TECHNICAL WORKING GROUP MEETING NO. 4

Marathon Government Center
2796 Overseas Highway, Room 104

March 23, 2007 ❖ 9:30 am – 1:30 pm

Agenda

I. Welcome
II. Review of Consensus Items
III. Water Quality Impacts on Living Resources UPDATE
IV. One-on-One Stakeholder Data Acquisition Meetings
V. Assessment of Selected Management Activities
VI. Schedules
VII. Action Items
VIII. Next Meeting

REVIEW OF CONSENSUS ITEMS

- Sound Science
- Preliminary Classification of Living Resources
- Linkages

Scott McClelland
CDM

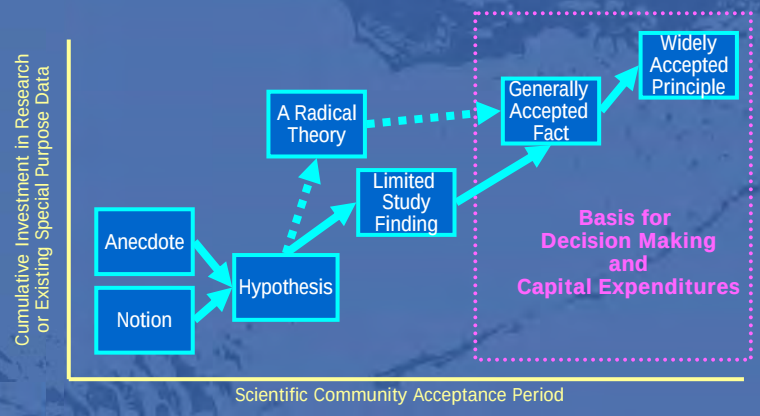
Recent Consensus Items

1. **Water Quality in the Keys is Impaired**
   a. Documentation of consistent impairments is difficult
   b. Water Quality improvements are required
2. **There Currently Are No Statistically Significant Linkages of Water Quality to Living Resources**
   a. Monitoring programs were not designed to document thresholds.
   b. Existing data are inadequate in many cases, for this purpose.
   c. Scientific understandings exist for few living resources.
   d. Nutrient thresholds for corals have not been scientifically supported.
   e. Nutrient thresholds for sea grasses have not been scientifically supported.
3. **Given the Current State of Knowledge In the Keys**
   a. The link between specific pollutants and living resource concerns is fuzzy.
   b. Because targets are uncertain, the approach to success has to be adaptive.

Florida Keys Reasonable Assurance Documentation

Recent Consensus Items

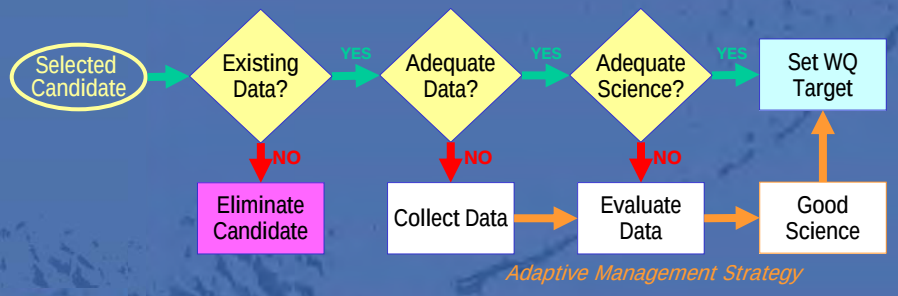
4. Decisions on Management Actions Should Be Based on Sound Data and Accepted Science



Florida Keys Reasonable Assurance Documentation

Recent Consensus Items

5. Water Quality Targets Should Be Based on Defensible Data, Sound Science and Proven Linkages Between WQ and Living Resources



Florida Keys Reasonable Assurance Documentation

Recent Consensus Items

6. Preliminary Assessment of the Status of Living Resources in the Water Quality Target Setting Process Based on Available Data and Science

Little or No Data	Limited Data	Adequate Data	Proven Linkages
Manatees Green Turtles Loggerhead Turtles Mermaids	Fish Queen Conchs FKNMS Reefs?	Algae Sea Grasses FKNMS Reefs?	???
↓	↓	↓	↓
Eliminate Candidate in FKRAD	Collect New Data on Candidate	Evaluate WQ vs. LR Linkages	Set WQ Target for Candidate

LIVING RESOURCE THRESHOLDS

- Queen Conch
- Seagrass and Algae
- Phytoplankton and Macro Algae
- Reef Building Corals
- Schooling Fish

Pat Fricano
Florida Department of Environmental Protection

Assessment of Living Resources Data For Water Quality Target Setting

Little or No Data	Limited Data	Adequate Data	Proven WQ vs. LR Linkages
Manatee Green Turtle Loggerhead Turtle Mermaids	Fish Queen Conch FKNMS Reefs?	Algae Seagrass FKNMS Reefs?	???
Eliminate Candidate in FKRAD	Collect New Data on Candidate	Evaluate WQ vs. LR Linkages	Set WQ Target for Candidate

Florida Keys Reasonable Assurance Documentation

Queen Conch

Progess Report Provided by FFWCC

- Oxidative stress is a biomarker that is being investigated and characterized in nearshore and offshore populations of conch
- Heavy metal content for copper, cadmium, tin, and mercury of near shore and offshore conch hemolymph were analyzed and compared
- All four metals were significantly lower in the near-shore females, which for copper may not be a good thing since the oxygen carrier in mollusks is copper-based
- The same results are noted for these metals in the digestive gland and the neural ganglia, except for Hg which is higher in the neural ganglia of the nearshore females than the offshore females
- The significance of these results is not yet understood

Florida Keys Reasonable Assurance Documentation

Seagrass and Algae

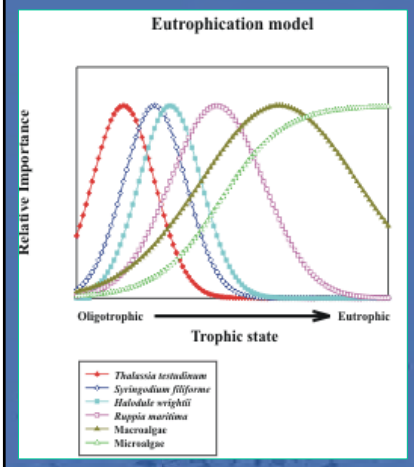
General Observations

- Seagrass species found in the Keys include *Thalassia, Halodule* and *Syringodium*, with *Thalassia* being by far the most common
- At the highest level, FDOT aerial photographs document very little change in the seagrass cover over the last 40 years

- **As you draw a closer focus, a relationship between nutrients and seagrass in the Keys begins to emerge . . .**

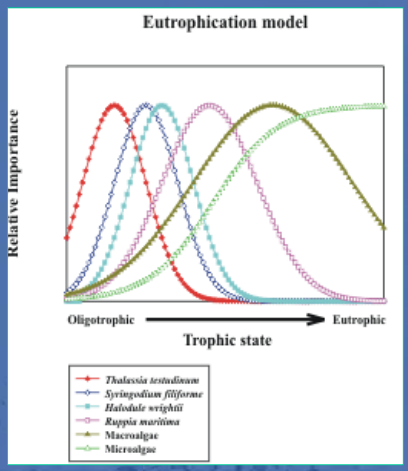
Sea Grass and Algae

Eutrophication Model



- The seagrass / algae dominance eutrophication gradient model predicts a change in species dominance as nutrient availability increases, shifting the competitive balance to faster-growing primary producers.
- Each species in the seagrass / algae eutrophication model can potentially dominate over a range of nutrient availability
- In an oligotrophic system like the Keys, nutrient availability will initially cause increases in seagrass biomass and growth rates

Sea Grass and Algae



Eutrophication Model

- As nutrient availability increases beyond what is required by a dense stand of Thalassia, the faster growing seagrass species *Halodule and Syringodium* will out-compete it (succession)
- At later stages of eutrophication, macroalgae and microalgae will become the dominant primary producers
- These changes are not instantaneous and species replacements may take place on a time scale of a decade or more

Seagrass and Algae

Seagrass Monitoring in FKNMS

- Changes have been noted at several of the 30 permanent Level 1 seagrass monitoring stations located closer to the shoreline in the Middle and Lower Keys
- The relative abundance of macro algae have increased at 4 sites, but no decreases in seagrass abundance were noted
- The eutrophication model predicts increases in fast growing macroalgae should precede decreases in seagrass abundance
- At 4 more Level 1 sites there have been long-term shifts in the ratio of nitrogen to phosphorus in seagrass leaves, consistent with increases in nutrient availability, but no changes in seagrass cover or community composition have occurred
- Excepting for the total loss of seagrasses at 3 Level 1 sites by hurricanes, there have been no large-scale trends in the abundance of dominant sea grasses over the past 7 years of seagrass monitoring in the Keys despite increases in nutrient availability

Sea Grass and Algae

Little Venice Study

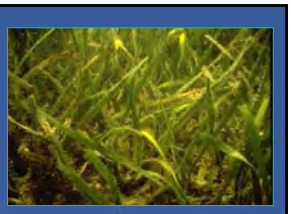
- Benthic sampling conducted as transects away from canal nutrient sources at Little Venice Subdivision
- Sampling transects were placed at the canal mouth (0 meters), then 50, 100 and 200 meters away from canal mouth
- Inshore waters clearly impacted by landuse and associated septic systems
- Seagrass abundance (*Thalassia* and *Halodule)* highest in sites furthest from the canal mouth

Sea Grass and Algae

Little Venice Study – cont.

- Seagrass densities are lowest at the canal mouth
- Sites closest to the canal mouths have the greatest abundance of green algae, which are typically considered to be strong indicators of elevated nutrient conditions
- Brown algae are also primarily found at the nearshore area along with lowered DO
- The authors expect that with decreased nutrient inputs, one would see a migration of *Thalassia* back into the nearshore waters off the canals

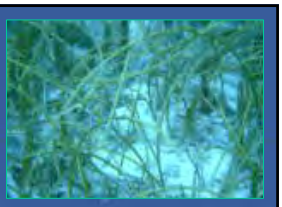
Sea Grass and Algae



Lapoint, Tomasko & Matzie (1994)

- Assessed nutrient concentrations and the productivity, biomass and epiphyte levels of the seagrasses *Thalassia* and *Halodule* along 3 onshore – offshore transects at Key West, Big Pine Key and Long Key
- Transects were stratified into hypereutrophic, eutrophic, mesotrophic and oligotrophic communities with increasing distance from shore
- *Halodule* was the dominant seagrass within the closer inshore hypereutrophic strata, whereas *Thalassia* was dominant in eutrophic, mesotrophic and oligotrophic strata further offshore
- Seagrasses at the hypereutrophic and eutrophic strata had low shoot densities, low production rates, but high levels of attached epiphytes and mat-forming macroalgae

Sea Grass and Algae



Lapointe et al. (1994) – cont.

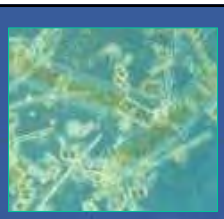
- Seagrasses at the oligotrophic strata had the highest shoot densities and areal biomass, and lowest epiphyte levels of all strata
- Nutrient metabolic analyses of the macroalgae and seagrass blade epiphytes in the hypereutrophic and eutrophic strata indicated they were phosphate limited due to high available concentrations of total nitrogen relative to total phosphate
- Sustained nutrient enrichment from land based activities results in increased biomass of epiphytes and macroalgae, which attenuate light, reduce DO and lead to the decline of *Thalassia* and a gradient of damage from nearshore to offshore waters

Algae

Lapoint & Matzie (1997)

- Assessed how physical forcing mechanisms (rainfall, wind, tides) linked land based wastewater discharges with the initiation of algal blooms in shallow (<10 m) waters between Big Pine and Looe Keys from January to October 1996
- Comparison of 3 sites; 1) an inshore station downgradient of 2,000 septic tanks in Spanish Harbor Channel, 2) a nearshore station near a patch reef ~ 0.5 km south of Munson Island, 3) an offshore station in the back reef at LKNMS
- Elevated concentrations of dissolved inorganic nitrogen (DIN), soluble reactive phosphorus (SRP) and chlorophyll a (chl a) following episodic events demonstrated importance of physical forcing to wastewater nutrient discharges and eutrophication

Algae



Lapoint & Matzie (1997)

- Following a wind event in mid February (~ 20 knots, NE) elevated concentrations of DIN, SRP and chl a were observed at the nearshore and offshore stations but not at the more protected inshore station
- Highest DIN (mostly $NH4^{+}$) and SRP concentrations of the entire study were recorded at the inshore station during a low tide event on March 19th
- DIN concentrations reached maximal values at the nearshore and offshore stations with the onset of the wet season in late May and early June, followed by maximal chl a concentrations at all 3 stations during the mid-summer period

Algae

Lapoint & Matzie (1997)

- Average chlorophyll-a concentrations throughout the entire study were more than 3X higher at the inshore station (1.86 ug/l) than the nearshore (0.55 ug/l) and offshore (0.60 ug/l) stations
- Fleshy macroalgae were present at all 3 stations in the winter but their biomass increased upwards of threefold at the inshore and nearshore stations following the onset of the rainy season
- Red macro algae were abundant at all 3 stations and the $\delta^{15}N$ values of this plant were highest at the inshore, intermediate at the nearshore and lowest at the offshore stations, indicating increasing wastewater N contributions to this alga with proximity to shore
- In summary, percolating stormwater forces out accumulated wastewater nutrients which can initiate harmful algal blooms in the nearshore waters of the FKNMS

Reef Building Corals

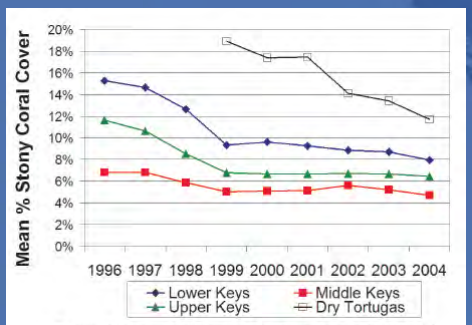


Figure 7. Stony coral cover for all regions (1996-2004).

Stony Coral Cover in Decline

- Declining trends noted FKNMS-wide
- Even the good water quality – in the Dry Tortugas – is not enough
- Stony coral decline is a regional phenomenon throughout the greater Caribbean
- No stated water quality limits or thresholds

Reef Building Corals

- Stony coral growth and health are dependent upon light transmission and their zooxanthellae are normally nitrogen limited
- Cook compared Middle Keys inshore and offshore sites and found:
  - Nitrogen at both sites was more than sufficient to support zooxanthellae
  - Increased Chl-a content of the zooxanthellae was found in the coral polyps of the inshore station
  - However, this was thought to be a photo-adaptive response at the inshore site resulting from decreased light levels caused by turbidity (not elevated nutrients) originating in Florida Bay
  - No stated water quality limits or thresholds

Coral Reef Fish

Key Points

- Parrot fish have become the dominant macro algae grazers on corals in the Florida Keys since the demise of the sea urchin decline starting in 1983
- Reduced fishing mortality inside regulated reserve areas resulted in a 4x reduction of macro algae growing on the coral
- Top-down control of macro algae through fishery management is less important if nutrient sources are not controlled
- No identified water quality limits, thresholds or toxicity concentrations

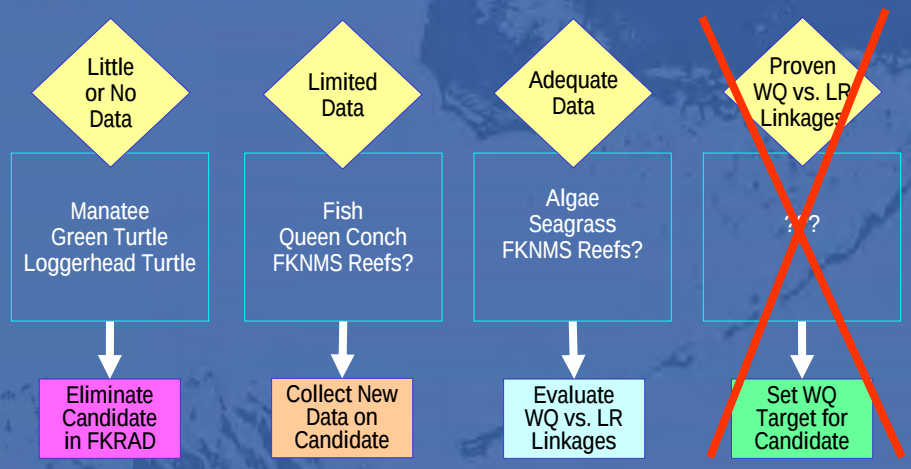
Other Fish

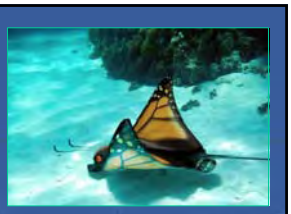
Key Points

- No studies on the relationship between nutrients and Florida Keys fisheries were found
- While sport fish are important to tourism, the economy and the quality of life enjoyed by Keys residents, they are not a good water quality indicator
- Consequently, no linkage was documented between nutrient concentrations and the health of the Keys fish
- No identified water quality limits, thresholds or toxicity concentrations

Current Findings

(Based on Last TWG Meeting Discussions)





ONE-ON-ONE STAKEHOLDER DATA ACQUISITION MEETINGS

- Stakeholder Summaries
- Status to Date

Scott McClelland
CDM

EPA Reasonable Assurance Guidance

- **Define What You are Going to Do?**
- **Will it Meet Water Quality Targets?**
- **If So, When?**

Stakeholder Summaries

- Water Quality Targets
- Management Goals
- Benchmark Conditions
- Management Actions
- Anticipated Benefits
  - Nutrient Load Reductions
  - Implementation Timing
- Monitoring Programs
  - Water Quality and Living Resources
  - Effectiveness of Pollution Controls

One-on-One Interview → Draft Summary → Stakeholder Edits → Final Summary → Stakeholder Sign-Off → FKRAD Document

Status to Date

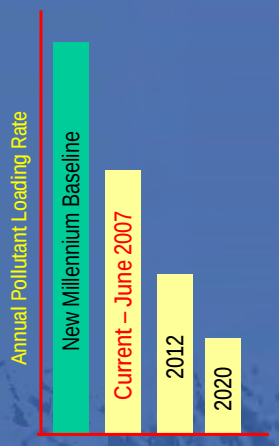
✓ Obtained but may need clarification

Stakeholder	Comp Plan	WW Master Plan	Stormwater Master Plan	Other Plans and Data	Implementation
FDOT	NA	NA	Waiting	Waiting	Waiting
Islamorada	✓	✓	✓	✓	Waiting
Key Colony Beach	✓	Not Required	✓	✓	✓
Key West	✓	Not Required	In Process	✓	✓
Layton	✓	In Process	None	NA	✓
Marathon	Waiting	Waiting	✓	Waiting	Waiting
Monroe County	✓	✓	✓	Waiting	Waiting
State Parks	NA	✓	✓	✓	Waiting
U. S. Navy	NA	Waiting	Waiting	Waiting	Waiting
FKAA	NA	✓	NA	Waiting	Waiting
KLWTD	NA	✓	NA	NA	✓

Management Actions Summary

WBID	Management Action	Estimated Total Nitrogen Load Reduction (lbs/year)	Estimated Total Phosphorous Load Reduction (lbs/year)	Anticipated Operational Date
CITY OF SPARKLING WATERS				
AAAA -S	Upgrade Existing Secondary WWTP to AWT (5-5-3-1) Treatment	XXX	YYY	ZZ/ZZ/ZZ
AAAA -S	Transition Existing Effluent Disposal Method from Ocean Outfall to Deep Injection Well	XXX	YYY	ZZ/ZZ/ZZ
AAAA -N	Reuse System Serving City Parks and Golf Course	XXX	YYY	ZZ/ZZ/ZZ
AAAA -S	Reuse System Serving City Parks and Schools	XXX	YYY	ZZ/ZZ/ZZ
AAAA -N	Street Sweeping Program	XXX	YYY	ZZ/ZZ/ZZ
AAAA -S	Street Sweeping Program	XXX	YYY	ZZ/ZZ/ZZ
AAAA -N	Addition of Capture Boxes and Disposal Wells	XXX	YYY	ZZ/ZZ/ZZ
AAAA -S	Addition of Capture Boxes and Disposal Wells	XXX	YYY	ZZ/ZZ/ZZ
	TOTAL COMMUNITY NUTRIENT REDUCTIONS	XXX	YYY	ZZ/ZZ/ZZ

Establishment of "Real" Schedules



- **Funded Activities**
- **Anticipated Activities**
- **FKRAD Scenarios**
  - **New Millennium Baseline**
    1999 FKCCS Loadings
  - **Scenario A** – Current Conditions
    Only Facilities Operational on June 2007
  - **Scenario B** – Target Date 2012
    Based on Compliance with 99.395 (2010.5);
    Fully Operational Facilities + Planned Facilities with Likely Funding
  - **Scenario C** – Target Date 2020
    Current Operational Facilities
    + All Currently Planned Facilities

Distribution of First Draft Stakeholder Summaries

- **These are Works in Progress**
  - FKCCS Data Has Not Been Included
  - Some Management Practices are Incomplete
  - Waiting on Some Stakeholder Documents
- **Stakeholder Actions**
  - Review Summaries for Interpretations
  - Call to Discuss Issues and Concerns
  - Edit Documents
    - ✓Use Track Changes → Send by E-mail
    - ✓Make Changes in Red Ink → Return by Mail
  - Provide Needed Documents

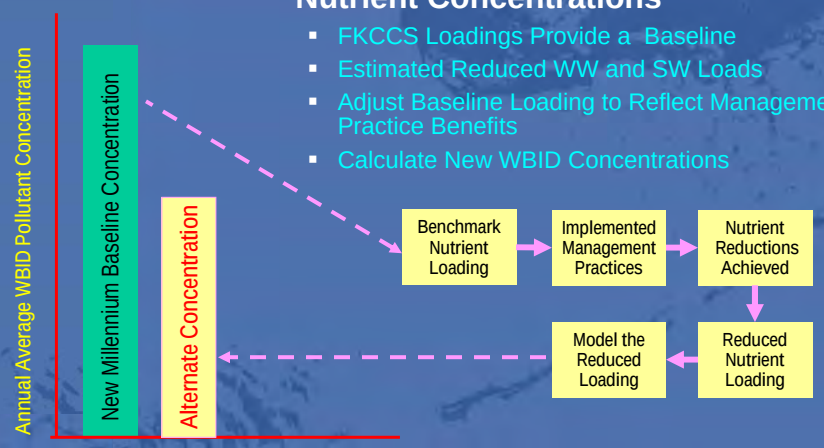
ASSESSMENT OF SELECTED MANAGEMENT ACTIVITIES

- Net Assessment Goal
- Evaluation of Effluent Disposal Wells
- Evaluation of Stormwater Management BMPs

Steve Lienhart
URS Corporation

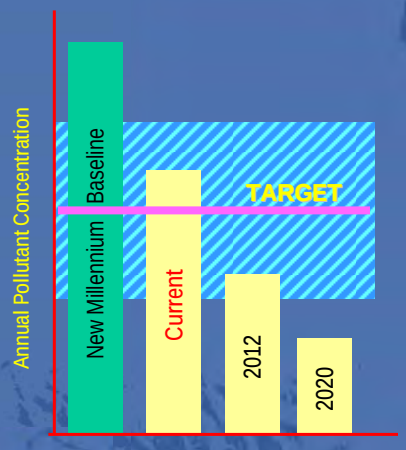
Net Assessment Goal

- **WBIDs Models Estimate Comparative Nutrient Concentrations**
  - FKCCS Loadings Provide a Baseline
  - Estimated Reduced WW and SW Loads
  - Adjust Baseline Loading to Reflect Management Practice Benefits
  - Calculate New WBID Concentrations



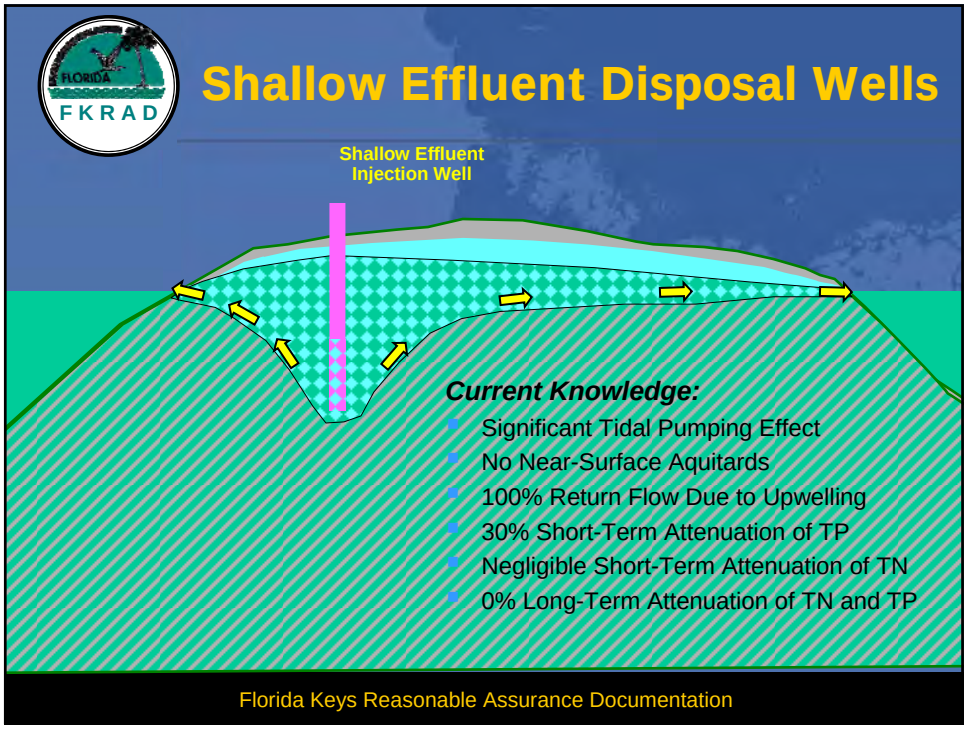
Florida Keys Reasonable Assurance Documentation

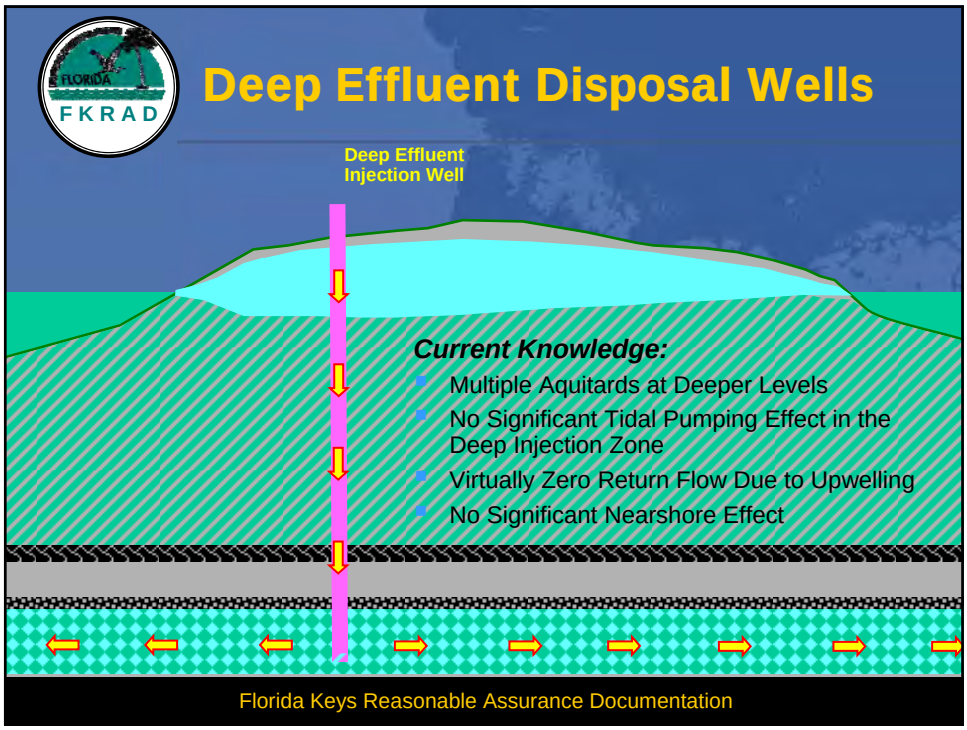
Net Assessment Goal

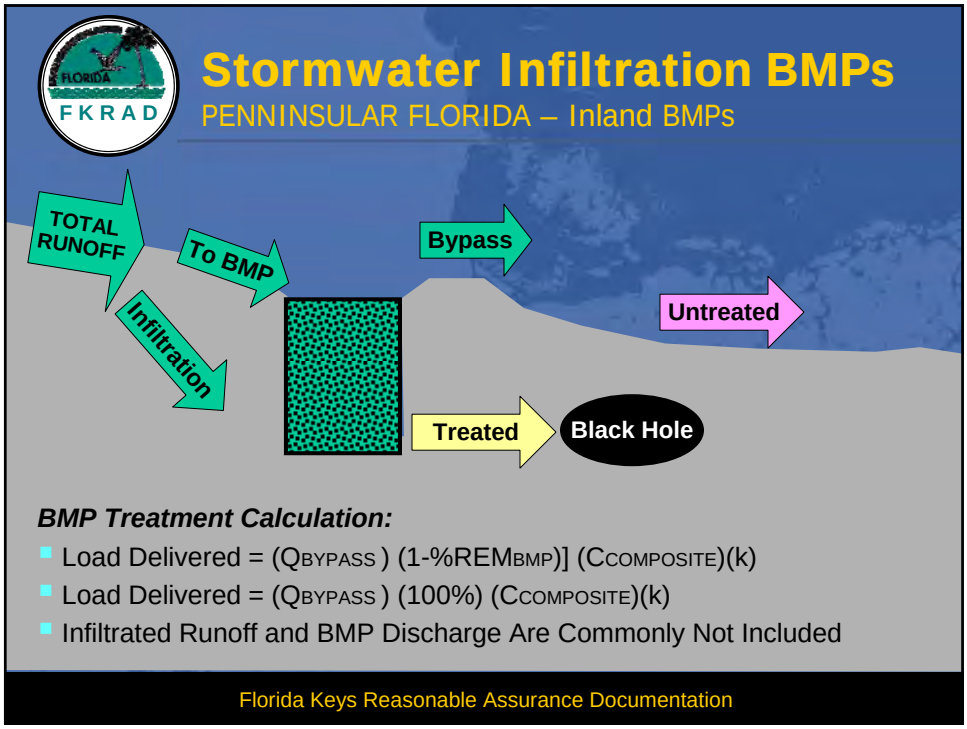


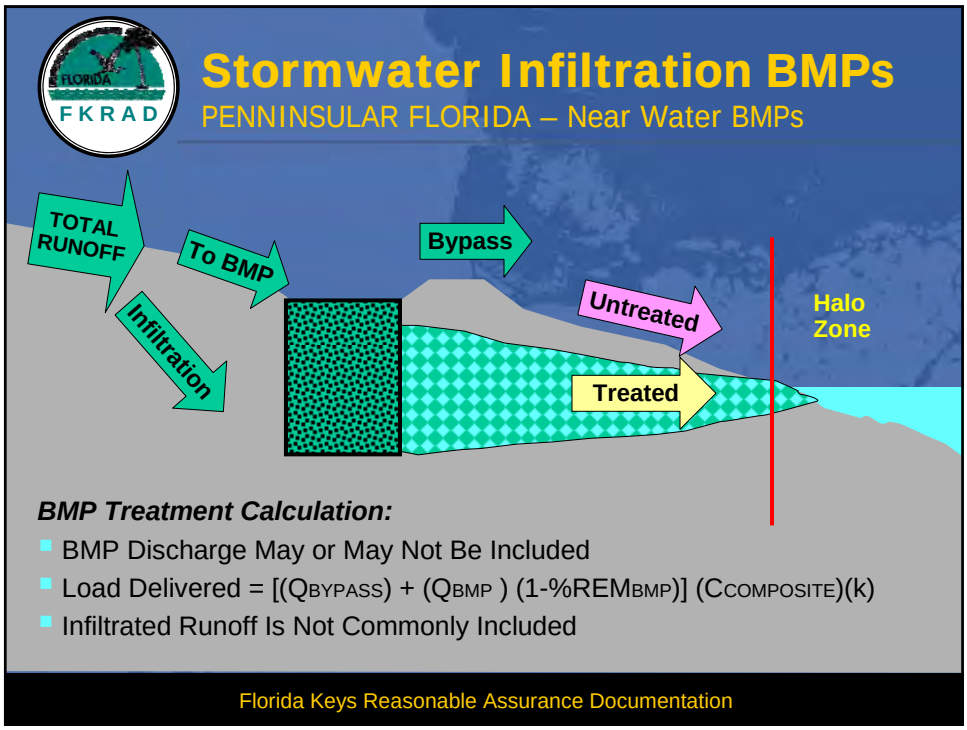
- **Estimate Comparative Water Quality Changes that Consider**
  - Stakeholder WW and SW Management Practices
  - Marine Water Quality Adjacent to the Nearshore WBIDs
- **Compare Estimated Water Quality Changes**
  - Water Quality Targets
  - Living Resource Requirements
  - Linkages Between Them

Florida Keys Reasonable Assurance Documentation


FLORIDA
FKRAD
Shallow Effluent Disposal Wells
Shallow Effluent Injection Well
Current Knowledge:
Significant Tidal Pumping Effect
No Near-Surface Aquitards
100% Return Flow Due to Upwelling
30% Short-Term Attenuation of TP
Negligible Short-Term Attenuation of TN
0% Long-Term Attenuation of TN and TP
Florida Keys Reasonable Assurance Documentation

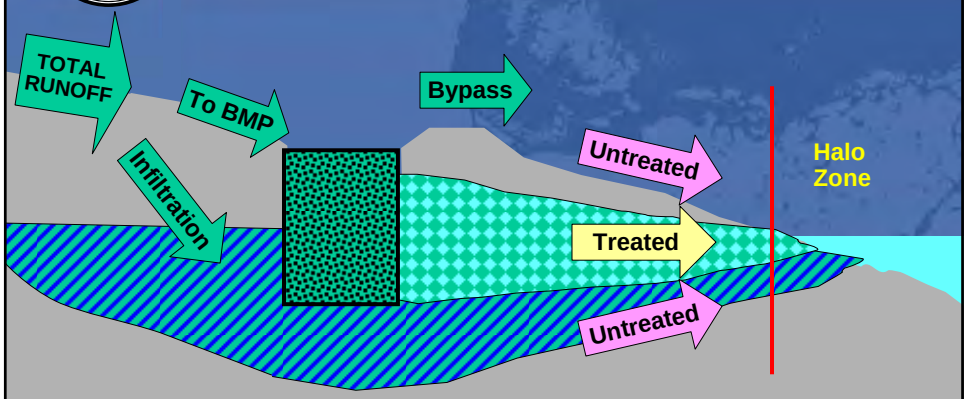

FLORIDA
FKRAD
Deep Effluent Disposal Wells
Deep Effluent Injection Well
Current Knowledge:
Multiple Aquitards at Deeper Levels
No Significant Tidal Pumping Effect in the Deep Injection Zone
Virtually Zero Return Flow Due to Upwelling
No Significant Nearshore Effect
Florida Keys Reasonable Assurance Documentation


FKRAD
Stormwater Infiltration BMPs
PENNINSULAR FLORIDA – Inland BMPs
TOTAL RUNOFF
To BMP
Infiltration
Bypass
Untreated
Treated
Black Hole
BMP Treatment Calculation:
Load Delivered = (QBYPASS) (1-%REMBMP)] (CCOMPOSITE)(k)
Load Delivered = (QBYPASS) (100%) (CCOMPOSITE)(k)
Infiltrated Runoff and BMP Discharge Are Commonly Not Included
Florida Keys Reasonable Assurance Documentation


FKRAD
Stormwater Infiltration BMPs
PENNINSULAR FLORIDA – Near Water BMPs
TOTAL RUNOFF
To BMP
Infiltration
Bypass
Untreated
Treated
Halo Zone
BMP Treatment Calculation:
BMP Discharge May or May Not Be Included
Load Delivered = [(QBYPASS) + (QBMP) (1-%REMBMP)] (CCOMPOSITE)(k)
Infiltrated Runoff Is Not Commonly Included
Florida Keys Reasonable Assurance Documentation

Stormwater Infiltration BMPs

FLORIDA KEYS



BMP Treatment Calculation:

- Load Delivered = $[(Q_{BYPASS} + Q_{INF}) + Q_{BMP}\ (1\text{-}\%REM_{BMP})]\ (C_{COMPOSITE})(k)$
- Infiltrated Runoff and BMP Discharge Are Included

Florida Keys Reasonable Assurance Documentation

ACTION ITEMS

- Information Requests
- Working Schedules
- Sanctuary Advisory Council Presentation
- Technical Working Group Meetings

Scott McClelland

CDM

Florida Keys Reasonable Assurance Documentation

Information Requests

- Living Resources Studies and Data
- Community Management Goals
- Management Actions
  - Adopted, Implemented and in Operation
  - Pending or Anticipated
- Community Issues and Concerns
  - Water Quality Management
  - Impacts of Pollutants on Aquatic Resources in Impaired WBIDs

Information Requests

IDENTIFY RESOURCE MANAGEMENT GOALS

- Local Living Resource Concerns
- Wastewater Plans
- Stormwater Management Plans
- Conservation and Marine Resource Management Plans
- Community Concerns

IDENTIFY MANAGEMENT ACTIVITIES

- Adopted Plans
- Completed Design Plans
- Operational Projects
- Funded CIP Projects
- Unfunded CIP Projects and Program Elements
- Enhanced Regulations

Revised Working Schedule

- Technical Working Group Meetings
  - Charter Meeting: October 24, 2006
  - Meeting 1: November 17, 2006
  - Meeting 2: December 13, 2006
  - Meeting 3: February 23, 2007
  - **Meeting 4: March 23, 2007**
  - Meeting 5: April 26, 2007
  - Meeting 6: May 24, 2007
  - Meeting 7: June 29, 2007 (Note Suggested Change)
  - Meeting 8: July 26, 2007

Revised Working Schedule

FKRAD Document

Completion of One-on-One Interviews	February (Done)
Delivery of Draft Stakeholder Summaries	March (This Meeting)
Completion of Initial Stakeholder Reviews	April (Next Meeting)
Finalization of Stakeholder Summaries	May
Digital Release of Draft FKRAD Document	June/July
Digital Release of Interim Document	July/August
Digital Release of Final Document	September
Distribution of Final Printed Document	September/October

Stakeholders Agreement

Release of Initial Draft Agreement	April (Next Meeting)
Release of Interim Draft Agreement	June
Distribution of Final Agreement	August
Execution of the Final Agreement	September

Next Meeting

TWG Meeting Number 5

ANTICIPATED BENEFITS OF IMPLEMENTED MANAGEMENT ACTIONS AND BMPS

April 26th ❖ 9:30AM – 1:30PM

Marathon Government Center
2796 Overseas Highway
Conference Room 104
Marathon, Florida

Questions?