

Water Budget and Modeling Workshops

Summary Document

Technical Report 04-5

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The Charlotte Harbor National Estuary Program is a partnership of citizens, elected officials, resource managers and commercial and recreational resource users working to improve the water quality and ecological integrity of the greater Charlotte Harbor watershed. A cooperative decision-making process is used within the program to address diverse resource management concerns in the 4,400 square mile study area. Many of these partners also financially support the Program, which, in turn, affords the Program opportunities to fund projects such as this. The entities that have financially supported the program include the following:

U.S. Environmental Protection Agency
Southwest Florida Water Management District
South Florida Water Management District
Florida Department of Environmental Protection
Florida Coastal Zone Management Program
Peace River/Manasota Regional Water Supply Authority
Polk, Sarasota, Manatee, Lee, Charlotte and Hardee Counties
Cities of Sanibel, Cape Coral, Fort Myers, Punta Gorda, North Port, Venice and Fort
Myers Beach
and the Southwest Florida Regional Planning Council.

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Introduction

The Charlotte Harbor National Estuary Program (NEP) is a partnership of citizens, elected officials, resource managers and commercial and recreational resource users working to protect the ecological integrity of the greater Charlotte Harbor watershed. A cooperative decision-making process is used within the Program to address diverse resource management concerns in the 4,400 square mile study area. Goals of the NEP include that our partners identify, establish and maintain a more natural seasonal variation in flows and natural hydrology to the greater Charlotte Harbor estuarine system.

To this end, the Charlotte Harbor NEP's Management Conference approved a 2-day technical exchange workshop to develop a "Water Budget" for the greater Charlotte Harbor estuarine system. The objectives of this workshop included the following:

1. Quantify the existing water budget—existing monthly inflows and outflows to Charlotte Harbor estuary
2. Estimate the "predevelopment" or natural system's water budget—monthly inflows and outflows to Charlotte Harbor estuary
3. Determine how to best enable the existing water budget to resemble the natural system's water budget.

Following the Water Budget workshop was a 1-day Modeling workshop to discuss hydrologic, hydrodynamic and habitat suitability models for the Charlotte Harbor system.

It was important to the Management Conference that the workshops be fact-finding, technical discussions, and if at all possible that individual basin water budgets be created at the Water Budget workshop from the information presented. The formats of the workshops were designed to allow for this. The first 1½ days of the Water Budget workshop consisted of a series of presentations aimed at addressing the aforementioned objectives. The workshop enlisted the help of 2 facilitators from the Florida Conflict Resolution Consortium (CRC) who then facilitated small group sessions at the end of the 2nd day to respond to a series of questions aimed at determining if a Water Budget was feasible and a priority for the Management Conference to pursue. The Modeling Workshop on the 3rd day then entailed detailed presentations on various hydrologic, hydrodynamic models created for the Charlotte Harbor system and an audience discussion facilitated by CRC staff to glean strengths and weaknesses of each model.

In planning and implementing the workshops, the Charlotte Harbor NEP enlisted the help of a **Steering Committee** composed of representatives from local governments, non-profit organizations, industry, agencies and citizens. This report is a summary of the planning and implementation of the workshops and the discussions that took place during the workshops.

Pre-workshop Activities

The Hydrologic Alterations Subcommittee (HAS) of the Charlotte Harbor NEP Technical Advisory Committee served as the Steering Committee for these workshops. This subcommittee was formed in early 2002 and is composed of representatives from local governments, non-profit organizations, industry, agencies and citizens. The subcommittee met several times to develop and refine the goals and format of the workshops, to give direction to NEP staff as the project progressed and to develop a list of speakers and small group session questions. Steering Committee members included:

Al Cheatham
Betty Staugler
Bill Byle
Chris Becker
Dale Huff
Jaime Ovsianik
Jennifer Steadman-Ryan
Jim Beever
Jon Hubertz
Judy Ott
Katie Fuhr
Michael Jones

Ralph Montgomery
Ross Franklin
Sam Stone
Steve Suau
Sunny Diver
Warren Rueschel
Wayne Daltry
and Charlotte Harbor NEP staff:
Catherine A. Corbett
Lisa B. Beever
Maran Brainard Hilgendorf
Liz Donley

The HAS approved the list of speakers, topics for presentations and questions for the small group sessions along with the workshop format, including issues associated with registration and workshop venue. (*The workshop agenda is included on the accompanying CD.*)

In May 2004 the Charlotte Harbor NEP contracted with the Florida *Conflict Resolution Consortium* (CRC) at the University of Central Florida to facilitate both workshops and provide NEP staff with a summary of the findings of both workshops. The FCRC is committed to assist communities and public agencies and private parties in Florida to resolve conflicts and seek consensus on critical decisions so regulatory programs and other processes will be fairer, faster and more efficient. Staff from CRC that worked on the workshops included:

Christian Pederson
Barbara Clegg

Rafael Montalvo

Water Budget Workshop

The workshop was held at Edison Community College in Punta Gorda, Florida on May 11 and 12, 2004. Approximately 20-30 scientists, resource managers, government officials and citizens participated in the workshop. Twenty oral presentations were given the first day and a half. Topics of the presentations were designed to give audience members an overview of the current regulatory framework for protecting freshwater flows, the water balance equation and its components and on-going research efforts that could be used to create a water budget for each basin. Each speaker was requested to address at least one of the following questions:

1. What information is needed to create a water budget for each basin or the Charlotte Harbor estuary as a whole? An example water balance equation is as follows:

$$P \ +/- \ OI = R + ET \ +/- \ \Delta S + I$$

Where,

P = precipitation

OI = outside inputs, including irrigation and tides

R = runoff

ET = evapotranspiration

ΔS = initial soil and surface water storage +/- final soil and surface water storage

I = groundwater recharge

2. What information exists that completes the equation above? (daily, monthly or other time step data that incorporates temporal and seasonal variability. A minimum of monthly is preferred.)
 - a) Does the data help complete a “predevelopment” or natural system water budget or
 - b) Does the data help complete an existing conditions water budget?
3. What are the gaps in knowledge for each basin for the natural system’s and existing condition’s water budgets? What steps need to be undertaken to fill them?
4. What are the economic processes and the current regulatory framework that affect water users and their shortcomings?
5. What are the political processes, including planning and permitting by which reforms can occur (for example, Minimum Flows and Levels and reservations rules)?

After each presentation, the audience was then permitted to ask questions of clarification from speakers. *The workshop agenda and presentations are included on the accompanying CD.*

SPEAKERS

The following speakers made presentations at the Water Budget Workshop:

- **Steve Seibert, Esq.**, Seibert Law Firm (former Secretary Florida Department of Community Affairs), “Current Regulatory and Economic Framework for Protecting Freshwater Flows”

(Steve Seibert, photo by L.Beever)

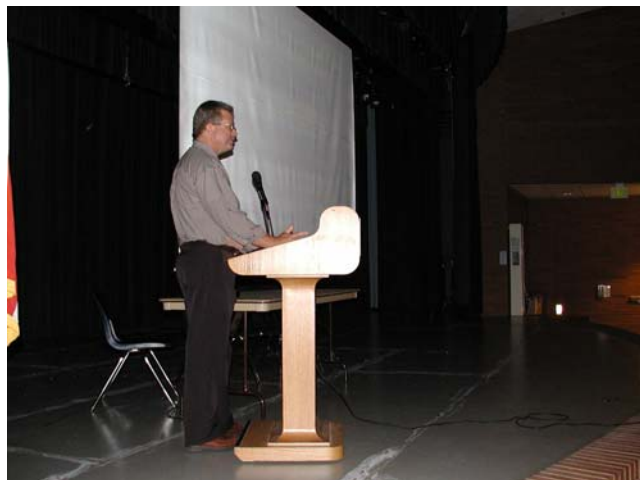


- **Randy Edwards, Ph.D.**, University of South Florida, College of Marine Science, “Experiences with Minimum Flows and Levels: the Caloosahatchee River”
- **Ken Tarboton, Ph.D., P.E.**, South Florida Water Management District, “Water Budget Concepts and Examples from Modeling the Comprehensive Everglades Restoration Plan”
- **Wayne Daltry, FAICP**, Lee County Smartgrowth Department, and Stephen M. Suau, P.E., Sarasota County Center for Watershed Management, “Explanation of the water balance equation and its components: $P \pm OI = R + ET \pm \Delta S + I$ ”
- **Paul T. Vickers** and L. Kellie Dixon, Mote Marine Laboratory, “Water Balances: Suitability of Literature Coefficients and Importance of Local Rainfall”
- **Richard Owen, AICP**, Southwest Florida Water Management District, “Southern Water Use Caution Area Recovery Strategy and Water Supply”
- **Sam Stone**, Peace River/Manasota Region Water Supply Authority, and Ralph Montgomery, PBS&J Inc., “History and Projected Future Freshwater Consumptive Use of the Peace River Regional Water Supply Facility”
- **Michael Jones**, Sarasota County Center for Watershed Management, “Estuarine Biology as an Indicator of Altered Water Budgets in the Dona and Roberts Bay Watershed, Sarasota County, Florida”
- **Ping Wang**, University of South Florida; Xinjian Chen and Michael S. Flannery, Southwest Florida Water Management District; and David K.

Tidwell, University of South Florida, “A New Shoreline and Bathymetry Database for the Upper Charlotte Harbor Estuarine System”

- **Stephen M. Suau, P.E.**, Sarasota County Center for Watershed Management, “Comparison of Monthly Runoff Volume Trends from Urban and Rural Watersheds in Sarasota County, Florida and its Implication on Restoring Natural Flows and Water Budgets to Bays and Estuaries”
- **Michael S. Flannery** and Martin Kelly, Ph.D., Southwest Florida Water Management District, “An Update of Hydrologic Analyses and Management Strategies to Address Streamflow Trends in the Upper Charlotte Harbor Watershed”
- **Cathleen Jonas** and Phillip R. Davis, SDI Environmental Services, Inc., “Cumulative Risk of Decreasing Streamflows in the Peace River Basin”
- **Ralph Montgomery**, PBS&J Inc. and Sam Stone, Peace River/Manasota Region Water Supply Authority, “Analyses of Historical Rainfall and Flow Patterns and Relationships in the Lower Peace River Watershed”
- **Martin Kelly, Ph.D.**, Southwest Florida Water Management District, “Peace River Flows and the Atlantic Multidecadal Oscillation”
- **Anura Karuna-Muni, P.E.**, Lee County, “Lee County Hydrological Data Network”
- **Greg Rawl, P.G.**, “Evapotranspiration in South Florida and Its Role in Water Budget Models”
- **Howard Wegis**, Lee County, “Demands for Potable Water in Lee County”
- **Linda Hoppes** and **Terrance Bengtsson**, South Florida Water Management District, “Lower West Coast Water Supply Plan” and “Trends in Hydrologic Conditions and Water Use”
- **Jeff Rogers, GISP** and Don Strickland, P.G., GeoSyntec Consultants, Inc. and Tommy Liddell, Santa Barbara County, “Detailed Impervious Surface Extraction Using Remote Sensing: Santa Barbara County, CA Case Study”
- **Don Strickland, P.G.**, GeoSyntec Consultants, Inc. and Don Thompson, “Application of Stable Isotope and Geochemical Analyses to Estimation of Base-Flow – An Alternative Approach”

(Most of these presentations are included within the associated CD)



(Sam Stone, photo by L. Beever)

SMALL GROUP BREAKOUT SESSIONS

In the afternoon of the second day, participants divided into two groups. One group discussed technical information issues regarding the creation of a water budget and the other group discussed management and regulatory issues. The overarching issues for the technical information group included whether it was possible to create a water budget for the Charlotte Harbor region, if it was a priority for the program and if so, listing data gaps. The overarching question for the management and regulatory group was how the program and its partners could best influence the current regulatory framework to manage freshwater flows using a water budget approach.

Each small group was asked to consider the presentations given at the workshop and the water balance equation below, as they answered a number of prepared questions.

$$P \ +/- \ OI = R + ET \ +/- \ \Delta S + I$$

Where,

P = precipitation

OI = outside inputs, including irrigation and tides

R = runoff

ET = evapotranspiration

ΔS = initial soil and surface water storage +/- final soil and surface water storage

I = groundwater recharge

Following the small group sessions, a representative of each group gave a 10-minute summary of the key points of their small group discussion.

Technical Information Group

The technical information group was asked to address 7 questions in their discussion. The questions and the responses are listed below:

Question 1: Is it possible to create a historic or “natural systems” water budget for your region of the Charlotte Harbor watershed or a specific water body with the information presented at this workshop? How about an existing conditions water budget?

Responses:

- It is possible to create a natural system water budget with available historical information, such as photographs, maps and other data.
 - The SFWMD has a pre-development vegetation map used to model natural and pre-development flows, etc. (SWFFS) for the southern Charlotte Harbor area.

- The SWFWMD also has core information and data for both natural systems and existing water budgets. They also have a pre-development vegetation map for the northern Charlotte Harbor region.
- Good estimates can be developed using literature values and reference sites.

Question 2: If it is not possible to develop a Water Budget for your region of the Charlotte Harbor watershed with the information presented at this workshop, should it be a priority for the NEP and its partners to pursue developing a historic and/or an existing conditions Water Budget?

Responses:

- It should be a priority for the Charlotte Harbor NEP to develop a water budget. This goal is too large for any one entity and will need a cooperative partnership between local, state and federal program partners.
- There are some fundamental differences between developing a monthly water budget and developing an annual water budget. Using an annual time scale, the components end the same as they began. Over long-time scale, things get hidden.
- The question the water balance needs to answer will be the CHNEP HA 4: restoring and maintaining the natural flow regime and hydrograph.



(photo by L. Beaver)

Question 3: What are the changes in the components of the Water Budget equation from historic conditions? For example, has groundwater recharge (I) or storage (S) changed since historic conditions? Which of these components are beyond our capabilities to modify, such as precipitation (P) perhaps? Are those impacts significant?

Responses:

- All components of the water balance equation have changed since pre-development. Perhaps the most important to the estuary is the freshwater flow quantity and timing; perhaps this should be the focus.
- Components of the equation beyond our control are rainfall, sea level rise, and groundwater.
- ET is strongly influenced by temperature and humidity.

Question 5: Are we reasonably knowledgeable of pre-development versus post-development runoff conditions? How about storage? Evapotranspiration? Are there specific changes would we should pursue for these?

Responses:

- Pre-development run-off conditions are not well understood. There are data gaps. In concept we have an understanding, but it is not well quantified. For example, flow gages don't go back to pre-development.
- If we understood pre versus post development runoff better, it may affect the policy and regulatory regime to better mimic pre-development.

Question 6: What are the monitoring or data gaps that need to be filled in order to obtain the following:

- a historic or “natural systems” water budget for the region
- an existing conditions water budget for the region
- a method of implementing a water budget that best mimics the historic or “natural systems” water budget for the region

What entity would be most appropriate for collecting those data?

Question 7: Which data gaps are the most time sensitive or important in order to develop a historic and existing Water Budget? Please prioritize the data gaps you develop.

When grappling with questions 6 and 7 (data gaps), the group listed potential data gaps and methods for potentially filling them. Following is the list the group developed:

Data gap: The natural system and historic conditions need definition.

Method: Use references sites or pre-development vegetation maps to determine natural systems water balance components.

Data gap: ET rates

Method: Pan ET data may be collected at only 4 stations in region – National Wetlands Survey. Will need to install more sites to get more accurate, site specific rates

Data gap: Data that has been collected but not analyzed.

Method: There will need to be different partnerships in each sub basin to collect and analyze data.

The group felt that a key finding from their discussion to convey was the need of the program and its partners to develop *a monthly water budget by basin*.

Management and Regulatory Group

Similar to the technical information group, the management and regulatory group members were asked to address a number of questions in their discussion. The questions and the responses are listed below:

Question 1: Is it possible to create a historic or “natural systems” water budget for your region of the Charlotte Harbor watershed or a specific water body with the information presented at this workshop? How about an existing conditions water budget?

Responses:

- There is pretty good data to create a historic water budget. The existing water budget would be easy.
- The first step should be to determine a base line year to establish the historic system (for each sub basin) that will be used in stakeholder decisions.
 - from that base line year (for example, 1900) a determination of the critical decisions that altered the basin's water budget is necessary
 - from that understanding, policy makers and resource managers can begin to chart a course back.
- Salinity is an indicator of when to turn the water on and off.



Photo by L. Beaver

Question 2: If it is not possible to develop a Water Budget for your region of the Charlotte Harbor watershed with the information presented at this workshop, should it be a priority for the NEP and its partners to pursue developing a historic and/or an existing conditions Water Budget?

Responses:

- There is a problem with the current water budget and a dearth of strategies to deal with these problems
- It should be a priority for CHNEP to develop an advocacy water budget that is basin specific.

Question 3: Can changes from the historic conditions be "harmful" to the natural resources of the Charlotte Harbor watershed? If so, what is the political/structure that caused the change? What change in the political/management structure is needed to reverse them?

Question 4: Has groundwater recharge changed since historic conditions? If so, is there a way to change this to recover or reach stasis in groundwater levels? Do these reforms vary based on locale/jurisdiction?

Responses:

- There is a need to bring together a complete stakeholder group to develop guiding principals for management practices. The principles should be periodically reviewed and updated.
- One difficulty would be establishing geographic boundaries.

Question 5: How will the TMDL or Minimum Flows and Levels programs help restore the water budget to historical conditions? What obstructions exist in the TMDL and MFL programs that would inhibit a restoration approach?

Responses:

- Establishing the base line year condition is a prerequisite for TMDLs and MFLs.
- The CHNEP should advocate for a certain flow regime from Lake Okeechobee.
- The CHNEP should be a stakeholder in every process that involves an allocation of water.

The group felt that a key finding from their discussion to convey was the need of the program and its partners to develop an *“advocacy” water budget by basin*. The group stated the following in their findings:

1. Whether we want to admit its existence, there is a "water budget" in nature, and we have been altering its inputs and outputs.
2. An understanding of the water budget is necessary in order to have effective water management.
3. Our land and water management has affected the water budget to such a degree that we have harmed the estuary.
4. We have to have an understanding of what and how changes can be made to



- restore to a degree the water budget the estuary needs to normal.
5. We should be the advocates for that change.

Closing Plenary Session

As part of the small group sessions, a representative of each group was designated to report back their findings to the workshop audience as a whole. Both groups agreed that developing a monthly historic or natural systems water budget by basin to compare to current conditions should be a priority goal of the program and its partners. Such a project should give area resource managers, planners and policy-makers specific goals for protecting the quantity and timing of freshwater flows to the estuary and dictate concrete milestones in obtaining these goals. Other findings include the following:

1. In the name of flood protection, we have overdrained the land to such a degree that we have incurred public harm.
2. We do not manage watersheds with an understanding of the impact of increased percentages of impervious surfaces.
3. Water quality impacts have occurred from overdrainage and impervious surfaces.
4. Water is no longer stored within the groundwater systems in the volumes that sustain our current and forecasted development nor our desired terrestrial ecology.
5. There are enough gaps and lack of information for reasonable people to differ on the appropriate management responses.
6. Land management and water management are not coordinating towards the same goals needed for the estuary.

CONCLUSION

The workshop ended by audience members discussing methods of undertaking the creation of pre-development and current conditions water budgets and the importance of doing so. The project would be too large a project for the program office to undertake alone; thus, such a project would have to include its partner agencies. A necessary first step in this process would be to include the project within the 5-year update of the Charlotte Harbor NEP's Comprehensive Conservation and Management Plan (CCMP). The process of updating the CCMP will generate discussion and inform others who did not participate in the workshop, thereby garnering support for the goal.

The two-day water budget workshop was successful in providing participants with a common forum for a fact-finding and technical discussion on the subject. It met the workshop objectives by allowing participants to review the current regulatory framework for protecting freshwater flows, a water balance equation and its components and on-going research efforts that could be used to create a water budget for each basin. During the workshop, the speakers provided clear and insightful information that summarized the present state of knowledge about water budgets and their components as well as basin-specific information. Workshop participants were then able to discuss these points in some detail before determining whether historic and current conditions water budgets are

important and a priority for the region. The workshop served as an important first step towards a common technical discussion and understanding of the issues and for planning a research and implementation agenda.

Modeling Workshop

The Modeling Workshop was held at Edison Community College in Punta Gorda, Florida on May 13, 2004. Approximately 20 scientists, resource managers, engineers and citizens participated in the 1-day workshop. Eight oral presentations were given by area modelers, and after each, the audience was given time to ask clarification questions. Topics of the presentations were designed to give audience members an overview of the ecological indicator, hydrologic and hydrodynamic models of Charlotte Harbor, its tributaries and/or the nearby Gulf of Mexico. The workshop then culminated into an audience discussion of the strengths and weakness of each model, the appropriate use for each model, such as Minimum Flows and Levels or Total Maximum Daily Loads development and whether the model could be expanded to incorporate water quality, and finally whether there is a need for one core model for the Charlotte Harbor region.

SPEAKERS

The following speakers made presentations at the Modeling Workshop:

- **Y. Peter Sheng**, K. Park, T. Kim and Y. Zhang, University of Florida, Civil & Coastal Engineering Department, “Modeling Circulation and Transport in Charlotte Harbor and Caloosahatchee River for MFL and Ecological Assessment”
- **Roger S. Copp**, Vice President, DHI, “Hydrologic Modeling for SFWMD and US ACE within the Caloosahatchee River and Estero-Imperial River Watersheds”
- **Y. Peter Sheng**, V. Schofield, V. Paramygin, T. Kim and K. Park, University of Florida, Civil & Coastal Engineering Department, “A Real Time Observing and Modeling System of Charlotte Harbor for Determination of Minimum Flow Criteria of the Peace River”
- **XinJian Chen, Ph.D., P.E.**, Senior Professional Engineer, SWIM Program, Southwest Florida Water Management District, “A Dynamically Coupled 3D-2DV Hydrodynamic Model for the Charlotte Harbor-Peace River System”
- **Ken Trout** and Mark Ross, PhD, P.E., University of South Florida, “Modeling the Ungaged Watershed Tributary to Charlotte Harbor for Freshwater Inputs and the Hydrology of Phosphate Clay Settling Areas”
- **Robert H. Weisberg, PhD**, and L. Zheng University of South Florida, “A Charlotte Estuary/Shelf Model driven by Rivers, Tides, and Winds & How



Estuaries Work: A Charlotte Harbor Example” and **Robert H. Weisberg, PhD**, M. Luther, C. Merz, and others “Observations and Models of the West Florida Continental Shelf (WFS) Circulation”

- **Leonard Pearlstine** and Frank Mazzotti, Ft Lauderdale Research and Education Center, University of Florida, “An Ecological Evaluation of Ecosystem Restoration in Southwest Florida”

After each presentation, the audience was then permitted to ask questions of clarification from speakers. *The workshop agenda and presentations are included on the accompanying CD.*

AFTERNOON PLENARY SESSION

In the afternoon, audience members participated in a facilitated session to discuss each model’s strengths and weaknesses. To begin the session, Tien-Shuenn Wu, Ph. D., P. E. with the Department of Environmental Protection highlighted some of the state’s needs in regards to modeling for the Watershed Management Program. Dr. Wu mentioned the following state modeling needs for each waterbody listed as impaired on the “Verified List”:

- Watershed or hydrologic Model
- Hydrodynamic Model
- Water Quality Model(nutrients, dissolved oxygen, and heavy metal)
- Groundwater Model

Next, the facilitator asked each presenter to offer the strengths and weaknesses of their particular model and then opened the discussion to other audience members. The following are the strengths and weaknesses for each model as summarized during the afternoon audience discussion.

Model 1 (CH3D and CH3D-IMS)

- presented by Y. Peter Sheng, University of Florida

Strengths

- It is an interdisciplinary model in modeling and measurement
- The model has been tested in many estuaries systems
- This model can be coupled with watershed & groundwater modules that include:
 - sediment



- wave
- water quality
- ecological

Weaknesses

- The model uses a structured, curvilinear grid
- Certain processes are not completely coupled. Hypoxia is an example because sediment oxygen demand and other processes are not completely understood.
- Not enough data to run model; more data is needed
- Hydrostatic approximation will breakdown
- Not clear if model is proprietary or if not, the extent of training users will need to use model

Model 2 (Mike She)

- presented by Roger Copp, DHI

Strengths

- South Florida Water Management District is using it widely
- Due to this, it has gained lots of experience in the field
- Hydrodynamic model is good
- Freshwater component is very good

Weakness

- The model is proprietary and not available for public use, although architecture is open and available
- There have been a few snags when put into use, such as with the groundwater module
- The water quality and tidal basin components are problematic

Model 3 (Coupled LESS 3D with LAMFE)

- presented by XinJian Chen, Ph.D., P.E., Southwest Florida Water Management District

Strengths

- The model uses the new generation of techniques
- 3D can be run with or without hydrostatic component
- It is a “z” level model; all others are sigma level models
- It is a structure and non structured model
- Coupled LESS 3D (Lake & Estuary Simulation System in 3D) with a 2DV model named LAMFE (Laterally Averaged Model For Estuaries)
- In public domain

Weakness

- The model is new
- The person using the model is the one who created it--the only person familiar with its codes and programming, etc—thus, it is not easily accessible to others

Model 4 (Integrated Hydrodynamic Model or IHM)

- presented by Ken Trout, University of South Florida

Strengths

- The model uses HSPF and MODFlow, which are widely used worldwide and within public domain
- Always being updated and modified
- There is a lot of knowledge and experience with this model because the programming is so widely used
- Can be used for TMDLs because it integrates surface and groundwater; and can couple with estuarine mixing (1-way coupling)

Weakness

- Coupling between HSPF & Mod Flow is new (used only a few times such as in Tampa Bay)

At this point, the audience wished to point out that MIKE SHE uses a grid system, whereas the IHM or coupling of HSPF and MODFLOW uses a basin and stream routing system.

Model 5 (Coupled POM, FVCOM, ROMS and ECOM-3Dsi)

Strengths

- Programming and model are within the public domain, and have public user manuals
- It is a strong, vetted model – it is not private
- This model has water quality and sediment modules in the application

Weaknesses

- Lack of correct forcing functions
- POM is slow
- Doesn't mode split
- Data for wind and sea level at mouth of Charlotte Harbor is lacking

Each presenter described the need for additional and more robust data collection efforts and that such data would strengthen their individual models. An imperative was wind data and flow gages in Pine Island Sound and Matlacha Pass where the upper Charlotte Harbor meets the lower.

Also, the audience discussed that proprietary models were more problematic than those within the public domain; however, the accessibility and/or training and educational needs of users for some models in the public domain was an issue. For example, Model 3, presented by SWFWMD staff, was developed and used by one



person at the District. It is inaccessible to others or would require a great deal of training for others to use this model even though the model is within the public domain. Programming and assumptions used within each model should be well documented so that other users would be aware of such.

CONCLUSION

After the strengths and weaknesses of the various models were presented and discussed, the group was asked if there should be one “Core Model” for the region. A few participants thought that a core modeling system would be desirable for resource managers and decision-makers, as it would allow them to determine similar or



comparable responses for their questions. For example, if there are a number of models that each determines disparate nutrient loading rates for tributaries into a bay system, resource managers may have a difficult time determining which model to use. In addition, the disparate numbers could confuse the public or economic interests within the watershed or be used as evidence against pollutant loading targets

derived from one of the models. The audience members stated that by using collaboration of the individual models, the state or regional needs could be wrapped into one core modeling system.

The majority of audience members felt that there should not be one core model but a multitude of models from which resource managers could choose. The audience agreed that it is not possible to create one “core model” for all purposes, and it is not really useful. Each model will be appropriate for only some specific uses, as no one model is good for everything. There is always uncertainty and some areas of deficiency in every model; thus, many models are needed to arrive at broad management decisions. In addition, competition between models and modelers is good and will create better and more useable models.

The Modeling Workshop was successful in providing participants with a common forum for a fact-finding and technical discussion on the subject of ecological indicator, hydrodynamic and hydrologic models of Charlotte Harbor, its tributaries and the nearby Gulf of Mexico. During the workshop, the speakers provided clear and insightful information that summarized the present state of knowledge about models within the Charlotte Harbor area. The workshop then culminated into an audience discussion of the strengths and weakness of each model, the appropriate use for each model, such as Minimum Flows and Levels or Total Maximum Daily Loads development and whether the model could be expanded to incorporate water quality. Workshop participants were then able to discuss these points in some detail before determining whether a core model was needed for the Charlotte Harbor region.