Northern Keys Area Reasonable Assurance Documentation

FKRAD Program

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Prepared for

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

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Northern Keys Area Stakeholders Agreements

As a measure of reasonable assurance and support of this document, the stakeholders in the Northern Keys Area (Villages of Islamorada, Monroe County, Key Largo Wastewater Treatment District, FDOT, and the Florida State Parks Service) have provided signed documents confirming that the management activities identified in this document indeed reflect the commitments of the stakeholders. The signed documents are contained in Exhibit 1.

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EXECUTIVE SUMMARY

In accordance with Section 62-303.600 FAC, this document provides reasonable assurance that stakeholders in the Northern Keys Area have provided or will implement sufficient control mechanisms to return the area's nearshore waters to the water quality targets. The Northern Keys Area is generally described as the Key Largo area of the unincorporated Monroe County and the islands associated with the Village of Islamorada. The stakeholders include the Village of Islamorada, Monroe County, Florida Department of Transportation (FDOT) and Florida State Parks System.

To provide reasonable assurance, the following elements are provided:

- Description of the Impaired Water
- Description of the Water Quality and Aquatic Ecological Goals
- Description of the Proposed Management Actions to Be Undertaken
- Description of Procedures for Monitoring and Reporting Results
- Description of Proposed Corrective Actions

The Florida Keys is a chain of islands approximately 220 miles long, extending from the end of the Florida peninsula curving southwest toward the Dry Tortugas. Consisting of 822 islands, of which about 30 are inhabited, the Florida Keys are traversed by U.S. Highway 1 (a.k.a., US 1 or Overseas Highway) with 19 miles of bridges. The Keys are entirely within Monroe County and includes the municipalities of Islamorada, Key Colony Beach, Layton Marathon and Key West. Key West represents about 30 percent (24,000 people) of the population of Monroe County, which, according to the 2000 Census, is about 79,600 people.

In general, Florida watersheds are characterized by a large land mass that concentrates and directs runoff to a relatively small waterbody. Thus, runoff is discharged to receiving waters wherein pollutants are concentrated. Soils allow infiltration and percolation slowing down nutrient runoff and soils facilitate the treatment of nutrients due the availability of land for conventional stormwater best management practices (BMPs). Also, the BMPs can be monitored using a relatively small number of sampling points. Similarly, with the large watersheds, wastewater can be controlled using septic tanks and large regional treatment facilities. Septic discharges through a drainfield can be absorbed into the soils and regional treatment discharges can be via reuse, storage, land application, deep well injection and in some cases, surface water discharge to receiving waters. As a result of all these factors, a conventional approach to pollutant controls is warranted and usually followed.

The Florida Keys, in contrast, is a 220 miles-long string of small narrow linear islands surrounded by a very large receiving waterbody. As a result, local runoff is not focused and pollutants are dispersed in the Gulf of Mexico and Straits of Florida. Soils are such that infiltration and percolation are relatively enhanced, moving infiltrated runoff and its pollutants to nearshore waters quickly, yielding little or no nutrient entrapment or treatment in the soils

matrix. The limited size of the land area limits the ability to place land intensive stormwater BMPs (such as detention or retention ponds). Also unique to the Florida Keys is the degree to which external farfield pollutants circulating in marine waters impact local waters. For wastewater, due to the soils, high water table and tides, septic tanks have limited treatment capability and "regional" systems are historically limited to small package plants. Finally, pollutant sources outside of the control of the local governments provide the dominant influence on the receiving waters of the area. In this case, unconventional approaches to pollutant controls are required.

Additionally, because they represents a unique terrestrial and aquatic ecosystem, Florida Keys have been the subject of significant regional, State and Federal scrutiny and regulatory oversight with most aspects of growth and development reviewed at all levels of government. The extent to this scrutiny will be discussed in other sections of this report since it is this oversight is an important element of reasonable assurance that pollution control activities have been, are and will be accomplished in the Florida Keys.

Impaired Waters:	Halo zone waters surrounding the Northern Keys Area are up to 500 meters offshore and nearshore waters up to 12,100 meters offshore; these waters are Class III (Recreation, Propagation and Maintenance of a Healthy, Well Balanced Population of Fish and Wildlife) and Outstanding Florida Waters (OFW). Waters are impaired based on 1998 303(d) List. Water Body Identification (WBID) numbers include: 6019, 6017, 6009, 6006A, 6006B, and 6005EB, which are the Halo Zone WBIDs surrounding the islands of Lower Matecumbe Key, Upper Matecumbe Key, Windley Key, Plantation Key and Largo Key.
Pollutants:	Nutrients (in particular, nitrogen and phosphorus)
Suspected Sources:	Halo Zone and Nearshore waters are dominated by farfield sources such as the natural and regulated discharges from the Everglades, regulated discharges from Lake Okeechobee through the Peace River, Caloosahatchee River, Mississippi River, etc. Anthropogenic sources from the Northern Keys Area are superimposed on this condition. Local sources include wastewater and stormwater originating in the unincorporated Monroe County in the Key Largo area (managed and operated by the Key Largo Wastewater Treatment District), the Villages of Islamorada, the Florida Department of Transportation (FDOT) in these areas and the Florida State Parks Service.
Applicable Standard:	Chapter 62-302.530(47)(b) – *"in no case shall nutrient concentrations of a water body be altered so as to cause an imbalance of natural populations of flora and fauna."* No scientifically supported nutrient thresholds have been defined for aquatic resources in the area.

Water Quality Target: Since the farfield sources dominate the nutrient concentrations in nearshore waters, the target is defined to be an insignificant concentration at 500 meters increase above natural background; insignificant means less than 10 µg/l for Total Nitrogen and 2 µg/l for Total Phosphorus and background means the Halo Zone condition in the absence of anthropogenic loads. Another target is that the nearshore ambient nutrient concentrations at 500 meters average less than the ambient concentrations measured for the OFW designation.

Management Actions: The list of completed and proposed management actions are provided in **Table ES-1**. Included are wastewater projects, stormwater programs and regulatory requirements.

Load Reductions: The management actions provide the following nutrient load reductions:

Nutrient	Anthropogenic Loading (1b/year)	Loading After Mgmt Actions (1b/year)	% Loading Reduction
Total Nitrogen	360,488	129,414	64%
Total Phosphorus	90,178	23,427	74%

Water Quality Result: The predicted nearshore nutrient concentrations as a result of the committed management actions are provided below (within nearshore modeled segment 500 meters from shore):

Nutrient	Model	Natural Concentration Conc (µg/l)	1999 Baseline Conc at 500 Meters(µg /l)	Conc After Management Actions at 500 Meters (µg /l)	Water Quality Target (µg /l)
Total Nitrogen	8N	754	762	756	764
	8S	114	122	115	124
	9N	729	732	730	739
	9S	113	119	114	123
	10N	324	324	324	324
	10S	118	121	119	128
Total Phosphorus	8N	9	11	9	11
	8S	6	8	6	8
	9N	8	9	8	10
	9S	5	7	5	7
	10N	6	7	6	8
	10S	6	7	6	8

Schedule:	Water quality targets (insignificant increase above farfield concentrations) are expected to be achieved by 2020, when all committed wastewater and stormwater management activities are completed.
Monitoring of WQ:	Monitoring will be completed via a number of ongoing ambient water quality and biological assessment stations throughout the Florida Keys; monitoring will be implemented by FDEP, SFWMD, and the Florida Keys National Marine Sanctuary (FKNMS); results are report to the FKNMS Sanctuary Advisory Council with studies by the Florida Marine Research Institute (FMRI) and the Florida International University (FIU) via the Water Quality Protection Program (WQPP). Monitoring will be reported to the FKNMS Steering Committee.
Monitoring Progress	Monitoring for success will include identification of physical connections to the central wastewater system; number of onsite systems (OSTDSs) eliminated; total nutrients in wastewater effluent discharged to deep well; number of stormwater systems installed; and decrease in nearshore nutrient concentrations in comparison to background. Management activities will be reported by stakeholders to the FKNMS Steering Committee.
Corrective Actions	None are recommended at this time. However, provisions have been identified for corrective actions that may be required for non-attainment of management actions.

In Summary:

The management actions proposed in the Northern Keys Area have, to a significant degree, already been implemented and are in operation.

- Collectively, the implemented and proposed wastewater management actions will virtually eliminate the baseline wastewater nutrient loads that were identified for the area and significantly reduce the nutrient loads in the remainder (unincorporated county portions) of the Northern Keys Area.

- Similarly, the implemented and proposed stormwater management actions represent a significant effort for removing the baseline anthropogenic stormwater nutrient load that was identified for the Northern Keys Area.

- Finally, state, regional and local regulatory controls of growth provide limits on increases to pollutant loading due to uncontrolled development.

The Stakeholders are confident that this plan provides reasonable assurance that water quality criteria will be met in the watersheds in the Northern Keys Area because this plan specifically removes or significantly reduces the known anthropogenic sources of the nutrient loads to result in concentrations increases above background such that the

increases are below the practical quantification limits for nitrogen and phosphorus as defined by FDEP.

Table ES-1
Summary of Estimated Nutrient Load Reductions For
Proposed and Implemented Management Practices

WBID	Management Action	Estimated Total Nitrogen Load Reduction (lbs/year)	Estimated Total Phosphorous Load Reduction (lbs/year)	Actual or Anticipated Operational Date
IMPLEMENTED MANAGEMENT PRACTICES				
6006A	Construction of 0.183 MGD demonstration AWT treatment facility with disposal in a shallow Class V effluent disposal well [KLWTD]	0	0	May 2006
6006A	Installation of Basin E (Phase 1) central wastewater collection system serving 999 EDUs with subsequent connection to the demonstration AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	7,689	2,149	October 2006
——	Installation of stormwater treatment systems for Existing Roadway [Islamorada]	Not Quantified	Not Quantified	2004-2007
PROPOSED FUTURE MANAGEMENT PRACTICES				
6009	Construction of the North Plantation Key central wastewater collection system, 0.25 MGD AWT treatment facility and shallow Class V effluent disposal well serving 1612 EDUs [Islamorada]	13,798	3,880	February 2008
6009	Construction of the South Plantation Key central wastewater collection system, 0.28 MGD AWT treatment facility and shallow Class V effluent disposal well serving 1,325 EDUs [Islamorada]	11,129	3,459	August 2008
6019	Construction of the Lower Matecumbe Key central wastewater collection system,0.29 MGD AWT treatment facility and shallow Class V effluent disposal well serving 1,351 EDUs [Islamorada]	10,518	3,107	September 2008
6006A	Construction of 2.3 MGD AWT treatment facility with disposal in a deep Class V effluent disposal well [KLWTD]	0	0	May 2009
6006A	Construction of the Basin A central wastewater collection system serving 1,324 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	11,850	3,459	May 2009
6006A	Construction of the Basin B central wastewater collection system serving 1,681 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	16,204	4,862	May 2009
6006A	Construction of the Basin D central wastewater collection system serving 2,548 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	21,759	6,241	May 2009
6006A	Construction of the Basin C central wastewater collection system serving 1,187 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	10,530	2,906	October 2009

WBID	Management Action	Estimated Total Nitrogen Load Reduction (lbs/year)	Estimated Total Phosphorous Load Reduction (lbs/year)	Actual or Anticipated Operational Date
PROPOSED FUTURE MANAGEMENT PRACTICES (CONTINUED)				
6017	Construction of the Upper Matecumbe Key central wastewater collection system, 0.585 MGD AWT treatment facility and shallow Class V effluent disposal well serving 2,700 EDUs [Islamorada]	21,217	6,266	February 2010
6017	Upper Matecumbe North 5: AWT- Shallow Well (1,506 EDU)	13,311	3,831	June 2010
6017	Upper Matecumbe South 6: AWT- Shallow Well (1,506 EDU)	11,214	3,279	June 2010
6006A	Construction of the Basin F central wastewater collection system serving 1,098 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	10,609	3,148	June 2010
6006A	Construction of the Basin G central wastewater collection system serving 1,616 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	15,494	4,603	September 2010
6006A	Construction of the Basin H central wastewater collection system serving 724 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	5,791	1,554	January 2011
6006A	Initial connection of John Pennekamp State Park to KLWTD central wastewater collection system serving 166 EDUs in Basins A-F [KLWTD]	38,584	11,226	June 2010
6009	Construction of the Windley Key central wastewater collection system, 0.13 MGD AWT treatment facility and shallow Class V effluent disposal well serving 1,088 EDUs [Islamorada]	8,451	2,486	October 2010
6006A	Final connection of John Pennekamp State Park to KLWTD central wastewater collection system serving 42 EDUs in Basins A-F [KLWTD]	54,603	15,877	January 2011
6006A	Construction of the Basin K central wastewater collection system serving 1,080 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	8,428	2,467	July 2011
6006A	Construction of the Basin I central wastewater collection system serving 1,910 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	13,931	4,031	October 2011
6006A	Construction of the Basin J central wastewater collection system serving 893 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	6,836	2,041	December 2011
6006A	Upgrade Private Facilities to BAT (128 EDU)	544	272	June 2010
6006A	Upgrade Cesspools to ATU (32 EDU)	137	0	June 2010

WBID	Management Action	Estimated Total Nitrogen Load Reduction (lbs/year)	Estimated Total Phosphorous Load Reduction (lbs/year)	Actual or Anticipated Operational Date
PROPOSED FUTURE MANAGEMENT PRACTICES (CONTINUED)				
6006B	Upgrade Private Facilities to BAT(30 EDUs)	143	72	June 2010
6006B	Upgrade Cesspools to ATU (47 EDUs)	218	0	June 2010
6006C	Ocean Reef Club AWT and Shallow Well (2,7686 EDU)	16,158	4,752	June 2010
6009	Middle Plantation 2 –AWT and Shallow Well (1,476 EDU)	13,274	3,553	June 2010
——	Installation of stormwater treatment systems for Existing Roadway [Islamorada]	Not Quantified	Not Quantified	2008-2010
——	Installation of stormwater treatment systems for Existing Roadway [FDOT]	Not Quantified	Not Quantified	2011-2020
NORTHERN KEYS AREA	TOTAL NUTRIENT REDUCTIONS	342,420	99,521	

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Section 1.0
BACKGROUND

1.1 PURPOSE OF THE DOCUMENT

The Impaired Waters Rule (IWR), Chapter 62-303, Florida Administrative Code (Identification of Impaired Surface Waters), establishes a formal mechanism for identifying surface waters in Florida that are impaired (do not meet applicable water quality standards) by pollutants. Most waters that are verified as being impaired by a pollutant will be listed on the state's 303(d) list pursuant to the Florida Watershed Restoration Act (FWRA) and Section 303(d) of the Clean Water Act. Once listed, Total Maximum Daily Loads (TMDLs) will be developed for the pollutants causing the impairment of the listed waters. However, as required by the FWRA, the Department will evaluate whether existing or proposed pollution control mechanisms will effectively address the impairment before placing a water body on the state's verified list. If the Department can document there is reasonable assurance that the impairment will be effectively addressed by the control measure(s), then the water will not be listed on the final verified list.

The rule text addressing the evaluation of proposed pollution control mechanisms is as follows:

> ***62-303.600 Evaluation of Pollution Control Mechanisms***
> *(1) Upon determining that a water body is impaired, the Department shall evaluate whether existing or proposed technology-based effluent limitations and other pollution control programs under local, state, or federal authority are sufficient to result in the attainment of applicable water quality standards.*
> *(2) If, as a result of the factors set forth in (1), the water segment is expected to attain water quality standards in the future and is expected to make reasonable progress towards attainment of water quality standards by the time the next 303(d) list is scheduled to be submitted to EPA, the segment shall not be listed on the verified list. The Department shall document the basis for its decision, noting any proposed pollution control mechanisms and expected improvements in water quality that provide reasonable assurance that the water segment will attain applicable water quality standards.*

It is ultimately the Department's responsibility to assure adequate documentation in the administrative record whenever the Department decides to not list an impaired water segment for a given pollutant. This documentation will be very important because verified lists will be adopted by Order of the Secretary and third parties will be provided an opportunity to challenge, via an administrative hearing, all listing decisions. However, the Department expects local stakeholders (including state and local government) will prepare the necessary documentation to demonstrate reasonable assurance that their proposed control mechanisms will restore a given water body. The Department will provide guidance to stakeholders on what information is needed and how it should be submitted.

The purpose of this document is to provide reasonable assurance that stakeholders in the Northern Keys Area have provided or will provide sufficient control mechanisms in place to return the area's near shore water quality to the targets set for total nitrogen and total phosphorus. For the purpose of this document, the stakeholders include the Village of Islamorada, Key Largo Wastewater Treatment District for the unincorporated Monroe County, Florida Department of Transportation (FDOT), and Florida State Parks Service.

1.2 REASONABLE ASSURANCE PROCESS

To provide reasonable assurance that existing or proposed pollution control mechanisms will restore designated uses, the following information should be evaluated and documented for the Administrative Record:

(a) **A Description of the Impaired Water** - name of the water listed on the verified list, the location of the water body and watershed, the watershed/8-digit cataloging unit code, the NHD identifier (when they become available), the type (lake, stream, or estuary) of water, the water use classification, the designated use not being attained, the length (miles) or area (acres) of impaired water, the pollutant(s) of concern (those identified as causing or contributing to the impairment), and the suspected or documented source(s) of the pollutant(s) of concern.

(b) **A Description of the Water Quality or Aquatic Ecological Goals** - a description of the water quality-based targets or aquatic ecological goals (both interim and final) that have been established for the pollutant(s) of concern, the averaging period for any numeric water quality goals, a discussion of how these goals will result in the restoration of the water body's impaired designated uses, a schedule indicating when interim and final targets are expected to be met, and a description of procedures (with thresholds) to determine whether additional (back-up) corrective actions are needed.

(c) **A Description of the Proposed Management Actions to be Undertaken** – names of the responsible participating entities (government, private, others), a summary and list of existing or proposed management activities designed to restore water quality, the geographic scope of any proposed management activities, documentation of the estimated pollutant load reduction and other benefits anticipated from implementation of individual management actions, copies of written agreements committing participants to the management actions, a discussion on how future growth and new sources will be addressed, confirmed sources of funding, an implementation schedule (including interim milestones and the date by which designated uses will be restored), and any enforcement programs or local ordinances, if the management strategy is not voluntary.

(d) **A Description of Procedures for Monitoring and Reporting Results** – a description of the water quality monitoring program to be implemented (including station locations, parameters sampled, and sampling frequencies) to demonstrate reasonable progress; quality assurance/quality control elements that demonstrate the monitoring will comply with Chapter 62-160, F.A.C.; procedures for entering all appropriate data into STORET; the responsible monitoring and reporting entity; the frequency and format for reporting results; the frequency and format for reporting on

the implementation of all proposed management activities; and methods for evaluating progress towards goals.

(e) **A Description of Proposed Corrective Actions** – a description of proposed corrective actions [and any supporting document(s)] that will be undertaken if water quality does not improve after implementation of the management actions or if management actions are not completed on schedule, and a process for notifying the Department that these corrective actions are being implemented.

Note: The above information regarding reasonable assurance is based on a draft memorandum issued by FDEP in 2006 and represents the latest guidance available from the State. Additional guidance has been issued by the US Environmental Protection Agency (USEPA) in October 12, 2007, by the Office of Wetlands, Oceans, and Watersheds (OWOW). The USEPA document added one element to the demonstration: "an estimate or projection of the time when [water quality standards] will be met," addressed in Section 5 of this report. Both of these documents are provided in **Appendix A**.

1.3 UNIQUENESS OF THE FLORIDA KEYS

The Florida Keys is a chain of islands approximately 220 miles long, extending from the end of the Florida peninsula curving southwest toward the Dry Tortugas (see **Figure 1-1**). Consisting of 822 islands, of which about 30 are inhabited, the Florida Keys are traversed by U.S. Highway 1 (a.k.a., US 1 or Overseas Highway) with 19 miles of bridges. The Keys are entirely within Monroe County and includes the municipalities of Islamorada, Key Colony Beach, Layton Marathon and Key West. Key West represents about 30 percent (24,000 people) of the population of Monroe County, which, according to the 2000 Census, is about 79,600 people.

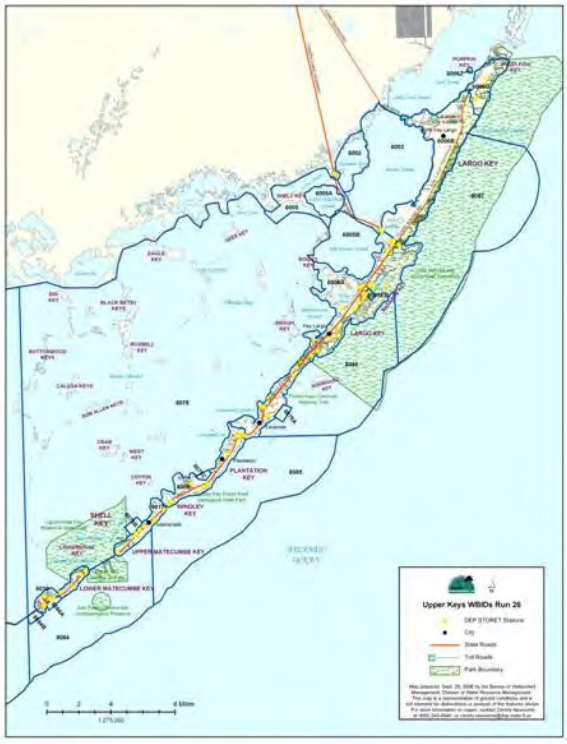
Figure 1-1
Florida Keys

In general, Florida watersheds are characterized by a large land mass with runoff flowing to a small (in surface area, at least) water body. Runoff is focused to receiving waters wherein pollutants are concentrated. Soils allow infiltration and percolation slowing down nutrient runoff and as well, soils can facilitate the treatment of nutrients due the availability of available land for common stormwater best management practices (BMPs). Also, the BMPs can generally be

monitored using a relatively small number of sampling points. Similarly, with the large watersheds, wastewater can be controlled using septic tanks and large regional treatment facilities. Septic discharges through a drainfield can be absorbed into the soils and regional treatment effluent can be discharged via reuse, storage, land application, deep well injection and in some cases, surface water discharge to receiving waters. As a result of all these factors, a conventional approach to pollutant controls is warranted and usually followed.

The Florida Keys, in contrast, is a 220 miles long string of small islands surrounded by a very large receiving water body. As a result, runoff is not focused and pollutants are dispersed. Soils are such that infiltration and percolation is relatively enhanced, moving infiltrated runoff to nearshore waters quickly, yielding little or no nutrient entrapment or treatment in the soils matrix. The limited size of the land area limits the ability to place land intensive stormwater BMPs (such as detention or retention ponds). For wastewater, due to the soils, high water table and tides, septic tanks have limited treatment capability and "regional" systems are historically limited to small package plants. Finally, pollutant sources outside of the control of the local governments provide the dominant influence on the receiving waters of the area. In this case, unconventional approaches to pollutant controls are required. Additionally, because they represents a unique terrestrial and aquatic ecosystem, the Florida Keys have been the subject of significant regional, state and federal scrutiny with most aspects of growth and development reviewed at all levels. The extent to this scrutiny will be expanded in other sections of this report since it is this oversight that provides reasonable assurance that pollution control activities will be accomplished in the Florida Keys.

1.4 GEOGRAPHIC EXTENT OF THE NORTHERN KEYS AREA



The Northern Keys Area is generally described as the Key Largo portion of the unincorporated Monroe County and the islands of the Village of Islamorada, about 32 miles long. **Figure 1-2** illustrates the area, which is approximately 25,830 ac acres (40.4 sm sq miles) in size. The keys include Lower Matecumbe, Upper Matecumbe, Windley, Plantation, Radabob and Largo Keys.

For the purposes of this document, three receiving water areas are defined:

- Bubble WBID or Halo Zone – from the coastline to 500 meters, within which the impairment has been defined;
- Nearshore waters – those modeled waters from 500 meters to 12,100 meters; and,

- Farfield waters – those waters beyond 12,100 meters from the coastline, the water quality of which is controlled by outside influences.

1.5 STAKEHOLDER GROUP PROCESS

In order to prepare the FKRAD, a stakeholder process was used starting in late 2006. The stakeholder process provided an opportunity for local, regional, state and federal governments (as well as other third party interest) to: understand the reasonable assurance process; provide data and research input into the development of the FKRAD documentation; and confirm that the FKRAD reasonably expresses the committed activities of the stakeholders. A brief description of the group is provided below.

1.5.1 Stakeholder Group Membership

The stakeholder group consisted of all of the local, regional, state and federal agencies as well as environmental and local groups interested in the Florida Keys. **Table 1-1** provides a list of the invited stakeholder group. Each stakeholder was contacted by e-mail periodically to identify upcoming meetings and provide meeting presentation material, minutes of meetings, and other material useful to the understanding of the program.

1.5.2 Technical Working Group

The Technical Working Group is comprised of representative of stakeholders who are party to the FKRAD and technical contributors. The Technical Working Group mission statement is: "The mission of the Florida Keys Reasonable Assurance Documentation (FKRAD) Program's Technical Working Group is to obtain information on existing and pending stakeholder programs required to describe and document regional water quality management actions that will provide reasonable assurance that existing programs will meet identified local goals for restoring nutrient impaired water bodies. "

The purpose of the Technical Working Group was to:

1. Define guiding principles to be adopted by stakeholders for achieving the mission of the FKRAD;
2. Identify nutrient impaired water bodies and the causes of impairment, document existing and pending stakeholder programs for reducing anthropogenic impacts in receiving water bodies;
3. Identify local and regional water quality targets and aquatic ecological goals, describe ongoing local and regional management actions to achieve nutrient load reductions in the impaired water bodies;
4. Identify procedures for monitoring and reporting the results of the management actions, describe proposed corrective actions, gather local information and data required to fill key knowledge gaps;
5. Identify necessary education, outreach, and implementation measures for moving the impaired water bodies toward meeting regional goals and achieving FDEP water quality standards; and,

6. Assist in securing participation of all interested groups, individuals, and agencies and involving the public throughout the process.

Copies of presentation and meeting minutes for the Technical Working Group are provided in **Appendix H**.

Table 1-1
Florida Keys Reasonable Assurance Documentation (FKRAD)
List of Stakeholders and Interested Parties

Stakeholders – NPDES Regulated Entities

City of Key Colony Beach *
City of Key West *
City of Marathon *
Florida Department of Transportation
Florida Keys Aqueduct Authority *
Islamorada, Village of Islands *
Key Largo Wastewater Treatment District *
Monroe County *
Monroe County Aviation Authority
National Oceanic and Atmospheric Administration – Aerostat Facility
U. S. Navy

Regulatory Agencies

Florida Department of Health – Bureau of Onsite Sewage Programs *
Florida Department of Community Affairs *
Florida Department of Environmental Protection *
U. S. Army Corps of Engineers *
U.S. Environmental Protection Agency - Region IV *
South Florida Water Management District *

Programs

Everglades & Dry Tortugas National Parks *
Florida Department of Health *
Florida Keys Environmental Fund *
Florida Keys National Marine Sanctuary (FKNMS) *
Florida Keys National Wildlife Refuges – USF&WS *
Florida Fish and Wildlife Conservation Commission
National Marine Sanctuaries Program - NOAA *
FKNMS Sanctuary Advisory Council *

Other Interested Parties

Earth Justice
Florida Audubon Society
Florida Keys Visitors and Convention Bureau
Monroe County Commercial Fishermen *
Sandra Walters Consultants, Inc. *
Sierra Club
Southeast Environmental Research Center (SERC) – FIU *
South Florida/Florida Keys Program – The Nature Conservancy *
Thousand Friends of Florida
Isaak Walton League of America

- Note: Member of Florida Keys National Marine Sanctuary Steering Committee

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Section 2.0

IDENTIFICATION OF THE IMPAIRED WATERS

2.1 UNDERSTANDING OF IMPAIRMENT IN FLORIDA KEYS

This section provides a description of the impaired waters, historical and recent information showing the waters to be impaired, and a consideration of the pollutants and suspected sources.

2.1.1 Problem Definition

The Bubble WBID and nearshore waters within the Northern Keys Area are designated Class III (Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife) and Outstanding Florida Waters (OFW, excluding canals). The operative criteria are listed, therefore, in Chapter 62-302.530(47), FAC (criteria for Class III) and Chapter 62.4-242(2), FAC (criteria for OFW). The 1998 303(d) Impaired Waters List lists "the Florida Keys" as impaired for nutrients, with no other specificity. To clarify the listing for impairment, more recent and other sources of data and information are considered below.

2.1.2 Historical Water Quality Information

The most comprehensive consideration of historical water quality and impairment information is provided by "Water Quality Concerns in the Florida Keys: Sources, Effects, and Solutions" (Kruczynski, Sept. 1999). Three key points made in this document on page 2:

> "The survival of the existing Florida Keys marine ecosystem is dependent upon clear, low-nutrient waters…"
>
> "The data demonstrate that the cumulative effects of continued discharges of nutrient-rich wastewater and stormwater into confined and some other adjacent nearshore waters have degraded the water quality of those waters…"
>
> "There is evidence that the degraded water quality has adversely impacted other nearshore communities."

There are extensive references to research done in Florida Keys waters, including manmade canals, and the document concludes that:

> "Scientists agree that canal and other nearshore waters are affected by human-derived nutrients from sewage" (Executive Summary)

Documents related to the Florida Keys National Marine Sanctuary (e.g., Final Management Plan/Environmental Impact Statement, 1996) and more recent documents from the Florida Keys Water Quality Improvement Program (US Army Corps of Engineers, USEPA and SFWMD) refer to similar statements. However, none of these documents provide evidence that nutrient concentrations exceed a certain threshold criteria thereby yielding measurable impairment.

In 1985, when the Florida Keys were made an Outstanding Florida Waters, water quality data were collected to define the existing ambient water quality at the point of designation. Data were collected at 165 stations from January to February 1985 in three areas: Bayside (49 stations north and northwest of the islands), Oceanside (46 stations south and southeast of the islands, and Canal (70 stations within the artificial waterways interior to the islands in canals, boat basins and marinas). Parameters measured included dissolved oxygen, pH, temperature, conductivity, salinity, nitrogen species, total phosphorus, and fecal coliform. The detection limits for total nitrogen and total phosphorus were recorded as 20.5 µg/l and 2 µg/l, respectively. For the Bayside and Oceanside, the results for nutrients are provided in the insert.

1985 FDEP OFW Water Quality Data						
	Total Nitrogen (µg/l)			Total Phosphorus (µg/l)		
Location	**Average**	**Minimum**	**Maximum**	**Average**	**Minimum**	**Maximum**
Bayside	370	130	697	14	1	54
Oceanside	288	145	489	15	4	80

According to Chapter 62-302.700 (Special Protection, Outstanding Florida Waters, Outstanding National Resource Waters):

> "(1) It shall be the Department policy to afford the highest protection to Outstanding Florida Waters and Outstanding National Resource Waters. No degradation of water quality, other than that allowed in Rule 62-4.242(2) and (3), F.A.C., is to be permitted in Outstanding Florida Waters and Outstanding National Resource Waters, respectively, notwithstanding any other Department rules that allow water quality lowering."

In practice, FDEP has defined "degradation of water quality" as noted in this rule as reduction of the ambient water quality identified at the time of designation. Therefore, in practice, the above table represents the range of nutrient water quality at the time of designation and the water quality that needs to be protected according to the OFW designation. The following table provides the estimated nutrient concentrations as a result of the nutrient models prepared for this document. These concentrations represent the ambient nutrient content of the nearshore waters in 1999.

1999 Baseline Nutrient Concentrations						
	Total Nitrogen (µg/l)			Total Phosphorus (µg/l)		
Location	**Average**	**Minimum**	**Maximum**	**Average**	**Minimum**	**Maximum**
Bayside	381	211	782	19	10	50
Oceanside	159	119	275	15	6	48

It can be seen that average total nitrogen and total phosphorus values (except Oceanside) exceed those of the 1985 OFW data, indicating, according to OFW criteria, a degradation of nutrient concentrations.

Other information was also considered in an attempt to identify nutrient water quality targets. Anecdotal information and observations from FDEP staff, scientists and engineers working in the Keys, and other observers point out increasing problems with water clarity, proliferation of macrophytic and epiphytic algae in the Halo Zone and nearshore waters which can be linked to nutrient enrichment.

Existing primary monitoring networks, which were designed and implemented for the purpose of documenting long-term water quality trends on a quarterly basis, have documented instances of elevated nutrient levels. However, the quarterly data, when combined with the marine circulation and net flow patterns in the nearshore waters of the Keys, cannot be used to provide data identifying a continuing or a consistent location.

2.1.3 Impacts of External/Far Field Sources

Historical and recent documents refer to the impacts of farfield sources in the Bubble WBIDs and nearshore waters of the Florida Keys. Farfield sources include outflow from the Florida Everglades into Florida Bay, flows from the Peace and Caloosahatchee Rivers including discharges from Lake Okeechobee, waters of the Gulf of Mexico (via the Loop Current which is impacted by nutrients from the Mississippi River),the Florida Current (between the Keys and Cuba) and periodic deep ocean upwelling. **Table 2-1** provides a list of anthropogenic and non-anthropogenic sources of nutrients in the Bubble WBIDs and nearshore waters of the Florida Keys in comparison to those controlled by Keys communities. Clearly the farfield sources are not controlled by the local governments in the Florida Keys.

Table 2-1
Issues Impacting Living Resources and Water Quality in the Florida Keys

Non-Anthropogenic Uncontrollable Sources Impacting the Keys	Anthropogenic Sources Associated with Non-Keys Communities	Anthropogenic Sources Controllable by Florida Keys Communities
▪ Deposition of African dust that contains micronutrients and pathogens ▪ Normal atmospheric deposition of nutrients and toxins ▪ Deep ocean upwelling that creates high nitrogen loads at low concentrations in the water column ▪ El Nino Cycles ▪ Elevated water temperature that exacerbate normal zooxanthellae expulsion rates causing coral bleaching ▪ Depressed water temperatures that cause hypothermic die-off of living coral cover ▪ Lower annual rainfall that causes natural hypersaline conditions in Florida Bay	▪ Boating discharges ▪ Gulf of Mexico flow-through ▪ Okeechobee waterway discharges ▪ Stormwater management practices and discharges from certain public properties (FDOT, military and SFWMD parcels) ▪ Wastewater management practices and discharges from certain public properties (FKAA, KLWTD and Military parcels) ▪ Regional water resource management and flood control practices and discharges from certain public properties (USACE, SFWMD, and military parcels) ▪ Water controls leading to reduced freshwater influences exacerbating hypersalinity ▪ Higher annual rainfall that necessitates USACE to initiate the flood management discharges from Lake Okeechobee via the Okeechobee Waterway (a/k/a Caloosahatchee River)	▪ Stormwater management practices and discharges from private properties ▪ Stormwater management practices and discharges from some public properties ▪ Wastewater management practices and discharges from private properties ▪ Wastewater management practices and discharges from some public properties

2.2 IMPAIRED WATERS

The following subsections were developed using the available information on impaired waters in the Florida Keys. The subsections are ordered in accordance with the FDEP and EPA guidelines.

Name of Waters Listed: The waters subject to this reasonable assurance document are the near shore waters in the Northern Keys Area (see Figure 1-2). For the purposes of this document, near shore waters include those waters that are within a boundary of 100 ± meters from the coastline of each island. Water Body Identification (WBID) numbers include: 6019, 6017, 6009, 6006A, 6006B, and 6005EB, which are the Halo Zone WBIDs surrounding the islands of Lower Matecumbe Key, Upper Matecumbe Key, Windley Key, Plantation Key and Largo Key.

Location of Waters/Watersheds: The waters are located in Monroe County, on the northeastern portion of the Florida Keys. These water bodies are located within the FDEP South District and the South Florida Water Management District (SFWMD).

Watershed Unit Code: Waters in the Florida Keys have been assigned a HUC code of 03090203.

Water Body Type: The waters in the Halo Zone (Bubble WBIDs) are marine.

Water Use Classification: The waters are classified by the state of Florida as Class III - Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife. Also, excluding interior canals, all of the waters in the Florida Keys are considered Outstanding Florida Waters as indicated in Chapter 62-302.700(12).

Designated Uses Not Attained: The designated use not attained for the near shore waters of the Florida Keys is “Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife” through the violation of the nutrient rule Chapter 62-302.530(48)(b) – “In no case shall nutrient concentrations of a body of water be altered so as to cause an imbalance in natural populations of aquatic flora and fauna.” However, as noted above, the definition of impairment in this area is based on historical and anecdotal information as well as stakeholder experience.

Length of Impaired Waters: The Northern Keys Area is a series of islands of approximately 32 miles long by about 2 miles wide. The impaired waters are the Bubble WBIDs or Halo Zone waters surrounding the islands consisting of the first 500 meters off the shoreline.

Pollutant(s) of Concern: The pollutants of concern are nutrients; in particular, total nitrogen and total phosphorus.

Suspected/Documented Sources: Documented sources of nutrient enrichment in the halo Zone waters of the Northern Keys Area include: stormwater runoff and indirect wastewater discharges (nonpoint sources) from two separate sources:

- Farfield Nutrient Loads: include outflow from the Florida Everglades into Florida Bay, flows from the Peace and Caloosahatchee Rivers including discharges from Lake Okeechobee, waters of the Gulf of Mexico (via the Loop Current which is impacted by nutrients from the Mississippi River), the Florida Current (between the Keys and Cuba) and periodic deep ocean upwelling.

- Local Nutrient Loads: Stormwater runoff is discharged to near interior canals and Halo Zone waters during rainfall events from existing developed areas. Wastewater discharges to canals and Halo Zone waters from cesspits (failed septic tanks), onsite treatment facilities and small wastewater treatment facilities.

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Section 3.0
DESCRIPTION OF WATER QUALITY TARGETS

3.1 WATER QUALITY TARGETS

This section defines the water quality targets used to evaluate the degree to which management activities with result in the attainment of the narrative nutrient water quality criterion ("an imbalance of aquatic flora and fauna"). The applicable water quality standards, resource targets and selected targets are discussed below.

3.1.1 Florida Water Quality Standards

The nearshore waters in the Northern Keys Area are classified as Class III (Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife) and Outstanding Florida Waters (OFW). These designations are discussed further in the Technical Information Document, Appendix A.

For these waters, the applicable water quality standard is §62-302.530(47), FAC, which states:

> "(a) The discharge of nutrients shall continue to be limited as needed to prevent violations of other standards contained in this chapter. Man-induced nutrient enrichment (total nitrogen or total phosphorus) shall be considered degradation in relation to the provisions of Sections 62-302.300, 62-302.700, and 62-4.242, FAC."
>
> (b) In no case shall nutrient concentrations of a water body be altered so as to cause an imbalance of natural population of aquatic flora and fauna."

To define impairment, Subpart (b) was the focus of the Impaired Water Rule (§62-303.353, FAC) in cases where nutrients are used to consider impairment:

> "Estuaries, or estuary segments, or open coastal waters shall be included on the planning list for nutrients if their annual mean chlorophyll a for any year is greater than 11 µg/l or if data indicate annual mean chlorophyll a values have increased by more than 50% over historical values for at least two consecutive years."

The threshold identified in this rule was not to be used as a target (§62-303.450, FAC). Therefore, with the nearshore waters in Florida Keys identified as impaired for nutrients, the applicable target was researched.

3.1.2 Water Quality Targets for Aquatic Resources

In an attempt to define water quality targets based on the protection or enhancement of aquatic resources, recent research was consulted and numerous personal contacts were made, the results of which are summarized by resource below.

Queen Conch

The queen conch is a large marine gastropod harvested intensively throughout the Caribbean for its meat and shell. Conch, in the Florida Keys, once supported commercial and recreational fisheries, but over-harvesting depleted the population. Though the harvesting of conch was banned in Florida in 1985, conch populations have not recovered to levels that support exploitation. Conch tend to occur in two spatially assemblages throughout the Florida Keys: nearshore assemblages that congregate in nearshore seagrass beds and hard bottom communities, and offshore assemblages that occupy soft bottom communities.

Recent studies have tried to identify stressors affecting the reproduction and mortality of queen conch. These studies observed that nearshore and offshore queen conch in the Florida Keys are subjected to oxidative stress. Furthermore, studies have observed retarded reproductive activity among nearshore queen conch. Yet, these studies failed to link the effects of increased nutrient levels on reproduction and mortality. Inadequate methods for determining conch age, variable fecundities, and studies conducted over long timescales are problematic variables for conch studies that do not yield conclusive results regarding the significance of nutrient levels on conch populations.

Coral Reefs

Reports on the Florida Keys coral reef species have raised concern about the continued decline of the coral reefs in nearshore and offshore waters, and the need to understand the causes of decline of coral populations. Coral reef communities, habitats for hundreds of marine species of fish and marine invertebrates, occur in rocky bottoms areas and are dominated by several species of stony corals, such as Acropora (branching corals), Montastrea (star corals), and Diploria (brain corals). Coral reefs also comprise soft corals, sponges, tunicates, and algae. Factors affecting coral reef development, growth, and sustenance include light transitivity, substrate availability, nutrient levels, salinity, temperature, sedimentation/turbidity, disease, and physical damage.

Recent studies on coral reef decline have focused on the effects of increased nutrient levels from runoff, outfalls, and septic systems on coral reef development. Nitrogen levels throughout the coral reef study areas are adequate to sustain proper coral reef development, although the nitrogen cycle in coral reef systems is not well understood and should not be used to indicate pollution levels in coral reefs. In addition, high concentrations of chlorophyll-a in coral tissue are thought to be an adaptive response resulting from decreased light levels caused by turbidity and increased algae productivity.

It is difficult to determine if there has been a conclusive decline in coverage of coral species because of a lack of continuity in monitoring specific sites. Documented coverage estimates and trends over time were obtained from

varying samples sizes, therefore results are not representative of coral species throughout the Keys.

Sea Grasses

Seagrass provide a number of ecological functions in the Florida Keys. They maintain water clarity by stabilizing benthic sediments and pulling nutrients out of the water column. They also provide a habitat for sea-dwelling creatures like fish and shellfish, provide food for many marine animals, and provide a nursery area for Florida's important marine life. Species of seagrass found in the Florida Keys include turtle-grass (Thalassia testudinum), manatee-grass (Syringodium), shoal-grass (Halodule wrightii), paddle-grass (Halophila decipiens), star-grass (Halophila englemanni), and widgeon-grass (Ruppia maritima).

As part of the Florida Keys Carrying Capacity Study, nearshore seagrass communities were studied to determine if temporal or spatial variation in seagrass communities were associated with human land use activity in the Florida Keys. Despite significant land development in the Florida Keys over the past 40 years, nearshore seagrass communities exhibited little variation. The results provided little evidence to support a relationship between land use and spatial or temporal variation of nearshore seagrass communities and their associated nutrient regimes throughout the Florida Keys. Despite visual evidence of anthropogenic effects on the near shore and offshore aquatic environment of the Florida Keys (prop scars and coral damage, among others), available reports and data are insufficient to establish a scientifically defensible nutrient target related to human land development, nutrient regimes, and nutrient effects on the seagrass communities.

Coral Reef Fish

Reef fishes are an essential component to the Florida Keys marine ecosystem that provides recreational activities for tourists and residents, and supports important commercial and recreational fisheries. Reef fishes include hundreds of species that vary in size, shape, and color, which can make the identification and quantification of species very difficult. One example of a reef fish is the parrotfish, which has become the dominant grazer on Caribbean reefs since the mass disease-induced die-off of the urchin Diadema antillarum in 1983.

Although monitoring programs remain the best source of information about changes in fish species in the Florida Keys, they are not specifically linked to the identification of stressors, such as nutrients concentrations, and overall health of fish populations. Rather, studies on fish populations through the Florida Keys have been focused on establishing biodiversity indices that provide the richness and evenness of species or on the potential effects of fishing pressure on fish populations. Neither of these types of studies establish thresholds for evaluating anthropogenic impacts on fish species development. The limited data linking water quality stressors to fish populations and the uncertainty associated with fish biodiversity assessment

highlight the difficulty in providing quantitative decisions regarding the effects of nutrient levels on fish in the Florida Keys.

Based on this research, no aquatic resource based targets or thresholds are scientifically supported to define a preferred nutrient condition in the halo zone of the Northern Keys Area waters.

3.1.3 Water Quality Targets Based on Insignificant Anthropogenic Increases

The previous subsection indicated that scientifically supported targets related to the protection of aquatic resources are not available for the significant aquatic flora or fauna in the halo zone waters of the Florida Keys. For this reason, a surrogate target is considered for the definition of targets – that the anthropogenic loads after the achievement of the management activities defined by this reasonable assurance documentation cause an "insignificant" increase in nutrient concentrations in the halo zone above the farfield concentration.

For the purposes of this document, "insignificant" means immeasurable above boundary conditions. For this reason, a surrogate target is considered for the definition of targets – that the anthropogenic loads after the achievement of the management activities defined by this reasonable assurance documentation cause an "insignificant" increase in nutrient concentrations in the halo zone above the farfield concentration.

For the purposes of this document, "insignificant" means 10 µg/l for Total Nitrogen and 2 µg/l for Total Phosphorus above natural background at 500 meters from the shore. Natural background is the predicted model result in the Halo Zone with all of the urban land uses changed to natural conditions (e.g., residential and commercial changed to forested land uses with no change to land uses that are already wetlands, water or forested).

According to the model the targets are defined as follows:

Nutrient		Natural Background Concentration (µg/l)	Water Quality Target Concentration @ 500 meters (µg/l)
Total Nitrogen	8N	754	764
	8S	114	124
	9N	729	739
	9S	113	123
	10N	324	334
	10S	118	128
Total Phosphorus	8N	9	11
	8S	6	8
	9N	8	10
	9S	6	8
	10N	6	8
	10S	6	8

3.1.4 Water Quality Targets Based on OFW Designation

As noted in Section 2.0, the Florida Keys have been designated Outstanding Florida Waters and as such, the water quality defined at the point of designation becomes the condition below which degradation is not allowed (Ch. 62-302.700, F.A.C). Data from the 1985 designation are provided below – the data and ranges represent nutrient thresholds as do the insignificant increases discussed above.

1985 FDEP OFW Water Quality Data						
	Total Nitrogen (µg/l)			Total Phosphorus (µg/l)		
Location	**Average**	**Minimum**	**Maximum**	**Average**	**Minimum**	**Maximum**
Bayside	370	130	697	14	1	54
Oceanside	288	145	489	15	4	80

3.1.5 Water Quality Standards For Hawaii As Comparison

Comparison of the situation in the Florida Keys to that in the State of Hawaii was considered as part of this program since Hawaii is the only potentially similar set receiving waters and watershed/hydrologic settings.

- Common Factors include their tropical settings, lack of "upstream" flows, relatively small watershed areas (islands) discharging to large receiving waters.

- Significant Differentiating Factors include the larger relative scale of the Hawaiian islands relative to the Keys (Kauai is about 25 miles in diameter while Key West is about 4 by 2 miles), the relatively farther distance to other anthropogenic nutrient sources, and the more pristine farfield water quality of the Pacific Ocean providing the boundary condition for the Hawaiian Islands.

Chapter 11-54, Hawaii Administrative Rules, were reviewed to consider nutrient water quality standards for Hawaii. For the various types of waters in the Hawaiian Islands, the standards are listed below.

Table 3-1
Summary of Hawaiian Nutrient Standards (Chapter 11-54, HAR)

	Total Nitrogen			Total Phosphorus		
Water Type	Geometric Mean	< 10% of Time	< 2% of time	Geometric Mean	< 10% of Time	< 2% of time
Island Waters	250	520	800	50	100	150
Estuaries (except Pearl Harbor)	200	350	500	25	50	75
Pearl Harbor	300	550	750	60	130	200
Embayments	150	250	350	20	40	60
Open Coastal Waters	110	180	250	20	40	60
Oceanic Waters	50	80	100	10	18	25

It should be noted that according to Chapter 11-54(c) Ocean Waters, the boundary of such waters is outside of the 183-meter (600-foot) depth contour. For most locations within the Hawaiian Islands, this is about 1,600 meters (1 mile) from the coast.

In comparison, the nutrient data for the Keys are summarized in the following tables, starting with the 1985 OFW data, the 1999 boundary condition data, and the 2020 Implemented Management Activities condition data (modeled, described in more detail in Section 4.0).

Table 3-2
1985 FDEP OFW Water Quality Data

	Total Nitrogen (pg/l)			Total Phosphorus (pg/l)		
Location	Average	Minimum	Maximum	Average	Minimum	Maximum
Bayside	370	130	697	14	1	54
Oceanside	288	145	489	15	4	80

Table 3-3
1999 Baseline Nutrient Concentrations

	Total Nitrogen (pg/l)			Total Phosphorus (pg/l)		
Location	Average	Minimum	Maximum	Average	Minimum	Maximum
Bayside	381	211	782	19	10	50
Oceanside	159	119	275	15	6	48

Table 3-4
2020 Simulated Nutrient Condtion with Implemented Management Actions

	Total Nitrogen (pg/l)			Total Phosphorus (pg/l)		
Location	Average	Minimum	Maximum	Average	Minimum	Maximum
Bayside	346	172	756	9	7	12
Oceanside	126	114	140	6	5	9

In comparison, the mean or average total nitrogen values are slightly larger than the Pearl Harbor values, with the 1987 OFW values also larger than the Pearl Harbor. The total phosphorus values for the OFW and Baseline condition are slightly larger than the Hawaiian open ocean standard (but less than any other listed) and for the 2020 condition, are less than the Hawaiian open ocean values. From this limited comparison, the total nitrogen targets are similar to Hawaii and the total phosphorus targets are lower than Hawaii, even though the Keys represent a different background condition (not pristine). Further, the Keys targets are set at 500 meters from the coast and Hawaii's are set at 183 meters of depth (not experienced in the Florida Keys) which translates in Hawaii to a minimum of 1,600 meters (1 mile) away from the island.

3.2 RESTORATION OF THE DESIGNATED USES OF THE IMPAIRED WATERS

The nutrient concentrations of the Bubble WBIDs (or Halo Zone) and nearshore waters are dominated by the farfield anthropogenic and natural nutrient loading, outside of the influence of the agencies in the Florida Keys. The participants in this reasonable assurance documentation, as shown below, will significantly reduce the additive anthropogenic nutrients due to wastewater and stormwater loads. As a result, the additive concentration in the Halo Zone will be insignificant once the management activities defined herein are completed. While the influences of the islands of the Florida Keys will be minimized by these activities, continuing work on the Everglades, Peace River, Caloosahatchee River, Mississippi River and other outside controlling factors is needed to return the water quality in the Keys to historical conditions.

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Section 4
DESCRIPTION OF PROPOSED MANAGEMENT ACTIONS TO BE UNDERTAKEN

4.1 NAMES OF THE RESPONSIBLE PARTICIPATING ENTITIES

There are a total of five stakeholders participating in the Northern Keys Area Reasonable Assurance documentation process including:

- Key Largo Wastewater Treatment District (WBIDs 6006A and 6006B)
- Islamorada, Village of Islands (WBIDs 6009, 6017 and 6019)
- Monroe County (WBIDs 6006B and 6006C)
- Florida Department of Transportation (WBIDs 6006A, 6006B, 6006C, 6009, 6017 and 6019)
- Florida State Parks System (WBIDs 6017)

Exhibit 4-1 at the end of this section provides a brief summary of each of these stakeholders and contains the contact information for the individual who has executed their stakeholder agreement, their Technical Working Group Representative, and in some cases their facility manager.

4.2 PROPOSED MANAGEMENT ACTIVITIES DESIGNED TO RESTORE WATER QUALITY

As previously discussed, the Florida Keys are unlike any other watershed in Florida in terms of the relationship of watersheds to receiving waterbodies, dispersion vs. concentration of nutrients, and the predominance of farfield sources on local water quality. Consequently, there are a number of important concepts that need to be understood relative to the management actions being proposed in the Northern Keys Area:

- Water quality in the nearshore waters (those areas seaward of a point approximately 100 meters off the shoreline) is dominated by farfield sources which are a combination of naturally occurring nutrient loads and anthropogenic sources located outside of the Florida Keys.

- Farfield sources are not within the control of the residents of the Florida Keys.

- Water quality in the Halo Zone waters (the area from the beach to line approximately 500 meters off the shoreline) are incrementally affected by a combination of natural stormwater discharges originating on undeveloped areas and anthropogenic discharges from developed land with loads attributable to wastewater and stormwater management practices from developed properties.

- Water quality in the Halo Zone waters are also incrementally affected, though to a much lesser degree, by nutrients discharged via stormwater from existing natural areas.

- Management actions being proposed in this document focus specifically on the reduction or elimination of the anthropogenic nutrient loads being discharged to the Halo Zone waters in the defined "bubble" WBIDs.

- No attempt to reduce farfield impacts has been incorporated into this document as these strategies are outside to the implementation abilities of the governments of the Florida Keys.

Management activities have been classified into three different categories: wastewater management practices; stormwater management practices; and regulatory programs. The implemented and anticipated management actions are summarized in Table 4-1.

Table 4-1
General Management Actions

Wastewater Management Practices	Stormwater Management Practices	Regulatory Programs
▪ Elimination of Cesspits ▪ Centralized Wastewater Services ▪ Upgraded Privately Owned Wastewater Systems ▪ Class V Deep Injection Well for Disposal of Wastewater Effluent (Replacing Existing Ocean Outfall) ▪ Marine Pump-Out Service for Moored Boats to Reduce Illicit Discharges	▪ Retrofitting Existing Drainage Systems with Stormwater Treatment prior to Outfall to Halo Zone Waters ▪ Retrofitting Existing Drainage Systems with Stormwater Treatment and Stormwater Disposal Wells (No Direct Outfall to Halo Zone) ▪ Incorporation of Treatment Components in New Transportation Projects	▪ Designation as an "Area of Critical State Concern" ▪ Local Development and Redevelopment Regulations ▪ Enforcement of Chapter 99-395 Requirements by FDEP and FDOH ▪ Chapter 62, FAC, including Outstanding Florida Waters (§62-302.700,FAC)
Refer to Exhibit 3	Refer to Exhibit 4	Refer to Appendix A

Cumulative Nutrient Loading Reduction Potential: The collectively effect of the proposed wastewater and stormwater management actions represent a significant effort for removing the 1999 baseline anthropogenic stormwater nutrient load that was identified for the Northern Keys Area. Continuing application of proposed management actions will also limit the additional nutrient loading associated with the anticipated future new growth and redevelopment within the Northern Keys Area.

4.3 SCOPE OF MANAGEMENT ACTIVITIES

Management actions associated with provision of central wastewater collection, treatment and disposal are targeted across the entire Northern Keys Area. Similarly, stormwater management treatment and recharge management actions have also been targeted throughout the City of Marathon as part of their infrastructure improvements.

Table 4-2
Northern Keys Area Management Actions

Management Action	EDUs Served	% of Total EDUs (28,371 EDUs)	Area Served (Acres)	% of Total Acreage (25,830 Ac)
IMPLEMENTED/OPERATIONAL MANAGEMENT ACTIONS				
▪ Elimination of Cesspits	82	0.3%		
▪ Centralized Wastewater Services with AWT Treatment Facilities	700	2.5%		
▪ Marine Pump-Out Service for Moored Boats to Reduce Illicit Discharges	999	3.5%		
▪ Localized Stormwater Treatment Systems				
PLANNED FUTURE MANAGEMENT ACTIONS				
▪ Elimination of Cesspits*	1,860			
▪ Elimination of Septic Tank Systems**	16,103			
▪ Upgraded Privately Owned Wastewater Systems	158	1%		
▪ Centralized Wastewater System with AWT Treatment Facilities	26,880	95%		
▪ Localized Stormwater Treatment Systems				
Totals	28,371	99%		

* Conversion to ATUs or Centralized Wastewater Services

** Connection to Central Sewer System and Formal Abandonment of Septic Tank System

All of the implemented/operational management actions identified in Table 4-2 have been, or will be, implemented through the direct involvement of individual stakeholders or the collective actions of multiple stakeholders working together as shown by participation in the plan as a signatory member.

4.4 ESTIMATED POLLUTANT LOAD REDUCTION FROM THE IMPLEMENTATION OF INDIVIDUAL MANAGEMENT ACTIONS

Nutrient loading to the Halo Zone waters peaked in 1999-2003 and began to decline with the City of Key Colony Beach's upgrading of their existing central wastewater system and subsequent elimination of effluent disposal via the ocean outfall. Baseline nutrient loading, reductions attributable to improved and new management practices and current and future nutrient loading estimates are generally shown in Table 4-3 and discussed in the following subsections.

Table 4-3
Estimated Nutrient Loadings in the Northern Keys Area

	Total Anthropogenic Nutrient Load	
	Total Nitrogen (lbs/year)	Total Phosphorus (lbs/year)
1999 Baseline Condition	360,488	90,178
July 1, 2007	352,799	88,029
July 1, 2010	129,414	23,427
July 1, 2020	129,414	23,427

** Excludes anticipated but as yet unquantified reductions from existing and anticipated stormwater management practices*

4.4.1 Baseline Nutrient Loading

Benchmark annual nutrient loadings for the Northern Keys Area, calculated from the Carrying Capacity Impact Assessment Model (CCIAM) GIS coverages which were developed as part of the Florida Keys Carrying Capacity Study, are based upon the number of EDUs, their estimated daily flows and the effluent characteristics of their wastewater treatment methods as summarized in Exhibits 4-2 and 4-3. These individual nutrient loads have been aggregated by WBID and source type, and are summarized in Table 4-4:

Table 4-4
Baseline Annual Nutrient Loadings

WBID	Sum of WW TN (lb)	Sum of WW TP (lb)	DEV SW TN_LB	DEV SW TP_LB
6006A-N Total	66,869	19,324	21,469	3,310
6006A-S Total	67,601	19,643	28,338	4,442
6006B-N Total	585	167	19,985	3,257
6006B-S Total	1,847	497	4,489	721
6006C-N Total	12,488	3,747	4,777	748
6006C-S Total	6,522	1,956	5,247	810
6009-N Total	30,541	8,829	8,988	1,288
6009-S Total	23,975	6,899	4,557	634
6017-N Total	12,643	3,709	3,035	423
6017-S Total	16,149	4,823	3,058	398
6019-N Total	7,920	2,315	3,496	574
6019-S Total	4,462	1,413	1,402	227
GRAND TOTAL	251,573	73,346	108,842	16,832

Source: Florida Keys Carrying Capacity Study, Deliverable 8, Water Module, CCIAM GIS coverages for wastewater management practices and land uses

4.4.2 Nutrient Removals by Proposed Management Activities

Nutrient removal rates for the proposed management practices are based on a combination of local performance data from facilities that have been installed and operated in the Florida Keys, treatment characteristic that have been adopted in previous wastewater and stormwater master plans, and available data from outside the Keys.

- Wastewater Treatment – The treatment characteristics for the wastewater management practices, discussed in Exhibit 4-2, are generally based on local monitoring data collected at facilities in the Florida Keys and the findings and recommendations of the *Monroe County Sanitary Wastewater Master Plan*.

- Stormwater Treatment – A wide variety of structural and nonstructural stormwater management practices were identified for potential use in the *Monroe County Stormwater Management Master Plan,* and are summarized in Exhibit 4-3.

- Disposal Wells – The "polishing" benefit of the shallow (at least 90 deep and cased to a minimum 60 foot depth) effluent disposal wells is based upon limited in-situ testing of their treatment characteristics in the Florida Keys. The Key Colony Beach investigation (Pennsylvania State University, 1999) indicates that there is virtually no attenuation of Total Nitrogen concentrations, a limited reduction of Total Phosphorus concentrations, and suggests that this reduction would disappear as the receptor sites in the limestone are saturated. Conversely, investigation of deep (cased to a minimum of 2,000 foot depth) effluent wells (FDEP UIC Section, 2007) indicated virtually zero detectable return flows.

- Other Management Actions – A number of other non-structural management actions (public education activities, consumer information programs, land use planning, vehicle use reduction and sharing programs, and routine pavement surface maintenance) are recognized as being beneficial with respect to reducing anthropogenic nutrient loads discharged to the halo zone waters. However, these practices have not been included in Table 4-5 as their nutrient reduction benefits have not been quantified.

4.4.3 Estimated Nutrient Load Reductions

Documentation of the estimated pollutant load reduction and other benefits are anticipated from implementation of individual management actions. Specific pollutant reductions have been documented for some of the individual management actions developed in response to water quality issues in the watershed, as well as established water resource management actions.

The Stakeholders Group is confident that this document provides reasonable assurance that water quality target will be met in the watershed because the plan specifically removes/reduces the known anthropogenic sources of the pollutants of concern.

The management actions proposed in the Northern Keys Area in the City of Key Colony Beach have, to a significant degree, already been implemented and are in operation. Table 4-5 presents a summary of the proposed and implemented management actions:

Table 4-5
Summary Of Estimated Nutrient Load Reductions For
Proposed And Implemented Management Practices

WBID	Management Action	Estimated Total Nitrogen Load Reduction (lbs/year)	Estimated Total Phosphorous Load Reduction (lbs/year)	Actual or Anticipated Operational Date
IMPLEMENTED MANAGEMENT PRACTICES				
6006A	Construction of 0.183 MGD demonstration AWT treatment facility with disposal in a shallow Class V effluent disposal well [KLWTD]	0	0	May 2006
6006A	Installation of Basin E (Phase 1) central wastewater collection system serving 999 EDUs with subsequent connection to the demonstration AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	7,689	2,149	October 2006
——	Installation of stormwater treatment systems for Existing Roadway [Islamorada]	Not Quantified	Not Quantified	2004-2007
PROPOSED FUTURE MANAGEMENT PRACTICES				
6009	Construction of the North Plantation Key central wastewater collection system, 0.25 MGD AWT treatment facility and shallow Class V effluent disposal well serving 1,612 EDUs [Islamorada]	13,798	3,880	February 2008
6009	Construction of the South Plantation Key central wastewater collection system, 0.28 MGD AWT treatment facility and shallow Class V effluent disposal well serving 1,325 EDUs [Islamorada]	11,129	3,459	August 2008
6019	Construction of the Lower Matecumbe Key central wastewater collection system, 0.29 MGD AWT treatment facility and shallow Class V effluent disposal well serving 1,351 EDUs [Islamorada]	10,518	3,107	September 2008
6006A	Construction of 2.3 MGD AWT treatment facility with disposal in a deep Class V effluent disposal well [KLWTD]	0	0	May 2009
6006A	Construction of the Basin A central wastewater collection system serving 1,324 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	11,850	3,459	May 2009
6006A	Construction of the Basin B central wastewater collection system serving 1,681 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	16,204	4,862	May 2009
6006A	Construction of the Basin D central wastewater collection system serving 2,548 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	21,759	6,241	May 2009
6006A	Construction of the Basin C central wastewater collection system serving 1,187 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	10,530	2,906	October 2009

WBID	Management Action	Estimated Total Nitrogen Load Reduction (lbs/year)	Estimated Total Phosphorous Load Reduction (lbs/year)	Actual or Anticipated Operational Date
PROPOSED FUTURE MANAGEMENT PRACTICES (CONTINUED)				
6017	Construction of the Upper Matecumbe Key central wastewater collection system, 0.585 MGD AWT treatment facility and shallow Class V effluent disposal well serving 2,700 EDUs [Islamorada]	21,217	6,266	February 2010
6017	Upper Matecumbe North 5: AWT- Shallow Well (1,506 EDU)	13,311	3,831	June 2010
6017	Upper Matecumbe South 6: AWT- Shallow Well (1,506 EDU)	11,214	3,279	June 2010
6006A	Construction of the Basin F central wastewater collection system serving 1,098 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	10,609	3,148	June 2010
6006A	Construction of the Basin G central wastewater collection system serving 1,616 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	15,494	4,603	September 2010
6006A	Construction of the Basin H central wastewater collection system serving 724 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	5,791	1,554	January 2011
6006A	Initial connection of John Pennekamp State Park to KLWTD central wastewater collection system serving 166 EDUs in Basins A-F [KLWTD]	38,584	11,226	June 2010
6009	Construction of the Windley Key central wastewater collection system, 0.13 MGD AWT treatment facility and shallow Class V effluent disposal well serving 1,088 EDUs [Islamorada]	8,451	2,486	October 2010
6006A	Final connection of John Pennekamp State Park to KLWTD central wastewater collection system serving 42 EDUs in Basins A-F [KLWTD]	54,603	15,877	January 2011
6006A	Construction of the Basin K central wastewater collection system serving 1,080 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	8,428	2,467	July 2011
6006A	Construction of the Basin I central wastewater collection system serving 1,910 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	13,931	4,031	October 2011
6006A	Construction of the Basin J central wastewater collection system serving 893 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	6,836	2,041	December 2011
6006A	Upgrade Private Facilities to BAT (128 EDUs)	544	272	June 2010
6006A	Upgrade Cesspools to ATU (32 EDUs)	137	0	June 2010

WBID	Management Action	Estimated Total Nitrogen Load Reduction (lbs/year)	Estimated Total Phosphorous Load Reduction (lbs/year)	Actual or Anticipated Operational Date
PROPOSED FUTURE MANAGEMENT PRACTICES (CONTINUED)				
6006B	Upgrade Private Facilities to BAT(30 EDUs)	143	72	June 2010
6006B	Upgrade Cesspools to ATU (47 EDUs)	218	0	June 2010
6006C	Ocean Reef Club AWT and Shallow Well (2,7686 EDUs)	16,158	4,752	June 2010
6009	Middle Plantation 2 – AWT and Shallow Well (1,476 EDUs)	13,274	3,553	June 2010
——	Installation of stormwater treatment systems for Existing Roadway [Islamorada]	Not Quantified	Not Quantified	2008-2010
——	Installation of stormwater treatment systems for Existing Roadway [FDOT]	Not Quantified	Not Quantified	2011-2020
NORTHERN KEYS AREA	TOTAL NUTRIENT REDUCTIONS	342,420	99,512	

4.4.4 Assessment of Water Quality Benefits

Quantification of the actual water quality benefits achieved in the receiving waters directly attributable to the reduction of the wastewater and anthropogenic stormwater nutrient loads, expressed in terms of water column and groundwater concentrations of nutrients, is technically difficult due to flushing characteristics of the surficial aquifers and the canal systems and the dynamic circulation patterns in the nearshore waters as discussed in Exhibit 4-4. Specific modeling procedures are presented in detail in Appendix F.

Simulated Nutrient Concentrations

WBIDs models 8N, 8S, 9N, 9S, 10N and 10S were used to estimate relative nutrient concentrations in the Northern Keys Area for the 1999 Baseline and projected June 30, 2010 nutrient loading conditions for the Halo Zone (Bubble WBID) waters and the 15 progressive cells that cumulatively extend to 12,100 meters off the shoreline. Simulation results are presented in Figures 4-1 through 4-6 where the dashed red lines represent 1999 Baseline nutrient loading conditions and the solid black lines represent the projected June 30, 2010 conditions.

Nutrient Concentration Improvements

The initial assessment of these simulation results focused on the changes between the model boundary and Halo Zone values for both the baseline and proposed the relationships between the baseline and projected June 30, 2010 loadings. The relative nutrient concentrations indicate that the proposed management actions will potentially produce:

- Significant Total Nitrogen concentration reductions in the Halo Zone waters that represent:
  - A reduction of 2-7 µg/l (approximately 2%) from 1999 conditions;

- A future TN condition that is only 1-3 µg/l above the external TN boundary conditions of the WBID model; and
- The net increase in TN above the natural background concentration within 500 meters of the coastline is less than the water quality target increase of 10 µg/l.

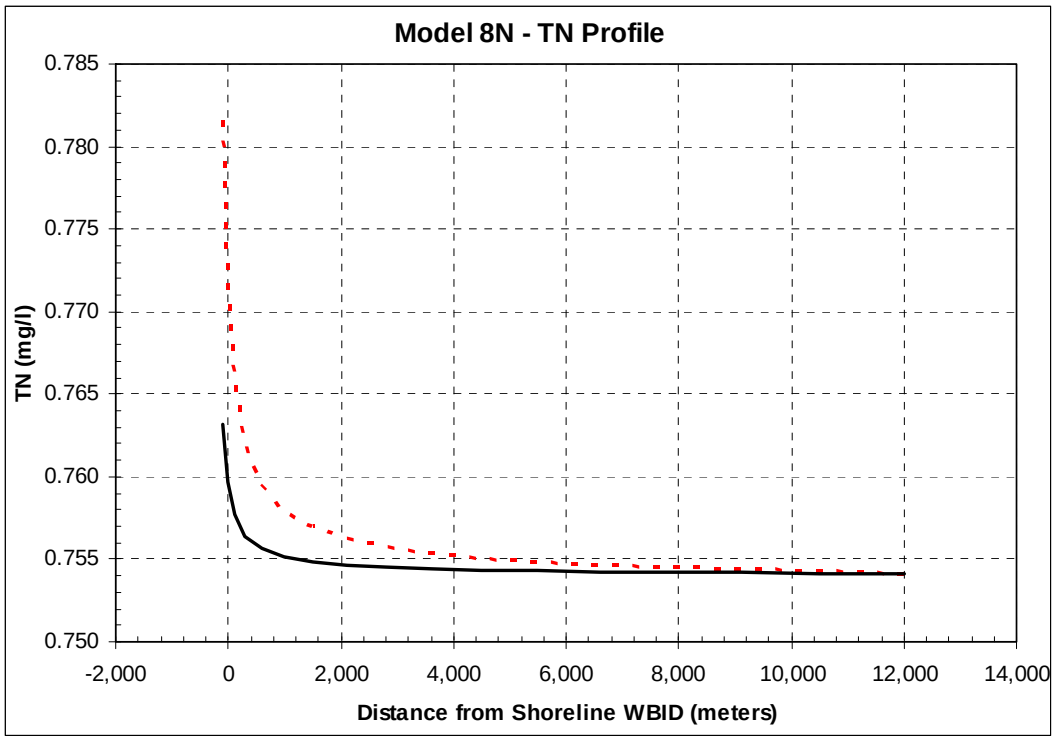
- Significant Total Phosphorus concentration reductions in the in the Halo Zone waters that represent:
  - A reduction of 0-2 µg/l (approximately 14%) from 1999 conditions; and
  - A future TP condition that is only 0 - 1 µg/l above the external TN boundary conditions of the WBID model and
  - The net increase in TP above the natural background concentration within 500 meters of the coastline is less than the water quality target increase of 2 µg/l.

The results of this analysis are summarized in Table 4-6.

Table 4-6
Simulated Concentrations In The Northern Keys Area Halo Zone

Nutrient	Model	Halo Zone Natural Conditions Concentration (µg/l)	1999 Baseline Concentration at 500 meters (µg /l)	Concentration After Management Actions at 500 meters (µg /l)	Water Quality Target (µg /l)
Total Nitrogen	8N	754	762	756	764
	8S	114	122	115	124
	9N	729	732	730	739
	9S	113	119	114	123
	10N	324	326	324	334
	10S	118	121	119	128
Total Phosphorus	8N	9	11	9	11
	8S	6	8	6	8
	9N	8	9	8	10
	9S	5	7	5	7
	10N	6	7	6	8
	10S	6	7	6	8

Figure 4-1
Simulated Nutrient Concentrations
Islamorada (Model 8N)



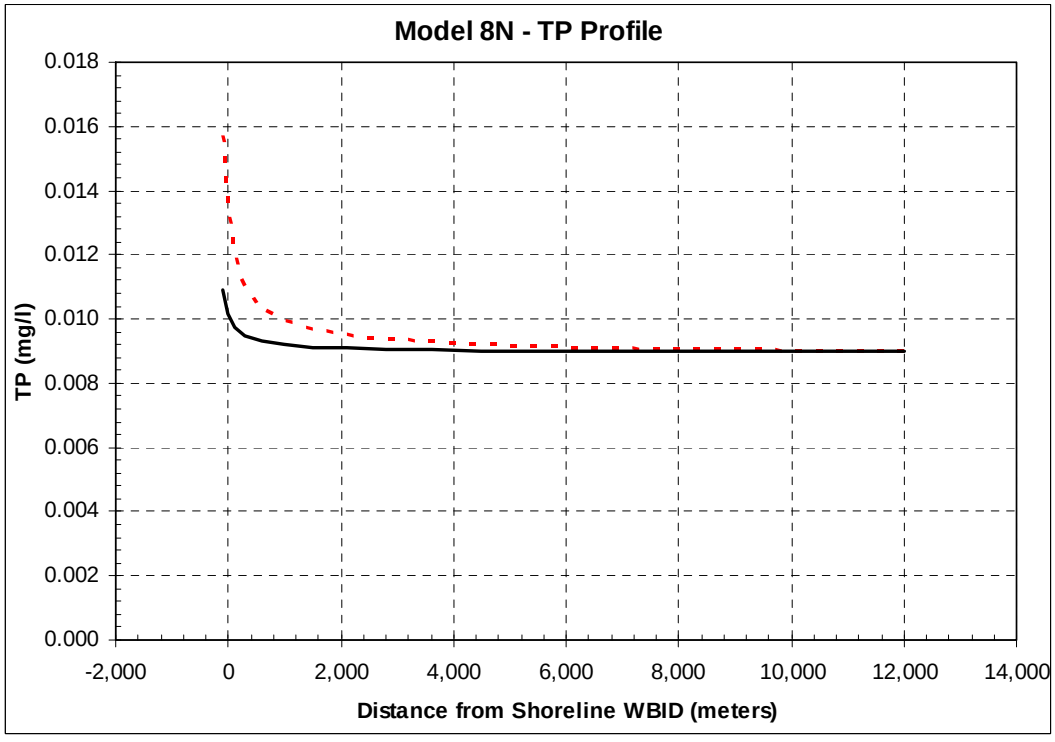
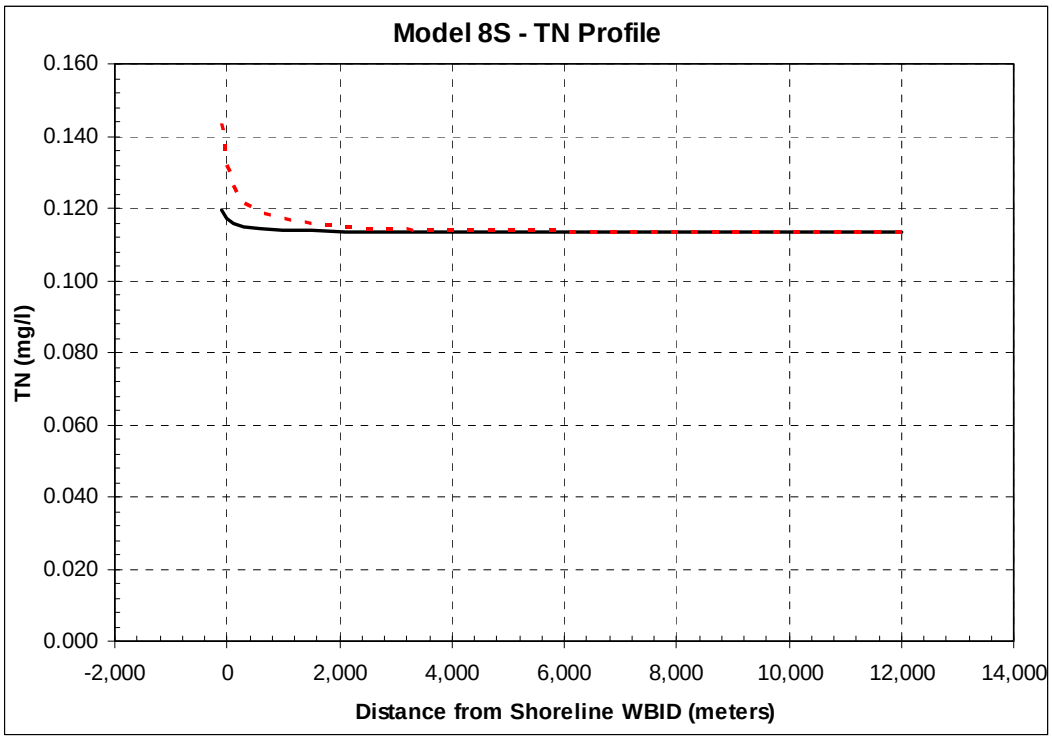


Figure 4-2
Simulated Nutrient Concentrations
Islamorada (Model 8S)



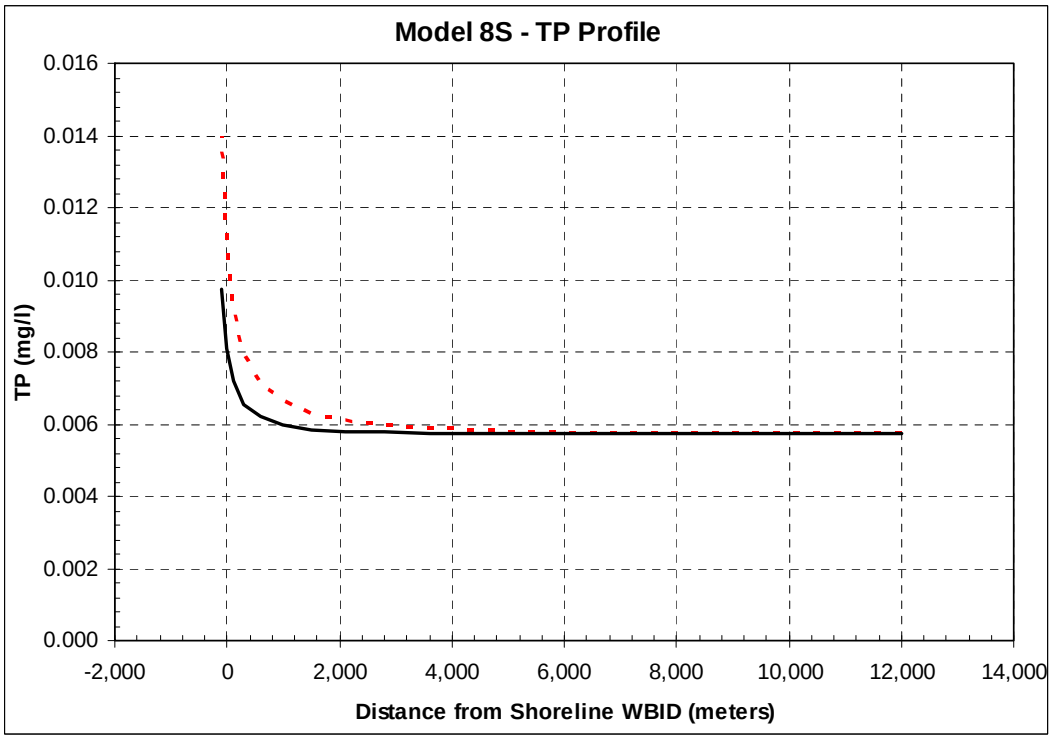


Figure 4-3
Simulated Nutrient Concentrations
Key Largo (Model 9N)

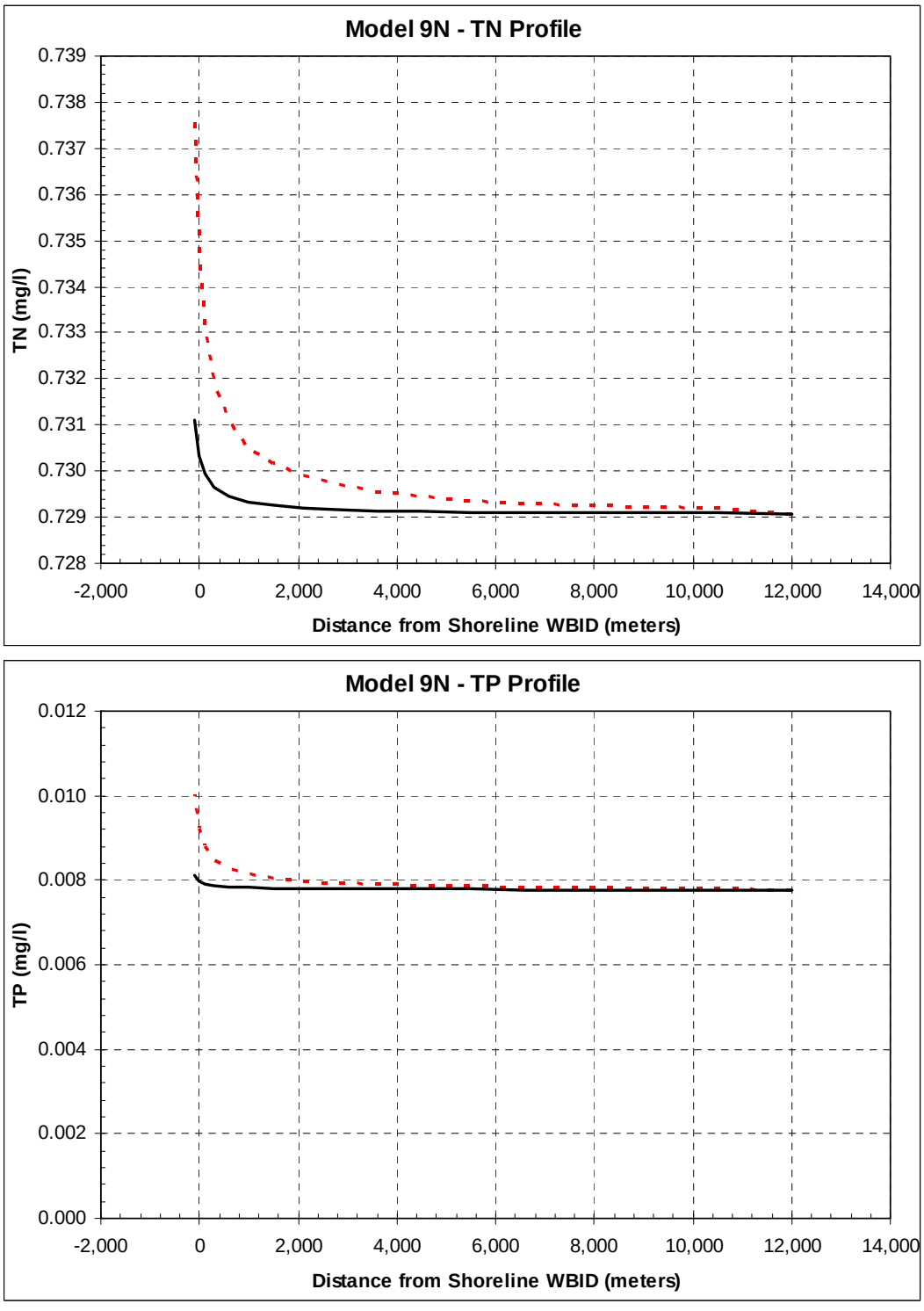


Figure 4-4
Simulated Nutrient Concentrations
Key Largo (Model 9S)

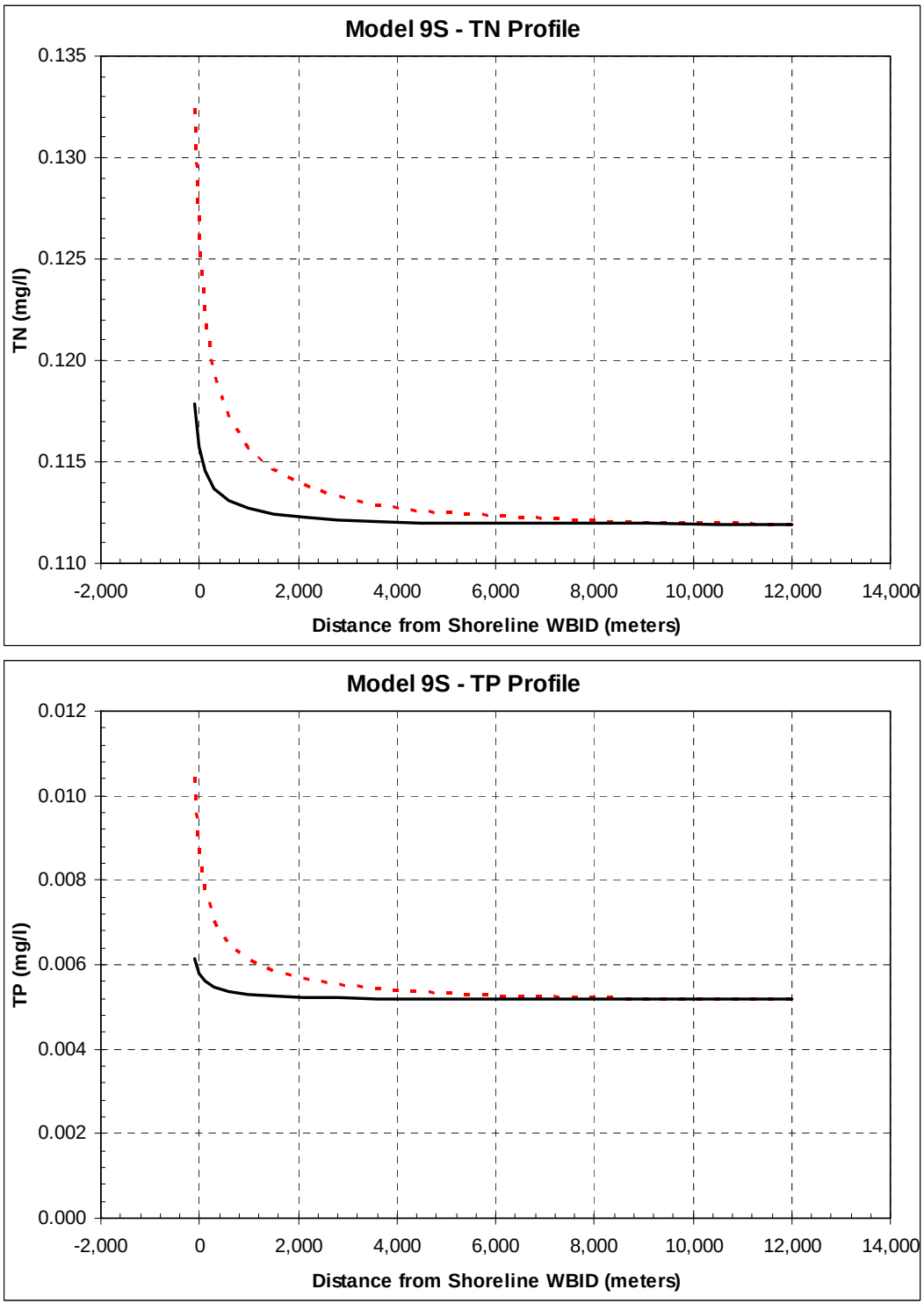
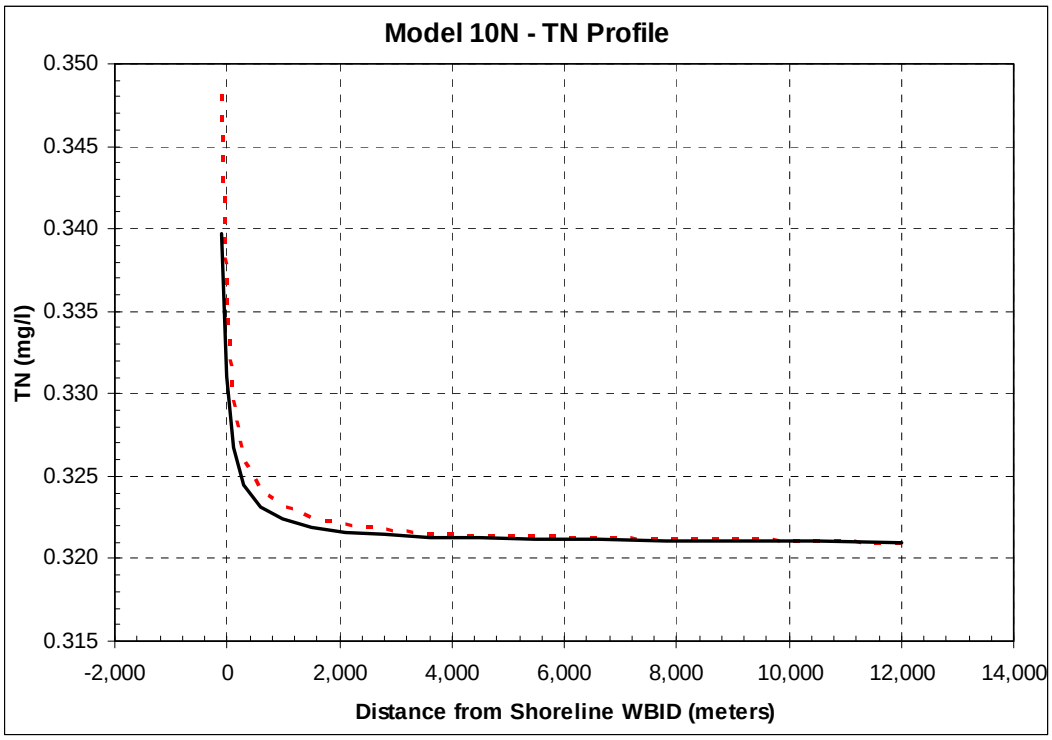


Figure 4-5
Simulated Nutrient Concentrations
North Key Largo and Ocean Reef Area (Model 10N)



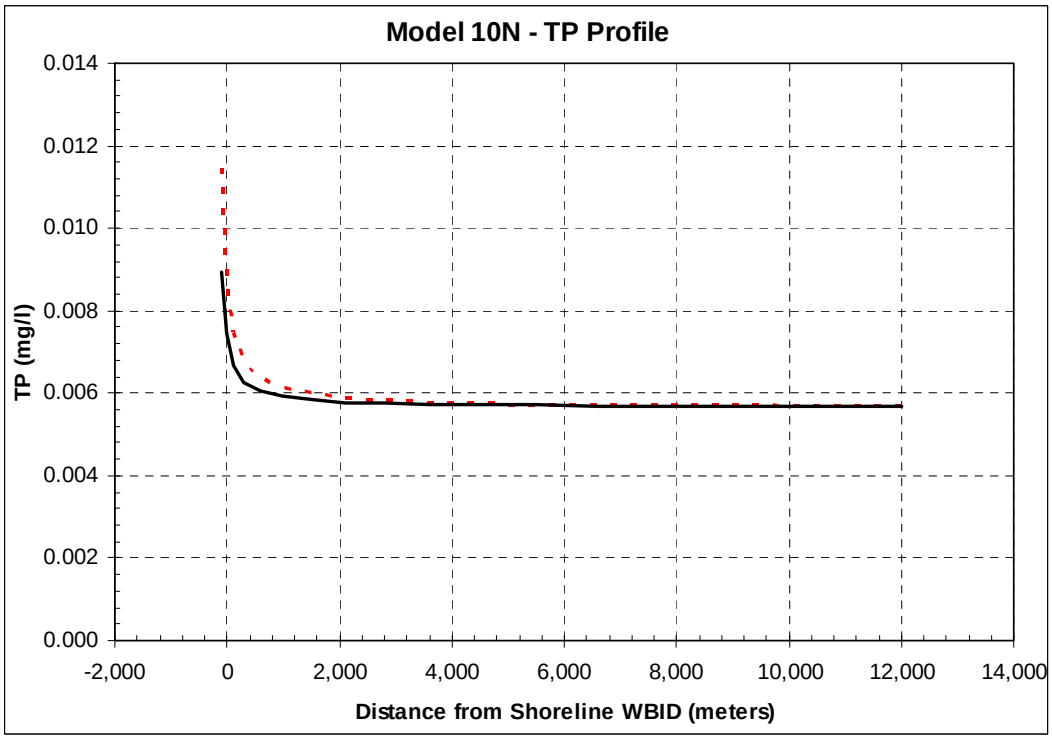
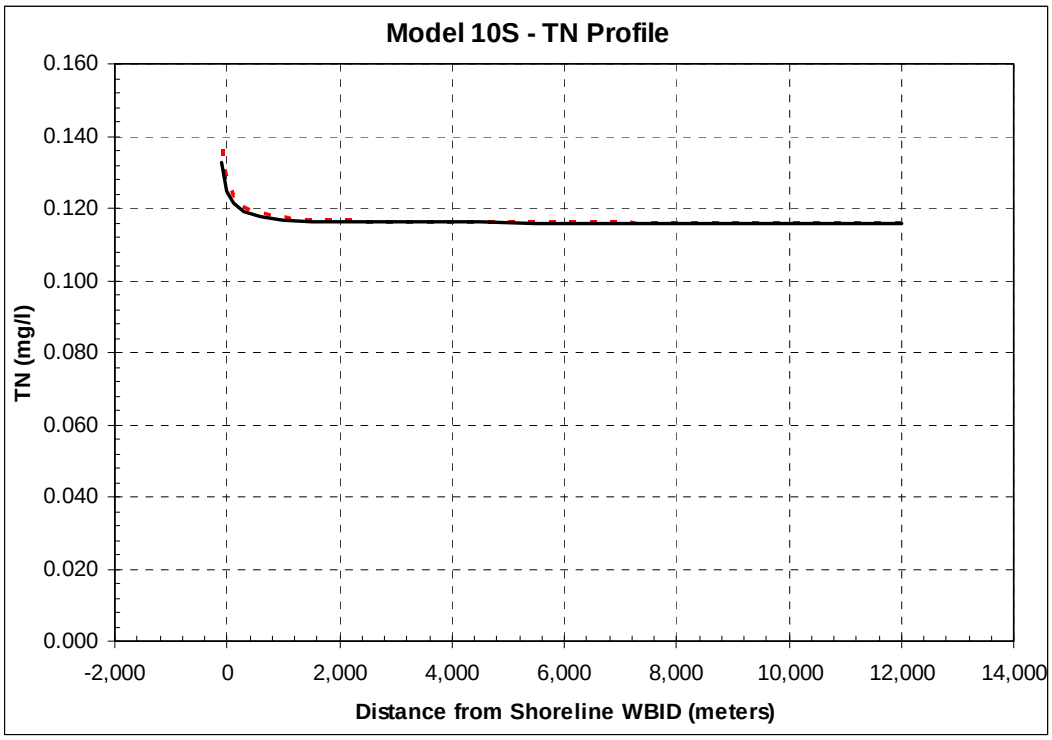
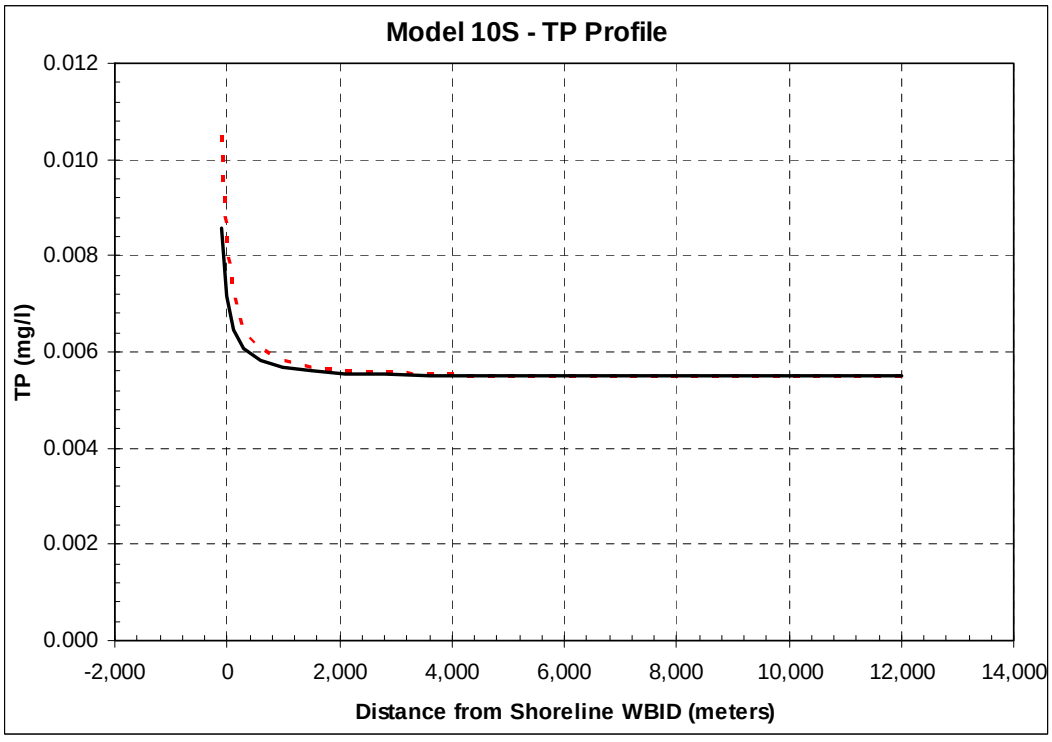


Figure 4-6
Simulated Nutrient Concentrations
North Key Largo and Ocean Reef Area (Model 10S)





4.5 OTHER BENEFITS ANTICIPATED FROM IMPLEMENTATION OF INDIVIDUAL MANAGEMENT ACTIONS

4.5.1 Modeled Canals

To consider the potential improvements that could be experienced in the canals of the Florida Keys as a result of the management activities, ten representative canals were modeled using the simulation techniques used in the Florida Keys Carrying Capacity Study (FKCCS).

The residential canals that were previously modeled in the FKCCS project in 2002 were revised to incorporate newer data and results from the WTFM. This included the following ten canals scattered throughout the Keys:

- 50 Key Largo
- 69 Rock Harbor
- 70 Rock Harbor
- 117 Plantation Key
- 152 Lower Matecumbe Key
- 204 Marathon
- 208 Marathon
- 246 Marathon
- 288 Big Pine Key
- 339 Little Torch Key

In the FKCCS work, canal segments were defined for each canal based upon geometry, connectivity and tidal connection. Canals were divided into segments of approximately equal length (roughly 150 feet, more or less), but segment lengths were varied to accommodate canal geometry, branches and turns.

Canal segment drainage areas were delineated based on the previously defined canal segments overlaid on the 1999 digital orthographic quarter-quads (DOQQs) aerials. Roads were frequently used to delineate drainage divides and the proximity of adjacent canals or other water bodies were often used to estimate split areas between the canal of interest and the adjacent canal/water body. Unfortunately, the original delineations had been developed using the GIS parcel coverage which suffers from projection errors as discussed earlier in this report. The original delineations could still be used for the wastewater load assessment and are stored in the Access database as a table [Canal_EDU]. A second set of delineations was developed based on the FLUCCS coverage and aerials for land use/stormwater loading assessment and is stored in the MS Access© database as a table [Canal_LU].

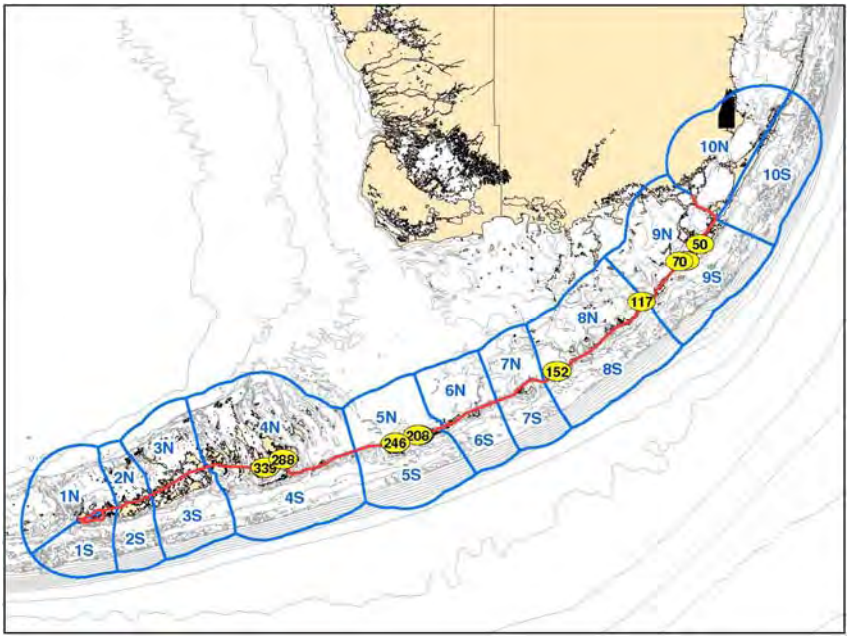
In the FKCCS project, receiving water discharge zone segments (mixing zones) were defined for each of the 10 representative canals. Those discharge zones were developed using a 250-foot radial distance from the outlet of each canal. The radial line was trimmed where it intersected the shoreline or other obstruction and was used to represent the

boundary between the nearshore water and the end of the discharge zone associated with the canal. It was assumed that the canal would not affect water quality beyond 250 feet from its outlet. The water quality at that boundary (Cell 0 of the large scale model) was used to characterize the quality of the source water during flood tides. The nearshore values for TN and TP were selected for each canal by taking the value computed by the large scale model for Cell 0 of the appropriate Model Zone. Table 4-7 below lists the modeled canals and their associated Model Zone from the large scale model.

Table 4-7
Modeled Canals and Model Zones

Canal ID	Canal Location	Model Zone
50	Key Largo	9S
69	Rock Harbor	9S
70	Rock Harbor	9N
117	Plantation Key	8N
152	Lower Matecumbe Key	8N
204	Marathon	5S
208	Marathon	5S
246	Marathon	5S
288	Big Pine Key	4N
339	Little Torch K	4S

Figure 4-7
Modeled Canal Locations



Canals were modeled with the same algorithm implemented in the larger scale WTFM, and were taken from the FKCCS project essentially unaltered with the exception of the loading data which was updated based on the Access database load projections. The predicted concentrations from the large scale model for Cell 0 were used as the boundary concentrations at the edge of the mixing zone for each canal model. An example of a modeled canal is shown in Figure 4-8.

Figure 4-8
Example Canal Model

Figure 4-9
Modeled Canals (Upper Keys)

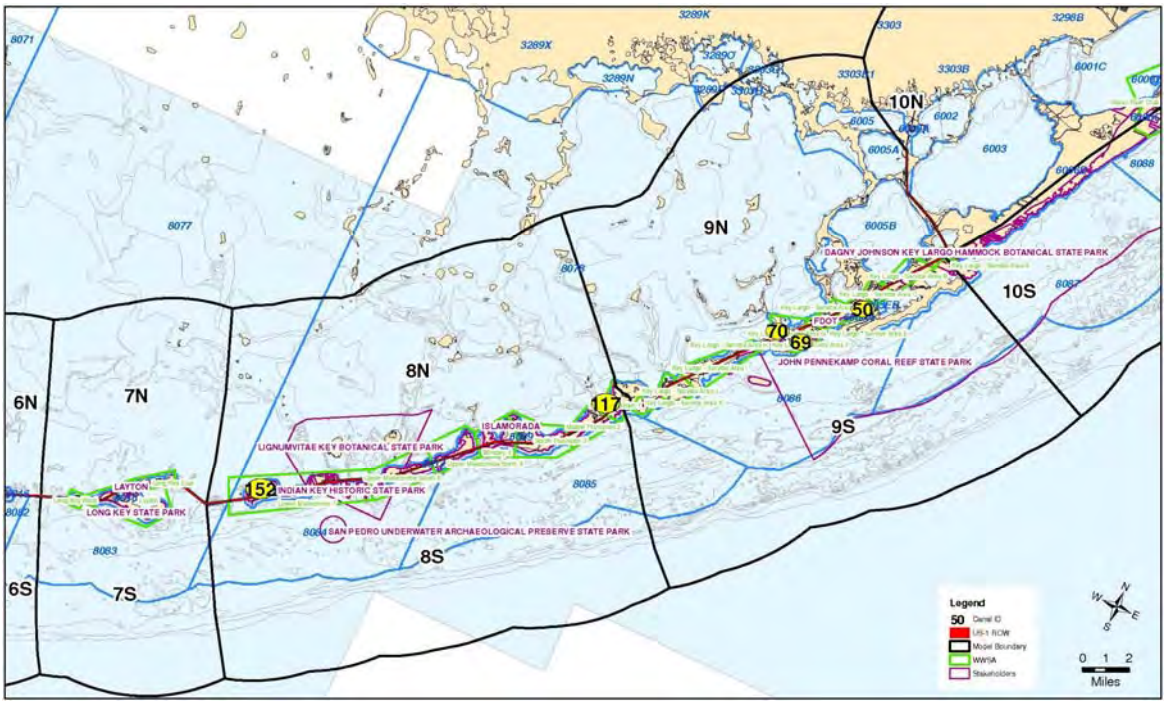
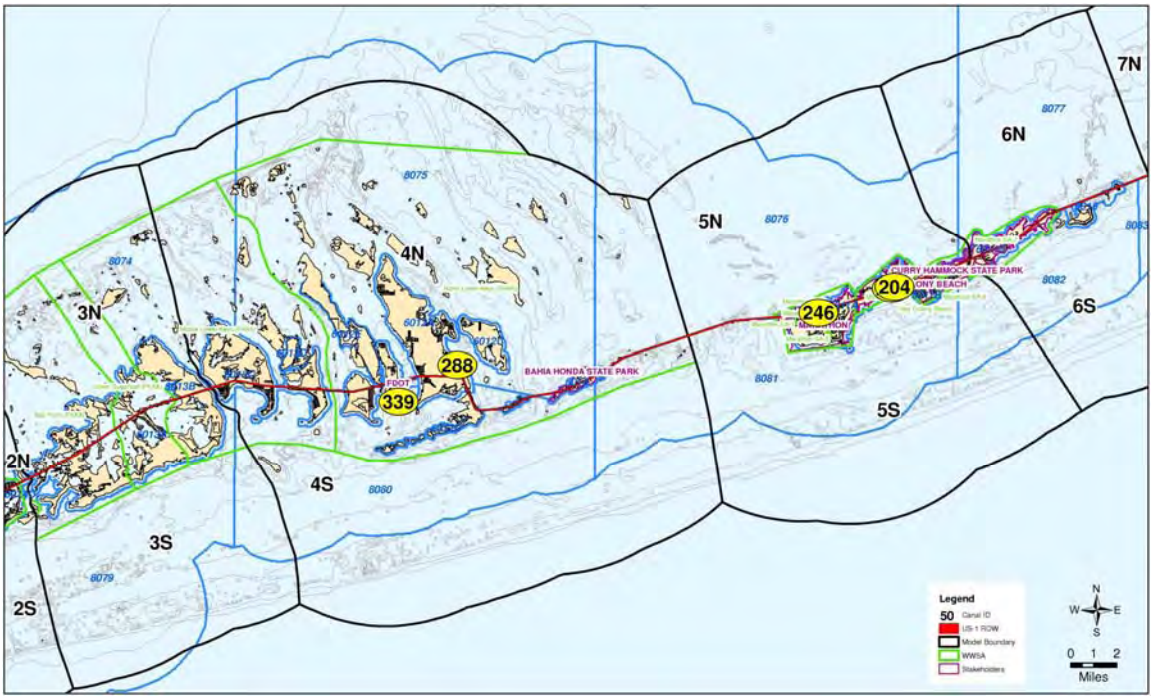


Figure 4-10
Modeled Canals (Mid/Lower Keys)



The ten canal models were run with both 1990 and projected 2020 nutrient loads to evaluate how nutrient concentrations within the canal segments are expected to change due to the proposed management actions. Generally, all of the canal models show significant improvements in nutrient concentrations attributable to identified management actions. Changes in Canal 50 are summarized as an example of anticipated improvements. The results for all ten canal models are presented in the Technical Reference Document.

Canal 50 Case Study

Canal 50 is located on the Atlantic side of Key Largo and has relatively simple canal geometry. The main canal segment is approximately 1,600 feet long with a general north-south orientation. The canal includes three short lateral branches on the east side of the main canal as shown in Figure 4-11.

Figure 4-11
Configuration of Canal 50

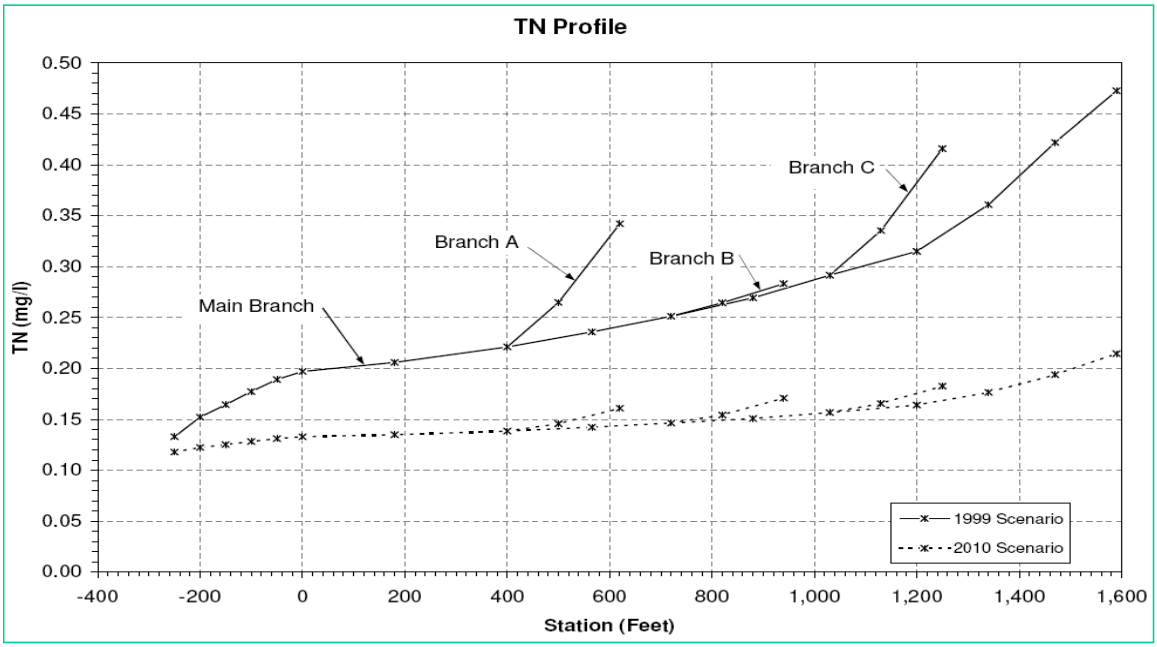
Comparison of the 1990 vs. 2010 Total Nitrogen profiles in the canal, as shown in Figure 4-12 and summarized in Table A4-8. Differences in the modeling results between the two scenarios include:

- Changes at the mouth of the canal is minimal, approximately 200 µg/l, because this is the area of the canal where the tidal exchange occurs and where maximum flushing rates are observed
- The largest improvements in of TN, approximately 55% reductions, occur at the ends of the canal segments where marginal flushing typically occurs.
- In Canal 50 the improvement at the end of branch B is about 40% reduction in TN, which is comparable to the improvement in the midpoint of the main branch of the canal.

Table 4-8
Total Nitrogen Concentrations and Differences in Canal 50

Location	1999 Scenario Concentration	2010 Scenario Concentration	Concentration Change	Percent TN Reduction
Canal Mouth	200 µg/l	130 µg/l	-70 µg/l	35%
End of Branch A	340 µg/l	160 µg/l	-180 µg/l	53%
End of Branch B	280 µg/l	170 µg/l	-110 µg/l	39%
End of Branch C	420 µg/l	180 µg/l	-240 µg/l	57%
End of Main Branch	480 µg/l	220 µg/l	-260 µg/l	55%

Figure 4-12
Total Nitrogen Concentrations in Canal 50



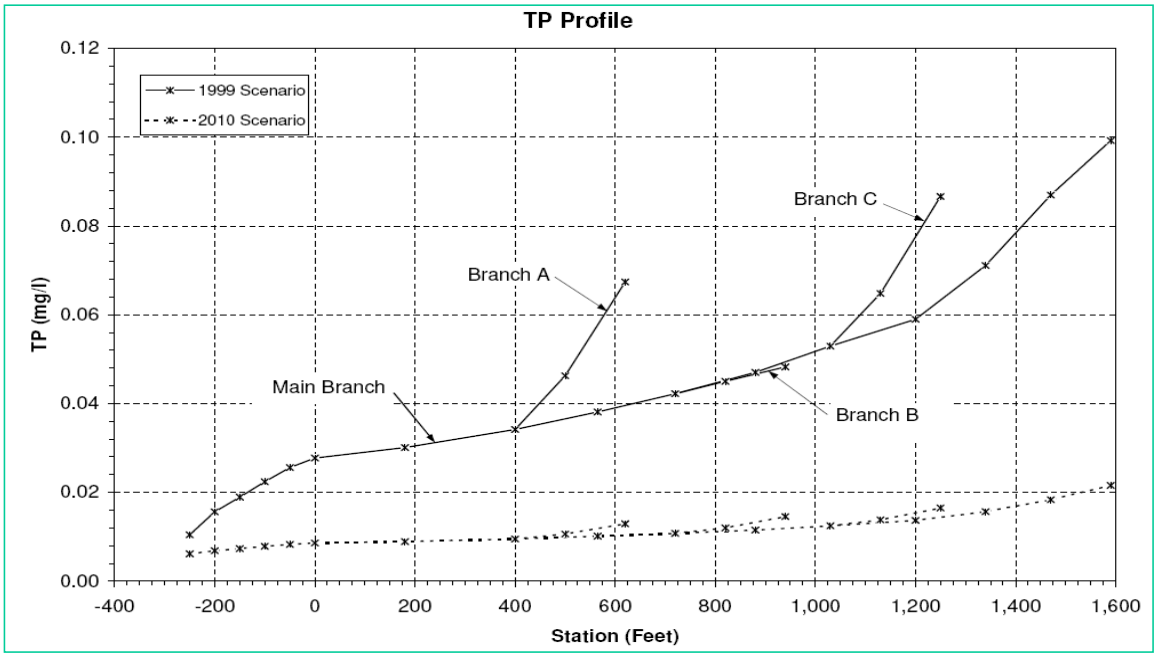
Similarly, comparison of the 1990 vs. 2010 Total Phosphorus profiles in the canal is shown in Figure 4-13 and summarized in Table 4-9. Differences in the modeling results between the two scenarios indicate similar the same general trends as the TP, but at significantly elevated improvement levels

- Changes at the mouth of the canal is minimal, approximately 20 µg/l, because this is the area of the canal where the tidal exchange occurs and where maximum flushing rates are observed
- The largest improvements in of TN, approximately 80% reductions, occur at the ends of the canal segments where marginal flushing typically occurs.
- In Canal 50 the improvement at the end of branch B is about 70% reduction in TN, which is comparable to the improvement in the midpoint of the main branch of the canal.

Table 4-9
Total Nitrogen Concentrations and Differences in Canal 50

Location	1999 Scenario Concentration	2010 Scenario Concentration	Concentration Change	Percent TN Reduction
Canal Mouth	28 µg/l	8 µg/l	-20 µg/l	83%
End of Branch A	68 µg/l	10 µg/l	-58 µg/l	85%
End of Branch B	44 µg/l	14 µg/l	-30 µg/l	68%
End of Branch C	86 µg/l	16 µg/l	-70 µg/l	81%
End of Main Branch	99 µg/l	22 µg/l	-77 µg/l	78%

Figure 4-13
Total Phosphorous Concentrations in Canal 50



The Simple transport models were developed for the ten canals that were previously modeled in the *Florida Keys Carrying Capacity Study* (URS Corporation, 2002) in order to assess the accumulation of nutrients in canals in the Keys and to estimate their transport within the canals and subsequent discharge to nearshore waters.

- Canal segments were defined for each canal based upon geometry, connectivity and tidal connection. Canals were divided into segments of approximately equal lengths, roughly 150 feet, and segment lengths were varied to accommodate canal geometry, branches and turns.
- Canal segment drainage areas were delineated based on the previously defined canal segments overlaid on the 1999 digital orthographic quarter-quads (DOQQs) aerials. Roads were frequently used to delineate drainage divides and the proximity of adjacent canals or other water bodies were often used to estimate split areas between the canal of interest and the adjacent canal/water body.
- Unfortunately, the original delineations were developed using the GIS parcel coverage which suffers from projection errors as discussed earlier in this report. The original delineations could still be used for the wastewater load assessment and are stored in the Access database as a table [Canal_EDU].
- These models focused on nutrient mass and calculated concentrations based on the nutrient mass and the simulated model segment volumes at any time step. Following the "conservative dictum" of the study, the nutrients were treated as conservative, neutral buoyant substances that did not change chemical forms and were assumed to be adequately represented as TN and TP.
- Receiving water discharge zone segments (mixing zones) were defined for each of the 10 representative canals using a 250-foot radial distance from the outlet of each canal. The radial line was trimmed where it intersected the shoreline or other obstruction and was used to represent the boundary between the nearshore water and the end of the discharge zone associated with the canal.
- It was assumed that the canal would not affect water quality beyond 250 feet from its outlet. The water quality at that boundary (Cell 0 of the large scale model) was used to characterize the quality of the source water during flood tides. The nearshore values for TN and TP were selected for each canal by taking the value computed by the large scale model for Cell 0 of the appropriate Model Zone. Table # below lists the modeled canals and their associated Model Zone from the large scale model.

The ten canals selected by Monroe County as being "representative" of the majority of the canals scattered throughout the Keys included:

Table 4-10
Modeled Canals and Model Zones

Monroe County Canal Inventory Number	Key on which Canal is Located	FKRAD Model Zone
50	Key Largo	9S
69	Rock Harbor	9S
70	Rock Harbor	9N
117	Plantation Key	8N
152	Lower Matecumbe Key	8N
204	Marathon	5S
208	Marathon	5S
246	Marathon	5S
288	Big Pine Key	4N
339	Little Torch Key	4S

4.5.2 Additional Benefits

The physical and operational nature of the proposed management actions will provide additional benefits, beyond reduction of nutrient concentrations, which are anticipated to include:

- Ancillary reduction of other (non-nutrient) pollutants
- Trash collection/removal
- Leaf collection and net pollutant load reduction
- Potential reduction of Inflow to the wastewater collection system
- Improvement of ambient Halo Zone water quality
- Improvement of ambient Canal water quality

4.6 AGREEMENTS COMMITTING PARTICIPANTS TO THE MANAGEMENT ACTIONS

Copies of the written agreements committing participants to the management actions described in this section are contained in the Northern Keys Area Stakeholders Agreements.

The stakeholders identified in this agreement have the ability to reduce the anthropogenic loads generated within their service areas that discharge to the Halo Zone waters in the bubble WBIDs adjacent to their service area. It is important to note that these stakeholders have no ability to – or responsibility for – regulating or reducing the farfield pollutant sources or otherwise moderating the water quality of the nearshore waters.

4.7 ASSESSMENT OF FUTURE GROWTH AND NEW SOURCES

The potential for growth of anthropogenic sources is generally believed to be limited due to the regulatory overlay of multiple Federal, State regional and local programs and plans, combined with the lack of raw land and the overall cost of living in the Florida Keys.

4.7.1 Future Growth Potential

Growth is limited in Northern Keys Area by a number of factors including:

- Available Developable Land
- Availability of Utilities
- Growth Management Elements of the Comprehensive Plan
- Rate of Growth Ordinance (ROGO)

AVAILABLE DEVELOPABLE LAND

An obvious constraint on growth potential in the Northern Keys Area is the lack of raw land for development. Most of the developable land has already been developed. Some opportunity exists with the redevelopment of existing properties, but most of the redevelopment in Islamorada and Monroe County is targeted at expanding the seasonal tourism market.

AVAILABILITY OF UTILITIES

There are no local supplies of raw water in the Northern Keys Area and the areas water is pumped from Florida Key Aqueduct Authority's well field located on in the southern tip of peninsular Florida. Consumptive use allocation of available raw water supplies has recently been capped by SFWMD. Water supply availability from SFWMD is not an absolute constraint to future development in the Northern Keys Area. Growth can be facilitated by much more expensive treatment of brackish and saline waters.

Wastewater service is a more readily solved challenge for new development. The future AWT wastewater treatment facility can be expanded to accommodate the anticipated levels of growth and effluent disposal can be accommodated by the planned injection well.

GROWTH MANAGEMENT CONTROLS

The Future Land Use element of the Monroe County comprehensive plan includes a goal (Goal 101) providing that the County must manage growth in a way which enhances the quality of life, ensures safety, and protects valuable natural resources. One of the policies critical to achieving this goal is development and implementation of the Permit Allocation System which limits the number of permits the County may issue for new residential development.

RATE OF GROWTH ORDINANCE

The Rate of Growth Ordinance ("ROGO") limits the number of permits issued for new residential development in each ROGO area to 255 per year. The interim system limits the number of new residential developments in each ROGO area to the number of cesspits replaced within each ROGO area. If less than 255 cesspits are replaced in a year, then 255 permits for development cannot be issued. If more than 255 cesspits are replaced in a ROGO area within a year, the associated development permits cannot be issued until the following year. These provisions apply to the unincorporated areas of Monroe County and Islamorada.

Allocation of permits is based not only on the number of cesspits eliminated but also on progress made on the Five Year Work Program. Each year the Administration Commission will review the County's progress on the program, and, if it determines substantial progress has not been made, the cap on new residential development will be reduced by at least 20% for the next year.

Implementation of the interim system requires that FDEP, FDOH, FDCA, FKWTD, Monroe County and Islamorada coordinate their permitting procedures so that the state agencies do not issue wastewater disposal permits that allow development beyond the number of permits Monroe County may issue. The County may not issue development permits in excess of those that DEP or DOH may issue.

4.7.2 New Pollutant Sources

New pollutant sources can be expected with growth in the Northern Keys Area. However, programs and management practices are already in place that will limit nutrient discharges to the Halo Zone WBIDS in the Florida Keys through minimum treatment standards and regulation of nutrient levels in new discharges.

WASTEWATER MANAGEMENT RULES

Current wastewater management programs will limit or preclude any significant increase in annual nutrient loading in the Halo Zone waters through the following provisions:

- Elimination of Cess Pits and conventional septic tank systems through the Chapter 99-395 requirements;
- City of Islamorada requirements that new development connect to central wastewater systems wherever feasible;
- Requirement that all new and existing WWTPs with average daily flows (ADF) of 100,000 GPD achieve BAT (10-10-10-1) standards and dispose of their finished in a shallow (at least 90 foot deep) Class V injection well pursuant to the Chapter 99-395 requirements ;
- Requirement that all new and existing WWTPs with average daily flows (ADF) of greater than 100,000 GPD achieve AWT (5-5-3-1) standards and dispose of their finished in a deep Class I injection well pursuant to the Chapter 99-395 requirements;
- Requirements for submission of monthly discharge monitoring reports that will allow FDEP staff to identify and address non-complying WWTPs; and,

- Authority for FDEP and DOH to undertake enforcement actions for non-complying wastewater treatment practices.

STORMWATER MANAGEMENT RULES

Current stormwater management programs will limit any significant increase in annual nutrient loading in anthropogenic stormwater discharged to the Halo Zone waters through the following provisions:

- Current authority of FDEP under the delegated Stormwater NPDES program to enforce permit conditions against communities that are not in compliance with their MS4 Permits;
- Existing on-site stormwater management requirements of SFWMD related to new development activities;
- Authority for FDEP and SFWMD to undertake enforcement actions for non-complying stormwater management practices;
- Local Monroe County and Islamorada land development regulations governing the development of raw land and the redevelopment of properties that establish on-site stormwater attenuation and treatment requirements prior to discharge; and
- Ability of Monroe County and Islamorada to undertake authorized enforcement actions for non-complying stormwater management practices.

OTHER RULES

FDCA, through the designation of the Florida Keys as an Area of Critical State Concern, has additional authority to:

- Require communities in the Florida Keys to modify their comprehensive plans to:
  - Protect shoreline and marine resources (including mangroves, coral reef formations, sea grass beds, fish and habitat
  - Limit the adverse impacts on the quality of water throughout the Florida Keys related to development activities; and
  - Protect existing and proposed major public investments related to public infrastructure; State parks, recreation facilities, aquatic preserves, and other publicly owned properties.
- To limit the adverse impacts of public investments on the environmental resources of the Florida Keys.
- To protect the public health, safety, and welfare of the citizens of the Florida Keys and maintain the Florida Keys as a unique Florida resource.

To accomplish this responsibility, FDCA can compel local communities to modify their regulations to achieve these mandates, review all development orders issued by communities

that are subject to these requirements, challenge development orders which are inconsistent with these requirements and impose development moratoriums.

NOTE: Additional discussion of the underlying regulations and authority of agencies is summarized in more detail in Appendix A.

4.8 CONFIRMED SOURCES OF FUNDING

The Reasonable Assurance program for the Northern Keys Area has an estimated aggregate cost of approximately $255,636,000. Dedicated funding for new management actions, as well as the ongoing operation and maintenance of already implemented management actions, will be essential for the expected reduction of nutrients in the Halo Zone waters.

Funding is being provided by the individual stakeholders and State agencies, working individually and collectively where appropriate. No other funding sources are currently designated or committed to provide funding for completion of the wastewater and stormwater infrastructure in the Northern Keys Area. Multiple sources of funded are confirmed for the reduction of nutrient loads entering the Halo Zone waters in the Northern Keys Area. Table 4-11 presents these commitments by participant and then summarizes the aggregate commitment in the Northern Keys Area.

Table 4-11
Aggregate Funding Commitment
For The Northern Keys Area

Stakeholder	Implemented Funding through FY06-07	Planned Funding	Total Funding Commitment
KLWTD	$ 48,386,000	$ 196,900,000	$ 245,286,000
Private Interests (NKLUC)		$ 10,350,000	$ 10,350,000
Total Committed Funding for Northern Keys Area	**$** 48,386,000	$ 207,250,000	**$** 255,636,000

It is significant to note that approximately 19% of the proposed management actions for the Northern Keys Area, over $48,000,000, have already been funded and construction is significantly underway**.** The largest investment to date has been made by the KLWTD which has implemented the first $60,000,000 of funding for construction of regional wastewater system components.

4.9 IMPLEMENTATION SCHEDULE

An integrated implementation schedule, previously summarized in Table 4-5, identifies specific management actions to be undertaken individually and collectively in the Northern Keys Area by the participating stakeholders. The activities presented in this table are segmented in order identify those management actions intended to achieve an interim milestone of measurable decreases in the concentrations of TN and TP by July 1, 2010 as well as subsequent management actions designed to assist in achieving the overall goal of this program by 2020.

4.10 ENFORCEMENT PROGRAMS AND LOCAL ORDINANCES FOR NON-VOLUNTARY STRATEGIES

Enforcement of existing ordinances by State, regional and local agencies will achieve the implementation of the wastewater and stormwater management actions included in the non-voluntary strategies previously discussed in this section. Two types of enforcement programs cover the Florida Keys including:

- Broad Scale Programs with general applicability to the Northern Keys Area (summarized in Appendix A of this document) including:
  - Statewide Programs administered by FDCA, FDEP and FDOH which regulate land use, resource protection, wastewater and stormwater activities Statewide; and
  - Regional regulatory programs administered by SFWMD that focus on stormwater management and water quality issues, and which are applicable throughout South Florida.
- Local Focus Programs which have been developed to meet the special needs of the Florida Keys and are applicable in the Northern Keys Area (discussed in subsequent paragraphs of this subsection).

Finally, the last portion of this subsection identifies specific responsibilities of State, regional and local agencies in enforcing non-voluntary strategies and management actions.

4.10.1 Local Focus Regulatory Program Elements

Recognizing the delicate nature and special needs of the Florida Keys, Florida has enacted legislation that focus on the specific needs of the Keys. These acts, intended to provide State agencies (FDCA, FDEP and FDOH) with special authority to manage and regulate those aspects of land use, wastewater treatment and effluent disposal practices to better protect local water quality the and fragile marine habitats of the Keys, include:

- Areas of Critical State Concern Designation
- Chapter 99-395, Laws of Florida

Both of these were previously discussed in Subsection 4-7.

While the regulatory agencies mainly responsible for enforcement by Chapter 99-395 FS, local participants (eg. Monroe County and the cities) will enforce hook-ups and upgrades to applicable residential and non-residential wastewater sources.

4.10.2 State Agency Enforcement Responsibilities

Enforcement programs, as applied to this program, are primarily the responsibility of the FDEP and FDOH for wastewater management actions, and FDEP and SFWMD for Stormwater management actions. The FDCA also has a limited number of responsibilities for regional

implementation of wastewater and stormwater management actions through its comprehensive planning responsibilities and its Areas of Critical State Concern designation for the Florida Keys.

FDEP ENFORCEMENT RESPONSIBILITIES

FDEP's focus in the Northern Keys Area for providing State enforcement and oversight activities to provide reasonable assurance for implementation non-voluntary wastewater management actions is split between the very different wastewater management practices which are in use on Islamorada and Key Largo Wastewater Treatment District:

Wastewater Activities

- Key Largo will be served by the KLWTD central wastewater system, which will have AWT treatment levels with a Class V deep effluent disposal well in order to meet the higher wastewater treatment standards mandated by Chapter 99-395 LF. The KLWTD will have a NPDES Permit that regulates it operation and contains sanctions and fines, as well as civil and criminal penalties, which can be used to compel compliance with permit requirements.

- FDEP's focus for these systems is generally limited to routine regulatory oversight activities including timely review of the facility's monthly DMRs to assure permit compliance and conducting enforcement actions if required to eliminate any non-compliance conditions.

- Islamorada will be served by new Wastewater facilities they are currently designing. Islamorada will have their own NPDES Permit that regulates it operation and contains sanctions and fines, as well as civil and criminal penalties, which can be used to compel compliance with permit requirements.

Stormwater Activities

FDEP's enforcement and oversight activities that will provide reasonable assurance of regional enforcement for achieving non-voluntary stormwater management actions basically focuses on Florida's NPDES and TMDL programs as they relate to the improvement of the impaired Halo Zone waters:

- FDEP also has provided strong guidance and support in the development of this RA plan, which indicates their support of the cooperative nature of the solutions to improve surface water quality in this region.

- Neither Key Largo's (unincorporated Monroe County) nor Islamorada's stormwater management facilities are regulated under a Municipal Separate Storm Sewer System (MS4) Permit.

FDOH ENFORCEMENT RESPONSIBILITIES

FDOH's enforcement and oversight activities that will provide reasonable assurance of regional enforcement for achieving non-voluntary wastewater management actions on the private facility level is anchored in the requirements and provisions of Chapter 99-395 LF which requires

FDOH to conduct enforcement actions against private owners of cesspits and non-complying septic tanks and OSTDS who have failed by July 1, 2010, to either:

- Connect to a central wastewater system that complies with higher standards mandated by Chapter 99-395 LF Laws of Florida; or
- Upgrade their non-complying treatment practices to achieve Chapter 99-395 LF requirements.

This requirement of State Law provides substantial authority and capability for reducing the discharge of nutrients from on-site wastewater treatment systems to the impaired Halo Zone waters from the developed areas of Islamorada city limits and unincorporated Monroe County that have cesspits, septic tanks, and ATUs which will need to be eliminated/upgraded to achieve the mandated higher wastewater treatment standards. Stock Island regulatory actions will be split between cesspits and the other non-complying on-site wastewater practices.

- Cesspit Elimination is mandated by Chapter 99-395 LF as part of the Keys-wide initiative to improve Halo Zone water quality. FDOH's focus for this responsibility will include the following:
  - Initial Focus (prior to July 1, 2010): Verification that the existing substandard WWTPs are being upgraded to meet the Chapter 99-395 LF deadline; and
  - Subsequent Focus (after to July 1, 2010): Routine regulatory oversight activities including timely review of the facility's monthly DMRs to assure permit compliance and conducting enforcement actions if required to eliminate any non-compliance conditions.
- Non-complying On-Site Systems require their owners to undertake one of the following actions to avoid violating Chapter 99-395 LF:
  - Initial Focus (prior to July 1, 2010): Verification that the existing substandard on-site systems have been eliminated or upgrade to meet the Chapter 99-395 LF deadline, or commencement of enforcement activities to compel elimination or upgrading to achieve compliance; and
  - Subsequent Focus (after to July 1, 2010): Routine regulatory oversight activities to assure permit compliance and conducting enforcement actions if required to eliminate any non-compliance conditions.

SFWMD ENFORCEMENT RESPONSIBILITIES

SFWMD, through its Environmental Resource Permit program, provides key enforcement activities for new development and redevelopment activities in the Florida Keys that discharge stormwater to impaired halo zone waters. District enforcement and oversight activities that will provide reasonable assurance of regional enforcement for achieving non-voluntary management actions and strategies include:

- Required construction permits and conduct inspection of construction activities which limits the short-term impacts during construction

- Required operating permits that focus on maximizing the treatment benefit of the stormwater facilities during the post-construction period

- Required field-verification the construction of permitted activities regulated through with Environmental Resource Permits by District enforcement staff.

- Required oversight for the operations of permitted facilities to assure that facilities are achieving their target water quality concentrations in discharged flows (while operating permits are in effect) to assure that permit requirements are met and that the overall water quality goals of the facilities obtained.

- Semi-annual helicopter and airplane aerial reconnaissance in some cases to identify activities that may not be visible during traditional land surveillance when it is determined that a potential violation exists to enable staff to conduct a site visit to determine the nature and extent of the possible violation and make determinations if additional enforcement is necessary

LOCAL ENFORCEMENT RESPONSIBILITIES

Enforcement of stormwater management activities associated with new development activities and redevelopment activities will be achieved through the Islamorada's and Monroe County's existing Land Development Regulations and Comprehensive Plan requirements. Monroe County and Islamorada will provide reasonable assurance of local enforcement for achieving non-voluntary management actions and strategies at the parcel level through the following regulatory actions:

- Continuing enforcement of their land development regulations with respect to new development activities and (as appropriate) redevelopment activities that generate short-term construction phase and long-term operating discharges of nutrients to the Halo Zone waters or the community MS4 facilities that subsequently discharge to the Halo Zone waters; and

- Enforcement of their existing requirement that developed parcels connect to the central wastewater treatment system whenever feasible in lieu of implementing on-site wastewater systems.

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Section 5.0
SCHEDULE TO ACHIEVE WATER QUALITY TARGETS

5.1 ACHIEVING WATER QUALITY TARGETS

As defined previously, the nutrient concentrations in the Halo Zone and nearshore waters of the Florida Keys are dominated by farfield effects and anthropogenic sources of nutrients in the Keys incrementally add loads with increases in the Halo Zone concentrations that will be minimized through management actions (see Section 4). The target to be achieved is an insignificant increase to farfield (boundary) concentrations. Also, as the 1999 ambient nutrient concentrations averaged greater than those measured for the OFW designation and are expected to improve, the OFW ambient concentrations are expected to be restored.

5.2 SCHEDULE TO ACHIEVE TARGETS

The management actions to be completed by the signatories will be completed in 2010 for wastewater activities and 2015 for stormwater activities. Based on modeling of the predicted impacts of the management actions superimposed on the farfield, the insignificant increase to the farfield concentration will be achieved soon after the management activities are completed. However, due to the nature of environmental processes, it is expected that the target conditions can be achieved in the Halo Zone waters for all of the Florida Keys by 2020.

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Section 6
PROCEDURES FOR MONITORING AND REPORTING RESULTS

6.1 DESCRIPTION OF PROCEDURES FOR MONITORING AND REPORTING RESULTS

Monitoring and reporting activities will provide the basis for establishing the water quality improvements that will be achieved through implementation of the proposed management actions. Monitoring, including both the sampling of water quality in the receiving waters and the oversight of management action implementation and operation, will provided the data and information required to assess improvements and compliance with the plan. Reporting activities will maintain a continuing flow of performance information that will support adaptive management efforts as may be required to achieve the anticipated benefits.

6.1.1 Monitoring Networks

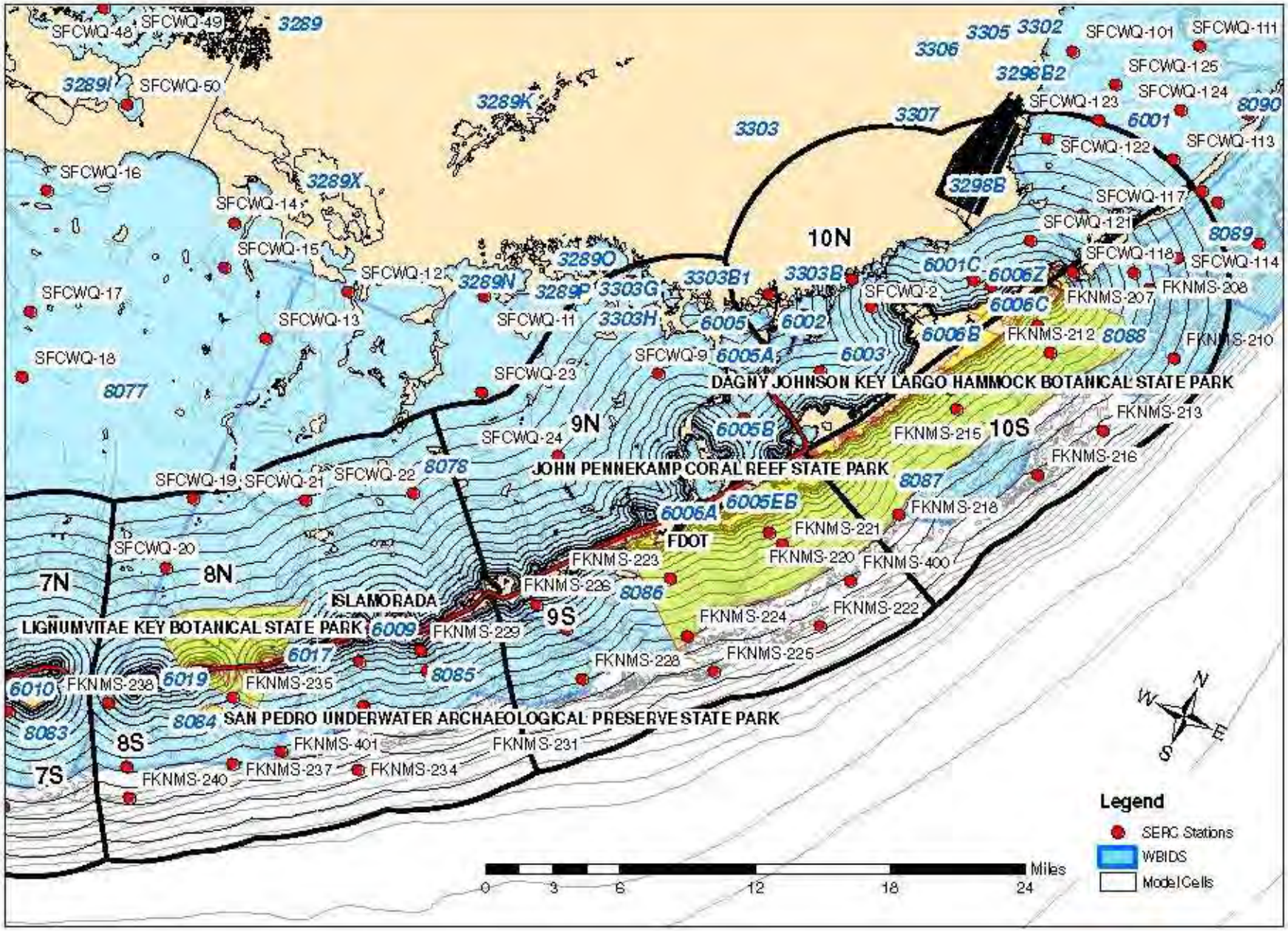
A number of monitoring networks that have been designed and implemented to document the effectiveness of the various management actions, demonstrate reasonable progress in the Northern Keys Area watersheds, and provide quantifiable results for the annual progress report (submitted to the FDEP) associated with this plan. Examination of STORET identified 155 FKNMS Stations in the general Florida Keys that collect beach, canal, estuary, operating facility, lake, ocean, river/stream, stormwater and well samples for a broad range of investigational and regulatory purposes.

These water quality monitoring networks are operated by a combination of stakeholders, interested parties, agencies. Approximately 155 FKNMS stations of these stations are associated with the Florida Keys National Marine Sanctuary's ongoing monitoring programs focused on long-term water quality and seagrass studies.

- The primary network of interest for the Northern Keys Area is the Water Quality Monitoring Program network, operated by FIU's SERC. The eastern portion of this network includes 61 "local" stations that have 10 years of quarterly data. These stations can be used to define long-term nutrient concentration trends in the waters that are most immediate to the WBIDs of interest including the Halo Zone and the more immediate nearshore waters.

- Other stations, including the eastern Florida Bay network stations, provide useful information on the more distant nearshore and marine waters outside of the immediate area of interest.

Figure 6-1 presents a map indicating the location of the 17 FKNMS monitoring stations located within the South-Central Area and identifies the boundaries of WBID 6014C, 6013A, 6013B, 6013C, 6013D, 6012A, 6012B, 6012C, 6012D, and 6018.



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6.1.2 Procedures for Monitoring and Reporting Results

Procedures to be used in the Northern Keys Area for monitoring implementation progress and water quality improvements must focus on the elimination of substandard wastewater treatment practices (pursuant to Chapter 99-395, LF) and corresponding changes in ambient water quality in the canals, halo zone and nearshore waters.

MONITORING PROCEDURES

The monitoring program for the Northern Keys Area primarily requires the efforts of the central wastewaters system operators and the operator of the operators of the existing FKNMS and Florida Bay ambient water quality monitoring networks. Phase I- INITIAL MONITORING ACTIVITIES

The monitoring program, which starts upon EPA's approval of the Northern Keys Area RAD, focuses upon immediate measurement of the benefits being produced by implementation of the proposed management activities:

1. Total Wastewater Service Level which is the basic measure of net nutrient reductions being achieved in the Northern Keys Area. Specific measures of progress include:

   A. Total number of physical connections to the central wastewater system;

   B. Total number of cess pit EDUs eliminated by connection;

   C. Total number of substandard septic tank system EDUs eliminated by connection;

   D. Total number of sub-BAT/BAT treatment facilities eliminated by connection;

   E. Total number of sub-BAT/BAT treatment facilities upgraded;

   F. Total number of connected EDUs; and

   G. Total pounds of nutrients in the finished effluent that is discharged to shallow disposal wells.

   Measurement of the total number of physical connections and eliminated cess pits, septic tanks and sub-BAT/BAT facilities will be tracked as part of the ongoing records of the central wastewater treatment system. Quarterly nutrient loads discharged in the finished effluent to shallow disposal wells will be calculated from the monthly Discharge Monitoring Reports (DMRs) routinely submitted to FDEP as part of ongoing operations. Nutrients discharged to deep disposal wells will be not be tracked as they are not expected to be measurable due to the depth at which they are being discharged.

2. Ambient Bubble WBID Water Quality Trends, measured in the Halo Zone WBID waters and the more immediate nearshore waters (at distances up to 5,600 meters off the shoreline), which demonstrate localized water quality improvement in the "backyard" of the Florida Keys. Specific measures of progress include:

   A. Quarterly measurement of Total Nitrogen and Total Phosphorus concentrations at the existing stations in the existing FKNMS and Florida Bay monitoring networks (currently operated by FIU/SERC) that are generally located inside of the Halo Zone WBIDs and nearshore waters at distances up to 5,600 meters off the shoreline. This includes 20 existing FKNMS stations and 11 SFCWQ stations adjacent to the Key Largo and Islamorada Service Areas.

   These open water stations are considered most important in the monitoring program due to their location in the "backyard waters" of the Florida Keys and their intimate and immediate interaction with the anthropogenic loads being discharged by the Northern Keys Area.

3. Nearshore Water Quality Trends, measured in the existing FKNMS and Florida Bay nearshore waters monitoring stations located in the nearshore waters (at distances greater than 5,600 meters off the shoreline), which generally indicate the water quality changes in the marine environment outside the general impact of Keys discharges that are attributable to changing farfield loadings. Specific measures of progress include:

   A. Quarterly measurement of Total Nitrogen and Total Phosphorus concentrations at the existing stations in the existing FKNMS and Florida Bay monitoring networks (currently operated by FIU/SERC) that are generally located outside of the halo zone WBIDs at distances greater than 5,600 meters off the shoreline. This includes 16 FKNMS and 14 SFCWQ stations in the proximity of the Key Largo and Islamorada Service Areas.

MONITORING OF VIOLATIONS AND EXCEPTIONS

A significant and parallel element of the monitoring program, which is currently in place irrespective of the receipt of EPA's approval of the Northern Keys Area RAD, is the monitoring of violations and exceptions. FDEP currently reviews DMR for all permitted wastewater treatment facilities in the Florida Keys to check for violations of permitted flow rates and discharge concentration limits, as well as exceptions which typically include instances where the operator of a permitted facility fails to submit their DMR in a timely manner.

Both of these monitoring activities provide additional assurance that facilities, once implemented, are properly operated so as not to exceed their permit limits and to ultimately achieve their planned nutrient load reductions.

REPORTING PROCEDURES

The following procedures and timing will be utilized to accomplish timely reporting of monitoring results in the Northern Keys Area:

REPORTING OF MONITORING RESULTS

1. Quarterly compilation of the total number of physical system connections and eliminated cess pits, septic tanks and sub-BAT/BAT facilities will be tracked as part of the ongoing records of the central wastewater treatment system.

2. Nutrient loads discharged in the finished effluent to shallow disposal wells will be calculated on a quarterly basis using the flow and nutrient concentration values documented in the monthly Discharge Monitoring Reports (DMRs) routinely submitted to FDEP as part of ongoing wastewater facility operations.

3. Values for each of the metrics will be reported to FKNMS Steering Committee on a quarterly basis by each central wastewater system.

4. Quarterly halo zone nutrient concentration results will be summarized by EPA or, alternately, their contractor (currently FIU/SERC) and reported to FKNMS Steering Committee.

6.2 QUALITY ASSURANCE/QUALITY CONTROL ELEMENTS

Quality assurance and quality control are important to the success of monitoring activities as they provide assurances that the data was collected using proper techniques to assure that it is representative and reliable.

- A Quality Assurance (QA) Plan is the planning process to confirm that a process is properly completed and checked to achieve a valid result.

- Quality Control is the actual process of implementing the QA plan.

- Quality Management (QM) refers to both and is necessary, especially for monitoring programs, to ensure that the inferences made from the results are scientifically justified and valid.

Spurious results oftentimes occur in monitoring programs due to improperly sampling ambient waters, poorly storing and transporting the samples, extended storage of the sample beyond proper holding times, and contaminated laboratory procedures, to name a few. For the FKRAD, ambient sampling and biological assessments will be done under contract to the State or EPA.

- State contracted monitoring will be conducted pursuant to FDEP's Quality Assurance Rule (Chapter 62-160, FAC).

- Federal monitoring is accomplished via the Florida Keys National Marine Sanctuary monitoring programs under the United States Environmental Protection Agency and National Oceanic and Atmospheric Administration (NOAA).

Monitoring is implemented through studies by the Florida Marine Research Institute (FMRI) and the Florida International University (FIU) via the Water Quality Protection Program (WQPP) and is governed by Federal quality management requirements.

ELEMENTS THAT DEMONSTRATE MONITORING AND LABORATORY ANALYSIS ACTIVITIES WILL COMPLY WITH CHAPTER 62-160, F.A.C.

Laboratories conducting field data collection and/or laboratory analyses in conjunction with this RAD program will comply with the following quality assurance protocols:

State Agencies, SFWMD, Islamorada and Key Largo WTD programs involved in monitoring activities as part of this RAD plan will comply with the following rules and/or have the following documents:

- Current State-approved Quality Assurance Plan on file that complies with FDEP's Quality Assurance rule, Chapter 62-160 F.A.C.;
- Analyzing laboratory will be NELAC certified; and
- FDEP approved Standard Operating Procedures will be used as required.

Federal Agencies, including USEPA, DOD and their Contractors, conducting field monitoring and laboratory activities as part of this RAD program, will comply with USEPA quality assurance protocols.

6.3 PROCEDURES FOR ENTERING ALL APPROPRIATE DATA INTO FL-STORET

Agencies involved in entering all appropriate data into FL-STORET include the following:

- The FIU/SERC will upload all surface water quality data for the monitoring networks to the EPA National STORET Database.
- The FDEP Tallahassee STORET section also receives a copy of these uploads. The District currently has a contractor developing programming methodologies using ADaPT / EDMS formatting, which will allow STORET uploads to occur directly from the District laboratory LIMS system. Ground water quality data will also accompany the STORET uploads when the new data-flow convention is completed.
- Data collected from each ambient water quality monitoring site in the FKNMS and Florida Bay Networks by FIU/SERC will be uploaded to STORET as individual, raw data values, assuming the upload process can be developed with the FDEP to handle this large volume of data. At a minimum, ACCESS tables consisting of the

raw data values and associated station metadata will be made available to the FDEP and other interested parties to perform data analysis of hourly values.

6.4 RESPONSIBLE MONITORING AND REPORTING ENTITY

The stakeholders, interested parties and contractors previously described in Subsection 6.1.2 are responsible for the collection of water quality data for their respective monitoring programs. All data collected for the management actions and projects listed in Section 4 will be utilized for reporting the status and progress of the Northern Keys Area program.

The FIU/SERC will be responsible for compiling the Northern Keys Area water quality monitoring data on an annual basis. All data collected for the monitoring networks will be checked for quality assurance and reviewed internally on either a monthly or quarterly basis.

6.5 FREQUENCY AND REPORTING FORMAT FOR REPORTING MONITORING RESULTS

Reporting will be submitted in written or digital form in any of customary and/or contractual formats including reports, spreadsheets, databases, GIS coverages and other graphical formats. Frequency of reporting results by monitoring network/management activity is summarized in the following table:

Table 6-1
Monitoring Network Reporting Frequencies

Monitoring Networks	Operator	Reporting Frequency
FKNMS Ambient Water Quality Network	Florida Keys National Marine Sanctuary	Annually
Florida Bay Ambient Water Quality Network	FIU/SERC	Annually
Supplemental Water Quality Monitoring Program Supporting TMDL/RAD Activities	FDEP	Periodically
Wastewater Effluent Regulatory Monitoring	Key Largo WTD; Villages of Islamorada	Daily

6.6 FREQUENCY AND REPORTING FORMAT FOR IMPLEMENTATION OF PROPOSED MANAGEMENT ACTIVITIES

The individual stakeholders will report on the implementation of management activities through an annual summary report generated each January. FDEP will update stakeholders

on the progress and results of the collective monitoring networks at periodic stakeholder group meetings.

6.7 METHODS FOR EVALUATING PROGRESS TOWARDS GOALS

FDEP will use water quality data results from all networks previously described, as available and appropriate, to evaluate the progress of the implemented management actions toward meeting water quality management goals. Aggregated data will be interpreted using graphical and statistical methodologies.

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Section 7

PROPOSED CORRECTIVE ACTIONS

7.1 CORRECTIVE ACTIONS FOR NON-IMPROVEMENT OF WATER QUALITY

It is anticipated that corrective actions will not be necessary as applied to the water quality impairment associated with the Northern Keys Area watersheds. Unlike many other areas of Florida that have been identified as impaired under the IWR, the causes of the impairment in this area originate from three known sources:

- Wastewater
- Anthropogenic Stormwater
- Farfield Effects

The management actions previously described in Section 4 are largely focused on the elimination or reduction of the local anthropogenic sources (primarily wastewater discharges) associated with existing human population in the Florida Keys. Therefore, direct improvement to the groundwater based nutrient discharges to local receiving waters (canals and the Halo Zone surface waters), can be reasonably predicted to occur.

In addition, the communities support the management actions that have been implemented and/or proposed due to the anticipated improvement in water quality, the marine environment and aesthetics which directly relate to their quality of life. These changes are also expected to directly benefit the local and regional tourist driven economies.

7.2 CORRECTIVE ACTIONS FOR SCHEDULE NON-ATTAINMENT OF MANAGEMENT ACTIONS

Reducing water quality impairments in the Florida Keys, due to the fragile nature of the nearshore waters and the numerous pollutant sources that act upon them, will require a concerted National, Regional and local effort for many years to come.

- The potential exists that the management actions implemented currently and proposed for implementation through summer of 2010 and subsequently over the next ten years will not correct locally-originated nutrient based water quality impairments in the Halo Zone waters as quickly as proposed (stated goal of no impairment by 2020).
- It is apparent that the cumulative effects of anthropogenic effects originating in the Gulf region and portions of peninsular Florida documented in terms of the ambient nutrient concentrations of the marine waters surrounding and circulating through the Florida Keys, will not likely be solved in the next few decades.

- It is sheer folly to believe that Man will be able to control or ameliorate the larger farfield effects of Nature such as deep ocean upwelling, African dust or global warming in the near future.

Of these concerns, the Keys communities can only work towards reducing the nutrient loads generated by anthropogenic activities occurring on the islands of the Florida Keys. They have no ability to control or reduce nutrient sources occurring naturally in the Keys or originating outside their local area.

CORRECTIVE ACTIONS

The provisions of Chapter 99-395 LF provide the basis for any corrective actions that may be required for schedule non-attainment of management actions. More specifically, this law requires:

- FDOH to conduct enforcement actions against owners cess pits to eliminate their cess pits and either:
  - Connect to a central wastewater system that meets the Chapter 99-395 LF standards; or
  - Secure a permit, install an acceptable OSTDS, and thereafter operate and maintain the OSTDS in such a manner that it complies with the requirements of Chapter 99-395 LF.
- FDOH to conduct enforcement actions against owners of non-complying OSTDSs as required have them:
  - Connect to a central wastewater system that meets the Chapter 99-395 LF standards;
  - Upgrade/repair their existing OSTD to meet the Chapter 99-395 LF standards, and thereafter operate and maintain their OSTDS in such a manner that it complies with the requirements of Chapter 99-395 LF; or
  - Secure a permit, install an acceptable new OSTDS, and thereafter operate and maintain the OSTDS in such a manner that it complies with the requirements of Chapter 99-395 LF.
- FDEP to conduct enforcement actions against public and privately owned WWTPs that do not produce an effluent and/or dispose of its effluent in a manner compliant with the requirements of Chapter 99-395 LF, in order to have them:
  - Connect to a central wastewater system that meets the Chapter 99-395 LF standards; or
  - Upgrade their existing WWTP to meet the Chapter 99-395 LF standards, and thereafter operate and maintain their WWTP in such a manner that it complies with the requirements of Chapter 99-395 LF.

7.3 FDEP NOTIFICATION PROCESS FOR CORRECTIVE ACTION IMPLEMENTATION

FDEP is an active member in the Northern Keys Area Watershed Management Plan Stakeholders group and will be aware of all actions of the group, including the status of the implementation of corrective management actions.

The annual report will be the formal mechanism for reporting the progress of various management actions, the overall success of the plan, and the need for corrective actions. This annual report will be transmitted to the FDEP – Tallahassee as well as the local Marathon and South Florida District offices.

- Corrective actions that are implemented will be documented in the annual report as a separate category to ensure the FDEP is provided sufficient information on the plans implementation and success.

- If a corrective action is deemed overly significant, such as the introduction of a new management action to address the failure of an existing management action, the FDEP will be notified formally through written correspondence of this significant change to the plans implementation. In addition, this plan will be updated and resubmitted to the FDEP-Tallahassee and the local FDEP offices to address the proposed changes.

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LIST OF ABBREVIATIONS AND ACRONYMS

ac-ft	Acre-feet
ACSC	Area of Critical State Concern
Al	Aluminum
Alk	Alkalinity
AMC	Annual Mean Concentration
As	Arsenic
ATT	Advanced Treatment Technology
AWT	Advanced Wastewater Treatment
BAPRT	Best Available Phosphorus Reduction Technology
BAT	Best Available Technology
BMAP	Basin Management Action Plan
BMP	Best Management Practice
BOD_5	Five-Day Biochemical Oxygen Demand
BST	Bacterial Source Tracking
$CaCO_3$	Calcium Carbonate
Cd	Cadmium
CDM	Camp Dresser & McKee, Inc
CERP	Comprehensive Everglades Restoration Plan
Chl-A	Chlorophyll – A
CIP	Capital Improvement Program
cm	Centimeter
cm/day	Centimeters Per Day
COD	Chemical Oxygen Demand
Cond	Conductivity
CPP	Continuing Planning Process
Cr	Chromium
CREP	USDA Conservation Reserve Enhancement Program
Cu	Copper
CWA	Clean Water Act
DCIA	Directly Connected Impervious Area
DIN	Dissolved Inorganic Nitrogen
Diss-	Dissolved-
DO	Dissolved Oxygen
DOQQ	Digital Orthographic Quartersection Quadrangle

EDU	Equivalent Dwelling Unit
EMC	Event Mean Concentration
EMS	Emergency Management Services
ENP	Everglades National Park
ERU	Equivalent Residential Unit
ESC	Erosion and Sediment Control
F.A.C.	Florida Administrative Code
F.S.	Florida Statutes
FAC	Florida Administrative Code
FAW	Florida Administrative Weekly
FC	Fecal Coliform Bacteria
FDACS	Florida Department of Agriculture and Consumer Services
FDCA	Florida Department of Community Affairs
FDEP	Florida Department of Environmental Protection
FDOH	Florida Department of Health
FDOR	Florida Department of Revenue
FDOT	Florida Department of Transportation
FIU	Florida International University
FKAA	Florida Keys Aqueduct Authority
FKNMS	Florida Keys National Marine Sanctuary
FKRAD	Florida Keys Reasonable Assurance Documentation
FS	Fecal Streptococcus Bacteria
FY	Fiscal Year
g/m2/yr	grams per square meter per year
GIS	Geographic Information System
GWLF	Generalized Watershed Loading Functions
ha	Hectare
Hg	Mercury
HLR	Hydraulic Loading Rate
HSG	Hydric Soil Group
HSPF	Hydrologic Simulation Programs in FORTRAN
HUC	Hydrologic Unit Code
IP	Implementation Plan
IWR	Impaired Waters Rule
kac-ft	Thousand acre-feet
kg	Kilograms
KLWTD	Key Largo Wastewater Treatment District

km	Kilometer
LA	Load Allocation
LF	Laws of Florida
LIMS	Laboratory Information Management System
LUC	Land Use Characterization
MFR	Multi-Family Residential
µg/l	Micrograms per Liter
mg/l	Milligram Per Liter
mg/L	Milligrams Per Liter
MLUS	Mixed Land Use Site
MS4	Municipal Separate Storm Sewer System
mt	Metric ton
NAD88	North American Datum of 1988
NAPP	National Aerial Photography Program
NAWQA	National Atmospheric Water Quality Assessment
NCDC	National Climactic Data Center
NGVD	National Geodetic Vertical Datum
NH_4	Ammonia
Ni	Nickel
NO_2	Nitrite
NO_3	Nitrate
NO_x	Nitrite + Nitrate
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint source
NRCS	Natural Resources Conservation Service
NTU	Nephelometric Turbidity Unit
NURP	Nationwide Urban Runoff Program
O&G	Oil and Grease
O&M	Operation and Maintenance
OFW	Outstanding Florida Water
OP	Ortho-Phosphorus
OSTDS	On-Site Treatment and Disposal System
P	Phosphorus
Pb	Lead
PCU	Platinum cobalt unit
Pest	Pesticide

pH	Logarithm of the Reciprocal of the Hydrogen Ion Concentration
PLR	Phosphorus Loading Rate
PLRG	Pollution Load Reduction Goals
Ppb	Parts per Billion
PPM	Pollution Prevention Measure
PS	Point Source
PY	Permit Year
QA	Quality Assurance
QAP	Quality Assurance Plan
QBEL	Quality-Based Effluent Limitation
QC	Quality Control
QM	Quality Management
RAD	Reasonable Assurance Documentation
RPD	Relative Percent Difference
SAV	Submerged Aquatic Vegetation
SERC	Southeast Environmental Research Center
SFR	Single Family Residential
SFUE	Single Family Unit Equivalent
SFWMD	South Florida Water Management District
SOD	Sediment Oxygen Demand
SPPM	Stormwater Pollutant Prediction Modeling
SSAC	Site Specific Alternative Criteria
SWAMP	Surface Water Assessment and Monitoring
SWAP	Source Water Assessment Program
SWCD	Soil and Water Conservation District
SWIM	Surface Water Improvement and Management
SWM	Stormwater Management
SWMM	Storm Water Management Model
SWQ	Stormwater Quality
SWU	Stormwater Utility
TBEL	Technology-Based Effluent Limitation
TC	Total Coliform Bacteria
Temp	Temperature
TF	Fecal Coliform Bacteria
TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
TN	Total Nitrogen

TP	Total Phosphorus
TS	Total Solids
TSI	Trophic State Index
TSS	Total Suspended Solids
Turb	Turbidity
TWG	Technical Working Group
UAA	Use Attainability Analysis
URS	URS Corporation
USACE	U.S. Army Corps of Engineers
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	U.S. Geological Survey
USLE	Universal Soil Loss Equation
VS	Volatile Solids
VSS	Volatile Suspended Solids
WBID	Waterbody identification number
WCA	Water Conservation Area
WLA	Waste Load Allocation
WMP	Watershed Management Plan
WQ	Water Quality
WQIP	Water Quality Improvement Plan
WQMP	Water Quality Management Plan
WQPP	Water Quality Protection Program
WS	Watershed
WSPP	Watershed Protection Plan
WWTP	Wastewater Treatment Plant
WY	Water year
Zn	Zinc

EXHIBITS

Exhibit 1
STAKEHOLDER AGREEMENTS

Key Largo Wastewater Treatment District Stakeholder Agreement

Islamorada, Village of Islands Stakeholder Agreement

Monroe County Stakeholder Agreement

Florida Division of Recreation & Parks Commitment Letter

FDOT Commitment Letter

Northern Keys Area
Reasonable Assurance Documentation

STAKEHOLDER AGREEMENT

Key Largo Wastewater Treatment District

Background

Whereas, the Signatory to this Agreement recognizes that the Florida Keys are a unique and irreplaceable natural system that constitutes a local, State and National treasure; and

Whereas, the Signatory to this Agreement recognizes that the Florida Keys are a linear collection of small watersheds which are hydrologically connected at the local level by the nearshore waters of the Keys; and

Whereas, the Signatory to this agreement has an interest and an obligation to manage local anthropogenic nutrient contributions in order to control cumulative water quality impacts within the local zone of impact in the nearshore waters of the Florida Keys; and

Whereas, the Signatory to this Agreement recognizes that the Florida Keys are continuously impacted by nutrient concentrations in offshore waters associated with a wide range of natural sources and phenomena including deep ocean upwelling, micro-nutrient and viruses in African dust storms that reach the Keys; and

Whereas, the Signatory to this Agreement recognizes that water quality in the nearshore waters of the Florida Keys are continuously influenced by their interactions with offshore waters and loop currents that have elevated nutrient concentrations attributable to a wide range of anthropogenic activities far outside of the Florida Keys; and

Whereas, the Signatory to this Agreement do not control the major sources of nutrient loading into the offshore and nearshore waters surrounding the Florida Keys; and

Whereas, the Signatory to this Agreement wishes, nevertheless, to control the nutrient loading generated by local wastewater and stormwater discharges to the extent practicable and

Whereas, the Signatory to this Agreement recognizes that elevated nutrient concentrations have contributed to the degradation of water quality in the Florida Keys; and

Whereas, the Signatory to this Agreement recognizes that a portion of the nutrients in the nearshore waters of the Florida Keys originate from anthropogenic activities occurring within the Florida Keys which are within the purview and scope of authority of the local Keys governments and agencies; and

Whereas, the Signatory to this Agreement recognizes that a portion of the nutrients in the nearshore waters of the Florida Keys originate from anthropogenic activities outside of the Florida Keys and are not within the purview and scope of authority of the local Keys governments and agencies; and

Whereas, the Signatory to this Agreement is interested in managing the water quality in the Florida Keys to preserve and improve the aquatic environment and living resources now existing in the Florida Keys; and

Whereas, the Signatory to this Agreement recognizes that a comprehensive watershed approach is needed to reduce nutrients and address water quality issues within the Florida Keys; and

Whereas, multiple regulatory, technical assistance, research, and education programs has been developed and are well coordinated but must be used in combination with incentives and other non-regulatory tools to form a comprehensive approach to address the full scope of water quality issues within the Florida Keys; and

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

Whereas, the resource management actions identified in this agreement are deemed effective in improving water quality within the Florida Keys watersheds.

Now therefore, in consideration of the foregoing premises, which are made part of this Agreement, the Signatory hereby agrees to the following:

I. Geographic Applicability

The geographic area of this agreement is limited to the Northern Keys Area.

II. Participants in the Northern Keys Area Reasonable Assurance Document

The following municipalities and agencies are participants in the Northern Keys Area Reasonable Assurance Document:

- Islamorada, Village of Islands;
- Key Largo Wastewater Treatment District;
- Florida Department of Transportation; and
- Florida Division of Recreation and Parks.
- Monroe County

III. Mission

The common mission of the signatories of this agreement is to reduce the annual discharge of nutrients to the halo zone waters of the Northern Keys Area (WBIDs 6006A, 6006B, 6006C, 6009, 6017 and 6019) in order to protect and enhance the unique marine environment of the nearshore waters of this portion of the Florida Keys. To this end the signatory stakeholders agree to:

1. Work together to assess anthropogenic sources of total nitrogen and total phosphorus being discharged to the halo zone waters;
2. Work individually to optimize reductions of locally generated anthropogenic nutrient concentrations in the local halo zones;
3. Work collaboratively to minimize discharges of anthropogenic sources of total nitrogen and total phosphorus to waters of these watersheds in compliance with existing federal and state laws and rules and regional requirements, and emphasizing voluntary, incentive-based programs for protecting the environment and public health;
4. Coordinate and collaborate with federal, state, regional agencies/programs, local governments and interested parties to improve the coordination, use and benefits provided by existing regulatory, technical assistance, research, and education programs; and,
5. Work individually and collaboratively to provide the required funding for wastewater and stormwater management activities using local, regional, state or federal funding

IV. Guiding Principles

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

1. Use a comprehensive, regionally integrated management approach to address Class III marine water quality standards for halo zone waters and encourage timely implementation of proposed and planned management actions within the Florida Keys watersheds.
2. Focus on management approaches which are technically feasible, economically practicable, and protective of the environment and public health.
3. Implement wastewater management actions – including wastewater collection, treatment and disposal practices – as required by Chapter 99-395, Laws of Florida, as amended as a primary management practice for reducing nutrient discharges to the halo zone waters.
4. Implement stormwater management actions – including regulations, design standards and criteria, education programs, collection systems and treatment facilities, and O&M activities – to the maximum extent practicable throughout their watersheds to achieve Class III water standards in the halo zone waters.
5. Maximize availability of local resources to the extent practicable, and the efficient coordination of federal, state, and regional agency resources and programs, and local resources and avoid unnecessary duplication of efforts.
6. Where appropriate, pursue opportunities for joint projects that provide more cost effective solutions and may make better use of consolidated and coordinated funding of projects.
7. Seek reasonable, incentive based solutions that can be embraced by leaders and stakeholders in the Keys communities and at all levels of government.
8. Develop consensus measures of success that include monitoring of the progress of management actions.
9. Achieve results that satisfy regulatory requirements.
10. Employ water quality monitoring to measure the effectiveness of implemented water quality improvement measures.
11. Continue to make good faith efforts in funding incentive-based programs.
12. Participate in annual reporting activities that demonstrate successful reduction of nutrient discharges.

V. Organization

The signatories, through their own individual efforts, combined with interlocal cooperation and the integrated efforts of numerous federal, state and local programs, have created a fabric of regulatory, operational, capital construction and educational programs that function collectively as an integrated management plan for the multiple watersheds in the Florida Keys.

While no designated leader or management committee exists for this informal watershed plan, there are a number of oversight entities that provide guidance and leadership including:

- DCA (by virtue of the Keys' designation as a Area of Critical State Concern);
- Florida Keys National Marine Sanctuary Steering Committee; and
- Sanctuary Advisory Committee.

Primary planning activities have been accomplished by the individual stakeholder governments for their jurisdictional areas. These planning activities have received a defacto integration effort through a number of studies, regulations and overlay planning including:

- Monroe County Sanitary Wastewater Master Plan;

- Monroe County Stormwater Master Plan;
- Growth Management Act, Chapter 163, Part II, Florida Statutes
- Monroe County Comprehensive Plan, regulated under Chapter 9J-14, Florida Administrative Code;
- Florida Keys Carrying Capacity Plan;
- FDEP's wastewater and stormwater management regulations;
- Designation of the Florida Keys as an Area of Critical State Concern, Chapters 163 and 380, Florida Statutes;
- Chapter 9J-5, Florida Administrative Code, Comprehensive Growth Management (monitored by DCA); and
- Chapter 99-395, Laws of Florida, as amended.

The combination of wastewater and stormwater regulatory programs will continue to address the specific impairments to water quality recognized at the time of signature.

This agreement applies only to the currently identified nutrient impairment in the halo zone WBIDs previously identified in Paragraph III. Nutrient impairments in other halo zone WBIDs in the Florida Keys will be addressed through a separate agreement(s) and the participation of appropriate stakeholders.

VI. Education, Outreach and Implementation

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

VII. Stakeholder Involvement and Commitments

For the collective stakeholders to be successful, the involvement of each individual stakeholder is critical. As part of this framework agreement, a process for stakeholder involvement is developed and will be implemented by the signatories. This commitment is based on mutual cooperation, shared objectives, fairness, and the support and participation from the Parties to this Agreement.

Specific management action commitments of the signatory stakeholder, with respect to the Northern Keys Area Reasonable Assurance Document, are summarized in their entirety in the following table:

KEY LARGO WASTEWATER TREATMENT DISTRICT
PROPOSED AND IMPLEMENTED MANAGEMENT PRACTICES

WBID	Management Action	Estimated Total Nitrogen Load Reduction (lbs/year)	Estimated Total Phosphorous Load Reduction (lbs/year)	Actual or Anticipated Operational Date
IMPLEMENTED MANAGEMENT PRACTICES				
6006A	Construction of 0.183 MGD demonstration AWT treatment facility with disposal in a shallow Class V effluent disposal well [KLWTD]	0	0	May 2006
6006A	Installation of Basin E (Phase 1) central wastewater collection system serving 999 EDUs with subsequent connection to the demonstration AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	7,689	2,149	October 2006
PROPOSED FUTURE MANAGEMENT PRACTICES				
6006A	Construction of 2.3 MGD AWT treatment facility with disposal in a deep Class V effluent disposal well [KLWTD]	0	0	May 2009
6006A	Construction of the Basin A central wastewater collection system serving 1,323 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	11,850	3,459	May 2009
6006A	Construction of the Basin B central wastewater collection system serving 1,861 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	16,204	4,862	May 2009
6006A	Construction of the Basin D central wastewater collection system serving 2,548 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	21,759	6,241	May 2009
6006A	Construction of the Basin C central wastewater collection system serving 1,207 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	10,530	2,906	October 2009
6006A	Construction of the Basin E (Phase II) central wastewater collection system serving 999 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	1,282	427	October 2009
6006A	Construction of the Basin F central wastewater collection system serving 1,111 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	10,609	3,148	June 2010
6006A	Construction of the Basin G central wastewater collection system serving 1,625 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	15,494	4,603	September 2010

WBID	Management Action	Estimated Total Nitrogen Load Reduction (lbs/year)	Estimated Total Phosphorous Load Reduction (lbs/year)	Actual or Anticipated Operational Date
6006A	Construction of the Basin H central wastewater collection system serving 737 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	5,791	1,554	January 2011
6006A	Initial connection of John Pennekamp State Park to KLWTD central wastewater collection system serving 167 EDUs in Basins A-C [KLWTD]	38,584	11,226	June 2010
6006A	Final connection of John Pennekamp State Park to KLWTD central wastewater collection system serving 43 EDUs in Basins C-H [KLWTD]	54,603	15,877	January 2011
6006A	Construction of the Basin K central wastewater collection system serving 1,080 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	8,428	2,467	July 2011
6006A	Construction of the Basin I central wastewater collection system serving 1,910 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	13,931	4,031	October 2011
6006A	Construction of the Basin J central wastewater collection system serving 893 EDUs with subsequent connection to the 2.3 MGD AWT treatment facility with finished effluent disposal in a deep Class V well [KLWTD]	6,836	2,041	December 2011
6006A	UPGRADE PRIVATE FACILITIES TO BAT (128 EDU)	544	272	
6006A	UPGRADE CESSPOOLS TO ATU (32 EDU)	137	0	
6006B	UPGRADE PRIVATE FACILITIES TO BAT (30 EDU)	143	72	
6006B	UPGRADE CESSPOOLS TO ATU (47 EDU)	218	0	
6006C	OCEAN REEF CLUB AWT AND SHALLOW WELL (2,786 EDU)	16,158	4,752	
NORTHERN KEYS AREA KEY LARGO WASTEWATER TREATMENT DISTRICT TOTAL NUTRIENT REDUCTIONS		240,790	70,087	

VIII. Measures of Success

Water quality issues in the Florida Keys watersheds have developed from various inputs over an extended period of time. Successfully addressing these issues will require sufficient time to implement management changes and evaluate their effect. Specific measures of success include:

- Reporting that specific management actions previously identified in VII have been implemented as of a specific date:
- Annually reporting that specific management actions previously identified in VII and are being operated and maintained to achieve their design treatment levels; and
- Submission of monthly Discharge Monitoring Reports (DMRs) to FDEP permitted wastewater treatment facilities to substantiate the actual levels of nutrient reduction being achieved by the operating systems on a continuing basis.

IX. Condition to Effectiveness

The signatories hereby agree that in the event the United States Environmental Protection Agency does not accept the Florida Keys Reasonable Assurance Document for the Northern Keys Area in lieu of the total maximum daily load approach under the Federal Clean Water Act, then this Agreement shall automatically be terminated and shall be of no further force or effect.

The undersigned, an authorized agent of the Key Largo Wastewater Treatment District, agrees to the foregoing Stakeholders Agreement for the Northern Keys Area Reasonable Assurance Documentation:

Key Largo Wastewater Treatment District
Name, Title ANDREW TOBIN, ACTING CHAIRMAN
Date: June 3 2008

Attest:

Name, Title
CAROL WALKER, DISTRICT CLERK
Date: June 3 2008

Key Largo Wastewater Treatment

Northern Keys Area
Reasonable Assurance Documentation

STAKEHOLDER AGREEMENT

Islamorada, Village of Islands

Background

Whereas, the Signatory to this Agreement recognizes that the Florida Keys are a unique and irreplaceable natural system that constitutes a local, State and National treasure; and

Whereas, the Signatory to this Agreement recognizes that the Florida Keys are a linear collection of small watersheds which are hydrologically connected at the local level by the nearshore waters of the Keys; and

Whereas, the Signatory to this agreement has an interest and an obligation to manage local anthropogenic nutrient contributions in order to control cumulative water quality impacts within the local zone of impact in the nearshore waters of the Florida Keys; and

Whereas, the Signatory to this Agreement recognizes that the Florida Keys are continuously impacted by nutrient concentrations in offshore waters associated with a wide range of natural sources and phenomena including deep ocean upwelling, micro-nutrient and viruses in African dust storms that reach the Keys; and

Whereas, the Signatory to this Agreement recognizes that water quality in the nearshore waters of the Florida Keys are continuously influenced by their interactions with offshore waters and loop currents that have elevated nutrient concentrations attributable to a wide range of anthropogenic activities far outside of the Florida Keys; and

Whereas, the Signatory to this Agreement do not control the major sources of nutrient loading into the offshore and nearshore waters surrounding the Florida Keys; and

Whereas, the Signatory to this Agreement wishes, nevertheless, to control the nutrient loading generated by local wastewater and stormwater discharges to the extent practicable and

Whereas, the Signatory to this Agreement recognizes that elevated nutrient concentrations have contributed to the degradation of water quality in the Florida Keys; and

Whereas, the Signatory to this Agreement recognizes that a portion of the nutrients in the nearshore waters of the Florida Keys originate from anthropogenic activities occurring within the Florida Keys which are within the purview and scope of authority of the local Keys governments and agencies; and

Whereas, the Signatory to this Agreement recognizes that a portion of the nutrients in the nearshore waters of the Florida Keys originate from anthropogenic activities outside of the Florida Keys and are not within the purview and scope of authority of the local Keys governments and agencies; and

Whereas, the Signatory to this Agreement is interested in managing the water quality in the Florida Keys to preserve and improve the marine environment and living resources now existing in the Florida Keys; and

Whereas, the Signatory to this Agreement recognizes that a comprehensive watershed approach is needed to reduce nutrients and address water quality issues within the Florida Keys; and

Whereas, multiple regulatory, technical assistance, research, and education programs has been developed and are well coordinated but must be used in combination with incentives and other non-

regulatory tools to form a comprehensive approach to address the full scope of water quality issues within the Florida Keys; and

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

Whereas, the Village believes its schedule to be realistic and intends to aggressively accelerate the schedule as much as possible by concurrent construction subject to availability of funding from public and private sources;

Whereas, the resource management actions identified in this agreement are deemed effective in improving water quality within the Florida Keys watersheds.

Now therefore, in consideration of the foregoing premises, which are made part of this Agreement, the Signatory hereby agrees to the following:

I. Geographic Applicability

The geographic area of this agreement is limited to the Northern Keys Area.

II. Participants in the Northern Keys Area Reasonable Assurance Document

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- Key Largo Wastewater Treatment District;
- Monroe County;
- Florida Department of Transportation; and
- Florida Division of Recreation and Parks.

III. Mission

The common mission of the signatories of this agreement is to reduce the annual discharge of nutrients to the halo zone waters of the Northern Keys Area (WBIDs 6006A, 6006B, 6006C, 6009, 6017 and 6019) in order to protect and enhance the unique marine environment of the nearshore waters of this portion of the Florida Keys. To this end the signatory stakeholders agree to:

1. Work together to assess anthropogenic sources of total nitrogen and total phosphorus being discharged to the halo zone waters;
2. Work individually to optimize reductions of locally generated anthropogenic nutrient concentrations in the local halo zones;
3. Work collaboratively to minimize discharges of anthropogenic sources of total nitrogen and total phosphorus to waters of these watersheds in compliance with existing federal and state laws and rules and regional requirements, and emphasizing voluntary, incentive-based programs for protecting the environment and public health;
4. Coordinate and collaborate with federal, state, regional agencies/programs, local governments and interested parties to improve the coordination, use and benefits provided by existing regulatory, technical assistance, research, and education programs; and,
5. Work individually and collaboratively to provide the required funding for wastewater and stormwater management activities using local, regional, state or federal funding.

IV. Guiding Principles

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

1. Use a comprehensive, regionally integrated management approach to address Class III marine water quality standards for halo zone waters and encourage timely implementation of proposed and planned management actions within the Florida Keys watersheds.
2. Focus on management approaches which are technically feasible, economically practicable, and protective of the environment and public health.
3. Implement wastewater management actions – including wastewater collection, treatment and disposal practices – as required by Chapter 99-395, Laws of Florida, as amended as a primary management practice for reducing nutrient discharges to the halo zone waters.
4. Implement stormwater management actions – including regulations, design standards and criteria, education programs, collection systems and treatment facilities, and O&M activities – to the maximum extent practicable throughout their watersheds to achieve Class III water standards in the halo zone waters.
5. Maximize availability of local resources to the extent practicable, and the efficient coordination of federal, state, and regional agency resources and programs, and local resources and avoid unnecessary duplication of efforts.
6. Where appropriate, pursue opportunities for joint projects that provide more cost effective solutions and may make better use of consolidated and coordinated funding of projects.
7. Seek reasonable, incentive based solutions that can be embraced by leaders and stakeholders in the Keys communities and at all levels of government.
8. Develop consensus measures of success that include monitoring of the progress of management actions.
9. Achieve results that satisfy regulatory requirements.
10. Employ water quality monitoring to measure the effectiveness of implemented water quality improvement measures to the extent practicable.
11. Continue to make good faith efforts in funding incentive-based programs in coordination and collaboration with federal, state, regional agencies/programs and local governments.
12. Participate in annual reporting activities that demonstrate successful reduction of nutrient discharges.

V. Organization

The signatories, through their own individual efforts, combined with interlocal cooperation and the integrated efforts of numerous federal, state and local programs, have created a fabric of regulatory, operational, capital construction and educational programs that function collectively as an integrated management plan for the multiple watersheds in the Florida Keys.

While no designated leader or management committee exists for this informal watershed plan, there are a number of oversight entities that provide guidance and leadership including:

- DCA (by virtue of the Keys' designation as a Area of Critical State Concern);
- Florida Keys National Marine Sanctuary Steering Committee; and
- Sanctuary Advisory Committee.

Primary planning activities have been accomplished by the individual stakeholder governments for their jurisdictional areas. These planning activities have received a defacto integration effort through a number of studies, regulations and overlay planning including:

- Monroe County Sanitary Wastewater Master Plan;
- Monroe County Stormwater Master Plan;
- Islamorada Wastewater Management Master Plan;
- Islamorada Stormwater Management Master Plan;
- Growth Management Act, Chapter 163, Part II, Florida Statutes
- Monroe County Comprehensive Plan, regulated under Chapter 9J-14, Florida Administrative Code;
- Islamorada, Village of Islands Comprehensive Plan, regulated under Chapter 9J-14, Florida Administrative Code;
- Florida Keys Carrying Capacity Plan;
- FDEP's wastewater and stormwater management regulations;
- Designation of the Florida Keys as an Area of Critical State Concern, Chapters 163 and 380, Florida Statutes;
- Chapter 9J-5, Florida Administrative Code, Comprehensive Growth Management (monitored by DCA); and
- Chapter 99-395, Laws of Florida, as amended.

The combination of wastewater and stormwater regulatory programs will continue to address the specific impairments to water quality recognized at the time of signature.

This agreement applies only to the currently identified nutrient impairment in the halo zone WBIDs previously identified in Paragraph III. Nutrient impairments in other halo zone WBIDs in the Florida Keys will be addressed through a separate agreement(s) and the participation of appropriate stakeholders.

VI. Education, Outreach and Implementation

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

VII. Stakeholder Involvement and Commitments

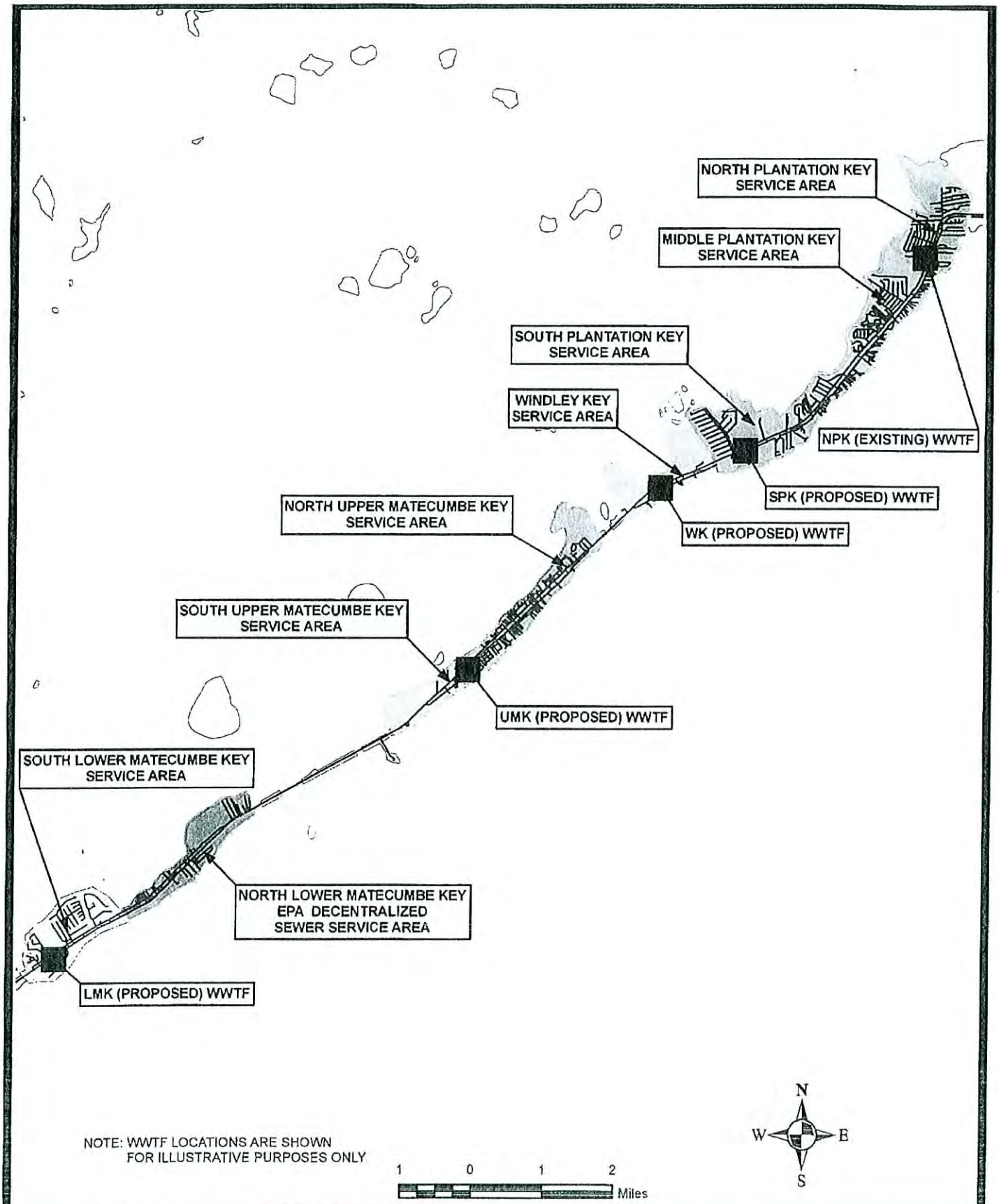
For the collective stakeholders to be successful, the involvement of each individual stakeholder is critical. As part of this framework agreement, a process for stakeholder involvement is developed and will be implemented by the signatories. This commitment is based on mutual cooperation, shared objectives, fairness, and the support and participation from the Parties to this Agreement.

Specific management action commitments of the signatory stakeholder, with respect to the Northern Keys Area Reasonable Assurance Document, are summarized in their entirety in the following table:

ISLAMORADA, VILLAGE OF ISLANDS
PROPOSED AND IMPLEMENTED MANAGEMENT PRACTICES

WBID	Management Action	Estimated Total Nitrogen Load Reduction (lbs/year)	Estimated Total Phosphorous Load Reduction (lbs/year)	Actual or Anticipated Operational Date
IMPLEMENTED MANAGEMENT PRACTICES				
—	Installation of stormwater treatment systems for Existing Roadway [Islamorada]	Being executed in accordance with the stormwater master plan.		2004-2007
PROPOSED FUTURE MANAGEMENT PRACTICES				
6009	Construction of the North Plantation Key Phase I central wastewater collection system, 0.250 MGD AWT treatment facility and shallow Class V effluent disposal well serving approximately 500 EDUs [Islamorada]	13,798	3,880	July 2006
6009	Construction of the North Plantation Key Phase II central wastewater collection system, to be connected to the existing North Plantation Key AWT treatment facility and shallow Class V effluent disposal well serving approximately 1,100 EDUs [Islamorada]	13,798	3,880	August 2008
6009	Construction of the Middle Plantation Key central wastewater collection system, 0.250 MGD AWT treatment facility expansion at North Plantation Key AWT treatment facility and shallow Class V effluent disposal well serving approximately 1,600 EDUs [Islamorada]	13,274	3,553	December 2010
6009	Construction of the South Plantation Key central wastewater collection system, 0.300 MGD AWT treatment facility and shallow Class V effluent disposal well serving approximately 1,900 EDUs [Islamorada]	11,129	3,188	December 2010
6009	Construction of the Windley Key central wastewater collection system, 0.140 MGD AWT treatment facility and shallow Class V effluent disposal well serving 900 EDUs [Islamorada]	8,451	2,486	March 2011
6017	Construction of the South Upper Matecumbe Key central wastewater collection system, 0.600 MGD AWT treatment facility and shallow Class V effluent disposal well serving approximately 2,700 EDUs [Islamorada]	11,214	3,279	December 2012
6017	Construction of the North Upper Matecumbe Key central wastewater collection system, to be connected to the proposed Upper Matecumbe Key AWT treatment facility and shallow Class V effluent disposal well serving approximately 1,100 EDUs [Islamorada]	13,311	3,831	December 2012
6019	Construction of the Lower Matecumbe Key central wastewater collection system, 0.250 MGD AWT treatment facility and shallow Class V effluent disposal well serving approximately 1,600 EDUs [Islamorada]	10,518	3,107	December 2012
—	Installation of stormwater treatment systems for Existing Roadway [Islamorada]	Being executed in accordance with the stormwater master plan.		2008-2010
NORTHERN KEYS AREA ISLAMORADA, VILLAGE OF ISLANDS TOTAL NUTRIENT REDUCTIONS		81,695	23,324	

ATTACHMENT
WASTEWATER TREATMENT SERVICE AREA MAP



E Sciences, Incorporated
FL Engineering Lic. #8691
34 East Pine Street
Orlando, Florida. 32801
www.esciencesinc.com
Fax: 407.481.9627
Phone. 407.481.9006

Wastewater Treatment Service Area Map

Islamorada, Village of Islands

FIGURE 1

SCALE: AS SHOWN

DATE: 5/28/2008

DRAWN BY:	CHECKED BY:	PROJECT NUMBER:
KSD		2-0110-029-605

P:\Projects\2-0110-029-605_Figures and Images\CAD\GIS\Service Area Map.dwg 5/28/2008 2:51 PM

ATTACHMENT
PROPOSED AND IMPLEMENTED PRACTICES

PROPOSED AND IMPLEMENTED PRACTICES

WBID 6009: Construction of North Plantation Key (NPK) Central Waste Water Collection System 0.250 MGD AWT Treatment facility and a Shallow Class V effluent disposal and reclamation system serving approximately 1,600 EDUs [Islamorada]. Phase I has been in operation since July 2006 and is serving approximately 500 EDUs [Islamorada]. The Phase II system serving approximately 1,100 EDUs [Islamorada] operational date is August 2008.

WBID 6009: Construction of Middle Plantation Key (MPK) Central Waste Water Collection System 0.250 MGD and Expansion of the North Plantation Key Central Waste Water Treatment facility to 0.500 MGD AWT Treatment facility and a Shallow Class V effluent disposal with the expansion serving approximately an additional 1,600 EDUs [Islamorada]. MPK operational date is December 2010.

WBID 6009: Construction of South Plantation Key (SPK) Central Waste Water Collection System 0.300 MGD AWT Treatment facility and a Shallow Class V effluent disposal serving approximately 1,900 EDUs [Islamorada]. SPK Operational date is December 2010.

WBID 6009: Construction of Windley Key (WK) Central Waste Water Collection System 0.140 MGD AWT Treatment facility and a Shallow Class V effluent disposal serving approximately 900 EDUs [Islamorada]. WK Operational date is March 2011.

WBID 6017: Construction of Upper Matecumbe Key (UMK) Central Waste Water Collection System 0.600 MGD AWT Treatment facility and a Shallow Class V effluent disposal serving approximately 3,800 EDUs [Islamorada]. UMK Operational date is December 2012.

WBID 6019: Construction of Lower Matecumbe Key (LMK) Central Waste Water Collection System 0.250 MGD AWT Treatment facility and a Shallow Class V effluent disposal serving approximately 1,600 EDUs [Islamorada]. LMK Operational date is December 2012.

WBID 6019: Construction on the Lower Matecumbe Key Decentralized Waste Water Collection System 0.045 MGD BAT Treatment facility and shallow Class V effluent disposal serving approximately 300 EDUs [Islamorada]. The Lower Matecumbe Decentralized Sewer Project operational date is July 2010.

Total Design EDUs approximately 11,700

Treatment Facility Average Annual Daily Design Flows

a. NPK – 0.50 MGD (includes 0.250 MGD for MPK)
b. SPK – 0.30 MGD
c. Windley – 0.14 MGD
d. UMK – 0.6 MGD
e. LMK – 0.3 MGD

Total – 1.84 MGD

ATTACHMENT
EXCERPT FROM FDEP REPORT TO DCA

Excerpt from the FDEP Report to the DCA

Plantation Key

- North Plantation Key Wastewater Treatment Facility (currently 250,000 GPD-AADF and proposed to be expanded to a design flow of approximately 500,000 GPD-AADF)
  - North Plantation Key Service Area from MM 89.8 to MM 90.8 is currently served by the NPK WWTF located at MM 89.9. Approximately 1,600 EDUs.
  - Middle Plantation Key Service Area from MM 88 to MM 89.8 will be served by the NPK WWTF which is estimated to be expanded to a design flow of approximately 500,000 GPD-AADF and located at MM 89.9. Approximately 1,600 EDUs.
- South Plantation Key Wastewater Treatment Facility (estimated design flow of 300,000 GPD-AADF)
  - South Plantation Key Service Area MM 85.9 to MM 88 is proposed to be served by the SPK WWTF Located in the vicinity of MM 86.7. Approximately 1,900 EDUs.

Windley Key

- Windley Key Wastewater Treatment Facility (estimated design flow of 140,000 GPD-AADF)
  - Windley Key Service Area MM 83.4 to MM 85.5 is proposed to be served by WK WWTF located in the vicinity of MM 84.6. Approximately 900 EDUs.

Upper Matecumbe Key

- Upper Matecumbe Key Wastewater Treatment Facility (estimated design flow of 600,000 GPD-AADF)
  - North Upper Matecumbe Key Service Area MM 81.8 to MM 83.4 is proposed to be served by the UMK WWTF. Approximately 1,100 EDUs.
  - South Upper Matecumbe Key Service Area MM 79 to MM 81.8 is proposed to be served by the UMK WWTF located in the vicinity of MM 80.9. Approximately 2,700 EDUs.

Lower Matecumbe Key

- Lower Matecumbe Key Wastewater Treatment Facility (estimated design flow of 250,000 GPD-AADF)
  - North Lower Matecumbe Key Service Area MM 76.2 to MM 77.7 will be served by the EPA Decentralized Sewer System and consist of an estimated flow of 45,000 GPD-AADF. Approximately 300 EDUs.
  - South Lower Matecumbe Key Service Area MM 73.5 to MM 76.2 is proposed to be served by the LMK WWTF located in the vicinity of MM 74.5. Approximately 1,600 EDUs.

*Note that wastewater calculations have been adjusted slightly from those of the Master Plan to reflect a more recent evaluation conducted in the Village of Islamorada Wastewater Treatment Alternatives Evaluation – November 2006 and concurrence of the North Lower Matecumbe EPA Decentralized Sewer Project and WWTF design flows have been rounded up to common design flows.

ATTACHMENT
EXCERPT FROM ISLAMORADA WASTEWATER MANAGEMENT MASTER PLAN (2 –PAGES)

VIII. Measures of Success

Water quality issues in the Florida Keys watersheds have developed from various inputs over an extended period of time. Successfully addressing these issues will require sufficient time to implement management changes and evaluate their effect. Specific measures of success include:

- Reporting that specific management actions previously identified in VII have been implemented in accordance with the target dates;
- Annually reporting that specific management actions previously identified in VII and are being operated and maintained to achieve their design treatment levels; and
- Submission of monthly Discharge Monitoring Reports (DMRs) to FDEP permitted wastewater treatment facilities to substantiate the actual levels of nutrient reduction being achieved by the operating systems on a continuing basis.

IX. Condition to Effectiveness

The signatories hereby agree that in the event the United States Environmental Protection Agency does not accept the Florida Keys Reasonable Assurance Document for the Northern Keys Area in lieu of the total maximum daily load approach under the Federal Clean Water Act, then this Agreement shall automatically be terminated and shall be of no further force or effect.

The undersigned, an authorized agent of the Islamorada, Village of Islands, agrees to the foregoing Stakeholders Agreement for the Northern Keys Area Reasonable Assurance Documentation:

Attest:

Islamorada, Village of Islands
Kenneth Fields, Village Manager

Date: 7/3/2008

Beverly Raddatz, Village Clerk

Date: 7/3/2008

TABLE 3-10
Wastewater Generation by Key

	10/94–9/97 Water Use (gpd) and Est. Wastewater Generation	10/94–9/97 Number of EDUs	1/02 – 7/04 Water Use (gpd)	% Increase in Water Use	Number of 2004 Water Use Records	1/02 – 7/04 Est. Wastewater Generation (gpd)	% of Islamorada Total	1/02 – 7/04 Number of EDUs
Plantation	632,500	4,007	780,900	23	2,903	702,800	45	4,476
Windley	126,300	842	129,600	3	51	116,600	8	743
Upper Matecumbe	362,400	2,169	530,700	46	699	477,600	31	3,042
Lower Matecumbe	177,700	1,175	281,200	58	1,001	253,100	16	1,612
Total	1,298,900	8,193	1,722,400	33%	4,654	1,550,100	100	9,873

Notes:
- The 10/94 – 9/97 values are from the Monroe County Wastewater Master Plan.
- The number of 10/94-9/97 EDUs are based on island-specific flows per EDU ranging from 150 – 167 gpd.
- The 1/02 – 7/04 number of EDUs are based on the estimated Islamorada-wide average single-family residential wastewater generation of 157 gpd/EDU.

1995 to September 1998. The Maximum Month Peak Factors for Islamorada for the three years analyzed were 1.17, 1.19, and 1.32 based on water usage. The Monroe County Master Plan recommends that the selection of peaking factors consider the size of the treatment system. Smaller systems can expect a greater variation in flow volume, requiring higher peaking factors.

E Sciences utilized water use data to

TABLE 3-11
Peak Factors Based on Average Monthly Water Use Data for Islamorada

	High (MGD)	Low (MGD)	Average (MGD)	% Variation Between High & Low	Max. Month Peak Factor
2000	2.14	1.27	1.76	68	1.22
2001	1.74	1.05	1.50	66	1.16
2002	2.18	1.27	1.70	72	1.28
2003	1.85	1.32	1.65	40	1.12
2004	2.40				

Land acquisition was included, however the costs of decommissioning existing systems and of connecting individual homes and facilities to the system were not included. The updated order-of-magnitude estimate to design and construct a wastewater treatment and collection system for Islamorada is $109,000,000 in January 2005 dollars. This estimate includes the North Plantation Key system.

The updated estimate equates to $60 per gallon of average daily wastewater treatment capacity. The amortized cost over the 20 year life of the project at a municipal bond rate of 5.25% is $13.48 per 1000 gallons treated.

For purposes of completing the cost estimate, the following assumptions were made:

1.) Two additional systems will be constructed on Plantation Key which will be separately bid and constructed.
2.) The systems that will service Windley Key and Upper Matecumbe Key will each be separately bid and will each be constructed in one phase.
3.) The costs for the Lower Matecumbe Key system were calculated as though the entire Key would be centrally serviced by one wastewater treatment plant, and assume that the system will be built as one construction project.

The phasing of wastewater treatment system implementation affects costs. Consolidation reduces the contractor's mobilization fees and the Village's professional services fees for administering the project.

Costs are also affected by the balance of single-family homes versus large-quantity

TABLE 9-1

Island	Capital Cost (Millions of Dollars)		Estimated Total Ave. Plant Capacity	Estimated Number of Connections	Estimated Number of EDUs	Estimated Cost per EDU	Ave. Est. Cost per Connection
	Treatment Plant	Collection System					
Plantation Key	16	42	825,000	2,900	5,255	$11,000	$20,000
Windley Key	3.5	3	140,000	42	892	$7,300	$155,000
Upper Matecumbe Key	9	15	550,000	700	3,503	$6,900	$34,300
Lower Matecumbe Key	5.5	15	300,000	1,000	1,911	10,500	$20,500
Totals	34	75	1,815,000	4,642	11,561	$9,400	$23,500

Note:
- Plant capacities are given as average daily flow. Actual plant capacities will be larger, reflecting maximum month peaking factors. Sizing included spare capacity to provide for future growth.
- The number of connections is an estimate based on the number of FKAA water use accounts.
- The number of EDUs was estimated by dividing plant capacity by 157 gpd per EDU.
- Cost per EDU is the cost per gallon of average daily capacity multiplied by 157 gpd/EDU, and is an average value presented for comparison purposes.

Florida Department of
Environmental Protection

Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Michael W. Sole
Secretary

November 5, 2008

Florida Department of Environmental Protection
Division of Recreation and Parks
3900 Commonwealth Boulevard, MS #500
Tallahassee, Florida 32399

To Whom It May Concern:

The Florida State Park System has jurisdiction over and maintains the following parks within the Florida Keys:

Fort Zachary Taylor Historic State Park
Bahia Honda State Park
Curry Hammock State Park
Long Key State Park
San Pedro Underwater Archaeological Preserve State Park
Indian Key Historic State Park
Lignumvitae Key Botanical State Park
Windley Key Fossil Reef Geological State Park
John Pennekamp Coral Reef State Park
Dagny Johnson Key Largo Hammock Botanical State Park

We have been apprised of the Florida Keys Reasonable Assurance Documentation (FKRAD) Technical Working Group since the beginning of the program and embrace the goal of documenting the nutrient loading management activities in the Florida Keys that will achieve water quality targets in the near shore waters.

The Florida State Park System recognizes, supports and complies with established water quality and quantity management concepts which have been promulgated and adopted in the Florida Keys for the protection of public health, safety and welfare. For the parks within the Florida Keys, we intend to comply with Chapter 99-395, Laws of Florida, related to wastewater controls within the parks.

As a result, the Florida State Park System, by way of this letter, endorses portions of the FKRAD related to the named parks and commits to complete the nutrient pollutant controls identified therein for the parks system. This commitment is defined as part of the management action report prepared by the Florida State Park System included as part of the Technical Information Document.

Should you have any questions about this matter, please contact Richard Reinart at (850) 488-5372.

Thank you for allowing us to participate in this important matter.

Sincerely,

Mike Bullock

Mike Bullock
Director
Florida Park Service

MB/sd

c: Richard Reinhart, Bureau of Design & Construction

Florida Department of Transportation

CHARLIE CRIST
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

STEPHANIE C. KOPELOUSOS
SECRETARY

September 29, 2008

Florida Department of Environmental Protection
2600 Blair Stone Road
Tallahassee, Florida

To Whom It May Concern:

The Florida Department of Transportation (FDOT), District VI has jurisdiction over and maintains the rights-of-way for State Road (SR) 5 and SR A-1-A in the Florida Keys, a total of about 119 miles. FDOT District VI has been part of the Florida Keys Reasonable Assurance Documentation (FKRAD) Technical Working Group since the beginning of the program. And, FDOT District VI is committed to monitoring the effectiveness of pollution controls as is outlined in Section 6 of the attached FKRAD FDOT VI Stakeholder Summary in order to achieve the water quality targets in the nearshore waters.

FDOT District VI recognizes, supports, and complies with established water quality and quantity management concepts, which have been promulgated and adopted in the Florida Keys for the protection of public health, safety and welfare. To control increases in pollutant loading from new roadway construction, FDOT District VI stormwater management activities include a treatment train approach that provides for control of runoff, and post development treatment. For all new roadway construction, FDOT District VI requires that stormwater facilities provide retention or detention with filtration for the first inch of rainfall runoff. FDOT District VI also encourages the use of best management practices to control pollutant loading including detention-like and retention facilities such as vegetated swales.

As a result, FDOT District VI, by way of this letter, endorses the portions of the FKRAD that are related to FDOT District VI and commits to complete the stormwater pollutant controls identified therein for FDOT District VI. This commitment is defined in more detail in the attached FKRAD FDOT VI Stakeholder Summary that was prepared by FDOT District VI and was included in the FKRAD Technical Information Document.

Should you have any questions about this matter, please contact Ricardo Salazar, District VI Drainage Engineer, at (305) 470-5264.

Sincerely,

Gus Pego, P.E.
District VI Secretary

Ricardo Salazar, P.E.
District VI Drainage Engineer

Attachment (1)

Florida Department of Transportation District VI

Florida Keys Reasonable Assurance Documentation

FDOT VI Stakeholder Summary

September 29, 2008

PREAMBLE

The following sections based on available information as of the date of this report, present the information to be included in the Florida Keys Reasonable Assurance Documentation (FKRAD).

1. COMMUNITY BACKGROUND

The Florida Department of Transportation (FDOT) District VI has jurisdiction over and maintains the rights-of-way for State Road (SR) 5, also known as US 1, and SR A-1-A, in the Florida Keys. The total length of all state roads (SR 5 and SR A-1-A) under FDOT District VI jurisdiction in the Florida Keys is 119.26 miles.

US 1 is the only road that travels continuously through the Florida Keys (Keys), a chain of more than 50 tropical isles that are connected to the Florida mainland and to each other by 42 scenic bridges. Locations along US 1 are expressed by Mile Marker (MM) numbers. The zero Mile Marker is found in Key West at the Monroe County Courthouse. Mile Marker numbers increase until the Monroe County line at Mile Marker 112 north of Key Largo.

Locally, US 1 is referred to as the Overseas Highway from the intersection with Roosevelt Boulevard in Key West (MM 3.9) to the Monroe County line (MM 112) North of Key Largo. From MM 3.9 to MM 0.0, US 1 is referred to as North Roosevelt Boulevard, Truman Avenue, and Whitehead Street ending at Jackson Square in Downtown Key West. SR A-1-A is referred to South Roosevelt Boulevard in the City of Key West.

FDOT District VI has a satellite construction/maintenance office located at 3100 Overseas Highway, Marathon, Florida, 33050.

2. WATER QUALITY TARGETS

Established District VI Water Quality Targets

FDOT District VI recognizes, supports, and complies with established water quality and quantity management concepts which have been promulgated and adopted in the Keys for the protection of public health, safety and welfare.

To control increases in pollutant loading from new roadway construction, FDOT District VI stormwater management activities include a treatment approach that provides for control of

runoff, and post development treatment. For all new roadway construction, FDOT requires that stormwater facilities provide retention or detention with filtration for the first inch of rainfall. FDOT District VI also encourages the use of best management practices to control pollutant loading including detention and retention facilities such as vegetated swales.

Established Living Resources Targets

FDOT embraces many of the living resource protection concepts that have evolved in the Keys relating to the protection of recognized living resources and protection of endangered species. FDOT has created the following wildlife crossings along their roadways:

- Key Deer Wildlife Crossings on Big Pine Key
- Crocodile Crossing on the 18 mile stretch North of Key Largo

3. MANAGEMENT GOALS

FDOT is fully committed to improving water quality for the Keys. FDOT strives to improve water quality for the Keys through the following actions and/or initiatives: 1) transportation projects for improving and maintaining state roads (e.g. SR-5); 2) grants to local governments for drainage/stormwater improvement via Joint Project Agreements (JPAs) and the Local Assistance Program (LAP); and 3) through cooperative efforts and coordination with State agencies (e.g., FDEP), regional authorities (e.g., SFWMD), local governments (e.g., City of Key West, Monroe County), and environmental and other special interest groups.

FDOT uses a Five-Year Work Program to identify and prioritize transportation projects, including drainage and stormwater projects in the Keys. The Five-Year Work Program is a statewide project specific list of transportation activities and improvements which addresses the development and maintenance of Florida's transportation system. The Work Program is updated annually for the ensuing five-year period.

FDOT's Work Program is developed by its Districts and the Florida Turnpike working with the Metropolitan Planning Organizations (MPOs) and local governments. Input is also received through public hearings, the Legislature, and the Governor's Office. Assuming funding is available, FDOT allocates funding to the approved projects.

In addition, FDOT performs routine maintenance of stormwater facilities in the Keys. Maintenance activities, including cleaning of stormwater structures to maximize their capacity, are performed as needed based on observations of maintenance staff or complaints. FDOT utilizes a maintenance management program to log, track and record complaints and maintenance activities.

4. BENCHMARK CONDITIONS

At the benchmark period for this reasonable assurance documentation, FDOT had already implemented the following management actions:

Stormwater Facilities

- FDOT recognizes and enforces State (FDEP) and regional (SFWMD) on-site stormwater management and off-site discharge regulations. FDOT requires that stormwater facilities provide retention or detention.
- FDOT recognizes the requirements and implications of Monroe County's Stormwater Management Master Plan with respect to management concepts and goals.
- FDOT properties are generally located within proximity to canals, the Florida Bay, or the Atlantic Ocean and stormwater runoff that does not percolate into the ground eventually enters these water bodies either through over land flow or through an outfall.
- Runoff from FDOT property that is discharged through outfalls to canals, the Florida Bay, or the Atlantic Ocean is first attenuated and pretreated using best management practices to limit associated nutrient loads into receiving water bodies.
- Impacts of stormwater runoff into adjacent water bodies are thought by FDOT to be minimal due to pretreatment.
- Since 1990, FDOT has more aggressively managed stormwater runoff for all new bridge projects. On short span bridges, stormwater runoff is diverted to the ends of the bridge and then into swales and/or other stormwater treatment structures. On longer span bridges, stormwater runoff is collected and conveyed via a "scupper" system to the ends of the bridge and then into swales and/or other stormwater treatment structures. **The Jewfish Creek Bridge, which is currently under construction, is an example of this type of stormwater management action.** This stormwater collection and treatment method is also implemented into bridge widening projects where lanes are being added. Stormwater management actions for older bridges (pre-1990) may be limited to the channeling of stormwater runoff at the ends of the bridge directly into the water and/or collecting runoff from the bridge deck by means of downspouts which discharge directly into the receiving water below. Retrofitting of an existing bridge with a runoff collection and conveyance system may be limited due to adverse impacts on the bridge structure.
- If there is a hazardous substance release or oil spill (e.g., accident) on a state road and/or associated drainage system, FDOT will dispatch crews in timely fashion to provide for the initial cleanup of the spill so that the road can be reopened to traffic and human and environmental damage is minimized. The cleanup of any residual environmental contamination is the responsibility of the one who caused the accident/spill. FDEP would follow-up with the responsible party (s) to ensure proper action."

Wastewater Facilities

- FDOT District VI does not maintain any wastewater facilities within the Florida Keys.

- FDOT eliminates reported illicit wastewater connections to the stormwater system. Illicit connections are identified by FDOT during stormwater maintenance activities and are also reported by local municipalities.

5. MANAGEMENT ACTIONS

FDOT has implemented a number of management actions since the benchmark conditions identified in 2003, which are summarized by categories in the following subsections:

Planning Actions

FDOT has a Five-Year Work Program, updated annually, that identifies and prioritizes transportation projects, including drainage and stormwater projects.

Regulation and Enforcement Actions

No new planning regulations or enforcement program enhancements are anticipated by FDOT relative to water quality enhancement or living resource protection in the near future.

Wastewater Management Actions

- FDOT does not have any wastewater collection or treatment facilities in the Keys.
- FDOT actively identifies illicit wastewater connections to the stormwater system and eliminates them when found.

Stormwater Management Actions

FDOT has assessed its stormwater issues and has reached the following conclusions:

1. FDOT will maintain an on-going program where stormwater management system improvements are identified and implemented with the assistance of local municipalities.
2. FDOT will maintain the existing drainage system as required to maintain current conveyance capacity.
3. FDOT staff will review plans for any proposed new roadway construction associated or connected to roads under FDOT jurisdiction to confirm that new roadway construction is designed to provide adequate drainage and comply with SFWMD and FDEP requirements for stormwater management.
4. FDOT stormwater management improvement projects in the Keys that were identified in the Monroe County Stormwater Management Master Plan (August 2001) are listed below:

    a. Sombrero Beach Road (on Marathon, vegetated swale along both sides of road)
    b. US 1 Big Coppitt Key Boat Ramp @ MM 11 (on Big Coppitt, berm with vegetated swales)

c. US 1 Boca Chica Channel to Rockland Channel (on Boca Chica, median to vegetated swale, swales along road, porous pavement.)
d. US 1 Long Key @ MM 66 (vegetated swale, regrading)
e. US 1 Lower Matecumbe @ MM 77 Bay and Ocean sides
f. US 1 Indian Key Bay Side Parking @ MM 78 (on lower Matecumbe, vegetated berm
g. Rockland to Shark Key Right-of-Way Improvements (On Big Coppitt Key, 1.3 miles of the edge of pavement of the Overseas Highway between Rockland Channel and Shark Channel, between MM 11-12, and 686,400 square feet of area
h. North Harris to Park Channel Improvements (On Park Key, one mile of the edge of pavement of the Overseas Highway between the North Harris Channel and Park Channel, between MM 17-19, and 528,000 square feet of area.
i. Bow to Kemp Channel Right-of-Way Improvements (On Cudjoe Key, 2.5 miles of the edge of pavement of the Overseas Highway between Bow Channel and to the East side of Cudjoe Key, between MM 20- 22, and 1,980,000 square feet of area.)

5. Additional FDOT projects located in the Keys as identified in FDOT's 5-Year Work Program, as listed in the FDOT District VI Consultant Project List dated May 2, 2007, and in the FDOT District VI 10 -Year Gaming Report dated May 8, 2007 are summarized in **Tables 1** and **2**. Table 2 is a secondary list that includes only resurfacing projects. Although these are not identified as stormwater improvement projects, whenever feasible these projects may include new swales, berms, or other pertinent improvements.

6. In the past, FDOT used more of a regional approach to stormwater management in the Keys. FDOT proposed to widen US 1 (State Road 5) to four lanes throughout the Keys. This would have allowed FDOT to acquire the additional right-of-way necessary to make drainage improvements for the older sections of US 1. Also, this would have allowed FDOT to replace many of the older bridges for which it is currently not feasible to retrofit with a stormwater runoff collection and conveyance system. Because of local concerns and potential environmental impacts, to date, this proposed project has not advanced beyond the planning stage. As a result, FDOT has adopted more of a local approach to stormwater management and provides substantial funding to local governments, including the Villages of Islamorada, to cost share with landscaping and drainage improvements. In addition, whenever feasible, FDOT incorporates stormwater improvements into resurfacing and reconstruction projects of existing FDOT roadways.

6. MONITORING THE EFFECTIVENESS OF POLLUTION CONTROLS

Procedures to Track Effectiveness of Pollution Controls

FDOT District VI will continue to institutionally monitor and track the effectiveness of its stormwater pollution controls and environmental protection actions through routine maintenance operations and as required by NPDES permits for the state roads in the City of Key West (includes only SR 5 and SR A-1-A) and the City of Marathon (includes only SR 5) through submission of MS4 Annual Reports to FDEP.

Water Quality Monitoring Plan

FDOT does not operate any freshwater or marine water quality monitoring programs or living resources monitoring programs at the current time, except the Key Deer crossing program. No water quality monitoring stations are currently located within the Florida Keys.

FDOT does not anticipate operating any water quality or living resources monitoring programs in the foreseeable future.

7. INFORMATION SOURCES

Persons Interviewed

1. Ricardo Salazar, FDOT District VI, District Drainage Engineer
2. Jaime Barrera, FDOT District VI, Drainage Engineer and NPDES Coordinator
3. John Palenchar, FDOT District VI, District Environmental Permits Coordinator

Data Sources

1. FDOT 5 -Year Work Program
2. Monroe County Stormwater Management Master Plan, CDM (August 2001)

Table 1
FDOT District VI
Florida Keys Identified Projects

FM Number	Local Name	Project Description	Date	Budget	References*
2504451	Jewfish Creek Bridge	SR 5/US 1/Jewfish Creek Bridge from Abaco Rd at Key Largo to north of Jewfish Creek - Construct Bridge – High Level.	2004-2009	$102,600,950	1, 2
2505341	Big Coppitt Key	From Shark Channel Bridge to Old Boca Chica Channel, (add turn lanes)	2006-2009	$7,879,000	1, 2
2505482	Key West, AIA/S. Roosevelt	Reconstruction from Bertha St. to US1	2007	-	1
2505483	Key West, SR5/N. Roosevelt	Reconstruction from Eisenhower Dr. to SR5/US1	2007	$300,000	1
2505893	SR 5/Over Big Spanish Channel	Bridge Repair/ Rehabilitation at Bahia Honda	2006-2008	$12,541,000	1,2
4055826	SR 5/Overseas Highway	Turn Lanes from Grassy Key to Knights Key	Jun-08	$6,018,000	1
4055828	SR 5 / Overseas Highway	Turn Lanes on Plantation Key from MM 85.7 to 86.7	Jan-08	$2,886,000	1
4055982	City of Key Colony Beach, Sadowski Causeway	Stormwater Mitigation, Drainage Improvements	2006-2007	$49,000	2
4056121	SR 5/ US1 at Big Pine Key	PD&E/ EMO Study (per Habitat Conservation Plan)	2007-2008	$25,000	2
4082922	SR 5/ US1	Monroe County Stormwater Runoff Management Drainage Improvements	2007	$10,000	2
4105043	Florida Keys Overseas Heritage Trail	Environmental Consultant/ Bike Path /Trail	2006-2007	$363,000	2
4106481	Sombrero Beach Road	Reconstruction from Avenida Prmiceria to Sombrero Boulevard	Jun-07	$248,000	1
4123321	Card Sound Road/CR-905 Intersection Conversion	PD&E/EMO Study	2006-2012	$7,760,000	2
4164731	US 1	Auxilary Lane from Card Sound Road to SR821/HEFT	Feb-07	$250,000	1
4213521	Little Venice Roads 107th Street & 109th Street and	Drainage Improvements	2007-2008	$639,000	2
4227141	Key West, 20th Street	Stormwater Mitigation (LAP Agreement) Master Drainage Plan	2007-2008	$221,000	1,2
4227151	Key West, United Street	Stormwater Mitigation (LAP Agreement) Master Drainage Plan	2007-2008	$150,000	1,2
4227161	Key West, Truman Avenue	Stormwater Mitigation (LAP Agreement) Master Drainage Plan	2007-2008	$240,000	1,2
4227171	Key West, United Street	Stormwater Mitigation (LAP Agreement) Master Drainage Plan	2008-2009	$1,004,000	2
4227181	Key West, North Side Drive	Stormwater Mitigation (LAP Agreement) Master Stormwater Plan	2007-2008	$425,000	1,2
4227191	Key West, 17th Street	Stormwater Mitigation (LAP Agreement) Master Drainage Plan	2007-2008	$165,000	2

*References: 1, FDOT District VI Consultant Project List, May 2, 2007
2, FDOT District VI 10-Year Gaming Report, May 8, 2007

Table 2
FDOT District VI
Florida Keys Identified Resurfacing Projects with Potential Associated Stormwater Improvements

FM Number	Local Name	Project Description	Date	Budget	References*
2514572	Key West, Flagler Ave	Resurfacing from Bertha Street to Roosevelt Ave	2006-2007	$27,000	2
4124821	SR 5/ Overseas Highway	Resurfacing from MM 19.43/E of Crane Boulevard to MM 19.8/W of N. Johnson Road	2006-2007	$749,000	1,2
4124831	SR 5/ Overseas Highway	Resurfacing from MM 33.8/Spanish Harbor Channel to MM 35.3/Big Spanish Channel	2009-2010	$2,701,000	2
4124841	SR 5 /Overseas Highway	Resurfacing from MM 73.74 /Caloosa Cove to MM 77.46 Lignumvitae Bridge	2006-2008	$5,988,000	1,2
4146481	SR5/US 1/Overseas Hwy	Resurfacing from 1100 ft. north of MM 37 to 1000 ft. north of MM 38/Bahia Honda Key	2007-2008	$2,254,000	1,2
4146491	SR5/US 1/Overseas Hwy	Resurfacing from MM 86.8/S of East Ridge Road to MM 90/ Royal Poinciana Boulevard	2007-2009	$7,069,000	1,2
4180851	SR 5/ Overseas Highway	Resurfacing from MM 31.6 Beach Drive to MM 32.3 Long Beach Boulevard	Oct-07	$657,000	1,2
4181001	SR 5/ Overseas Highway	Resurfacing from MM 20.8 South of Drost Drive to MM 23 North of Cut Throat	2006-2008	$3,717,000	1,2
4192531	SR 5/ Overseas Highway	Resurfacing from South of MM 100 to South of MM 97	Jul-07	$322,000	1
4198461	SR 5/ Overseas Highway	Resurfacing from MM 103.2 Hialeah Lane to MM 106.6 Reef Drive	2006-2010	$10,951,000	1,2
4198481	SR 5/Overseas Highway	Resurfacing from MM 93 to MM 97	2006-2010	$11,586,000	1,2
4198491	SR 5/Overseas Highway	Resurfacing from MM 93 to MM 97	2006-2010	$1,652,000	2
4198511	SR 5/ Overseas Highway	Resurfacing from SR A1A to 320 ft. north of Cross Street	2007-2009	$2,732,000	1,2
4198531	SR 5/ Overseas Highway	Resurfacing from 2000 ft. south of MM100 to 2580 ft. south of MM 97	2006-2010	$5,535,000	2
4198541	SR 5/ Overseas Highway	Resurfacing from MM 49.1/north of 37th St. to MM 53.1/Bridge over Vaca Cut	2006-2012	$11,383,000	2
4198591	SR 5/ Overseas Highway	Resurfacing from MP 99.7/south of Laguna Avenue to MM 103.1/Hialeah Lane	2006-2011	$11,057,000	1,2
4226181	SR 5/ Overseas Highway	Resurfacing from 500 ft north of Cut Throat Drive to 500 ft. north of Spanish Drive	2008-2011	$565,000	2

*References: 1, FDOT District VI Consultant Project List, May 2, 2007
2, FDOT District VI 10-Year Gaming Report, May 8, 2007

FDOT's representatives in this RA process include:

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Technical Working Group representative:

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305-470-5281

Exhibit 2
STAKEHOLDER CONTACT INFORMATION

Key Largo Wastewater Treatment District – The Key Largo WTD is an independent utility district (created in June 2002) that implements wastewater services in the northern keys area, including Largo Key. The WTD's representatives in this RA process include:

Authorized representative for execution of the stakeholder's agreement:

Andrew Tobin, KLWTD Commissioner
98880 Overseas Highway
Key Largo, Florida 33037
Tobinlaw@terranova.net
305-453-5804

Technical Working Group representative:

Margaret Blank, Construction Manager
98880 Overseas Highway
Key Largo, Florida 33037
margaretblank@bellsouth.com
305-453-5804

Islamorada, Village of Islands – Islamorada is an incorporated city on Lower and Upper Matecumbe Keys, Windley Key and Plantation Key. The City's representatives in this RA process include:

Authorized representative for execution of the stakeholder's agreement:

Kenneth Fields, Village Manager
Islamorada, Village of Islands
P.O. Box 568
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Technical Working Group representatives:

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Zully Hemeyer, Assistant Director of Public Works
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305-664-6427

Monroe County – The County has offices and facilities that are located within the Key West city limits and is responsible for the stormwater services on Key Largo. Additionally, the County has historically been responsible for Keys-wide planning and infrastructure programs which have directly affected the Northern Keys Area. The County's representatives in this RA process include:

Authorized representative for execution of the stakeholder's agreement:

David Mario Di Gennario, Monroe County Mayor
9400 Overseas Highway
Florida Keys Marathon Airport, Suite 210
Marathon, Florida 33050
boccdis4@monroecounty.gov
305-289-6000

Technical Working Group representative:

Judith S. Clarke, Assistant County Engineer
1100 Simonton Street
Key West, Florida 33040
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305-295-4329

Elizabeth Wood, Wastewater Section Chief
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wood-liz@monroecounty-fl.gov
305-295-4321

Florida Department of Transportation – FDOT is responsible for the operation and maintenance of a number of roadways including portions of the Overseas Highway within the Northern Keys Area. FDOT's representatives in this RA process include:

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Florida Division of Recreation & Parks – FDR&P, through the participation of the following State Parks:

- Dagny Johnson Key Largo Hammock Botanical State Park
- Indian Key Historic State Park
- John Pennekamp Coral Reef State Park
- Lignumvitae Key Botanical State Park
- Windley Key Fossil Reef Geological State Park

The Park's representatives in this RA process include:

Authorized representative for execution of the stakeholder's agreement:

Michael Bullock, Director
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3900 Commonwealth Blvd.
Tallahassee, Florida 32399-3000
Michael.bullock@dep.state.fl.us
850-245-3029

Representative for Technical Issues Related to Wastewater Management

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Exhibit 3
WASTEWATER MANAGEMENT PRACTICES

Wastewater management practices were instituted in the Keys during World War II when the U.S. Navy connected the elevated levels of illness in Naval flyers operating seaplanes in Garrison Bight with the discharge of untreated wastewaters to that waterbody. The Navy constructed the first wastewater treatment facility in the Florida Keys, as a means of improving the health of personnel assigned in Key West. This treatment plan, crude by today's standards, was located on Fleming Island (on the North side of Key West) and included an ocean outfall that discharged off the Northern shore of Key West. During the post-war period this facility was expanded to serve the growing needs of the community.

BASELINE CONDITIONS MANAGEMENT PRACTICES

In 1999, the baseline conditions reference date, less than 35% of the Northern Keys Area were served by central wastewater systems with secondary treatment facilities operated by the Key Largo Wastewater Treatment District and the Village of Islamorada (approximately 9,780 EDUs) and a private franchise (the Ocean Reef Club with approximately 2,065 EDUs) serving portions of the unincorporated county in the Northern portion of Key Largo. The remaining Northern Keys Area EDUs were served by a combination of cess pits, septic tanks, an IQ Part II, and an IQ/Part III treatment facility.

The wastewater spatial distribution of the more than 28,000 EDUs that existed in the Northern Keys Area under baseline conditions, as established in the *Florida Keys Carrying Capacity Study*, are summarized in Table EX 3-1 by management practices.

Table EX 3-1
SUMMARY OF WASTEWATER MANAGEMENT PRACTICES
UNDER BASELINE CONDITIONS

Management Practice	Islamorada (EDUs)	State Parks (EDUs)	Unincorporated (EDUs)	Northern Keys Area (EDUs)
Cess Pit	603	99	1,244	1,947
Septic Tank	5,806	230	10,324	16,360
OSTDS				
ATU				
FDEP Secondary	2,501	614	6,667	9,782
IQ/PART II	104		153	257
IQ/Part III	25			25
Totals	9,039	943	18,389	28,371

Source: Florida Keys Carrying Capacity Study, Delivery Order 8 – Water Module

Wastewater treatment effluent quality, summarized by treatment method, is summarized in Table EX 3-2.

Table EX 3-2

FINISHED EFFLUENT NUTRIENT CONCENTRATIONS

Wastewater Treatment Method	Finished Effluent Nutrient Concentration (mg/l)	
	Total Nitrogen	Total Phosphorus
Cesspool	30	6
Septic Tank with Drainfield	20	6
Aerobic Treatment Unit with Drainfield	20	6
Secondary Treatment	20	6
Advance Secondary Wastewater Treatment	10	6
IQ Part II Wastewater Treatment	10	6
IQ Part III Wastewater Treatment	10	6
Best Available Technology Wastewater Treatment*	10	1
Onsite OWNRS	5	1
Advanced Wastewater Treatment *	3	1

* Pursuant to Chapter 99-395 Requirements

PROPOSED MANAGEMENT PRACTICES

Wastewater facilities are provided by two separate governmental entities in the Northern Keys Area as follows:

Key Largo Wastewater Treatment District. The Key Largo Wastewater Treatment District (KLWTD) is a special purpose district that was created to provide wastewater collection and treatment and effluent disposal for the general Key Largo area of the Northern Keys Area. The defined KLWTD service area has been divided into 11 service areas (A through K) which is served by one centrally located wastewater treatment facility providing AWT treatment levels with discharge to a deep effluent disposal well to comply with the requirements of Chapter 99-395 LF.

Islamorada, Village of Islands. Islamorada, Village of Islands (Islamorada) will eventually be served by five separate central wastewater systems, served by five separate AWT facilities, each discharging to separate shallow effluent disposal wells in compliance with the requirements of Chapter 99-395 LF. Islamorada has recently finalized its planning process and selected its design consultants and construction phase management consultant.

Islamorada WWSA	EDUs
<None>	2.5
Lower Matecumbe 7	1,276.4
Middle Plantation 2	1,380.8
North Plantation 1	1,588.1
South Plantation 3	1,253.9
Upper Matecumbe North 5	1,445.0
Upper Matecumbe South 6	1,117.1
Windley 4	974.8

All of the existing WWTPs serving the communities of the Northern Keys Area have NPDES Permits that:

- Regulate their operation;
- Require scheduled discharge monitoring and sampling;
- Require submittal of monthly Discharge Monitoring Reports; and
- Include sanctions and fines, as well as civil and criminal penalties, which can be used to compel compliance with permit requirements.

All of the new WWTPs that are in design and/or under construction to serve the residents of Islamorada and the KLWTD area will also have NPDES permits that will have the same (foregoing) requirements.

Private Facility Owners, being those residents and business owners who are not served by either City of County wastewater systems, are required to upgrade their non-complying treatment practices to meet the higher standards mandated by Chapter 99-395 Laws of Florida (LF) by July 1, 2010. Based upon this requirement, existing cess pits and un-permitted/non-complying septic tanks will have to be replaced with acceptable OSTDS that achieve the minimum effluent quality standards of Chapter 99-395 LF. Consequently, the following privately funded management actions have been assumed to occur:

1. Eliminate All Cess Pits and replacement with FDOH permitted OSTDS that achieve the minimum effluent quality standards of Chapter 99-395 LF;

2. Upgrade/Replacement of All Non-Complying OSTDSs and replacement with FDOH permitted OSTDS that achieve the minimum effluent quality standards of Chapter 99-395 LF with appropriate effluent discharge/disposal practices; and

3. Upgrade/Replacement of Non-Complying WWTPs in private ownership with FDEP permitted OSTDS that achieve the minimum effluent quality standards of Chapter 99-395 LF with appropriate Class V injection wells.

Cumulative Nutrient Loading Reduction Potential: Collectively, these management actions will virtually eliminate the entire baseline wastewater nutrient loads that were identified for the City service area and significantly reduce the nutrient loads in the remainder (unincorporated county portions) of the Northern Keys Area.

Exhibit 4
STORMWATER MANAGEMENT PRACTICES

Most of the land in the Florida Keys is less than five feet above mean sea level, is within a short distance of receiving waters via proximity to the shoreline or a manmade canal, and drains rapidly due to the lack of organic soils. Consequently, stormwater management practices have historically not been a high priority with developers or local governments. Stormwater management practices focusing on the treatment of stormwater runoff, versus conveyance of drainage flows, are a relatively new concept in the Keys which have only recently evolved in response to increasing degradation of nearshore water quality.

BEST MANAGEMENT PRACTICES

In general, the term "Best Management Practices" (BMPs) refers to a practice or combination of practices based on research, sound science and best professional judgment to be the most effective and practicable on-site means, including economic and technological considerations, of improving water quality. A wide variety of structural and nonstructural stormwater management practices were identified for potential use in the Monroe County Stormwater Master Plan which included:

Structural Stormwater Controls

- Aeration
- Alum Injection Systems
- Buffer Strips
- Dry Detention Ponds
- Dry Wells
- Exfiltration Trenches
- Hydrodynamic Separators
- Infiltration Drainfield
- Level Spreaders
- Modular Treatment Systems
- Oil/Grease Separators
- Bore Holes with Pretreatment
- Porous Pavement
- Rain Gardens
- Recharge Wells with Pretreatment
- Retention Basins
- Shallow Grassed Swales
- Stormwater Wetlands
- Underdrains and Stormwater Filter Systems
- Water Quality Inlets and Baffle Boxes
- Wet Detention Ponds

Nonstructural Stormwater Controls

- Fertilizer Application Controls
- Low Impact Development
- Operation and Maintenance
- Pesticide Use Controls
- Solid Waste Management
- Street Sweeping
- Source Control on Construction Sites
- Hazardous Materials Management
- Erosion and Sediment Control on Construction Sites
- Stormwater Management Ordinance Requirements
- Gray Water Controls (Cisterns and Rain barrels)
- Directly Connected Impervious Area (DCIA) Minimization
- Illicit Connections (Non-Stormwater Discharges) Identification and Removal

The treatment characteristics for many of the identified stormwater management practices, particularly the nonstructural management practices, have not been established for facilities in the Florida Keys. The *Monroe County Stormwater Management Master Plan* collected compiled pollutant removal characteristics from other Florida communities, adjusted using best professional judgment in the absence of performance data for local facilities, which in summarized in Table EX 4-1.

Table EX 4-1
MONROE COUNTY STORMWATER MANAGEMENT MASTER PLAN
SUMMARY OF STORMWATER BMP TREATMENT EFFICIENCIES[1]

Type of System	Estimated Removal Efficiencies [2]						
	TN	TP	TSS	BOD	Cu	Pb	Zn
Dry Detention Pond							
0.25-inch retention	60%	60%	60%	60%	60%	60%	60%
0.50-inch retention	80%	80%	80%	80%	80%	80%	80%
0.75-inch retention	90%	90%	90%	90%	90%	90%	90%
1.00-inch retention	95%	95%	95%	95%	95%	95%	95%
1.25-inch retention	98%	98%	98%	98%	98%	98%	98%
Offline Retention/Detention	60%	85%	90%	80%	65%	75%	85%
Wet Retention Pond	40%	50%	85%	40%	25%	50%	70%
Wet Detention Pond	25%	65%	85%	55%	60%	75%	85%
Wet Detention Pond w/Filtration	0%	60%	98%	99%	35%	70%	90%
Dry Detention Pond	15%	25%	70%	40%	35%	60%	75%
Dry Detention Pond w/ Filtration							
Type A or B Soils	0%	0%	75%	0%	65%	90%	25%
Type C or D Soils	0%	0%	60%	0%	45%	90%	10%
Alum Treatment	50%	90%	90%	75%	80%	90%	80%

Notes: (1) Harper, H.H., 1985. *Pollutant Removal Efficiencies for Typical Stormwater Management Symposium Florida*. In Proceedings of the 4th Biennial Stormwater Research Conference, SWFWMD, pp. 6-17.

BMPs which have been proven to work well in the Florida Keys include:

- Baffle Boxes
- Buffers Zones Using Natural Vegetation
- Deep Stormwater Disposal Wells
- Other Water Conservation Methods
- Rain Barrels
- Reduction of Impervious areas
- Source Controls
- Xeriscape

INTUITIVE TREATMENT APPROACHES

Development and subsequent adoption of management BMPs that are effective in the Florida Keys may require several decades due to limited inquiry and research, lack of monitoring information and data gaps, unproven science and other causes. The term "intuitive treatment approach" is used in this document to describe any stormwater treatment approach that appear to have a rational basis for reducing pollutant loads but has yet to be proven effective in a specific region or setting.

In essence, intuitive treatment approaches are a set of logically implemented practices employed largely through best professional judgment on an experimental basis. Intuitive treatment approaches are oftentimes an adaptation of stormwater treatment strategies that have been proven successful in other areas with different settings (soils, groundwater conditions, vegetation, rainfall, etc…) with no apparent fatal flaws, which should logically work in the local setting.

If successful in field trials, intuitive treatment approaches ultimately evolve into more formal BMPs once the supporting scientific research proves the effectiveness of such practices in protecting the state's water resources. Innovative and alternative technologies which have been employed in the Florida Keys include:

- Bank Stabilization Using Limestone Gravel
- Gravel Pavement Bank Using Limestone Gravel
- Pervious Pavement
- Rain Gardens
- Retention and Detention Ponds
- Shallow Stormwater Disposal Wells
- Swales Topped with Natural Vegetation
- Swales Without Vegetated

The performance of many of these stormwater BMPs is well documented in peninsular Florida for given soil types and groundwater regimes. Unfortunately, their performance is not documented in the Florida Keys which lack organic soils, typically has much higher infiltration rates, and may not provide a comparable level of physical filtration of stormwater.

It is generally recognized that successful BMP implementation will ultimately exist as a mosaic of practices collectively and synergistically working together to mitigate adverse impacts to the environment.

Cautionary Notes

One of the problems in using the treatment characteristics for any of the stormwater management practices presented in Table EX4-1 is that they are based on monitoring data collected at facilities that have been operated in "non-Keys" conditions. Unlike peninsular Florida, there is very little naturally occurring organic soils in the Florida Keys. The keys are a

mixture of limestone formations and ancient coral reef formations topped with a thin layer of granular material that is virtually devoid of organic content.

With the exception of the baffle box, all of the stormwater BMPs utilize soils/soil processes to provide a portion of their reported nutrient removals. One can reasonably infer that the stormwater BMPs that rely on soils/soil interactions will not perform as well in the Florida Keys.

BASELINE CONDITIONS MANAGEMENT PRACTICES

No stormwater management practices were identified in 1999 in the *Florida Keys Carrying Capacity Study* for any of the stakeholders in the Northern Keys Area.

PROPOSED MANAGEMENT PRACTICES

Key Largo Wastewater Treatment District is not responsible for implementation of any stormwater management actions as its sole mission is to construct and operate central wastewater treatment infrastructure.

Monroe County is responsible for stormwater management activities in the unincorporated area of the County in the Northern Keys Area. The County has not identified any planned or implemented stormwater management projects that would reduce its anthropogenic stormwater pollutant loads discharged in the Northern Keys Area. However, the County will conform to its own standards as well as SFWMD/FDEP requirements and obtain Environmental Resource Permits requirements (where required) for future upgrading of existing facilities and construction of new facilities.

Islamorada, Village of Islands has undertaken a number of stand-alone and joint projects within the village limits designed to stabilize erosive areas and treat stormwater runoff prior to its discharge to receiving waterbodies. Islamorada has identified and scheduled a number of additional stormwater management practices intended to reduce the anthropogenic stormwater pollutant loads discharged from its facilities in the Northern Keys Area. Unfortunately, Islamorada has not provided an estimate of the TN or TP reductions that are anticipated to be achieved by these projects. Islamorada will also conform to its own standards as well as SFWMD/FDEP requirements and obtain Environmental Resource Permits requirements (where required) for future upgrading of existing facilities and construction of new facilities.

The Florida Department of Transportation has identified no individual stormwater management practices to reduce the anthropogenic stormwater pollutant loads discharged from its roadway facilities in the Northern Keys Area. However, FDOT has an ongoing working process with Monroe County for participating in joint projects where appropriate that eliminate and retrofit stormwater outfalls to reduce the nutrient loads associated with anthropogenic stormwater flows discharged Halo Zone waters.

Florida Division of Recreation & Parks has already implemented a number of management actions to reduce the nutrient loads associated with anthropogenic stormwater impacts originating at park facilities located in the Northern Keys Area. Parks will also conform to its own standards as well as SFWMD/FDEP requirements and obtain Environmental Resource Permits requirements (where required) for future upgrading of existing facilities and construction of new facilities.

Exhibit 5
ESTIMATED NUTRIENT LOAD REDUCTIONS

CONSERVATIVE ASSESSMENT PROTOCOLS

One of the challenges of assessing the nutrient reductions that will be produced by the proposed management practices is determining the uncertainty associated with each practice.

- Well Documented Management Practices provide the highest level of certainty in that they have adequate performance monitoring data to enable the development of a reasonable range of performance expectations for the general geographic area of application. Examples of well documented practices are BAT and AWT treatment facilities that, while having a relatively short history of application in the Florida Keys, nonetheless have a well established history of stable and reliable performance as documented by their monthly discharge monitoring reports.

- Marginally Documented Management Practices provide some hope that they have the potential to perform at a reasonable level in the general geographic area of application, but raise the issue of how to adequately establish a margin of safety. Examples of marginally documented practices are septic tanks and cess pits that, while having a longer history of use in the Florida Keys, have a limited amount of performance data that has been documented through a limited number of studies.

- Undocumented Management Practices provide no certainty that they will perform at any reasonable level in the general geographic area of application and provide no basis for establishing a margin of safety. Examples of undocumented practices include virtually all stormwater management practices as they are relatively new and have not been formally monitored to establish performance characteristics in the Florida Keys.

Conservative assessment protocols, with respect to the published ranges of treatment benefits for the management practices identified in Table EX 5-1, dictate the following protocols:

1. Use of maximum expected effluent concentrations for all wastewater management practices;

2. Use of the median nutrient discharge concentration value, based on a minimum of 8 samples, that has been documented by a discharge characterization program for a specific stormwater management practices;

3. Use of an assumed nutrient removal rate of 10% for all unmonitored stormwater management practices;

4. Use of a “zero” post-injection nutrient removal rate, in combination with a 100% return rate, for all wastewater and stormwater effluents discharged to shallow disposal wells; and

5. Use of a “100%” post-injection nutrient removal rate, in combination with a “zero” return rate, for all wastewater and stormwater effluents discharged to deep disposal wells.

Table EX 5-1
ADOPTED EFFLUENT CONCENTRATIONS FOR
PROPOSED MANAGEMENT PRACTICES

Management Action	Adopted "Conservative" Effluent Concentrations (mg/l)		Adopted "Conservative" Net Removal Rates (Percent of Input)	
	Total Nitrogen (mg/l)	Total Phosphorus (mg/l)	Total Nitrogen (mg/l)	Total Phosphorus (mg/l)
WASTEWATER TREATMENT				
▪ Cess Pits	30	6	--	--
▪ Septic Tank Systems	20	6	--	--
▪ Aerobic Treatment Units	20	6	--	--
▪ Onsite OWNRS	10	1	--	--
▪ BAT Treatment Plants	5	1	--	--
▪ AWT Treatment Plants	3	1	--	--
STORMWATER TREATMEMT				
▪ Vegetated Swales	--	--	10%	10%
▪ Baffle Box Systems	--	--	10%	10%
▪ Stormwater Disposal Wells	--	--	10%	10%
▪				
DISPOSAL WELLS				
▪ Deep	--	--	100%	100%
▪ Shallow	--	--	0%	0%

ESTIMATED NUTRIENT LOAD REDUCTIONS

Specific pollutant reductions have been identified in Table 4-5 for all of the management actions identified by stakeholders in response to water quality issues in the watershed, as well as established water resource management actions. Several stakeholders have identified management actions and BMPs which have been/will be implemented but their potential nutrient load reductions were not identified due to lack of monitoring data or lack of a specific service area for which benefits might be quantified. In these cases, the management actions and BMPs have been included in Table 4-5 to indicate the potential benefit that they represent in the Halo Zone waters, but their reduction is identified as "unquantified" due to lack of the stakeholder's inability to quantify a specific annual load reduction.

Exhibit 6
ASSESSMENT OF WATER QUALITY BENEFITS

Quantification of the actual water quality benefits achieved in the receiving waters directly attributable to the reduction of the wastewater and anthropogenic stormwater nutrient loads, expressed in terms of water column and groundwater concentrations of nutrients, is technically difficult due to flushing characteristics of the surficial aquifers and the canal systems and the dynamic circulation patterns in the nearshore waters.

AQUIFER FLUSHING

The shallow aquifer systems underlying the chain of islands in the Florida Keys are known to flush very rapidly due to the following conditions:

- Immediate proximity to open waters;
- Highly porous nature of the limestone/coral subsurface geology of the islands;
- Narrow width-to-length aspect ratio of most of the islands; and,
- Documented tidal pumping conditions,

Extensive anecdotal information and empirical observations support this technical basis.

HALO ZONE/NEARSHORE CIRCULATION

The ability to quantify the actual improvement in water quality as a result of decreased nutrient inputs is constrained at this time by the lack of a high precision marine model for the nearshore waters surrounding the Florida Keys.

- A gross scale finite element model which incorporated circulation and water quality was developed as part of the Marine Module circulation module of Florida Keys Carrying Capacity Study (URS, 2002). Unfortunately, this model was abandoned during the study due to concerns about the size of the elements and the paucity of data for model calibration.
- A GIS-based module was also developed as part of the Carrying Capacity Impacts Assessment Model (CCIAM) as part of Florida Keys Carrying Capacity Study (URS Corporation, 2002) to simulate simple off-shore migration of nutrients from the halo zones of the Keys to the nearshore waters. The size, complexity and data requirements of the CCIAM and its runtime preclude its use in the FKRAD process.
- Smaller models have been developed for portions of Florida Bay and Biscayne Bay which provide valuable insights, but do not cover the complete areas within the nearshore waters of any of the RA areas in the Keys.

A spreadsheet model has been developed as part of the FKRAD process to evaluate the relative reductions in nutrient concentrations in the halo zone and the nearshore waters

attributable to the proposed management practices. A detailed discussion of this model is presented in Appendix D of this document.

CANAL FLUSHING

The manmade canals in the Florida Keys were generally intended to provide water access for inland parcels, were often times cut deep to provide fill, and generally constructed as dead-end channels. Initially good water quality in these canals has become degraded due to:

- Limited flushing potential due to the relationship between the existing tidal range in the Keys and the depth and length of the constructed canals;
- Discharge of marginally treated effluents from cess pits and substandard septic tank systems many of which are not properly maintained by their owners, or cannot function properly due to site constraints;
- Periodic receipt of natural loading from tide and currents (weed rack); and other anthropogenic inputs from fish cleaning, boat operations, stormwater runoff from developed;
- Leaching of fertilizers, herbicides and pesticides in combination with improper disposal of clippings, weeds and other lawn maintenance debris; and
- Untreated runoff from the Overseas Highway, city/county roadways and unpaved streets.

Ten spreadsheet models were developed for Monroe County (URS Corporation, 2002), in conjunction with the Florida Keys Carrying Capacity Study, which were generally representative of the range of complexity of the developed canals in the Florida Keys. The objective of these models was to provide a tool for evaluating the effect of nutrient loadings and flushing behavior of the canals with respect to ambient water quality for steady state operations.

These canal models have been updated and utilized in the FKRAD process to evaluate the relative reductions in nutrient concentrations in the ten representative canal systems based upon the nutrient loading reductions achieved by the proposed nutrient management practices and the ambient halo zone/nearshore water quality conditions attributable to the proposed management practices. A detailed discussion of these models is presented in Appendix D of this document.