In order to evaluate the alternative scenarios, a similar scoring method will be used. The calculated monthly flows for each scenario will be compared to the NSM calculated monthly flows.

For instance, for a project implemented in the Golden Gate-Naples Bay watershed that leads to a reduction in flow to the estuary, the calculated monthly flow for September might be 5.0 inches. In the ECM, the score for September is one (1), but for the alterative, the score would be two (2):

$$(0.78/5.0) \times 10 = 2$$

where:

0.78 = the NSM monthly flow for September, and
5.0 = the Alternative monthly flow for September

4.3 POLLUTANT LOAD

The methods described in this memorandum, will also be used as performance measures to evaluate proposed watershed improvement projects. Anthropogenic pollution load reductions will be used to evaluate potential benefits. An important criterion for assessing project feasibility will be the estimated cost per pound of pollution load removed.

4.3.1 Surface Water Pollution Loads Performance Measures

The magnitude of the estimated pollutant loads by cell becomes meaningful when compared to a data normalization factor. For this analysis, it was determined that the gross load from a medium density residential development not including treatment facilities was an appropriate normalization factor because it provides an easily understandable means of comparing the magnitude of the pollutant load from different model cells and watersheds. That normalization factor was developed by averaging the annual runoff from all cells having a predominant medium density residential land use, which was determined to be 8.3 inches, and multiplying it by the corresponding EMC associated with a chemical parameter. Subsequently the ratios of total load from a cell to the normalization factor were scored as shown in **Table 4-6**. The scoring system is consistent with the scoring used for the other analyses conducted as part of the overall study. A score of 10 indicates no anthropogenic pollution, whereas a score of 1 or less indicates areas (urban or agriculture) that exhibit pollutant loads equal to or larger than those from a typical residential development with no stormwater runoff treatment.

Table 4-6
Pollutant Load Scores and Ratios

Score	Ratio of Net Load to Normalization Factor Load
10	< 10% of Normalization Factor
9	10% < Normalization Factor < 20%
8	20% < Normalization Factor < 30%
7	30% < Normalization Factor < 40%
6	40% < Normalization Factor < 50%
5	50% < Normalization Factor < 60%
4	60% < Normalization Factor < 70%
3	70% < Normalization Factor < 80%
2	80% < Normalization Factor < 90%
1 or less	> 90% of Normalization Factor

Figures 4-1 through 4-7 show the distribution of pollution load scores in the study area. As shown the areas of low TSS scores are in the older urban developments located along the coast as TSS

result from the resuspension of sediment accumulated on roads and drainage facilities. In terms of nutrient pollution, areas of interest are older developments, golf courses, and agriculture. The nutrient source is likely the excessive use of fertilizers. It must be noted that the largest EMC value used in the SWFFS analysis is for agricultural land uses. Further wet weather sampling is necessary to better define areas of agricultural nutrient concern.

Areas of concern for BOD-5 primarily those of low and medium density residential land uses that do not incorporate treatment facilities. In terms of heavy metals, lead tends to accumulate in soils and sediment and has remained in the environment because of its former use as an additive in gasoline and paints. Primary sources of copper in urban runoff have been determined to be vehicle brake pads and the use of copper-containing herbicides and chemicals for algae control. Zinc commonly occurs due to its industrial uses as a rust preventative in iron-containing metals. These metals are also associated with urban land uses with no stormwater treatment.

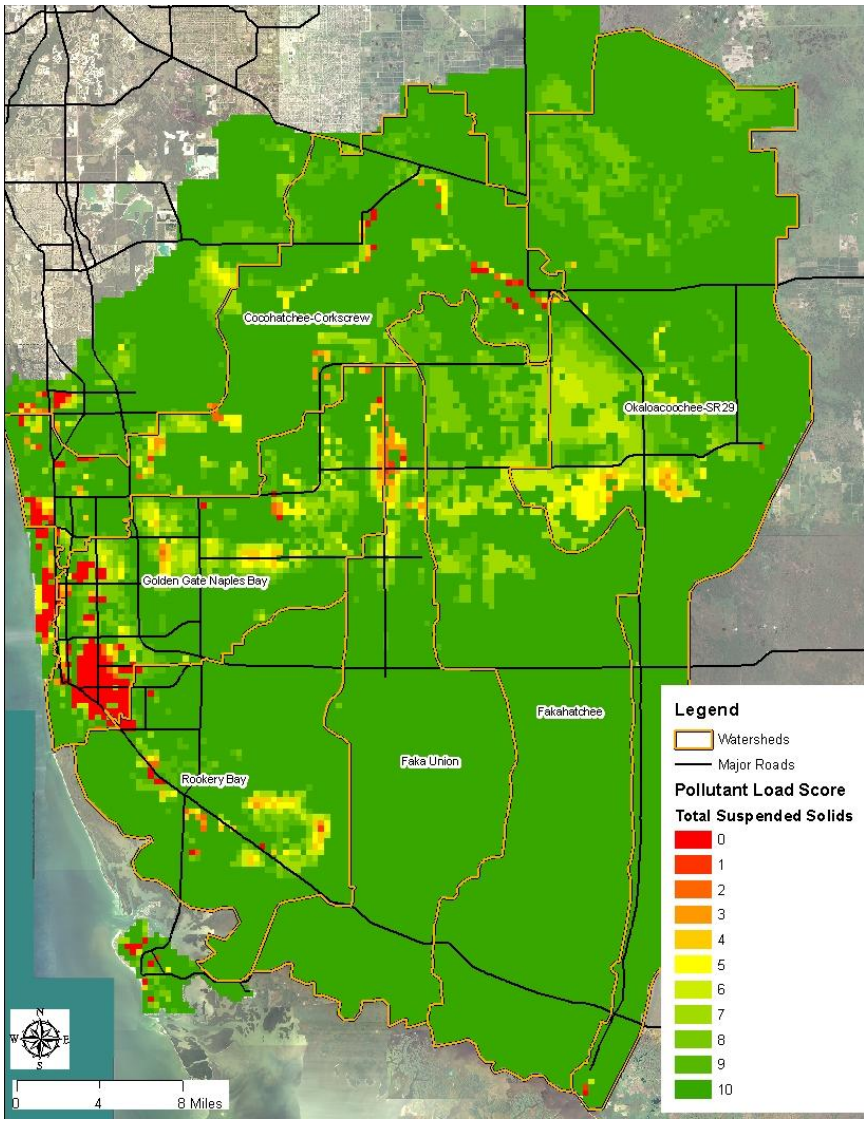

Figure 4-1. TSS Pollution Load Scores

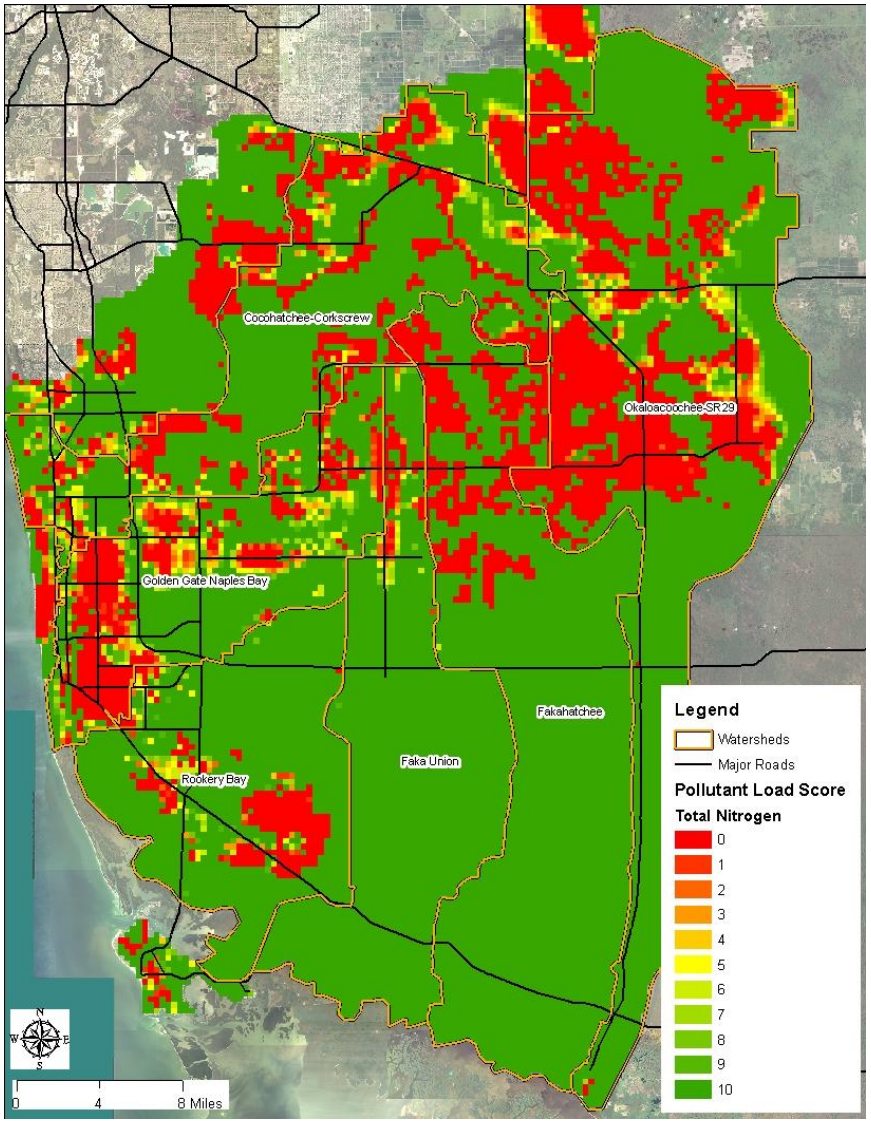

Figure 4-2. Total Nitrogen Pollution Load Scores

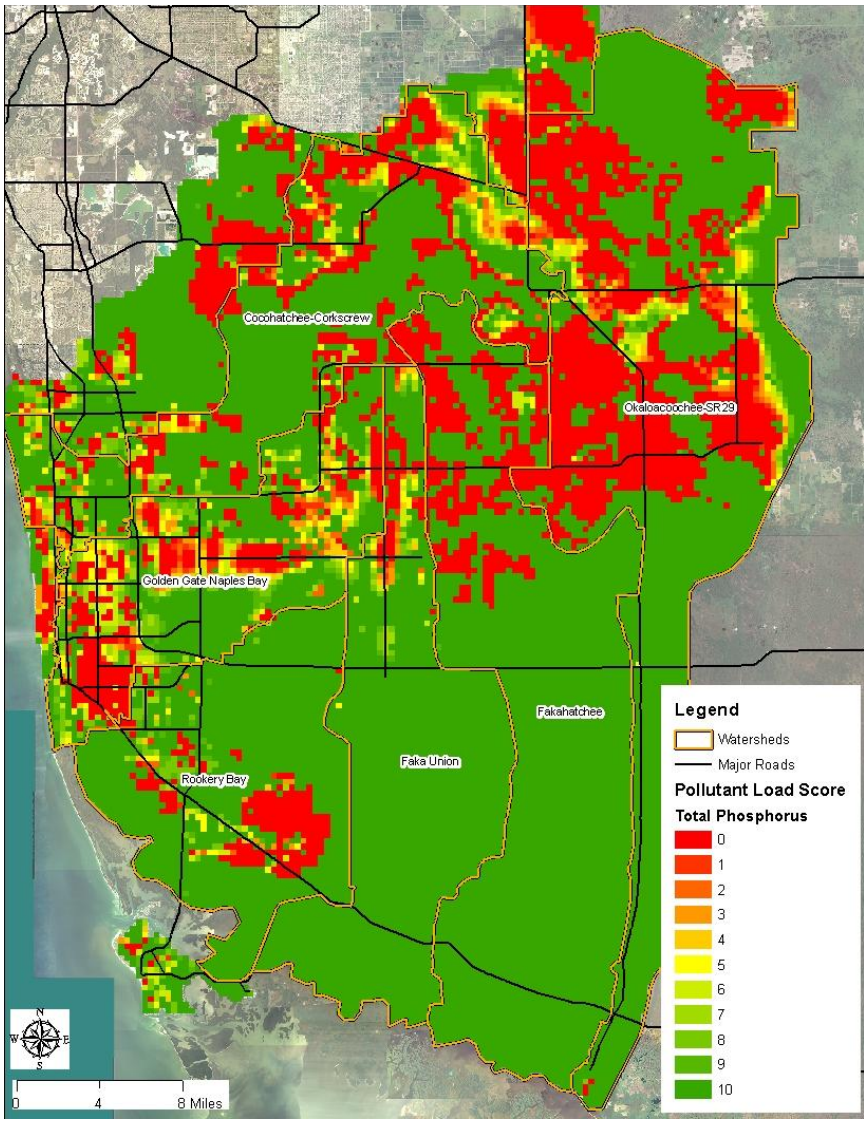

Figure 4-3. Total Phosphorus Pollution Load Scores

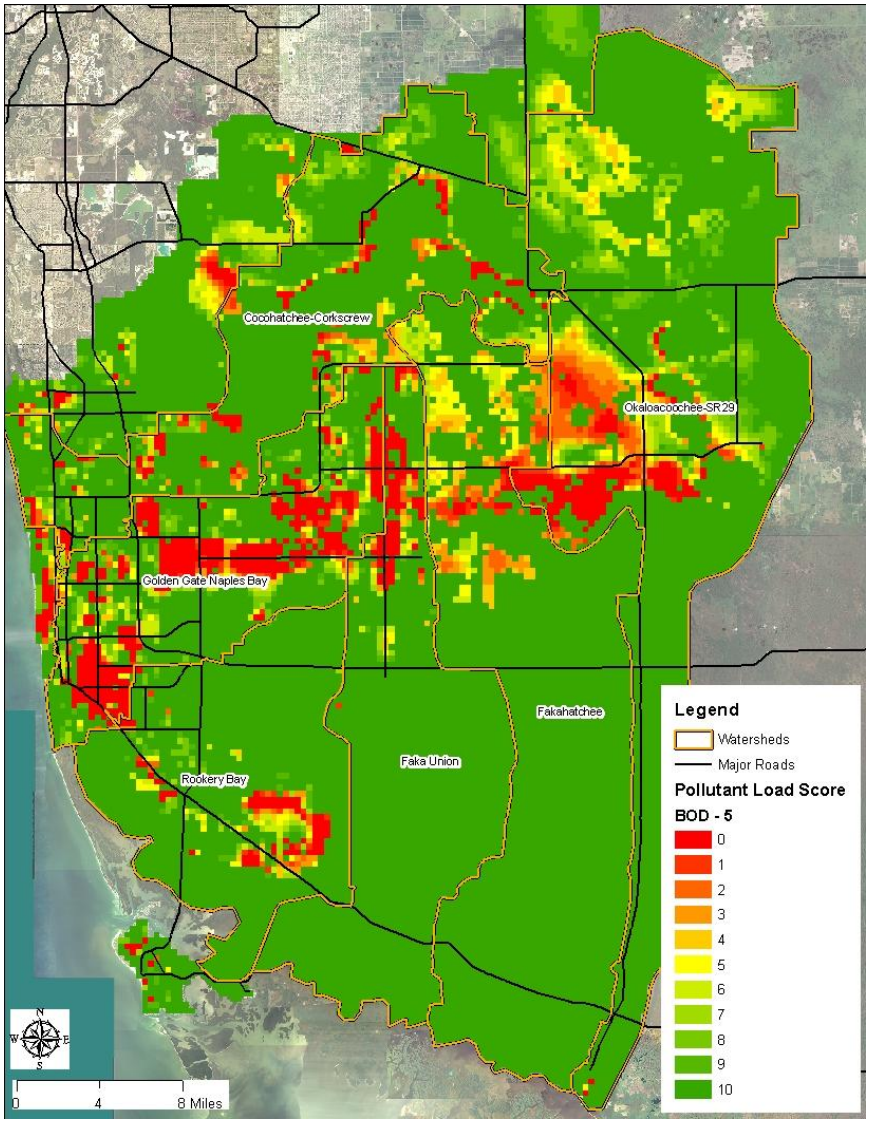

Figure 4-4. BOD-5 Pollution Load Scores

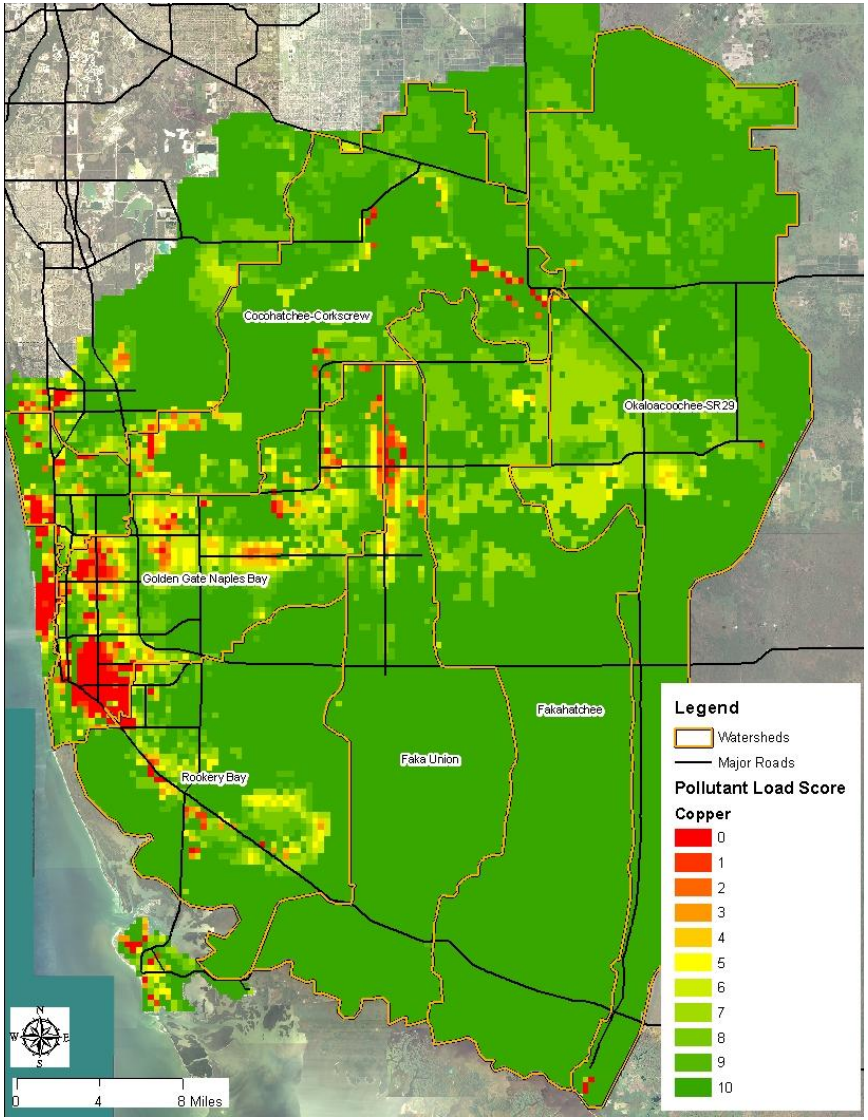

Figure 4-5. Copper (Cu) Pollution Load Scores

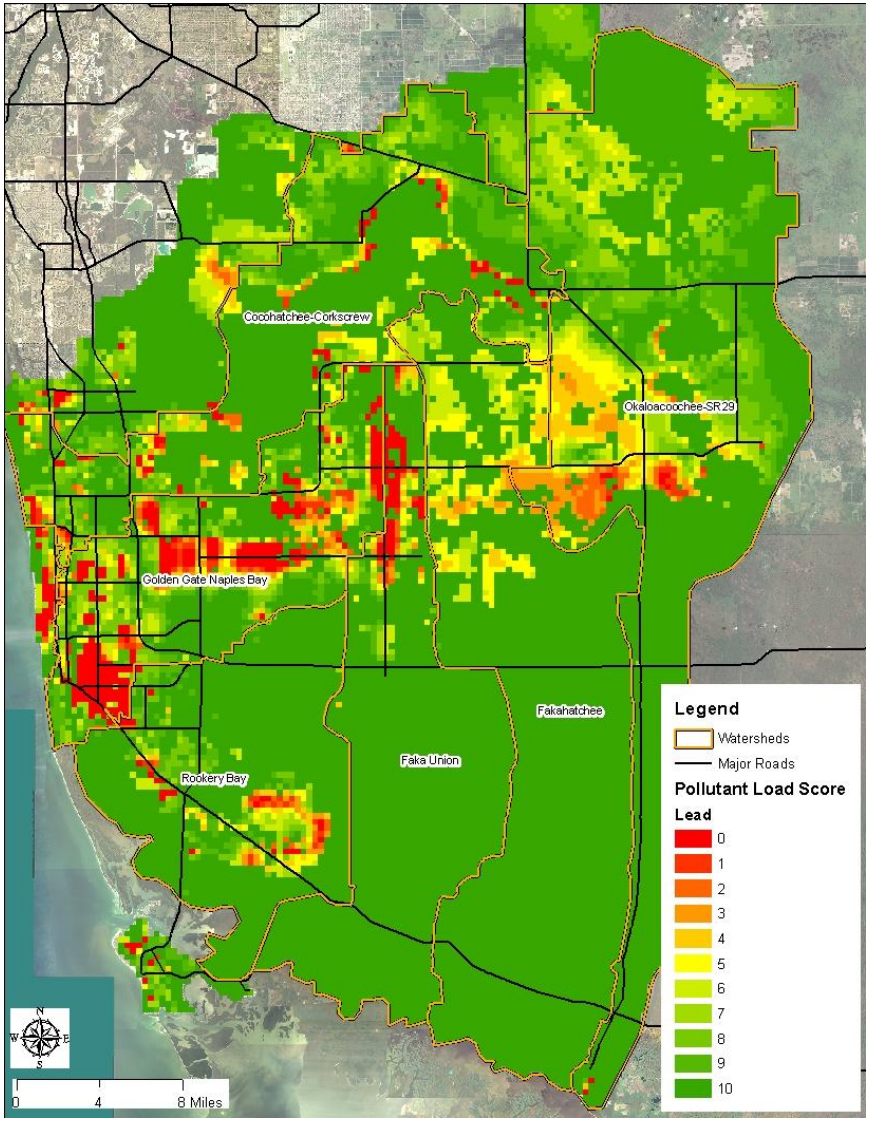

Figure 4-6. Lead (Pb) Pollution Load Scores

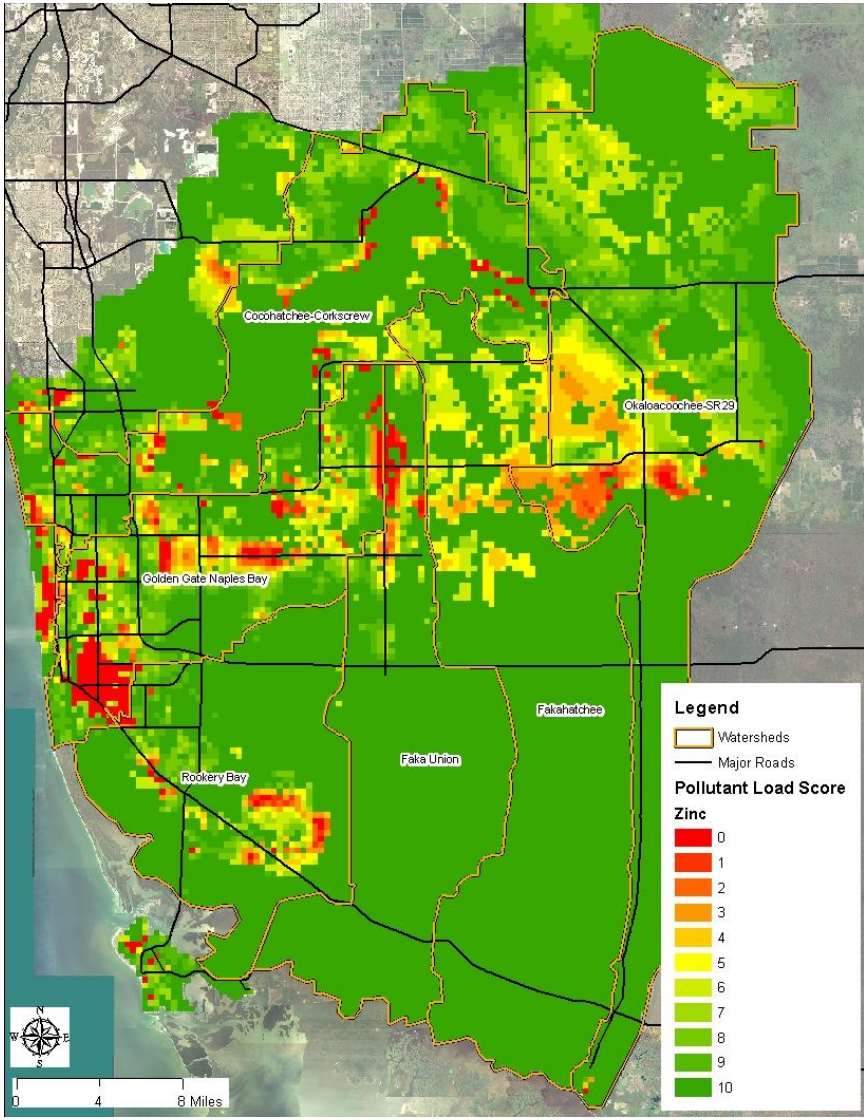

Figure 4-7. Zinc (Zn) Pollution Load Scores

4.4 AQUIFER RECHARGE/YIELD

The continued use of groundwater resources in Collier County has resulted in groundwater levels that fluctuate seasonally in response to the demand for withdrawals. During the wet season, sufficient rainfall and recharge typically result in higher aquifer storage and hydraulic heads. However, during the dry season, limited rainfall leads to additional groundwater pumping to meet seasonal population needs and increased demand for irrigation purposes.

In order to assess the relative yield or quantity of available water within each aquifer, the ECM-predicted hydraulic heads were compared to those obtained from the Natural Systems Model (NSM) that was developed for the SWFFS. The NSM was an approximation of the predevelopment hydrologic and hydrogeologic conditions of the region. The NSM did not include the Mid-Hawthorn Aquifer and so comparisons were completed for the Water Table, Lower Tamiami, and Sandstone aquifers.

The SFWMD has defined the Minimum Aquifer Level (MAL) for confined aquifers to be the structural top of each aquifer. The lower limit of the performance measure was therefore designated as the physical top of the aquifer unit. The upper limit of the Water Table Aquifer is defined by the simulated NSM results. For the water table, the lower limit was defined as the bottom of the aquifer.

A performance measure score (0 to 10) was calculated for the top three aquifers and each cell in the model grid. The NSM does not include the Mid-Hawthorn Aquifer so no performance score was been calculated for the Mid-Hawthorn. The score was defined as follows:

Score = ((ECM Head Elevation – Structural Top of Aquifer) /
(NSM Head Elevation – Structural Top of Aquifer)) x 10

Figure 4-8 illustrates a theoretical aquifer condition representing performance scores for a confined aquifer system.

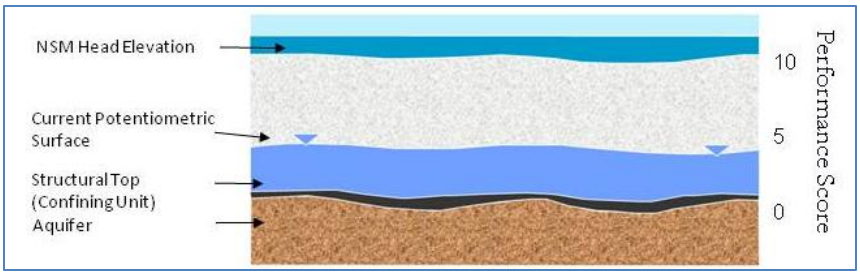

Figure 4-8. Theoretical Condition for Confined Aquifer Performance Score

Figures 4-9 through 4-11 show the difference between the average annual groundwater surface elevation for the NSM and ECM models for the Water Table, Lower Tamiami, and Sandstone aquifer

systems. The results show that the most drawdown occurs near municipal wells fields and in areas where there is demand for irrigation or domestic self supply. These figures also indicate that boundary conditions can contribute to significant differences in predicted groundwater elevations. Negative values indicate that the ECM groundwater elevation is lower than the NSM groundwater elevation.

Aquifer performance measure scores were calculated for each aquifer on a cell-by-cell basis within the model area. The scores for each aquifer were then averaged within WBIDs and watersheds. Table 4-7 lists each WBID and the performance score for each aquifer. These scores are based on the average dry season water level for the ECM and the NSM. The relatively high performance scores averaged over WBID and watershed areas do not provide the resolution to evaluate local effects of groundwater drawdown. Figures 4-12 through 4-14 show the distribution of grid level performance scores within each watershed.

Figure 4-12 shows the cell by cell performance score in the Water Table Aquifer. The areas in green indicate high performance or relatively little change in dry season conditions from the NSM. Areas in red indicate locations where water demand to meet agricultural and potable water supply needs results in low performance scores relative to historic groundwater levels. Areas that score poorly tend to correspond to well field locations. This is most apparent in the Rookery Bay and Golden Gate watersheds. Other areas that correspond to well field locations include the area near Immokalee and in the northern portion of the Faka Union watershed. Another area that scores poorly is in the Okaloacoochee watershed and corresponds with agricultural areas with significant irrigation demands. Projects and policies that encourage additional recharge and reduce demand on the shallow aquifer systems would most likely lead to improved scores in these areas.

A final area that scores poorly is in the southern Faka Union watershed. This poor score is likely attributable to the canal network that has effectively drained this historic wetland area. Similar results are observed in portions of the Golden Gate-Naples Bay Watershed. The high level of baseflow in these areas influences the groundwater elevation and contributes to lower water table elevations. Changes in structure operations could have a positive influence on groundwater elevation and availability in the watershed.

The results for the Lower Tamiami Aquifer (Figure 4-13) show that poor scores correspond with similar locations in the Water Table Aquifer. This can be attributed to the significant interaction between the aquifer systems coupled with the high water demand.

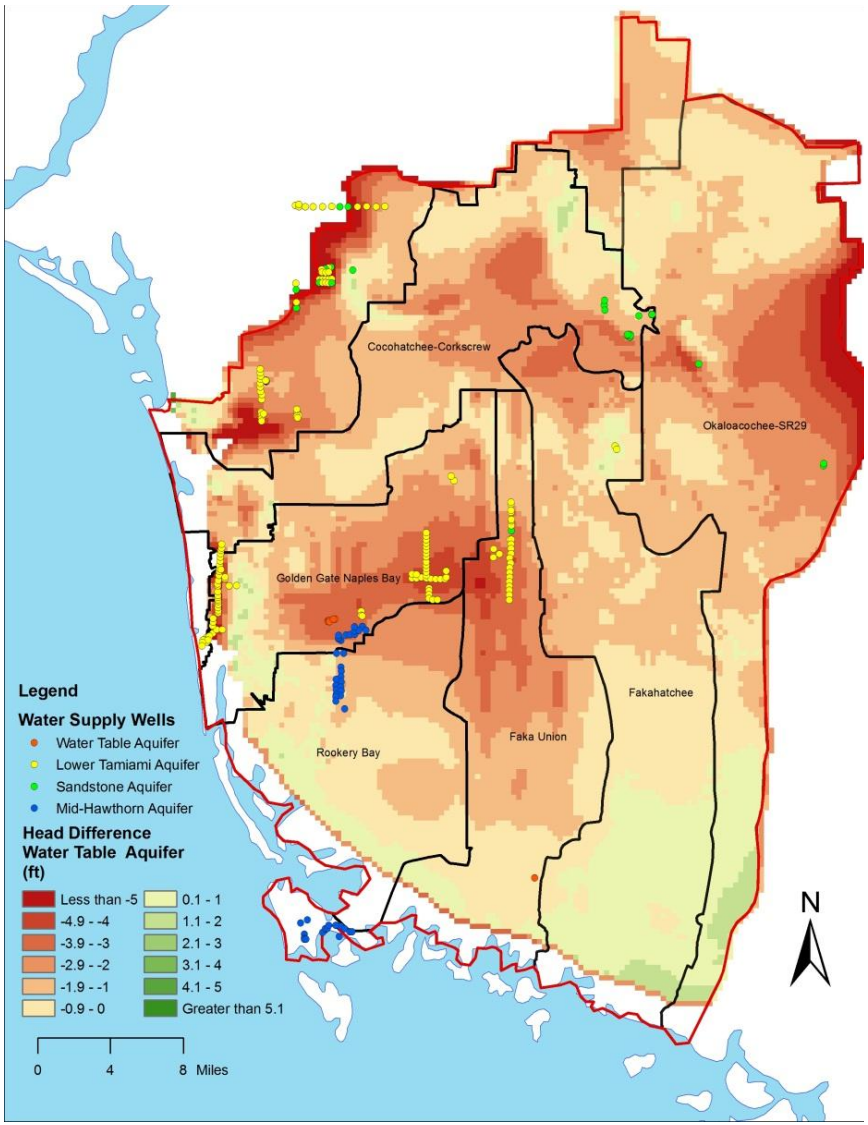

Figure 4-9. Water Table Aquifer, Average Annual Elevation Difference ECM–NSM

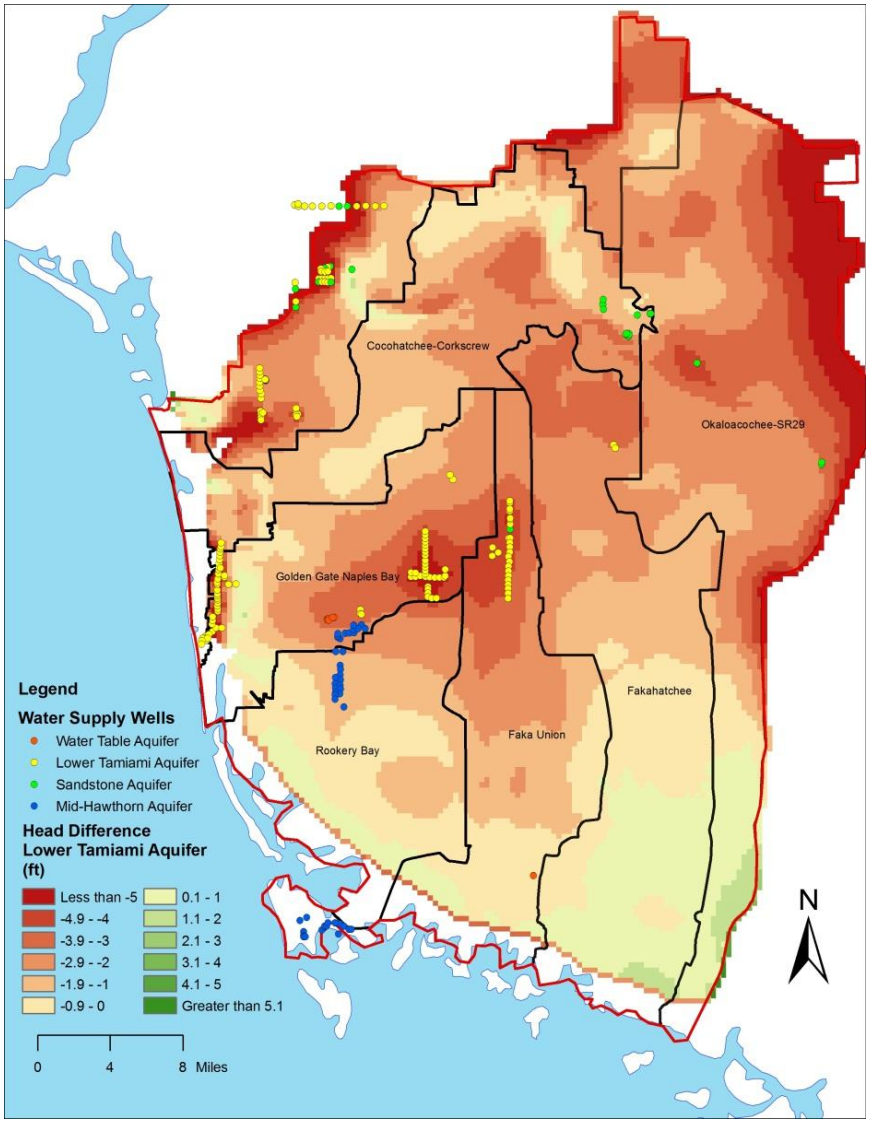

Figure 4-10. Lower Tamiami Aquifer, Average Annual Elevation Difference ECM–NSM

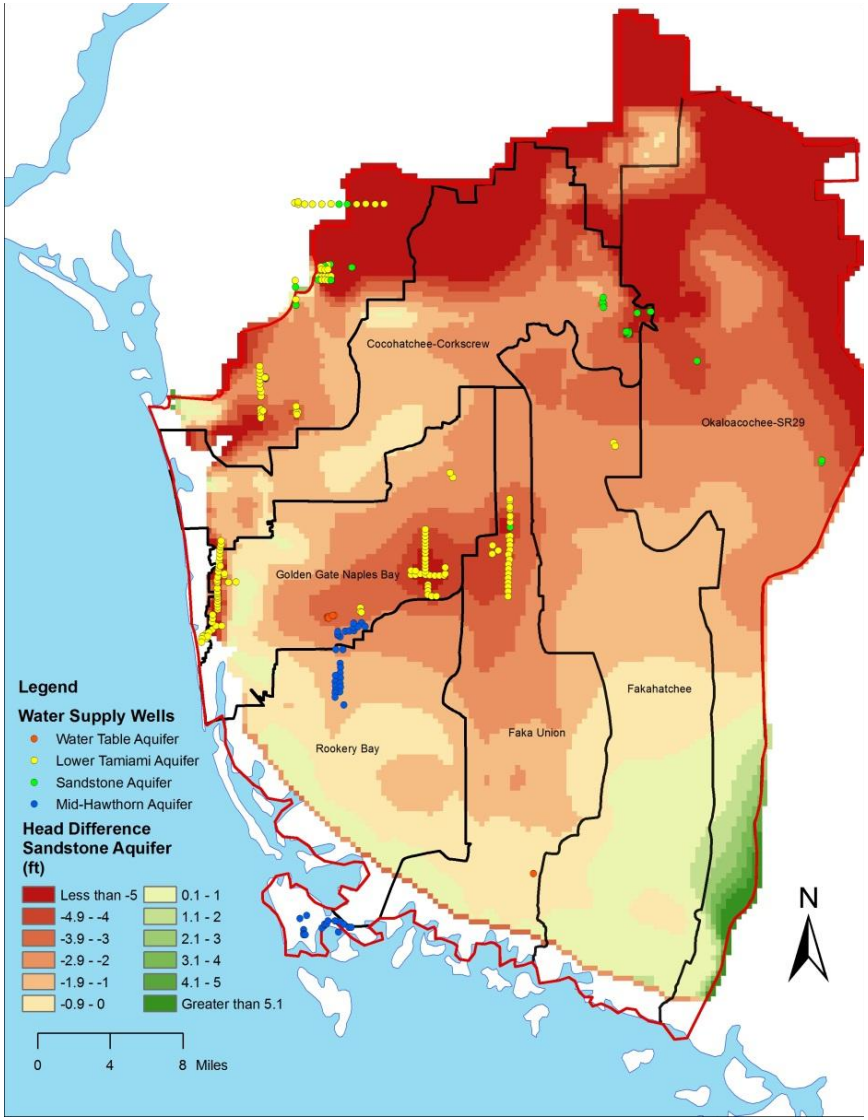

Figure 4-11. Sandstone Aquifer, Average Annual Elevation Difference ECM–NSM

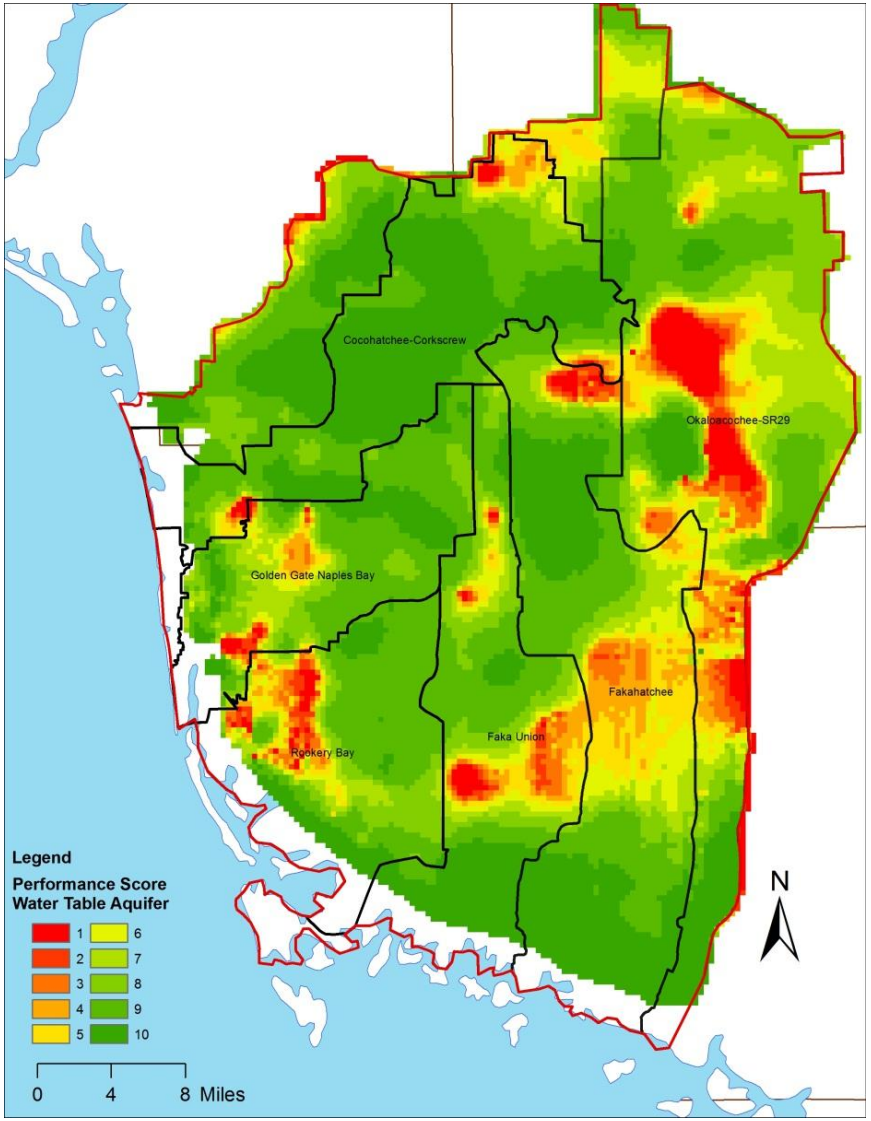

Figure 4-12. Water Table Aquifer, Average Dry Season Performance Score

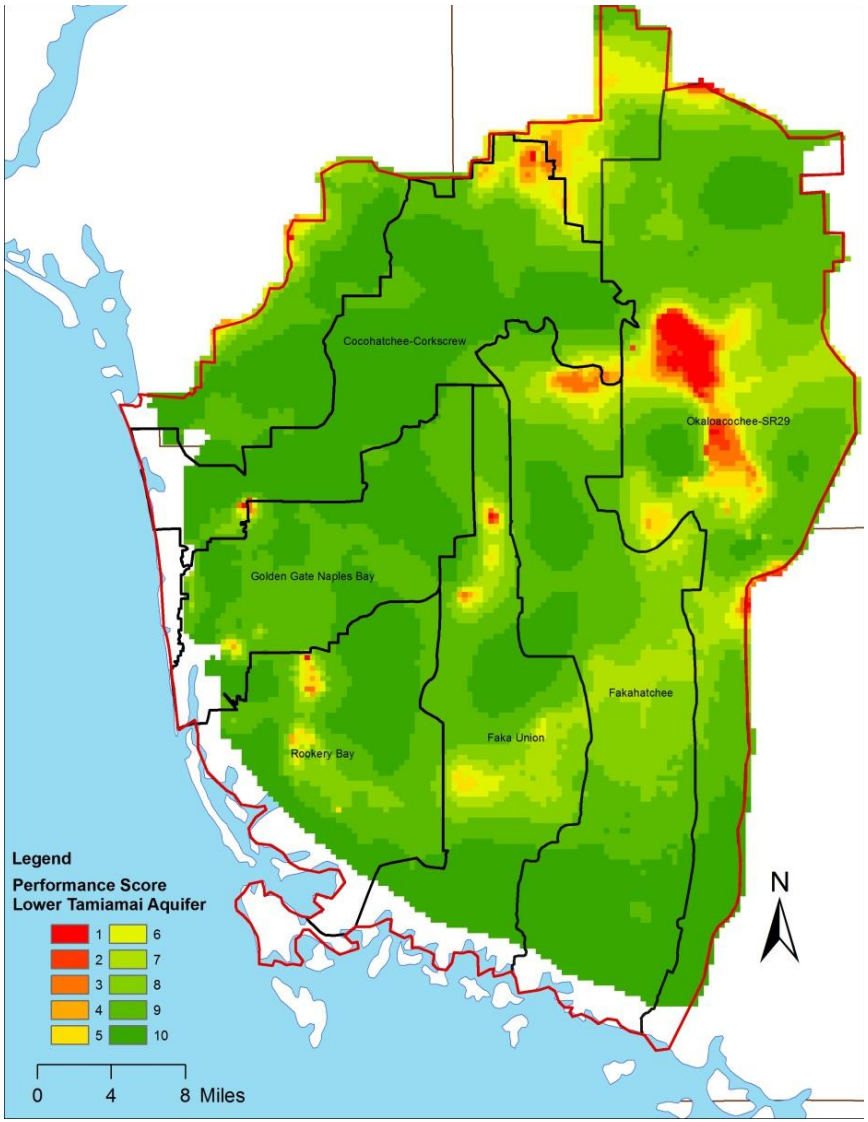

Figure 4-13. Lower Tamiami Aquifer, Average Dry Season Performance Score

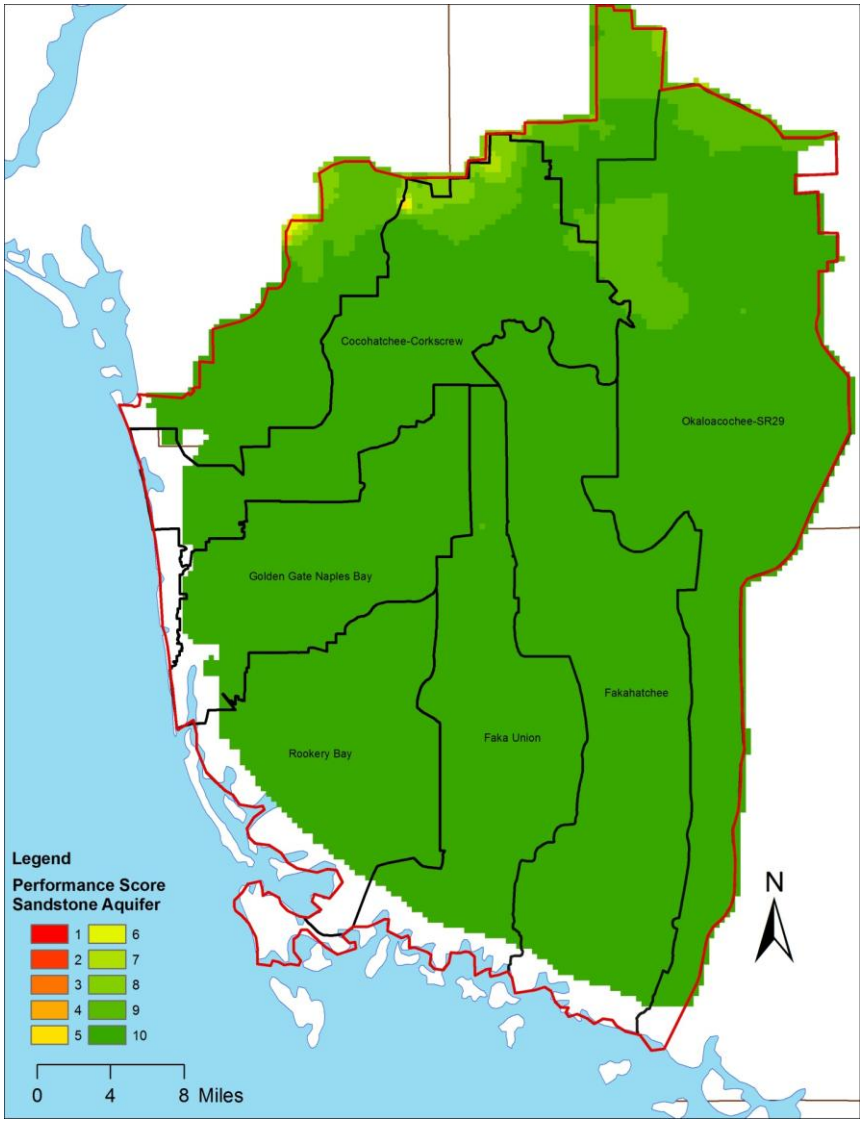

Figure 4-14. Sandstone Aquifer, Average Dry Season Performance Score

Table 4-7. Performance scores for each aquifer by WBID

Watershed	WBID	WBID Name	Water Table Aquifer	Lower Tamiami Aquifer	Sandstone Aquifer
Cocohatchee-Corkscrew	3278D	Cocohatchee (Inland Segment)	9.3	9.6	9.9
	3278C	Cocohatchee Golf Course Discharge	9.1	9.6	9.7
	3278F	Corkscrew Marsh	9.4	9.4	9.6
	3278E	Cow Slough	9.5	9.4	9.5
	3259B	Drainage to Corkscrew	9.5	9.6	9.5
	3278L	Immokalee Basin	9.1	9.2	9.5
	3259W	Lake Trafford	9.4	9.4	9.7
	3259Z	Little Hickory Bay	8.9	9.6	9.7
	Weighted Average		9.4	9.5	9.6
Golden Gate - Naples Bay	3278K	Gordon River Extension	9.3	9.5	9.8
	3278R	Naples Bay (Coastal Segment)	9.6	9.6	10.0
	3278S	North Golden Gate	8.9	9.3	9.8
	Weighted Average		9.0	9.3	9.8
Rookery Bay	3278U	Rookery Bay (Coastal Segment)	9.6	9.8	10.0
	3278V	Rookery Bay (Inland East Segment)	9.0	9.2	9.9
	3278Y	Rookery Bay (Inland West Segment)	7.2	9.1	9.9
	Weighted Average		8.7	9.3	9.9
Faka Union	3278H	Faka Union (North Segment)	8.5	8.8	9.7
	3278I	Faka Union (South Segment)	8.4	8.9	9.8
	Weighted Average		8.5	8.9	9.8
Fakahatchee	3259I	Camp Keais	9.3	9.2	9.8
	3278G	Fakahatchee Strand	8.7	9.0	9.9
	Weighted Average		8.9	9.1	9.8
Okaloacochee-SR29	3261C	Barron River Canal	8.4	8.8	10.0
	3278T	Okaloacoochee Slough	8.5	8.9	9.3
	3278W	Silver Strand	8.4	8.6	9.5
	Weighted Average		8.4	8.8	9.5

Areas in red along the model boundaries in both the Water Table and Lower Tamiami Aquifers are likely not real and caused by the differences in defined boundary conditions between the ECM and NSM.

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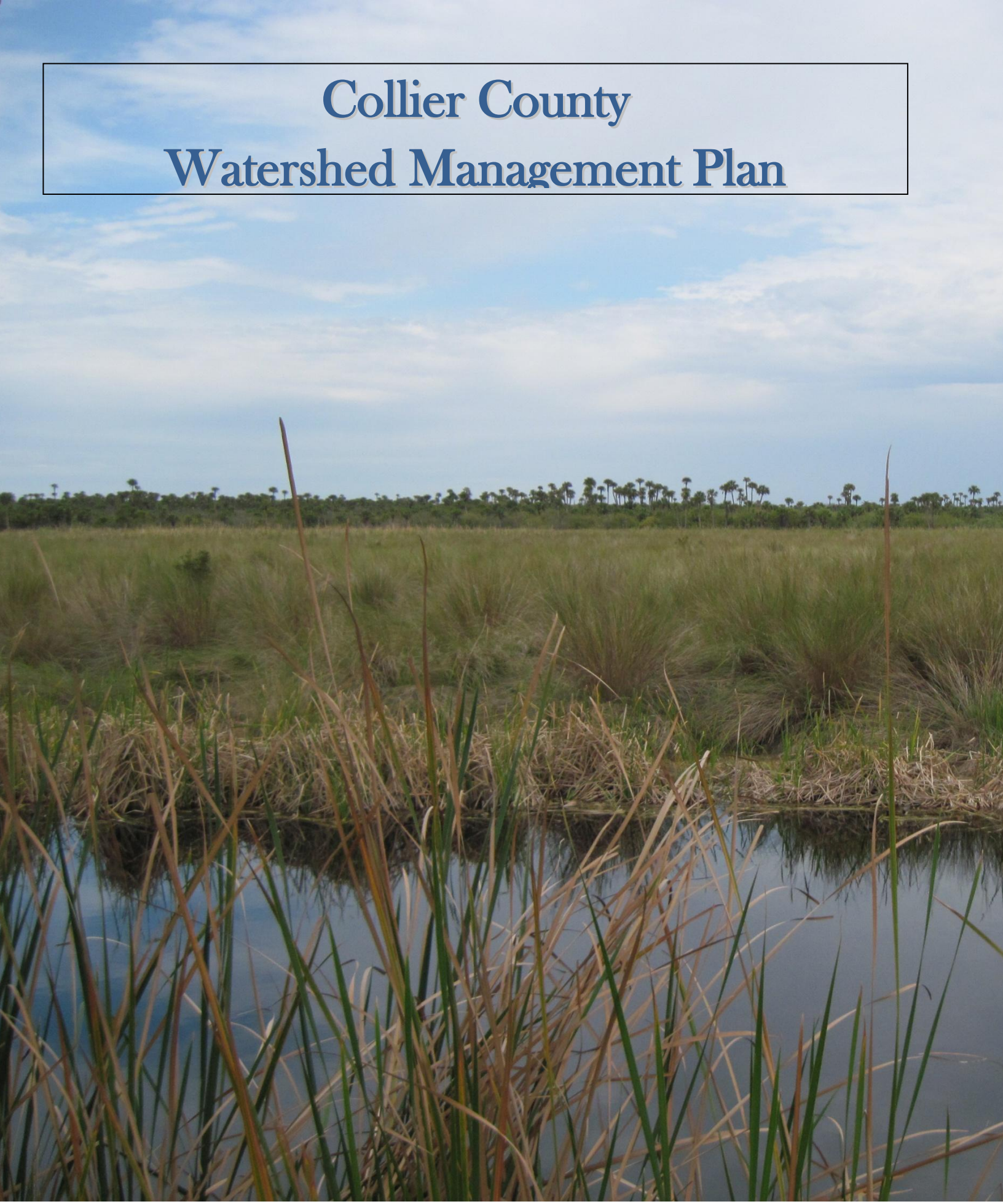
Collier County
Watershed Management Plan



Collier County

ATKINS

EXECUTIVE SUMMARY

Recommendation for the Board of County Commissioners (Board) to accept the Watershed Management Plan (WMP) and direct the County Manager or Designee to implement the WMP Initiatives utilizing existing Staff and Budget.

OBJECTIVE: To have the Board of County Commissioners accept the WMP and direct the County Manager or designee to implement the recommended Watershed Management Plan (WMP) initiatives utilizing the existing staff and budget.

CONSIDERATIONS: The WMP was developed to satisfy a Growth Management Plan commitment to assess and protect water resources. The project was funded in 2007. Atkins (formerly PBSJ) was hired in 2009 to update the Big Cypress Basin hydrologic / hydraulic model, and develop the WMP. They reviewed existing reports, evaluated existing water resource conditions and developed alternatives to restore or mitigate identified problems.

The WMP in and of itself is not intended to be regulatory. The WMP recommended initiatives may lead to regulations and/or regulatory policies if supported through future vetting and approval by the Board. Nothing contained in the WMP or these recommendations shall bind the Board in any way except that where Board-approved recommendations result in staff developing program, policy, ordinance or regulation for further Board action. The recommendations serve as a guide for staff in developing the resultant policy, program, ordinance or regulation for further consideration by the Board.

The final draft of the WMP is attached. The WMP has been discussed at 7 Environmental Advisory Council (EAC) Meetings, 6 Collier County Planning Commission (CCPC) meetings, and 4 public workshops this year and 31 committee and public workshops have been held since 2007. The WMP has identified water resource concerns regarding:

- Excessive fresh water discharges from canals (including ground water discharges) especially to Naples Bay;
- The drainage system does not provide the desired level of flood protection;
- Pollutant loading associated with development may degrade water quality conditions;
- Aquifer impacts due to canal discharge, reduced recharge, and potable and agricultural withdrawal demands.

Some concerns are being addressed by ongoing and completed restoration projects in South Golden Gate and Lake Trafford. Projects, regulations and policy changes were evaluated to mitigate these remaining identified concerns. The recommended projects and initiatives are listed below and discussed in the Recommendations. (The text of the Recommendations here may vary from the text in the WMP due to vetting with advisory committees and time constraints. The final approved Board recommendations will be inserted in the final WMP.) Implementation of the WMP recommendations is to be accomplished by utilizing existing staff to manage the recommended projects (Table 1) and non structural initiatives (Table 2) as time and existing budget allow.

Implementation of recommended projects will be accomplished with the existing stormwater budget, partnering, and grants as funds become available following the Lely Area Stormwater Improvement Project completion. The projects can be phased into the Capital Project schedule as the budget permits. Non-structural initiatives are to be implemented by developing policy, standards, and or criteria in scheduled Land Development Code (LDC) and Growth Management Plan amendment cycles utilizing existing staff, committees and with only minor consulting technical assistance.

The Low Impact Development (LID) stormwater treatment best management practices (BMPs) will be an incentive based program where target LDC requirements will be relaxed to encourage LID components. The Flood Protection Level of Service (LOS) program will be contingent upon acceptance of the alternate base standard and analysis per the policy development process. The Florida - Friendly Fertilizer Ordinance was developed separately from the report and was approved by the Board on 7/26/11.

Table 1. Projects Benefit to cost ratio (Recommendation 1).

Project Name	**Total Normalized Project Score**	**Estimated Project Cost**	**Benefit-to-Cost Ratio**
		(Millions)	
North Golden Gate Estates Flowway Restoration	30.09	2.37	12.71
North Belle Meade Spreader Swale (1)	25.24	7.03	3.59
Henderson Creek Diversion (1)	20.00	5.71	3.50
South I-75 Canal Spreader Swale	10.49	3.13	3.35
Wolfe Road Wetland Treatment System	3.45	1.42	2.44
Corkscrew Regional Ecosystem Watershed	2.01	0.10	20.95
Upper Golden Gate Estates Canal Weir Construction	0.67	0.55	1.21
Orange Tree Canal Control Structure Installation	0.67	0.55	1.21
Henderson Creek Off-Line Storage Reservoir	2.33	2.93	0.79
US HWY 41 Stormwater Treatment Area	0.15	0.54	0.28

(1) Weighting considers benefits to two (2) watersheds.

Table 2. Non-structural initiatives identified to contribute to hydrologic restoration and or pollutant reduction

Recommendation	Initiative
2	Low Impact Development Program (LID)
3	Stormwater Retrofit Program
4	Fee-Based Stormwater Utility Incentive Program
5	Flood Protection Initiatives
6	Flood Protection Levels of Service Criteria
7	Golden Gate Estates Transfer of Development Rights Program
8	Golden Gate Estates Watershed Mitigation Program
9	Improved Operations of Water Control Structures
10	Water Quality Monitoring Program
11	Additional Watershed Protection Programs
12	Detention Pond Certification Program
13	Florida Friendly Fertilizer Ordinance

Environmental Advisory Council (EAC) Recommendation: On September 7, 2011, the Environmental Advisory Council (EAC) recommended unanimously to approve the Watershed Management Plans with the following conditions:

1. *Staff to review and comment on the conformance of the Plan in staff reports with respect to any environmental applications presented to the EAC for consideration.*
2. *Staff to provide an annual update to the EAC on the status of implementing the Plan.*
3. *Staff to begin the process of developing a Low Impact Development (LID) Manual.*

Collier County Planning Commission (CCPC) Recommendation: On October 20, 2011, The Collier County Planning Commission (CCPC) voted unanimously to move the 13 identified recommendations forward and:

1. *Include SFWMD coordination in the certification program (Recommendation 12). Add a Lake Management Best Management Practices education program to Recommendation 12, including guidance for alternatives to copper based algaecides.*
2. *Evaluate effectiveness of the Watershed Management Plans in 7 years and then every 5th year.*

FISCAL IMPACT: The proposed implementation strategy is to utilize existing staff and advisory committees with minimal consultant technical support to develop Growth Management Plan (GMP) revisions and LDC amendments that are incentive based. Structural Projects may be implemented as stormwater funds, partners, or grants become available. The implementation of the initiatives will be cost neutral.

LEGAL CONSIDERATIONS: This item has been reviewed by the County Attorney's Office and has been found legally sufficient. A majority vote is required for approval. -STW

GROWTH MANAGEMENT IMPACT: Completion of the WMP and implementation initiatives will support objective 2.1 of the Conservation and Coastal Management Element of the County Growth Management Plan.

RECOMMENDATION: That the Board directs the County Manager or designee to consider projects identified in Table 1 during the development of the surface water business plan and continue to develop the other following cost neutral and incentive based initiatives: *(Note: All of the projects and initiatives below will require additional Board approval during subsequent phases as they are brought forward.)*

1. Implementation of the projects in Table 1 as funding is available using existing Stormwater budget funds, grants, and by partnering with other entities.
2. In addition to current stormwater treatment standards (150% water quality volume requirements), develop a LID treatment program with existing staff by creating LDC incentives to encourage and offset any additional startup or operational costs. Focus will be on techniques that maximize water quality and recharge benefits.
3. Start a Stormwater Treatment System Retrofit program to retrofit public stormwater systems with LID and other treatment BMPs to maximize water quality and recharge benefits as grants and stormwater budget funds are available.
4. Evaluate the effectiveness of a Fee-Based Stormwater Utility to create incentives to improve water quality treatment and recharge. Structure of the fees would not increase the total revenues but would reward users with effective treatment systems. This initiative would require an initial fee rate study that would be funded by grant or from existing stormwater funds.
5. Utilize existing staff to develop flood protection LDC requirements for stormwater discharge rates, volume discharge limits, and verification of no downstream floodplain impacts to prevent increased flooding risk to downstream properties.
6. Consider changing the Flood Protection LOS standard by utilizing existing staff to analyze the WMP proposed system to insure it has the intended benefit of expanding the range of grading and identifying critical areas for improvement. If analysis is positive, develop an implementation plan to amend the standards in the Growth Management Plan.
7. Evaluate a North Golden Gate Estates (NGGE) Transfer of Development Rights program with a sending area as the North Golden Gates Flowway Restoration Area to encourage restoration of resource protective lands, and improve recharge of surficial aquifers. The receiving area would not be in the rural Golden Gate Estates area. This will be accomplished utilizing existing staff and an oversight committee to determine if there is support for the program. Final acceptance of the program will be through EAC, and CCPC reviews and Board approval.
8. Evaluate a NGGE mitigation program to ensure stormwater treatment, and floodplain storage capacity within the basin is not lost. This will be a pilot program that can be utilized in other basins if it is effective. Existing staff will work alternatives through the review process during the nest Golden Gate Master Plan revision.
9. To maximize ground water recharge, improve water quality, and reduce ground water discharge to the canal network staff will work with South Florida Water Management and Big Cypress Basin staff to improve the operation and or design of the Water Control Structures in future planned basin and structure evaluations.
10. Refinement of the existing Water Quality Monitoring program to prioritize sampling to impairments and include focused stormwater runoff sampling. This will be accomplished through contract negotiation with partners, reevaluation of the existing monitoring program during Florida Department of Environmental Protection Water Quality Assessment, and or grant opportunities.
11. Existing staff will work with state and federal partners to develop the Additional Watershed Protection Program as stormwater funds and or grants are available. This program includes

efforts to encourage storage and treatment of stormwater in fallow agriculture areas and undeveloped estates lots to improve water quality, recharge and delivery of fresh water to the estuaries. The other component of the program is to reevaluate the preservation standards in rural fringe neutral areas with identified resource protective lands.

12. Develop a stormwater treatment system certification program with existing staff and utilizing guidance in the draft State Stormwater Quality Applicant's Handbook and Conservation and Coastal Management Element Policy 2.2.5 in the next LDC. As an alternative staff could be directed to modify CCME Policy 2.2.5 through the EAR Based amendments to eliminate this requirement.
13. Implement the Board adopted Florida-Friendly Fertilizer Use on Urban Landscapes ordinance and complimentary public education program utilizing existing staff.

Prepared By: Mac Hatcher, Senior Environmental Specialist, Land Development Services

Attachments:

1. Collier County Watershed Management Plan*
2. Watershed Management Plan Presentation

*It should be noted that due to the size of the WMP, it was not uploaded to the SIRE viewing system. A Public View Copy has been provided to the County Manager's Office at Building "F", Second Floor, 3299 Tamiami Trail East, Naples FL, 34112. The full report can be found on-line at http://www.colliergov.net/Index.aspx?page=2302