

**STEERING COMMITTEE MEETING
FLORIDA KEYS NATIONAL MARINE SANCTUARY
WATER QUALITY PROTECTION PROGRAM**

STEERING COMMITTEE DRAFT MEETING MINUTES

July 22, 2009

**Florida Keys Mosquito Control District
Marathon, Florida**

Members Present:

Billy Causey—Southeast Regional Director, NOAA's Office of National Marine Sanctuaries
Ron Sutton—Mayor of Key Colony Beach
Bruce Popham--Chair of FKNMS Sanctuary Advisory Council
Pete Worthington—Marathon City Council
Gerald Briggs—Bureau of Onsite Sewage Programs Florida Department of Health
Bob Johnson—Director of South Florida Natural Resource Center (Everglades and Dry Tortugas National Park) sitting in for Greg May
Tom Genovese—Florida Keys Service Center Director for South Florida Water Management District
Charles Brooks—Key Largo Wastewater Treatment District
Don Ashenburg—Mayor of Islamorada
Debra Stucki—SWC, Inc., (representing member Sandra Walters)
Shelley Trulock—Project Manager, U.S. Army Corps of Engineers
Charles Causey – Florida Keys Environmental Fund
Chris Bergh—Director of Coastal and Marine Resilience in Florida, The Nature Conservancy
George Neugent—Monroe County Commissioner
Ed Fussell—Florida Keys Mosquito Control District
Jim Reynolds—Director, Florida Keys Aqueduct Authority
Jon Iglehart—Florida Department of Environmental Protection, representing DEP Secretary Mike Sole
Mike Peyton, representing Regional administrator for EPA Region IV

Scott Zimmerman was not present for the meeting and has moved from the area.

I. Opening Remarks: Mr. Jon Iglehart - Director, South Florida District, FDEP and Mr. Mike Peyton, Director, SESD, EPA, Region 4

Mr. Jon Iglehart welcomed everyone to the meeting. He thanked Superintendent Ed Fussell for use of the very nice facility and thanked sanctuary staff Joy Tatgenhorst and Nancy Diersing for meeting set-up and taking meeting notes. Speaker cards are available for public comment, which is at 4pm today. Please give the completed cards to Nancy.

Mr. Iglehart informed everyone that Mike Sole, FDEP Secretary, traveled down the Keys visiting wastewater facilities and learning about wastewater improvements. He was very impressed with the wastewater infrastructure projects in the Keys. Secretary Sole would have liked to have been here at this meeting, but had a previous commitment. He wanted to express his appreciation for the regional leadership and continued efforts looking for ways to achieve the 2010 wastewater criteria. Mr. Iglehart introduced Mike Peyton, EPA.

Mr. Peyton let the steering committee know that he and other folks have spent a great deal of time examining the existing WQPP monitoring program. A fruitful meeting was held yesterday to talk over objectives and research questions with the WQPP management committee and principal investigators. EPA scientists felt that there was no need to rush into making any changes in the program and that more time for discussion was needed between now and January 2010. EPA will take a deliberative approach toward evaluating the current monitoring efforts to see if they can be optimized. If things are good the way they are now, that is fine, too. They also discussed special projects at yesterday's meeting. Mr. Peyton reminded everyone that he was the director of EPA Science and Ecosystems Support Division in Athens, GA. They have many fine scientists and could be available to help where and when needed. They have already been interested in canal degradation in the Keys and will be providing expertise on this topic. Mr. Peyton knows first-hand how the canals have deteriorated over the years. EPA will study the canals and then develop some restoration options. Money will be an issue, but the management committee feels that this is a great pressing need. They have developed a plan of action that needs to be tweaked in the next few weeks. The management committee will help with the canals that need to be in the study. They have done some recon trips and would like to start before the federal fiscal year. A presentation will be given today by one of the EPA scientists, Mel Parsons.

Introductions of the WQSC members were made. Mr. Iglehart noted that there was a quorum present at the meeting.

A. Review Agenda, Jon Iglehart

Mr. Iglehart reviewed the agenda and pointed out that the committee would be hearing research results from the monitoring program. He asked for any comments or changes to the agenda. There were no comments or changes.

B. Discussion and Approval of Minutes, Steering Committee Vote

Mr. Iglehart called for approval of the draft minutes from the July 2009 meeting. The minutes were approved unanimously by the committee.

C. Management Committee Membership Update

Mr. Iglehart called for discussion on the management committee membership. Mr. Harvey made some comments on this topic. He had recently discussed this committee with Dr. Kruczynski and the question arose as to whether the management committee is a committee of the sanctuary or of the WQSC. The answer might help decide who should be on the management committee. He discussed this with Dr. Causey earlier and thinks it would be good to hear from him on this topic. Dr. Kruczynski explained that historically

each member was a “worker bee” appointed by a member of the steering committee, but a few years ago, they organized a technical advisory panel (TAC) to be a sanctuary advisory committee. The TAC reviews research in the sanctuary, including the research being done that is not funded as part of the WQPP. At this time, the management committee became a sanctuary management committee. The roles have changed somewhat over the years.

Dr. Causey added that is the point of integration between what the sanctuary is required to do under the National Marine Sanctuary Act and the WQPP. He explained that the management committee works closely with the TAC and that the TAC uses a very thorough process to review WQPP research and other research that takes place in the sanctuary. The steering committee uses the TAC for reviewing special studies, too. The management committee sets up agenda items. The names of management committee members were displayed in a slide for discussion purposes. Dr. Causey commented that he should not be on both committees and that perhaps John Halas and Kent Edwards do not need to be on the list either. Mr. Peyton suggested adding Richard Harvey, but removing himself. The management committee would set the agenda for the TAC and would call the experts together when discussion was needed. Dr. Causey suggested that Dr. Kruczynski serve as the “driver” for the committee. Dr. Kruczynski introduced Steve Blackburn who replaced Fred McManus and suggested that he could be the “driver” for the committee. A motion was made by Dr. Causey to accept the names on the list and name Bill Kruczynski as chair of the management committee. The motion passed unanimously.

They are as follows: Sean Morton- FKNMS, Scott Donahue- FKNMS, John Hunt- FFWCC, Tom Genovese- SFWMD, George Garrett- City of Marathon, Steve Blackburn- U.S. EPA, Bill Kruczynski- U.S. EPA, Roman Gastesi- Monroe Co., Gus Rios- FDEP, Richard Harvey- U.S. EPA.

Dr. Kruczynski suggested that the committee discuss the members of the TAC of the WQSC, even though it is not on the agenda. The idea of special studies was discussed in January and that meant that it would be necessary to revisit the TAC, which has traditionally reviewed the special study proposals. Dr. Kruczynski met with Dr. Keller and Mr. Scott Donahue to discuss who should be on the TAC. They also poled former members of the TAC to see if they still wanted to serve. He mentioned the names of people who were on the committee and would like to remain. Mr. Dave Makepeace, Carrollyn Cox and Martin Moe were added as new members to replace those who have moved away. Rob Ruzicka, CREMP, replaced Walt Jaap, who retired. Dr. Kruczynski reviewed the names on the list and they were as follows: Jerry Ault- U. Miami, Doug Morrison-NPS, John Hunt- FWCC, Joe Boyer- FIU, Kim Ritchie-Mote John Ogden- USF, Gus Rios- FDEP, Alina Szmant- UNCW, Dave Makepeace, Carrollyn Cox, Martin Moe, Mark Chiappone- MDC, Rob Ruzicka- FWCC, Josh Voss- Harbor Branch, Ilsa Kuffner- USGS, Jim Fourquarean- FIU, George Garrett- Marathon.

Mr. Bob Johnson suggested that Tracy Ziegler replace Doug Morrison on the committee as she was a more appropriate person for the job and Dr. Kruczynski accepted that

suggestion. Mr. Hunt suggested that Bill Sharp replace Carrollyn Cox as the FWC representative, but it was explained that she is not serving as the FWC representative in this capacity. Dr. Kruczynski chairs the TAC.

D. New Steering Committee Representatives for FWC

Dr. Causey nominated Gil McCrae as the new representative for FWC on the committee. Mr. McCrae is currently the director of the FWC Fish and Wildlife Research Institute and serves on Florida's Ocean Council. Mr. McCrae was unanimously voted in as a new member. He explained that he is glad that his group is participating again on the WQSC.

E. Plaque for Fred McManus

Mr. Iglehart noted that at the last meeting, they voted to recognize Fred McManus for his dedicated efforts for the WQSC for many years. The EPA folks will take the plaque with them and make sure that he receives it.

II. Update on Consent Agreements to meet 2010 deadline, Jon Iglehart

Mr. Rios explained that nutrients are a major source of degradation of nearshore waters in the Keys. The Monroe County Year 2010 Comprehensive Plan stated as one of its goals that wastewater treatment facilities should meet advanced wastewater treatment or best available technology standards. The 1999 Florida Legislature bolstered these goals by establishing wastewater treatment and disposal standards for Monroe County by passing Chapter 99-395, which will become effective in July 2010. This law affects all owners of wastewater treatment disposal plants and onsite systems in Monroe County and states that existing systems must comply with the new standards or cease to operate. Owners of FDEP permitted facilities have been notified in their permits of these upcoming requirements. Mr. Rios showed a slide that provided the effluent treatment standards with regards to BOD (biological oxygen demand), TSS (total suspended solids), TN (total nitrogen) and TP (total phosphorus) for facilities with flows less than 100,000 gallons per day and for those with flows equal to or greater than 100,000 gallons per day. The larger facilities are held to higher standards. A slide with graphs was used to illustrate the differences in the three types of treatment (secondary, best available and AWT) for effluent concentrations of TP and TN. Advanced Wastewater Treatment (AWT) is the best treatment and effectively reduces phosphorus and most nitrogen, much more than the best available or secondary treatments. It is much more difficult to reduce nitrogen than it is to reduce phosphorus.

Local governments in Monroe County are currently, planning, designing and building public wastewater systems and central sewers. Local ordinances require property owners to connect to municipal central wastewater systems after they become available. However, not all these systems will be completed by July 1, 2010. That creates a dilemma for property and treatment plant owners. The only available options for the package plant operators is to cease operation, upgrade to new standards or connect to an approved facility by July 2010. Another option is to enter into a consent agreement with FDEP until the approved connection is available to them. Such agreements establish a legally binding schedule until full hookup can be achieved. FDEP has been working with

package plant owners and local governments currently facing this dilemma to draw up consent agreements. FDEP has received requests for revisions and are currently reviewing those requests. Mr. Iglehart added that they held several public meetings to gather input on this topic, but it was difficult to reach that way. Currently they are accepting written comments to arrive at a consensus point.

Most package plants in the county are relying on the new wastewater facilities that are being constructed. Mr. Iglehart added that FDEP will not penalize a plant owner as long as they maintain the terms of their permit and continue current treatment level until the facility is online.

Mr. Brooks mentioned that they discussed consent agreements last night at the KLWTD board meeting. The board is concerned about liability for penalties if the deadline is not met. Hopefully, at the same time, in his view, the best thing is for the state to adjust the deadline to make it more realistic. The KLWTD has one plant that will come up for permit review in June 2010. He doesn't really know where they will be at that time with respect to central sewer, but feels certain the facility will be ready will be shortly after that date. The ultimate solution in his view is for the state to make some adjustments, so that the liability is not put on the community. He understands that something along those lines might be in the works and that would be preferable to entering into consent agreements. Mr. Iglehart stated that the liability question is something that the FDEP attorneys are examining. The second point would require changing the law and that is a legislative action that would not take place until next year, and arrangements need to be made for package plant owners now. Mr. Brooks asked if this committee could encourage the legislature to make a change on the deadline. Mr. Iglehart responded that the committee can do what it wants to do.

Mr. Reynolds added that the package plant owners are concerned that they will have to pay twice, but that is based on a local ordinance that requires the plant to connect to the facility in that municipality. Right now, the plants are free to upgrade. In some areas like the lower keys, it might be years before the funding is available for wastewater improvements. Maybe the local ordinances should be changed even though they were put in place to help support the new facilities.

Mr. Rios explained that larger facilities are depending upon the revenue from the package plants. If they upgrade on their own, there would have to be a way for the facility to deal with that loss of income. The manager of the Village, Ken Fields, was recognized by the committee. He explained that the issue came up that in the settlement agreement with FDEP. In this agreement, the package plants are given 18 months to comply if the municipality doesn't meet its deadline. The at this time at this time Village staff will be proposing to the council that if they are forced to upgrade because the Village failed to meet its deadline, the plant owners can't be forced to connect for five years. The length of time is subject to debate at this point. This 5-year period is the way that the Village proposes to deal with the timing/connection issue.

Mr. Charles Causey noted that if they did extend the period to 18 months that will mean that the income for the plant will not be available and this is a critical time. Mr. Iglehart stated that FDEP doesn't want to see anyone pay twice. The larger facilities provide better treatment, though, so ultimately, the treatment overall will be better if fewer small plants are built. FDEP has almost worked it out with the Village and want to make these agreements consistent among municipalities.

Mr. Brooks explained that KLWTD is taking the approach of building everything at once and are moving forward rapidly. Once a plant is complete, the revenue is needed right away to survive. The Islamorada five-year plan would be detrimental for Key Largo because they are relying on package plants to make their facilities profitable, rather than being a drain.

Mr. Reynolds mentioned that FDEP was working with Islamorada to work out an agreement that would serve as a model for other entities and inquired as to whether the other entities would be consulted on the details of the Islamorada agreement before it is applied to other entities. Mr. Iglehart responded that they are at that point now. FDEP has taken a step back to get consensus. Mr. Rios stated that they already have drafts of consent agreements with entities and are in the process of getting comments. They want to make sure that they have consent and that the lawyers have reviewed the documents. Mr. Fields added that FDEP has been very cooperative in this area and that there are provisions for extensions in these agreements for hurricanes and other unavoidable situations. The local ordinance serves as an incentive to stay on schedule because a revenue loss would take place if they did not comply on time and was requested by the package plant owners who wanted to see the projects move forward on schedule. This process was a balancing act with FDEP and takes into consideration the realities of construction and commitment from package plant owners. Councilman Worthington added that Marathon is moving forward with wastewater projects. With respect to the consent agreement, the council is looking for consistency. They feel sure come very close to meeting the 2010 deadline.

Mr. Briggs reported that they are working to formulate a MOA with FCAA and Monroe County to address onsite systems in unincorporated Monroe County. They have had active discussions at the state level with the governor's office, DEP and DCA. They do not want people to have to upgrade twice either, but they do want to see a definite schedule and progress on this issue. They are still hammering out enforcement should they need it. The other issue is funding. They are moving toward the deadline and understand that Marathon and Key Largo will be addressing the onsite systems that may remain in their areas and we will be working with them on those systems. The other issue is pinning down what systems are going to be needed to be upgraded.

III. Update on stimulus package funding for the Keys, Ms. Shelley Trulock, U.S Army Corps of Engineers/Jacksonville District

Ms. Trulock introduced herself and explained it has been her pleasure to be affiliated with this group since 2001 as the project manager for the Florida Keys Water Quality

Improvements Program. She noted that this group has come far since that time and provided some background information about the Florida Keys Water Quality Improvement Program (FKWQIP) for those people who are new. Public Law 106-554 authorized the Army Corps of Engineers to provide technical and financial assistance to carry out projects for the planning, design and construction of treatment works to improve water quality in the Florida Keys National Marine Sanctuary. The federal funding limit, spending authority, was \$100M, but that does not mean that amount was available. The distribution for the authorized funds was determined by an intergovernmental task force in 2000-2001. The split is 65% federal and 35% state funding. That means, the total non-federal funding possible is \$53.8 million and the total federal funding is \$100 million, which together makes a total cost of \$153.8 million. To this date, a total of \$9,889,000 was received (through 2009) via Congressional Ads. The \$100 million authorization was distributed the following way: \$200,000 to Key Colony Beach, \$800,000 to Layton, \$10,320,000 Key West, \$29,560,000 to Key Largo, Marathon and Islamorada each. In January 2009, Ms. Trulock had reimbursed about \$600,000, but since that time, she has reimbursed \$ 6,341,519.22, which is phenomenal. She thanked everyone and there was applause from everyone. She read the reimbursements for each entity: \$1,453,542.98 for Key Largo, \$3,657,743.82 for Marathon, \$5,104.34 for Islamorada, \$442,890.08 for Key West and \$782,238.00 for Layton.

Ms. Trulock announced some additional good news. The FKWQIP received \$25,408,000 in Stimulus Funding (American Recovery and Reinvestment Act – ARRA). Securing this money is going to be very helpful. There are some conditions that go along with the funds, though. The \$100 million must be spent by 30 September 2010, which makes it even more important for municipalities to get their invoices turned into her. She feels very confident about meeting this deadline if everyone stays on track. The process is straightforward. Once the invoice is submitted, she has 30 days to pay it. The way to spend the remaining funds was decided two years ago since Key Colony Beach and Layton were already whole. The stimulus money will be spent equally between Key Largo, Key West Islamorada, and Marathon until they reach their maximum 2009 allocation. Key West will be the first to become whole and the next sum of money will then be spent three ways and so forth. In terms of the next steps, Ms. Trulock has to modify the PCAs (program contract agreements) to add some ARRA (stimulus act) language. She already has an attorney working on these modifications, which then can be approved by the District office. She thinks this process will go smoothly. She will continue reimbursing up to the limit of the PCA and the funds allocated to date per municipality, but there were some entities with PCAs that did not cover the full authorized amount. Key Largo, Key West, Key Colony Beach and Islamorada need PCA amendments to accommodate scope changes. It is important to note for these scope changes being developed, the NEPA process is still good. Thus, they do not have to reopen the NEPA process again, which would work against the deadline. She is trying to get approval to the District level for these amendment changes, but they might have to go through division office in Atlanta. Either way, the time frame is not bad.

Ms. Trulock distributed a spreadsheet with the allocations per municipality and explained the reimbursements. She uses this funding source spreadsheet to keep track of allocations, spending, invoices, etc. The last column shows where the municipalities stand after these monies are distributed. She did reserve the room until 6pm today and can take any questions from people after the meeting or during lunch. She will leave some business cards for anyone who needs one.

Mr. Popham inquired as to why unincorporated Monroe County was not included in this process. It was explained that Key Largo had no district at that time and the Sheriff's office had received a grant for the Key Largo project, which stayed with the district when it was formed.

Dr. Hammaker explained that unincorporated Monroe was not one of the authorized bodies recognized by the Army Corps. If they had intervened before this process, it may have set things back quite some time because of the impact statements and regulations that are required by the system. Commissioner Neugent added that this authorization goes back to our previous Congressional Representative, Peter Deutsch. The stimulus money has triggered the distribution and appropriation of the original \$100 million. He explained that there was no KLWTD at the time the decision was made to distribute this money to what was then unincorporated Monroe. Commissioner Neugent pointed out that had this money had been appropriated in a timely fashion, the Keys would be much further along in addressing this unfunded mandate by the State. Ten years later, the money is now available. The KLWTD has been established in unincorporated Monroe County and the commission voted to establish the KLWTD and still today support the distribution of those dollars the way they are going out right now. Even though \$25 million is a lot of money, it is not a lot when paying a billion dollar unfunded state mandate. The Keys will still need outside funds to pay down the cost of implementation and are working collaboratively toward this end.

Ms. Trulock does not have any comments or information regarding funding for next year.

IV. Status of Implementation of Monroe County Wastewater Master Plan and Waterwater Upgrades by Municipalities and Key Largo Wastewater Treatment District, Ms. Liz Wood, Monroe County, Representatives of Municipalities and Key Largo Wastewater Treatment District

City of Marathon Update: Ms. Susan Thomas explained that Marathon has six regional wastewater plants. They will be 85-90% complete by July 2010 and expect to be completely done by the end of 2010. The plant in service area 6 will be tested next week to bring it online. The plant for service area 4 will come online in November and that will cover over 50 % of the EDUs used in the entire system. They are happy with their progress and are getting very good pricing because of the economy. Ms. Thomas acknowledged the help she received from Shelley Trulock, Richard Harvey, Secretary Sole and Tim Banks (SRF funds). Marathon is very interested in the settlement agreement and should the state law be changed, Marathon would not like to see any settlement agreements have a date that is stricter than the new deadline in the new law. She also asked Mr. Briggs with

DOH if they are thinking about some kind of agreement. Mr. Briggs responded by stating that they are working on an agreement, but do need a definite answer that the local entity will not sue. Ms. Thomas thanked everyone for their help again and acknowledged Tom Genovese for his help in obtaining grant money. The city is doing wastewater and storm water at the same time.

Village of Islands/Islamorada Update: Mr. Fields stated that Phase II of the North Plantation Key Service Area went online about 6 weeks ago. Subphases A and B are available for connection. Subphases C and D will be ready in August and at that time they will be ready to service almost 1500 EDUs. Middle Plantation, which has another 1500 EDUs, is currently under design. The Army Corp money that was mentioned earlier was dedicated to that design and they expect to begin construction early next year. The balance of the Village depends upon a vote at this time. They voted an initial assessment resolution. The final vote is scheduled for August 6. At that time, the modification for the connect ordinance for the FDEP agreement will also be on the agenda. If that assessment goes through, it will generate enough funds to finish the design for of the Village. Then, they can start working on getting funding for construction at that time. They are making progress and plan to continue doing so. Things depend somewhat on the outcome of the August 6th vote as where the Village will be by the next committee meeting.

KLWTD Update: Mr. Martin Waits, chief financial officer, stated that the district will be 80-85% easily by July 2010. He distributed a map showing the status of the different basins in the district. Basically, basins A and D are complete. Basins B and C are 50-60% complete. The regional treatment plant at MM 101.3 is truly impressive and can't be seen from the road. In the south, they are under engineering. They will be working in Basins D and F in construction in the next few months. In terms of package plants, they have sent out 1 year notices to the entire service area. He wishes that they could build more in pieces like Marathon, but they will need the revenues immediately when the plants come online. They have a staff person who is the "hookup" czar. He is working with the package plant owners to make sure they have their engineering started and offering assistance. He is also coordinating neighborhood activities, so that people don't wait until their 30 day notices come. They are also sending out postcard notices to remind people about their lateral connections (not legal notices). The district should be easily 80-85% connected by 2010. Mr. Iglehart added that he visited the Key Largo facility last week and he looked over the areas near the construction and saw that they had done a nice job avoiding damage to surrounding areas. Mr. Fishburn also commented about their approach to unique parcels. The district has about 200 of such parcels and have not decided how to service them. Although he cannot speak for the board, he does not believe that KLWTD board will let not any parcel go on its own. They will find a relatively uniform solution for the unique parcels. Last night, the board directed the attorney a resolution as to how this can be accomplished. He also mentioned that in terms of package plants they would be nearly 100% serviced by the 2010 deadline because they are serviced on our forced main. There are 4-5 plants that cannot be connected to the forced main because of their location. For those properties, it might be appropriate to have an agreement. Mr. Rios asked as to which areas will be connected later. Mr. Fields responded that that will be up to the board as to how they decide to

proceed. He suspects that the last area will be basin I, MM 93-97 area. This is the most expensive area and is also an area that will mostly be serviced by the package plants connected to the forced main. The other properties are sprinkle properties and are not high density. The high density areas will be serviced by the package plants.

Unincorporated Monroe County Update: Mr. Reynolds gave the county update. He mentioned the Big Coppitt wastewater treatment plant that services over a 1,000 EDUs in the lower Keys. The next big project is the Cudjoe Regional System, which stretches from Lower Sugarloaf to Big Pine, including No Name Key. The project did not qualify for stimulus funding, so they are working with the county to identify ways to fund that project. That area will be serviced by one plant on Cudjoe and a series of onsite systems. They are working with the DOH to make sure that everyone, especially those who have onsite systems, are treated the same in terms of monthly fees, assessments, etc. That project is almost designed and hopefully it will not have to wait too long for funding. They also have Duck Key, which needs a collection system. They already have the reclaimed water pipes in place, but they need the treated sewer to fill the reclaimed pipes. They also installed a reclaimed water system on Big Coppitt. The county just granted money to upgrade and expand Hawk's Cay Wastewater treatment plant to service Duck Key. They also need to connect the people outside of Layton at either end of Long Key. The Big Cudjoe Regional is a big one and the geographic area is similar to Key Largo, but more spread out with more bridges.

Mr. Charlie Causey asked about pipes crossing bridges and inquired about the safety mechanism that keeps pipes from blowing away. Mr. Reynolds said that it is like the water system. The pipes are as safe as the bridges. This could be of more concern in the future when the bridges are older. They have never had a failure of pipeline on bridge, except they do need to be maintained. If the bridge is lost in a storm, the pipeline will be lost, too.

Mr. Peter Rosasco with Marathon's finance department stated that the City of Marathon is very proud of coming very close to meeting deadline. He acknowledged the help from FDEP and recently with assistance from Mr. Harvey, they were able to get some stimulus money. Five years ago, several local representatives went to Army Corp for money and they weren't all that well received, but now they are seeing a strong commitment from the Corp. They are now submitting invoices and getting paid. They have come a long way in that regard.

Mr. Fields added that when phase II comes online by the end of August, that will allow us to turnover a reuse facility and that reuse facility will service Founder Park and both the schools will be hooked up to that reuse facility. The schools in the Village will be compliant by the 2010 deadline.

Mr. Iglehart informed everyone that the deep-well requirement did not pass in this session of the legislature, but the Department will support that in the next session. Mr. Bergh asked about the consent agreements and whether they would involve fines that could be used to pay for the facilities that are being constructed. Mr. Iglehart responded

that a fine is a civil penalty and the department is not interested in penalizing people for things that are somewhat out their control because of the municipality and funding aspects. Monies from penalties go into the general legislative fund and not back to sewage upgrade. Mr. Rios added that the consent agreements do have fines if the plant owner does not meet the requirements of the agreement. They are not penalized when the service is not available if they have signed the agreement and abide by it.

Mr. Iglehart announced time for a 15 minute break.

Break (15 minutes)

Mr. Iglehart reconvened the meeting after the break.

V. Update on FKNMS book, Dr. Bill Kruczynski – EPA, Region 4
Dr. Kruczynski provided an update on the book, *South Florida Marine Environments: An ecological synthesis*, which came about because they wanted to summarize the past 10 years of monitoring. At the last budget time, the committee allocated \$25K for production. The original book was sanctuary oriented, but then when other entities found out they were putting such a book together, they got involved and now the book included areas as far away as Martin County and Charlotte Harbor. The idea was to educate the people who are spending money to connect to central treatment and answer why this action needs to be taken. It is now a book targeted toward the educated lay reader, congress people, etc., as to what is known about the South Florida system. It has therefore taken longer than he originally thought. His partner is Pamela Fletcher with Florida Sea Grant. The goal is to bring a draft of the book by the next meeting, January 2010. Then, the book will go out for outside review. People have been identified as reviewers. It will also be sent to the Florida Bay Program Management Committee since it contains a great deal about Florida Bay science. The oversight panel for Florida Bay has been suggesting that the Florida Bay Program Management Committee (PMC) compile such a book for some time. The sanctuary TAC and the WQSC will also be given the draft for review. The book was produced through a series of workshops on various topics and then worked up a list of pages that experts thought would be good for the public to know. They then developed storyboards for each page. It has not been an easy process. Each page/topic has to be written, edited, and revised as needed. Cartoons and images must be added entered into the software that can be used by the publisher. Forty thousand dollars of the money allocated from the WQPP funds was provided to the printer at University of Florida to print out 40,000 copies that will be distributed free of charge. The rest of the money, \$80K, goes to University of Maryland for the cartoons and remaining printing of the book. Dr. Kruczynski added that Ms. Fletcher's salary (\$30K) has been paid for the past two years by grant monies allocated through the "Protect Our Reef" license plate fund, which is chaired by Mote Marine Lab. The grant money was awarded through a competitive process. A year ago, Dr. Kruczynski prepared the lobster chapter and printed it up to give people an idea of what the book would look like when it was finished. He passed out a few copies for those who have not already seen the book. About 6 months ago, they dummied up a copy of what the book would look like as a final product, which will be 7 x 10 inches. Dr. Kruczynski showed several slides with the outline of the book. Two topics, uniqueness of south Florida habitats and effects of hurricanes, have not been assigned authors yet. There are a number of authors

that have not submitted their papers. They expect to have over 200 pages and can have up to 207 pages for the price that they contracted. Dr. Kruczynski reviewed the outline and pointed out the stage of completion for the chapters: oceanography, water quality, coral reef and hard bottom communities, seagrasses, mangroves, important biota of south Florida and some important management actions. The oceanography chapter is basically done. They have only received about half the drafts for water quality and not very many for coral reefs. The mangrove chapter is almost done and the seagrass one is more than half done. Most of the important biota pages, including lobster pages, are done. They have drafts for management actions. The bottom line is that they are 66% done with total number pages. Dr. Kruczynski has prepared an outline for the introduction to the book and the introduction and conclusion for some of the chapters. He still needs to write these after all the pages are done. If people want to track the progress, they can visit: <ftp://ftp.aoml.noaa.gov/ocd/pub/fletcher>. This site contains a WQSC folder with drafts of all the pages in PDF format. People cannot make changes to these drafts. He showed an example of a page that contains history about the reefs in the Keys and reviewed other pages on corals, fishing and other topics. The theme of the book is connectivity and that means when the mangrove are affected, that affects the seagrass and so forth. All of the cartoons are done in the same style by the University of Maryland. He thanked Ed Fussell for use of this great facility.

Mr. Iglehart turned the meeting over to Mr. Mike Peyton for the next couple of items.

VI. FKNMS Canal Characterization Project QAPP, Bill Cosgrove, Mel Parsons, SESD, EPA, Region 4

Mr. Peyton explained that his team has been trying to come up to speed with the origin of the program and decision-making process. They have put a lot of time and effort in this and he brought some people down here to give updates on monitoring and special studies. He emphasized that the EPA role down here is a collaborative one and they want to contribute their services for free, although EPA pays for them out of its budget. This work in no way will come out of the WQPP monies that are appropriated and hopefully they can continue to make available to this group. He then introduced EPA staff: Bill Cosgrove, Branch Chief of Ecological Assessment, Antonio Quinones, Pete Kalla, John Deatrck, engineer, and Mel Parsons, team project leader on canal study. They are communicating with people on TAC and management committee to make sure that these projects meet the needs of the sanctuary and others on this committee.

Mr. Deatrck explained that the last two trips he has taken to the Keys have been really good and he has learned a lot of history about this amazing place. His branch in Athens has about 20 people, mostly scientists and engineers, who work in the field of water quality. They have a tremendous amount of inland experience and do a lot of civil and criminal support for water protection division in Atlanta. His division does a lot of support of TMDL programs and data collection and assessment. On the biology side, they do jurisdictional work for criminal investigation division on wetlands issues across the southeast. They have a good mix of experience. In the division, which has about 100 people, they have law enforcement and analytical branches that might be helpful as well as quality assurance experts. He explained that they would not misrepresent or their

capabilities, but would to fit in where they can help. They have experts with experience in wastewater treatment. There are a variety of skills in Athens that might be available to the work that is taking place here in the Keys. He explained that they have been discussing ways to improve residential canal water quality with the management committee and Mel Parsons will be reporting on that study.

Mr. Parsons gave a presentation to the committee in which he explained that one suggestion from the management committee was to conduct a comprehensive canal study with the goal of developing models for water quality in canals. To conduct an initial examination, they chose canal 47 in Key Largo (MM 103) for the pilot study. It is a complicated canal system that is very long and empties into Blackwater Sound, adjacent to Florida Bay. At the very end of the canal, the water is pea soup green in color and has a lot of hydrogen sulfide and no dissolved oxygen. There are some very sharp corners in the canal and the mouth is only six feet deep. There is very little tidal influence in some of the far reaches of the canal. Dissolved oxygen is low in many places, too. They looked at the oxygen budget in the water column, salinity, pH, turbidity, etc. They put out current meters to measure flow on the surface and in the water column and measured nutrient flux in the silt on the bottom at the water-sediment interface. Mr. Parsons used a protective helmet when diving in this water to check the nutrient chambers. People in the community were very receptive and helpful and allowed them to tie up to their docks for the work. Yesterday, they had a meeting to discuss which canal to focus on in future studies. They plan to revisit this one and to study more canals for model development. Each multiple canal system will take 3-5 days to study and it may be a multi-year project to look at more than one canal system.

Mr. Brooks commented that from this study, he understands that the condition of the canal is not governed just by wastewater, but by the canal structure. He has seen the changes in his canal in the last 18 years. He asked if these wastewater improvements will improve nutrient level in canals and are there any studies that confirm that nutrients will be reduced. Mr. Parsons answered that there is no question that wastewater treatment systems in will improve nutrients. But, there are so many issues that affect water quality. Almost every canal system is different. One of the biggest issues is tidal flushing and that creates a huge oxygen demand. In some cases, oxygen may still be present, but in other cases, there is none and that means that there is basically no marine life like fish, etc. Little Venice is also one canal that they may look at in the future. Water quality is affected by tidal flows and flushing in canals and other factors like the number of turns, orientation, weed rack, depth. The other issue is how the limestone is like sponge and substances in the limestone may take a while to be flushed out of the system. There also a layer of this fluffy, unconsolidated organic material at the bottom of the canal that sucks oxygen. Aerators and pumps may assist in this process. They will be looking at ways to ameliorate these water quality issues in the canals. With the sewer system, water quality will eventually improve but will take a while.

Some questions and comments were made from the audience regarding algae blooms that caused depletion of the dissolved oxygen in local canals that resulted in fish and lobster kills. Shallow canal entrances and long canals with lots of turns have very low oxygen

levels toward the end because of the lack of flow/flushing. Aerators have helped with this problem in several canals in the lower Keys, however, aerators do not reduce the influence of nutrients or pollutants in the canal. Reducing the nutrient load is very important. The weed wrack that accumulates in some canals really contributes to depleting the oxygen. Not all canals are equally affected by weed wrack materials. Canal water quality can be a complex problem. Mechanical means might be a way to deal with some of this extra material.

Mr. Parsons commented that it doesn't take much in the way of nutrients to affect the system in the Keys because it is sensitive to nutrients and the effects of such changes can be seen for many years. Dr. Kruczynski reiterated what was said at the meeting yesterday and let the steering committee know that this is not another canal study that documents the problem. Instead, it will be investigating what needs to be done to improve the canals. Mr. Peyton added that he is anxious to get people working on this issue in the next few months. Mr. Harvey reminded everyone about the residual material in the canal that continues to contribute to the degradation of canal water quality. It is the right thing to implement the wastewater master plan, but that in and of itself will not bring the canals back to class III. They will look at things like removing sediment and other mechanical methods that could help improve. The Athens folks will complete the field work and some modeling, but will not be doing the engineering evaluations needed to determine the costs for dredging, etc. The engineering and implementation will have to be done by someone else due to lack of funds.

VII. FKNMS Monitoring Program Review, Dr. Bill Kruczynski, Dr. Pete Kalla, EPA, Region 4

Dr. Kruczynski introduced the monitoring program, which began in 1995. One of the main goals of the program was to track the status and trends of water quality, seagrasses and coral reefs in the Keys with the purpose of detecting changes that take place over time due to wastewater improvements or restoration activities on the mainland. The water quality monitoring program is part of the sanctuary's science program. In 2000, the science program underwent an independent external review to see if the research is meeting sanctuary managers' goals. This report stated that the sanctuary was basically on track, but they needed a science plan to identify needs and streamline programs when possible. Both of these things have been done over the years. Last year, a second review was conducted because a request by Mike Collins. A sanctuary science plan was developed as a result of recommendations made from the 2000 review. Another similar review was conducted last year by Battelle. This reported suggested conducting a statistical analysis to see if the program could be streamlined in any way. At yesterday's meeting, some possibilities were discussed with the principal investigators. They will be meeting further to continue these discussions and will report back next year about any changes. Mr. Kalla added that the plan is to discuss ideas and details at one-two day workshops held in the near future. They recognize that the program has evolved and needs to continue to evolve. No decisions have been made at this time and they plan to be very deliberative about this process. They will be considering the possibility of adding probabilistic elements to the design and sentinel stations. Mr. Harvey mentioned that EPA has funded the majority of the program and the budget is not expected to increase

soon. The idea is to concentrate on the most important management information needs. The goal is to adequately characterize the resource. They may want to focus on zoning and take a look near the Keys themselves where land activities are impacting the water. Scientists understand these issues the best. EPA wants to hear from everyone. Typically, when this committee meets in January, they propose a budget. This year it was 100% EPA and they would like to see other agencies make contributions. The canal study will be done with EPA money and will not affect the monitoring budget. As far as Mr. Harvey is concerned, they will be considering all options on the table in terms of revising the existing studies. They do need to make sure that the information needs are met. There are several ideas for special studies. The management committee working with their supervisors needs to help shape these questions. Mr. Peyton added that it would be great if there was some way to do monitoring studies to free up funds for special studies without compromising the monitoring efforts. But, he wanted to make it clear that the work from his group is coming out of his budget.

Dr. Causey stated that he has heard Dr. John Ogden tell people in international venues, that this sanctuary has the most comprehensive monitoring program as any place in the world. In addition, this reef is used heavily. For that reason, it is important to get this right. Until the funding opportunities changed within NOAA a few years back, the sanctuary had dedicated money for the monitoring studies. The sanctuary is constantly on the search for new funds. NOAA's Coral Reef Conservation Program (CRCP) has picked up the costs for some of what was lost and that has been very helpful. The sanctuary just met with the director of the conservation program, Kacky Andrews. The CRCP has been reconfiguring its goals and plans to focus on the following: land based sources of pollution, climate change and fisheries. Dr. Causey added that the sanctuary needs help in letting principals know about importance of having the Keys studied. The sanctuary exhibited the effects of climate change before many other areas and may be considered a national sentinel site for climate change. He is not asking anyone to lobby. Mr. Harvey reminded everyone about the time that the sanctuary coordinated the presentations from scientists in Silver Spring about work done in the sanctuary. It might be a good idea to do something like this again to show the results of the programs. Dr. Causey also reminded everyone that Dr. Jane Lubchenco, NOAA's new administrator, is a marine ecologist interested in spatial planning and climate change issues. He cannot think of a more appropriate site to study climate change. Mr. Harvey added that a lot of other efforts around the world are based on the monitoring done here first.

Mr. Popham wanted to express some caution. He recently learned that the SEAKEYS program is no longer being funded and that is a critical program that is going to go away. It is important to approach this carefully. This monitoring program is a benchmark for around the world and we are now just now seeing results that we can quantify and qualify. In his view, the bigger push should be to get more funding and add more things like canals and to do things that affect change. Water quality is one of the three key objectives for the SAC. He agrees that the program should go to D.C. to show what is being done to get more funds. Mr. Peyton added that the EPA program is shrinking drastically. It is imperative to continue to show results from the monitoring that is being funded. Mr. Popham recalled about three to four years ago when WQSC was not

meeting regularly. The SAC helped to get things back on track based on a groundswell up from the community. There is support in the community, but we need support from D.C. Everyone is fighting the same economic battles and diminishing funds. He is committed to seeing these programs continue long term because of their value and supports the idea of taking the results to D.C.

Mr. Johnson added there are similar studies going on in adjacent waters by the same investigators and it is important to make sure the results from these studies are considered in the review. Some of the impacts that are seen originate in adjacent waters. He also mentioned that the South Florida Ecosystem Task Force/Working Group is undergoing a restructuring of sorts. Some of the research topics that were recently deemed important include exotic animals and their effects and controls. He agrees that it is important to keep pushing these topics and science done here could be important for restoration. Sometimes, the focus is lost with the engineering details, but the system is connected and the science should be driving the restoration.

Dr. Causey agreed with Mr. Johnson and added that NOAA is a charter member of the Task Force because the sanctuary is at the receiving end of the system. Recently, scientists and managers have just started to talk about the fact that areas that receive a lot of freshwater seem to be hotspots for acidification. Ocean acidification is not uniform throughout the ocean. Carbon can cause the carbonic acid to rise and that can impact the skeletons of corals, lobsters, etc. It is really important to pay attention to the west coast of Florida and any animals that use calcium that could also be impacted.

Mr. Harvey added that the funding for the water quality stations in the SW Shelf were dropped, but fortunately Ms. Anne Morkill was able to fund them. There are no funds for next year, though. This group might want to consider what to do about that because it is necessary to know what is coming into the system from that area.

Mayor Worthington added that there have been a lot of studies done over the years that concern the canals and Boot Key harbor, for example. Some problems with the canals were identified back in the 1990s. Similar studies were also done on the West Coast of Florida. It might be a good idea to revisit some of the sites that were included in earlier studies to see the nutrient changes that may have taken place, even if it means doing Little Venice testing every other year. Older studies might be helpful in detecting the long-term changes that have been taking place. Mr. Iglehart asked if the committee wants to direct the management committee to look into these topics. This topic can be resumed after lunch. There were no other comments on the subject.

Break for Lunch. Resumed meeting at 1:30.

Instead of continuing with the monitoring results, Ms. Liz Wood, Monroe County, added to the summarization of the status of the wastewater systems in the county. The entire Keys community has made a lot of progress in the last four years and they are almost 50% compliant in Monroe County. The Big Coppitt treatment plant was commissioned last Tuesday. Ocean Reef has begun construction of their treatment plant upgrade and

Marathon has moved many EDUs from design to construction as was mentioned previously by Susan Thomas. The Duck's Key treatment upgrade was recently approved by the county and that moved another 1600 EDUs into construction. She expressed some disappointment over the fact that the stimulus package was \$800 billion and the state of Florida only received \$132 million in SRF funds for clean water. This state has a huge coastline and a reef that contributes to the economy significantly. About 70% of fish and shellfish that are caught in the Gulf and Atlantic regions travel through the national marine sanctuary. Fishing is a \$125 billion industry, which is a fifth of the stimulus package. There is a sustainable industry that is being overlooked. She is hoping that we can look beyond our boundaries to get the funding needed to address this issue of nutrients because nutrients affect places elsewhere because of the connectivity. As a community, some thought should be given as to how committed we are to completing these projects on behalf of recreational fishers and people who fish to sustain themselves. From an engineering and planning perspective we are on task, but the money was not there. Now, they are trying to figure out about whether the community will extend sales tax and if not, they may have to do a second assessment or they have to give the money back, which is a difficult task at best.

The science that told Ms. Wood that wastewater and storm water has impacts on the local water quality has led the community to this point of improving wastewater. It took 25 years to get here today and this is just the beginning. Farfield sources will have to be addressed and we will need to show how valuable our oceans are to society. The county recently eliminated 500 onsite systems in certain areas by reexamining the master plan and allowing them to hook up to central treatment. They still need the money for the Cudjoe system. She would expect to see increases in home foreclosures if the costs become too high for residents since the mean income in the county is \$58K per year. This community needs to be saved and the work needs to be there to make more effort to get the money. There are only 75,000 people in the county to share the financial burden of these upgrades. Ms. Wood is tracking EDUs and connections on a spreadsheet, which eventually will be necessary for the Reasonable Assurance Documents.

Mr. Harvey pointed out that they will still need some EDU information to show measurable outcomes for this program. The connections, etc, are one of the more tangible things that they measure and have to report to Washington. She is tracking the projects from design to construction to completion. If only the connections are reported, that should be done with caution.

A. Data Management, Mr. Chris Anderson, Fish and Wildlife Research Institute (FWRI)

Mr. Chris Anderson explained that one of the main tasks of this data management project is to continuously enter data into STORET (EPA water quality/biological) database. Data are also sent to the national data warehouse in Washington DC, where anyone can query them. They also submit data to DEP for use in TMDLs and other things. He does a lot of one-to-one work getting the information from the PIs and then converting it into STORET. The old version of STORET was a very difficult database with which to work. EPA recognized this limitation and has finished converting to WQX. DEP is working on

a version of STORET. FWRI will adopt WQX as FL DEP transitions from STORET to WQX in late 2009. They have a website (http://ocean.floridamarine.org/fknms_wqpp) with the data and reports and a CD rom with the same information. The metadata and descriptions of methodology are provided on the site. They are not including everything, but are providing a snapshot and then interested parties can go to the investigator's website for more information through links that are provided on the site. One idea that came across from the meetings in the past is to make these data available to the general public in a form that is more understandable. Mr. Anderson's team has been working on that task using Google Earth software that makes the data accessible by anyone. There is a tremendous amount of information that has been collected for the projects. They have developed Google Earth maps containing the study sites with data that is viewable using a mouse rollover. Thus, a single map can contain many layers of information displayed in a visual format that can be accessed upon request. He is working with corals right now to get their data in the system and they are determining the best way to disseminate this information. The website is very useful for program reviews, etc. and the entire website can be put on a CD for use when the internet is not available.

This project takes care of storage of raw and synthesized data collected by the monitoring programs and special projects. All data are backed up and stored in a waterproof fire safe in case of hurricanes, etc. He also pointed out that FWRI is involved in another project in the sanctuary that is water quality related. They work closely with the Coast Guard., DEP, EPA and other folks involved in oil spill response. They have helped create the Digital Area Contingency Plans (DACP) and are now finalizing DACP for USCG Sector Key West. The DACP contains information used by responders in an oil spill and can be put on a CD for easy distribution in an emergency. Mr. Anderson can provide anyone with an updated monitoring program CD upon request.

B. Water Quality (Sanctuary/Little Venice/Port Everglades), Dr. Joe Boyer, Florida International University

Dr. Boyer will show everyone where the 2008 annual report can be found on the website at the end of the presentation. The report is too large for email. The objectives of the project from the very beginning were to determine the status of water quality in the FKNMS by developing a long term database, assess the temporal and spatial trends in water quality in the FKNMS and surrounding waters. Early in the process, they added these ideas of regional integration of water quality from other monitoring programs to aid in evaluating the relative effects of internal and external influences on water quality

On a quarterly basis, they sample 155 fixed sites from Key Largo to the Dry Tortugas. Sampling is a semi-synoptic event (generally within a month or two). At each site, they collect vertical profile data, including salinity, temperature, density, dissolved oxygen light penetration, turbidity, and chlorophyll fluorescence. The surface and bottom water is analyzed for nutrients, ammonia, total nitrogen, total phosphorus, silicate, total organic carbon and chlorophyll. He showed a map with the sanctuary sampling sites, which are funded by EPA, and the west coast sampling sites, which have been funded by the SFWMD for a long time. The SW Shelf sites were dropped from the program in 2007

due to lack of funding, but then Fish and Wildlife Service was able to provide funds to keep them operational and there is a crew out on the shelf right now. However, those funds were for one year only. Mr. Peyton asked if there was any chance of getting the money for the SW Shelf from the water management district again and Dr. Boyer replied that it was not possible. The district is still monitoring the area using contractors, but he has seen no data as of this time. FIU is no longer sampling the bays, either and has not seen any data emerge as a result of the contractor's sampling work. Dr. Causey reminded everyone how important the shelf monitoring data was for ruling out agriculture as the cause of the "blackwater" event that was so visible in 2001-2002. The next time this won't be possible because the monitoring won't be there and even if it is not true, agriculture might be blamed. Dr. Causey explained that it is so critical because the water doesn't stop at the coastal margin. Using the data from other programs, Dr. Keller was able to put together a scenario that explained the cause of the bloom, which was a natural event. Mr. Genovese doesn't know the specifics of why things changed with the shelf funding. Dr. Causey added that Naples newspapers were blaming big sugar, but they were able to show that wasn't true.

Mr. Charlie Causey stated that algae blooms in Florida Bay have been of interest to him for many years. He inquired as to whether the monitoring on the SW Shelf would show the increase in nutrients on the west coast. Dr. Causey responded that at this time, the sampling would not capture the area far enough away from the shelf. They can pick up some of the other algal blooms that are closer to shore. Mr. Charles Causey thinks that the nutrients along the west coast should be assessed to see if they are affecting the Keys and see if something can be done to prevent blooms. Dr. Causey explained that the system is still broken and once it is fixed through restoration, monitoring will still be critical so that the system can be managed in an adaptive manner. This is really more evidence that the quality, quantity and timing of water distribution need to be done right. He wanted Mr. Genovese to know the history of sampling the shelf and thinks that it is the business of the district and the corps as partners in water management to know the quality of the water that they are managing.

Mr. Johnson added that the district is now contracting to collect the water samples and analyzing them in-house. His group wanted to fund what was being lost, but the district said that the loss was not there; they were just doing their own lab work. But, he keeps looking at the database and there is nothing there. If data are being collected, they are not being posted anywhere. Mr. Causey asked about the cost of the shelf stations, which will be going away after this year. The cost is close to \$150K.

Analysis of long-term record for nitrates along a transect from shore to offshore shows an elevated level in inshore waters of the Keys as compared with offshore or with the Tortugas. A small amount of this is due to an "island effect", which is observed even in the uninhabited Tortugas area. They do not see elevated TP or CHLA in Keys or Tortugas transects, but do see elevated total organic carbon (TOC) & total organic nitrogen (TON) in Keys but not in Tortugas transects. EPA requested that the program develop strategic targets for light penetration, chlorophyll, ammonia, and total phosphorus (TP). These targets were based on the data up to 2005. They are very

stringent targets and that may prove to be a problem. For example, .2 mg per liter of chlorophyll, the value for 2008, on the reef is very, very low, especially when compared with the level of detection for chlorophyll. In 2008, 64.7% of the reef sites were above the target. Light penetration is also measured and a low value means greater penetration. About 25% of the reef sites were above the target value for light penetration and about 10% of all of the sites were above the ammonia target. The TP target of .20 mg per liter, which is below 10 ppb set for the Everglades, was exceeded in 52.7% of all stations.

Rainfall is very important because it directly and indirectly affects water quality. He showed a chart of the rainfall comparing the average rainfall with the actual rainfall for each month in 2008. Last year had a drier than normal spring, but a wetter than average summer. This rainfall pattern resulted in hypersalinity developing early in the year. Even though there was water coming out of the Everglades, it was not enough to affect the western part of the bay at all and that also affects the Keys. This pool of hypersaline water runs down the bayside of the Keys. It was exacerbated in the late summer when it reached salinities of 55 ppt., but it came back down in the fall. In terms of chlorophyll, it is highest in the fall. The stations along the Gulf boundary of the Keys are the ones that are exceeding the EPA chlorophyll targets. It is easy to see that there is water moving down on the bayside that is bringing nutrients. Light penetration slide pointed out turbid areas, mostly on the bayside, rather than the ocean side. Maybe the targets should be specific to the different areas because of the differences in the water in the region.

There was an interesting event with regards to ammonia in 2008. The surface waters in the Marquesas and Tortugas had pretty high ammonia levels. A slug of high level nitrogen appeared in the Marquesas area earlier in the year and then again in the fall. This points out that there are a lot of nutrients that are coming down through the system that are not being accounted for (outside of the sampling boundaries).

In terms of total phosphorus, it was relatively high on the ocean side in the Upper Keys and typically, the Gulf has high levels. During the fall, there were high concentrations in the same bayside lower Keys area.

Dr. Boyer then showed a simple plot that shows the four quarterly samplings in the reef tract and Tortugas clusters taken together and comparing them to the median for the 15 year record. In 2008, TON levels tend to be higher than normal and TOC was much lower than the median. This low TOC is the result of a long term trend in declining organic carbon coming out of the Everglades and through the system. Phosphorus on the reef tract is a little higher than normal, and chlorophyll is slightly elevated. Dissolved oxygen is better than the long term record. Light penetration was better in many areas than the long term record.

When analyzing the inshore to middle keys station cluster compared with the long-term median, hypersalinity observed in 2008 is very apparent. With that hypersalinity, there are much lower nitrogen levels and that is indicative that freshwater is the source of the inorganic nitrogen. The backcountry north sluiceway area on the Gulf side showed some high salinity levels and low dissolved oxygen levels. This is a good way to compare years

to the long term record. Dr. Boyer is not doing a full blown trend analysis this year; it is usually done every five years for every station.

In terms of regional integration, there were several programmatic issues. SFWMD cancelled SW Shelf monitoring September 2007 and they cancelled the contract to sample Biscayne and Florida Bays as of September 2008. Some monitoring of bays is supposed to be ongoing, but data is unavailable. He will incorporate these data when they become available. The district is in process of “re-engineering” network sampling design, including pooling sites, etc. Fish and Wildlife Service contributed to FKNMS program, freeing up funds to monitor SW Shelf for one year (starting 7/09).

Dr. Boyer showed a regional map depicting the regional circulation. Characterizing the internal and external sources of nutrients has proven to be somewhat complex and there are several presentations on the topic. The Keys are next to a huge stream of flowing water, which has low nutrients in its surface waters, but relatively high levels just beneath the surface. Upwelling events and things like that stir up nutrients, too. He shared this quote from Scott McClelland about the Keys, “The Keys are different from any other place that the team has encountered because the far field sources dominate over the near shore sources.”

Dr. Boyer pointed out that the water quality monitoring program has been instrumental in showing the effects of far field sources. Water quality responds to differences in long term changes in water masses moving through the system. The Gulf of Mexico is a huge influence on the system. He thinks a nutrient budgeting approach might help in the future. More of these kinds of studies will help. The modeling has not gone very far and needs to engage with the model from the Florida Keys Feasibility Study. He stands ready to modify the program as seen fit by the management and steering committees. The data and reports are available on this website: serc.fiu.edu/wqmnetwork/.

Mr. Harvey asked Dr. Boyer what the minimum number of stations would be necessary to adequately characterize the water in the shelf area. There are 49 stations on the shelf now. Dr. Boyer recommended cutting the number in half before the program was cut the first time. It would probably work okay with 25 stations in that area. Mr. Harvey asked if 25 stations from elsewhere could be cut to make up for that loss. Dr. Boyer explained that it would be hard to decide which stations to omit. NOAA’s AOML staff still samples every two months in Florida and Biscayne Bays, but does not sample the shelf.

Mr. Iglehart had a question about the high salinity and the role of rainfall vs. surface water inputs from the land. Dr. Boyer responded that both rainfall and evaporation play a big role in salinity. Several years ago, Dr. Bill Nuttle studied the water balance and determined that rainfall is just about equal to evaporation in south Florida on an annual cycle, so even small changes affect the salinity levels. Any change in water flow management or in rainfall has a big effect on water salinities. Mr. Iglehart stated that then the opposite would be true for a very wet season. Dr. Boyer pointed out that this sensitivity to inflows applies to the entire west coast. Mr. Johnson added that the benefits to the bay and Keys are much greater when the water is delivered through Taylor Slough

rather than in the northeastern bay. There is not enough water overall, but it will make a very big difference to use the water that is available in a better way. Dr. Causey mentioned that during the 1987 die-off of mangroves and seagrass were dying because of the high salinities. Dr. Boyer noted that he is concerned about the effects on the sanctuary because the saline water moves down through the backcountry along the Keys.

Mr. Causey asked if Dr. Boyer could get a number to show the percentage of nutrients coming from the shelf as compared with nearshore waters. In other words, is it possible to get a number that depicts the phosphate load coming down through that area? Dr. Boyer responded by stating that it is very difficult. In the past, he conducted a study involving Long Key Pass that calculated current and nutrient loads. The nutrient flow there is as great as many rivers. To get the input from the entire shelf could be done, but it would be expensive. It would require nutrient data and a series of current meters. Mr. Causey asked if it would be possible to obtain a measurement for an unusual event like those that have happened in the past. Dr. Boyer said that it could be done if they knew how much mass of water was flowing through and how fast, a measurement could be calculated.

Mr. Ruzicka inquired about long term regional trends in the water quality data. He commented that it looks as though the hypersalinity came down the on the back side of the Keys and then wrapped around the ocean side. Dr. Boyer stated that they typically see higher nutrient levels inshore. These data can be viewed both regionally and/or together. Trends tend to start and reverse and then start again. They want to look for cycles of 2 or 5 years, for example, with these events that take place when different masses of waters from the shelf come down to the bay and Keys. The drivers for these events are out in the middle of the Gulf of Mexico, which makes it hard to get a handle on these drivers without real satellite measurements and well-developed models. Typically, along shore the concentration of nutrients is lower in the Upper Keys.

Mr. Harvey inquired about the capability of Dr. Boyer's team to collect field data in response to an event. Dr. Boyer said that it could be done, but Mote Marine Lab's MEERA is set up to that kind of thing and regularly respond to reports of fish kills. He added that there has been discussion about what can be done to get early warning of events like the blackwater event. Remote sensing might be helpful, but it may not show up on the sensing. Taking a sample doesn't always answer the question, either, though. There has been talk of having a subset of sites that are sampled on a more frequent scale (monthly, weekly, hourly). They might be able to partner with AOML to get nutrient sensors in place. There are possibilities, but there should be a response trigger. His crew is Key Largo based and they keep a boat at the Key Largo ranger station. He can hire two private captains, too. They can mobilize if he receives a call from Billy about an event.

Councilman Pete Worthington mentioned that he had heard reports of deep water being warmer in the deeper areas. Dr. Boyer calculates the density of surface and bottom waters at sampling sites in deeper areas. Typically, the bottom water is cooler and denser, but the reverse can be true. They see the hot saline bay water coming in to the ocean side and going underneath the water above.

C. Little Venice Canal Study, Henry Briceno, Florida International University

Dr. Henry O Briceño gave a slide presentation about the Little Venice Water Quality Monitoring Program, which began in 2001 using EPA and State of Florida funding. The goal of the program was to track water quality changes with the implementation of wastewater treatment. Fecal coliform and *Enterococci coli* are two traditional inexpensive indicators of fecal contamination that are used in the study. They are not the cause of contamination themselves, but only indicators. Indicators are complicated because sources (soil) other than sewage can affect the indicators. His team has done a lot of work to extract the information from the data. He showed a regional map with the inputs and currents in the region, including the water from the Everglades.

He explained that the water quality in the Little Venice area is the result of a dynamic interaction of complex environmental conditions with a man-modified landscape. He showed an aerial photograph of the complex canal system that is part of the study, followed by a diagram depicting a cross section of the canal system with houses, high/low tide, cesspits, leakage, runoff, organic debris and stirred sediments. These factors affect water quality at the site or most local level. There is a great deal of organic matter accumulated on the bottom that serves as soup for bacteria. They even still have some coprolites at the bottom. Tides and currents stir up sediments and that will increase the bacteria in the water column. All of these conditions affect water quality. In the 1980s, water quality in 89th – 91st street canals was studied in 1984-1985 (FDER, 1987). They found significant nutrient enrichment of the canals, high chlorophyll-*a* content, and high coprostanol concentrations in sediments. Coprostanol is a byproduct of cholesterol and is associated with humans.

In order to address this pollution, they implemented phase I of monitoring (pre-remediation), which lasted from 2001 to 2003. Phase II began in 2005 and ended in 2009. Sampling took place every week for bacteria and nutrients at monitoring sites in 3 canals, one control canal, offshore and sample site note within the canal. They took surface samples at the head of the canal (mouth) and end. They identified changes by comparing before and after mean concentrations, before and after number of exceedances and before and after concentration ratios between remedied and control stations. They found that nutrient values, especially nitrogen, were higher in phase I when compared to phase II. There are trends outside of the canal that are related to larger scale phenomena that are out of our control. For example, Everglades' waters are now adding fewer nutrients to Florida Bay than 10 years ago and there are other changes due to climate change. In the results, they see that TP levels at the heads of the canals are generally greater than at the mouths. The TP values are high in the head of the control canal, the one that has not been remediated. The phosphorus is even higher in phase II in this canal. Chlorophyll values are significantly greater in phase II than in phase I. They have been increasing everywhere throughout the study area, not just in Little Venice. Salinity is also higher in phase II than in phase I. It is higher everywhere, including the whole of south Florida, including the bays, shelf, etc. This may be due to sea level rise or other reasons and may explain some changes observed, like those related to phosphates

because marine waters are higher in phosphorus and lower in nitrogen. They also examined exceedances. In phase I, TN was exceeded 60% of the time. Since remediation, they have decreased at all stations. They have also seen improvements in the dissolved oxygen. Before remediation in phase I, they were below the 4 mg/l standard of DO 70% of the time, but that is much better in phase II. In terms of fecal coliform and *E. coli*, those stations in worse conditions in Phase I experienced the largest improvements.

To provide a measure of improvement, the ratios of how the indicator values related to the control station before and after remediation were calculated. This meant that the canal was not compared to itself, but to a control canal before and after the study canal itself underwent remediation. This method eliminates other influences that affect all of the canals equally. When viewed using the ratio approach, the canals have shown great improvement by decreasing 50% or more in sewage indicator values. The trend of improvement is in the right direction and canals that have been treated are in better shape than those that are not treated. Basically, after remediation canals that were in worse shape became closer to control canals.

One of the main conclusions was that trends in nutrient concentrations are not unique to Little Venice canals, but seem to partially respond to large scale phenomena, which strongly influence regional water quality. The relevance of this fact is that regional processes may drive these nutrients concentration beyond changes induced by remediation activities. Both, fecal coliforms and *E. coli* counts have declined after Little Venice received the low-pressure, vacuum wastewater collection system to convey wastewater to a central treatment plant. This decline is in absolute terms and relative to the un-remediated sites. Their results suggest that polluted sites may be improved by remediation actions, as those performed in Little Venice, by close to 77% for fecal coliform and 57% for *E. coli*.

Given the evidence that fecal coliforms and *E. coli* occur in soils and sediments, that residual bacteria survive for months in dried algae and readily grow upon re-hydration, immediate remediation results may be masked. Hence, it is advisable to implement new methodologies, such as Microbial Source Tracking techniques to directly assess the type and amount of bacterial contamination. Removing the sources of wastewater (septic tanks and cesspits) in Little Venice Area has lead to water quality improvements by eliminating a substantial portion of bacteria and nutrient loading into the canals. Hence, similar remedial actions are recommended for other impacted areas in the Florida Keys.

D. Coral Reef, Mr. Mike Callahan/Mr. Rob Ruzicka, Fish and Wildlife
Research Institute (FWRI)

Mr. Rob Ruzicka named those persons who are working on this project and presented the results of the CREMP 2008 data collection. Originally, the study had 43 sites with 172 stations throughout the sanctuary and Dry Tortugas. In 2008, underwent reduction in sites, mostly at the hardbottom sites where coral cover is so low that it is sometimes hard to detect changes over time. Today, the sanctuary has 35 sites, with 101 stations. The hardbottom habitat has 1 site/4 stations, patch reef has 11 sites/32 stations, shallow fore

reef has 12 sites/39 stations and deep fore reef has 11 sites/26 stations. The Dry Tortugas has a total of 3 sites with 12 stations: deep fore reef (2 sites/8 stations) and patch reef (1 site/4 stations). There has been no reduction in station number in the Dry Tortugas since the establishment of the sites in 1999. Mr. Ruzicka explained the site and station transect set-up. Divers swim with video three different transects within a station and each station covers an area of roughly 44 square meters from inshore to offshore. Divers swim to collect data for the station species inventory. They document species richness, inventory of coral disease based on presence or absence and conduct *Diadema* (urchin) counts. The digital video transects give 65-85 frames per each of the three transects. From the video, they are able to get coral cover/benthic community composition (sponge, macroalgal cover).

Mr. Ruzicka summarized the results of the species richness inventory from 1996 to 2008, broken down by habitat (hardbottom, patch reef, shallow fore reef and deep fore reef). Most sites have declined in species richness on average lost 2.5 species per station. This loss applies to all habitat sites. The decline in the mean at shallow fore reefs is less because initial species richness was low. There are some sites that have increased in species richness, though. Reefs are dynamic and are changing through time.

A graph depicted the difference in species presence/absence from 1996 to 2008 at the 101 stations. Three corals, *F. fragum* (golfball coral), *M. lamarckiana*, and *A. cervicornis* have disappeared from greater than 50% of the stations and there were significant declines in the presence of seven of the inventoried species. Mr. Ruzicka showed the results of the coral disease inventory for blackband, white disease and the other disease category. In the sanctuary, the presence of disease greatest between 1999 and 2003, then leveled off and decreased in more recent years. In Dry Tortugas, the disease peak was reached in 2004. This area experienced mortality in *A. cervicornis*. Hurricanes passed through and damaged the one patch reef site and so the decline in disease after that period on the graph was related to the reduction of *A. cervicornis*. Typically, blackband disease has remained relatively low throughout the study period. This methodology does not provide a measure of lethality or provide information as to how the disease is affecting the coral. To answer some disease related questions, they conducted a coral disease lethality survey in 2002-2005. In this study, 646 coral colonies were tracked at nine CREMP sites. Seven percent of colonies tracked over three years suffered complete mortality. Many of these losses were the smaller golfball corals. About 50% of the tracked colonies had partial mortality and about 15% were actually able to recover and regenerate tissue.

Mr. Ruzicka showed a graph of stony coral cover sanctuary-wide that combined all data from 1996-2008. The graph shows the four phases of decline. The first phase took place from 1996 to 1999. This decline was due to severe bleaching from thermal stress in 1997-98. This thermal stress and bleaching event was documented globally. In the Keys, Hurricane Georges came after the thermal stress and caused further impacts. This period of decline ended in 1999 and was followed by a relatively stable period. Then, a decline appeared between 2003 and 2004, but this decline might not be sanctuary-wide. They are still trying to determine if that drop was due to a few sites or sanctuary-wide. This time

period did not have high temperatures or hurricanes, so it is hard to say. The hurricane season of 2005 and 2006 resulted in a significant decline. The percent coral cover appears stable after 2006 and there is no significant difference between 2007 and 2008 with respect to coral cover. Mr. Ruzicka explained that it is helpful to examine their results at the site and even sometimes, at the station, level. He added that it is interesting to look at the data from 1999 to 2008, leaving out the period of decline beginning in 1996 because that story is already known. When viewing the data by site and percentage of decline/gain, it is apparent that many sites in the lower Keys showed greater than 25% declines. Based upon Dr. Boyer's presentation, it is very interesting that the lower Keys sites are in offshore shallow and deep fore reef sites. Due to the blackwater event of 2001, the backcountry patch reefs declined significantly. There are a few ocean side patch reefs that show increases in coral cover. The middle Keys didn't have much change, but Molasses reef in the upper keys showed an increase in coral cover in the last decade.

Dr. Causey pointed out that the water from Florida Bay comes out toward the reef track in the lower Keys. The best recovery of *A. palmata* is taking place in the north, where the influence of bay water is less. Mr. Ruzicka commented that it was very important to look at these sites individually, too, to get the full story. They have documented on video what seems to be a recovery of *A. palmata* at Molasses reef.

As part of the project, they examined stony coral cover by region, which involved comparing the coral cover in 2008 with a 1999 baseline. There were no significant declines in the lower Keys and Dry Tortugas, but no changes in cover in the Middle and Upper Keys regions. The greater losses noted for the Dry Tortugas were due to disease and hurricanes. CREMP also broke the data down by habitat for the same period and noted significant declines in coral cover at offshore deep & shallow fore reef sites, but the no significant declines at patch reefs. Eight of nine patch reefs (excluding back country sites because of blackwater event) demonstrated no change or a gain in coral cover between 1999 and 2008. The question as to why the patch reefs are doing well, it helps to look at the species composition, which is different for different types of reefs. The species percent coral cover (sanctuary-wide) 1996-2008 was determined for the common species. *M. annularis* is most abundant species by cover. There was a collapse of *A. palmata* between 1997 and 1999 and again starting after 2004. The coral cover for *M. cavernosa*, *C. natans*, and *S. siderea* is relatively similar to 1999. *P. astreoides* has been slowly declining since 2002. In terms of change in coral species percent cover in the lower Keys, the coral cover loss at deep fore reef sites was due to *M. annularis*, *M. cavernosa*, *C. natans*. The decline at shallow fore reef sites was due to *A. palmata*, *M. annularis*, *P. astreoides*. In 2008, the percent coral cover for *M. annularis* and *M. cavernosa* at patch reefs remained similar to 1999. This decline is huge at deep sites. Even a weedy species like mustard coral that regenerates quickly also shows large declines at shallow sites. A look at the patch reefs shows that many common species remain similar to 1999 levels. In the Upper Keys, there was a decline of *M. annularis* at shallow and deep fore reef sites especially Carysfort and Grecian Rocks. The changes at shallow fore reef sites are site specific. *A. palmata* is slightly increasing at Molasses, decreasing at Grecian Rocks. At the patch reefs, coral cover of *P. astreoides*, *M.*

annularis, & *S. siderea* is unchanged or slightly increasing. The patch reefs show more resiliency and better tolerance to recuperate. In 2002, CREMP began installing in situ temperature data loggers at all sites representing different habitat types. They looked at the temperature results at different sites from June to October 2003 and then again during the same period in 2007. Temperature data documented that in the summer, the inshore patch and hardbottom sites experienced highest temperatures and that there was a significant difference in temperature regime between shallow fore reef and patch reef sites. All sites experience several weeks or more above 30° C, but higher temperatures did not have an adverse effect on all sites (e.g. Jaap reef). This observation runs contrary to the conventional dogma that corals need optimal water quality conditions. In winter, the patch reef sites are subjected to much cooler water temperatures than offshore shallow sites. Inshore patch and hardbottom sites experience lowest temperatures. Most differences in temperature regime between fore reef and patch reef sites take place during the early winter. The patch reefs are undergoing a phenomenal amount of stress over the year. This exposure might toughen them up against bleaching somehow. Other factors, including turbidity and irradiance may also play a role in influencing how temperature affects coral because high temperatures did not always result in bleaching.

CREMP also examined the recovery of *Acropora palmata* by fate tracking 105 colonies from 2004 through 2007. In 2004, healthy colonies were noted at Rock Key, but declined after Hurricane Dennis in 2005 and were completely gone in 2006. Of the 105 colonies tracked, 88% of them were lost due to disease and hurricanes. They are also conducting expanded monitoring including targeted benthic fauna surveys that involve sponge surveys and fate tracking *M. annularis* and the sponge, *Xestospongia muta*.

Mr. Ruzicka summarized the current and future initiatives of CREMP. At the request of the sanctuary, they recently installed six new patch reef sites (2 in each region). He stated that it will be interesting to classify these sites according to the TNC scheme and see how they fit into that model. They will now have additional sampling effort on the patch reefs. He has recently discussed with Chris Bergh the idea of incorporation of CREMP sites into TNC Disturbance Response Monitoring. They discussed with EPA about the inclusion of a probabilistic sampling design to corroborate results from fixed sites. They will be picking up the population and disease assessments, which have not been done in the past few years. They will be moving to high definition video in 2010, which will expand their ability to detect small recruits and identify macroalgae.

In summary, major losses in coral cover in the FKNMS have occurred after hurricanes and during major thermal stress events, however, disease is a consistent cause of mortality. There is an ongoing significant decline in coral cover at the Lower Keys shallow and deep fore reef sites. They will look for a water quality pattern to see if that is affecting these sites. Over the last decade, eight of the nine Atlantic patch reefs have showed no significant decline in coral cover. Corals at patch reefs experience greater fluctuations in water temperature than fore reef sites. They also experience more turbidity, which reduces irradiance exposure. Changes observed in cover may be site specific, though. Declines of coral at CREMP sites located within Sanctuary Preservation Areas are noticeable especially in Lower Keys (like rock key, sand key),

which might be important when re-evaluating FKNMS marine zoning strategies. Mr. Ruzicka extended a very special thanks to Fred McManus for his help with the program.

E. Seagrass, Dr. Jim Fourqurean, Florida International University

Dr. Fourqurean addressed the committee about the benthic habitat (seagrass) monitoring program. This project tracks the status and trends of seagrass/benthic habitats in the sanctuary on a regional, not a very fine, scale. With relatively limited resources, they have been asked to describe the condition of about 10,000 square kilometers of seafloor. Thus, the methods have been designed for that purpose and the effort is somewhat diffuse because of the large study task. They measure parameters that are related to water quality and how it affects benthic habitat structure. One of the many pre-defined management goals is to understand the nutrients and how they are having an effect on the benthic organisms. Another is to develop and use explicit models of things that they monitoring change as nutrient availability changes. Their measurements must be precise enough to allow for change detection and be statistically defensible. It is also important to provide information that can be used to inform resource managers of problems before undesirable changes occur. It is best to predict the losses in advance so that there is time to react. He will discuss the distribution and abundance of seagrass and not spend a lot of time of probability sampling. He will also discuss species composition and nutrient availability and stable isotopes.

He showed a slide of the eutrophication model upon which the sampling is based. Plants require different nutrient conditions and the faster growing plants need more nutrients, while slower growing ones prefer lower nutrient conditions. The slowest growing marine plant in south Florida is *Thalassia testudinum* (turtle grass) and it is normally limited by nutrients. When nutrients become available, the first thing that happens is that the grass becomes denser. When even more nutrients become available, *Thalassia* will be replaced with *Syringodium filiformes*, manatee grass, which is more nutrient loving and faster growing. There is a predictable shift in the species that are favored with increasing nutrients. By monitoring the bottom at permanent sites, they can detect any changes in species that point toward or away from eutrophication. They are also monitoring the amount of nutrients in the leaf tissue, which is expressed as a N:P ratio. When the ratio reaches the 30:1 range, it means that nutrients are available and no longer limiting growth. A ratio of 60:1 is typical of many Florida Bay sites. A decrease toward 30:1 means that light availability has gone down or phosphorus has gone up and conditions are a signal of eutrophication. The converse is also true. They are monitoring to see which way this ratio is trending.

The seagrass program is also measuring stable isotopes. In terms of stable isotopes, as light decreases and nutrients increase, the stable carbon isotope in the plants gets lighter. Nutrient pollution will shift seagrass carbon isotope towards more negative values because of increased discrimination against heavy carbon in low light conditions. Stable nitrogen is not as explicit. The story with the heavy and light nitrogen is more complex. An increase in stable isotope ratio is consistent with delivery of nitrogen from treatment plant, but fertilizer is lighter than atmospheric nitrogen and so a decrease can also be

detected with eutrophication associated with fertilizer. So far this is not a very practical monitoring tool, but they are evaluating it.

Due to constraints with resources and time, they have two kinds of sampling efforts—one that involves permanent sites and the other involves random synoptic sampling of species composition. The program was designed to look at broad scale impacts and not all impacts are from nutrients. Seagrasses are affected by physical damage from boats, etc. To learn more about these other impacts, the monitoring program might have to be tweaked.

Dr. Fourqurean showed a map of the 30 permanent monitoring sites that are sampled on a quarterly basis. If they look at Dr. Boyer's data, they do not see an increase in phytoplankton at these sites, so they are not seeing extreme eutrophication (where the faster growing plants, specifically microalgae, are increasing). They have been seeing lots of epiphytes on seagrass, which is indicative of eutrophication in Tampa Bay. In this area, they have found a strong seasonal pattern in terms of epiphyte growth (heavy in winter, less in summer). However, unlike more eutrophic systems, epiphyte loads are not correlated with increased nutrient loads at the scale of our sampling in the FKNMS. So, they will not be using epiphytes as a monitoring tool at the broad spatial scale. In terms of long term trends, at 19 of 30 sites, species composition has shifted in a manner consistent with increased nutrient availability (compared with 13 of 30 sites last year).

Dr. Fourqurean showed a map of the spatial pattern of the relative availability of phosphorus and nitrogen. Most offshore areas and areas away from shore on the bayside are phosphate limited, but areas near the islands are nitrogen limited. This pattern suggests that controlling phosphorus near shore (where phosphorus is limited) is very important. It also shows that nitrogen nearshore will not have much effect, but will affect offshore benthic communities where nitrogen is limited. At 10 of 30 sites, N:P is trending toward 30. Last year, there were only 5 trending toward 30. Now, a full third of the sites shows that trend toward the ratio.

In terms of spatial patterns in stable carbon isotope ratios, isotopes get lighter in deeper waters. They know that as the water becomes deeper, the carbon isotopes become lighter. They are seeing that pattern in all three seagrass species on a regional scale as further evidence that light really does influence the carbon isotope ratio. They are also seeing a decrease in carbon isotope ratio at individual sites and those are the sites that suggest that it is getting darker on the bottom. They are also seeing long term changes in the stable nitrogen isotope ratios, with many sites showing increases and a few sites showing decreases. There seems to be something going on with nitrogen sampling at this very broad scale.

Dr. Fourqurean summarized these data by area (offshore upper keys, etc. backcountry middle, lower, etc.) in a site specific indicator diagram for the entire study period. There are very few sites in the entire study that have no significant changes in the indicators that are being used (N:P, Species index, isotope ratios for carbon, nitrogen).

In most of sites multiple indicators saying the same thing, that is, that nutrients are becoming more available over time. They developed two indices, SCI and EI. The

Species Composition Index (SCI) is a description how important the slow growing plants are in that site and the other, the Elemental Index (EI), is measure of the deviation from the redfield ratio of 30:1 N:P. A decrease in the SCI across the sanctuary means that the faster growing plants are dominating and a decrease in the EI means that light has become limiting factor instead of nutrients. The SCI for 2008 was compared with the baseline and the 2007 value and is within the confidence interval for 2007 and the baseline. There is a clearer (decreasing) trend in the EI, which means that things are relatively rapidly becoming close to the redfield ratios.

Dr. Fourqurean described the hexagon stratified sampling pattern for collecting data for the other half of his work. They are collecting isotope and species composition data at random sites within polygons. They have been through two complete cycles of sampling the entire sanctuary. Pairwise comparisons of surveys repeated on 7-year intervals are now being made. He will discuss these data in more depth next time due to time constraints. They also have data for corals and sponges in these comparisons. In summary, they are seeing trends toward increasing nutrient availability. They are seeing these trends in the benthos, even though Dr. Boyer is not seeing them in the water column in terms of phytoplankton. These changes are relatively subtle; we have not witnessed loss of seagrass beds in this regional and decadal scale program. Implementing wastewater is taking place now and not after the seagrass has already disappeared. There is congruence of patterns among independent indicators, which increases confidence in the observations.

IX. Pesticide Study, Dr. Richard Pierce, Mote Marine Laboratory, Sarasota, FL

Dr. Kruczynski introduced Dr. Richard Pierce, marine chemist from Mote Marine Lab, who conducted a WQPP special study about the effects of mosquito spraying on non-target organisms in 1998. Two years ago, after reviewing the science needs, they decided that the topic of impacts from mosquito spraying on non-target organisms belongs at the top of the priority list. Dr. Pierce conducted a study about mosquito control pesticides in the Key Deer Refuge in Big Pine Key that was funded by FWS. The purpose of the study was to assist the USFWS and the Florida Keys Mosquito Control District with establishing protocol for pesticide applications that will provide adequate mosquito control, while reducing the risk to non-target organisms. The goals were to monitor mosquito adulticide applications by the mosquito district and determine concentration, distribution and persistence of mosquito control adulticides impacting non-target organisms in the National Key Deer Refuge on Big Pine Key, FL. The study specifically targeted listed species of butterflies. Results of this field monitoring could be applied to lab exposure studies to provide a probabilistic risk assessment for selected non-target organisms and thereby help establish protocols for pesticide applications. The protocol involved monitoring two adulticide applications (evening truck, morning aerial) simultaneously at three locations. The evening truck pesticide is 30% Permethrin and 30% Piperonyl Butoxide, whereas the morning aerial is 78% Naled. Permethrin is a nerve poison and Naled is an organophosphate that is a nerve poison in insects, but not too toxic to mammals. At each sampling site prior to the application of the pesticide, they collected four composite sets of leaves (locust berry, pineland croton). After the

application at each of the three monitoring sites, they recovered four sets of filters and four sets of leaves at specified times. They extracted the pesticide and determined percent standard recovery of pesticides. The results of preliminary study in 2004 to 2007 showed that pesticide concentrations were well above level of detection. Residual permethrin was observed on foliage prior to 10/4/07 application (permethrin persists > 2 weeks). No naled or DDVP detected on foliage pre-application. There was uneven spatial distribution and accumulation, with good recovery from leaves. The recovery from filters was more difficult. There was good agreement between filters and foliage concentrations.

They conducted additional sampling in 2008 and 2009 in the Big Pine Key area with respect to these pesticides. The results were summarized. It was difficult to assess initial permethrin concentrations due to persistence, multiple applications at adjacent communities and aerial drift. Permethrin residues persisted for weeks on foliage. Its half-life on foliage was 24 to 72 hours and its half-life in sediment greater than a year. Naled/DDVP was not detectable after 48 hours. Its half-life on foliage was 4 to 6 hours. The concentration of permethrin on foliage was $40 \mu\text{g}/\text{M}^2$ and with a dry weight of 200 ng/g, whereas the concentration of Naled on foliage was $180 \mu\text{g}/\text{M}^2$ with a dry weight of 1,600 ng/g. Permethrin and Naled are both low in toxicity to birds and mammals, but highly toxic to fish and invertebrates (including both aquatic and terrestrial). Both permethrin and Naled-DDVP inhibited Queen conch embryonic development at field exposure concentrations (Delgado, et al., 2006). The proposed continuation of this study involves assessing pesticide drift, distribution and persistence into the National Key Deer Refuge on foliage and in freshwater ponds. They would also assess drift into surface waters, microlayer, and sediment of the sanctuary and assess risk for marine and terrestrial invertebrates.

Public comment

Key Largo Wastewater Treatment District Chairwoman Dr. Hammaker suggested that the committee consider the idea of securing an additional authorization for funds for the Army Corps program, FKWQIP, to be ready to accept funds in the future.

Closing remarks

The committee held a brief discussion about how to set the agenda items and how the management committee should present the WQSC with items they want to see addressed at the next meeting. The management committee can listen in on the conference call that will be held in the fall. A motion was made and passed to have the management committee review the canal proposal.

A brief discussion was held about the history of the WQSC and how it had many accomplishments, beginning with getting people to understand how important wastewater improvements were to protecting the marine environment. The committee was instrumental in supporting the county's wastewater master plan and a great deal of time was devoted to the plan. In recent years, they have heard reports on special studies and

monitoring that has been completed as part of the WQPP. Mr. Popham suggested that the committee become more action oriented than it has been in recent times. More time needs to be allotted at the meetings for discussion of the scientific results and of possible actions and projects. The committee would then have time to discuss possible remediation projects to improve water quality. Mr. Causey pointed out that certain kinds of direct improvement projects could be very much of interest to government decision makers who could fund such projects. Mr. Bergh suggested that the management committee and the co-chairs should structure agendas that leave room for the WQSC to be action-oriented. He mentioned that the committee might want to spend some time during the next meeting deciding upon what to focus.

Mr. Iglehart explained past the committee had more time for discussion because they met for two days, with one day dedicated to action items and the other dedicated to scientific results. However, a two-day meeting meant a big time commitment from people, so the meeting was shortened it to one long day.

The idea of having a conference/workshop to convey the results of these long term monitoring programs to decision makers in Silver Spring and Washington was discussed, as was the idea of a Keys based workshop. The fact that travel is restricted to conferences for state employees was mentioned. Mr. Bergh stated that the TNC is sponsoring a reef resilience workshop in the spring of 2010, location to be determined. He suggested that this might be a possible venue to feature some scientific results and discuss them in detail.

The date for the next meeting will be in the third week in January, with a conference call on November 16th.

Mr. Iglehart thanked everyone for their participation and adjourned the meeting.