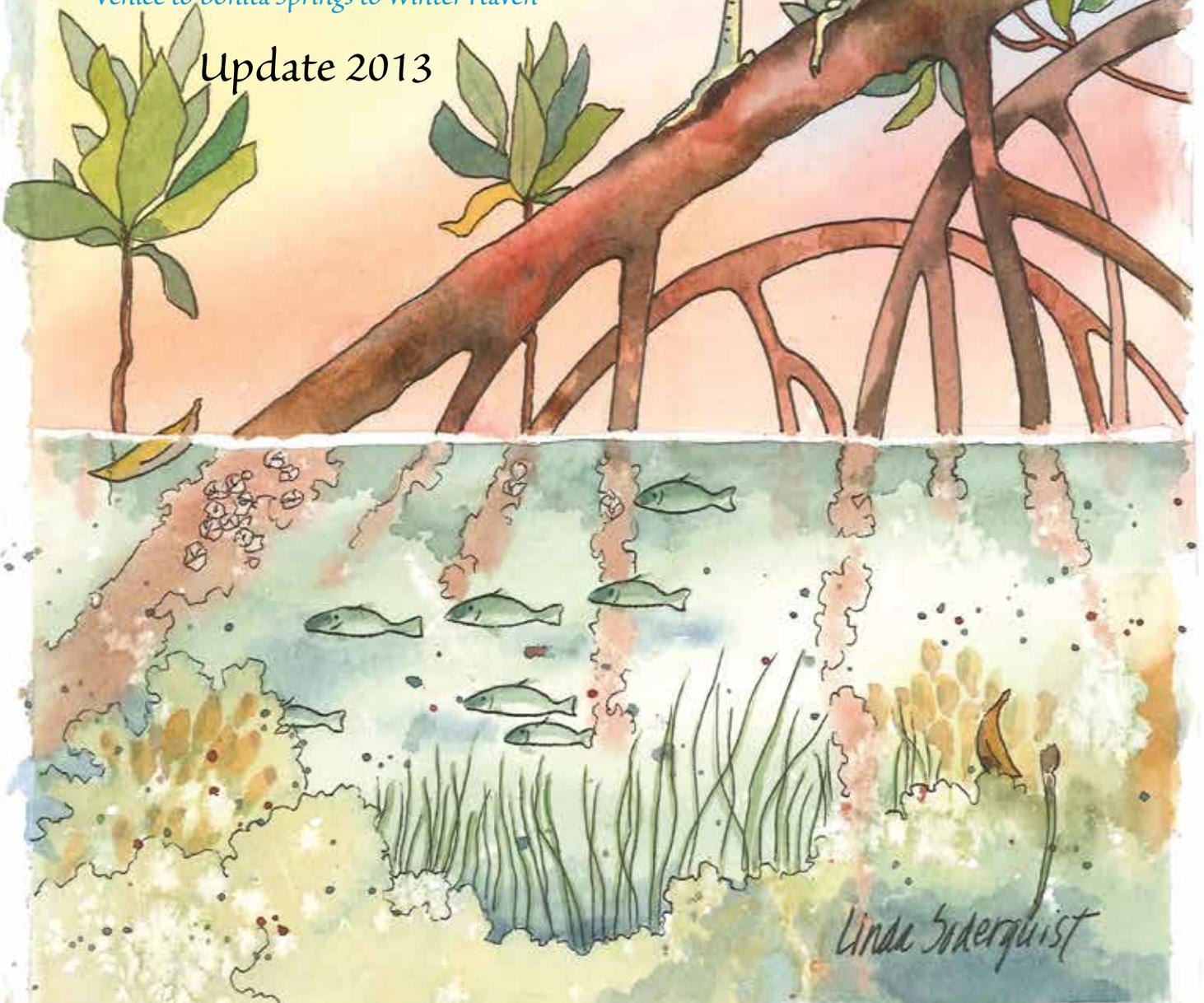


Committing to Our Future

A Comprehensive Conservation and Management Plan

for the Greater Charlotte Harbor Watershed from
Venice to Bonita Springs to Winter Haven

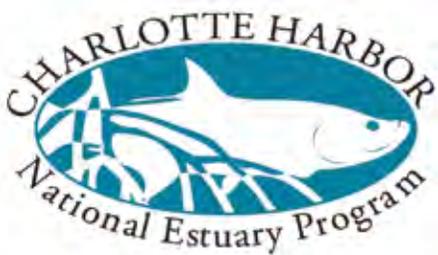
Update 2013



Linda Soderquist

The *Comprehensive Conservation and Management Plan (CCMP)* was first adopted by the CHNEP Policy Committee on April 13, 2000. It was updated and adopted on March 24, 2008 and again on March 18, 2013.

The *Comprehensive Conservation and Management Plan (CCMP)*, this document, may be obtained as a PDF from the website. For additional copies of the printed book, please contact the Program Office or place an order through the website.



Charlotte Harbor National Estuary Program
1926 Victoria Avenue
Fort Myers, FL 33901-3414
239/338-2556, Toll-free 866/835-5785
www.CHNEP.org

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Cover art donated by Linda Soderquist (www.LindasIslandArt.com) to the CHNEP originally for the Charlotte Harbor Nature Festival.

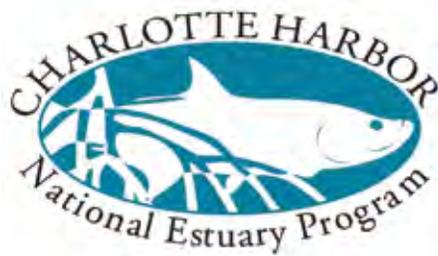
Committing to Our Future

A Comprehensive Conservation and Management Plan

for the Greater Charlotte Harbor Watershed

from Venice to Bonita Springs to Winter Haven

Update 2013



The Charlotte Harbor National Estuary Program (CHNEP) is a partnership of citizens, elected officials, resource managers and commercial and recreational resource users who are working to improve the water quality and ecological integrity of the CHNEP study area. A cooperative decision-making process is used within the program to address diverse resource management concerns in the 4,700-square-mile CHNEP study area. *This plan is our commitment to the future.*

Adopted April 13, 2000.

Updated March 24, 2008 and March 18, 2013.

Charlotte Harbor National Estuary Program

March 2013

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U.S. Environmental Protection Agency, Region 4

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Artwork by Diane Pierce

Osprey Nesting Along the Peace River

From the very beginning of the CHNEP, art has played an important role in the program's efforts to protect the natural environment of Florida from Venice to Bonita Springs to Winter Haven. In 1998, the CHNEP commissioned artist Diane Pierce to paint *Osprey Nesting Along the Peace River*.



Committing to Our Future

A Comprehensive Conservation and Management Plan for the Greater Charlotte Harbor Watershed from Venice to Bonita Springs to Winter Haven

The Charlotte Harbor National Estuary Program (CHNEP) is a partnership of citizens, elected officials, resource managers and commercial and recreational resource users who are working to improve the water quality and ecological integrity of Charlotte Harbor's estuaries and watersheds. A cooperative decision-making process is used to address diverse resource management concerns in the 4,700-square-mile CHNEP study area. This plan is our commitment to the future.

The *Comprehensive Conservation and Management Plan* (CCMP) addresses four *priority problems* that are common throughout the CHNEP study area and that have been identified to impede the health of the watersheds and estuaries. They are water quality degradation, hydrologic alterations, fish and wildlife habitat loss and stewardship gaps. The CCMP includes a series of graphic vision maps, quantifiable objectives, priority actions and many support documents.

The CHNEP Management Conference (further explanation beginning on p. 7) developed a *graphic vision* of the CHNEP study area to illustrate the condition of the watersheds and estuaries in a perfect world. This vision is not to set a target but to set a direction. To move in the direction of the vision, *quantifiable objectives* were developed. The development of appropriate quantifiable objectives supports the goals for preservation, restoration and enhancement of the natural resources of the CHNEP study area. Quantifiable objectives will allow the CHNEP to gauge the success or failure of subsequent management activities initiated throughout the CHNEP study area. Each quantifiable objective is technically sound, defensible, objective and able to be assessed utilizing either existing or future monitoring programs. Once the quantifiable objectives were approved, the Management Conference developed a series of *priority actions* and strategies to achieve the quantifiable objectives for each of the four priority problems.

Several documents supplement the CCMP:

- A database tracks implementation projects planned and completed by our partnership. This database replaces Volume 2 of the CCMP adopted in 2000. The CHNEP stands ready to support implementation of additional projects to complete all priority actions listed in this plan.
- The *Long-Term Monitoring Strategy and Gap Analysis* and the *Data Management, Analysis and Exchange Strategy* were adopted by the CHNEP.
- A *State of the Charlotte Harbor Watersheds and Estuaries* will evaluate progress based on the indicators, targets and the CCMP vision.
- The *Advocacy and Review Procedures* outlines steps to develop and transmit CHNEP advocacy positions, including those generated through public input.
- The *Research and Monitoring Needs Inventory* and *Restoration Needs Inventory* identify gaps in science that are obstacles to sound decision making or gaps in restoration.
- The *Long-Range Funding Strategy* helps the CHNEP achieve equitable contributions from stakeholders/partners along with participation agreements with partners.
- The *Strategic Communications Plan* is a multi-year plan for communicating with, educating and engaging the public while considering the unique characteristics, structure and goals of the CHNEP.
- The CHNEP Water Atlas is a repository for regional water resource data provided by multiple sources. This website tool is available to all in order to better their understanding of the watershed and ecological systems. It delivers data via a user-friendly, web-based interface that employs interactive maps, graphs and charts, and easy-to-understand explanations of scientific concepts and processes.



Preface

The watersheds and estuaries of the 4,700-square-mile Charlotte Harbor National Estuary Program (CHNEP) study area are wonderful places to live, play and work. In 1995, Charlotte Harbor was designated as an “estuary of national significance” through the Clean Water Act. In five short years, the Management Conference of citizens, scientists, resource managers and elected officials was created and a plan was adopted. The talented and dedicated people of this partnership used the *Comprehensive Conservation and Management Plan for the Greater Charlotte Harbor Watershed* (CCMP) to accomplish much to protect natural resources and to help identify new challenges.

Since the adoption of the CCMP in 2000, we have a better understanding of the value of the resource. Protecting the estuaries and watersheds through partnerships of citizens and agencies has moved from a novelty to a standard approach. Most now agree that protecting this harbor and its tributaries is in their own best interests.

What are the activities that we can do that will arrest and reverse the decline of the watersheds and estuaries? This document, the *Comprehensive Conservation and Management Plan for the Greater Charlotte Harbor Watershed Update 2013*, is our best answer to that question. This update identifies research needed to address management questions, restoration activities, legislative changes and public outreach needs. It expresses a vision, quantifiable objectives and priority actions with strategies.

There are many extraordinary people to recognize who were key to the update of the CCMP. First of all, I want to recognize the Management Conference subcommittees where most of the hard work occurred. These subcommittees were chaired by Jim Beever, Greg Blanchard, Debra Highsmith, Mike Jones, Keith Kibbey, Kaley Miller, Annette Nielson and Betty Staugler. Other significant contributors included Liz Abbott, Jaime Boswell, Joan Bush, Warren Bush, Wayne Daltry, Rhonda Evans, Lizanne Garcia, Jason Hale, Mark Hammond, Jennifer Hecker, Bob Howard, Connie Jarvis, Carla Kappmeyer, Kris Kaufman,

Ernesto Lasso de la Vega, Peggy Morgan, Judy Ott, Bobbi Rodgers, John Ryan, Stuart Stauss, Jon Thaxton and Ford Walton. I also want to thank the program staff for their energy and contributions to the CCMP, including Maran Hilgendorf, Judy Ott and Liz Donley.

This plan begins a new chapter to improve the estuaries and watersheds that we value. To everybody who contributed, your efforts are embodied in this plan. To the residents and visitors of the CHNEP study area who are learning about our issues, we hope you will join us in our efforts to improve the health of this special region. This is our “commitment to the future.”



Lisa Beever, Director
Charlotte Harbor National Estuary Program



Artwork by Lisa Beever



Introduction

The CHNEP study area is a special place. Three large rivers—the Myakka, Peace and Caloosahatchee—flow westward to the Gulf of Mexico. These rivers start as headwater wetlands, lakes, creeks and ground water that combine and meander until they become substantial rivers. The rivers flow through cities and towns, cattle pastures and citrus groves, pine flatwoods and cypress swamps. When these rivers meet the salty water of the Gulf of Mexico, they form estuaries, which are one of the most productive natural systems on earth. Coastal bays such as Lemon Bay and Estero Bay are influenced by smaller streams and are spectacular havens for fish and wildlife. The CHNEP study area is defined by subtle topography, subtropical climate and subtropical plant communities.

As more people discover the beauty of this region and the demands for land and water intensify, the special qualities of the region are threatened. The human demands for land, water, food, transportation, and access to water and recreational lands can take precedence over the quality of water and wildlife habitat. Urban communities struggle to balance housing, transportation and commercial growth while maintaining the quality of life that drew people and businesses to their communities in the first place. Rural communities are challenged by changing markets for their products while managing the pressures of regulation, international competition and the encroachment of suburbs from nearby urban areas.

Action is needed to balance important natural characteristics and human needs. Without careful management and protection, the basic nature of the region could be spoiled. Fortunately, we know the pitfalls of overstressing our natural and municipal communities. We can measure the connections between the quality of the environment and the health of the local economy. We know the real costs of fixing problems are much greater than preventing difficulties from occurring.

This *Comprehensive Conservation and Management Plan* (CCMP) details the actions needed to protect and improve our watershed as we try to balance human needs with the needs of the natural systems.



Artwork by Shelly Castle

Our plan is ambitious in scope and time frame. For the CCMP to be realized, citizens, governments and industry of the region will need to work together. The CCMP objectives are specific so we can measure our progress. The timelines are short to encourage immediate attention and action. Many of the actions will require multiple groups and agencies to work together, combine resources and overcome institutional boundaries. All these challenges are surmountable because we are unified in our mission—to keep the CHNEP study area a special place for ourselves and our children’s children.

Special places and special people

This CCMP was written by literally hundreds of people. Citizen volunteers, scientists, engineers, resource managers and elected officials have contributed countless hours, essential knowledge



and informed opinions. The CCMP was written in locations throughout the watershed such as Bartow and Boca Grande, Venice and Myakka City, Winter Haven and Sanibel, Punta Gorda and Wauchula.

The scale of participation with this CCMP reflects the size of the CHNEP study area. Although Charlotte Harbor only covers 350 square miles, the CHNEP study area extends over an area of 4,700 square miles. At its northern end, the Peace River watershed begins in Polk County near Lakeland and travels more than 100 miles to the Harbor. The Myakka River watershed starts in eastern Manatee County until it winds and meanders to meet the north side of Charlotte Harbor. Along the coast to the north, Charlotte Harbor affects the watersheds of Dona, Roberts and Lemon bays. To the south, Pine Island Sound and Matlacha Pass connect Charlotte Harbor to the tidal Caloosahatchee and Estero Bay in Lee County.

The CHNEP study area includes all or significant portions of 7 counties, as well as very small portions of 4 more counties and 24 incorporated cities and towns. The extent of the CHNEP study area broadens the number of organizations that manage, regulate and govern its uses and resources. In the CHNEP study area, two water management districts have four areas of responsibility—flood protection, water supply, water quality and natural systems. Three regional planning councils conduct regional and emergency planning. Two districts of the Florida Department of Environmental Protection perform environmental regulation, park management, enforcement and aquatic preserve management.

In 1995, then Governor Lawton Chiles nominated Charlotte Harbor as an “estuary of national significance.” As a result of this nomination, Charlotte Harbor was accepted into the National Estuary Program, becoming one of 28 other watersheds in the United States so designated. The CHNEP brings together all the local organizations, both public and private, into a “Management Conference” to write and implement a CCMP for the watershed. The CHNEP Management Conference is discussed in detail beginning on p. 7.

Through the participation of hundreds of people, the CHNEP held its kickoff ceremony in September 1996 and began the process of writing a regional CCMP. Local problems were identified, goals were

established, information was collected and special projects were funded. Local governments, basin boards and public agencies funded programs to develop monitoring programs, make scientific information more accessible and encourage local environmental education programs.

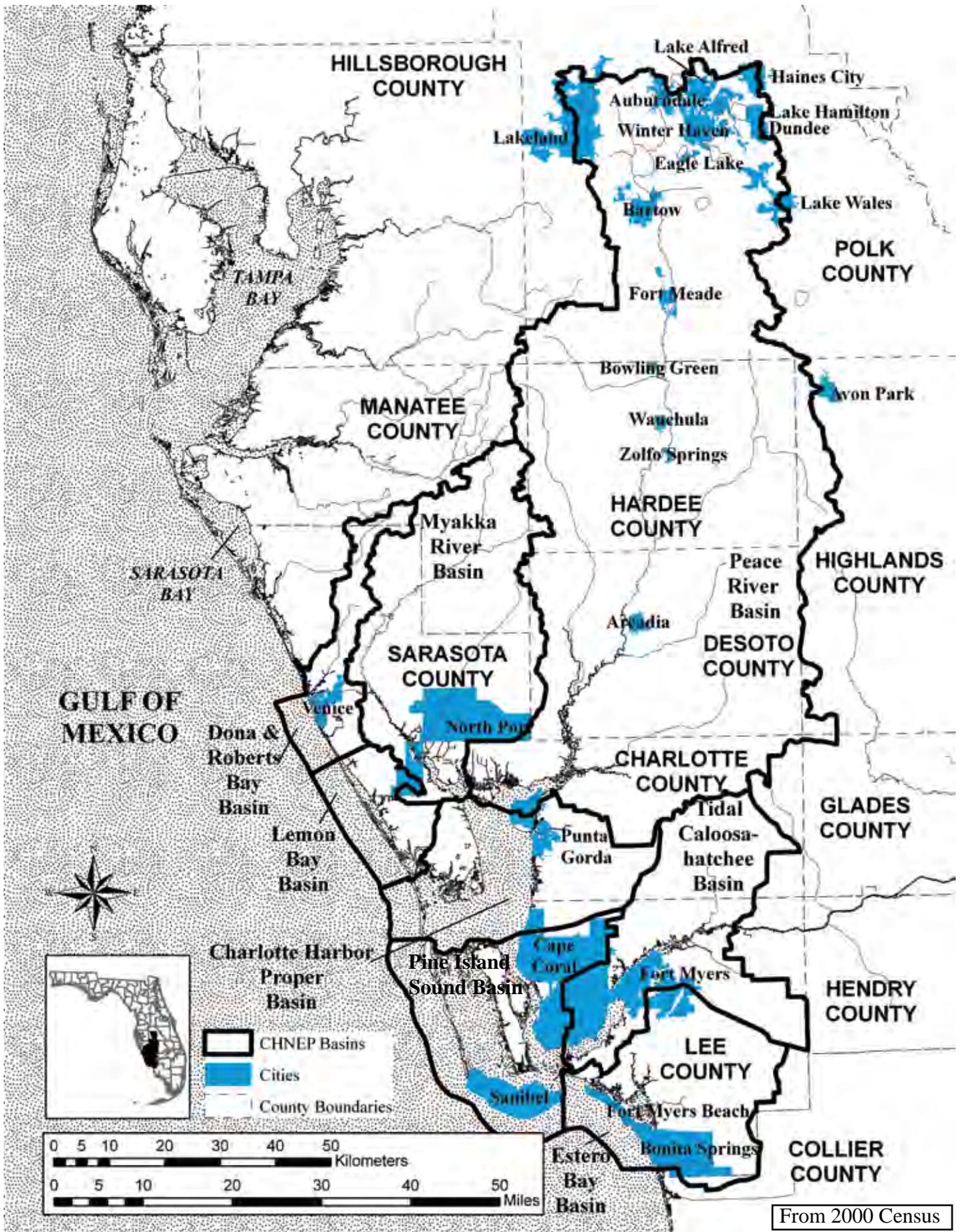
With more than 200 citizens, elected officials, resource managers and commercial and recreational resource users present, the *Greater Charlotte Harbor Watershed Comprehensive Conservation and Management Plan* was endorsed by members of the CCMP Management Conference. The signing ceremony, held on April 13, 2000, at the Bayfront Center in Punta Gorda, celebrated the completion of the CCMP and the beginning of action to restore and protect the estuary and its 4,700-square-mile watershed. Since that time, the Management Conference has worked together to implement the CCMP. This plan is the second update of the version adopted in 2000.

The CHNEP implements the CCMP by building partnerships to develop integrated plans, education and outreach programs and management structures to achieve a sustainable balance between the economy, society and the environment.

Since the CCMP was approved in 2000, significant strides have been made in implementing the CCMP. By 2006, progress had been made on all original 15 quantifiable objectives, with 2 of the 15 (13 percent) objectives and 13 of the 48 (27 percent) original priority actions having been accomplished.

The Management Conference recognized that the CCMP is a dynamic document and that periodic modification is appropriate. In 2003, a CCMP minor amendment process was adopted in order to add exotic nuisance animals and the term “minimum flows and levels” to the document. In 2004, a CCMP major amendment process was adopted by the Management Conference. As a result of the newly adopted major amendment process, the Management Conference initiated an in-depth review and revision of the CCMP in 2005. The Management Conference refined the original quantifiable objectives and priority actions based on new data and better knowledge of the natural and anthropogenic changes within the CHNEP study area. These revised, updated and new quantifiable objectives and priority actions capture, in text, the Management Conference’s vision for the CHNEP.





Map 1: Cities and Counties in the CHNEP Study Area



Hundreds of citizen volunteers continue working on “getting the word out” to their communities, taking water quality samples, planting at restoration sites, giving presentations to schools and civic organizations, and learning more about the issues impacting the future health of the estuaries and watersheds. They voice their concerns and visions of the future. All these institutions, together with the many homeowner associations, school districts, nonprofits, universities and research facilities, affect the condition of the environment. Our awareness of these problems and our ability to correct them is dependent on the effectiveness and the dedication of our communities and these institutions.

This CCMP addresses the natural resource issues in the entire CHNEP study area. Some of our problems are regional and will require breaking down institutional barriers to address them. Some problems are local—specific sites that require special attention from the local community. In every case, we gain from focusing our efforts where they will be most effective and by sharing solutions because the entire region benefits from the results.

Resource management in the twenty-first century is fundamentally different than in decades past. It is less about resource managers applying their technical knowledge through mandated regulations and enforcement and more about local communities broadening their knowledge. It is more about coordinating a regional approach to tackle problems such as pervasive habitat loss, diffuse nonpoint-sources of pollution and freshwater inflow changes. These types of problems are complex and interrelate. In the process, local communities are helped to become true stewards of their own resources. As a result, “sustainable development” becomes key to pursuing economic growth compatible with maintaining the natural environment.

The National Society of Professional Engineers defines sustainable development as “the challenge of meeting human needs for natural resources, industrial products, energy, food, transportation, shelter and effective waste management while conserving and protecting environmental quality and the natural resource base essential for future development.”

Program goals

The Management Conference developed program goals as a guide in the development of the first CCMP. These goals institute a long-term vision of the regional resources. With the adoption of the CCMP in 2000, the goals have been incorporated into the quantifiable objectives. All the quantifiable objectives and, therefore, the goals are achievable with local commitment and participation in the implementation of this CCMP.

Community involvement in the development and review of the CCMP

The CHNEP has brought together many diverse sectors of the region in the development of this CCMP. This effort began in 1996 with the establishment of the Citizens Advisory Committee (CAC) and has continued throughout the CCMP development, implementation and updates. Specific efforts to expand public participation and inform the public about the program, plan review and finalization have been successful.

At the program beginning, six public hearings were held in September 1996 to solicit public comment on the region’s problems and priorities. Based on these comments and committee input, the CCMP goals and quantifiable objectives were outlined in an early document titled *Framework for Action*, which was distributed in 1998. When the priority actions were written and the preliminary action plans collected, a draft CCMP was released in September 1999. The finalized complete plan was available in book form and on the Internet at www.CHNEP.org. With the release of the draft CCMP, the Program Office held six public hearings to answer questions about the document and to solicit public comments. The revised plan was distributed to the Management Conference and adopted in 2000. The U.S. Environmental Protection Agency approved the CCMP in 2001.

The CAC has been an important part of the process to implement the CCMP and to develop the 2008 update to the CCMP. Based in large measure on citizen input, a new priority problem, “stewardship gaps,” was identified for the 2008 CCMP update. This



priority problem focuses on issues dealing with public outreach, monitoring, data management and advocacy. The Policy Committee charged the CAC with drafting stewardship objectives and priority actions for consideration by the Management Conference. The CAC also reviewed every part of the CCMP and was instrumental in ensuring that it was understandable by citizens.

Additional objectives and actions were identified for the 2008 update by all the program committees and through a *Call for Recommendations* that was posted on the www.CHNEP.org website, listed in the *Harbor Happenings* magazine and discussed at several public workshops. These needs were collected and a survey instrument was developed to prioritize these alternatives. The survey was sent to all committee members, posted on the website and distributed at public workshops. The survey was used as a tool to identify objectives and actions for which there was a broad constituency. Priorities from the individual committees, including the CAC respondents, were included with the overall priorities.

The Habitat Conservation Subcommittee, Hydrologic Alterations Subcommittee, Water Quality and Quantity Objective Subcommittee and the CAC Plan Subcommittee drafted the core components of the CCMP under each of the four priority problem areas. All subcommittees reviewed the vision series and the

relationships between vision, objectives and actions. The complete plan was posted on the website, sent to partners as an editable computer file and made available in book form.

All comments received were distributed to the Management Conference. This final version of the CCMP was edited under their guidance to address the concerns expressed in the public comments received. In addition, the U.S. Fish and Wildlife Service and the National Marine Fisheries Service were represented on one or more committees and participated in the CCMP development, particularly with respect to federal endangered species impacts and essential fish habitat.

The *Call for Recommendations* was replicated for the 2013 update. All suggestions were incorporated. In addition, new policies such as seagrass and nutrient targets were added. The most major change was to eliminate potential coordinating agencies from each priority action page and to add environmental indicators and targets.

Each version of the CCMP was submitted to state and regional clearinghouses for consistency review, which includes reviews by the Florida Coastal Management Program as well as the State Historic Preservation Officer under the guidelines of the National Historic Preservation Act.



Photo by Lisa Beever, 3/21/07

Citizens Advisory Committee members tour Jacaranda Library native plant garden, Venice



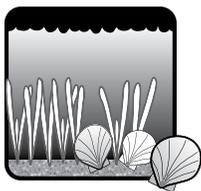
Nature of the Problem

Priority problems

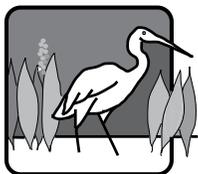
One of the Management Conference's early achievements was to identify regional priority problems. These problems, summarized below, vary geographically in extent and severity, but they are common regional issues.



Hydrologic alterations: Adverse changes to amounts, locations and timing of freshwater flows, the hydrologic function of floodplain systems and natural river flows.



Water quality degradation: Pollution from agricultural and urban runoff, point-source discharges, septic systems and wastewater treatment systems, atmospheric deposition, ground water and other sources.



Fish and wildlife habitat loss: Degradation and elimination of headwater streams and other habitats, conversion of natural shorelines caused by development, cumulative impacts of docks and boats, invasion of exotic species and cumulative and future impacts.



Stewardship gaps: Limitations in people's knowledge of choices and management decisions that will lead to sustainability within their community. These gaps include overarching issues such as public outreach, advocacy and data management.

Coast into the future

This CCMP is a call for action from our citizens, our governments, our industries. Everyone who lives, works and plays in the CHNEP study area is called to help in the implementation of this CCMP.

There is much to be accomplished. Residents can decrease water use on their lawns and in their homes to reduce the stress on our limited freshwater resources. Homeowners can also decrease stormwater pollution by minimizing use of and properly disposing of chemicals, fertilizers and household waste. Boaters can act to avoid damaging seagrass beds and harming manatees and other fragile living resources. Agriculture can decrease its water use and utilize reuse water for irrigation. Tourism-based industries can work to minimize visitor impact on the natural resources and teach an appreciation for the natural environment. Local governments can implement effective growth management to control the impacts of septic systems, sewage plant discharges and habitat destruction.

This plan represents our commitment to the future. The implementation of this plan will determine our legacy to future generations. We are determined to create our own future by working together and acknowledging the challenges we face. The dedication and participation of so many people to create this plan is an important first step. Many of our choices are not easy, but they have lasting effects. We hope you and your children will help us keep the CHNEP study area a special place to live, work and visit.



Management Conference

The National Estuary Program was established in 1987 by amendments to the Clean Water Act to restore and protect estuaries along the coast of the United States. In 1995, Charlotte Harbor was designated as an “estuary of national significance” and accepted into the National Estuary Program.

The geography of the CHNEP includes the southwest Florida coastline from Venice to Bonita Springs and contains a watershed including all or portions of Charlotte, DeSoto, Hardee, Lee, Manatee, Polk and Sarasota counties. (A very small portion of Highlands, Glades, Collier and Hillsborough counties is also contained within the watershed.) By engaging all types of local communities and activities in the process, the program focuses on improving the water quality of the estuaries while maintaining the integrity of the whole system—its chemical, physical and biological properties as well as its economic, recreational and aesthetic values—and the land/water connection.

Consensus for action

The Management Conference is a partnership working together through structured committees. The partnership works as an advocate for the estuarine system by building consensus that is based on sound science.

The CHNEP Management Conference is made up of four committees and a Program Office. Each committee serves a specific purpose and brings together a diverse representation of expertise, interests and points of view. Since January 25, 1996, nearly 600 people have participated on one or more committees. (These wonderful volunteers are listed in an appendix.) They have dedicated thousands of hours to building consensus for the actions in this CCMP. The Program Office performs the administrative functions of the program and supports the activities of the committees. The CCMP guides the work of all activities in the Management Conference.

CHNEP Management Conference committees

The CHNEP Management Conference includes the Policy Committee, the Management Committee, the Citizens Advisory Committee (CAC) and the Technical Advisory Committee (TAC).

The **Policy Committee** establishes general policy for the CHNEP and has ultimate authority in program administration. The Policy Committee appoints members to other committees and approves budgets. This committee is the bridge between the Management Conference and local governments and agencies of the region. In fact, all but 3 of the 24 members of the Policy Committee represent city, county or regional governing bodies in southwest Florida. Policy Committee members represent the citizenry of the CHNEP study area.

The **Management Committee** provides strong institutional support for the CHNEP by staffing, funding or otherwise facilitating projects. This committee reviews work plans, contract proposals, work schedules and products. It also ensures that program milestones and objectives are accomplished. Each member of the Policy Committee has an analogous representative on the Management Committee.

The **Citizens Advisory Committee (CAC)** provides a mechanism for citizens to influence the policies of the CHNEP. The CAC works closely with staff to reinforce and maintain public support for the CHNEP, develop public participation strategies and provide input on public education programs. This committee also helps develop work plans and public workshops, provides a forum for public comment and directs public concerns to the other committees of the Management Conference. A CAC officer is a voting member of the Management Committee.

The **Technical Advisory Committee (TAC)** provides technical support to the CHNEP. The TAC identifies scientific problems facing the CHNEP study area. The TAC helps develop work plans, develops requests for technical proposals and reviews contract deliverables.



It also assists with information management and coordinates agency research. A TAC officer is a voting member of the Management Committee.

In 2003, a **Legislative Subcommittee** was created with representatives for the entire Management Conference to (1) refine the Legislation Agenda for consideration by the Policy Committee, (2) increase communication and discussion on proposed legislation that may affect the program's ability to implement the CCMP, (3) provide members an opportunity to learn about and consider proposed legislation for action by their member organizations, (4) establish a quick response for the CHNEP to have a voice in proposed legislation, following the *Advocacy and Review Procedures* adopted February 21, 2003, and (5) provide an informal subcommittee structure for direct communication among conference members of different roles—citizen, scientist, manager, agency official and elected official.

In 2007, the CHNEP began holding regular **Science Forums** to present the latest scientific findings for wide-ranging discussion. The Science Forums are a popular and exciting venue for scientists, citizens and decision-makers to discuss emerging issues as they relate to the CCMP. Recommendations are not derived at these forums but instead ideas are developed for later discussion and action by the committees.

In 2011, the CHNEP established a **Restoration and Management Projects Review Forum**. Each forum invites members of the Management Conference and the public to review significant projects in the study area.

Overseeing implementation

The success of the CHNEP ultimately will be measured in the protection and management achieved through implementation of the CCMP. Consequently, a key ingredient for success is defining who should oversee implementation of the CCMP and what oversight should entail. Through the Program Office and the four committees, a comprehensive evaluation of the goals and quantifiable objectives established through the CHNEP will be initiated five years after the adoption of the CCMP to ensure that efforts and funding are effectively targeted.

The CHNEP itself, in addition to the projects conducted by its partner organizations, has defined

some specific responsibilities to enhance existing efforts and to improve coordination among the many active organizations in the region. Through the CHNEP office and assistance from the committees, the CHNEP will conduct the following activities:

- Implement CHNEP initiatives.
- Coordinate data management programs.
- Assist in implementation of the long-term monitoring strategy.
- Monitor progress and assist implementation.
- Support the Management Conference structure and activities.
- Monitor progress of the implementation of the CCMP.
- Conduct the triennial review (every three years) of implementation, as required by the U.S. EPA.
- Produce “report cards” on the environmental status of the CHNEP study area.
- Prepare the annual work plan and perform grant administration.
- Locate funding sources and grants for project implementation.
- Conduct the federal consistency review process.
- Assist the Management Conference in modifying the quantifiable objectives and priority actions as needed to meet the program goals.
- Support public outreach and involvement.
- Continue activities for public education as described in the *Strategic Communications Plan*.
- Implement new public involvement activities, with the assistance of the Citizens Advisory Committee, as identified in the *Strategic Communications Plan*.

The Management Conference of the CHNEP decided to continue the four committees of the conference and to preserve the existing structure to oversee the implementation of the CCMP. The primary oversight roles of the CHNEP will be to monitor progress in implementation and the environmental conditions, assist implementation, continue public outreach and involvement and implement the long-term monitoring and data management strategies. Specific efforts associated with these functions are outlined elsewhere.

Role of the Citizens Advisory Committee

The Citizens Advisory Committee (CAC) is the critical link between the program and the public. An active CAC is well suited to provide information to the Management Conference about public concerns and sentiments. The CAC is also an essential mechanism



for dispersing program information to key community organizations and individuals that may not be directly involved with the program. The primary roles of the CAC during implementation are defined as:

- Make recommendations to the Policy Committee regarding citizen perspectives on public outreach, advocacy positions and policies to implement the CCMP.
- Give individuals access to the CHNEP Management Conference.
- Provide input on the outreach strategy.
- Provide input on the public involvement work plan components/budget.
- Distribute information and materials to other organizations.
- Establish standing and ad hoc subcommittees as needed to fulfill specific roles.
- Contribute in other areas as needed.

The CAC has several standing committees to address:

Standing Rules, Membership, Nominating, Grants, Work Plan and Environmental Indicators. A nonprofit support organization was created by the CAC but has not yet been active.

Role of the Technical Advisory Committee

The Technical Advisory Committee (TAC) provides a wealth of knowledge and a diversity of technical expertise to the program and its projects. As more information is gathered and new projects are initiated, additional technical input will be needed. The main roles of the TAC during implementation are defined as:

- Perform fact-finding activities, i.e., strictly information gathering and reporting to the

Management Conference for matters within the scope of the CCMP.

- Provide revised technical information about the CHNEP study area.
- Exchange information among technical users.
- Provide input on the data management program.
- Provide input on the long-term monitoring program.
- Establish standing and ad hoc subcommittees.
- Provide other technical input as needed.

The TAC has created four committees:

The **Water Quality Quantifiable Objectives Subcommittee (WQQOS)** determines water quality performance/biological indicators for the water bodies in the CHNEP study area. This subcommittee first met on May 9, 2000, and continues to meet regularly.

The **Habitat Conservation Subcommittee (HCS)** addresses issues related to the fish and wildlife habitat loss quantifiable objectives. Their first meeting was March 19, 2001, and they continue to meet regularly.

The **Hydrologic Alterations Subcommittee (HAS)** addresses the issues related to the hydrologic alterations quantifiable objectives in the CCMP. Their first meeting was May 8, 2002, and they continue to meet regularly.

The **Charlotte Harbor Regional Ambient Monitoring Program (CH RAMP)** worked on coordinating water quality monitoring programs and their methodologies in the CHNEP study area. This subcommittee consists mainly of staff from agencies or organizations that monitor water quality. Their first

meeting was October 11, 2000, and they dissolved in 2001 after voting to instead participate in the quarterly meetings of the Southwest Florida RAMP. This allows the greater coordination of water quality monitoring throughout the southwest Florida region from Pinellas to Collier counties. The former co-chair of the Charlotte Harbor RAMP is currently a co-chair of the Southwest Florida RAMP.



Photo by Lisa Beever, 9/11/03

Technical Advisory Committee reviews research findings, Punta Gorda



Role of the Management Committee

The Management Committee continues to serve an important role of integrating the desires of the Citizens Advisory Committee with the scientific information from the Technical Advisory Committee. The Management Committee members are also primary advisors to their Policy Committee counterparts and are, therefore, an important source of accurate information to elected officials and policymakers. The Management Committee's role is to:

- Implement projects.
- Apply for additional grant funding.
- Coordinate regional efforts.
- Check progress/environmental results.

Role of the Policy Committee

During implementation, the Policy Committee continues to be the final decision-maker for program spending, membership and overall direction.

The importance of involving local officials in the decisions of the program cannot be overstated. The Policy Committee's continued activity is equally important for successful implementation. The Policy Committee's role is to:

- Support implementation.
- Periodically review the quantifiable objectives and priority actions, as well as recommend modifications to fulfill the CCMP.
- Oversee the Program Office.
- Authorize work plan and funding.
- Raise matching funds.

One of the strengths of the CHNEP is the alliance of local government and regulatory agencies for the entire region represented on the Policy Committee. Our local government and agency partners feel that maintaining this decision-making structure—with regulators and regulated interests working together toward common goals and assisted by scientific and citizen advisors—is critical to assuring implementation of the CCMP. The “bottom-up” approach to environmental management gives all partners a commitment to the future of the region.

U.S. Environmental Protection Agency role

The U.S. EPA administers the National Estuary Program that Congress funds through its budget. Under the Estuary and Clean Waters Act of 2000, Congress increased its annual funding support of the 28 National Estuary Programs to implement each *Comprehensive Conservation and Management Plan*. The funding increased to approximately \$500,000 per year for each National Estuary Program, with local funding match of at least 50 percent. The U.S. EPA is also an implementing partner, along with many other organizations in the Management Conference.

Staff and local sponsorship

Maintaining an active Program Office is necessary to support committee activities, manage the U.S. EPA grants and other funding, provide a central information source and conduct the federal consistency review process. Maintenance of a core staff including a director, communications manager, scientist and grants/contracts manager is recommended, along with maintaining clerical support through the local sponsor.

Throughout the planning phase of the CHNEP, the Southwest Florida Regional Planning Council (SWFRPC) has been the sponsor. A local sponsor is required to receive CHNEP funding from the U.S. EPA. In keeping with its sponsorship, the council has provided office space, supplies, computers and secretarial support for the CHNEP Program Office. The Management Conference recommends that this relationship continue.



Photo by Maran Hilgendorf, 8/21/06

Policy Committee honored Commissioner Pat Glass (5th from right)



State of the Watershed

Natural geography links inland areas with the coast

Inland areas with freshwater lakes, headwater wetlands and rivers combine with coastal areas to make up the CHNEP study area ecosystem. The watershed extends approximately 130 miles from the northern headwaters of the Peace River in Polk County to southern Estero Bay in Lee County. The CHNEP study area is divided into eight watersheds by hydrological, ecological and management distinctions (see Map 1, p. 3). In each of these watersheds, rainfall collects in wetlands and runs to streams and rivers through a rich variety of plant and animal habitat, soils and surficial geology. These watersheds include Dona and Roberts bays, Lemon Bay, Myakka River, Charlotte Harbor, Peace River, Pine Island Sound/Matlacha Pass, Tidal Caloosahatchee River and Estero Bay.



A satellite image depicts the Charlotte Harbor watershed

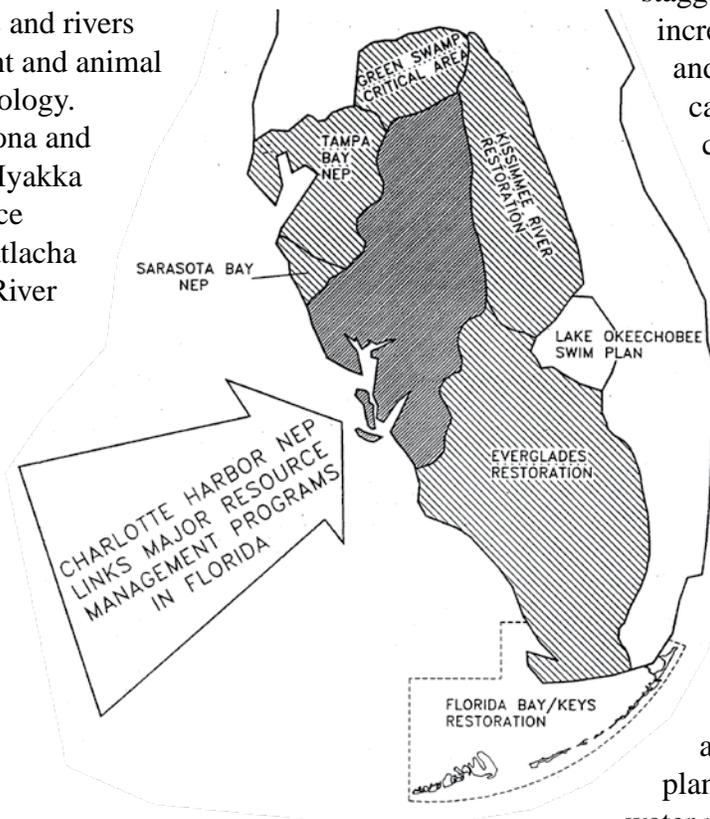
Unlike other estuaries in southwest Florida that are mostly influenced by the Gulf of Mexico, the large rivers of the Peace, Myakka and Caloosahatchee give Charlotte Harbor its special freshwater characteristics. Large fluctuations of river flows between wet and dry seasons strongly affect the

water salinity and dissolved oxygen. In contrast, nearby estuaries in Tampa and Sarasota are more influenced by the Gulf and are usually well mixed.

The CHNEP study area adjoins the watersheds of Tampa and Sarasota bays in Hillsborough, Manatee and Sarasota counties. The three combined estuaries are the fourth largest estuary system in the entire Gulf of Mexico. These estuaries are complemented by intensive ecosystem management initiatives to solve some of the problems with Lake Okeechobee, the Everglades, the Ten Thousand Islands, Florida Bay and the Florida Keys.

Difficult resource management issues confront both the freshwater inland areas and the coastal estuary region. Inland, groundwater levels have declined significantly, phosphate mining is moving into new areas and some lakes and rivers suffer from chronic water quality problems. More intensive agriculture, mining and residential development are replacing native upland habitats and grazing lands. On the southwest Florida coast, projected increases in visitors, residents and urban development are

staggering. Upstream pollution, increasing water consumption, and intensive use of boats, cars and roads, threaten coastal habitats.



Political geography links governments in the watershed. The CHNEP study area has distinct demographic, cultural and political features. The watershed includes 24 municipalities in Polk, Hardee, Highlands, DeSoto, Manatee, Sarasota, Charlotte and Lee counties. Regionally, these local governments are linked by three regional planning councils, two water management districts and



numerous district divisions of state agencies. Also active in this region are 9 federal agencies, 16 private science or resource management groups and numerous land trusts and environmental educators. Many of these agencies have multiple roles in managing natural resources in the CHNEP study area.

The economic geography of the watershed covers a diverse region of important rural and urban communities and a natural environment worth protecting. The industries of fishing, agriculture, mining, tourism, retirement and construction provide the economic base of the region. The economy has diversified and strengthened because people have moved to the area to enjoy the natural environment. The region, especially coastal counties, has grown at a faster rate since 1950 than the state and the nation. Highways link inland rural communities with jobs and services in more populous urban communities on the interstate freeway system.

Challenges to resource management

The large size of the CHNEP study area creates challenges for managers and citizens alike. The watershed has both rural and urban characteristics, freshwater and marine ecosystems, tourism- and

agricultural-based economies and diverse local issues and priorities. This diversity creates a need for improved regional management as well as public education about the interconnections among the benefits we treasure.

The complexity of the CHNEP study area does not lend itself to simple management solutions. Since the watershed is large, it is often difficult to determine how changes are caused by natural conditions versus human impacts. When a watershed undergoes rapid simultaneous changes, such as the construction of canals, the expansion of urban development and the intensification of agriculture, it can be troublesome to link environmental problems to a single activity. Understanding how human activities affect water quality, hydrology and habitat requires intensive monitoring and analysis over the long term. In our diverse region with a constantly growing population, not enough consistent information exists to make perfect decisions. In these circumstances, both resource managers and the public have to make the best judgments possible, even though opinions about the best course of action may differ.

Declines in habitat, water quality and water flows are usually caused by a combination of effects called cumulative impacts. All of us contribute to cumulative

impacts when we drive our cars, flush our toilets and build new houses. The challenge to resource management in southwest Florida is to ensure that the cumulative effects are not so large that the natural systems and the benefits they provide are beyond repair. When the quality of natural resources is diminished, the regional economy can also be adversely affected. Understanding how natural resources and the economy are related is also a challenge to resource management.



Photo by Lisa Beever, 9/11/07

Tree die-off at Flatford Swamp in the Myakka River watershed



Freshwater creeks and rivers

Freshwater resources are worth protecting. As freshwater resources decline and demand for water grows, inland freshwater resources increase in value. These waters are particularly important to inland economies, but their quality affects the entire CHNEP study area. Agricultural land uses, including cattle, row crop and citrus groves, is one of the three traditional components of the statewide economic base. The rivers and economies are linked by freshwater-based uses and the coastal communities they supply with food and other products.

Freshwater resources define the quality of residential life in both coastal and inland communities. These resources support agriculture, fishing, mining and recreation/tourism uses valued annually in billions of dollars. Three watersheds contain our major surface freshwater supplies—the upper watersheds of the Myakka, Peace and Caloosahatchee rivers.

Myakka River

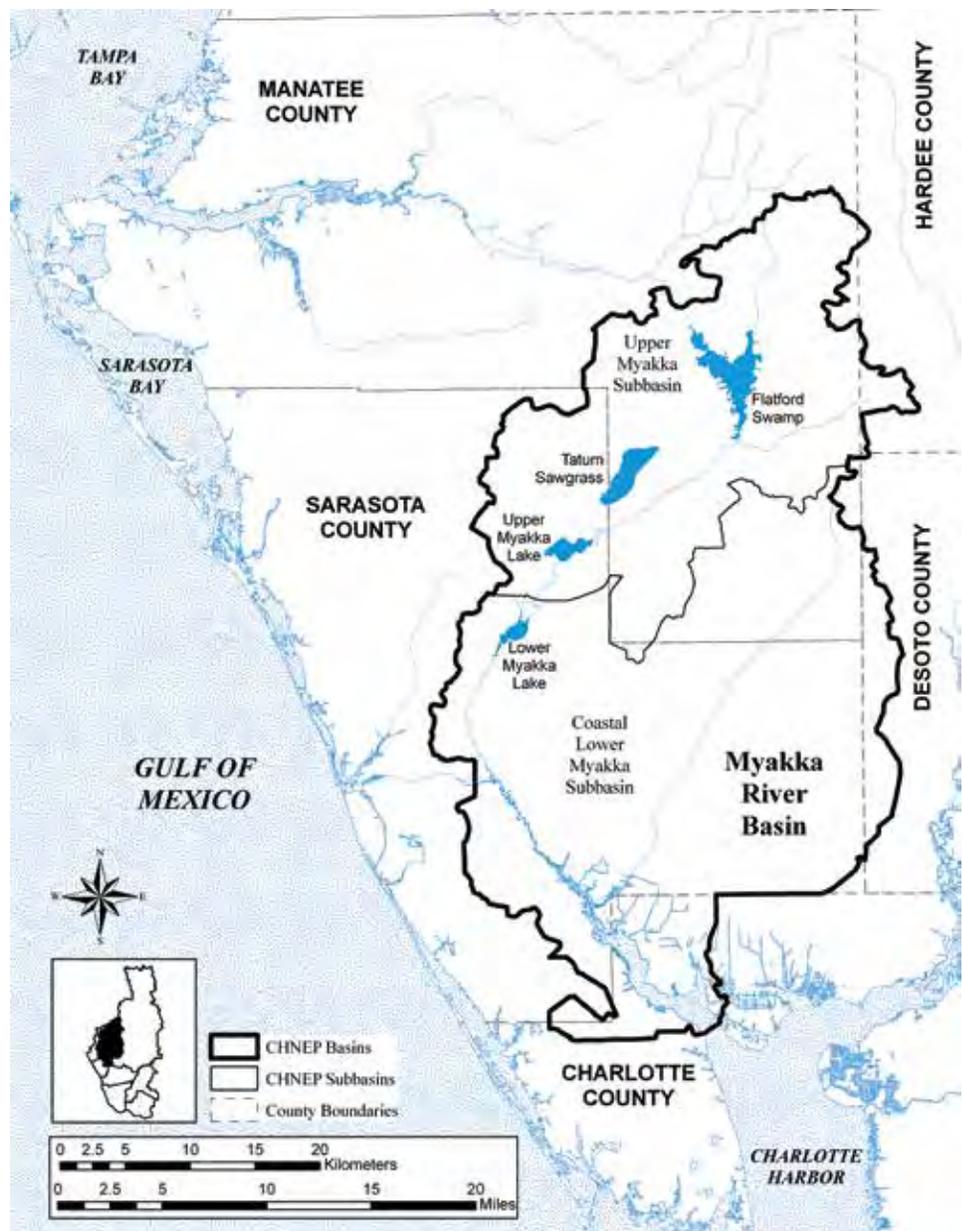
The Myakka River watershed has the largest contiguous wetland landscape of the three watersheds. The 66-mile river begins its southerly flow from headwaters in Manatee and Hardee counties. After following a narrow floodplain forest corridor, the river slows and enters a series of lakes in Myakka River State Park, the largest state park in Florida. Deer Prairie Creek and Big Slough feed the river as it widens and enters Charlotte Harbor. The 34-mile portion of Myakka River in Sarasota County is designated a “Florida Wild and Scenic River.”

Cattle ranching dominates the majority of the watershed, especially upstream of Myakka River State Park. To satisfy the need for range and pastureland, much of the watershed was drained and diverted. These alterations enabled some of the drained area to be used for row crops

and citrus groves. Other parts of the upper and central portions of the Myakka River watershed have been acquired for state management and protection.

In the lower portion of the Myakka River watershed, urban development is displacing agriculture. Former grazing lands along the banks of the lower Myakka River are now being converted to urban uses, mostly homes. Construction is occurring on the vast inventory of lands that were platted in the 1960s. At that time, these plats displaced agriculture in western Port Charlotte and in the City of North Port. The Myakka River now becomes even more important to these areas, supplying their drinking water as well as habitat for fish and wildlife.

From 2007 CHNEP Basin Update



Map 2: Myakka River Watershed (Basin)



Peace River

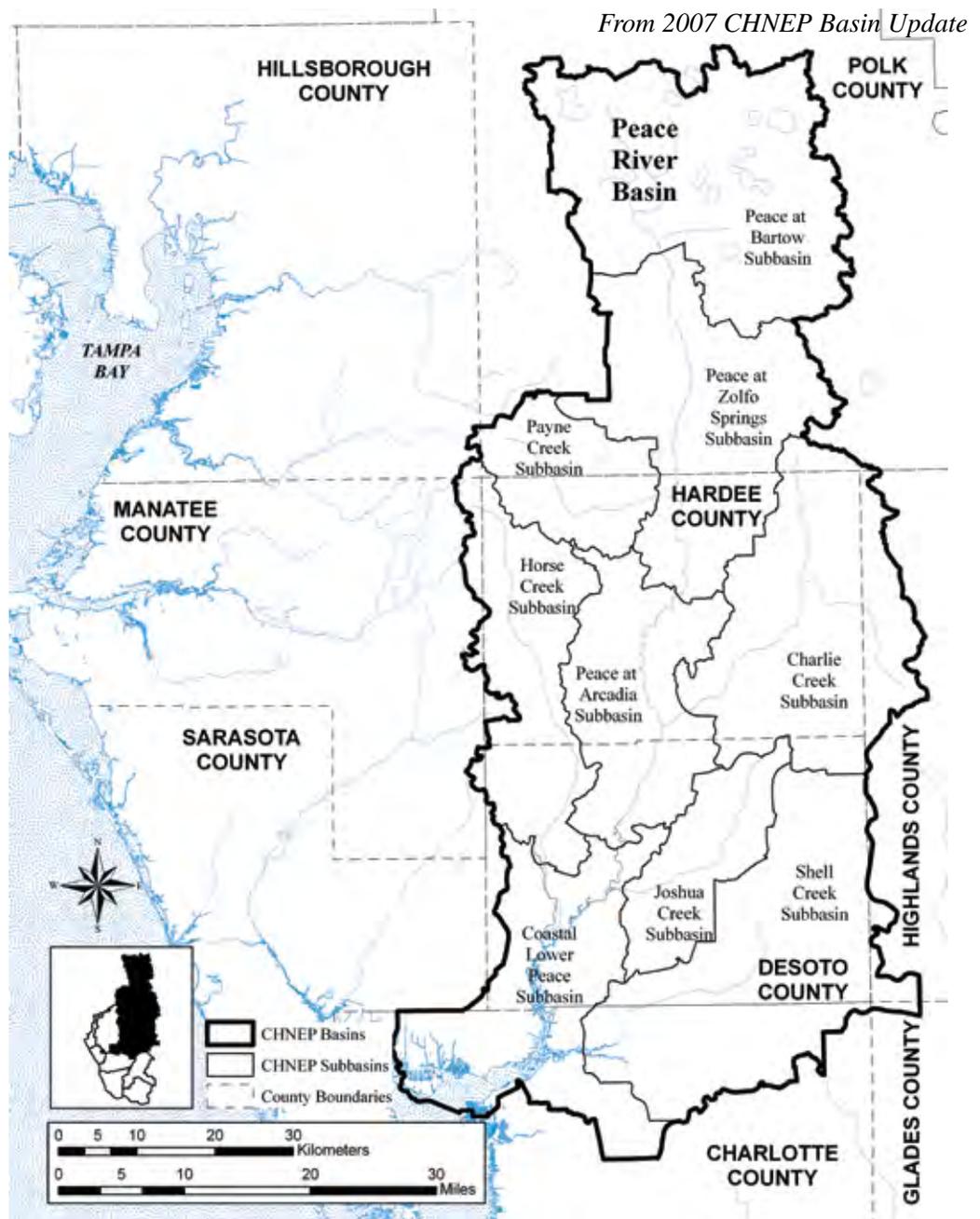
At 2,315 square miles, the Peace River watershed is the largest and most diverse in the CHNEP study area. The river originates at the Green Swamp in central Polk County, draining a series of wetlands and lakes. The rate of flow is directly proportional to groundwater levels. Underground and overland flows follow natural and altered paths through canals, flood control structures, former and active phosphate mines, wetlands and Lake Hancock. South of Lake Hancock, canals and tributaries combine to define the main channel of the Peace River that eventually flows more than 100 miles southwest to Charlotte Harbor.

Phosphate mining has been a major land use in the Polk County headwaters of the Peace River for more than a century, altering the hydrology, flora and fauna of the landscape. State law requires all lands mined after July 1, 1975, to be reclaimed. In addition, the adoption of a state trust fund in 1977 allowed a portion of areas mined prior to 1975 to be voluntarily reclaimed. Citrus, cattle ranching and row crop farming also occur in Polk County, but are more common downstream in Hardee, DeSoto and Highlands counties.

The Peace River is the largest freshwater contributor to Charlotte Harbor. It is a source of drinking water for about 90,000 people in Charlotte, DeSoto and Sarasota counties. With the effects of reduced rainfall, combined with mining, agriculture and municipal water uses, freshwater flows have declined, threatening the ecology of the river system and Charlotte Harbor.

Reduced flows are most apparent upstream, although declines have also been recorded in the Peace River as far downstream as Arcadia.

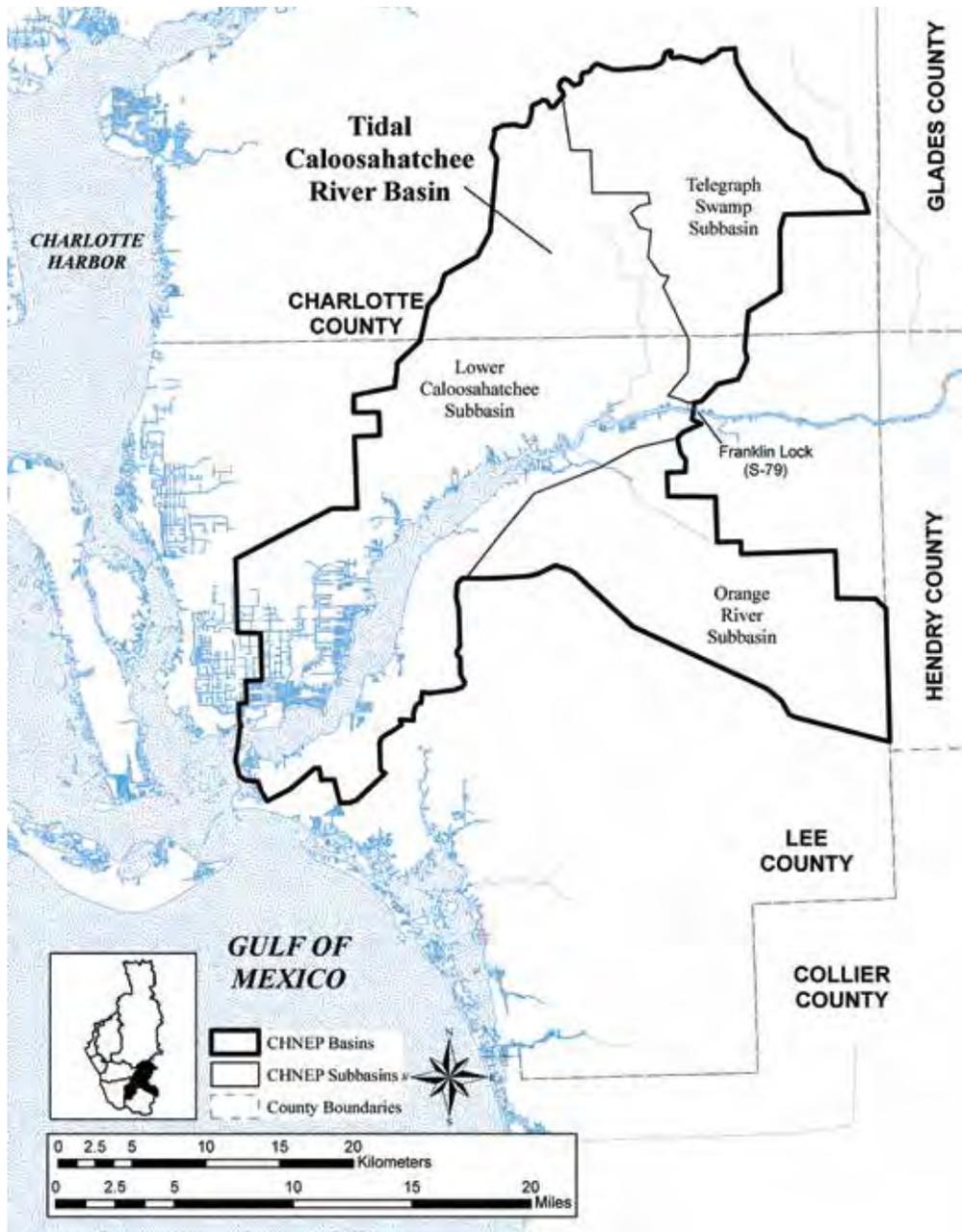
The Peace River basin is of particular concern to the Florida Legislature, which directed the Florida Department of Environmental Protection (FDEP) to study the cumulative effects of major changes in “landform and hydrology in the Peace River basin.” In March 2007, the FDEP transmitted the *Peace River Basin Resource Management Plan* to the Florida Legislature. The plan was based on the *Peace River Cumulative Impact Study*, which is available at www.dep.state.fl.us/water/mines/.



Caloosahatchee River

The Caloosahatchee River originated as overland flow through marshlands and swamp forest until 1881 when it was connected to Lake Okeechobee. Since then, the U.S. Army Corps of Engineers has converted the upper river into a canal, connecting the lake to the river and controlling discharge by structures and locks. Today, Franklin Lock in Lee County separates the fresh water of the river from the salt water of the estuary. The lock also marks the beginning of the 30-mile tidal watershed of the Caloosahatchee River that starts at the lock and continues to the Gulf of Mexico.

From 2007 CHNEP Basin Update



Map 4: Tidal Caloosahatchee River Watershed (Basin)

Twentieth century transportation, drainage, irrigation and waste disposal have been hard on the Caloosahatchee River and its watershed. The channels have been straightened, shorelines hardened and oyster reefs dredged. Remnants of the old river course, termed “oxbows,” have been neglected. The river has been assaulted by raw sewage, stormwater runoff, great counter-seasonal freshwater releases, pesticide spills, thermal effluent and exotic nuisance species.

Dominated by the human uses in the surrounding cities of Cape Coral and Fort Myers, the estuary still provides critical habitat that requires careful management. Despite the accumulated damages, seagrasses still flourish when river conditions are

suitable. Boaters delight upon seeing manatees (*Trichechus manatus*) and anglers speak of remarkable catches of snook (*Centropomus undecimalis*) or redfish (*Sciaenops ocellatus*) from secret fishing holes. Agribusiness has converted many uplands and wetlands east of Franklin Lock to intensive agricultural uses. Conversion includes numerous drainage and irrigation canals where crop demands regulate river water flows into or out of the adjacent canals. The citrus industry has expanded significantly into the upper watershed during the past decade and depends highly on controlling soil water levels. In addition to the upstream channel, small creeks and tributaries contribute significant fresh water to the watershed. Considerable freshwater urban runoff also enters the river and estuary from the extensive network of navigation and drainage channels in Lee County.



Coastal environments

Estuaries are among the most productive environments on earth. When the freshwater creeks and rivers meet the salty waters of the Gulf of Mexico, they create a productive estuarine environment. Plants, animals and people take advantage of the places we call estuaries. Many species of freshwater and marine animals rely on the estuary and spend a portion of their life cycles in this environment.

A series of distinct but related bays and estuaries make up the coastal environment of southwest Florida. These bays and estuaries include Dona and Roberts bays, Lemon Bay, Charlotte Harbor proper, Pine Island Sound/Matlacha Pass and Estero Bay. Together they form one of the largest systems in the state and the most productive estuarine area of Florida's west coast.

Estuarine environments require careful management. The estuaries in the CHNEP study area are heavily influenced by fresh water and intense use. Restoration and maintenance of high environmental quality should sustain the coastal economic base for tourism, fishing, recreation and quality of life for area residents.

Dona, Roberts and Lemon bays

Bays, beaches, barrier islands and mangroves dominate Dona and Roberts bays to Cape Haze. The barrier islands separate the waterway running from Venice Inlet through Lemon Bay from the open waters of the Gulf of Mexico and Charlotte Harbor. Gasparilla Sound, a broad open water body, forms the exception to this pattern of lagoons. Southward, Gasparilla Sound merges into Charlotte Harbor proper. This part of the CHNEP study area has some important resource management challenges:

- Restoration of historic basin boundaries and resulting freshwater flows to estuaries.
- Effects of boat traffic and dredging on the Intracoastal Waterway and other channels.
- Retention of mangrove areas and protection of seagrass.
- Large areas of undeveloped platted lots.
- Effects of septic systems and stormwater runoff from development on water quality.
- Dynamically unstable tidal inlets.
- Nuisance exotic vegetation removed

All these factors characterize the neighborhoods and habitats in this coastal area.

Charlotte Harbor, Myakka and Peace estuaries

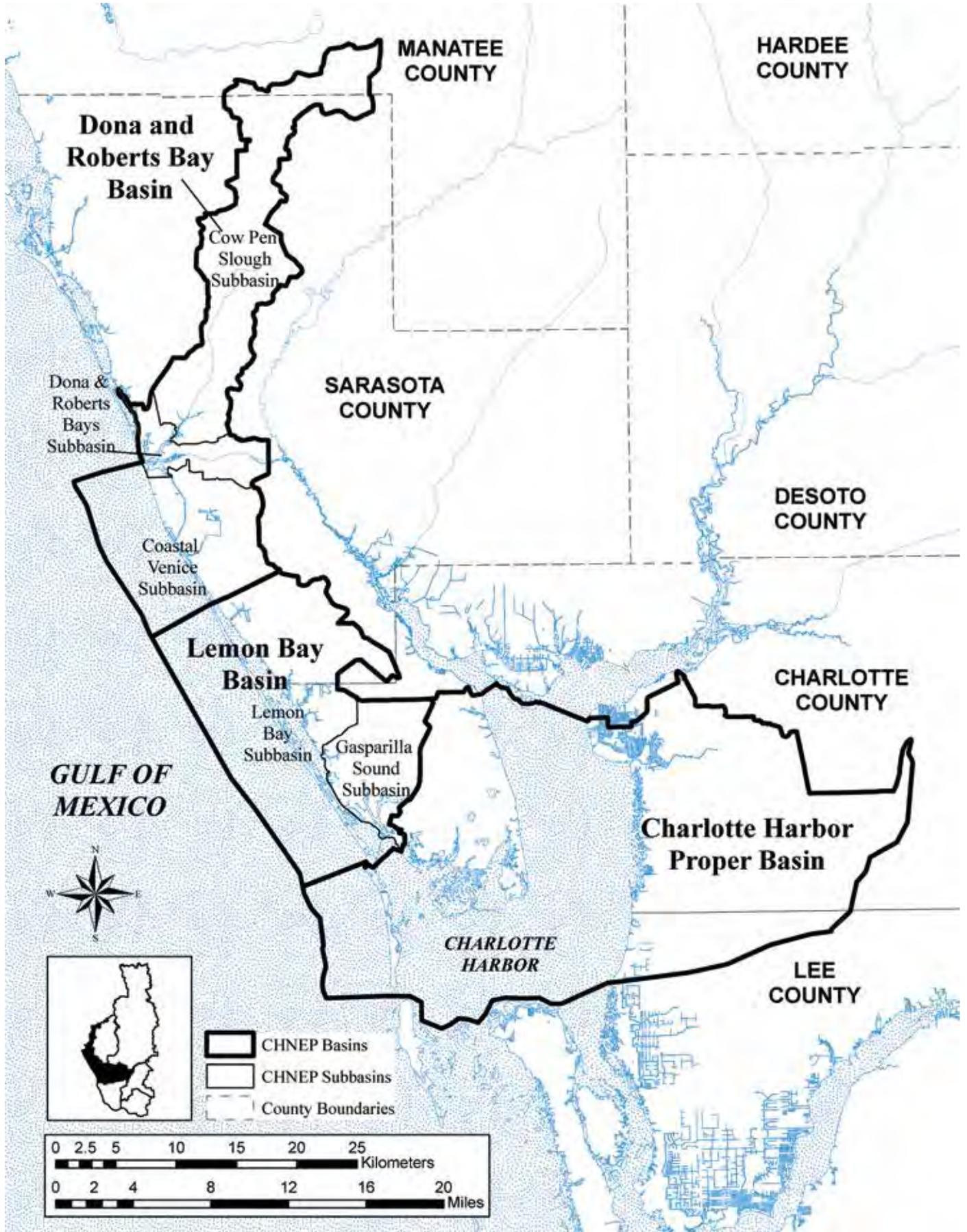
Charlotte Harbor proper lies primarily in Charlotte County and connects to the Gulf of Mexico through Boca Grande Pass. Although the Harbor has an area of about 130 square miles, much of it is very shallow. Areas of deep Harbor water extend up into the lower Myakka and Peace rivers. Sandy shelves make up the Harbor "walls," including Cape Haze on the west and Punta Gorda/Cape Coral on the east. These east and west walls are covered by seagrass beds—essential habitat for young fish and other wildlife.

The tides from the Gulf of Mexico affect water levels far up the Myakka and Peace rivers. Although salt water migrates up the rivers during low river flow periods, typical high water flows in the summer freshen the rivers and lower Harbor salinity. Thus, the Harbor changes dramatically with the seasons.

The Charlotte Harbor Aquatic Preserves are five contiguous aquatic preserves within the greater Charlotte Harbor estuary complex designated by the state Legislature for inclusion in the aquatic preserve system under the Florida Aquatic Preserve Act of 1975. The preserves are (from north to south): Lemon Bay Aquatic Preserve, Cape Haze Aquatic Preserve, Gasparilla Sound–Charlotte Harbor Aquatic Preserve, Matlacha Pass Aquatic Preserve and Pine Island Sound Aquatic Preserve. All these areas are included in the *Charlotte Harbor Aquatic Preserves Management Plan*. Additional information can be found at www.dep.state.fl.us/coastal/sites/charlotte/info.htm.

The public owns many of the wetlands, mangrove forests and salt marshes surrounding the Harbor. Very large buffer areas, part of the Charlotte Harbor Preserve State Park and mangrove islands are also publicly owned. However, much of the former ranch land and natural habitat have been displaced by platted lots and suburban development. As people continue to move to the communities around Charlotte Harbor, the impacts of man-made canals, septic systems, mangrove trimming and loss of upland habitats require more careful management. One excellent example is the recent decision by Charlotte County to provide central sewers to the South Gulf Cove development.

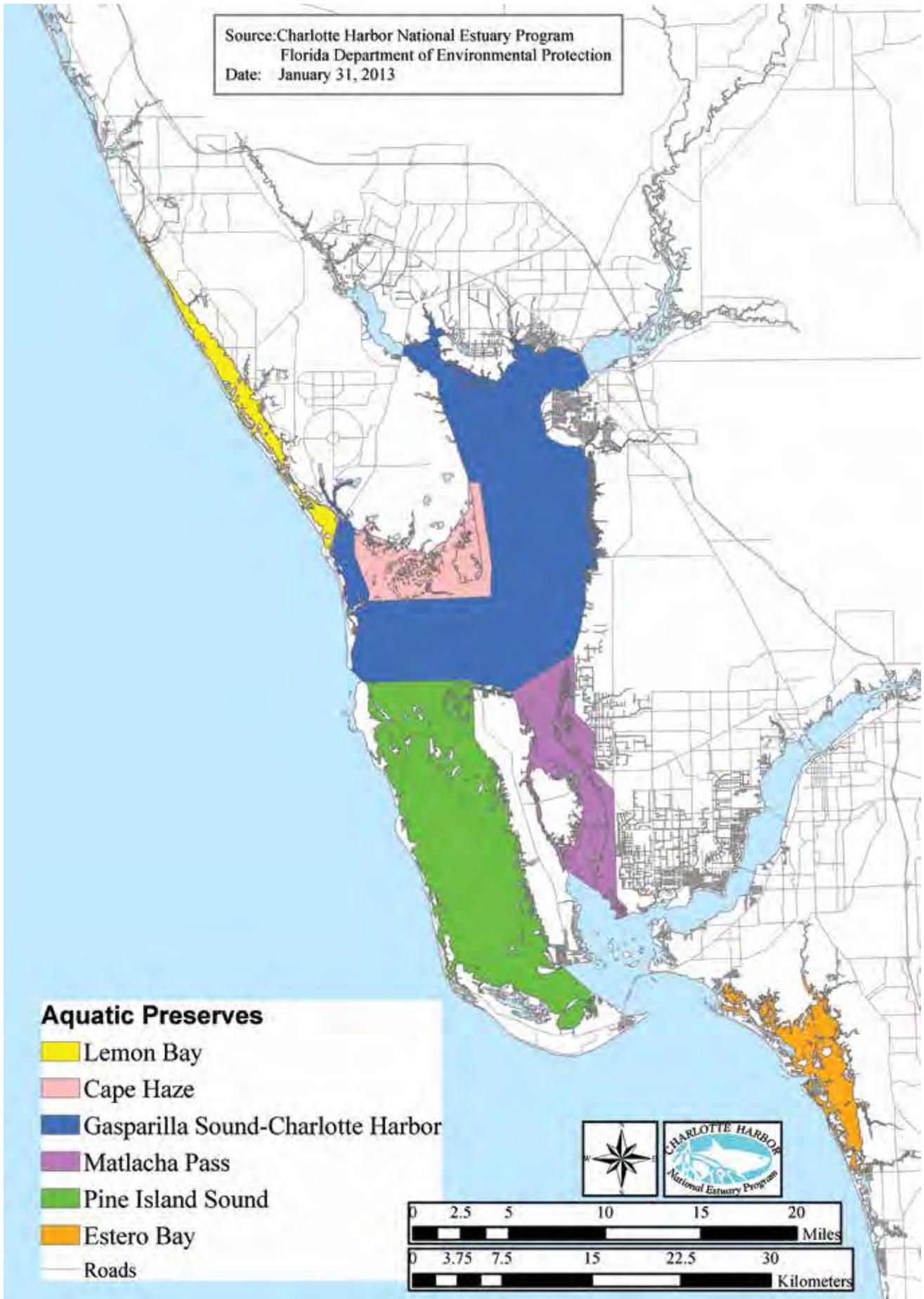




Map 5: Northern Estuarine Watersheds (Basins)



Source: Charlotte Harbor National Estuary Program
Florida Department of Environmental Protection
Date: January 31, 2013



Map 6: Aquatic Preserves



Pine Island Sound and Matlacha Pass

Pine Island Sound and Matlacha Pass are two large estuaries that lie immediately south of Charlotte Harbor. Pine Island separates the two estuaries and provides them with limited fresh water from numerous small creeks and wetland areas. Direct rainfall and runoff from western Cape Coral provide the major portion of fresh water. The Cape Coral interceptor waterways directly influence the quantity and quality of the freshwater inflow.

Both estuaries have extensive seagrass beds that provide essential habitat for young fish. Periodically, during large releases from the Caloosahatchee River, outflow can discharge fresh water through San Carlos Bay into southern Pine Island Sound and southern Matlacha Pass. Dredging, altered

timing and volumes of freshwater discharges from the Caloosahatchee River system have harmed these estuaries. Seagrasses, oyster beds and other plants and animals are vulnerable to salinity changes, sediments and pollutants that occur during dramatic changes in freshwater inflows. A better understanding of these impacts and improved management of freshwater releases is necessary to protect and restore these coastal habitats.

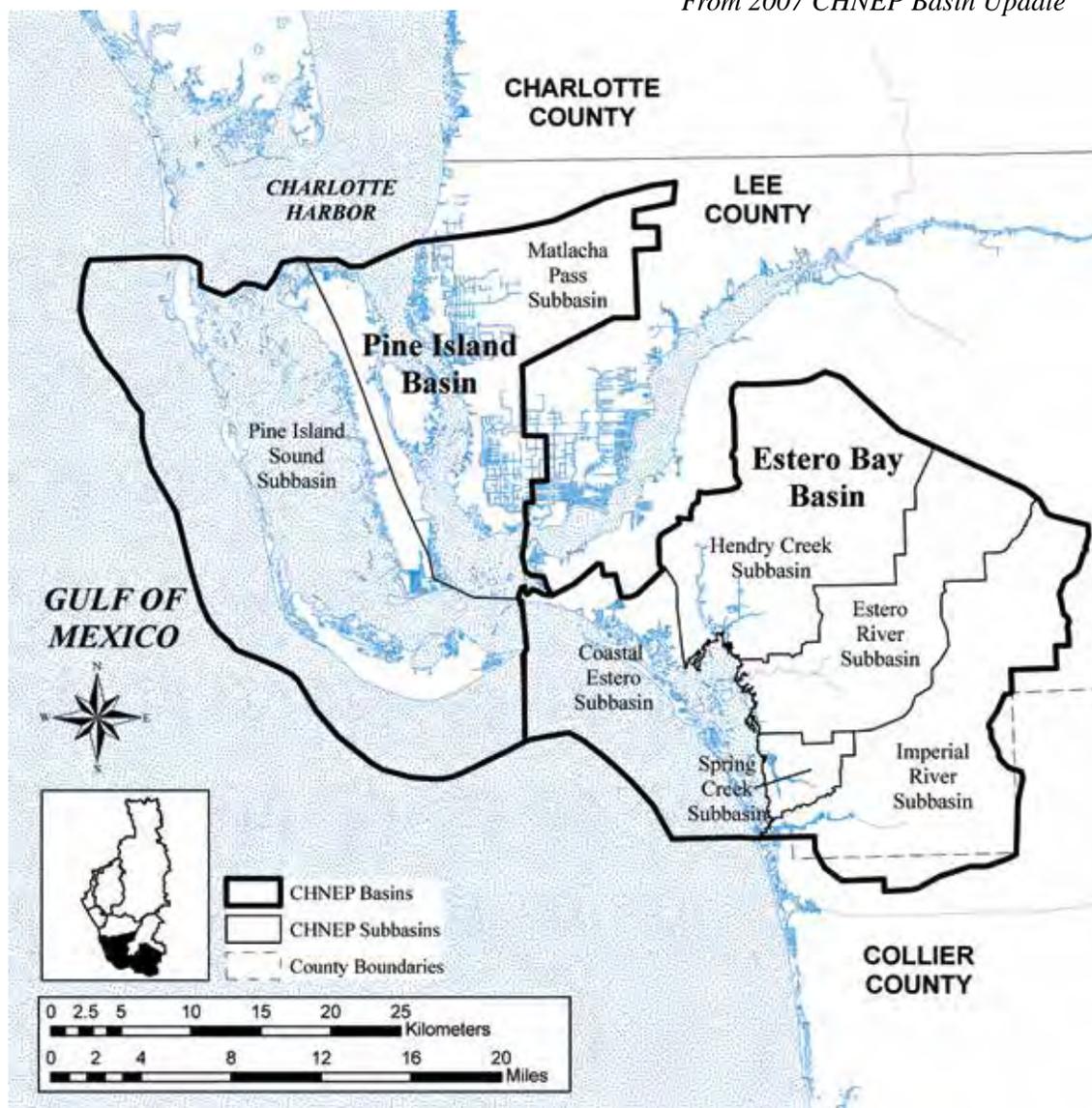
Estero Bay

Estero Bay is protected on the west by a barrier island chain including the Town of Fort Myers Beach and Bonita Beach. The estuary stretches southeast to the mouth of the Imperial River. Extensive seagrass beds support young fish and crabs in the shallow bays, and

mangroves support large bird rookeries on the numerous islands. As with Charlotte Harbor, the public owns many of the wetlands, mangrove forests and salt marshes surrounding the bay.

The Estero Bay Aquatic Preserve was dedicated in December 1966—Florida’s first aquatic preserve. The state also protects tributaries in the Estero Bay watershed by the “Outstanding Florida Waters” designation. The Estero Bay watershed is currently subject to significant growth and development, including Florida Gulf Coast University. The CHNEP is conducting a study regarding permitting and growth in the basin.

From 2007 CHNEP Basin Update



Map 7: Southern Estuarine Watersheds (Basins)



Water quality degradation

Water quality is critical for human and environmental health. There are multiple threats to water quality in the CHNEP study area. They include nutrients, bacteria, dissolved oxygen, toxics, water clarity and harmful algal blooms.

Nutrients

The amount of nutrients entering a water body has important effects on water quality. Plants and animals that live in lakes, rivers and estuaries use these nutrients, especially nitrogen and phosphorus, to grow and survive. However, when excessive amounts of nutrients enter the water, negative impacts can occur. Excessive nutrients may cause algal blooms that turn the water green and block sunlight for aquatic plants. When the nutrients are used up, the algae dies in large quantities and the bacteria that consume the algae deplete the oxygen in the water. Low oxygen, in turn, can kill fish and other animals that cannot escape the low-oxygen zone. Low levels of oxygen in the water are sometimes called “hypoxia.”

Nutrients cycle through water, plants, animals and soils. Problems occur when people add nutrients to the water in excess of natural levels. Nutrients can come from a large number of sources and are, therefore, one of our leading threats to water quality. Below are some examples of sources of nutrients:

Sewage treatment plants/domestic point sources:

When sewage treatment plants process residential and commercial waste, they remove most of the nutrients from the water. However, water discharged from sewage treatment plants still contains some nutrients. These discharges are point sources of nutrients to the lakes, estuaries and streams where they are located, but they must meet state standards. The Southwest Florida Regional Planning Council adopted a resolution that provides guidance for improved standards for sewage treatment plants in order to reduce nutrient levels within discharges. As an extension of this resolution, the Council is working with plant managers to identify infrastructure needs for a regional funding effort. Beneficial products from sewage treatment plants, such as reuse water and biosolids used to fertilize agricultural land, also carry excess nutrients.

Industrial sources: Many types of industrial facilities discharge water used in their manufacturing processes. These discharges are regulated and, therefore, must meet state standards. Industries such as citrus processing, phosphate mining, beneficiation, fertilizer manufacturing and animal feedlots are sources of nutrients, although they are limited to the state standards for their discharges.

Atmospheric deposition: The air around us also contains nutrients. Nutrients are released into the air from local sources such as car engines and power plants. Distant sources such as fires in Mexico and out-of-state industries can also be nutrient sources. Nutrients from the air can fall directly onto the land and water in rain or as tiny dry particles. They are then carried to a nearby water body during a rain event. It is estimated that atmospheric deposition is the source of 20 percent of the total nitrogen and 8 percent of the total phosphorus loads to water bodies in the CHNEP study area (PBS&J 1999).

Nonpoint sources: This term is used for the many places where nutrients come from when they are carried by rainwater to a storm drain, creek or canal and into our lakes, rivers and estuaries. These sources are many and have the largest impact on the amount of nutrients in the water. Sources include fertilizers from residential/commercial lawns, golf courses and agricultural operations, litter and oil on roads and animal waste from livestock. It is important to note that everyone contributes to these sources and it is the most difficult category of sources to control.

Septic systems: Septic systems are common in the region. These systems process waste in areas where central sewage treatment is not available. Proper placement and maintenance of these systems are critical to their effective use. When these systems malfunction, even one household can be a large local source of nutrients and bacteria. The nutrients can have adverse effects on water quality and the bacteria can cause disease in animals, including humans.

Ground water: Water that has been stored in the ground and then travels to the surface contains nutrients. Groundwater sources of nutrients are estimated to be small but may be important to streams and rivers with large springs or areas where people are pumping ground water and then discharging it to local water bodies. Within parts of the CHNEP study



area, water quality impairments due to groundwater contributions of salt, dissolved solids and iron is more significant than nutrients. Since the region water table is high, there is much interaction between surface water and ground water. Therefore, surface and groundwater quantity and quality are strongly related.

Bacteria

Bacteria in the water affect our ability to use the water for drinking, swimming and shellfishing. The state water standards establish bacteria limits for different types of uses. The most stringent standards are for shellfishing areas. Shellfish such as clams and oysters can concentrate bacteria in their bodies. When they are eaten raw, these bacteria can cause serious illness or even death. Therefore, only the waters that are regularly monitored and show very low levels of bacteria are open for shellfish collection. Other, less stringent standards, apply for drinking water and for water recreation such as swimming and fishing.

Bacteria can come from a variety of sources, but those of most concern come from fecal waste of animals and people. Sources of fecal bacteria include malfunctioning septic systems, leaking sanitary sewers, confined animal feedlots and untreated waste from wastewater plant overflows. Other sources such as urban pet waste and storm water are significant sources, especially after a heavy rainfall. For this reason, many shellfish areas are closed immediately after a large rain event.

Dissolved oxygen

When dissolved oxygen is low in the water, fish and other aquatic animals cannot breathe and may die. The factors that control oxygen levels are complex and change not only throughout the year but also during a single day. Sources of oxygen include plant photosynthesis and surface mixing from wind. Uses of oxygen include decomposition, sediment oxygen demand and plant and animal respiration.

Human impacts on water quality can affect the amount of oxygen available for aquatic animals. Excess nutrients can cause algal blooms. When the algae die, their decomposition can use up most of the water oxygen. During the rainy season, large amounts of fresh water can flow over the top of saltier and heavier water, creating a freshwater cap that reduces the

movement of oxygen to deeper water. Nutrients and bacteria in bottom sediments can combine to create a demand for oxygen that limits the oxygen available in the water column. Also, sediments and particles in the water can limit sunlight that, in turn, lowers the amount of oxygen-producing photosynthesis that occurs in plants.

Toxics

The sources of toxics are numerous and are expensive to monitor. Toxics include heavy metals such as lead and mercury. Pesticides and chemicals that are unhealthy for plants and animals, including people, are also considered toxics. Toxics can be released into the air from power plants, manufacturing facilities or autos. They can be deposited on land and water though the use of pesticides, illegal dumping and accidental spills. After a rain, storm water carries oil, heavy metals, lawn chemicals and waste into rivers and estuaries. Some toxic chemicals can be stored in the sediments of lakes and estuaries, allowing their ill effects to continue for extended periods of time. Pharmaceuticals and personal care products are an emerging category of toxics of concern.

Water clarity

Water clarity is a measure of the amount of sunlight entering the water that reaches seagrass blades or the estuary bed. As sunlight enters a water body, it is either absorbed or scattered when it interacts with the particles and the dissolved materials within the water column. When light is scattered, the direction of the light can be changed or reversed and, in some cases, this greatly increases the likelihood that the light will then be absorbed before reaching seagrass or other benthic habitats. Absorption and scattering of light in the water column can essentially be broken down into four components: water itself, colored dissolved organic matter (CDOM), photosynthetic organisms (e.g., phytoplankton) and suspended particulate matter consisting of floating particles from land or marine sediments, minerals and humics (Kirk 1994).

While phytoplankton largely limits the amount of light reaching seagrass in Lemon Bay (Tomasko et al., 2001), water clarity in Charlotte Harbor is greatly influenced by dissolved and suspended matter (McPherson and Miller 1987; McPherson and Miller 1994; Dixon and Kirkpatrick 1999). Research has



found that suspended matter accounts for an average of 30 to 72 percent of light attenuation in the water column, CDOM accounts for 13 to 66 percent, phytoplankton concentrations for 4 to 18 percent and water itself for approximately 4 percent (McPherson and Miller 1987; McPherson and Miller 1994; Dixon and Kirkpatrick 1999). Water clarity improves with distance from the major tributaries in Charlotte Harbor and with increasing salinities (McPherson and Miller 1987; Dixon and Kirkpatrick 1999; Tomasko and Hall 1999).

Long-term data sets from monitoring and research programs are essential in understanding the current health of an ecosystem and to put changes into a historical perspective. Recent analyses of these long-term water quality data collected by the CHNEP partnership demonstrate deteriorating trends in water clarity in the region. CHNEP studies document significant increases in total suspended solids (TSS) throughout Charlotte Harbor and increasing turbidity and nutrients in the lower Charlotte Harbor region (Janicki Environmental Inc. 2003 and 2007).

Harmful algal blooms (HABs)

Harmful algal blooms (HABs) are the proliferation of harmful or nuisance algae that adversely affect aquatic resources or humans. The algae can be either microscopic organisms in seawater and fresh water or large aquatic plants that can be seen with the unaided eye. The term “bloom” indicates an increase in abundance above normal background numbers of a species in a specific geographic location. This increase can be within the water column or on estuary bed substrates, such as seagrass blades. HABs are so named because of their harmful results, such as floating or beached dead fish, the alteration of a food chain or the loss of benthic habitat. HABs may also affect public health, as people can become ill when they inhale toxins in the air or consume shellfish that have been exposed to toxins from a bloom.

There are several types of HABs: dinoflagellates, blue-green algae and macroalgae. One well-known toxic dinoflagellate species frequently occurring in southwest Florida is *Karenia brevis*, the organism that causes red tide. Other organisms are well known in other parts of the U.S. and may be a concern in the future in southwest Florida due to its wide temperature and salinity tolerances. *Pfiesteria*

piscicida and *Pfiesteria*-like organisms have not been documented in Charlotte Harbor, but they have been found in nearby Florida estuaries. These organisms often act as significant but undetected sources of fish mortality and disease.

In Florida waters, there are about 20 species or groups of freshwater or freshwater-estuarine blue-green algae that are potentially toxic. Also known as cyanobacteria, potentially toxic cyanobacteria that are known to bloom frequently in the Charlotte Harbor watershed include *Microcystis aeruginosa*, *Anabaena circinalis*, *Cylindrospermopsis raciborskii* and *Lyngbya wollei*. Cyanobacteria can exhibit severe neurotoxicity (poisonous to nerves), cytotoxicity (toxic to living cells) and hepatotoxicity (toxic to liver) to a variety of mammals, including humans, birds, fish, and invertebrates such as zooplankton. Cyanobacteria blooms produce negative aesthetic qualities, such as bright green water in canals and along shorelines, and cause taste and odor problems in public water supplies. These blooms rapidly “crash” in response to sudden physical changes, causing excessive oxygen consumption and anoxic/hypoxic conditions. This chain of events has been responsible for major estuarine fish and shellfish kills and loss of habitat for benthic organisms within the CHNEP study area and other locations.

Over the past several decades, blooms of macroalgae have been increasing along many of the world’s developing coastlines in response to nutrient enrichment associated with coastal eutrophication. In southern Florida, a diverse group of opportunistic macroalgal species outcompete, overgrow and replace seagrass that are adapted to stable, oligotrophic conditions. Once they are established, the macroalgal blooms may remain for years to decades until the nutrient supply decreases. This is in contrast to phytoplankton blooms that are usually relatively short-lived (days to weeks). Nuisance blooms of macroalgae and attached filamentous epiphytes reduce light availability to seagrasses, resulting in lower seagrass productivity, habitat loss from anoxia/hypoxia and eventual die-off of sensitive species. Large drifts of macroalgae can wash ashore onto bathing beaches, interfering with recreation. Decaying, malodorous material is a concern for the local tourist economy.

Our actions to address water quality degradation can be found on pages 71 to 87.



Hydrologic alterations

Aquatic plants and animals are adapted to certain types of environments. Some species prefer the salty water of the Gulf of Mexico. Others thrive in the dynamic environment of the estuary where salinity changes throughout the day and throughout the year. Some plants and animals can only survive in a freshwater environment where the salty ocean waters never invade.

When people modify the level of the water table, dam rivers or divert freshwater flows, the amount, timing and placement of fresh and salty water can change dramatically.

Changes in total flows

Over time, people have changed the total amount of fresh water that reaches the estuaries and the Gulf of Mexico. For some fish and plants, these changes have significant impacts on their ability to colonize, grow and reproduce. Here are some examples of human impacts on total freshwater flows in southwest Florida:

Reduced groundwater levels: When too much ground water is pumped from underground, the level of the water table and deeper aquifers can drop significantly. In southwest Florida, ground water is an important contributor to creeks and rivers. In the upper Peace watershed, cessation of flow from Kissengen Springs and other minor springs is generally attributed to the decline in the hydraulic potential of the confined aquifers caused by the development of the groundwater resource (PBS&J 2007). These springs, once sources of fresh water, no longer contribute to the Peace River flows. Similar effects can occur when water tables drop in other watersheds, decreasing the amount of groundwater contribution to rivers and estuaries.

Dams, locks and weirs: Water-control structures are very effective at their job—to hold back fresh water and release it when it is unwanted. Often these structures store water for important dry season uses such as irrigation, water supply and navigation. Their net effect to the receiving waters, however, is to decrease the amount of fresh water downstream while it is diverted for other uses and to release excess fresh water downstream when sufficient fresh water is available.

Channelization and canals: Straightening rivers and streams as well as connecting new areas through canals and pipes can increase the amount of fresh water in a river and estuary. If these changes are substantial, they also can have serious adverse impacts on plants and animals. Many species require a minimum level of salt or can only endure freshwater conditions for a limited period of time. An example of connection and channelization is the straightening of the Caloosahatchee River and connection of Lake Okeechobee to the riverhead.

Table 1: Examples of Hydrologic Alterations in Watersheds of the Charlotte Harbor National Estuary Program

	<i>Decreased Flow</i>	<i>Increased Flow</i>	<i>Altered Timing</i>	<i>Altered Location</i>
<i>Myakka Watershed</i>	Peak flow transfer to coastal watershed via Blackburn Canal	Big Slough channelization; Flatford Swamp	Drainage of Tatum Sawgrass	Clay Gully Cutoff; Vanderipe Slough levee
<i>Peace Watershed</i>	Loss of Kissengen Springs and increased number of sinkholes	Groundwater pumping near Joshua, Prairie and Shell creeks	Green Swamp and Lake Hancock regulation	Charlotte County drainage/canal system
<i>Caloosahatchee Watershed</i>	Reduction of dry season flows to tide	Agricultural tailwater runoff	Drainage of Lake Okeechobee	Sanibel Causeway
<i>Coastal Systems*</i>	Sanibel Causeway	Myakka River discharge to Dona Bay	Salinity barriers (Coral Creek)	Drainage culverts, interceptor waterways

*Estero, Lemon, Dona and Roberts bays; Pine Island and Gasparilla sounds; Matlacha Pass.

Source: *The Story of the Greater Charlotte Harbor Watershed*, CHNEP 1998





Photo by Richard Gant, SWFWMD, 6/23/00

In year 2000, portions of the upper Peace River disappeared due to drought. The SWFWMD's Southern Water Use Caution Area (SWUCA) Recovery Strategy and the FDEP's Peace River Resource Management Plan address this problem.

Altered timing of water flows

The timing of the arrival of fresh water to estuarine areas is also important to plants and animals. Their life cycles are often triggered or are conditional to the salinity of the water. Therefore, man-made changes, such as dams, locks, canals and channels, change not just the water quantity but also the timing of freshwater flows. These changes, particularly when they are large and contrary to the usual seasonal conditions, can be very detrimental to plants and animals in the estuary.

Altered location of water flows

Placement of freshwater sources also has strong impacts on aquatic life. Sources of fresh water keep the water relatively salt-free and can push back saltier water from entering an area during high tide. When traditionally freshwater places become salty, the plants and animals that live there usually cannot survive. Similar situations occur in saltwater areas where

plants and animals are not adapted to a freshwater environment. If large amounts of fresh water are suddenly directed into a marine (salty) system, the existing wildlife cannot remain for an extended period of time. Particularly in estuarine areas, small changes in freshwater sources can have significant impacts. Drainage systems and canal systems are common examples of causes that change the location of freshwater flows. These changes must be minimized to maintain the biological conditions.

Hydrology can be a complex and subtle issue, affecting water quality and habitat. Though there is not sufficient space in this plan to adequately discuss hydrologic issues, there are many excellent references. These references include *Peace River Cumulative Impact Study* (PBS&J 2007,) and *The Determination of Minimum Flows for the Lower Myakka River* (SWFWMD 2011,)

Our actions to address hydrologic alterations can be found on pages 88 to 104.



Fish and wildlife habitat loss

Florida's growing population and development are replacing natural habitat. Without the proper habitat, plant communities and wildlife disappear. Florida remains one of North America's most important reserves of biological diversity (Cox et al., 1994). Occupying an important transitional zone between tropical and temperate climates, more than 1,300 fish and wildlife species and about 3,500 plant species can be found in Florida. Preserving this biodiversity in the CHNEP study area requires protection and restoration of regional fish and wildlife habitat. High rates of land conversion and habitat modification create a critical need for regional wildlife habitat planning in the watershed.

When development breaks up natural lands, habitat fragmentation results. The remaining isolated landscapes are often too small to support breeding pairs of animals and preclude intermixing of breeding populations. Also, the margins of these fragmented natural lands create "edge habitat" that alters species composition and can increase human impacts.

More than 43 percent of original wetlands converted to human uses

The CHNEP study area has lost more than 43 percent of its original wetland habitat—mostly to agricultural drainage, mining and urban development. Land drained by connector ditches for farming accounts for the largest loss of freshwater wetlands. More recently, wetland conversions to farmland or open water have accelerated, especially in smaller unregulated wetlands.

Mining activities have also impacted wetlands. Prior to 1975, phosphate companies strip-mined but did not restore many wetlands. This happened especially along tributaries of the Peace River in Polk County when mining was the leading economic force in the region. Now, due to regulation, the phosphate industry is required to reconstruct and replace every acre of wetlands that it destroys.

Urban and rural development also destroys wetlands. Most elimination of wetlands goes through a permitting process with mitigation requirements. However, some wetland losses are currently permitted with no mitigation requirements (SWFRPC 2007).

Spurred largely by citizen initiatives, local and state governments and private conservation organizations acquire extensive wetlands, including coastal and barrier island tracts. Public or private holdings now preserve extensive portions of the mangrove coast from Placida to Estero Bay. Extensive public "buffer uplands" further protect saltwater wetlands around Charlotte Harbor proper.

Mangroves maintain vital fish and wildlife habitat

Mangrove forests form a distinctive broad margin around the estuaries of southwest Florida. They cover several thousand acres and may extend inland several miles from open water. Mangroves perform vital, irreplaceable roles in providing food for species such as striped mullet (*Mugil cephalus*) and pink shrimp (*Farfantepenaeus duorarum*), habitat for birds and wildlife, and they buffer inland areas from storm surges. Southwest Florida mangrove species include red (*Rhizophora mangle*), black (*Avicennia germinans*), white (*Laguncularia racemosa*) and buttonwood (*Conocarpus erectus*). Mangrove systems have the highest measured annual productivity of any system measured in the world. They are critical to the world's carbon balance.

Over the years, dredge-and-fill operations have reduced about 25 percent of the mangrove habitat in the CHNEP study area. In addition to direct loss, urban and agricultural runoff changes water flows to interfere with the beneficial functions performed by mangrove systems. The high cost of developing mangrove habitat is ultimately paid by taxpayers in terms of flood damage, shoreline erosion and water quality corrections. Despite increased regulation, cutting and trimming continues to threaten mangroves.

Seagrass beds also perform vital roles

Seagrasses play several vital roles in the estuary. These plants "clean" the water by trapping suspended sediments. They provide food directly to manatees and sea turtles and indirectly support sport and commercial fisheries by supplying habitat for fish. Spotted seatrout (*Cynoscion nebulosus*), for example, live out their entire lives within seagrass beds. Seagrasses provide habitat for a wide variety of sea life, giving the beds a high recreation value for shelling and snorkeling.





Photo by Jaime Boswell, 4/13/05

the severity and extent of scarring since the 1995 effort. Simultaneously, the region faces the pressures of a robust tourism industry and a rapidly growing population, which includes an increase in boating activities as well as dock and marina construction. A study of docks constructed over grass beds in Pine Island Sound and San Carlos Bay found that boat propeller dredging was roughly one-third the area of the docks and that seagrass loss in dock “shadow” areas correlated with the total size of each dock (Loflin 1995).

Seagrasses provide critical habitat for invertebrates and fishes in the estuary. As plants, they also provide much-needed oxygen to seawater.

One study (Harris et al., 1983) documented a 29 percent Harborwide decrease in seagrass coverage from the 1940s to 1982, excluding Estero and Lemon bays. The study found that most of this loss was located in southern Charlotte Harbor and was a result of the dredging of the Intracoastal Waterway and construction of the Sanibel Island Causeway. These researchers also found losses throughout the Harbor and suggested some of this resulted from seagrasses receding from deeper depths due to decreasing water clarity resulting from hydrologic changes and increased pollutant loads. Since systematic mapping of seagrass started in 1988, seagrass coverage remains stable (Corbett 2006), although there are signs of losses in the thickness in which seagrasses grow and a change to less stable seagrass species, which may be a precursor to larger-scale losses (Greenawalt-Boswell et al., 2006).

Loss of seagrass by the scarring of seagrass beds by boat propellers has been a significant issue in the entire Charlotte Harbor region. Because Charlotte Harbor is shallow, it is vulnerable to the propeller dredging of inexperienced or imprudent boaters. A 1995 effort by the Florida Fish and Wildlife Research Institute (Sargent et al., 1995) determined that the Charlotte Harbor region is one of the most heavily scarred areas in Florida, while a more recent update by the CHNEP (FWRI 2003) found an increase in

Little of coastal strand habitat remains

In southwest Florida, little of the original coastal strand ecosystem remains. This plant community can be found in long narrow bands of well-drained sandy soils affected by salt spray along the Gulf and estuaries. Vegetation includes low-growing grasses, sea grape (*Coccoloba uvifera*), prickly pear cactus (*Opuntia humilis*), cabbage palm (*Sabal palmetto*) and live oak (*Quercus virginiana*).

While residential and urban development converted most of the original coastal strand community, large adjacent sections do remain. These include the undeveloped barrier islands in Lee County, particularly Cayo Costa, and also the Stump Pass area of Charlotte County. Coastal strands provide invaluable habitat to sea turtles, shorebirds and amphibians.

Urban and agricultural uses replacing pine flatwoods

Until the 1920s, the landscape of the CHNEP study area was mostly pine flatwoods. One or more pine species grow on these nearly level lands, accompanied by understory wax myrtle (*Myrica cerifera*) and saw palmetto (*Serenoa repens*). The pines were then intensively logged off for a period extending through



World War II and until the resource was commercially exhausted. By 1987, pine flatwoods had dropped to sixth place in area coverage, behind grasslands, cypress swamp, dry prairies, freshwater marsh and urban areas.

Throughout the CHNEP study area, improved pasture, citrus, vegetable farms and urban development have commonly replaced pine flatwoods. Displaced animal inhabitants include the pileated woodpecker (*Dryocopus pileatus*), American kestrel (*Falco sparverius*), sandhill crane (*Grus canadensis*), black bear (*Ursus americanus*), Florida panther (*Puma concolor coryi*), eastern indigo snake (*Drymarchon corais couperi*) and gopher tortoise (*Gopherus polyphemus*).

Oak scrub and scrubby flatwoods depleted

Within the CHNEP study area, both oak scrub and scrubby flatwood ecosystems provide animal habitat similar to pine flatwoods.

Various species of oak, as well as saw palmetto (*Serenoa repens*), Florida rosemary (*Ceratiola ericoides*) and fetterbush (*Lyonia lucida*), dominate oak scrub habitat. Ground cover is generally sparse and is dominated by grasses, herbs and ground lichens. Occurring along coastal shorelines, ridges, tributaries and rivers such as the Caloosahatchee, it has been vulnerable to urban development.

The CHNEP study area also includes scrubby flatwoods. Similar to sand pine scrub, the south Florida slash pine (*Pinus elliottii densa*) generally dominates this community. Typical understory consists of wiregrass (*Aristida stricta*) and herbs. Remaining stands of scrubby flatwood have been severely depleted by selective- or clear-cutting of the pines. Due to the flatwood's rapidly percolating soils and high elevations, citrus groves and residential development commonly displace this habitat.

Based on historical estimates, slightly more than 1 percent of oak scrub communities remain and only 10 percent of scrubby flatwoods. Flatwoods, although providing critical habitat, are quickly disappearing from the landscape.

Many exotic plants and animals invade and destroy habitat

Many nonnative plant species now invade and displace natural habitat in the CHNEP study area. A partial list of "out-of-control" species includes:

Australian pine (*Casuarina equisetifolia*): Pinelike trees introduced a century ago for windbreaks and erosion control along coastlines; toppled by winds; displaces coastal vegetation and spreads easily.

Brazilian pepper (*Schinus terebinthifolius*): Holly look-alike brought to Manatee and Charlotte counties in the 1920s; irritant sap; forms dense stands; displaces wildlife and native plants; encroaches into wetlands; easily spread by wildlife.

Punk tree or melaleuca (*Melaleuca quinquenervia*): Fast-growing, white-barked tree intended for windbreaks and draining of wetlands; forms dense thickets, displacing wildlife; very common throughout southwest Florida and the Everglades and is spreading northward; eradication effort is a constant battle.

Hydrilla (*Hydrilla verticillata*): Aquatic plant that entered Tampa in 1950s; grows dense strands of whorled leaves that choke water bodies and deplete oxygen; displaces native plants and fish; control efforts making steady progress.

Water hyacinth (*Eichhornia crassipes*): Large floating plant with dark green leaves and lavender flowers; introduced in the 1800s; slows water flow and boats; depletes oxygen; increasingly managed, which also assists hydrilla control.

Cogon grass (*Imperata cylindrica*): Introduced in 1911 for cattle forage and soil stabilization; found not to be good forage for cattle; can increase fire intensity; invades native habitats, agricultural forests, roadsides, phosphate mining lands and altered pinelands; takes over large areas, crowding out native species.

Nile monitor lizard (*Varanus niloticus*): First identified in Cape Coral as a problem after the adoption of the CCMP in 2000; a nuisance animal that can prey on native animals and small pets.

Our actions to address fish and wildlife habitat loss can be found on pages 105 to 121.



Economic activities in the watershed

Economic activities in the watershed include tourism, agriculture, phosphate mining, commercial fishing, sportfishing, shellfishing and residential land uses.

Tourism

Tourism plays a major economic role in all of Florida. Many residents initially came to the area on business or on vacation and then decided to make Florida home. Surveys indicate that beaches remain the top attraction for both domestic and international visitors.

On a regional basis for central Florida, tourism is considered the “third industry,” behind citrus and phosphate mining. In the upper Peace River basin, tourists are attracted to Cypress Gardens, Bok Tower and its botanical gardens, and major league baseball training sites. Tourists and winter visitors are drawn to natural resource attractions in the inland parts of the CHNEP study area such as the Winter Haven Chain of Lakes, the Peace River and the Highlands Hammock State Park. Canoeing and freshwater fishing are common attractions in central Florida lakes, canals and rivers.

In coastal southwest Florida, tourism has been an important element of the economy since the nineteenth century. In 1993, approximately 1.7 million tourists visited coastal southwest Florida. Seasonal residents spend extended periods of time enjoying the temperate winter climate and warm Gulf waters. Longer visits are also common by international travelers from places such as Canada and Germany. The coastal area also attracts vacationing tourists and business travelers for shorter periods of time. The total coastal population, therefore, increases by more than 30 percent above the permanent population because of seasonal, business and vacationing tourists. In 1993, total tourism expenditures were more than \$1.1 billion in Sarasota, Charlotte and Lee counties. Coastal residents and tourists alike enjoy renowned boating and fishing, a moderate climate, shelling and bird watching and spring baseball training. Attractions include a number of state parks in CHNEP’s coastal area. Polluted water and red tide threaten the tourism economy of the area.



Photo by Lisa Beever, 9/11/07

The main agricultural activity in the Myakka River watershed is cattle ranching. In Long Creek, cattle coexist with cattle egrets and ducks.

Agriculture

Agriculture is the economic anchor in the area, second only to tourism. Curiously, as Florida loses record levels of wetlands and native uplands to farmland, the state also leads the nation in farmland lost to development. Former ranches and farms in coastal counties are especially vulnerable to wholesale transformation into bedroom communities.

Citrus is the main agricultural product. Freezes in the 1980s in northern Florida accelerated the establishment of citrus groves in southwest Florida, notably Lee County. More than a dozen citrus varieties are grown, although most acreage goes into juice oranges. In 2006, a total of 193,000 acres of land in the CHNEP study area was dedicated to citrus — 30 percent of all Florida citrus acreage.

Other crops are characteristic of the region. Manatee County produces more cucumbers than any other county in the state. Lee County is ranked second for mangoes, fifth for bees and ninth for cucumbers. Charlotte is ranked fifth for rabbits and sixth for watermelons. Hardee County is ranked fifth in cattle and fifth in orange production. DeSoto County is ranked sixth in cattle, fourth in oranges and fourth in sod production. Approximately 35 percent of the land in the CHNEP study area is dedicated to agriculture.

Beef cattle follows citrus in economic importance. In 1996, Polk, Hardee, DeSoto and Manatee counties ranked in the top 10 beef producers in Florida. Hardee County leads the region in dairy production with



8,000 cows, and Polk County was the second largest egg producer in Florida.

Ranches occupy vast areas of the CHNEP study area. These ranches are predominantly cow/calf ranches rather than dairies. Calves born throughout the watershed are shipped to Midwestern and Plains states where they can be fed abundant and inexpensive corn. Ranching is a relatively benign land use. Fencing interferes little with movements of native wildlife. Natural landscapes are opened up without completely removing wetlands or forested areas. Much of the Peace and Myakka rivers' natural shoreline beauty results from ranchers' decisions to keep cattle from wetter areas. Ranchers also use prescribed burns to manage grasslands and native habitats. Runoff from ranch land tends to have few contaminants other than coliform bacteria and nitrogen. Earlier practices of required pesticide use at cattle dipping vats are now prohibited and remediated.

Agricultural land clearing, leveling and drainage improvements transform habitats. The greatest water demand in Florida is for agriculture (FDEP 2000). Overpumping of the Floridan aquifer has caused large decreases of the groundwater pressure and also increases the potential for saltwater intrusion. Mineralized groundwater use for irrigation purposes may leave agricultural areas by runoff or seepage and add to streamflows and change the natural water chemistry of Myakka and Peace River tributaries. Fertilizers and pesticides, which may find their way to surface and ground waters, are addressed through recently adopted agricultural best management practices.

Economic pressures endanger future ranching. The federal tax code can compel families to sell farms in order to pay estate taxes. Others will lease ranch land to citrus or tomato producers that often degrade land, soils and water. Despite greenbelt exemptions, development potential has raised the tax costs of some ranches to critical levels as nearby rural lands are developed. Citrus falls unpicked as crop prices fluctuate unpredictably. Citrus canker and citrus greening have also added unpredictable aspects to growers. Preserving the economic viability of ranches and family farms while at the same time providing for regional ecological integrity is one of our greatest challenges. The rural quality of the region depends on the maintenance of our ranching heritage.

Phosphate mining

The phosphate industry is a significant factor in resource management within the CHNEP watershed. The "Bone Valley" phosphate deposit of more than 500,000 acres lies mainly within the Peace River watershed. This deposit is a large resource within North and South America. Mineable reserves within the Bone Valley deposit are projected to last at least an additional 40 years. The deposit provides approximately 75 percent of the phosphate required by U.S. farmers and about 25 percent of the world supply. Approximately 240,000 acres have been mined in Polk, Hillsborough, Hardee and Manatee counties. Previous mining in Polk County accounts for more than 197,000 acres of the total mined area. Additional mines are under consideration for Hardee, DeSoto and Manatee counties. Approximately 6 percent of the land in the CHNEP study area is dedicated to phosphate and rock mining.

The phosphate industry is an important segment of the economy within the central and northern portions of the CHNEP watershed. The Florida phosphate industry employs more than 5,000 people with a total annual payroll of more than \$400 million. In addition, the industry contributed nearly \$86 million in severance, property, sales and other taxes in 2003.

The first \$10 million collected in severance tax each year is directed to the Florida Forever Trust Fund. The state of Florida uses this money to purchase environmentally sensitive lands. Since 1979, the state land acquisition program has received more than \$530 million from the phosphate industry severance tax. A



The mining process significantly changes the landform of large areas within the CHNEP watershed.

Photo courtesy of László Benczel/
Mosaic Fertilizer, 2005



significant majority of these funds have been spent on the acquisition of environmentally sensitive lands elsewhere in Florida. Since 1975, all mined lands are required to be reclaimed to the landforms that existed prior to mining. Today, all lands are reclaimed with native plant species. Current industry practices promote coordinated reclamation, allowing for the integration of habitat networks and habitat buffers in protected environmentally sensitive areas.

Mining and reclamation processes have significantly changed the landform of large areas within the CHNEP watershed. However, with the advent of regulation in the 1970s, subsequent regulatory enhancements and improved mine planning and operating techniques, environmental impacts have been reduced. The visual impact of mining, especially prior to reclamation, is nevertheless significant. Real and perceived environmental impacts due to mining and chemical processing are a source of significant public concern. The nature of that concern contributes toward differing perspectives of the industry held by citizens of the CHNEP study area.

Commercial and sport fisheries

Charlotte Harbor is highly significant to Florida as a nursery ground for marine and estuarine species. Up to 90 percent of commercial and 70 percent of recreational species landed (caught) in Florida spend all or part of their lives in estuaries. The main fishery species of commercial and recreational value in the CHNEP study area include black mullet (*Mugil niger*), spotted seatrout (*Cynoscion nebulosus*), red fish (*Sciaenops ocellatus*), black drum (*Pogonias cromis*), kingfish (*Menticirrhus* spp), southern flounder (*Paralichthys lethostigma*), blue crab (*Callinectes sapidus*), pink shrimp (*Farfantepenaeus duorarum*), stone crab (*Menippe mercenaria*), southern hard clam (*Mercenaria campechiensis*), snook (*Centropomus undecimalis*), tarpon (*Megalops atlanticus*), grouper (*Epinephelus* spp and *Mycteroperca* spp), black sea bass (*Centropristis striata*), snapper (*Lutjanus* spp), Florida pompano (*Trachinotus carolinus*), bluefish (*Pomatomus saltatrix*), sand seatrout (*Cynoscion arenarius*), Spanish and king mackerel (*Scomberomorus maculatus* and *S. cavalla*), sheepshead (*Archosargus probatocephalus*) and several species of sharks.



Photo by Catherine Corbett, 8/29/07

Shrimp trawlers at Matlacha

Recreational fishing in freshwater creeks, rivers and lakes is a popular pastime in inland counties. Snook (*Centropomus undecimalis*) are caught as far upstream as Fort Meade, while freshwater fish such as largemouth bass (*Micropterus salmoides*), black crappie (*Pomoxis nigromaculatus*), gar (*Lepisosteus platyrhynchus*) and the exotic species blue tilapia (*Oreochromis aureus*) are also highly prized game fish throughout the CHNEP study area.

The bountiful waters off Charlotte Harbor provide some of the best saltwater sportfishing in the world. Snook (*Centropomus undecimalis*), tarpon (*Megalops atlanticus*), red fish (*Sciaenops ocellatus*) and spotted seatrout (*Cynoscion nebulosus*) are just a few game fish found here. One of every three tourists comes to Florida to fish. As a result, the Charlotte Harbor region derives substantial economic benefits from the maintenance of a healthy estuarine and coastal sport fishery. It is difficult to establish a precise monetary value because of the industry's close relationship to tourism facilities and service, but the Florida Department of Environmental Protection data indicate that 21 percent of our population engages in recreational fishing, and total angling in the region exceeds \$1.1 billion annually.

Shellfish harvesting

More than 275 species of shellfish are found throughout the waters of the Charlotte Harbor estuaries. In the ancient past, the Calusa Indians of southwest Florida gathered enormous amounts of shellfish and constructed immense mounds from the shell. These shell mounds still dot the coastal landscape of the CHNEP study area, and some are protected as state archaeological sites.



In the more recent past, oysters (*Crassostrea virginica*), clams (*Mercenaria campechiensis*) and scallops (*Argopecten irradians*) were harvested commercially and recreationally throughout Lemon Bay, Gasparilla Sound, Charlotte Harbor and Pine Island Sound. The height of the shellfish industry in the Charlotte Harbor area occurred during the 1940s. Since then, the commercial harvest of shellfish has been declining with the disappearance of the scallop fishery in Pine Island Sound in the early 1960s.

Shellfish are a reliable measure of the environmental health of an estuary. Because shellfish feed by filtering estuary water, they assimilate and concentrate materials carried in the water. In clean water free from bacteria, red tide and other pollutants, the shellfish can be safely eaten year round. In areas of the estuaries affected seasonally by red tide or nearby urban areas, shellfish may not be safe to consume. Therefore, shellfish must be monitored regularly to protect public health. Currently, about one-third of Pine Island Sound is approved for shellfish harvesting year round. Many areas in Lemon Bay, Gasparilla Sound and the Myakka River are conditionally approved for seasonal harvest when bacteria and red tide levels are at safe levels. Pine Island Sound and Estero Bay are closed to shellfish harvesting throughout the year due to measured or probable bacterial contamination.

The importance of healthy waters for safe shellfisheries has taken on a new significance in Charlotte Harbor. A 1995 state constitutional amendment precluded the use of typical nets used in commercial fishing. Many of the commercial fishermen in the Charlotte Harbor area took advantage of training aquaculture programs. Areas of the submerged estuary bottomlands are leased to individuals by the state for shellfish aquaculture. Areas where such leases have been issued include Gasparilla Sound and Pine Island Sound. Marine shellfish aquaculture in Charlotte Harbor is primarily hardshell clams (*Mercenaria campechiensis*). Clams require proper salinity, oxygen and nutrients to grow at a reasonable rate, as well as good water quality to be safe to eat.

Residential land uses

The land-sale development that began in the 1950s dramatically and permanently changed the character and use of the land. Pastures and croplands were

drained and cleared and coastal lowlands were dredged and filled to create developable home sites by the tens of thousands. The land was subdivided, canals were dug and streets were paved. Even though some of this land was platted and sold 20 years ago, today a large percentage of it remains sparsely populated. The existing residential centers such as Fort Myers, Fort Myers Beach, Bonita Springs, Sanibel, Cape Coral, Port Charlotte, North Port, Punta Gorda, Englewood and Venice have expanded and grown.

The thousands of acres of land subdivided in the 1950s and 1960s have permanently cast the form of future development. The platting of these extensive tracts of land removed thousands of acres from agricultural and other productive uses years in advance of when the land would actually be needed for housing. Agricultural land is under considerable development pressure near existing urban centers, particularly south and east of Fort Myers. There, flower and vegetable cropland is being rapidly displaced by urban land uses. Since so much land has already been converted, local governments may find it preferable to encourage new development to infill platted areas before covering additional high-quality habitat areas or existing agricultural areas.

The regional economy

Measuring the economic value of the environment and its quality is a difficult assessment. Although the value is rarely considered, the economic value associated with the current uses of our resources, such as tarpon fishing in the Peace River or “nonuse” values such as the wetlands naturally providing treatment of storm water, are extremely important to the regional economy. A functional environment provides clean drinking water for our homes, soil and nutrients for our crops and wading birds and other wildlife to complement a canoe trip through the mangroves. None of these resources are limitless, although they are often treated as such.

Tourists and residents are drawn to southwest Florida because of many natural amenities. Tourists demand clean beaches or they will seek other destinations with their vacation dollars. Likewise, residents are entitled to a healthy community and yet they have a stewardship responsibility to ensure its health. The strength of our economy rests on the quality of



our environment and nearly every household and occupation is in some way affected by the health of the ecosystem. Conversion of natural landscapes has a cost in addition to that of permits, blueprints, materials and labor. Natural ecosystems directly or indirectly support a multitude of jobs, provide essential services for our communities and make this a place to enjoy.

Agriculture and phosphate mining dominate the inland economies of DeSoto, Hardee, Polk and Manatee counties, while tourism and residential and commercial development play the dominant role in the coastal economies of Sarasota, Charlotte and Lee counties. Although the outputs of goods, services and revenues from all sectors of the economy are constantly changing, it is useful to understand the economic value associated with the current activities, amenities and nonuse satisfaction levels dependent on natural resources.

Many economic activities are affected by environmental quality. The natural habitats, water quality and freshwater flows maintain the amenities and natural resources necessary to sustain fishing, tourism, recreation and the businesses that sustain these activities. Agriculture requires that the water used for irrigation and livestock meet certain water quality standards. Mining operations require adequate quantities of water, but they are also charged with meeting state water quality regulations for any water they release. The quality and economic output of the activities is dependent on the extent and quality of the natural resources.

Estimating the value of natural resources

All residents benefit economically from the natural resources of the CHNEP study area. The multibillion dollar agriculture, championship fishing and tourism industries are directly related to the quality of the environment. Natural resources provide jobs and industry earnings as well as other public and private benefits, such as recharging groundwater aquifer water supplies and providing fish and wildlife habitat.

Assessments of the value of natural resources must make certain assumptions and use estimates. These assumptions make the results imprecise and may overestimate some economic values. Nonetheless, the methods provide a very useful estimate of natural

resources values. Economists used two methods to estimate the total economic value of CHNEP study area natural resources—consumer surplus and total income.

Consumer surplus may be thought of as consumer “profit.” Although this money does not actually change hands, it represents the value of human satisfaction from using the resource. For example, if a family on vacation rented kayaks at a wildlife refuge for \$100 but had been willing to pay up to \$120, they would receive a \$20 benefit in consumer surplus.

Total income cannot be added to consumer surplus, it simply reflects value differently. It includes income from direct, indirect and induced wages. Any business that relies on natural resources to make money usually requires goods and services from other businesses. Typically, this support includes food, transportation, utilities, office supplies and professional services. These related goods and services also produce an income and additional benefits, such as jobs.

The combined income of a business and the related sales it generates from other companies is the total income that a particular business generates in the regional economy. For example, the same family on vacation that rented kayaks also likely spent money for gas, meals and hotel lodgings. In this case, total income attempts to account for the additional expenditures required to use the resource.

Economic value of the CHNEP study area

The CHNEP study area supports 124,000 full-time and part-time jobs and \$6.8 billion in total sales annually according to the 1998 *Estimated Value of Resources* study commissioned by the CHNEP. Based on this level of economic activity, the watershed also provides about \$1.8 billion per year in net value to recreation users and produces about \$3.2 billion per year total income to the area. Table 2 (p. 32) summarizes consumer surplus and total income derived from natural resources in the watershed. This one-year estimate is based on the best information available for 1994 through 1996. In addition to these billions of dollars in annual benefits, we receive uncounted benefits, such as clean air to breathe or the scenic beauty of a river—values difficult to quantify yet still tied to the quality of the environment.



What happens to these counted and uncounted economic benefits if our natural resources are damaged? Certainly the number of wildlife will decline and so will other natural benefits such as purifying and recharging our drinking water supply. While jobs in mining or construction may be created, if there are declines in environmental quality, more environmental jobs may be destroyed and higher pollution costs imposed.

Economic and natural resource decisions are connected. When considering land-use changes, should we only look at initial project payoffs or, on the other hand, consider both the short- and long-term costs and benefits? For example, building roads and causeways not only increases access to public lakes, trails and beaches, but it also increases the value of adjacent private lands for more intensive use. Therefore, the cost of such new facilities should include the natural benefits lost not only from the right-of-ways, but also from the adjacent lands opened up for urban development. Do we consider these total costs when planning for the future?

Economic assessments help us to understand the basic linkage between our natural and economic geography. Natural resources are commonly taken for granted or simply discounted when assessed with more traditional methods of economic valuation. By considering the economic value of natural resources,



Photo by Lisa Beever, 8/3/07

Charlotte Harbor waters have become an important tourism destination for people who enjoy kayaking.

we may avoid passing on the costs of our present natural resource alterations to our children and grandchildren.

Total Economic Valuation (TEV) of ecosystem services is needed to understand impacts of decisions. With CHNEP and Dunn Foundation assistance, the Southwest Florida Regional Planning Council and the Sanibel-Captiva Conservation Foundation modeled TEV for the Pine Island Sound subbasin. The report is expected to be published in 2013. At the time of this writing, this small portion of the study area is valued at more than \$7 billion. Furthermore, land-use development is expected to reduce these services by 16 percent.

Table 2: Annual 1998 Consumer Surplus and Annual Total Income in the CHNEP Study Area

<i>Resource Activity/Amenity</i>	<i>Consumer Surplus</i>	<i>Total Direct, Indirect and Induced Income</i>
Tourism and Recreational Industries	(in Other Recreational Activities)	\$2,196,941,059
Commercial Fishing	*	22,635,667
Recreational Fishing	\$107,228,991	(in Tourism)
Other Recreational Activities**	809,448,482	(in Tourism)
Agriculture	*	671,580,307
Mining	*	270,250,299
Nonuse Value of Wetland Areas in the CHNEP Study Area	884,028,344	Not applicable
TOTAL	\$1,800,705,817	\$3,161,407,332

* Not provided due to information disclosure constraints.

** e.g., boating, swimming and other water sports, nature observation

Source: CHNEP, *Estimated Economic Value of Resources*, Hazen and Sawyer, 1998



Land use and environmental management

Land-use changes are constantly occurring in the CHNEP study area. The CHNEP reviewed land-use planning efforts as part of an evaluation of the region's environmental management. This analysis included information about specific local issues and how government and property owners make land-use decisions. Year 2009 land uses are shown in Map 8 (p. 36). The following activities and land-use decisions affect environmental management:

- Residential land sales since the 1950s dramatically and permanently changed land-use patterns. Lowlands were dredged and filled and pastures and cropland were drained and cleared to create almost a million outlying homesites in the three coastal counties. Most of these platted lots and streets still lie empty and overgrown, but continued road building near the urban centers of Venice, Englewood, Punta Gorda, Bartow, Fort Myers, Bonita Springs and Sanibel is opening up even more agricultural lands and natural habitat for urban development. Shoreline development has transformed mangrove fringe and other wetland systems to canals, seawalls and riprap.
- Tourist surveys indicate that water and beaches remain the top attractions for visitors. The total coastal population in Charlotte, Lee and Sarasota counties now increases by more than 30 percent above permanent residents for seasonal, business and vacationing visitors. Many of these visitors decide to buy a residence in Florida, adding more population and pressure on land and water resources.
- Surface or "strip" mines extract phosphate rock in Polk, Hardee and Manatee counties. Phosphate reserves in DeSoto County may also be mined someday. Although early operations went unchecked, regulation has reduced pollution and water conservation has resulted in the industry currently recycling 95 percent of the water required for its operation. However, mining operations may result in some changes to water quality, disrupt wildlife habitats and change the way water is stored in the system.
- Compared to more intensive land uses, runoff from cattle ranching carries relatively few contaminants other than coliform bacteria and nitrogen. But land

clearing, leveling and draining for crops can have more serious effects. Citrus and row crop farming can transform habitats, deplete aquifers and pollute surface and ground water with fertilizers and pesticides.

Who makes land-use decisions?

However unintentionally, some land-use decisions can degrade the value of the environment and our quality of life. Many different private organizations and public agencies make these decisions—some through multiple roles and programs.

Florida law delegates most land-use authority to local governments, with state and regional oversight. City and county plans, regulations, taxes and public facilities create a framework for private land-use decisions. About three-fourths of the applicable policies in all city and county comprehensive plans within the watershed implement this CCMP. Most gaps in local policies concern point-source pollution and freshwater inflows that are usually regulated by regional and state agencies.

Growth requires improved management of urban and rural resources. Census-designated urban areas have grown. In 1980, urban areas were confined to small areas within Lakeland/Winter Haven and Cape Coral/Fort Myers. By 2000, all counties within the CHNEP study area, except Manatee County, have census-designated urban areas (see Map 9, p. 37). In 2000, there were 1,052,344 residents in the CHNEP study area. The CHNEP study area population nearly doubled between 1980 and 2000. By 2025, the CHNEP study area population is projected to be more than 1,750,000.

Under current local government comprehensive plans with planning horizons of 2025 to 2040, urban uses and more intensive agriculture and phosphate mining are expected to increase. It is anticipated that improved environmental performance in urban, farming and mining activities may minimize the impacts of those operations on water quality and quantity degradation.

Not surprisingly, most local plans assume a majority of new residents will continue to choose traditional single-family housing or multifamily apartment/condominiums. Together with supporting commerce,



office and industrial development, the plans project that these urban uses will take over a fifth of the region's land area by the year 2025. At the same time, areas devoted to natural preserves and water resources are not projected to grow at the same pace.

Urban development can cause water quality and quantity problems, as well as loss of natural habitat. Improved environmental management of this development will be required. Land use and management, for example, affect the timing of rainwater traveling to a water body, subsequent nutrient concentrations and loading rates and habitat availability. The following sections describe current issues of the region's water quality degradation, hydrologic alterations, habitat loss and stewardship gaps with regard to predicted growth and development.

Growth and stewardship

Growth and environmental stewardship are not exclusive. Vibrant communities require ongoing sustainability of economic, residential and environmental interests. Growth is inevitable and it can be done well. To do so, responsible decisions and behavior must be made by all stakeholders. The need for sustainable growth is critical to closing stewardship gaps.

Growth is a driving force behind the Florida economy. Efforts have been made to ensure that new growth will have as little impact on the environment as possible. Even so, growth is a great threat to the environment and to the quality of life in the already existing communities.



Photo by Lisa Beever, 3/19/04

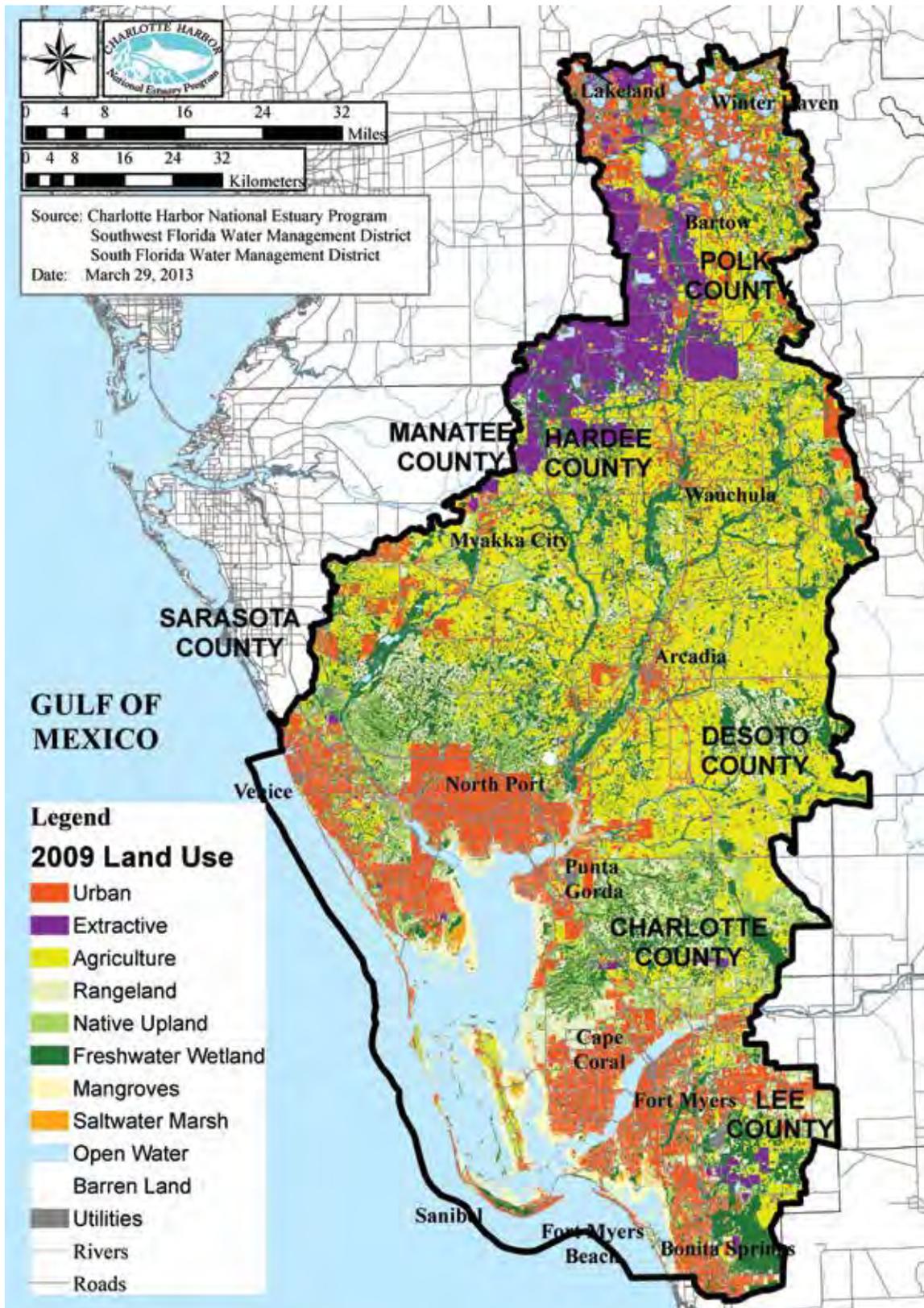
Urban development need not degrade water quality and habitat. This lakeside resident maintains a littoral shelf to protect water quality and habitat.

Residential and economic growth results in a constant demand for resources and places a strain on our most beautiful and most ecologically fragile land. Growth can divert large quantities of water away from the rivers, bays and estuaries and can degrade water quality. Growth certainly disrupts native habitat and wildlife. In addition, existing communities are falling further and further behind in providing roads, schools and other public infrastructure necessary for life.

Everyone wants to live near the water or enjoy the great recreational opportunities the water provides. At the same time, however, we also want to preserve the great natural beauty and wildlife that surrounds us and the "Old Florida" quality of life that attracted us. We each must become stewards of our environment and advocate for sustainable, vibrant communities that attracted us here in the first place.

It is important to keep our community well informed with meaningful information about the environmental changes and alterations caused by growth in our region. This level of awareness and knowledge translates into behavior changes that eventually can result in personal actions required to maintain a sustainable future.

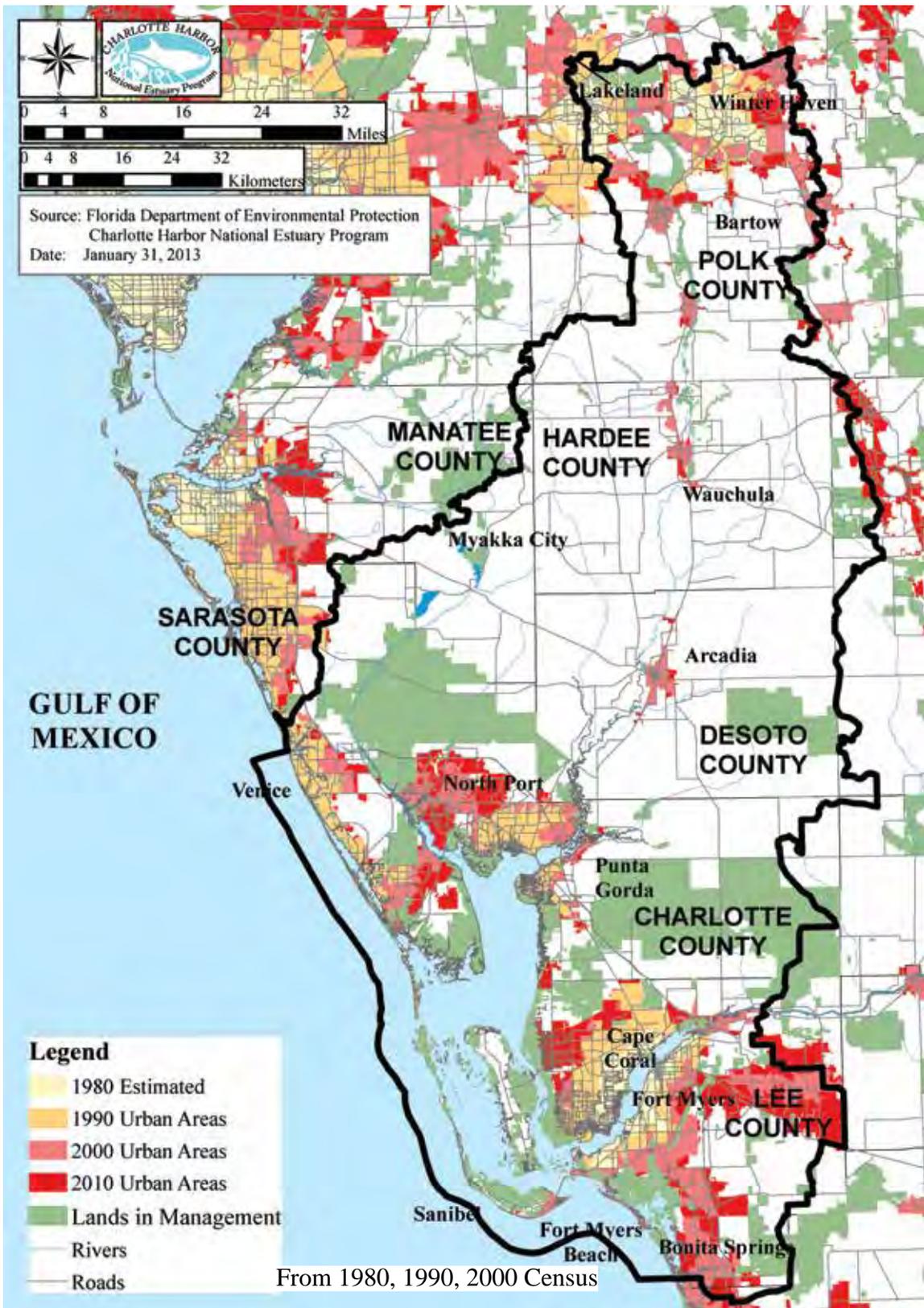




Map 8: 2009 Land Use

Both the Southwest and South Florida water management districts map land uses using the Florida Land Use Code and Classification System (FLUCCS). The land use map for 2009 illustrates the distribution of urban, extractive, agriculture, wetlands and uplands within the CHNEP study area.





Map 9: Urbanized Area Growth

The Census Bureau identifies urbanized areas with a density of at least 1,000 people per square mile. In 1980, the only urbanized areas within the CHNEP boundaries were Fort Myers/Cape Coral and Lakeland/Winter Haven. By 1990, these areas had increased in size and Venice/Englewood and Punta Gorda/Port Charlotte were added. By 2000, these areas expanded and new urban areas included coastal Estero, Lehigh Acres, North Port, Arcadia, Wauchula, Fort Meade and Bartow. Lands in management that may function as urban buffers are green.



Managing Partnerships

A network of existing public and private organizations, in addition to citizen volunteers, creates the CHNEP. These organizations manage resources in different capacities including issuing permits, conducting research, monitoring water quality and educating the public about natural resources. The large study area of the CHNEP and the interconnected jurisdictions of public and private institutions have created both management opportunities as well as critical gaps in our complex legal and organizational framework. This chapter briefly summarizes the management connections that have been made to successfully address problems, as well as the continuing management challenges that need to be resolved.

This CCMP is designed to focus efforts on the region's most important issues and to encourage the many local organizations to work together to solve problems. This section, therefore, identifies the organizations in the region that are working to manage our resources. Once identified, the role of each organization is determined by its mission, jurisdiction, legal authority and budget. This chapter summarizes the environmental organizations in the CHNEP study area and their areas of management. With this information, the CHNEP can build on the existing management infrastructure to work together for implementation of this CCMP.

Regional organizational network

A large array of public agencies and private organizations work to protect and manage natural resources within the CHNEP study area. Most of these organizations have several roles in natural resource management. The types of organizations include the following:

- 24 cities and towns
- 7 counties
- 3 regional planning councils
- 2 water management districts
- 26 divisions of 8 state agencies
- More than 80 special districts, including aquatic plant control, community development, conservation and easement, soil and water conservation, water control and water and sewer
- 8 federal agencies
- 16 private science or resource management groups
- 14 land trusts

Local governments

Local governments manage natural resources through their considerable authority for zoning, land use, transportation planning and local ordinances. In the CHNEP study area there are 7 counties and 24 cities and towns.



Photo by David Modal, 7/13/99

Bartow represents 1 of 24 cities within the CHNEP study area.



Each local government has its own board, ordinances, comprehensive plan and zoning. The implementation and enforcement of these authorities are critical components of effective environmental management, particularly since local governments have the most authority among government entities over land-use issues.

Regional organizations

Regional organizations include regional planning councils and water supply authorities.

The Central Florida, Southwest Florida and Tampa Bay regional planning councils use their strategic regional policy plans to review and coordinate local plans and large developments of regional impact. Regional planning councils also include programs such as emergency preparedness, transportation and natural resource protection. Agreements among the three councils ensure that issues and policies are coordinated in the CHNEP.

Four counties in the CHNEP created the Peace River/Manasota Regional Water Supply Authority. Representatives from Manatee, Sarasota, Charlotte and DeSoto counties direct the design, construction, operation and maintenance of facilities to ensure adequate water supplies for citizens within their four-county area. The Peace River water plant and reservoir provide the major municipal water supply for those areas.

State government

State agencies play important roles in the region's management. Policies in the State Comprehensive Plan form a framework for all Florida budgeting, planning and regulation programs in the watershed. The state agencies with major roles in natural resource management include:

- Board of Trustees of the Internal Improvement Trust Fund
- Florida Land and Water Adjudicatory Commission
- Attorney General
- Forestry Division of Agriculture
- Education Commissioner and Department
- Fish and Wildlife Conservation Commission (FWC)
- Florida Department of Environmental Protection (FDEP)

- Department of Health (DOH)
- Florida Department of Transportation (FDOT)
- State Office of Trade and Tourism Development
- South and Southwest Florida water management districts (SFWMD, SWFWMD)

State agencies report to the Governor and Cabinet and are administered through a series of district and central offices. State permit, enforcement and planning functions play important roles not often covered by local or federal efforts.

The SWFWMD and the SFWMD make up part of a statewide system of water management districts created by the state Legislature. Responsibilities of water management districts include water supply, flood protection, natural systems and water quality.

Federal government

The states, in our U.S. Constitution, delegate broad responsibilities for our national resources to the federal government. Over the last century, Congress has adopted policies and created agencies to administer these policies.

These federal agencies do not directly approve land uses, except for special uses such as nuclear power plants. However, federal taxes, grants and loans and economic policy can increase or decrease activities that directly affect land use. Federal agencies with major roles in natural resource management include:

- Environmental Protection Agency (EPA)
- Department of Agriculture (DOA)
- Department of Commerce (DOC), including National Oceanic and Atmospheric Administration (NOAA) and National Marine Fisheries Service (NMFS)
- Department of Defense (DOD), including Army Corps of Engineers (ACOE)
- Department of Housing and Urban Development (HUD)
- Department of the Interior (DOI), including U.S. Geological Survey (USGS) and U.S. Fish and Wildlife Service (USFWS)
- Department of Transportation (DOT)
- Federal Emergency Management Agency (FEMA)



Federal agencies provide a consistent framework for environmental laws and management. These agencies conduct research, review and issue permits, and apply engineering expertise that is ultimately put to use at the state and local levels. Most federal agencies have local or regional offices that are charged with specific project and regulatory responsibilities. Although policy consistency between regions is sometimes an issue, the presence of regional offices enhances local expertise and accessibility for local organizations.

Private organizations

In addition to the local, regional, state and federal agencies, private groups and nonprofit organizations are important contributors to environmental management. These groups often target their efforts toward needs where government is weak or absent. Private groups are very effective at education,

outreach and “whistle blowing” when programs and enforcement are lacking. Some of the private organizations include Charlotte Harbor Environmental Center, Mote Marine Laboratory, Audubon Society, Sierra Club, Lemon Bay Conservancy, Environmental Confederation of Southwest Florida, Sanibel-Captiva Conservation Foundation, Lakes Education/Action Drive and the Gasparilla Island Conservation and Improvement Association.

Each public and private organization confronts management challenges in an attempt to protect the web of life that makes up the ecosystem. How can these organizations better understand systemwide problems and work closely together to effectively manage the area resources? One way to start is to evaluate the management connections and gaps among these organizations.



Photo by Lisa Beever, 9/14/07

Cedar Point Environmental Park consists of 88 acres crossed by five marked hiking trails through Florida pine flatwoods, oak scrub and salt flats and the mangrove fringe of Lemon Bay. In 1994, the Charlotte Harbor Environmental Center, a private, not-for-profit organization, was appointed to manage and protect the park. Note the kiosk and trail in the lower right of the photograph, beneath the majestic slash pine trees.



Watershed Management

Management connections and gaps

At the federal level, the U.S. Constitution fails to provide any specific responsibility for maintaining environmental quality. Over time, Congress and the courts have defined the general welfare provisions of the U.S. Constitution to include environmental conservation and protection policies. The Executive branch contains the agencies responsible for initiating programs to implement these federal environmental policies. The U.S. Environmental Protection Agency (EPA) is often the lead federal agency on natural resource issues.

However, Table 3 below illustrates that seven federal agencies, in addition to EPA, share seven distinct management functions, resulting in 33 different programs within the CHNEP study area.

It should be noted that although one agency may play a role in several management areas, the level of funding dedicated to the different functions may vary significantly. Also, as congressional funding changes and new initiatives are started, the agencies' priorities may change.

At the state level, Florida programs represent an even more complex allocation of natural resource management roles. The Florida Fish and Wildlife Conservation Commission receives authority from the state Constitution. The other state agencies receive authority from specific Florida Statutes. Together they share seven management functions, resulting in 54 program areas as illustrated in Table 4 (p. 41).

Levels of funding and priorities within state agencies can change over time, as they do on the federal level. However, the information in the table indicates each agency's main goals and authorities.

Local and regional agencies include cities, counties and water supply authorities. In the CHNEP study area, the Peace River/Manasota Regional Water Supply Authority provides water to Sarasota, Manatee, Charlotte and DeSoto counties. The regional water supply authority, cities and counties share seven management functions and 30 program areas, as shown on Table 5 (p. 42).

Table 3: Federal Agency Management Roles

Agency	Regulatory	Review	Planning	Research	Outreach	Funding	Ownership
Environmental Protection Agency	X	X	X	X	X	X	
Department of Agriculture	X			X		X	
Department of Commerce		X	X	X		X	
Defense/Army Corps of Engineers	X		X		X	X	X
Housing and Urban Development			X			X	
Department of the Interior	X	X	X	X	X	X	X
Department of Transportation	X					X	
Federal Emergency Management Agency	X		X	X		X	

Source: CHNEP, *Base Programs Analysis*, Volume 1, 1998



Table 4: State Agency Management Roles

<i>Agency</i>	<i>Regulatory</i>	<i>Review</i>	<i>Planning</i>	<i>Research</i>	<i>Outreach</i>	<i>Funding</i>	<i>Ownership</i>
Board of Trustees of the Internal Improvement Trust Fund		X	X				X
Florida Land and Water Adjudicatory Commission	X						
Attorney General		X					
Department of Agriculture Forestry Division	X	X	X	X			X
Commissioner and Department of Education				X	X	X	X
Department of Economic Opportunity (was Community Affairs)	X	X	X		X	X	
Department of Environmental Protection	X	X	X	X	X	X	X
Department of Health	X	X		X			
Department of Transportation	X	X	X			X	X
Fish and Wildlife Conservation Commission	X	X	X	X	X		X
South Florida Water Management District	X	X	X	X	X	X	X
Southwest Florida Water Management District	X	X	X	X	X	X	X

Source: CHNEP, *Base Programs Analysis*, Volume 1, 1998

Table 5: Local and Regional Agency Management Roles

<i>Agency</i>	<i>Regulatory</i>	<i>Review</i>	<i>Planning</i>	<i>Research</i>	<i>Outreach</i>	<i>Funding</i>	<i>Ownership</i>
Cities	X	X	X		X	X	X
Counties	X	X	X		X	X	X
Water Supply Authorities		X	X	X			

Source: Discussions with members of the CHNEP Management Conference



Layers of management create problems and opportunities

With this overlapping framework of federal and state organizations, both problems and opportunities are inevitable. Within each priority problem category of water quality degradation, hydrologic alterations, fish and wildlife habitat loss, and stewardship gaps there are good management connections as well as management gaps. During the planning phase, the CHNEP identified the best examples of management connections in the hope that our management successes will serve as examples for further cooperation. The management gaps are described to highlight our management weaknesses and to correct our shortfalls. The following sections describe the management connections and gaps for each of the four priority problem areas.

Our region's hydrologic management connections

Management connections for hydrologic conditions such as restoring groundwater levels and maintaining ecologically balanced river flows are important. Water resources do not usually follow jurisdictional lines of local, regional and state governments. Since the resources are affected by management at all levels of government, effective management approaches are important to the long-term health of water flows and levels.

Authority to coordinate land and water decisions: The cumulative impact of many small land and water decisions can remain hidden until after problems with hydrologic alterations arise. However, the review process for developments of regional impact and power plant sitings provide good examples of reviews that consider regional effects, not just site-specific considerations.

General resource assessment, protection and use: Although surface and groundwater data are not complete, land acquisition programs, such as Florida Forever, consider freshwater conditions to prioritize land parcels with the most water protection benefits.

Use permitting, planning and public benefit test: Water use permits must meet the strong legal test of public benefit. As agencies fill information gaps,

public benefit may be expanded to consider long-term regional impacts when issuing water use permits.

A “post = pre” public policy: The guiding rule for drainage permits requires stormwater management after development to equal or improve conditions before development.

Restoration and mitigation: Hydrologically oriented permit programs have helped reestablish hydrologic flows in parts of the watershed, such as the upper Peace River. New or renewed permits require damage reduction and mitigation.

Our region's hydrologic management gaps

When addressing hydrologic alteration problems, the challenge in the CHNEP study area is to identify mistakes that can be reversed, especially in extensive undeveloped platted lands. Past mistakes include overdrainage, direct sewer and stormwater discharges and development in low-lying floodplains. Listed below are examples of gaps in our management of hydrologic problems:

Development in floodplains: Although the environmental resource permit process administered by the Florida Department of Environmental Protection and the water management districts requires mitigation for development in wetlands, public policy has not been effective in keeping development out of flood-prone areas.

Freshwater and saltwater management: Overpumping freshwater aquifers has allowed contamination by salty ground water. Improved management focuses on new development. Plans for areas such as the Southern Water Use Caution Area (SWUCA) are developed to reduce the rate of saltwater intrusion. Water management districts evaluate the timing and volume of discharges as a component of developing minimum flows and levels (MFLs).

Evaluation and prediction models: Estuarine mixing models and integrated surface water/groundwater models are needed in the CHNEP study area to evaluate restoration alternatives and public infrastructure (e.g., roads and stormwater systems) alternatives. Advances are currently being made with the development of public domain software and training of modelers using more uniform methods.



Inadequate enforcement and penalties: Small staff sizes and increasing responsibilities limit inspections and deter legal enforcement procedures. Conversely, the limited penalties seem too small to deter violations.

Our region's management connections in water quality

A general level of regulatory authority has been established at the federal, state and local government level to prevent or eliminate water pollution in the CHNEP study area. Some of the management connections include the categories listed below:

Authority to prevent or eliminate pollution:

Institutional structures presently exist to regulate land, water or air uses known to cause pollution. Reporting requirements keep information on hazardous materials and uses relatively current.

Sampling data and predictive models:

Where reliable data sets have been gathered, different pollution treatment techniques can be modeled and effects predicted. The example of Tampa Bay improvements justifies this monitoring and conservation.

Water use permitting: Water management districts require water withdrawal or use to be reasonable-beneficial, not interfere with existing water uses, be consistent with the public interest and use conservation measures.

Best management practices: Impacts to land, water and air resources may be reduced through simple alterations in landform or effective resource engineering, such as aerobic septic systems to minimize negative impacts.

Our region's management gaps in water quality

Water quality degradation issues intertwine with those of hydrology. Water quality modeling, monitoring and enforcement in the CHNEP study area remain as gaps to be closed.

“Best” level of nutrients: Plants and animals that live in lakes, rivers and estuaries use nutrients, especially nitrogen and phosphorus, to grow and survive.

However when excessive amounts of nutrients enter the water, imbalances such as algal blooms and low dissolved oxygen can occur.

Competing funding demands: Funding for water quality management competes with other public policies. For example, some proposals to monitor water quality for public health threats at Fort Myers-area beaches were turned down.

Voluntary prevention versus mandatory

correction: Failure to use best management practices will degrade areawide water quality. It is undecided what degradation level justifies a shift from voluntary prevention to enforceable regulation.

Lack of intergovernmental support of common goals:

State environmental agencies have not supported local governments pursuing common goals, such as Punta Gorda expanding mandatory sewer hookups and Lee County denying extensive wetland filling.

Our region's management connections in habitat

Among the priority problems in the CHNEP study area, habitat protection may be the most intensely discussed. While most water and water bodies are considered public property to be managed for the public, most habitat exists on private property. Even on public lands, sometimes the appropriate uses and priorities for land acquisition are debated. The best habitat management incorporates effective management of public lands along with good management on private lands.

Basic research and understanding: The Florida Fish and Wildlife Conservation Commission has distributed maps of likely species present on both public and private lands. With this tool, the general public, private conservation groups and regulatory agencies have a better idea what wildlife may exist in specific areas.

Land acquisition, restoration and other mitigation:

Over the last 25 years, government and private programs purchased or acquired large land holdings. These programs have also encouraged land banking and tested habitat restoration programs.

Jeopardy: Habitat information and public support to promote enforcement actions to protect a listed





Morgan Park in DeSoto County provides habitat and protects water quality and quantity while providing residents with recreational opportunities.

Habitat preservation in “penny packets”: Most habitat management occurs through land and water permitting agencies that review permits based on property boundaries, not ecosystem boundaries, and developers propose land use for small, defined areas that seldom cover entire habitat communities.

Conflicting public policy for baseline species’ habitat protection: Habitat identified by state agencies for high priority protection of baseline species may include areas necessary to meet the economic assumptions of the community or region.

species in “jeopardy” of harm or danger led to acceptable private and public mitigation and prevention programs.

Our region’s management gaps in habitat

Any land development or alteration, such as water management or transportation, changes the habitat value for wildlife. Only recently has the impact on wildlife been part of permitting processes. Even now, developers and regulatory officials may not understand public policy on the value of fish and wildlife habitat, creating many gaps in preventing habitat loss.

Gaps in habitat issues: When land is not owned by government, private owners, by right, do not have to manage their property as potential wildlife habitat. The purpose of most requirements for landscaping or trees is aesthetics or to provide shade, not habitat.

Separation of plants from animals: In ecosystem habitats, animal and plant populations operate in an integrated “web of life.” Yet, the state manages animals through one agency focused on restoring species and manages plants through another agency focused on commercial marketability or scarcity of plants.

Our region’s management connections in stewardship

Just what is stewardship, anyway? Ask a dozen people and you’ll get a dozen answers. For our purposes, stewardship is the careful and responsible management of natural resources such as water quality, hydrology and habitat entrusted to our care. Who are stewards of our watershed? You. Me. Students. Teachers. Scientists. Civic organizations. Environmental and conservation groups. Government agencies. Elected officials. The CHNEP and our partners. All of us. Some of the management connections include the categories listed below:

Public outreach: Public outreach by many cooperating partners with resulting changes of behavior is considered one of the most valuable ways to protect estuaries and watersheds.

Data management: Various agencies and organizations collect data for a variety of environmental monitoring programs. Efforts are being made to ensure that data sets from different geographic areas can be used in concert with each other.



Legislative advocacy: The CHNEP made the decision to include a legislative advocacy component to its activities. Upon adoption of the advocacy position, Policy Committee members acknowledged that the CHNEP would direct most comments toward their own agencies. However, the members saw value in receiving well-considered comments that went through a review by concerned citizens, scientists, resource managers and colleagues.

Our region's management gaps in stewardship

Improving stewardship of natural resources is imperative in high-growth areas to arrest declines in environmental health.

Development methods are not sustainable:

Platting frequently fails to address adequate stormwater treatment, sanitary sewer services, water needs, consideration for open spaces and wildlife preservation. Large areas of coastal counties were platted in the 1950s and 1960s without adequate stormwater treatment, sanitary sewer services and open spaces. Local ordinances often require impervious areas that are not needed throughout most of the year. Parking is an example. Sustainable development, as defined by the National Society of Professional Engineers, is “the challenge of meeting human needs for natural resources, industrial products, energy, food, transportation, shelter and effective waste management while conserving and protecting environmental quality and the natural resource base essential for future development.”

Inadequate stewardship:

Stewardship is a dedication to preserve and improve the condition of the surrounding world. It implies not just a choice but a responsibility to care and to be accountable for that which has been entrusted to us. We should never leave things in worse condition than we found them. Every person who visits, lives, works or is involved in activities in the region has a daily impact on the

condition of the estuary. We all need a strong sense of stewardship of “do no harm,” “do the right thing,” “do well,” but many do not know what they need to do to comply. The foundation of this sense of stewardship is a universal public education, outreach and information program.

Public apathy: People that could gain the most from stewardship information are the least likely to participate.

Monitoring programs are difficult to sustain:

Monitoring programs are difficult to fund in tight budgets. The greatest benefit is from long-term data sets.

Management connections point the way to fixing gaps

As our population grows and changes, so will our management techniques and gaps. Some resource management and land-use programs have been linked, but despite these efforts, other programs do not work in harmony. The result is loss of effectiveness and

efficiency in natural resource protection. The public understands the purpose of resource management systems and this understanding provides the critical motivation tension necessary for reform and improvement in the CHNEP study area.

This CCMP and the continuation of the CHNEP Management Conference will promote management connections and the filling of management gaps. Regular meetings of the committees of the Management Conference will promote communications among both agencies and interest groups. The meetings and information materials generated through the CHNEP are also helpful for

calling attention to new research, studies and data that become available. Continued participation from the private groups as well as federal, state, regional and local agencies will be important to the continued value of the CHNEP activities.

Principles of Smart Growth

1. Create a range of housing choices.
2. Create walkable neighborhoods.
3. Encourage community and stakeholder collaboration.
4. Foster distinctive, attractive communities with a strong sense of place.
5. Make development decisions predictable, fair and cost-effective.
6. Mix land uses.
7. Preserve open space, farmland, natural beauty and critical environmental areas.
8. Provide a variety of transportation choices.
9. Strengthen and direct development toward existing communities.



Vision

On April 13, 2000, the Charlotte Harbor National Estuary Program's (CHNEP) *Comprehensive Conservation and Management Plan* (CCMP) was approved by the Program Management Conference. The Management Conference has made significant strides in implementing the CCMP. Progress has been made on all the original 15 quantifiable objectives. By 2008, 2 of 15 (13 percent) quantifiable objectives and 13 of 48 (27 percent) original priority actions have been accomplished.

In late 2005, the Management Conference initiated an in-depth review and revision of the CCMP, acknowledging the significant CCMP accomplishments achieved within the CHNEP study area. The Management Conference recognized that the CCMP is a dynamic document and that periodic modification is appropriate.

The Management Conference refined the original quantifiable objectives and priority actions based on new data, deeper knowledge and the natural and anthropogenic changes within the CHNEP study area. These revised, updated and new quantifiable objectives and priority actions capture, in text, the Management Conference's vision for the CHNEP.

On December 6, 2002, the Management Conference requested preparation of a vision map series to augment the CCMP. Committee members agreed that such a picture would be a valuable tool for policy development. The conference agreed that the vision should account for natural and seasonal variation. Graphic depictions of the vision for the CHNEP study area are presented in this section of the CCMP.

Water flow across the landscape to the estuaries (hydrology)

The estuary is defined by the mixing of fresh and salt water. In other words, the estuary is where the river meets the sea. Throughout the year, boundaries of the estuary change. The mixing zones shrink and grow as freshwater inflows diminish in the dry season and increase in the wet season. The mixing zones are not uniform from side to side and from top to

bottom. There are three named estuarine zones—the oligohaline (0.5 to 5 parts per thousand of salt, ppt), the mesohaline (5 to 18 ppt) and the polyhaline (18 to 32 ppt). These zones reflect the mixing of the Gulf with rivers, streams and seepage, and the rainfall on the estuary itself. It is important for estuarine productivity to not shrink or expand these zones too quickly or too much. Yet that is what we have done in some areas. Our vision is to mimic natural salinity conditions and changes with improved management of flows—surface and ground water.

The oligohaline environment is critical for many young-of-the-year marine fish species. Ideal salinity ranges for oysters to survive are 5 to 15 ppt during the wet season and 10 to 19 ppt during the dry season—near the range identified for the mesohaline zone. This zone is also important for essential fish habitat, juvenile crocodiles and the newly listed sawfish. (Listed species are in danger of extinction.) Polyhaline habitats are important for many juvenile fish, such as gag (*Mycteroperca microlepis*).

Consider the course of the raindrop as the annual hydrologic cycle deposits it on the land and the river flow brings it to the estuary. Prior to development, with the Caloosahatchee as an example, a lower percentage of rainfall made it to the estuary. The remainder was recycled back to the atmosphere through evapotranspiration or stored in groundwater aquifers. The wet season contributed about 75 percent of the discharge to the estuary, the dry season about 25 percent (George B. Hills Co. 1927). The estuary evolved under those conditions, along with the chemical and nutrient content of the water, with the uplands leaching out some of the content and adding others, and wetlands providing delay in travel and also adding and taking away the content of the water. Today, the raindrop may be described as taking the same journey, only now the trip doesn't take as long because of drainage projects and impervious surfaces. In addition, the contributory watersheds have changed in dimension and character, with adverse consequences. Now, the wet season contributes 95 percent of the flow and the dry season only 5 percent in some locations. We need to be informed that the



actions we take cause the journey of the raindrop to cease to provide for a productive estuary and instead become a harmful and destructive addition. We need to know what we can do in our homes, our work and our public and private infrastructure that can be changed to restore the course of the raindrop.

The salinity vision maps illustrate the range of salinity we would like to see in a very wet season to a very dry season (see Maps 10 and 11, pp. 51–52). Currently, the Caloosahatchee exceeds these ranges on both ends. The Myakka gets too much water in the dry season.

Many of these disruptions in water flow are due to changes in historic river watershed boundaries. Drainage projects sought to move water to the closest water bodies. As a result, land that naturally drained to one water body was channeled to another. The most notable example: Cow Pen Canal and Blackburn Canal carry water that once drained to the Myakka River, but they now shunt water to Dona and Roberts bays. Excess water has caused these little bays to receive triple their historic water flows, affecting estuarine species. Another example is the doubling in area of the relatively small Orange River watershed. At the same time, Estero Bay is starved of some of its natural water flows. To identify all areas that have been affected, the CHNEP prepared a historic watershed boundary map (see Map 12, p. 53). This information will assist the CHNEP in identifying needed restoration projects and developing natural systems' water budgets as a tool.

Other disruptions in water flow can be ascribed to artificially created structures such as dams, weirs and canals. Our vision is to enhance and improve water bodies that are affected by artificially created structures (See Map 13, p. 54.).

The water management we have today is the result of government development permitting and capital improvement programs. The relationships and linkages of these programs at the local, water management district, state and federal governments can be quite complex. The SWFRPC is currently developing a diagram of these processes and a vision diagram highlighting recommended reforms. Because of the number of programs throughout the CHNEP study area, the diagram included illustrates linkages in the Estero Bay watershed (see Figure 1, p. 55).

Fishable, swimmable and drinkable water (water quality)

Alteration of the land has interrupted the water and it has also changed water chemistry. Various contaminants adversely affect the function of the lakes, streams, rivers and estuaries. Even state water quality regulations may in some degree be deficient in protecting living resources. Point-source and nonpoint-source pollutants directly introduced into the water, increasing degrees of imperviousness and the functions of urban and rural resource exploitation all have unavoidable side effects. Our vision is to reverse these impacts. Our vision is to eliminate these impairments and to identify local criteria that are protective of living resources (see Maps 14 to 18, pp. 56–60). The maps illustrate the known water quality impairments using Florida water quality standards. Our ultimate vision is to maintain water quality at a standard necessary to sustain living resources. These standards may include issues such as pharmaceuticals and personal care products that currently have no state standard associated with them.

Water quality impairments in the CHNEP study area include nutrient pollution, low dissolved oxygen, bacteria in shellfish and water bodies and metals. Metals of concern are copper, iron and dissolved solids (salts.) In addition, conductance, chlorides and dissolved solids are of concern, especially in the Shell Creek, Prairie Creek and Myrtle Slough basins.

An additional metal concern is mercury in fish tissue, mostly tied to the Gulf of Mexico. Mercury in fish tissue will require state, national and global solutions. Our vision is to not have unnatural levels of mercury in fish tissue.

Another water quality concern is harmful algal blooms, also known as HABs, which include macro-algae, phytoplankton and periphyton. Of particular concern are red tide and blue-green algae. These forms of life are natural in our waters; however, excessive bloom events occur because of man-made imbalances. In the case of red tide and blue-green algae, death can occur to living organisms and affect the economy of the area. Maximum red tide levels were derived from historic red tide data from the FWC Florida Wildlife Research Institute. Our vision is to reduce the severity, extent, duration and frequency of HABs, including red tide (see Map 19, p. 61).



Shellfish clean the water column and are an essential component of the food web. The CHNEP study area has six conditionally approved shellfish areas, but they need to have sufficient water quality to be open for harvest throughout their season. Our vision is to have no closures (see Map 20, p. 62).

Fish, wildlife and vegetation (habitat)

Water flows, water quality and habitat are interconnected. Fish and wildlife resources require good water quality, the right water flows and habitat. An understanding of wetland, creek and slough systems is critical to establishing restoration programs. A predevelopment vegetation map (see Map 21, p. 63) and historic benthic habitat map (see Map 22, p. 64) provide some guidance. Together they will show us the historic extent and locations of habitats that are important to us and suggest what a good balance of plant and animal communities might be.

Submerged aquatic vegetation (SAV) includes marine and estuarine submerged vascular plants (seagrasses) as well as submerged freshwater vascular plants. Current SAV mapping efforts concentrate on seagrass occurrence within near-shore estuaries of sufficient water clarity to allow aerial photographic monitoring. The approximately 54 submerged freshwater vascular plant species in southwest Florida typically occur in dark-water streams and rivers with optical properties that prevent this manner of monitoring. Both water management districts currently map seagrasses and we can coordinate these existing efforts. A vision of maximum seagrass extent was created using various sources of historic seagrass extent minus permanent losses such as the construction of the Intracoastal Waterway (see Map 23, p. 65).

Conservation, preservation and stewardship of sensitive lands is needed to protect not only habitat but water quality and water flows. Our vision includes a balance of acquisition of critical sensitive lands for public management, conservation of agricultural lands and restoration of hydrologic features. This integrated network of land use necessitates a large partnership of agencies, private organizations, citizens and businesses to identify restoration and public management

alternatives. Our vision of restoration was developed through a multiple-agency effort and has been incorporated into such plans as the Lee County Master Mitigation Plan and Southwest Florida Comprehensive Watershed Plan, formerly the Southwest Florida Feasibility Study (see Map 24, p. 66).

Our vision for exotic pest plants and exotic nuisance animals is to stop new infestations and bring current infestations to manageable levels, especially on publicly owned lands. The vision map (Map 25, p. 67) shows areas that have been identified through our partnerships as needing exotic invasive plant or exotic nuisance animal controls. The Florida Exotic Pest Plant Council maintains a database of sightings and locations. A total of 67 exotic pest plant species have been identified from the CHNEP study area.

Taking care of our watershed (stewardship)

We envision everyone making daily choices, large or small, that protect and improve estuaries and watersheds. We are all partners in resource conservation and protection. We share a community-wide vision of a healthy environmental future. As stewards, we are advocates for positive changes in watershed hydrology, water quality and habitat.

To a large degree, gaps in stewardship are correlated with gaps in information and education. Residents need scientific information that is meaningful and useful to help them make daily choices. Scientists need long-term monitoring and data management strategies in order to analyze changes to the environment. Resource managers utilize data analysis to create sound management plans. Government leaders need resources like the CHNEP and solid management plans to help them make effective policy decisions. The entire chain begins with closing gaps in information and education.

Stewardship is the shared responsibility for environmental quality by anyone whose actions affect the environment. Stewardship also means more than just the need for information for residents, government leaders and scientists. Stewardship begins with raised awareness, increased knowledge and shared responsibility, resulting in altered behavior toward the sustainable care of our planet.



Stewards appreciate, respect and take positive actions for the natural environment. Good stewards make good advocates. The land and its resources are ours to conserve or to waste. Once lost, they may never be regained. With knowledge, intelligent choices that promote quality of life can be made by all.

Our vision for stewardship is fourfold: strong education and outreach programs, leadership and advocacy, long-term monitoring and data management strategies, and scientific information presented in ways that are meaningful.

Any discussion on natural resource protection inevitably leads to a discussion of public education. Although most people want to do the right thing for the world around them, they may have misconceptions. Effective outreach and education programs can help erase misconceptions. Our current outreach and education programs reach thousands of citizens every year through a variety of methods. Outreach programs build knowledge and awareness that can translate into personal action and advocacy.

Effective stewardship requires leadership and advocacy. Our voice for the natural system must be based on the best scientific information available. One example of the need for leadership is related to the problems of climate change facing coastal communities. Leadership will be necessary to make the difficult decisions concerning changing coastlines, water tables and public investments. Our vision is to provide elected officials and other policy decision-makers access to timely and key environmental information. This will help our leadership to make decisions when they are most cost-effective and have greater likelihood of success.

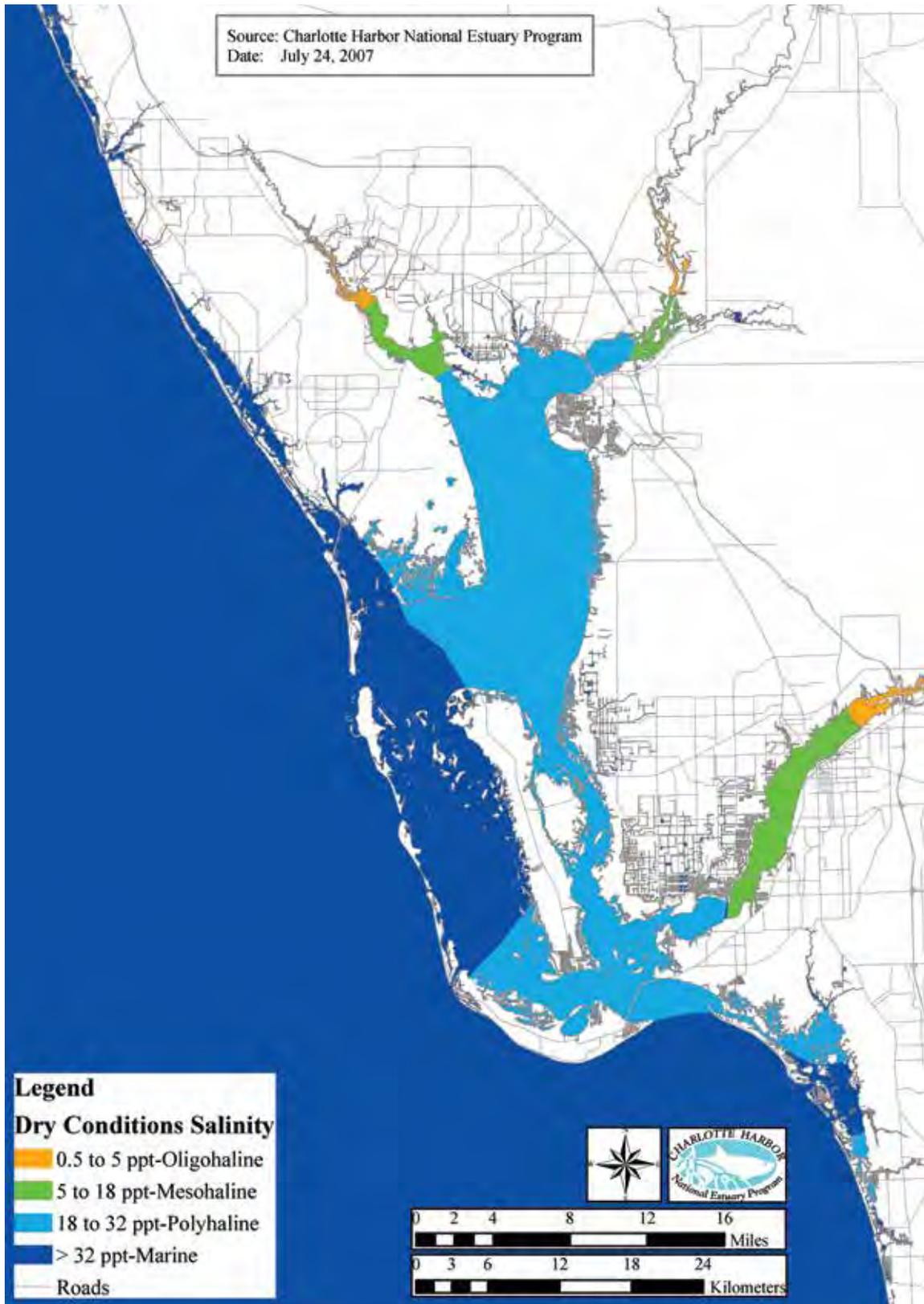
Long-term monitoring and data management strategies are the second leg. Sound scientific data borne of extensive research and monitoring efforts is the basis of the environmental message. Management of the data ensures up-to-date information is readily available and useful to all interested parties. Map 26 (p. 68) provides an example of a multiagency monitoring effort that is integrated. Although this map is the current structure, our vision is to maintain the Coastal Charlotte Harbor Monitoring Network into the long term. We will continue to use the best available methods consistently throughout the network. Map 27 (p. 69) provides an example of gaps in water quality

nutrient information throughout the watersheds. Our vision is to have a better understanding of water quality impairments throughout our watershed.

Finally, our vision is to present volumes of complicated scientific information in ways that are meaningful to a number of different audiences. Public education and outreach efforts attempt to reach a wide audience of the general public. However, to address specific problems, information must be tailored to the audiences most related to that problem. Figure 2 (p. 70) provides an example of how highly technical information can be presented to a citizen or elected official audience.

In addition to information targeted to specific audiences, information must be timely. The massive compendium of technical data grows daily as science adds to our wealth of knowledge. We must coordinate information management and analysis to enhance the data exchange processes. Data and analysis must be a useful tool for everyone—from private citizen to scientist to engineer to business professional to elected official to educator.

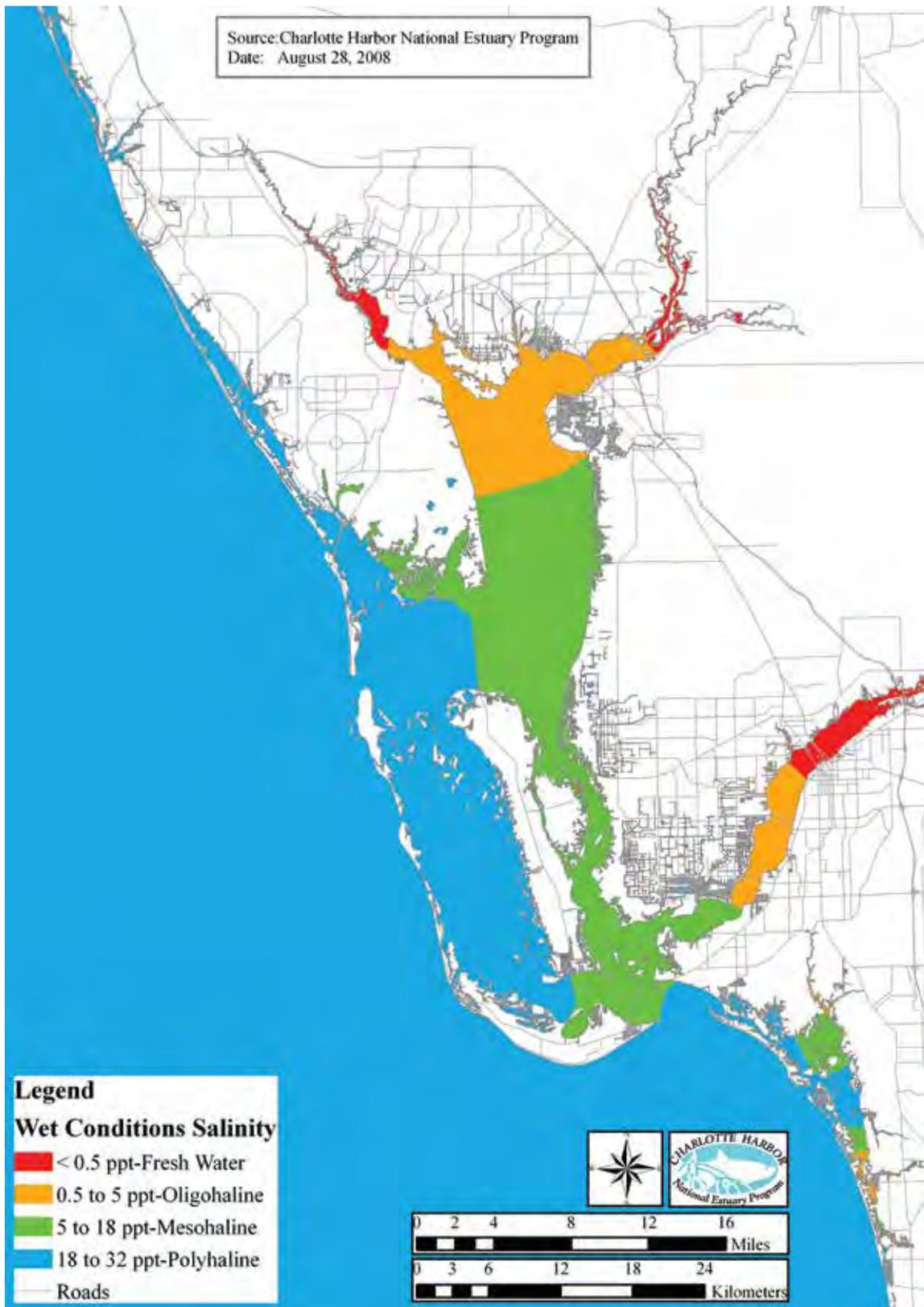




Map 10: Hydrologic Vision for Dry Conditions

This map represents our vision for salinity conditions in very dry conditions. When salinities rise above these levels, concerns regarding the health of the estuaries increase. Our vision is to have salinity at these levels or lower (fresher) during dry conditions.





Map 11: Hydrologic Vision for Wet Conditions

This map represents our vision for salinity conditions in very wet conditions. When salinities in the estuary are below these levels, concerns regarding the health of the estuaries increase. Our vision is to have salinities at these levels or higher during the wet season.

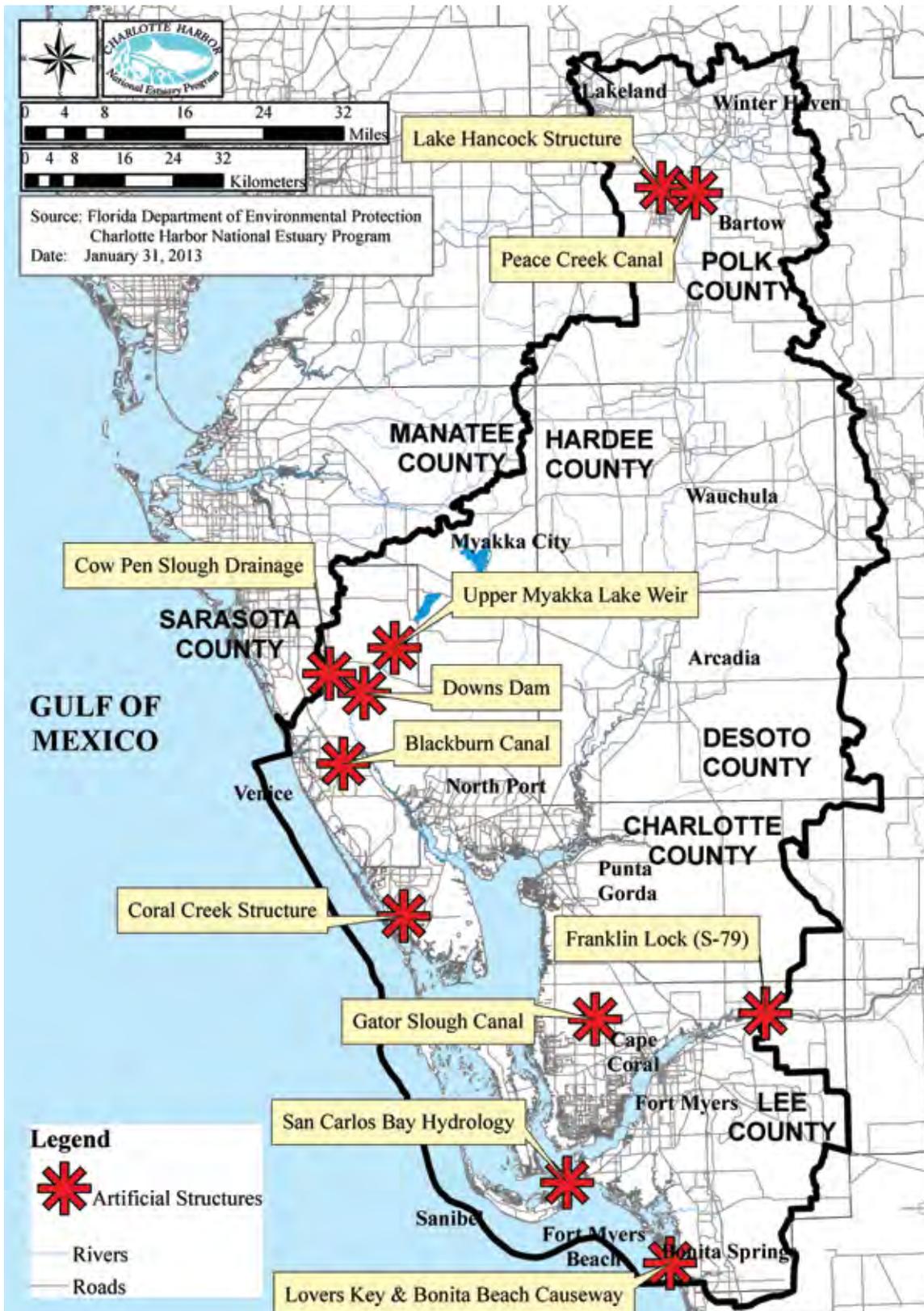




Map 12: Historic Subbasins

In the 1800s and 1900s, drainage projects were designed to dry land to make it available for agriculture and urban development. Water was routed through canals to the closest available water body. Often, this resulted in water being moved across hydrologic boundaries to different receiving waters. For example, Cow Pen Canal and Blackburn Canal moved over 4,500 acres of Cow Pen Slough from the Myakka River basin to the much smaller Dona Bay watershed, tripling water volumes. Our vision is for basins to be restored to their historic configuration.





Map 13: Artificial Structures

Many structures have been built that alter hydrology in the CHNEP study area. Our vision is to enhance and improve to more natural hydrologic conditions water bodies affected by these 11 artificially created structures.



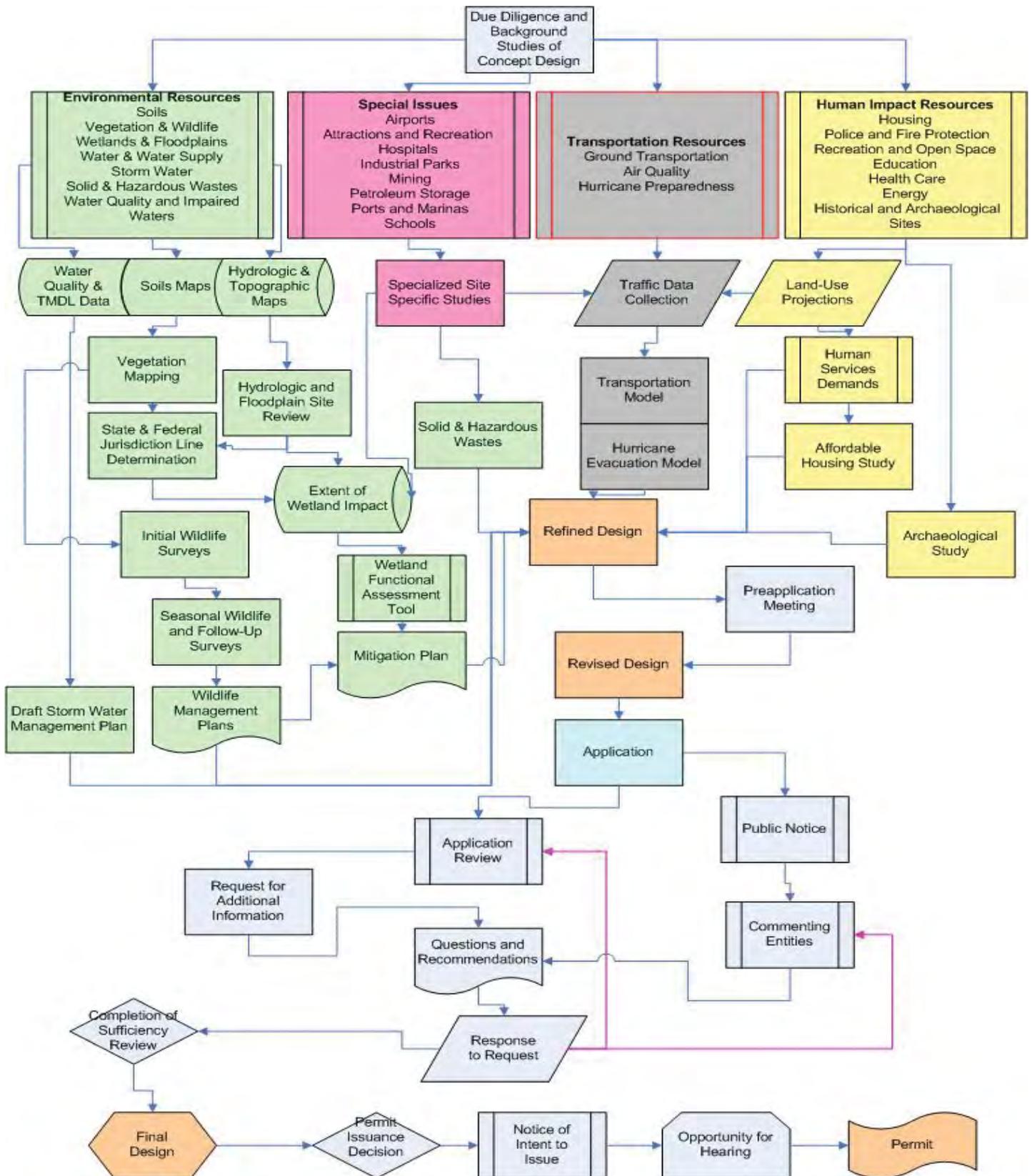
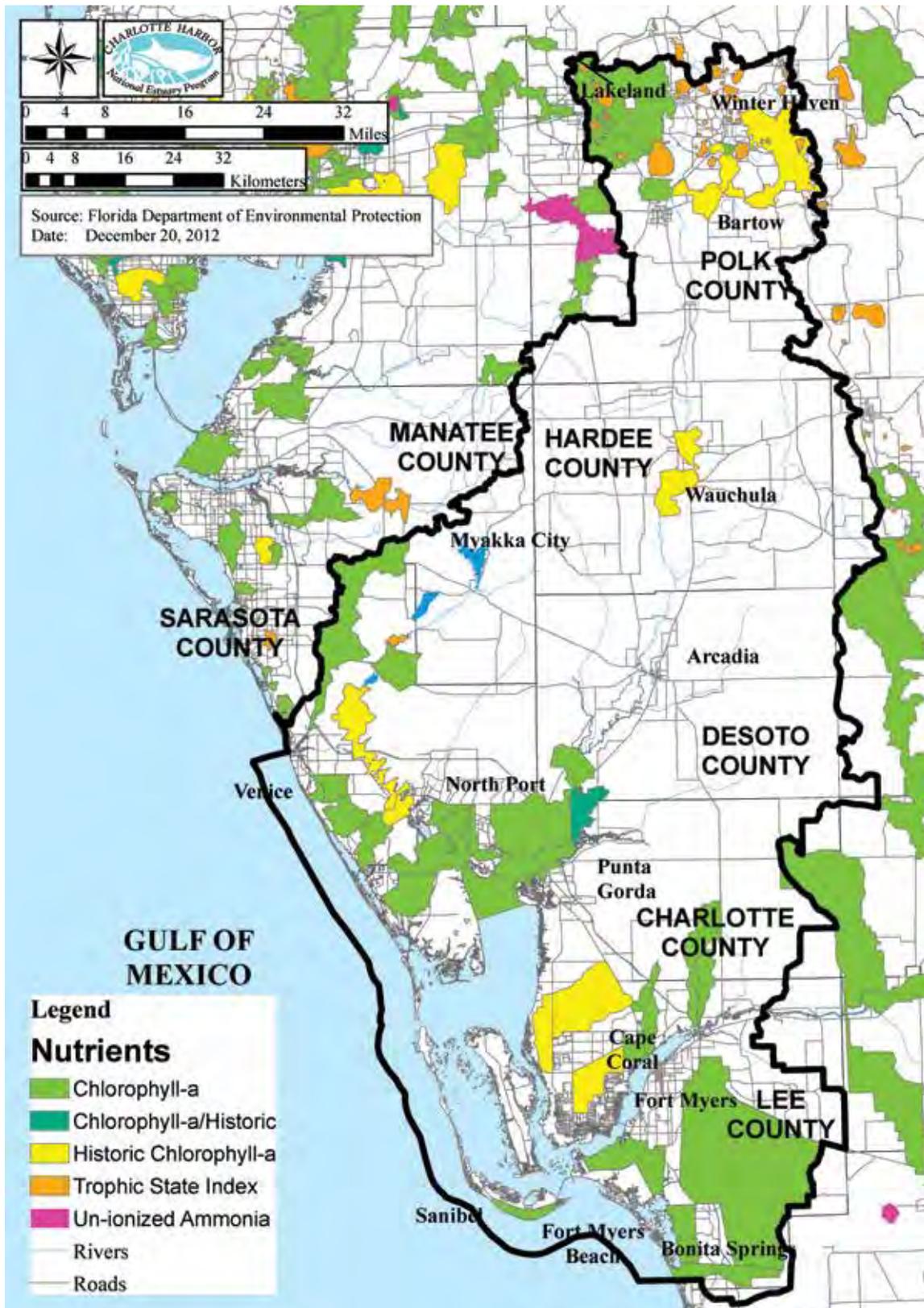


Figure 1: Basic Development Permitting Decision Tree

The CHNEP and the Southwest Florida Regional Planning Council are analyzing growth management permitting in the Estero Bay watershed to identify potential reforms to better protect and improve water quality, water flows and habitat. The existing development permitting decision tree above will provide a vision of reform at the conclusion of the study.

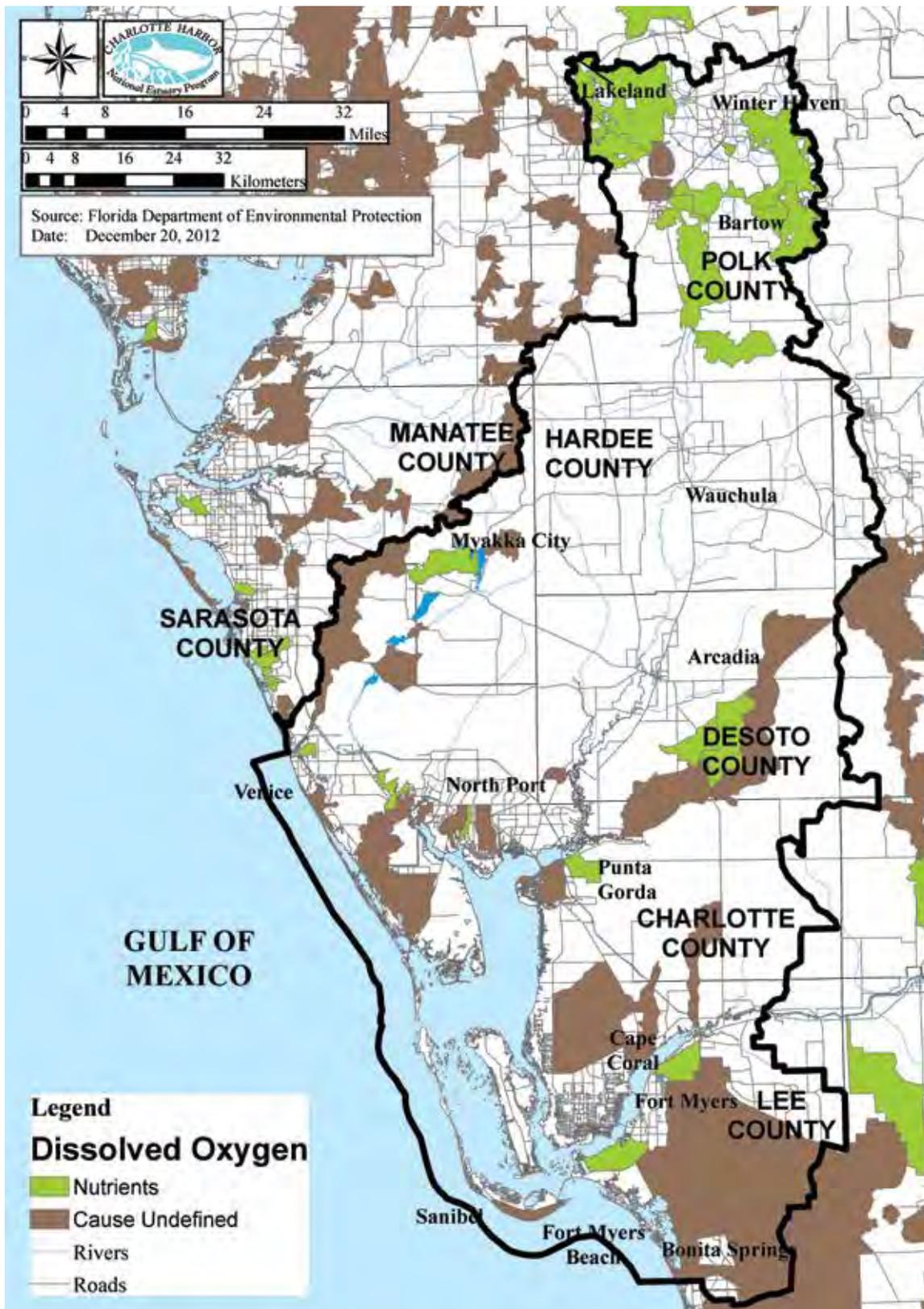




Map 14: Nutrient Impairments

The Florida Department of Environmental Protection uses several indicators of nutrient water impairments, including chlorophyll *a*, historic chlorophyll and trophic state index (used for lakes), and unionized ammonia. Nutrient impairments are most frequent in the Caloosahatchee watershed, Estero Bay basin, tidal Myakka and Peace rivers, and the lakes region. Our vision is to have no water body impaired for nutrients.

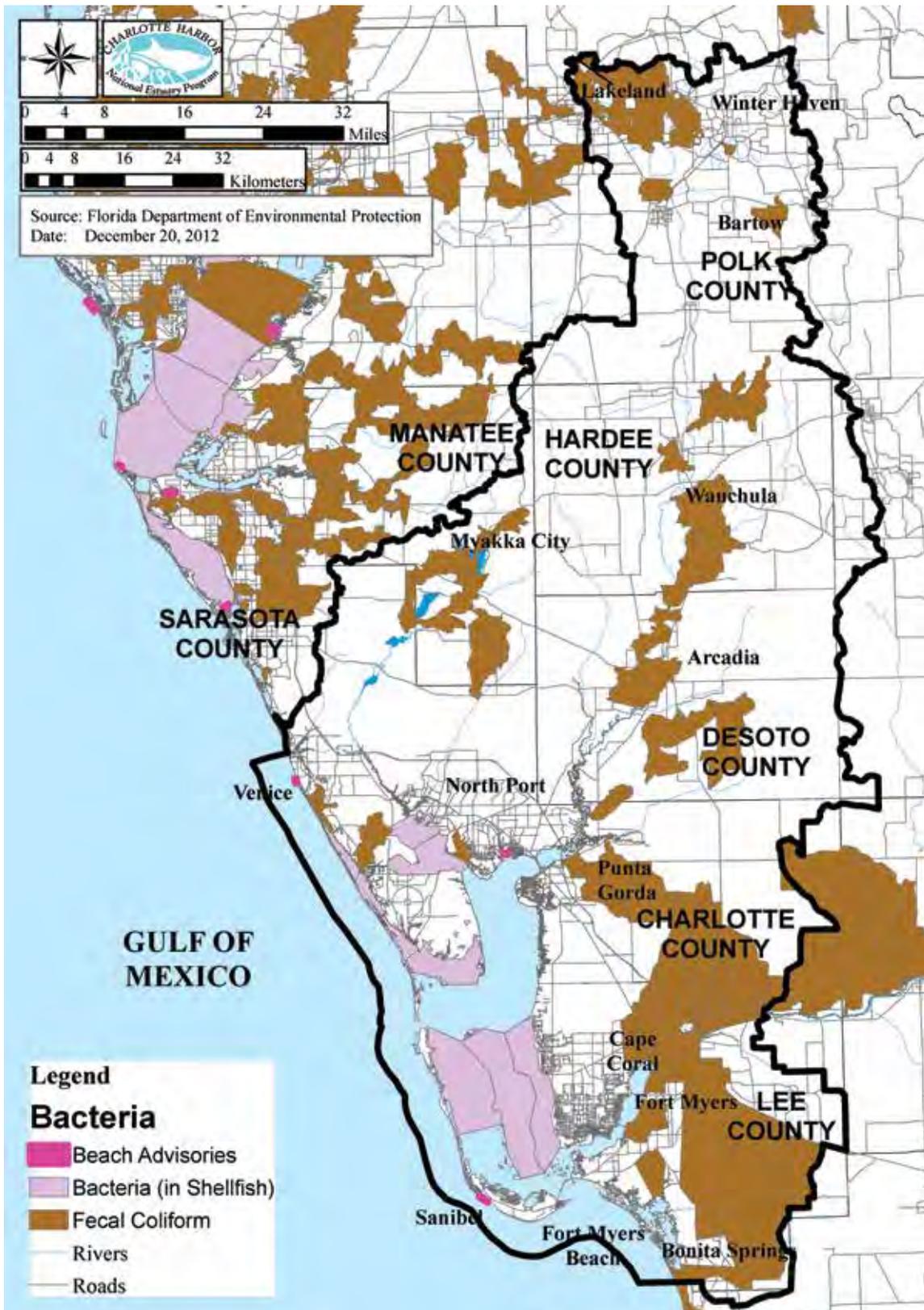




Map 15: Dissolved Oxygen Impairments

Water quality impairments caused by low dissolved oxygen levels are typically associated with areas with nutrient impairments. High biochemical oxygen demand also characterizes areas impaired for low dissolved oxygen. Our vision is to have no water body impaired for dissolved oxygen.

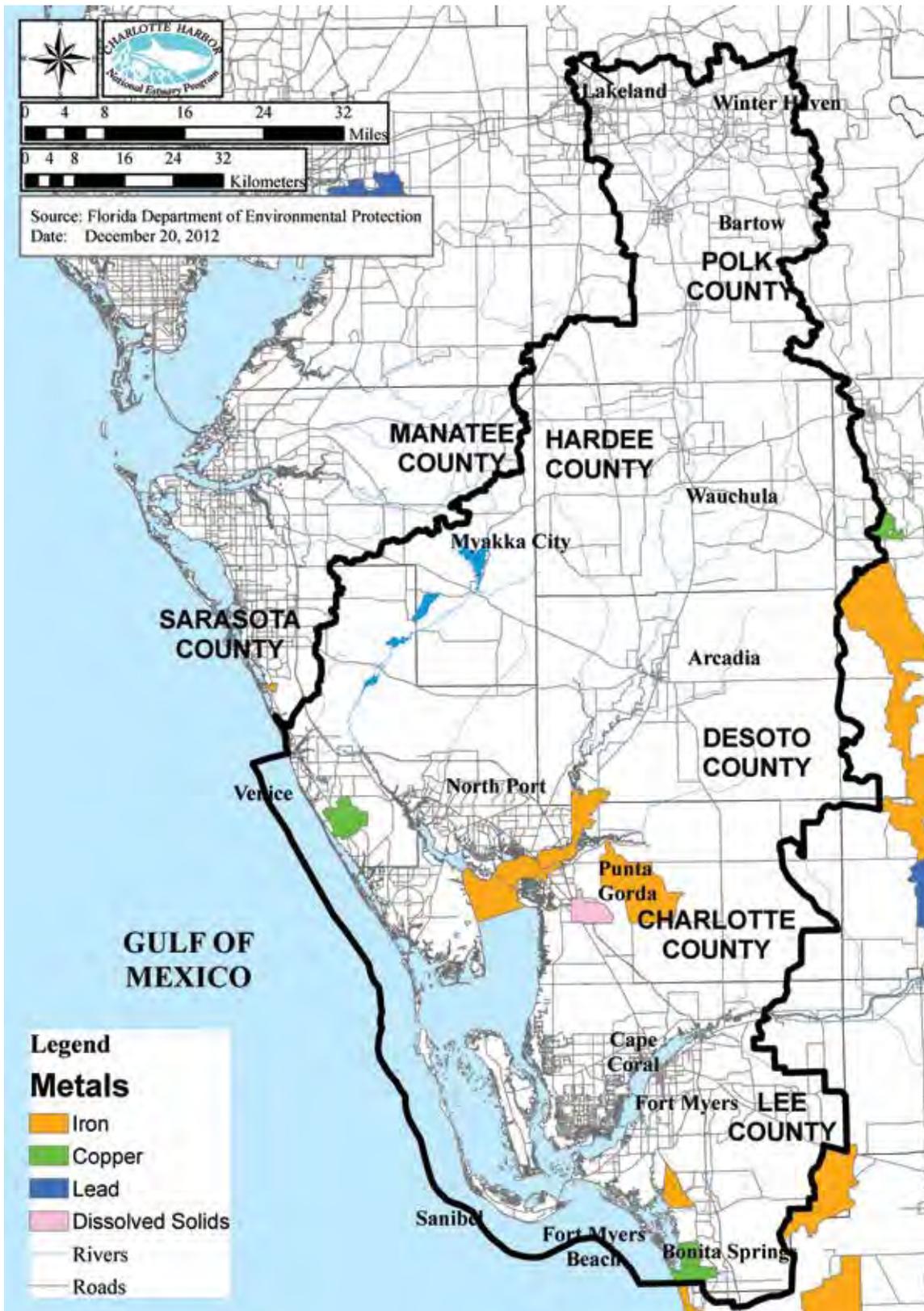




Map 16: Bacteria Impairments

Bacteria impairments include beach advisories, fecal coliform and bacteria in shellfish. Fecal coliform impairments are located primarily in the Caloosahatchee, upper Myakka and Peace River watersheds. Nearly all areas open to shellfishing have bacteria impairments, and harvesting closures occur routinely. Our vision is to have no water body impaired for beach advisories, bacteria in shellfish or fecal coliform.

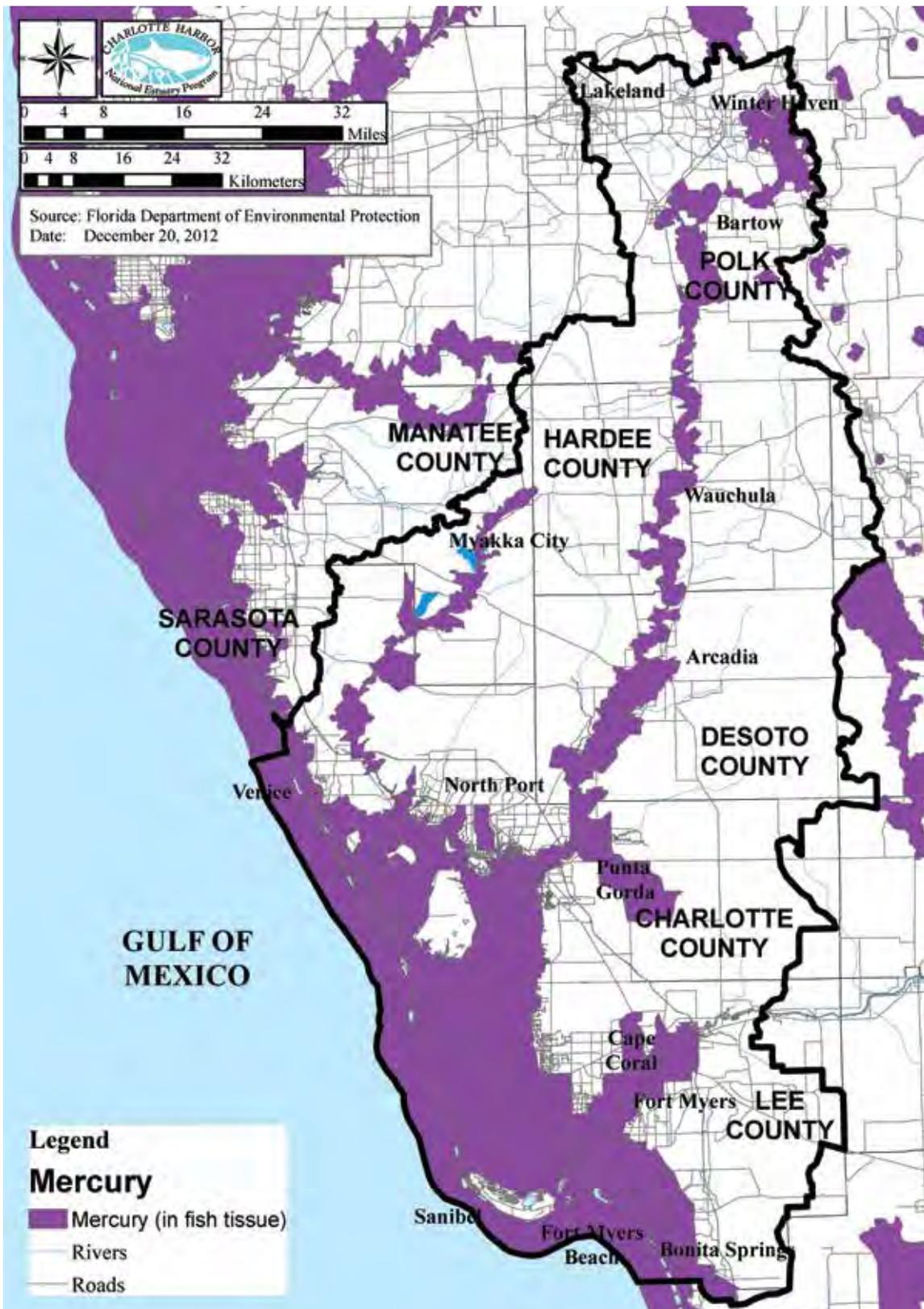




Map 17: Metals and Salts Impairments

Metal impairments occur in three general classes within the CHNEP study area: iron, copper and dissolved solids (salts). Conductivity (high mineral salt content), chlorides and dissolved solids impair the Shell, Joshua and Prairie creeks, for which there is a reasonable assurance plan. Our vision is to have no water body impaired for metals or dissolved solids.

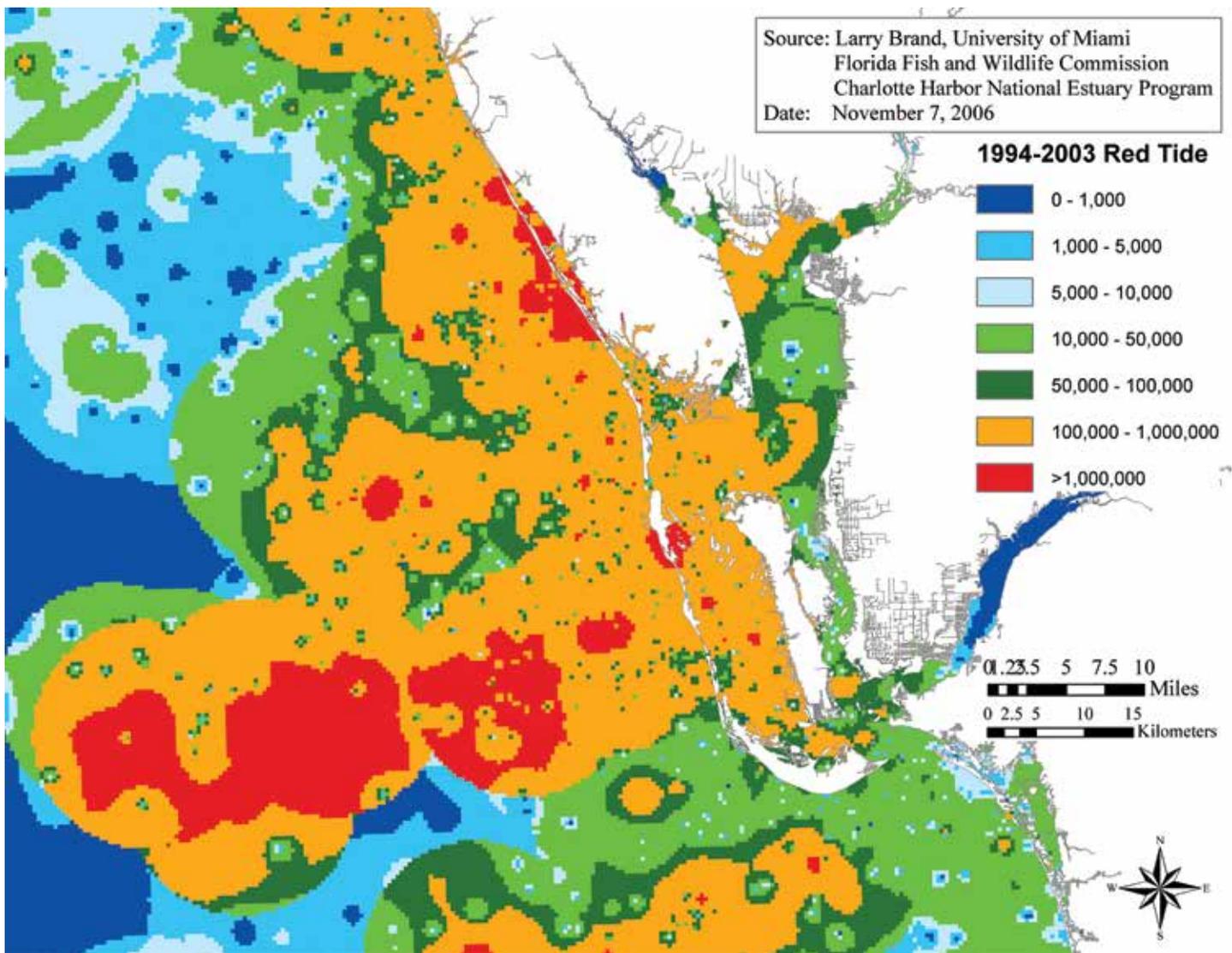




Map 18: Mercury Impairments

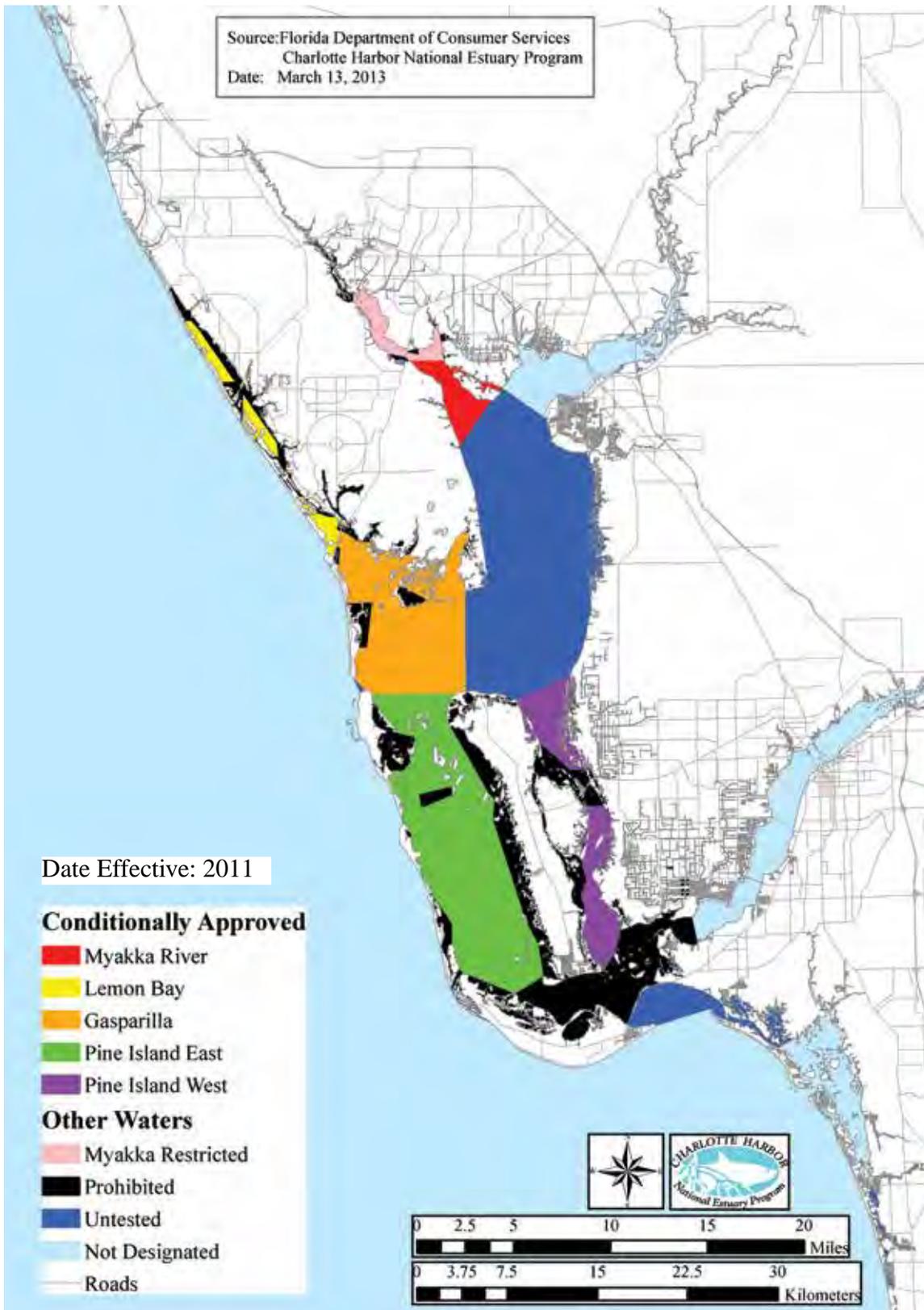
Mercury impairments are determined by mercury found in fish tissue. Mercury impairments are found in estuarine waters near the Gulf of Mexico as well as in the Peace River and Myakka River watersheds. Our vision is to have no water body impaired for mercury.





Map 19: Red Tide Concentrations (1994–2003)

This map provides average red tide concentrations from 1994–2003. At 5,000 cells per liter (light blue), shellfish areas are closed to harvest. At 10,000 cells per liter (green), human respiratory irritation occurs for most people. At 100,000 cells per liter (orange), fish kills are probable. At over a million cells per liter (red), discoloration occurs. Our vision is to reduce the severity, extent, duration and frequency of harmful algal blooms (HABs), including red tide.



Map 20: Shellfish Harvest Areas

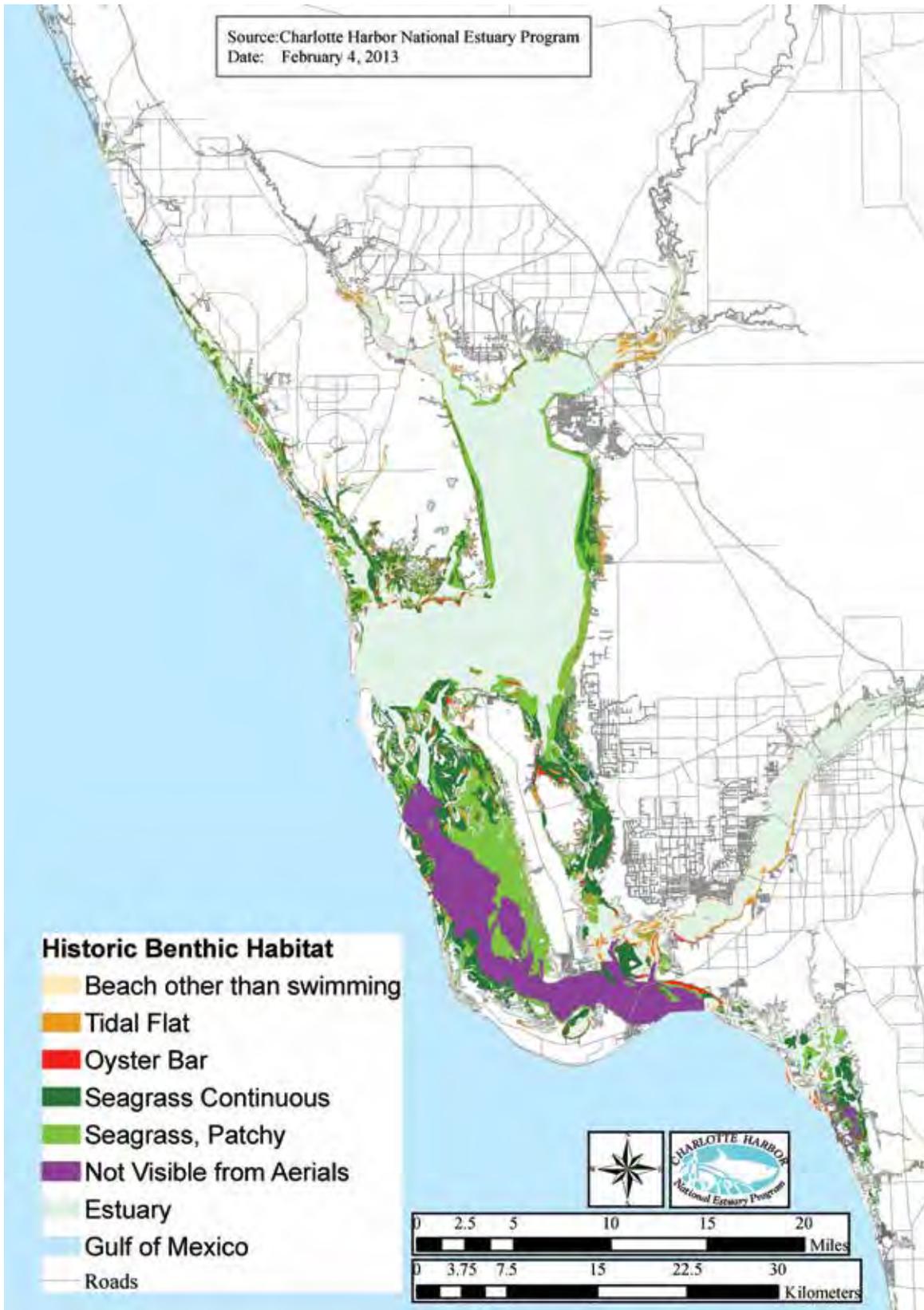
This map indicates shellfish harvest areas. The areas shaded in bright colors represent Class 2 waters where shellfish harvesting is allowed when water quality conditions merit it. Areas shaded in black were also designated Class 2 waters by the Florida Department of Environmental Protection; however, historic water quality data indicate the area was too degraded to allow consumption of healthy shellfish. Our vision is to have all Class 2 waters open 100 percent of the time for shellfish harvest.



Map 21: Predevelopment Vegetation Map

This map illustrates the pattern of upland (light green), freshwater wetland (dark green), saltwater marsh (orange) and mangrove (light yellow) habitats prior to development. The information was developed using soils, expert opinion, historic aerial photographs and mid-1880s General Land Office Surveyor notes. Our vision is to restore mangrove, saltwater marsh, freshwater wetland and native upland systems as much as possible. This map provides a tool to help with individual restoration project concepts.





Map 22: Historic Benthic Habitat

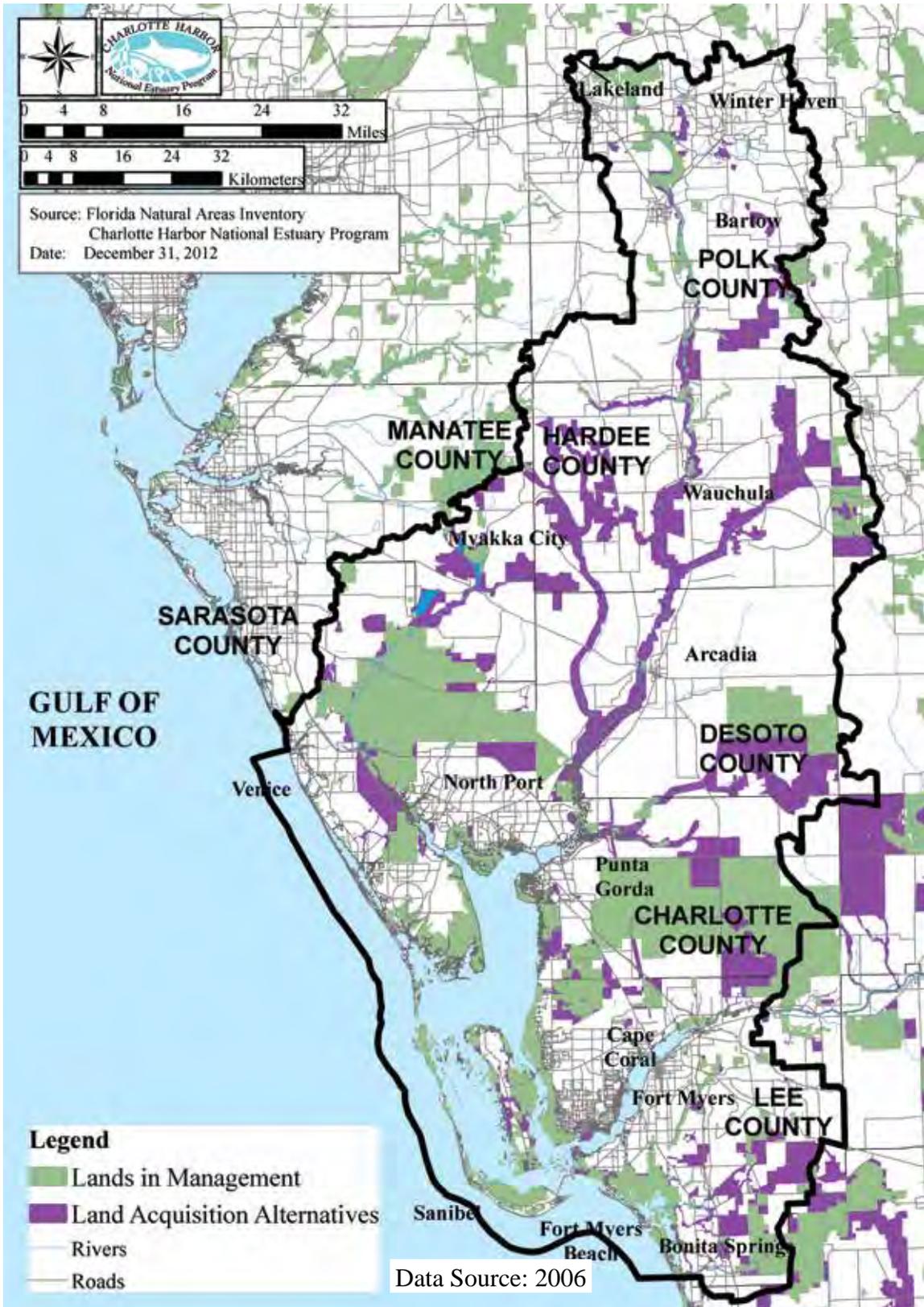
Our vision for seagrass is based on benthic habitat information from 1950s-era aerial photographs. Our vision is to restore oysters, seagrass and unvegetated bottoms as much as possible. This map provides a tool to help with individual restoration project concepts.



Map 23: Seagrass Vision

Our vision for seagrass is based on benthic habitat information from 1950s-era aerial photographs and mapping efforts that have been completed through the years. Permanent losses such as the Intracoastal Waterway and spoil islands are not included in this vision. Green represents the latest seagrass extent mapped, while the red is our vision for seagrass distribution expansion. More detailed mapping efforts occurred in 1982 and 1993 and are shown here for reference.

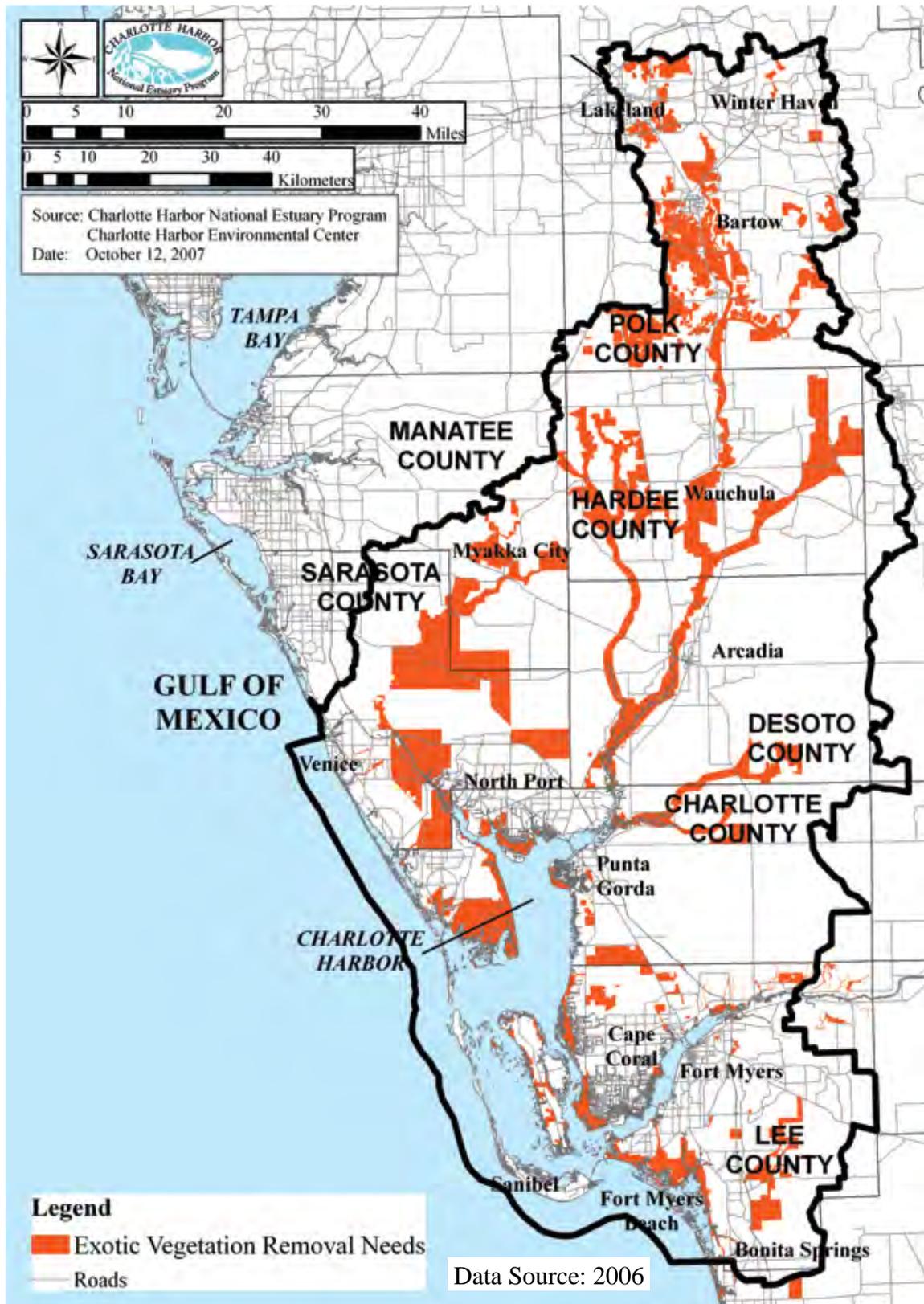




Map 24: Land Acquisition Alternatives

An interagency effort to identify potential habitat, water quality and hydrologic restoration activities was coordinated by the CHNEP and its partners. The projects shown are included in the Lee County Master Mitigation Plan and the Southwest Florida Comprehensive Watershed Plan. Existing land under some form of management, including conservation easements, is shown in green, while areas that would be useful for restoration and management are shown in purple. Our vision is to have the purple area under management.

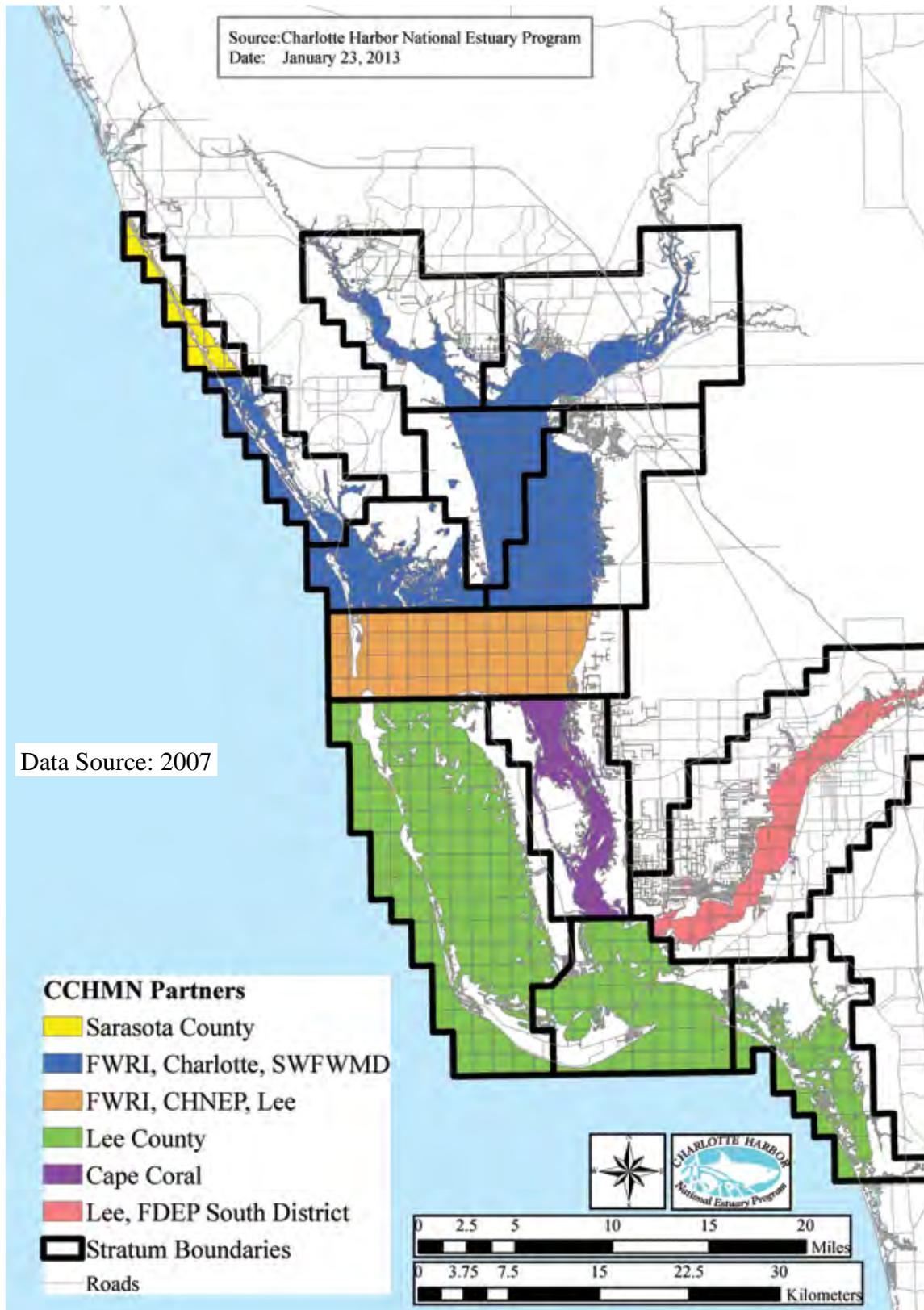




Map 25: Exotic Vegetation Removal Needs

Exotic vegetation removal needs on both public and private land were identified (red) as part of an interagency restoration project. Our vision is to have exotic vegetation removed from the areas shown in red.

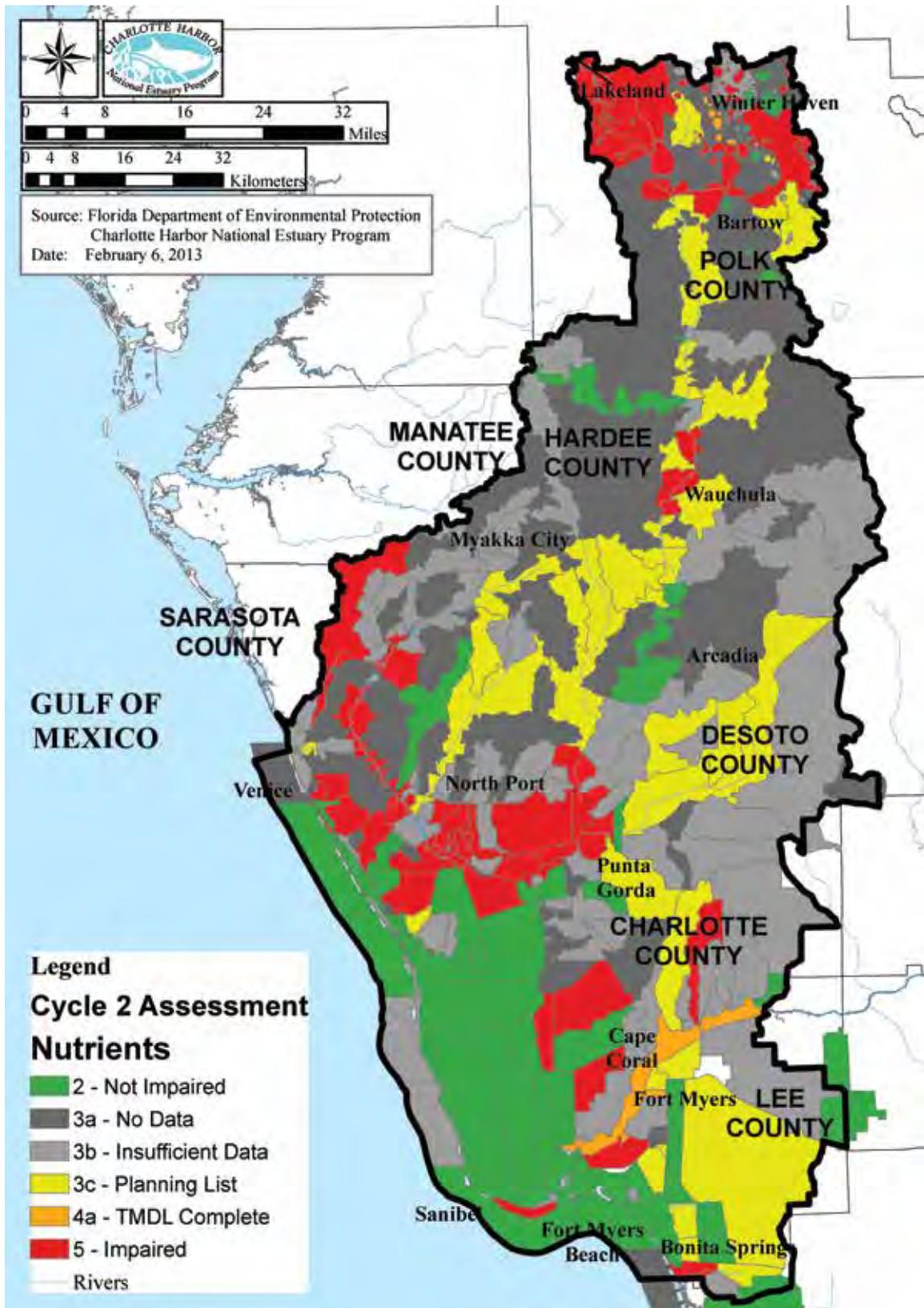




Map 26: Coastal Charlotte Harbor Monitoring Network

Our vision is to conduct integrated and long-term environmental monitoring programs. Integrated means that multiple agencies monitor but use consistent methods so that the data are comparable. Long-term data allows analysis of change with possible causes and restoration solutions. The Coastal Charlotte Harbor Monitoring Network is an example of our monitoring vision. Other examples include the Charlotte Harbor Estuary Volunteer Water Quality Monitoring Network and the Volunteer Tidal Shoreline Mapping Network.





Map 27: Water Quality Monitoring

Our vision is to have a better understanding of water quality impairments throughout our watershed. Within Map 27, the dark grey areas show where FDEP possesses no nutrient data to assess water quality impairments. The light grey areas show where there is insufficient nutrient data to assess water quality impairments. The green areas show where impairments have been assessed and the area is not impaired. Red and orange areas are impaired, while yellow areas are on a planning list.



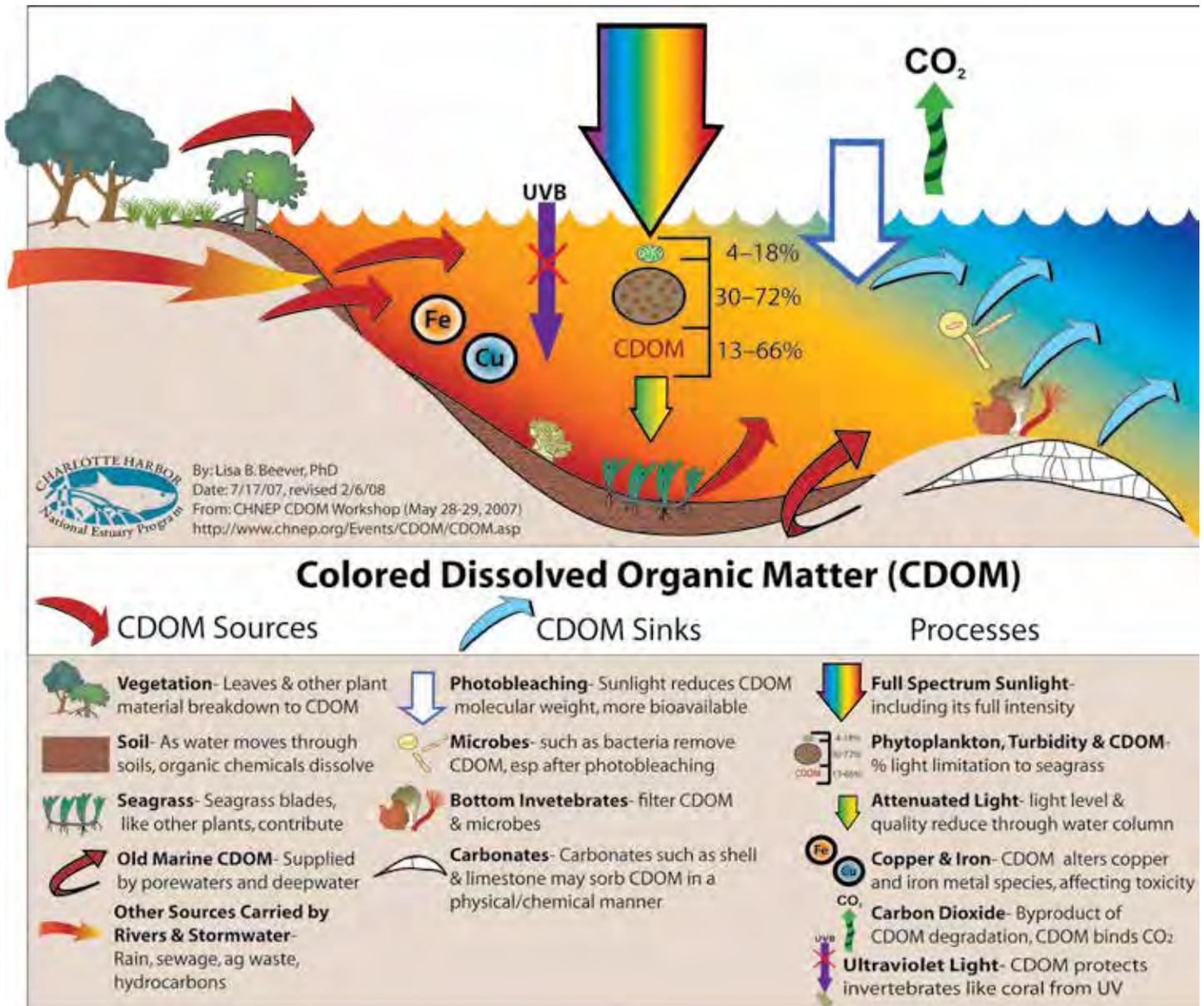


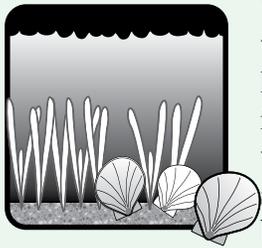
Figure 2: Communicating Science in Meaningful Ways

Our vision is to communicate up-to-date research findings in meaningful ways to citizens and decision-makers. On May 28–29, 2007, the CHNEP conducted a technical workshop on colored dissolved organic matter (CDOM). While CDOM is a natural component of the estuaries in this region, it limits the depth to which seagrass may grow. The above conceptual diagram was developed to encapsulate the major points of the workshop and serves as an example of our communication vision. The process of creating the conceptual diagram served as a valuable communication tool among the workshop participants.

Quantifiable Objectives

The following 15 quantifiable objectives address specific problems associated with water quality (WQ) degradation, hydrologic alteration (HA), fish and wildlife (FW) habitat loss and stewardship gaps (SG). These quantifiable objectives were used to develop the priority actions for this management plan. All these objectives are measurable and have an ambitious timeline to provide incentive for action. Progress will be measured against these quantifiable objectives.

Water quality degradation



WQ-1: Maintain or improve water quality from year 2000 levels. By 2018, bring all impaired water bodies into a watershed management program such as reasonable assurance or basin management action plan. By 2015, remove at least two water

bodies from the impaired list by improving water quality.

WQ-2: By 2020, develop and meet water quality criteria that are protective of living resources for dissolved oxygen, nutrients, chlorophyll *a*, turbidity, salinity and other constituents.

WQ-3: By 2025, reduce severity, extent, duration and frequency of harmful algal blooms (HABs), including macroalgae, phytoplankton and periphyton, through the identification and reduction of anthropogenic influences.

WQ-4: By 2025, meet shellfish harvesting standards year round for the Myakka River conditionally restricted area and the conditionally approved areas of Lemon Bay, Gasparilla Sound, Myakka River, Pine Island Sound Western Section and Pine Island Sound Eastern Section.

Hydrologic alterations



HA-1: By 2020, identify, establish and maintain a more natural seasonal variation (annual hydrograph) in freshwater flows for:

- Caloosahatchee River.
- Peace River and its tributaries.
- Myakka River, with special attention to Flatford Swamp and Tatum Sawgrass.
- Estero Bay and its tributaries.

HA-2: By 2020, restore, enhance and improve where practical historic watershed boundaries and natural hydrology for watersheds within the CHNEP study area, with special attention to Outstanding Florida Waters and Class I water bodies.

HA-3: By 2020, enhance and improve to more natural hydrologic conditions water bodies affected by artificially created structures throughout the CHNEP study area, including:

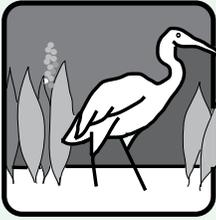
- Sanibel Causeway in Lee County.
- Franklin Lock (S-79) in Lee County.
- Dams on the Myakka River that flows through Manatee, Sarasota and Charlotte counties.
- Causeway between Lovers Key State Recreation Area and Bonita Beach in Lee County.
- Water-control structure on the south end of Lake Hancock in Polk County.
- Structure on Coral Creek in Charlotte County.
- Gator Slough canal collector system in Lee and Charlotte counties.
- Peace Creek canal system in Polk County.
- Cow Pen Slough in Sarasota County.

Reduce negative hydrologic effects of artificially created structures such as weirs, causeways, dams, clay settling areas and new reservoirs.

HA-4: By 2020, for each watershed, identify and recommend additional reforms to improve linkages between local, water management district, state and federal government development permitting and capital programs affecting water storage, flood control and water quality. By 2025, implement the additional reforms.



Fish and wildlife habitat loss



FW-1: Protect, enhance and restore native habitats where physically feasible and within natural variability, including:

- Submerged aquatic vegetation (SAV);
- Submerged and intertidal unvegetated bottoms;
- Oyster;
- Mangrove;
- Salt marsh;
- Freshwater wetland;
- Native upland;
- Water column.

FW-2: By 2020, achieve a 100 percent increase in conservation, preservation and stewardship lands within the boundaries of the CHNEP study area. The increase will be based upon 1998 acreage.

FW-3: By 2020, achieve controllable levels of invasive exotic plants, as defined by the Florida Exotic Pest Plant Council, and exotic nuisance animals, as defined by the Florida Fish and Wildlife Conservation Commission, on publicly managed lands. Encourage and support the removal and management of invasive exotic plants and exotic nuisance animals on private lands.

Stewardship gaps



SG-1: By 2025, a minimum of 75 percent of all residents will have recalled attending a watershed event, reading watershed material or hearing watershed/estuary information on radio or TV. A minimum of 50 percent of all residents in

the CHNEP study area can recognize estuaries and watersheds. A minimum of 10 percent of all residents will be able to claim personal actions that protect the estuaries and watersheds.

SG-2: By 2020, the CHNEP will expand its role as a recognized resource to elected officials or their agents from local, state and federal government for policy advice.

SG-3: Through 2020, the CHNEP long-term monitoring strategy and data management strategy will continue and be enhanced. Resulting informational websites will be maintained systematically.

SG-4: Though 2020, key geographic and scientific information will be presented in ways that are meaningful to the majority of people.



Priority Actions

Priority actions describe the necessary management activities to attain the quantifiable objectives. Most of the quantifiable objectives are broad aims that require many individual tasks to be accomplished. Often tasks will address multiple objectives. The priority actions detail these tasks and key information about how they might be carried out. The priority actions included in this chapter were written by the Management Conference through a series of workshops and retreats.

The actions are grouped into the four priority problem areas: water quality degradation (WQ), hydrologic alterations (HA), fish and wildlife habitat loss (FW) and stewardship gaps (SG). Each priority action describes the key elements of management action including:

Priority action statement is the activity that is needed to achieve the quantifiable objective.

The **background** section explains the priority action, how it will satisfy its quantifiable objective and the rationale for its implementation. The background may include a description of how the priority action will fit with past or ongoing management activities, how the priority action will achieve the objectives and expected benefits of the action.

Carrying out this priority action is progress toward achieving the **quantifiable objective**. Many priority action strategies support more than one quantifiable objective.

Strategy provides specific steps about how the priority action could be carried out. Some of the priority actions will require several steps to be accomplished. The strategy details the steps that could be taken, but there may be shorter methods or more steps that will be necessary. This information was provided by the committees as suggestions for the project managers and implementing organizations on how this action could be carried out. The actual steps must be determined based on the location and the actual projects being carried out by the coordinating and implementing organizations.

Potential coordinating organizations is a list of the entities that may implement each priority action. These groups may include local, regional, state or federal government agencies, nonprofit groups, private organizations, industry or other private interests. Each listed organization may play a role in only one part of the strategy or region.

Our success in carrying out each of these priority actions will be measured and tracked. To achieve complete implementation of these actions, more projects, in addition to the ones listed, will be needed. Therefore, the regional management activities will require consistent measurement and evaluation as the benefits are realized and projects are completed. All priority actions describe timely, needed management actions to fulfill the *Comprehensive Conservation and Management Plan*.



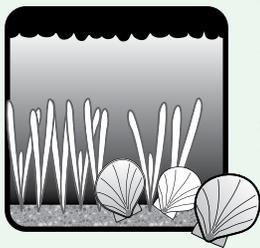
Diagram of Comprehensive Conservation and Management Plan (CCMP) structure



Water Quality Degradation

Quantifiable objectives

WQ-1: Maintain or improve water quality from year 2000 levels. By 2018, bring all impaired water bodies into a watershed management program such as reasonable assurance or basin management action plan. By 2015, remove at least two water bodies from the impaired list by improving water quality.



WQ-2: By 2020, develop and meet water quality criteria that are protective of living resources for dissolved oxygen, nutrients, chlorophyll *a*, turbidity, salinity and other constituents.

WQ-3: By 2025, reduce severity, extent, duration and frequency of harmful algal blooms (HABs), including macroalgae, phytoplankton and periphyton, through the identification and reduction of anthropogenic influences.

WQ-4: By 2025, meet shellfish harvesting standards year round for the Myakka River conditionally restricted area and the conditionally approved areas of Lemon Bay, Gasparilla Sound, Myakka River, Pine Island Sound Western Section and Pine Island Sound Eastern Section.

Priority actions

WQ-A: Participate in the development and implementation of coordinated watershed management programs that accommodate the variable mission and funding priorities of program participants. Encourage the application of flexible, goal-oriented approaches in reasonable assurance plans, basin management action plans (BMAPs), *Implementation Guidance for the Fecal Coliform Total Daily Maximum Loads* and nutrient reduction plans.

WQ-B: Continue collecting consistent water quality data from throughout the study area used to assess impairments, determine total maximum daily load (TMDL) limits and develop basin management action plans (BMAPs). Support key programs such as the Coastal Charlotte Harbor Monitoring Network, partners' long-term fixed stations and volunteer monitoring programs.

WQ-C: Use tools such as geographic information systems, integrated ground and surface water quality models and pollutant loading models to identify water quality problems and select less polluting alternatives.

WQ-D: Reduce nonpoint-source pollutants associated with stormwater runoff. Install or retrofit best management practices (BMPs) to maintain or improve water quality and flows.

WQ-E: Implement projects to improve or protect water quality to offset anthropogenic impacts.

WQ-F: Promote water conservation, stormwater treatment and intergovernmental coordination within local plans and codes to prevent the impacts of increasing levels of impervious surface and fill to achieve improvements to water quality and groundwater and surface water storage.

WQ-G: Develop and implement water quality criteria that are protective of living resources for dissolved oxygen, nutrients, chlorophyll *a*, turbidity, salinity and other constituents as applicable.

WQ-H: Assess the bacteria, nutrient load and base flow impacts of septic systems, wastewater treatment plants and reuse water. Recommend effective corrective action.

WQ-I: Determine the relationship between macro- and micronutrients and phytoplankton/algal blooms. Support measures to reduce phytoplankton/algal blooms where relationships have been determined.

WQ-J: Provide central sanitary sewers to developed areas within 900 feet of waters such as estuarine shorelines, rivers, creeks, canals and lakes.

WQ-K: Implement conservation landscaping plant programs, including the Florida Yards & Neighborhoods program, throughout the CHNEP study area.

WQ-L: Increase the use of personal and home best management practices by residents and visitors throughout the watershed to reduce nonpoint-source pollution.

WQ-M: Support public involvement programs addressing water quality issues.



WQ-A

Participate in the development and implementation of coordinated watershed management programs that accommodate the variable mission and funding priorities of program participants. Encourage the application of flexible, goal-oriented approaches in reasonable assurance plans, basin management action plans (BMAPs), *Implementation Guidance for the Fecal Coliform Total Daily Maximum Loads* and nutrient reduction plans.

Background

Total maximum daily loads (TMDLs) is a federal and state program to identify water bodies impaired by pollutants, to calculate a protective load and to regulate polluters so that the aggregate of all loads does not exceed levels acceptable for the “health” of the water body and its designated uses. Another term for this level is assimilative capacity. Reasonable assurance and basin management action plans (BMAPs) are watershed management plans that consolidate existing efforts in one document and set a course for restoration to acceptable pollutant loads. Because they are legally binding, TMDLs provide a unique opportunity to focus community efforts on maintaining bays, rivers and lakes in a sustainable condition. The FDEP, in cooperation with the EPA and water management districts, is eager to work with local stakeholders to use the TMDL framework to set water quality targets, monitor and assess status and trends, identify high priority projects and implement projects with quantifiable outcomes. Because the CHNEP is not subject to TMDL regulations, the CHNEP is a natural arbiter among stakeholders.

This priority action helps fulfill WQ-1.

Strategy

- 1) Track and participate in review of EPA and FDEP regulations and policy changes, including designated uses, nutrient criteria, pollutant trading and water body identification policies.
- 2) Review draft impaired water list for accuracy.
- 3) Ensure adequate, high-quality data are submitted to state database used for impairment verification.
- 4) Review and correct station location relationship to water body identification boundaries and similar factual errors.
- 5) Review of water body identification (WBID) boundaries to ensure they are accurate and agree with watershed boundaries.
- 6) Evaluate proposed TMDLs, including watershed models used to develop load estimates, assimilative capacity determination and pollutant load reductions.

- 7) Provide comments as necessary within the comment period.
- 8) Participate in the development of watershed management plans such as reasonable assurance (RA) and BMAP development. Incorporate CCMP objectives and actions in such plans. Encourage effective alternatives such as *Implementation Guidance for the Fecal Coliform Total Daily Maximum Loads* and nutrient reduction plans.
- 9) Participate in the implementation of the *Shell Creek and Prairie Creek Watersheds Management Plan* reasonable assurance document. A copy is available at www.swfwmd.state.fl.us/documents/plans/spjc_wmp.pdf.
- 10) Encourage implementation of capital improvement projects that reduce pollutant loads.
- 11) Encourage low-impact development and pollutant load reduction needs into new development projects.
- 12) Advocate consistency of point-source discharge permits with pollutant load reductions into impaired and potentially impaired water bodies. Permitted loads should not cause impairment.
- 13) Consider role of the CHNEP as facilitator of BMAP development and implementation.
- 14) Adopt and implement TMDL determinations and BMAPs for impaired surface waters, as identified through the *Peace River Resource Management Plan*.
- 15) Monitor *Shell Creek and Prairie Creek Watersheds Management Plan* to ensure protection of Punta Gorda’s water supply; develop similar plans in other watersheds.

Environmental indicator and target

WQ-a: Water bodies (identified by water body IDs) on the Florida Department of Environmental Protection’s Verified Lists for Impairments (see surface water quality criteria as listed in 62-302.530 in Appendix B).

Remove at least two water bodies from the impaired list by improving water quality by 2015.



WQ-B

Continue collecting consistent water quality data from throughout the study area used to assess impairments, determine total maximum daily load (TMDL) limits and develop basin management action plans (BMAPs). Support key programs such as the Coastal Charlotte Harbor Monitoring Network, partners' long-term fixed stations and volunteer monitoring programs.

Background

The Florida Department of Environmental Protection (FDEP) assesses impairments, establishes TMDLs for water bodies within the state that have been identified as not meeting current water quality standards, and participates in the development of BMAPs. Over the last decade, FDEP has sampled water bodies for short periods, but sufficient to verify impairments. Though long-term stations are preferable to fully assess the status and trends of a water body, the short period sampling implemented by FDEP may be currently the most cost-effective approach to fill identified gaps in water quality data.

This priority action helps fulfill WQ-1.

Strategy

- 1) Work with partners to keep the Coastal Charlotte Harbor Monitoring Network (CCHMN) fully operational. The CCHMN is a stratified random sample program designed to assess ambient conditions. Partners follow the same protocols to obtain consistently derived data. These data were used to determine nitrogen and phosphorus numeric criteria.
- 2) Support volunteer monitoring networks such as FDEP's Charlotte Harbor Estuaries Volunteer Monitoring Network (CHEVWQMN), Lee County Hyacinth Control District's PondWatch, Cape Coral's CanalWatch and Polk County Extension's LakeWatch programs. Support may include technical transfer and serving data on the CHNEP Water Atlas.
- 3) Evaluate water body identification (WBID) boundary changes or other assessment changes (e.g., reach-based National Hydrologic Data) in relation to monitoring programs.
- 4) Continue to support adding water quality data to the standard common database (e.g., STORET) and its availability to citizens and scientists through the CHNEP Water Atlas.
- 5) Continue to identify parameters of concern such as various pharmaceuticals and potential sources,

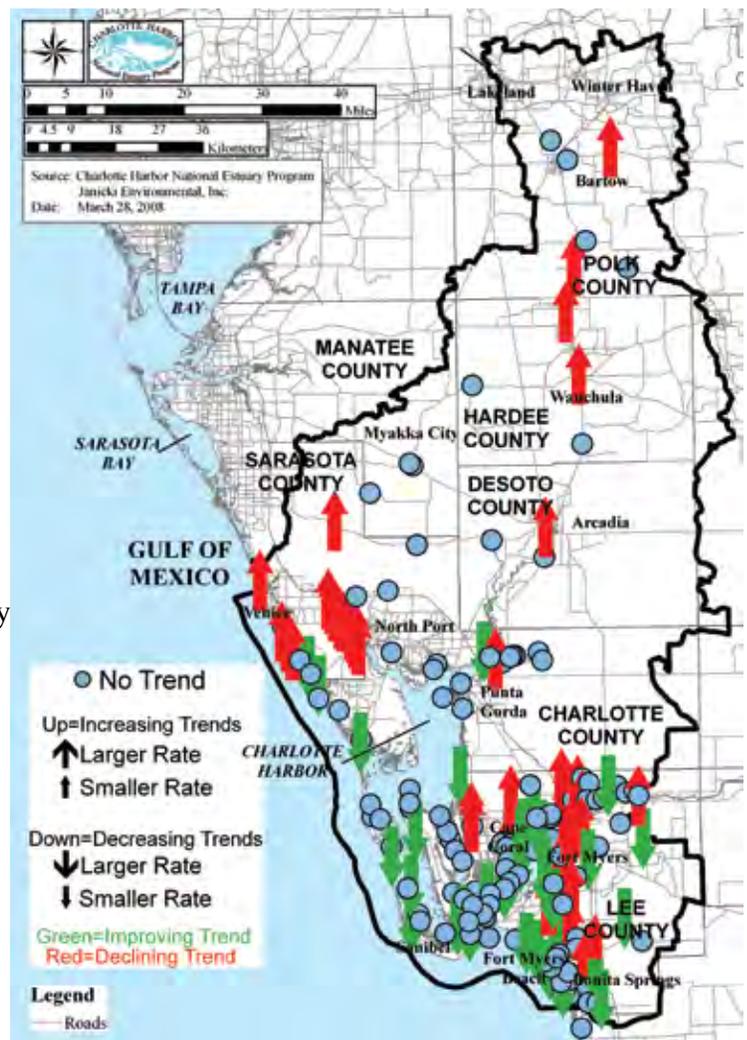
including reuse water and other wastewater treatment products.

- 6) Conduct water quality analyses to identify trends.

Environmental indicator and target

WQ-b: Random stratified sample water quality monitoring program for 13 strata, monthly.

Continued monthly water quality monitoring through the CCHMN.



Map 28: Turbidity Trends

This map is a product of the Triennial Water Quality Status and Trends, representing turbidity trends from 1995–2005. Turbidity is cloudiness in the water.



WQ-C

Use tools such as geographic information systems, integrated ground and surface water quality models and pollutant loading models to identify water quality problems and select less polluting alternatives.

Background

The amount of pollutants entering water bodies has important effects on water quality. It is necessary to understand the relationship between pollutants and land use. Spatial analyst application in geographic information systems can be used to express water quality data as maps that can expose locations with consistent or acute water quality problems. Accurate pollutant loading rates from event mean concentration (EMC) and runoff estimates are useful for National Pollutant Discharge Elimination System (NPDES) permits for municipal (and county) stormwater systems and basin management action plans (BMAPs). For NPDES permits, Rule 62-624.5, FAC, requires an estimate for seasonal pollutant load and the EMC of a representative storm for each major outfall or watershed within the Municipal Separate Storm Sewer System (MS4), which are included in an annual report. Parameters for all Florida Phase I permits include: biochemical oxygen demand (BOD5), total phosphorus, chemical oxygen demand (COD), dissolved phosphorus, total suspended solids (TSS), total recoverable copper, total dissolved solids (TDS), total recoverable lead, total nitrogen (N), total recoverable zinc, total ammonia plus organic N, and total recoverable cadmium. Highways and future highway projects are critical since they also require drainage facilities that will gather, concentrate and discharge many of the pollutants mentioned above. Common public domain GIS-based models include HSPF (Hydrological Simulation Program - FORTRAN), found at www.epa.gov/ceampubl/swater/hspf/.

This priority action helps fulfill WQ-1.

Strategy

- 1) Review loading/water quality models for Florida and CHNEP study area, including ACOE and FDEP pre-/post-construction loading models.
- 2) Through review of models and other literature, identify which land uses are the largest contributors of pollutants per unit area.

- 3) Collect information to determine event mean concentration (EMC) and runoff estimates for different local crop types within the general agricultural land use. Information collected may include runoff rates and surveys of farmer associations to determine acreage of specific crops grown.
- 4) Rank land uses considering two criteria: loading potential and the potential to ameliorate loading through management. Support mitigation of hydrologic alterations and impacts to water quality as part of future roadway improvement projects.
- 5) Determine the land use of highest priority, then characterize the uncertainty in EMC and runoff estimates for that land use.
- 6) If it is determined that existing data does not adequately characterize the priority land use, design and implement a monitoring effort to refine the estimate(s) and reduce the uncertainty to an acceptable level.
- 7) Confirm and update existing point discharge information through NPDES permit reported data review.
- 8) Compile data on or conduct a study of implemented BMP reuse water projects in the CHNEP study area.
- 9) Inventory BMP manuals with monitoring program data.
- 10) Estimate removal efficiency of different BMPs.
- 11) Establish an EMC working group, similar to what was done by Tampa Bay Estuary Program. Charge the working group with determining whether to develop pollutant load models or to rely on a Level 1 spreadsheet that provides bounds or the magnitude of pollution.

Environmental indicator and target

WQ-c: Pollution sources that have been identified using tools such as geographic information systems and models.

Confirm five sources of pollution and eliminate them by 2018.



WQ-D

Reduce nonpoint-source pollutants associated with stormwater runoff. Install or retrofit best management practices (BMPs) to maintain or improve water quality and flows.

Background

According to the 2010 CHNEP study to estimate pollutant loads, the largest source of total nitrogen (TN), total phosphorus (TP), total suspended solids (TSS) and biochemical oxygen demand (BOD) within each of the identified watersheds comes from nonpoint-source stormwater runoff, 70 percent, 68 percent, 95 percent and 90 percent respectively. The atmosphere deposits 6 percent of TN loads within the study area. Industrial point sources account for 20 percent of TN, 28 percent of TP, 3 percent of TSS and 7 percent of BOD. The CHNEP assessed pollutant loads by land use and by basin for the periods from 1975 to 1990 and from 1995 to 2007. Final estimates showed an apparent reduction of pollutant loads between the two 12- to 15-year blocks.

This priority action helps fulfill WQ-1.

Strategy

- 1) Implement source reduction of pollutants. Examples include adoption of Urban Fertilizer Ordinances in accordance with SWFRPC Resolution 2007-01, implementation of low-impact development regulations, adoption of the draft Lower West Coast basin rule, tailwater recovery and/or surface water reservoir systems

on agricultural property and acquisition of conservation lands.

- 2) Encourage redevelopment of older properties and businesses to improve stormwater treatment whenever possible.
- 3) Reduce impervious paved surface required by various land uses. Monitor using periodic land-use updates and impervious estimates. Correlate with load and event mean concentration (EMC) estimates.
- 4) Evaluate the impacts of sludge and sediments on water quality.
- 5) Identify locations to install stormwater treatment areas (STAs) and pursue installation of top-priority STAs.
- 6) Implement Florida Department of Agriculture and Consumer Affairs Office of Agricultural Water Policy best management practices (BMP) manuals found at: www.floridaagwaterpolicy.com/BestManagementPractices.html.

Environmental indicator and target

WQ-d: Nitrogen, phosphorus, suspended solids and biochemical oxygen demand pollutant loads estimated and validated by land use, per acre and by basin.

Reduce average nitrogen, phosphorus, suspended solids and biochemical oxygen demand pollutant loads by land use on a per acre basis by 2025.

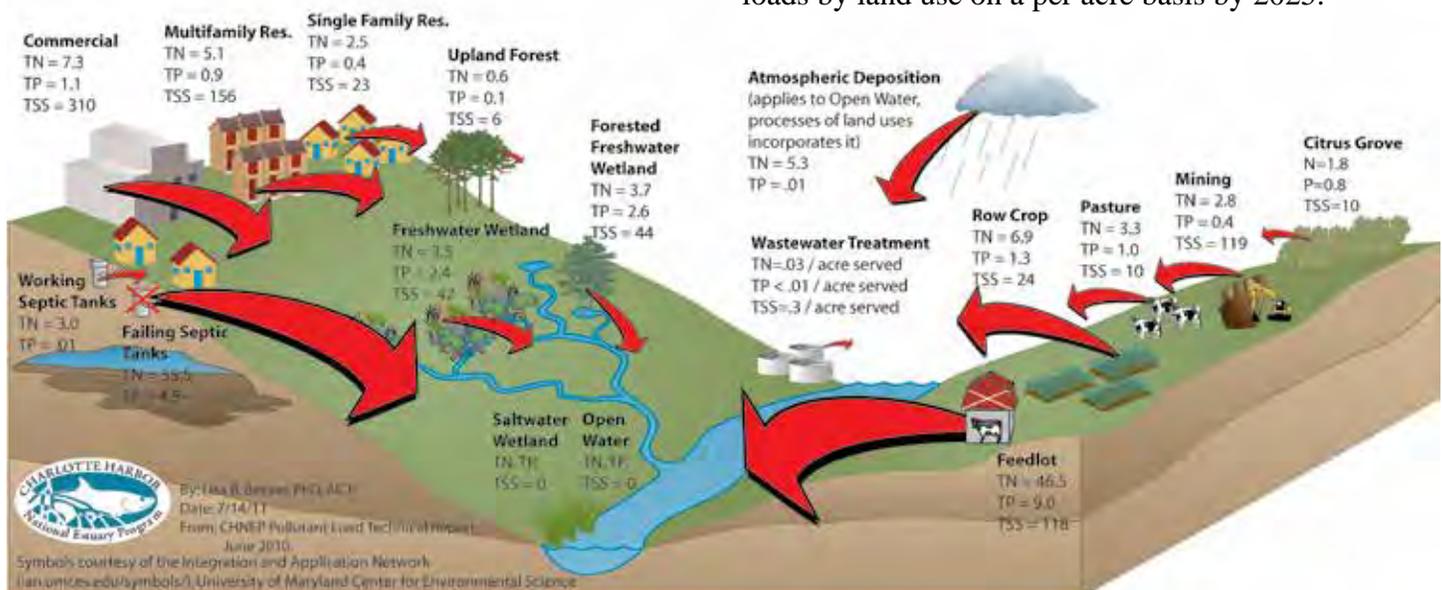


Figure 3: Conceptual Diagram of Pollution Load Estimates

(Source: CHNEP Pollutant Load Estimates, 2010)



WQ-E Implement projects to improve or protect water quality to offset anthropogenic impacts.

Background

Southwest Florida is one of the fastest-growing areas in the country. Adverse water quality impacts usually accompany increases in population and additional impervious surface. Some water bodies within the Charlotte Harbor region may suffer from adverse anthropogenic (man-made) impacts without triggering FDEP water quality standards. A variety of reasons exist for not triggering standards, including lack of data for some parameters and basic difficulty in developing scientifically defensible standards that can be broadly applied. Therefore, water quality projects that are developed with watersheds in mind can yield positive results.

An example is at Prairie Creek. Although there is a long-term dataset collected by USGS on Prairie Creek at Fort Ogden, chlorophyll *a* was not a collected parameter. Although there were other agencies collecting chlorophyll *a* at that site, according to the Impaired Waters Rule qualitative nutrient standards, insufficient data were available to confirm a nutrient impairment. Chloride, conductance and dissolved solids impairments were verified downstream at the Shell Creek (public water supply) Reservoir. Management actions taken by the SWFMWD under the Facilitating Agricultural Resource Management Systems (FARMS) program and area property owners included well back-plugging and surface water tailwater recovery ponds. After the projects were implemented, these best management practices (BMPs) also address verified impairments, whereby nitrogen and phosphorus levels also decreased at Prairie Creek. In 2011, numeric nutrient criteria were proposed for streams. Although Prairie Creek exceeded these standards for nutrients before 2001, Prairie Creek has met the numeric standards all years since the management actions.

Specific planning for improvements in permitted design and in retrofit standards is needed to reduce identified nutrient pollution in many subwatersheds. Retrofit plans for the major subwatersheds identified as having the highest nutrient loading are needed to begin to address existing and future nutrient pollution in the watershed. In order to reduce current pollution

and avoid cumulative impacts, specific works projects will be needed—including regional stormwater treatment facilities, regional stormwater conveyance reconstruction to retain rather than drain water, expanded on-site detention, and designs that utilize BMPs in series.

This priority action helps fulfill WQ-1.

Strategy

- 1) Determine if a water body is degraded or has declining trends and target it for restoration.
- 2) Identify appropriate numeric pollutant load reduction goal(s) for maintenance or restoration activities to offset and decrease anthropogenic water quality impacts.
- 3) Establish partners and funding sources to implement projects.
- 4) Review the SFWMD report *Nutrient Load Assessment Estero Bay and Caloosahatchee River Watershed Report* and identify which subwatersheds are the largest contributors of pollutants to the area.
- 5) Collect information to determine source land uses that are contributing the major part of the current nutrient loading. Assess potential changes in pollutant loads using projected build-out scenarios derived from local government comprehensive plan future land uses and proposed zoning changes. Provide resulting information to improve management decisions.
- 6) Prioritize the nutrient and other pollutant sources of highest concern in each subwatershed and identify available actions that could be undertaken to reduce/eliminate those sources. Other pollutant sources of highest concern include specific water quality impairments and emerging contaminants.

Environmental indicator and target

WQ-e: Percent of water quality stations showing declining and/or improving trends by parameter by basin.

No more than 10 percent of water quality stations shall show a declining trend.



WQ-F

Promote water conservation, stormwater treatment and intergovernmental coordination within local plans and codes to prevent the impacts of increasing levels of impervious surface and fill to achieve improvements to water quality and groundwater and surface water storage.

Background

Research has shown that watersheds with increasing percentages of impervious surface had higher levels of total organic carbon, total phosphate and fecal coliforms. The diagram below illustrates the relationship between impervious surface, changes in the physical and chemical environment and ecological responses. These changes begin at 10 percent impervious surface. Models developed by Lee County indicate that the some watersheds within the CHNEP study area currently have impervious surface coverage of 10 to 20 percent, but growth projections indicate impervious coverage of 20 to 40 percent by 2050. Moreover, percentage coverage within various land-use categories shows an increasing trend. Local comprehensive plans should be consistent with and help to implement the CCMP.

This priority action helps fulfill WQ-1.

Strategy

- 1) Identify the drainage watersheds for water courses.
- 2) Continue to monitor the degree of impervious surfaces within the watershed.
- 3) Forecast the degree of change of these conditions to the end of the planning period.
- 4) Evaluate the current capacity of stormwater systems of the watershed to store and treat storm water from the design storm and its frequency, under current conditions and future conditions.

- 5) Pursue coordinated approaches with neighboring jurisdictions.
- 6) Subsequent to local comprehensive plan amendments, implement land development regulations that restore, mitigate or prevent the impacts of increasing levels of impervious surface and fill from having a negative effect and achieve improvements to water quality and groundwater and surface water storage.
- 7) Develop accurate analytical tools.
- 8) Work with water management districts and area local governments to improve the use of zoning, land-use and comprehensive planning tools to protect water resources in the watershed. Provide technical assistance to evaluate, plan and initiate financing for environmental infrastructure necessary to assure sustainable water supplies and improved water quality.

Environmental indicator and target

WQ-f: Reforms within government development permitting and capital improvements that improve hydrology and water quality.

Five major reforms within government development permitting or capital improvement standards that improve hydrology and water quality between 1998 and 2020.

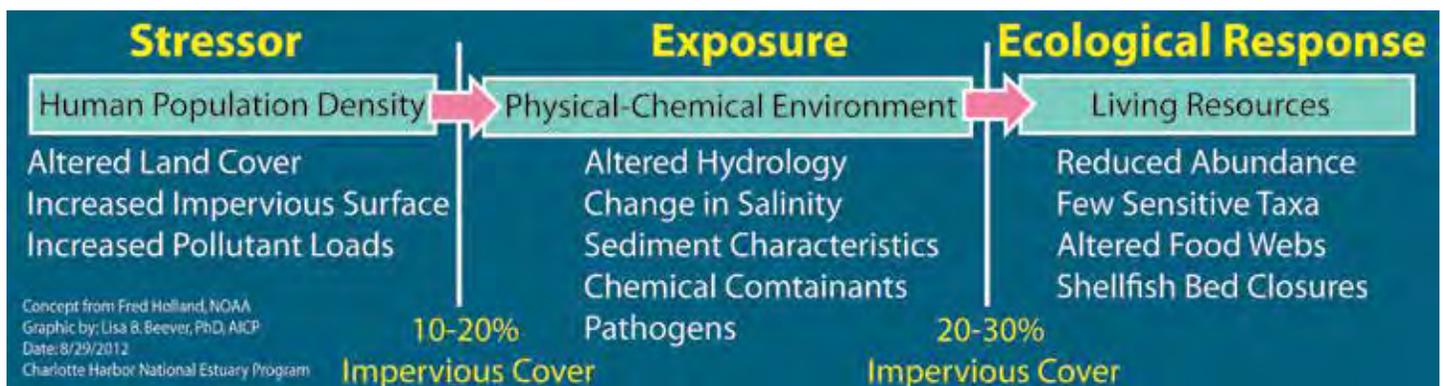


Figure 4: Conceptual Diagram of the Relationship of Impervious Surface to the Environment
(Source: The Tidal Creek Project, South Carolina Sea Grant and NOAA)



WQ-G

Develop and implement water quality criteria that are protective of living resources for dissolved oxygen, nutrients, chlorophyll *a*, turbidity, salinity and other constituents, as applicable.

Background

In 2008, the CHNEP embarked on developing seagrass targets and related water clarity targets. In January 2009, and as a result of a lawsuit, the EPA informed the FDEP that their narrative nutrient standards do not comply with the Clean Water Act and directed them to develop state numeric nutrient standards for rivers and lakes by January 2010 and estuarine and coastal waters by January 2011. The Tampa Bay Estuary Program, Sarasota Bay Estuary Program and the CHNEP developed and recommended estuary-specific numeric nutrient criteria (NNC), using the NEP science-driven and consensus-based process. The three NEPs used similar analytical methods to develop their criteria. By 2011, the CHNEP adopted recommended nitrogen, phosphorus and chlorophyll *a* criteria by estuary segment, based on seagrass light requirements and water clarity. These criteria were included in the September 29, 2011 draft FDEP rule under consideration by the EPA. Between 2006 and 2009, the CHNEP sponsored several studies to investigate pharmaceuticals in tidal rivers. Estrogens, steroids, impotence treatments, lipid-lowering drugs and antidepressant chemicals were either undetectable or at near detectable levels.

This priority action helps fulfill WQ-2.

Strategy

- 1) Continue to develop water quality criteria that are protective of living resources for consideration by state and federal agencies.
- 2) Develop water clarity (spectral) models to accurately describe the annual state of estuarine waters, according to seagrass light needs.
- 3) Investigate the relationship between conductivity variations caused by groundwater pumping and aquatic life use support in predominantly freshwater areas.
- 4) Establish or expand monitoring programs for emerging contaminants such as pharmaceuticals and personal care products, pesticides in sediment and nanomaterials.

Environmental indicator and target

WQ-g: Chlorophyll, nitrogen, phosphorus and water clarity conditions that are protective of seagrass and fish by basin.

Meet or exceed the annual arithmetic mean of chlorophyll, nitrogen and phosphorus for the below-listed segments in at least two years of every five.

Bay Segment	Seagrass Targets			Water Quality		
	Goal	Total Target	Restore Acres	Chlorophyll (µg/L)	Nitrogen (mg/L)	Phosphorus (mg/L)
Dona and Roberts	Restore	112	21	4.9	0.42	0.18
Upper Lemon Bay	Preserve	1,009		8.9	0.56	0.26
Lower Lemon Bay	Restore	2,882	380	6.1	0.62	0.17
Tidal Myakka	Preserve	456		11.7	1.02	0.31
Tidal Peace	Restore	975	591	12.6	1.08	0.50
Charlotte Harbor	Restore	16,344	632	6.1	0.67	0.19
Pine Island Sound	Preserve	26,837		6.5	0.57	0.06
Matlacha Pass	Restore	9,315	1,733	6.1	0.58	0.08
Tidal Caloosahatchee	Restore	93	6	TBD	TBD	TBD
San Carlos Bay	Preserve	4,372		3.5	0.56	0.07
Estero Bay	Restore	3,662	591	5.9	0.63	0.07
Total		66,057	3,954			

Table 5: Living Resource and Nutrient Targets



WQ-H

Assess the bacteria, nutrient load and base flow impacts of septic systems, wastewater treatment plants and reuse water. Recommend effective corrective action.

Background

Florida regulations refer to septic systems as onsite sewage treatment and disposal systems (OSTDS). A basic OSTDS can contain one or more of the following components: septic tank, subsurface drain field, aerobic treatment unit, graywater tank, or laundry wastewater tank. An OSTDS must provide for subsurface effluent disposal and not have any open tanks. In 2010, the state legislature adopted a statewide septic evaluation program to require septic tank maintenance. Though this requirement was repealed in 2012, legislation allows local governments to adopt septic tank maintenance ordinances. In preparation for the implementation date within the 2010 legislation, the Department of Health prepared a draft rule (www.doh.state.fl.us/environment/ostds/New.htm), components of which may be used for development of septic tank maintenance ordinances.

This priority action helps fulfill WQ-2 and WQ-4.

Strategy

- 1) Identify sources of bacteria, nutrients and other indicators in water bodies.
- 2) Conduct appropriate groundwater and surface water studies necessary to determine the cumulative impacts of high densities of septic systems.
- 3) Promote recommendations of the *Southwest Florida Regional Planning Council Resolution 07-02* regarding wastewater discharge, *Southwest Florida Regional Planning Council Resolution 07-05* regarding wastewater package plants of less than 100,000 gpd capacity, and *Southwest Florida Regional Planning Council Resolution 08-02* regarding onsite wastewater system planning, treatment and management.

- 4) Identify appropriate indicators and rapid cost-effective methods to identify septic system discharges.
- 5) Support appropriate changes in state laws and local septic system ordinances to mitigate impacts to the greatest practical extent.
- 6) Support periodic inspection of all septic systems where impacts to ground water/surface waters have been shown. Counties should be encouraged to include such language within their updated comprehensive plans.
- 7) Enhance enforcement to ensure appropriate repairs are made when necessary.
- 8) Establish homeowner education programs.

Environmental indicator and target

WQ-h: Percent of urbanized areas served by septic tanks where maintenance is required.

By 2020, 75 percent of urbanized areas have regular septic system maintenance programs implemented.



Photo by Lisa Beever, 5/19/03

View at the Cape Coral Wastewater Treatment Plant. This plant meets state water quality standards for wastewater discharge.



WQ-I

Determine the relationship between macro- and micronutrients and phytoplankton/algal blooms. Support measures to reduce phytoplankton/algal blooms where relationships have been determined.

Background

Land development and population rise is often linked to increased nutrient loading and eutrophication of surrounding water bodies. Locally, within the CHNEP watershed, there has been quick growth and increased development over the past several decades, leading to concerns of water quality degradation, including increased occurrence and duration of phytoplankton and algal blooms. Phytoplankton blooms occur when conditions are adequate for rapid growth and cell division. This requires sufficient light for photosynthesis and sufficient concentrations of macro- and micronutrients to fuel carbon fixation during photosynthesis. A suite of macronutrients (e.g., ammonia, nitrate, phosphate and silica) and micronutrients (e.g., iron, copper, zinc, boron, molybdenum and manganese) are used during the photosynthetic process at varying ratios. The general ratios of the nutrient requirements are known; however, specialized phytoplanktonic groups (e.g., nitrogen fixers) will thrive under conditions outside of the defined ratios. Any one of the nutrients can be limiting phytoplankton production at any one time; if the limiting nutrient is supplied, phytoplankton will bloom until another nutrient or light becomes limited. In the open ocean, micronutrients are often the limiting factor; whereas in estuaries, macronutrients (e.g., nitrogen and phosphorus) are typically limiting. Identifying the limiting nutrient and the source of nutrients within the system allows for better management.

This priority action helps fulfill WQ-3.

Strategy

- 1) Identify programs currently in place to monitor nutrient concentrations within the watershed (spatial extent, frequency, duration, nutrients).
- 2) Determine programs that systematically collect phytoplankton/algal species and location information.
- 3) Identify areas lacking adequate sampling programs and support implementation of collection of nutrient and phytoplankton/algal data.

- 4) Support installation of continuous nutrient monitoring devices in critical locations (e.g., areas commonly experiencing phytoplankton blooms).
- 5) Analyze data, calculate ratios and compare the general nutrient ratio requirements to those present in the systems to identify limiting factors. Determine natural phytoplankton/algal bloom occurrences and those caused by anthropogenic impacts.
- 6) If there is a relationship between phytoplankton/algal blooms and nutrients, identify sources of the nutrients.
- 7) Perform bioassays using water collected from water bodies/areas of concern to identify the limiting nutrient for the phytoplankton composition present in the water column.
- 8) During bloom events, identify to the lowest biologically significant taxonomic level the phytoplankton composition.
- 9) Monitor zooplankton concentrations that may exhibit top-down, grazing influence on phytoplankton and therefore mask the effect of increased nutrients.
- 10) Determine if and to what extent the practice of removing drift algae affects natural systems.

Environmental indicator and target

WQ-i: Taxonomic composition, severity (cell count), extent, and duration of red tide blooms, blue-green algal blooms, nuisance blooms of macro-algae and filamentous green algal blooms and other toxic dinoflagellates of concern.

Targets have not been set because the relationships between macro- and micronutrients and phytoplankton/algal blooms have not been determined, nor have the natural phytoplankton composition and background levels been determined.



WQ-J

Provide central sanitary sewers to developed areas within 900 feet of waters such as estuarine shorelines, rivers, creeks, canals and lakes.

Background

In 1992, the Sarasota Bay National Estuary Program set a principle to have wastewater from all sources to meet advanced wastewater treatment standards of 3 mg/l. A nitrogen-diffusing algorithm was utilized to

determine that, on average, the total nitrogen from raw waste product required 900 feet to defuse through the ground water to meet that standard.

This priority action helps fulfill WQ-4.

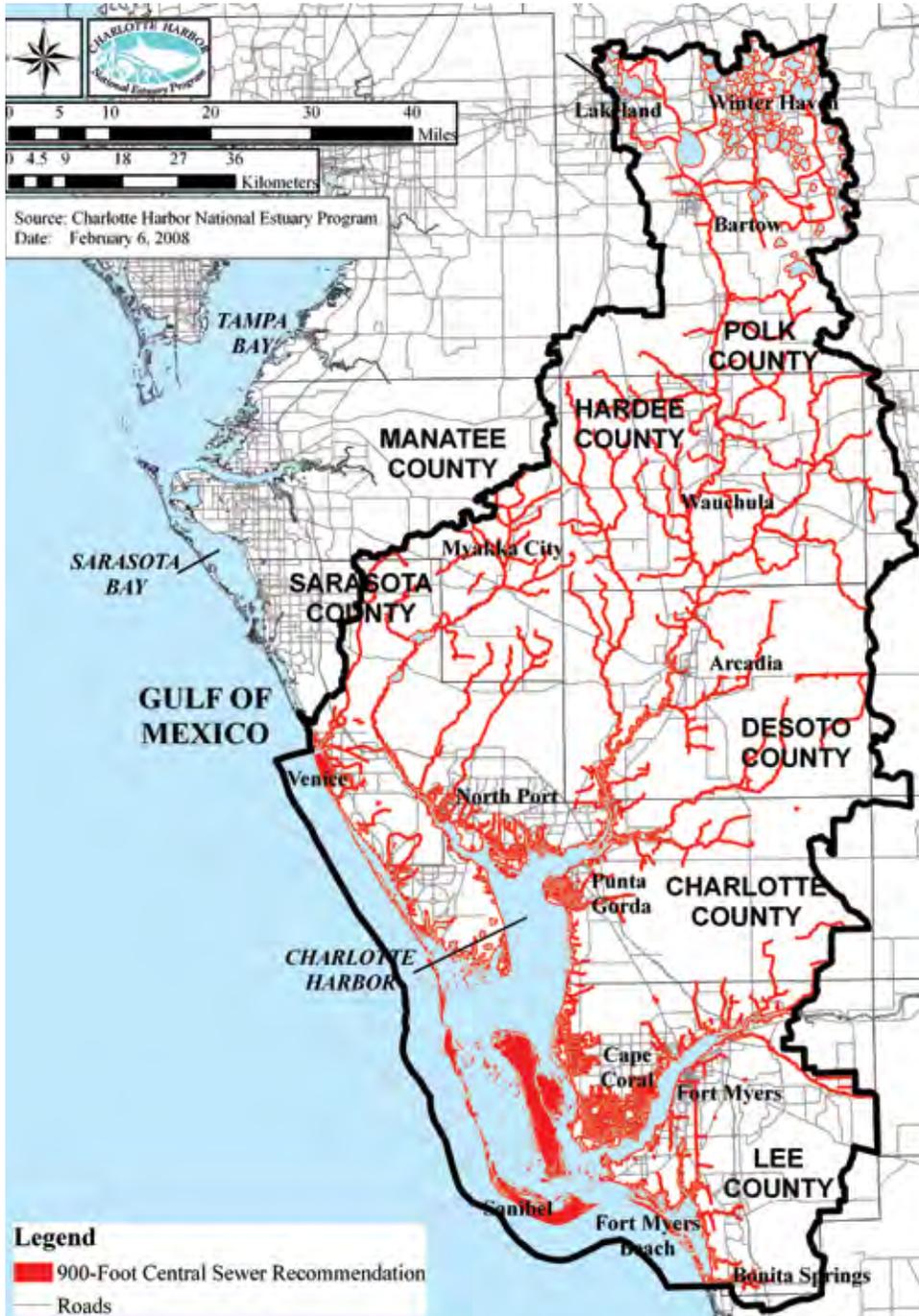
Strategy

- 1) Support development and implementation of plans to provide central sewer to higher-density developed areas. Encourage siting central sewer system facilities pumping stations, treatment plants) beyond the 900-foot water body buffer.
- 2) In such areas where densities are low, support rules that require advanced on-site septic systems.
- 3) Support improving the quality and availability of central sanitary sewage package plants to service more developed areas. Encourage siting central sewer system facilities pumping stations (treatment plants) beyond the 900-foot water body buffer.
- 4) Incorporate action into local government comprehensive plans.

Environmental indicator and target

WQ-j: Percent of urban use areas within 900-feet of estuarine shorelines, rivers, creeks, canals and lakes having central sanitary sewers.

Seventy-five percent of urban use areas have a 900 foot buffer of estuarine shorelines, rivers, creeks, canals and lakes.



Map 29: 900-Footer Buffer From Shorelines

The red areas represent a 900-foot buffer from estuarine shorelines, rivers, creeks, major canals and lakes. Map developed by the CHNEP in 2007 based on 2000 census hydrographic information.



WQ-K

Implement conservation landscaping plant programs, including the Florida Yards & Neighborhoods program, throughout the CHNEP study area.

Background

Several programs now exist to help homeowners become more environmentally friendly with their landscape practices. One such program is the IFAS Florida Yards & Neighborhoods (FYN) program. Objectives of the FYN program are to reduce stormwater runoff, decrease nonpoint-source pollution, conserve water, enhance wildlife habitat and create beautiful landscapes. This program has developed nine principles for homeowners to follow: right plant, right place; water efficiently; fertilize appropriately; mulch; attract wildlife; manage yard pests responsibly; recycle; reduce stormwater runoff; and protect the waterfront.

The CHNEP encourages the use of species native to the CHNEP study area because they typically require far less water, fertilizers and pesticides than commonly used nonnative landscaping species, thus reducing both water consumption as well as nonpoint-source pollutants in stormwater runoff.

This priority action helps fulfill WQ-1 and SG-1.

Strategy

- 1) Double the number of yards following FYN and similar principles.
- 2) Evaluate water quality impacts of FYN principles.
- 3) Distribute information to homeowners about

methods they can easily implement to reduce sources of pollution.

- 4) Make the business community aware of the kinds of activities and programs they can undertake to reduce nonpoint-stormwater sources from their property.
- 5) Develop programs for providing training and certification for landscaping contractors.
- 6) Use mobile irrigation labs to reduce water use.
- 7) Incorporate FYN in land development codes and land-use regulations.
- 8) Encourage public properties to use FYN principles and other water conservation practices in their planted areas.
- 9) Create a portfolio of FYN demonstration areas.
- 10) Partner with big box stores (such as Lowe's, Home Depot, Wal-Mart), asking that they feature native plants, replace the sale of cypress mulch with more environmentally friendly alternatives and reduce the sale of exotic species that are known to have negative environmental impacts.

Environmental indicator and target

Public knowledge and implementation for conservation landscaping principles is part of an overall approach to reduce nonpoint-source pollution. Effects may be seen under Priority Action WQ-D.

Photo by Maran Hilgendorf, 2/6/07



Conservation landscaping workshops in the rural communities in DeSoto and Hardee counties have been well attended.



WQ-L

Increase the use of personal and home best management practices by residents and visitors throughout the watershed to reduce nonpoint-source pollution.

Background

Many significant nonpoint-source pollution reduction decisions are made in the home by the actions of individual residents and by people visiting the region, such as seasonal residents and tourists. New residents and visitors in southwest Florida lack regionally appropriate guidance to help them make environmentally sound decisions. In other areas, environmental programs have attempted to address this issue by preparing, publishing and distributing residential best management practice (BMP) guides. A similar strategy is proposed here, customized for local needs and accompanied by a marketing and incentive program to encourage people to use the BMPs. Given the difficulty of effecting large-scale changes in personal behaviors, the overall effectiveness of the program should also be evaluated.

This priority action helps fulfill WQ-1 and SG-1.

Strategy

- 1) Search compilations of residential or consumer BMPs prepared by others and compile a list of regionally appropriate BMPs. Include such items as septic and drain field care, proper pharmaceutical disposal and yard practices. Include EPA programs at sites such as www.epa.gov/WaterSense/.
- 2) Examine the BMP compilation for coverage or subject-area gaps and develop BMPs to fill these gaps.
- 3) Refine ways to distribute BMPs to area residents and visitors. The form and cost of the final product will depend upon the distribution channel(s) selected. Consider multiple distribution channels such as newspaper inserts, utility bill inserts, Internet delivery, direct mail or local government TV.
- 4) Identify market segments, possibly using the Stormwater Academy of the University of Central Florida.
- 5) Develop a companion marketing program to encourage use of the BMPs and help effect the desired behavior changes. Develop an interstitial (public service announcement) on home BMPs; investigate the use of the Ad Council.

- 6) Offer residents appropriate incentives to use the BMPs.
- 7) Establish partnerships with area agencies or businesses so that significant incentives can be offered, such as meaningful discounts on products or services.
- 8) Evaluate consumer behavior changes and assess the overall effectiveness of the program in terms of per-capita pollutant load reductions.
- 9) Reduce harmful pesticides and fertilizers sold throughout the watershed, using the Babcock settlement as a model.
- 10) Show how “begin at home” programs geared to individuals, homes, businesses and at play have a cumulative impact through the group, community and region. Such programs include Florida Water StarSM, Water PROSM and Water ChampSM by the SWFWMD.

Environmental indicator and target

Public knowledge and implementation for conservation landscaping principles is part of an overall approach to reduce non-point source pollution. Effects may be seen under Priority Action WQ-D.



EPA is building WaterSense as a national brand for water efficiency. Manufacturers, retailers, distributors, utilities, governments and certified professionals are asked to use the program to encourage water-efficient behavior and the purchase of quality products that use less water.



WQ-M Support public involvement programs addressing water quality issues.

Background

Public exposure to water quality issues most commonly occurs through the media, especially when a red tide outbreak washes dead fish on the beaches, rivers experience neon-green algal blooms, beaches are closed with health warnings or shellfish are contaminated. Newsworthy water quality issues certainly affect the public. Likewise, the public can affect water quality but may not understand their link to large-scale degradation. It becomes important to deepen and broaden the public awareness and knowledge of water quality issues and to promote how individual actions can improve or degrade water. Reaching and enlisting public participation in water quality issues is a start in effecting positive behavioral change.

This priority action helps fulfill WQ-1, WQ-2, WQ-3, WQ-4 and SG-1.

Strategy

- 1) Compile water quality success stories from businesses and industrial parks and homeowners.
- 2) Work with partners to inform the public concerning significant water quality projects such as Lake Hancock and Billy's Creek.
- 3) Place and maintain stencils at stormwater drains. Consider developing "Do not dump" signs to include the name of the receiving water body.
- 4) Place and maintain signs at road/water body crossings to establish sense of place. Consider customizing signs to include names of receiving water bodies.
- 5) Implement household hazardous waste disposal and recycling programs.
- 6) Expand training and resources for coordinators of volunteer water quality sampling programs.

- 7) Work with media in getting accurate water quality information to the public.
- 8) Increase public awareness of potential sources of pollution, agencies responsible for enforcement and public reporting processes.
- 9) Utilize existing videos and public service announcements (PSAs) for public education.
- 10) Develop a companion marketing program to inform the public about water quality issues and help effect the desired behavior changes. Develop an interstitial (PSA) on water quality issues.
- 11) Hold public education workshops on specific water quality topics, such as those already held featuring the Myakka River watershed, Cape Coral canals and clay settling areas.
- 12) Investigate the idea of water filtration parks/marshes, complete with an educational nature center, especially in Cape Coral.
- 13) Construct water quality demonstration projects.

Environmental indicator and target

Public knowledge and implementation for conservation landscaping principles is part of an overall approach to reduce nonpoint-source pollution. Effects may be seen under Priority Action WQ-D.



Photo by Maran Hilgendorf, 5/1/06

Interpretive signage at Lake Hollingsworth in Lakeland provides citizens with information on watersheds and stormwater quality.



Hydrologic Alterations

Quantifiable objectives

HA-1: By 2020, identify, establish and maintain a more natural seasonal variation (annual hydrograph) in freshwater flows for:

- Caloosahatchee River.
- Peace River and its tributaries.
- Myakka River, with special attention to Flatford Swamp and Tatum Sawgrass.
- Estero Bay and its tributaries.

HA-2: By 2020, restore, enhance and improve where practical historic watershed boundaries and natural hydrology for watersheds within the CHNEP study area, with special attention to Outstanding Florida Waters and Class I water bodies.

HA-3: By 2020, enhance and improve to more natural hydrologic conditions water bodies affected by artificially created structures throughout the CHNEP study area, including:

- Sanibel Causeway in Lee County.
- Franklin Lock (S-79) in Lee County.
- Dams on the Myakka River that flows through Manatee, Sarasota and Charlotte counties.
- Causeway between Lovers Key State Recreation Area and Bonita Beach in Lee County.
- Water-control structure on the south end of Lake Hancock in Polk County.
- Structure on Coral Creek in Charlotte County.
- Gator Slough canal collector system in Lee and Charlotte counties.
- Peace Creek canal system in Polk County.
- Cow Pen Slough in Sarasota County.

Reduce negative hydrologic effects of artificially created structures such as weirs, causeways, dams, clay settling areas and new reservoirs.

HA-4: By 2020, for each watershed, identify and recommend additional reforms to improve linkages between local, water management district, state and federal government development permitting and capital programs affecting water storage, flood control and water quality. By 2025, implement the additional reforms.

Priority actions

HA-A: Utilize historic, current and future scenario estuarine mixing models, focusing on salinity and indicator species for better evaluation of proposed capital and operations projects.

HA-B: Utilize integrated ground and surface water models to improve decision making, addressing ecosystem needs in the context of population growth, development, agriculture and mining water demands.

HA-C: Protect headwater tributaries from elimination and restore these tributary courses and their floodplains where opportunities exist.

HA-D: Set and achieve minimum aquifer levels. Reduce the rate of saltwater intrusion in the Floridan aquifer.

HA-E: Meet established minimum flows and levels (MFLs). Establish and meet Estero Bay and major tributary MFLs.

HA-F: Participate in Everglades restoration and related planning and restoration efforts.

HA-G: Reestablish hydrologic watersheds to contribute flows to their historic receiving water bodies.

HA-H: Identify natural, existing and target water budgets for each watershed. Use water budgets as tools to improve decision-making.

HA-I: Evaluate the impacts of man-made barriers to historic flows and modify them to establish more natural hydrologic conditions.

HA-J: Build and restore water conveyances to have shallow, broad, vegetated and serpentine components that also restore floodplains.

HA-K: Identify the hydrologic and environmental impacts of surface water reservoirs on estuaries within the watershed. Mimic natural systems in the choice site selection, design and operation of reservoirs.

HA-L: Encourage the use of low-impact development (LID) and green infrastructure techniques in new and old developments.

HA-M: Limit big-pulsed release events.

HA-N: Implement watershed (basin) initiative projects to address hydrologic alterations, loss of water storage and changed hydroperiod, and improve water quality.

HA-O: Encourage, expand and develop incentives for the reuse of waters that are protective of water quality and natural hydrology.

HA-P: Support public involvement programs addressing watershed management issues of hydrology, water resources, water conservation and water use.



HA-A

Utilize historic, current and future scenario estuarine mixing models, focusing on salinity and indicator species for better evaluation of proposed capital and operations projects.

Background

The need for a peer-reviewed estuarine model was identified as a need related to the Sanibel Causeway modifications at the time the CCMP was adopted in 2000. Because of various restoration activities and other modifications to flows, an areawide estuarine model was identified as a need. Necessary data has been collected, such as an update to bathymetry, continuous salinity measurements and U.S. Geological Survey mapping of thousands of measurements taken in a day. These data help to obtain better calibration. The Environmental Fluid Dynamics Code (EFDC Hydro) is available at www.epa.gov/athens/wwqtsc/html/efdc.html.

This priority action helps fulfill HA-1.

Strategy

- 1) Identify indicator species, variables to be modeled and spatiotemporal data needs.
- 2) Support collection of data for flow, stage, salinity, indicator species and others for model calibration.
- 3) Identify a host agency to run, maintain and update models.
- 4) Develop an overarching three-dimensional model for the entire tidal Charlotte Harbor system and more detailed watershed models for each estuary watershed.
- 5) Update land-use change analysis with 2010 aerial photography and conduct similar analyses every five years.

Environmental indicator and target

HA-a: Oligohaline, mesohaline, and polyhaline locations in the Myakka, Peace and Caloosahatchee rivers.

Mean seasonal (wet/dry) isohalines should be spatially similar to those outlined in the CCMP vision and correspond with the following biological guidelines:

- (a) Maintain a monthly average salinity < 10 ppt during the dry season at the Ft. Myers continuous salinity sensor; such that tape grass in the Beautiful Island area does not decrease below 20 percent coverage and blade length is > 10 cm (values may be adjusted after current is evaluated). Salinity should not exceed 20 ppt for longer than one day at Ft Myers.
- (b) Maintain salinity at Piney Point > 5 ppt, so that conditions are supportive for the recruitment, survival, and growth of juvenile oysters upstream of Shell Point during March to October (juvenile oyster growth > 2.5 mm a month; recruitment > 3 spats per substrate shell a month; and mortality < 20 percent per month).
- (c) Maintain an average monthly salinity > 20-25 ppt, as measured at the Sanibel Causeway continuous sensor, so that historical seagrass density and coverage in the area is maintained.

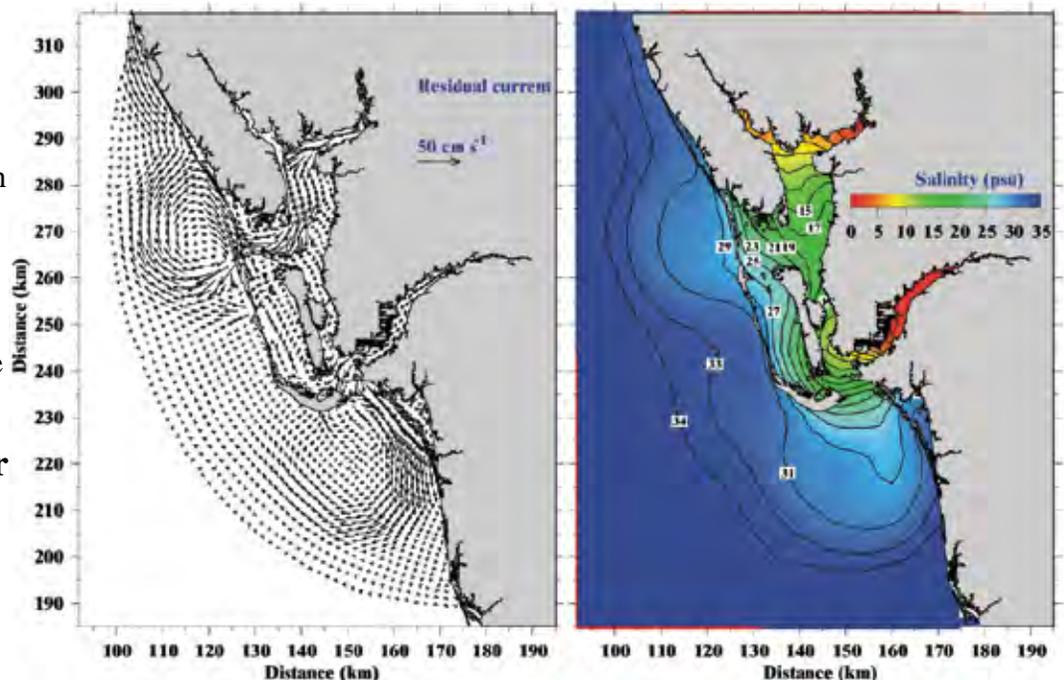


Figure 5: Three-Dimensional Estuarine Models in the Charlotte Harbor Area

Developed by Robert Weisberg, University of South Florida.



HA-B

Utilize integrated ground and surface water models to improve decision making, addressing ecosystem needs in the context of population growth, development, agriculture and mining water demands.

Background

To document changes in surface water flows and patterns due to hydrologic alterations, it is important that accurate, long-term databases be developed for all watersheds within the CHNEP study area. While many areas within the CHNEP have extensive historical flow records, other areas lack this historic record. Accurate data will also be needed to assess the effectiveness of the action plans. Action will provide accurate, long-term information on amounts and variability of surface water resources and provide a basis for planning. Identifying gaps in flow data will provide a scientific basis for the establishment of minimum flows and levels and assess future changes related to projected development and consumptive uses.

South Florida Water Management District uses a validated Mike-She model to provide existing and target flows for use in other models like STELLA. STELLA is a model used to assess relative contributions of hydrologic projects to overall flows.

This priority action helps fulfill HA-1.

Strategy

- 1) Identify watersheds where there is insufficient watershed flow data to accurately assess seasonal and long-term changes in water resources, such as the tidal creeks along the east wall of Charlotte Harbor and Cape Haze peninsula.
- 2) Determine the minimum number and appropriate locations of needed gauges. Install appropriate monitoring gauges.
- 3) Support integration of flow and stage monitoring into stormwater utility programs.
- 4) Support collection of information and analyze effects that stormwater runoff has on flow characteristics of tributaries. (This is already planned for Estero Bay tributaries.)
- 5) Monitor surface water stages and groundwater levels in the Caloosahatchee, Peace and Myakka rivers' watersheds.

- 6) Fill in data gaps on flow and salinity patterns to support the development and implementation of hydrodynamic models as planned in Lee County, portions of Charlotte County and as needed in Sarasota and Charlotte counties.
- 7) Expand the "Continuous Surface Water Level Monitoring" to monitor surface water levels in the CHNEP study area within South Florida Water Management District's jurisdiction.
- 8) Encourage the development and implementation of local government "Stormwater Management Plans" to improve the timing of water flows reaching natural water bodies.
- 9) The CHNEP and its partners should participate in the feasibility study and implementation activities for the Comprehensive Everglades Restoration Plan, Southwest Florida Feasibility Study, the Caloosahatchee Water Management Plan, the Lower West Coast Water Supply Plan and any efforts that will be measuring and managing flows in the Caloosahatchee River.
- 10) Consider utilizing the Peace River and Myakka River integrated ground and surface water models for future water resources investigations.

Environmental indicator and target

HA-b: Water is delivered according to the timing and distribution needed by ecosystems notwithstanding changing human water demands.

By 2020, five major decisions are improved using integrated ground and surface water models.

TIP: Acre-feet per day can be converted to cubic feet per second. Divide acre-feet per day by 2 (or more precisely 1.98) to get cubic feet per second. Double cubic feet per second to get acre-feet per day.



HA-C

Protect headwater tributaries from elimination and restore these tributary courses and their floodplains where opportunities exist.

Background

Headwater tributaries are like the capillary system of a blood supply network. Just as the health of the whole organism depends upon a functioning capillary system, the health of larger streams and rivers depend upon an intact primary headwater stream network. The hydrology of headwater streams can be altered directly (e.g., phosphate mining, channelization, transportation) and indirectly (e.g., groundwater withdrawals). Headwater streams benefit entire river systems through sediment deposition reduction, nutrient input reduction, flood control, wildlife habitat corridor protection and water and food supply for fish and wildlife. An intact network of functioning primary headwater streams can reduce dredging costs, reduce water treatment costs, reduce the siltation of larger stream habitats, improve recreational opportunities, reduce water treatment costs, reduce human health risks, reduce degradation of downstream waters, reduce local and downstream flooding, prevent excess erosion, increase property values, increase or maintain biological diversity, improve opportunities for hunting and fishing and maintain base flow in larger streams in times of drought. They are a key determinant in the overall condition of the river system.

This priority action helps fulfill HA-1.

Strategy

- 1) Work with phosphate and fertilizer facilities to protect and restore the hydrology of headwater tributaries, such as Wingate Creek in Manatee County, Bowlegs Creek in Polk County, Horse Creek in Hardee and DeSoto counties, Upper Saddle Creek in Polk County, McCullough Creek in Polk County, Six-Mile Creek in Polk County, Bear Creek Branch in

DeSoto County, Brushy Creek in Hardee County and Payne Creek/Little Payne Creek in Polk and Hardee counties.

- 2) Work with the agriculture industry to protect and restore hydrology on private lands, such as Owen Branch in Manatee County, Peace Creek Canal in Polk County, Joshua Creek in DeSoto County, Prairie Creek in Charlotte and DeSoto counties, Myrtle Slough in Charlotte County and upper Myakka River (e.g., Ogleby, Long, Coker creeks) in Manatee County.
- 3) Encourage local governments to protect headwater tributaries, such as the Orange River and Telegraph Creek in Lee County, and assist in the development and implementation of restoration plans.

Environmental indicator and target

HA-c: Kilometers of freshwater first- and second-order streams by basin.

No long-term net declines in the length of first- and second-order streams contributing to each basin.



Healthy headwater tributary in the upper Horse Creek watershed.

Photo by Catherine Corbett, 6/25/03



HA-D

Set and achieve minimum aquifer levels. Reduce the rate of saltwater intrusion in the Floridan aquifer.

Background

The Southwest Florida Water Management District (SWFWMD) established minimum flows and levels in the Southern Water Use Caution Area (SWUCA). Recovery efforts will slow the inland movement of saltwater intrusion such that the withdrawal infrastructure will be at minimal risk of water quality deterioration over the next century. In March 2006, the SWFWMD Governing Board adopted the minimum flows and levels, including a saltwater intrusion minimum aquifer level of 13.1 feet above sea level. Based on the existing distribution of withdrawals, it is estimated that long-term average annual withdrawals from the Floridan aquifer need to be reduced by up to 50 mgd to ensure saltwater intrusion minimum aquifer levels are met. If withdrawals were more optimally distributed, a reduction of significantly less than 50 mgd would be required. Currently, annual groundwater withdrawals average about 600 to 650 mgd.

The South Florida Water Management District (SFWMD) established minimum aquifer levels for the lower Tamiami aquifer, the Sandstone aquifer and the mid-Hawthorn aquifer to equal the structural top of the aquifer. The draft recovery strategy (i.e., Lower West Coast Plan) for this rule states: (a) establish “no harm” maximum permissible levels for each aquifer for a 1-in-10-year level of certainty, (b) implement rule criteria to prevent harm through the consumptive use permitting process, (c) construct and operate water resource and supply development projects and (d) implement the water shortage plan. The draft document *Proposed Minimum Water Levels for the Lower West Coast Aquifer System Within the SFWMD*, dated September 5, 2000, proposed further research into what constitutes “significant harm” to the water table aquifer before proposing a minimum aquifer level (MAL) for this aquifer. According to this document, water levels in the mid-Hawthorn aquifer have dropped approximately 60 to 80 feet, and more than 15 to 30 feet locally in the lower Tamiami, Sandstone and Floridan aquifers, from estimated pre-development levels in Lee County.

This priority action helps fulfill HA-1.

Strategy

- 1) Develop a priority for the establishment of minimum aquifer levels (MALs) in the South Florida Water Management District portion of the CHNEP study area.
- 2) Collect the data and conduct the necessary research to establish MALs on a watershed approach.
 - a. Develop better surface water/groundwater model parameters (discharge, seepage and water level data) through analysis of field data and use of statistical techniques.
 - b. Expand the groundwater and surface water monitoring networks to monitor groundwater levels and surface water stages at select wells.
- 3) Establish an MFL rule for the water table aquifer in Lee and southern Charlotte counties protective of aquatic resources and water supply.
- 4) Encourage conservation and development of alternative supplies through projects such as reuse water projects, low-volume plumbing rebate programs, potable water aquifer storage and recovery systems, BMP implementation and water resource development projects.
- 5) Identify and plug abandoned artesian wells that allow uncontrolled surface discharge.
- 6) Reduce interaquifer contamination through reestablishment of the confinement between aquifers by back-plugging sections of well bores.
- 7) Retire water use permits associated with acquired preservation lands.
- 8) Streamline analysis of water use permitting data.
- 9) Increase efficiency of irrigation water use and promote the use of tailwater recovery reservoirs as an alternative to groundwater use (e.g., FARMS projects and FDACS enrollment).

Environmental indicator and target

HA-d: Long-term average annual withdrawals from the Floridan aquifer.

By 2020, reduce long-term average annual withdrawals from the Floridan aquifer by 50 mgd to ensure saltwater intrusion minimum aquifer levels are met. Currently 650 mgd are withdrawn annually.



HA-E

Meet established minimum flows and levels (MFLs). Establish and meet Estero Bay and major tributary MFLs.

Background

The water management districts are directed by Chapter 373.042, Florida Statutes, to set minimum flows and levels. The minimum flow for a given watercourse is the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area.

The minimum level is the level of ground water in an aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources of the area. Each water management district is required to annually submit to the Florida Department of Environmental Protection for review and approval a priority list and schedule for establishment of minimum flows and levels for surface watercourses, aquifers and surface waters within the district. The list shall be based on the importance of the waters to the state or region and shall include those waters that are experiencing or may reasonably be expected to experience adverse impacts.

This priority action helps fulfill HA-1.

Strategy

- 1) Collect the data and conduct the necessary research to establish MFLs for Estero Bay tributaries on a watershed approach.
- 2) Participate in peer review for select methodologies.
- 3) Set MFLs for Estero Bay tributaries.
- 4) Encourage conservation and development of alternative supplies through projects such as reuse water projects, stormwater reuse systems, potable water aquifer storage and recovery systems, BMP implementation and water resource development projects.
- 5) Develop MFL recovery strategies where needed.

Environmental indicator and target

HA-e: Adopted minimum flows and levels (MFLs).

Caloosahatchee: Monthly mean of 300 cfs at S-79 (Franklin Locks) plus a salinity of 10 ppt for a 30-day average or a single daily average of 20 ppt at the gauge in Fort Myers by 2016.

Peace: Required fish passage and wetted perimeter inflection point (17 cfs at Bartow, 27 cfs at Fort Meade and 45 cfs at Zolfo Springs) by 2016.

Myakka: There has been an increase in low flows in the Myakka River. This increase has resulted in a previously non-perennial river becoming perennial. Historic flows went to zero on a regular and consistent basis. Therefore, a low-flow threshold of 0 cfs is recommended for the USGS Myakka River near the gage site at Sarasota, Florida.

Estero: Minimal and maximal seasonal flows were identified for the major tributaries of Estero Bay through the Natural Systems Model. These flows will help establish the target.

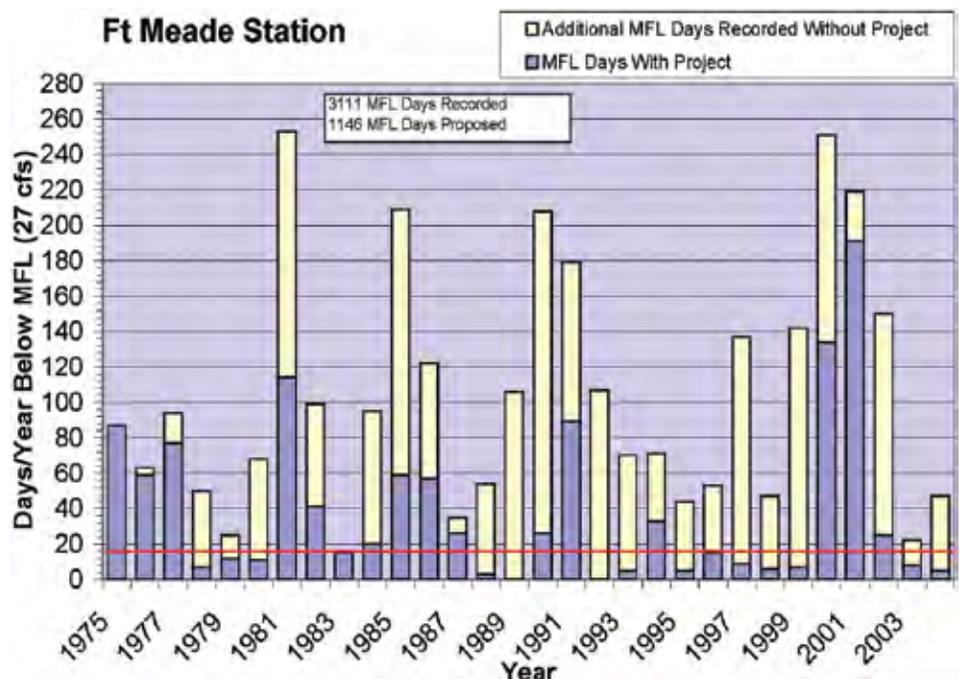


Figure 6: MFL at Fort Meade Station

The Southwest Florida Water Management District Lake Hancock Lake Level Modification Project is expected to provide approximately 50 percent of minimum flow requirements for a 20-mile portion of river, protect thousands of acres of floodplain and reduce nitrogen levels by 27 percent.



HA-F

Participate in Everglades restoration and related planning and restoration efforts.

Background

The Comprehensive Everglades Restoration Plan (CERP) provides a framework and guide to restore, protect and preserve the water resources of central and southern Florida, including the Everglades. It covers 16 counties over an 18,000-square-mile area and centers on an update of the Central and Southern Florida (C and SF) Project, also known as the Restudy. The Plan was approved in the Water Resources Development Act (WRDA) of 2000. It includes more than 60 elements, will take more than 30 years to construct and will cost an estimated \$7.8 billion. WRDA 2000 also included a component known as the Southwest Florida Feasibility Study (SWFFS), which has been substituted with the Southwest Florida Comprehensive Watershed Plan, currently undergoing federal review.

This priority action helps fulfill HA-1, HA-2 and HA-3.

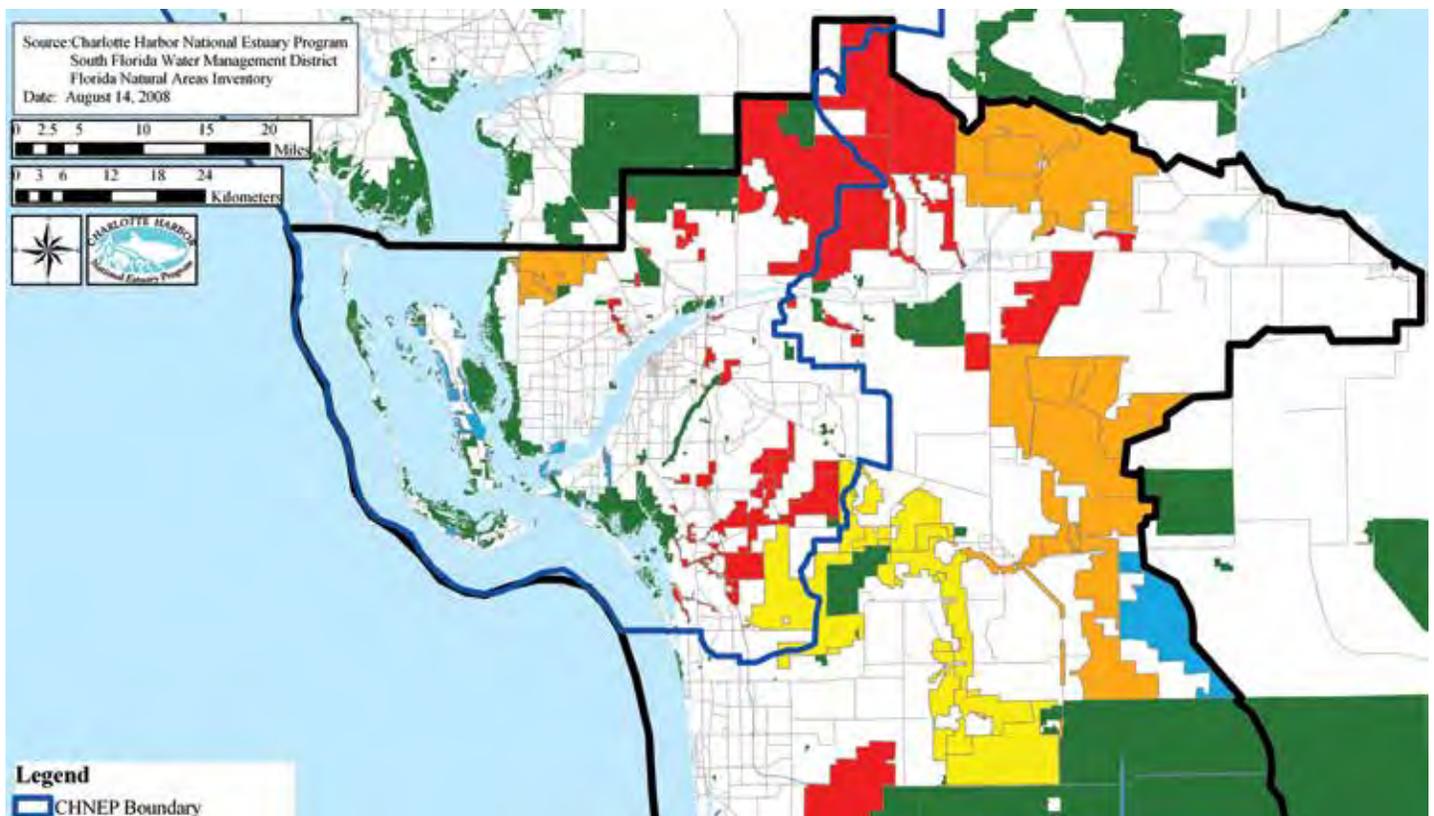
Strategy

- 1) Provide that members of the review committees for the U.S. Army Corps of Engineers' C and SF are aware of the concerns in the *Comprehensive Conservation and Management Plan*.
- 2) Include CHNEP partners on the CERP and SWFFS committees to develop, review and evaluate results.
- 3) Restore seasonal extent of the isohaline (natural seasonality of salinity) in the Caloosahatchee to stabilize valued ecosystem components including wild celery (*Vallisneria*), blue crab, oysters, clams and juvenile fish.
- 4) Continue to review proposed Everglades restoration projects, including the C-43 reservoir.

Environmental indicator and target

HA-f: Implementation of Everglades and related restoration projects.

Target is funding dependent.



Map 30: Restoration Needs

The Southwest Florida Comprehensive Watershed Plan identifies a wide range of restoration needs. The CHNEP helped develop the methodology to obtain initial alternatives. Data Source: 2007



HA-G

Reestablish hydrologic watersheds to contribute flows to their historic receiving water bodies.

Background

There are regions where surface flows no longer contribute or contribute too much flow to their historic watersheds. In some areas, hydrologic alterations have accounted for significant changes in both the amount and seasonal characteristics of flows of the major tributaries within these watersheds.

This priority action helps fulfill HA-2.

Strategy

- 1) Assess and document changes in historic watersheds caused by past and current alterations, including mining, ditching, channelizing, damming and other structural changes.
- 2) Inventory stormwater systems and facilities so that alternatives for redirecting flows to historic water bodies can be assessed.
- 3) Promote projects that address freshwater runoff problems from canal systems, including the Gator Canal System in Lee County, Blackburn Canal in Sarasota County, Curry Canal in Sarasota County and Peace Creek Canal in Polk County.
- 4) Evaluate plans to establish more natural surface water flows from historic watersheds.
- 5) Encourage coordination among stormwater

utilities, natural resource managers and transportation planning and projects.

- 6) Determine and promote mechanisms to fund restoration projects, including property taxes to purchase environmentally sensitive lands to place in public trust in order to preserve natural hydrology.
- 7) Develop a proposal to ensure adequate funding for the Nonmandatory Reclamation Program to fund reclamation targeted at specific water resource benefits, as identified through the *Peace River Resource Management Plan*.

Environmental indicator and target

HA-g: Net difference between the acreage of subbasins that no longer contribute flows to their historic receiving water bodies and the acreage of subbasins returned to historic receiving water bodies.

No new creation of internally drained or non-contributing lands.

Reduce the acreage of internally drained or non-contributing basins by 25 percent by 2020.



Photo from the *Dona Bay Watershed Management Plan*

The Cow Pen Canal construction shifted historic flows from the Myakka River to Dona and Roberts bays.



HA-H

Identify natural, existing and target water budgets for each watershed.
Use water budgets as tools to improve decision making.

Background

Water flow has been modified by humans since they first came to the region and continues today. Inadvertent ecological degradation resulted from these modifications. To balance the demands of people for drainage, drinking water, navigation and recreation with preservation of ecological health, one must first understand water flow. Significant benchmarks for studying volume and timing of flow include natural flows from a time before human influence, flow at the present time and a practical estimate of future water budgets that would more wisely balance conflicting needs.

This priority action helps fulfill HA-2.

Strategy

- 1) Define natural, existing and projected evapotranspiration, precipitation and other input and outputs of a water budget equation for each watershed. Consider the effects of ground water converted to surface water, wastewater reuse, connections between watersheds, impermeable surfaces and constructed conveyances.
- 2) Determine target water budgets by watershed.

Involve stakeholders in the discussion of target water budgets to include planning efforts already expected.

- 3) Promote changing stormwater design criteria from the rate of flow to the volume of storage, pre equals post storage, not pre equals post drainage.
- 4) Determine negative hydrologic modifications that can be improved through restoration. Rank potential projects by geographic areas based on significant modifications and potential for remediation.

Environmental indicator and target

HA-h: Percentage change toward target water budgets. If targets have not been set, percentage change toward natural water budgets where they have been validated.

Targets have not been set for all watersheds.

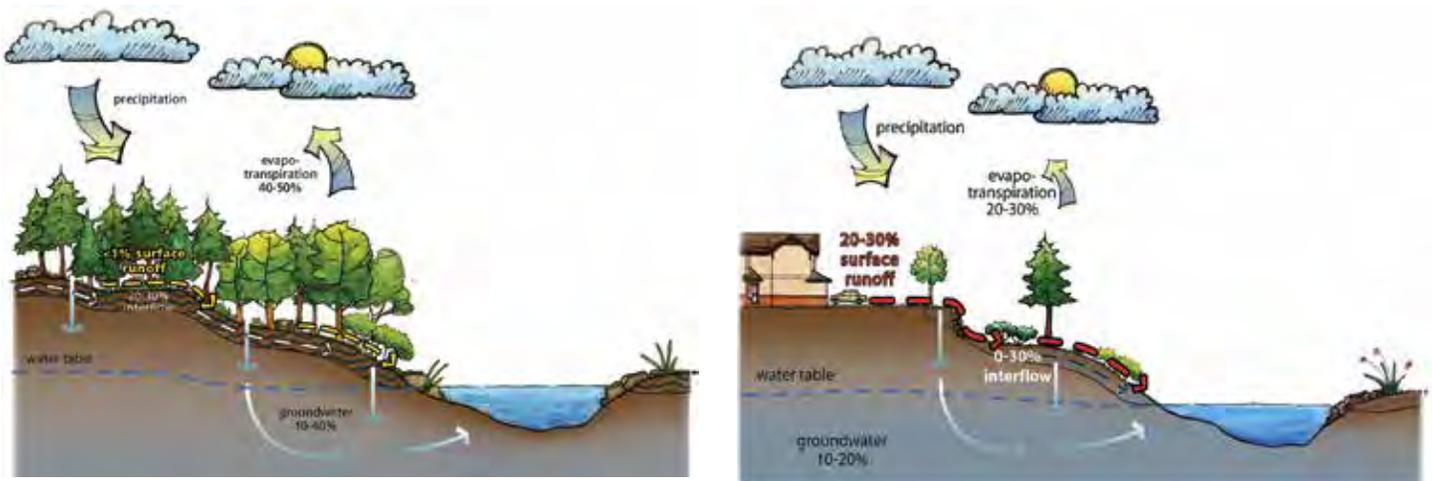


Figure 7: Groundwater Budget

Groundwater resources are dependent on areas inside and outside of the CHNEP study area. Installation of impervious surface has shifted the water budget toward reduced ground water and increased runoff.

Graphics are from *Low Impact Development Technical Guidance Manual for Puget Sound*, produced by the Puget Sound Partnership and WSU Extension. Credit for the diagram goes to AHBL, Inc. Planners.



HA-I

Evaluate the impacts of man-made barriers to historic flows and modify them to establish more natural hydrologic conditions.



Photo by Bob Howard, EPA, 11/16/05

The Peace Creek Canal changes historic flows.

Background

Historic flow patterns, including timing and volume, are critical needs for the aquatic life in the ecosystem that has evolved and adapted to natural conditions. Large and small opportunities to restore historic flows are possible if decision-makers are provided with comprehensive information about them.

The alterations with the most dramatic impact have been highway projects, large-scale mining and drainage works. Watershed flows, volumes and timing have been redirected, impeded or accelerated by such projects. Remediation of existing and new construction of roads and drainage works need special attention to ensure that the resources of the CHNEP study area are sustained. Remaining natural flow ways deserve particular attention for remaining unaltered.

This priority action helps fulfill HA-3.

Strategy

1) Develop a map of historic flow ways and watershed boundaries. Poll the CHNEP membership to supplement the restoration plan to create a preliminary list of barriers to historic surface and groundwater flow and suggestions for additional sources of information. Particular attention should be given to drainage works, mining or roadbeds that change watershed boundaries.

- 2) Supplement the preliminary list after tracking down additional sources of information.
- 3) Propose restoration projects for each site using creative but practical ideas. Consider phased projects or small projects as well as comprehensive restorations.
- 4) Rank the projects using a matrix based on possibility for permitting, relative cost, relative ecological value of the outcomes and other criteria learned from adaptive management during the project effort. Identify the agencies that may be willing to do the project.
- 5) For top-ranked projects, contact the agencies and private entities that may implement them and identify

what additional information they need to fund and execute the projects. Based on feedback, rerank the projects and provide needed information to potential project implementers.

- 6) Make mitigation of any potential hydrologic alterations a key criterion for evaluation during any new roadway, drainage, mining and construction projects.

Environmental indicator and target

HA-i: Acres and percent of watershed restored to more natural hydrologic condition as demonstrated by pre and post hydrologic monitoring of implemented projects.

Targets have not been set for hydrologic restoration. Tracking this indicator over time will provide data for targets.



HA-J

Build and restore water conveyances to have shallow, broad, vegetated and serpentine components that also restore floodplains.

Background

The history of Florida is replete with drainage improvements that reduced wetlands and made streams straighter and deeper. Channelized waterways offer fewer habitat opportunities for terrestrial and aquatic wildlife, degrade water quality by quickly forcing fresh water into estuaries and reduce the natural beauty of Florida for its human residents. There are abundant opportunities for improvements to the drainage system that still allow for flood protection in cooperation with wetland restoration, recreational opportunities, improved water quality and perhaps even water supply enhancement.

This priority action helps fulfill HA-3.

Strategy

- 1) Inventory innovative stormwater treatment and conveyance systems from around the CHNEP study area and other areas.
- 2) Provide educational opportunities, including workshops, to engineers and planners of environmentally friendly design techniques.

- 3) Create a large “toolbox” of engineering techniques that improve environmental quality. Make it easy to choose environmentally friendly techniques.
- 4) Create demonstration projects that combine drainage, environmental and neighborhood concerns. Advertise this information to engineers and others outside the environmental community.
- 5) Initiate discussions with significant stakeholders at Blackburn Canal, Gator Slough Canal, Peace Creek Canal and 10-Mile Canal.
- 6) Apply geomorphology to this effort: build and modify systems so they coincide with how nature would have done it.

Environmental indicator and target

HA-j: Linear miles of ditches and canals that have been modified to slow flow, including broad, shallow, vegetated and serpentine components.

Improve 100 miles of ditch and canal between 1998 and 2020.



Photo by Lisa Beever, 8/12/03

Bonita Bay Development Group created broad and shallow flow ways to restore flows to water-starved Halfway Creek and provide an amenity.



HA-K

Identify the hydrologic and environmental impacts of surface water reservoirs on estuaries within the watershed. Mimic natural systems in the choice site selection, design and operation of reservoirs.

Background

The hydrologic interactions between reservoirs and downstream estuaries should be scientifically determined. In cases like Lake Okeechobee, maintaining specific water levels has been given a higher priority than maintaining a relatively natural flow to the estuary, disrupting natural balances. On the other hand, a reservoir can smooth out large flow variations caused by a disturbed upstream water supply, if that smoothing is made a high priority for the reservoir management. Identifying the relationship between reservoirs and adjacent systems requires monitoring water flows and salinity variations downstream of the reservoir. A study of these relationships includes an analysis of chemistry and biology of water reaching the estuaries.

This priority action helps fulfill HA-3.

Strategy

- 1) Evaluate relationships between reservoirs and downstream water resources, including above- and below-surface reservoirs for water supply, restoration or mining.
- 2) Examine soil chemistry at proposed reservoir sites, including pesticides and metals.
- 3) Examine groundwater chemistry at proposed reservoir sites.
- 4) Monitor water chemistry and biology (esp. algae/phytoplankton) in and downstream of reservoirs. Possible parameters for monitoring include salts, metals, nutrients and pesticides that may be present in the soil or rock that form the reservoir. Seepage interactions could also change its chemical composition.
- 5) Ensure that the protection of the estuarine health is a reservoir management priority.
- 6) Where appropriate, develop education programs to disseminate information that the protection of estuaries is vital to reservoir management priorities.
- 7) Develop professional presentations for legislators and commissioners.
- 8) With input from utilities, water supply authorities, local municipalities, industry, agriculture, water management districts, resource managers and the public, develop scientifically based educational materials and programs to emphasize the interactions between reservoirs and natural resources. Present these materials/programs at events, trade shows and other venues.
- 9) Encourage federal and state regulations and statute changes as appropriate based on scientific evaluation described above related to reservoir siting, construction and operations to protect natural resources.



C-43 (Caloosahatchee) Reservoir test cells.

Environmental indicator and target

HA-k: Increase in downstream abundance and diversity of biota.

C-43 Reservoir: 100 acres of oysters 15 years after construction and 350–500 acres with addition of hard substrate.



HA-L

Encourage the use of low-impact development (LID) and green infrastructure techniques in new and old developments.

Background

Low-impact development (LID) is a comprehensive land planning and engineering design approach with a goal of maintaining and restoring the predevelopment hydrologic regime of urban and developing watersheds. It is best applied in redevelopment areas to restore hydrologic regimes and provide water quality treatment rather than simply reduce the impacts of new development. In the CHNEP study area, the water resource is stressed in two ways: (1) altering storage to drainage by extensive stormwater works stresses vegetation such that artificial irrigation is needed, which further impacts the water resource and (2) “downstream” impact of flooding and drought extreme variations cause estuarine salinity “yo-yo” in short cycles. Implementation of low-impact techniques reduces drainage and impacts stresses by implemented storage and treatment standards. Retrofitting older developments utilizing low-impact techniques is particularly effective.

This priority action helps fulfill HA-4.

Strategy

- 1) Promote alternatives to the local and state criteria used by engineers who design stormwater systems and determine relationships with natural systems.
- 2) Establish land alteration monitoring programs that evaluate the current condition of “impervious surface” by watershed for prioritization for more storage efforts and attenuation BMPs.
- 3) Support and encourage retrofitting older developments with LID technologies. Promote utilization and expansion of existing efforts such as Adopt-A-Pond and Florida Yards & Neighborhoods to reduce impervious surface, increase small-scale water storage, integrate stormwater systems, reduce dependence on septic systems and enhance existing stormwater systems.
- 4) Advocate LID in new developments through programs such as the SFWMD Southwest Florida



Figure 8: Residential Low-Impact Development

Low impact development (LID) practices, many of which are shown above, reduce stormwater runoff and reduce the need for large regional stormwater treatment systems.

Graphic from *Low Impact Development Technical Guidance Manual for Puget Sound* produced by the Puget Sound Partnership and WSU Extension. Credit for the diagram goes to AHBL, Inc. Planners.

Basin Rule, Sarasota County Sustainability program, Lee County Smart Growth LDRs, Charlotte County stem-wall construction rule, transfer of development rights (TDR) ordinance and Puget Sound’s LID technical manual.

Environmental indicator and target

HA-1: Low Impact Development (LID) rules adopted and infrastructure constructed.

Example LID modifications (rules adopted or infrastructure constructed) within all CHNEP study urban counties by 2015.

Background

Decades of development, including agriculture, in southwest Florida have altered landscape drainage patterns. In order to drain the landscape quickly and efficiently, excessive ditching has often circumvented the traditional water retention and water quality treatment function of wetland systems. These alterations have caused increased and excessive wet season discharge to our coastal environment. The excessive discharge volumes contain higher pollutant loads and freshwater pulses that alter and impact estuarine and marine habitat. Additionally, these alterations have resulted in a lower surface groundwater table than existed historically. The lower surface groundwater table alters freshwater wetland hydroperiods and increases the annual need for irrigation. Development pressure, construction techniques and agricultural practices have also resulted in areas where dry season retention and water supply needs for irrigation require holding more fresh water back on the landscape.

Balancing water budget needs around the four areas of responsibility (natural systems, flood protection, water supply and water quality) established by the water management districts reduces development impacts on our natural systems. Drafting comprehensive watershed management plans around these areas of responsibility will identify the water resource requirements for major watersheds and establish goals and objectives that meet the needs of those major watersheds.

The SFWMD has taken an additional step for certain water bodies in establishing “maximum” water flows. These are flows for any sustained period or an intense special event that can be expected to damage either the quality of receiving water bodies or, through flooding, economic activities or endangering human health. This approach may be examined for additional water bodies in the future.

Sarasota County and the SWFWMD are developing strategies to limit big-pulsed events in Dona Bay. East (Lee) County Water Control District are implementing projects to reduce such releases to the Orange River.

This priority action helps fulfill HA-4.

Strategy

- 1) Encourage and support the drafting of comprehensive watershed management plans for major contributing watersheds.
- 2) Advocate stormwater ordinance revisions so that off-site discharges mimic natural system flow rates and timing.
- 3) Encourage and support stormwater retrofit projects to restore natural system flow rates and timing.
- 4) Reevaluate water and consumptive use permits to bring permits in line with actual needs and usage, accounting for on-site storage. On-site storage would allow for adequate residence time, increased recharge and reduction of discharging off-site, which would better mimic natural wetland hydrology.
- 5) Rehydrate surficial aquifer to historic levels by protecting existing wetlands, limiting impervious surfaces and reducing drainage canal depths.

Environmental indicator and target

HA-m: No high water flow events over the Franklin Locks (S-79).

2,800 cubic feet per second (cfs) and over.

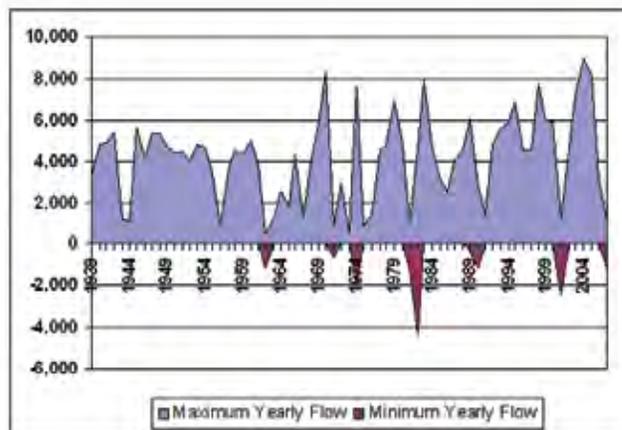


Figure 9: Flow Levels to the Caloosahatchee After S-77 (Moore Haven Lock) was modified in the 1960s, maximum flows to the Caloosahatchee increased from 4,500 to 8,000 cubic feet per second.

HA-N

Implement watershed (basin) initiative projects to address hydrologic alterations, loss of water storage and changed hydroperiod, and improve water quality.

Background

Both the Southwest Florida Water Management District and the South Florida Water Management District have developed watershed (basin) initiative strategies. By focusing energy and resources on an overall watershed strategy, projects can yield greater cost benefit toward restoration. Watershed initiatives are a way to build partnerships, leverage funding and address complex problems. Watershed initiatives in the CHNEP study area include the Upper Peace Initiative (SWFWMD), the Myakka River Initiative (SWFWMD), Cow Pen Slough restoration (Sarasota County), the Charlotte Harbor Initiative (SFWMD), the Caloosahatchee Initiative (SFWMD) and the Estero Bay Initiative (SFWMD).

This priority action helps fulfill HA-4.

Strategy

- 1) Implement projects in the upper Peace River to address alterations and loss of storage to restore minimum flows and levels, and to protect and improve water quality in the Peace River and Charlotte Harbor.
 - a. Reestablish historic surface water connections.
 - b. Complete watershed management programs for priority watersheds.
 - c. Continue to develop and implement resource recovery projects in the upper Peace River watershed that are consistent with the SWFWMD *Southern Water Use Caution Area (SWUCA) Recovery Strategy*.
 - d. Implement alternatives identified in the SWFWMD *SWUCA Recovery Strategy* and in completed watershed management plans.
 - e. Implement projects to reduce nonpoint-source loadings of nutrients and other pollutants.

- 2) Collect the necessary data, develop, and implement water resource projects to restore hydroperiods in the Myakka River watershed.
 - a. Develop the technical analysis and modeling tools necessary for assessing management options.
 - b. Identify and evaluate BMPs being implemented and that can be implemented.
 - c. Implement alternatives identified in the SWFWMD *SWUCA Recovery Strategy* and in completed watershed management plans.
 - d. Monitor response to implemented projects and adapt management as necessary.
- 3) Support new watershed initiatives by advocating a watershed approach to addressing problems and pursuing funding.
- 4) Promote greater participation in the Facilitating Agricultural Resource Management Systems program.
- 5) Promote greater use of the mobile irrigation laboratory program.
- 6) Implement SWUCA recovery strategies.
- 7) Accelerate and secure funding for Upper Peace River/Saddle Creek restoration project.
- 8) Implement projects in Charlotte Harbor, Caloosahatchee and Estero Bay that are defined annually by the SFWMD for lower Charlotte Harbor.

Environmental indicator and target

HA-n: Acres of habitat hydrologically restored.

Restore 1,000 acres of habitat for hydrology by 2015.



Photo by Lisa Beever, 7/31/07

In-progress hydrologic restoration of a salt marsh in the Estero Bay basin.

HA-O

Encourage, expand and develop incentives for the reuse of waters that are protective of water quality and natural hydrology.

Background

Water supplies in southwest Florida are being stressed by the area's rapid growth. The efficient use and reuse of water should be made a key planning element at the local, regional and state levels. Water reuse programs can be an effective method of reducing pressures on surface and groundwater resources. However, excessive irrigation with reuse water may elevate nutrient loads to adjacent wetlands and water bodies and could contribute to water body impairments.

This priority action helps fulfill HA-4, WQ-1 and SG-1.

Strategy

- 1) Develop a regional reuse water policy that considers the conventional benefit of the resource and the potential for nutrient impacts on adjacent wetlands and water bodies.
- 2) Identify areas where reuse water service has the greatest potential for benefit, evaluate options for providing such service and study the feasibility of setting up service to areas without reuse water service.
- 3) Encourage utilities to quantify reuse for large reuse water users. Encourage nutrient management plans for large reuse water users.
- 4) Encourage utilities to adopt progressive rate structures for all water services (potable and reuse) to encourage efficient use of the resource.
- 5) Enhance existing education programs designed to inform and promote public awareness of the importance of efficient water use.
- 6) Evaluate public perceptions concerning the use of reuse water. Determine the barriers and benefits surrounding the acceptance of reuse water for recharge and natural system enhancement projects.
- 7) Use rebates or other incentives to encourage the retrofitting of pre-1992 irrigation systems with a sensor to interrupt irrigation when rain or moisture is present.
- 8) Study the effectiveness, benefits and impacts of existing reuse water services. Determine if the



Photo by Lisa Beever, 5/19/03

Inside the reclaimed water facility at the Cape Coral Wastewater Treatment Plant.

- runoff of reuse water is contributing to impairments of adjacent wetlands and water bodies. Review published reports as benchmarks, such as the WaterReuse Research Foundation *Nutrient Study WRF-09-08 and Sources of Nutrient Impacts to Surface Waters in Florida in Journal of Environmental Management.*
- 9) Discourage the disposal of a potential reuse water resource, such as highly treated wastewater, through industrial outfalls or deep well injection.
- 10) Encourage the use of storm water as a water resource that protects or restores natural hydrology.
- 11) Determine if wet-weather temporary reservoir availability is a significant barrier to reuse water system development and, if so, develop feasible alternatives.
- 12) Investigate the use of water from reclaimed mine lakes to recharge aquifer systems.

Environmental indicator and target

HA-o: Effluent from wastewater treatment plants within the study area that is treated and delivered for reuse.

Seventy-five percent of treated wastewater is reused by 2018.



HA-P

Support public involvement programs addressing watershed management issues of hydrology, water resources, water conservation and water use.

Background

Hydrology—the study of water flow—is a little-understood environmental value. The land in the CHNEP study area has little variation in elevation and is characterized by water flowing over land as opposed to being dominated by major streams and rivers. In order to conduct agricultural and land development, drainage has been altered. This has resulted in the loss of water storage and an increase in stormwater runoff. Homeowners have the opportunity to reduce these impacts through choices made at home such as water conservation, landscaping best management practices and incorporating water storage features into landscape design.

This priority action helps fulfill HA-1, HA-2, HA-3, HA-4 and SG-1.

Strategy

- 1) Promote and support programs and opportunities for citizens to be involved with water conservation and hydrology issues.
- 2) Promote and support demonstration areas that instruct people on water conservation and hydrology issues.
- 3) Provide water conservation and hydrology information through local media and other outlets.

Environmental indicator and target

Public knowledge of hydrology and water conservation techniques is part of an overall approach to improve water flows and reduce stresses on water resources. Effects may be seen under Priority Action WQ-D.



Photo by Maran Hilgendorf, 5/1/06

Children learning about the hydrologic cycle through play at the Explorations V Science Museum in Lakeland.

Fish and Wildlife Habitat Loss

Quantifiable objectives

FW-1: Protect, enhance and restore native habitats where physically feasible and within natural variability, including

- Submerged aquatic vegetation (SAV);
- Submerged and intertidal unvegetated bottoms;
- Oyster;
- Mangrove;
- Salt marsh;
- Freshwater wetland;
- Native upland;
- Water column.

FW-2: By 2025, achieve a 100 percent increase in conservation, preservation and stewardship lands within the boundaries of the CHNEP study area. The increase will be based upon 1998 acreage.

FW-3: By 2020, achieve controllable levels of invasive exotic plants, as defined by the Florida Exotic Pest Plant Council, and exotic nuisance animals, as defined by the Florida Fish and Wildlife Conservation Commission, on publicly managed lands. Encourage and support the removal and management of invasive exotic plants and exotic nuisance animals on private lands.

Priority actions

FW-A: Restore submerged and intertidal habitats (seagrass, oyster and unvegetated bottoms) from the effects of anthropogenic stresses.

FW-B: Ensure navigation programs protect CHNEP study area habitat resources.

FW-C: Restore freshwater and estuarine wetland areas, especially those adversely impacted by ditching, using methods such as the backfilling of ditches, the removal of spoil piles and the elimination of exotic vegetation.

FW-D: Enhance fish and wildlife habitat along shorelines, including canals, lakes, riverine systems and artificial waterways.

FW-E: Improve canal, pond, lake and river management activities to benefit fish and wildlife.

FW-F: Restore and protect a balance of native plant and animal communities.

FW-G: Provide additional support for environmental compliance and enforcement on land and water. Ensure uniform compliance and enforcement of environmental regulations and permitting criteria.

FW-H: Bring environmentally sensitive land under protection through ownership and/or management and expand conservation areas, reserves and preserves, including undeveloped platted lots.

FW-I: Advocate land acquisition and conservation easement programs.

FW-J: Provide information on the economic, social and environmental benefits of protected land and environmental restoration, including ecosystem services.

FW-K: Acquire as much of Babcock Ranch as possible for public stewardship and promote conservation management of the entire ranch.

FW-L: Where practical, identify and remove areas of heavy invasive exotic vegetation and exotic nuisance animals.

FW-M: Promote local programs to research and eliminate nuisance exotic animal species.

FW-N: Provide education programs on the impacts of invasive exotic plants and exotic nuisance animals.

FW-O: Provide multifaceted environmentally responsible boater education programs.

FW-P: Support public involvement programs in habitat and wildlife issues.



FW-A

Restore submerged and intertidal habitats (seagrass, oyster and unvegetated bottoms) from the effects of anthropogenic stresses.

Background

On August 17, 2009, the CHNEP approved targets for seagrass acreage. Seagrass acreage is 95 percent of that found in the 1950s. Seagrass extent has expanded 10 percent since the recorded low in 1999. However, severe prop scars and other stresses are taking a toll on the quality of our seagrasses.

On December 7, 2012, the CHNEP adopted its *Oyster Habitat Restoration Plan*. The purpose of the plan is to guide implementation of partnership oyster habitat monitoring and restoration projects throughout the CHNEP estuaries in areas identified as capable of supporting sustainable populations. The plan considered unvegetated bottoms, which are critical for endangered smalltooth sawfish (*Pristis pectinata*).

This priority action helps fulfill FW-1.

Strategy

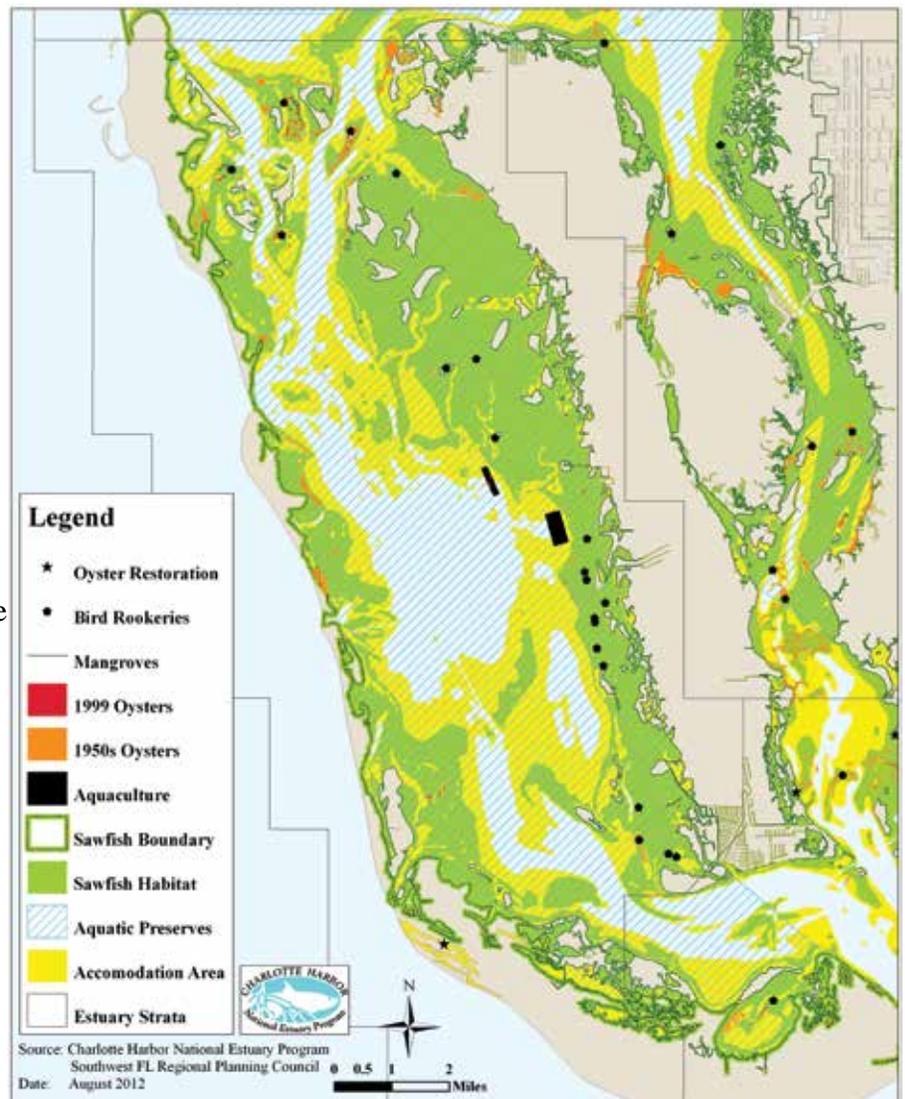
- 1) Develop benthic indices for tidal creeks, mud flats, sand flats and subtidal vegetated bottoms to measure the health of these systems.
- 2) Provide scientists, decision-makers and the general public with information regarding the abundance and diversity of benthic animals to highlight the value of unvegetated bottoms and other benthic habitats.
- 3) Restore oyster beds using appropriate substrates in locations of suitable water quality.
- 4) Promote biennial seagrass mappings that are coordinated between the water management districts.
- 5) Conduct a decennial seagrass scar mapping project for the CHNEP study area.
- 6) Gather existing information on methods to prevent or recover seagrass scarring (e.g., sediment restoration and closed areas), craft recommendations and make the information available to decision makers.

- 7) Encourage rule changes and enforcement of existing rules to protect shallow-water environments from boat impacts.
- 8) Consider legislative changes that are successful elsewhere.

Environmental indicator and target

FW-a: Acres of SAV and native oysters by estuary strata.

Maintain and increase the number of acres of SAV and oysters in each estuary strata by the amount defined in WQ-G and the *Oyster Habitat Restoration Plan*.



Map 31: Oyster Habitat Restoration Considerations for Pine Island Sound

Background

Charlotte Harbor is a generally shallow-water system. Pressure from development and increased public access to our shallow areas stresses the system. Dredging can reduce or degrade water quality during and after construction. It can also reduce or degrade natural habitat and its functions, adversely affecting fish and wildlife. Dredge-and-fill projects and associated degraded water quality are partially responsible for the precipitous decline of seagrass losses in Florida. New navigation channels can cause changes in hydrodynamics, creating erosion in some areas and building sediment in others. In the long term, dredging usually has to be repeatedly performed to maintain the channel, causing continuing impacts on aquatic life. According to Chapter 18-20.004(2), FAC, new dredging in Florida aquatic preserves must be clearly in the public interest. Taken together, dredging projects often result in adverse cumulative impacts.

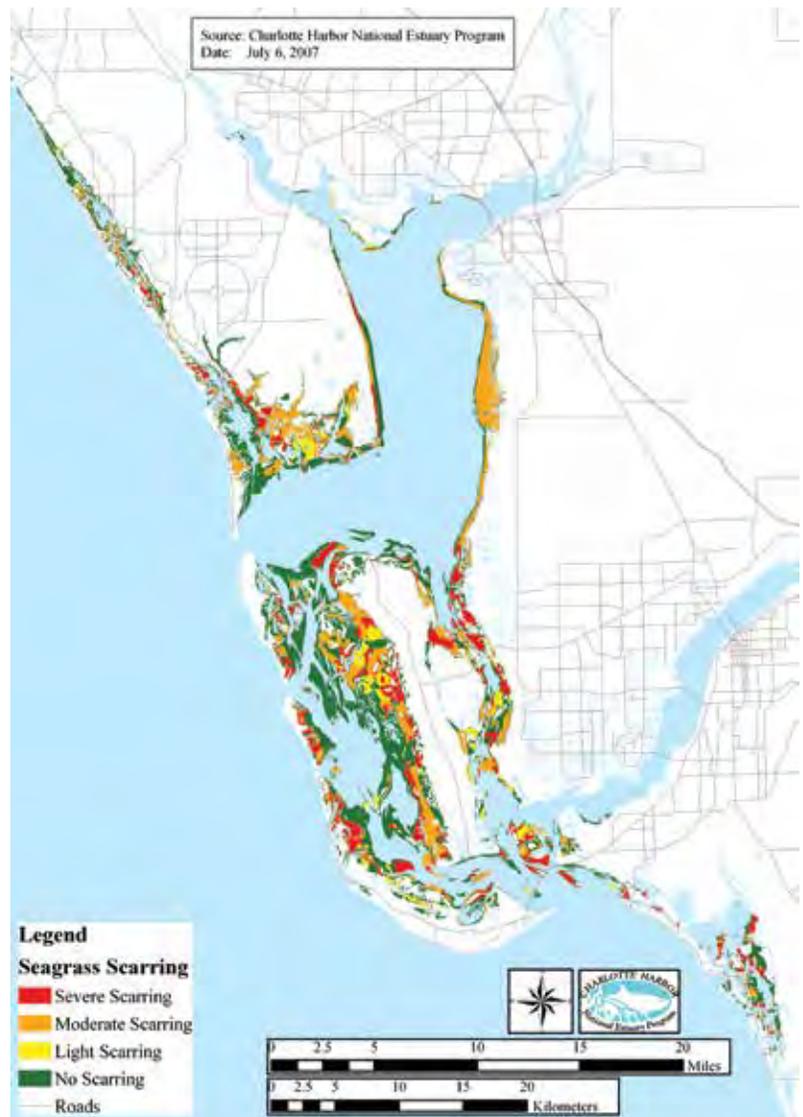
This priority action helps fulfill FW-1.

Strategy

- 1) Participate in Aquatic Preserve Management Plan revisions.
- 2) Participate in the revision of the plan for the Statewide Coastal and Aquatic Managed Areas.
- 3) Track, review and comment on new dredging in the CHNEP study area.
- 4) Advocate dredging permits with projected environmental benefits, e.g., water quality improvements due to increased flushing of degraded water bodies.
- 5) Examine pre- and post-dredging impacts on the environment.
- 6) Require pre- and post-dredging evaluations as a permit requirement.
- 7) Provide technical assistance and current scientific study results to the FDEP for permit examination.
- 8) Adopt county and city blue-belt plans (identify appropriate locations for boating access) to sustain and protect Charlotte Harbor area resources.

Environmental indicator and target

FW-b: Boat propeller scar acreage, severity and location by basin. No net increase in acreage of propeller damage to seagrass beds from the 1999 levels by the year 2018 by basin and seagrass segment. Reduce all severely scarred areas to moderate scarring and reduce 70 percent or more of the moderately scarred areas to light scarring by basin.



Map 32: 1999 Prop Scar Severity

Prop scar severity in the Charlotte Harbor estuaries, 2003–04.

FW-C

Restore freshwater and estuarine wetland areas, especially those adversely impacted by ditching, using methods such as the backfilling of ditches, the removal of spoil piles and the elimination of exotic vegetation.

Background

Many tidally flooded wetland areas within the coastal areas of the CHNEP were historically “ditched” to hydrologically alter these habitats to reduce the breeding of salt marsh mosquitoes. Many of these areas have been heavily invaded by exotic vegetation that colonizes spoil piles left by such ditching activities. Currently there are approximately 60,000 acres of mangrove and 12,000 acres of salt marsh in the CHNEP study area.

Many freshwater wetland areas within the watershed of the CHNEP were historically “ditched” to drain wetlands for development, agriculture and industry. These areas have been severely altered with regard to wetland structure and function, resulting in the loss of fish and wildlife habitats, particularly for species dependent upon isolated wetlands with short hydroperiods. Many of these ecosystems have been significantly altered to the point that they are no longer legally considered wetlands during permitting processes. Currently there are approximately 325,000 acres of freshwater wetlands in the CHNEP study area.

This priority action helps fulfill FW-1.

Strategy

- 1) Potential responsible agencies and organizations should develop a plan to identify and restore impacted areas within their communities or jurisdiction.
- 2) Refine geographic information system (GIS) data layers of mosquito ditching and other ditches in the CHNEP study area and use this information to prioritize restoration projects.
- 3) Develop an areawide plan and rank areas for restoration. Use pre-vegetation and historic watershed maps to develop an approach to restore the balance.
- 4) Implement the prioritized restoration program.

Environmental indicator and target

FW-c: Mangrove, salt marsh and freshwater wetland acreage.

Maintain and increase the number of mangrove to 60,000 acres, salt marsh to 12,000 acres and freshwater wetlands to 325,000 acres throughout the CHNEP study area.



Photo by Clay Simmons, Lee County, 8/1/06

Island Park Regional Mitigation Park is the first restoration constructed from the Lee County Master Mitigation Plan. Restoration needs are matched with mitigation needs of public capital projects.

FW-D

Enhance fish and wildlife habitat along shorelines, including canals, lakes, riverine systems and artificial waterways.

Background

In many areas of the CHNEP, natural marine, estuarine and freshwater shorelines have been hardened or modified during development. Programs and incentives should be developed to encourage “softening” and increase the habitat structure of these previously modified areas. In addition, such procedures should become standard operation procedures for any future permitted shoreline alterations.

This priority action helps fulfill FW-1.

Strategy

- 1) Compile data and study the cumulative impacts of boat docks and hardened shorelines on submerged aquatic vegetation (SAV), oyster bar, intertidal, unvegetated and other habitats.
- 2) Update shoreline treatment inventories, including hedged mangrove, windowed mangrove, uplifted mangrove, vertical seawall, riprap revetment, lawn, herbaceous wetlands, etc., every three years.
- 3) Remove hardened shorelines wherever possible and replace with environmentally beneficial natural shorelines.
- 4) Encourage planting of appropriate native vegetation and allow trimming and maintenance of newly planted vegetation by property owners.
- 5) Encourage the use of artificial reef structures under docks and along existing seawalls to enhance habitat value.

- 6) Develop and support incentive programs for private landowners to soften shorelines and plant appropriate native vegetation.
- 7) Encourage the use of alternatives to vertical bulkheads along developed shorelines through the permitting process.
- 8) Develop education programs and literature directed at residents living along artificial canals.

Environmental indicator and target

FW-d: Condition of shoreline (i.e., percent hedged mangroves, hardened shoreline, and damaged mangroves) by basin.

Reduce the percent of urban lots, as defined by the CHNEP Shoreline Survey, with mangroves to less than 39 percent trimmed and with vegetation to less than 3 percent with invasive exotic vegetation.



Photo by Channing Boswell, 9/4/04

Charlotte Harbor mangroves were damaged as a result of Hurricane Charley in 2004. Mangrove propagule development was suppressed for two years, resulting in no regeneration of the red mangrove forest in some areas. Loss of root mass has allowed soil to leach into the estuaries, causing water quality problems.



FW-E

Improve canal, pond, lake and river management activities to benefit fish and wildlife.

Background

Estuarine habitats are being challenged by anthropogenic changes in salinity. By not following historical gradual changes (aside from catastrophic events, i.e., hurricanes), systems are being consistently stressed with no chance for a recovery period. This includes excess freshwater impacts when upstream systems are too full, as well as cessation of flowing water when human use (i.e., mitigation or potable) of the resource is needed. Water elevations are impacted one way or another by this and these level changes also change habitat for fish and wildlife.

This priority action helps fulfill FW-1.

Strategy

- 1) Study effects of freshwater releases on submerged aquatic vegetation, oysters, ichthyoplankton and others in the lower Caloosahatchee, San Carlos Bay, Matlacha, Pine Island Sound, Dona Bay and Roberts Bay.
- 2) Work with responsible agencies to limit impacts to downstream systems, including better uses of

excess water and conservation/other sources when water is needed.

- 3) Coordinate with LakeWatch in upper watersheds and LE/AD and FLMS on monitoring and data available (vegetation and water quality).
- 4) Compile from local governments' management activities for lakes and canals; determine gaps and fill gaps.
- 5) Determine from water management districts and water control districts the rationale for lake levels and releases.
- 6) Compile fish kill quantity and causes data on lakes and canals.
- 7) Determine the impacts of raising the water levels in north Cape Coral freshwater canals.

Environmental indicator and target

FW-e: Lake, pond and canal water quality and quantity status and trends.

Improved dissolved oxygen, nutrient and copper trends in lakes and artificial water bodies.

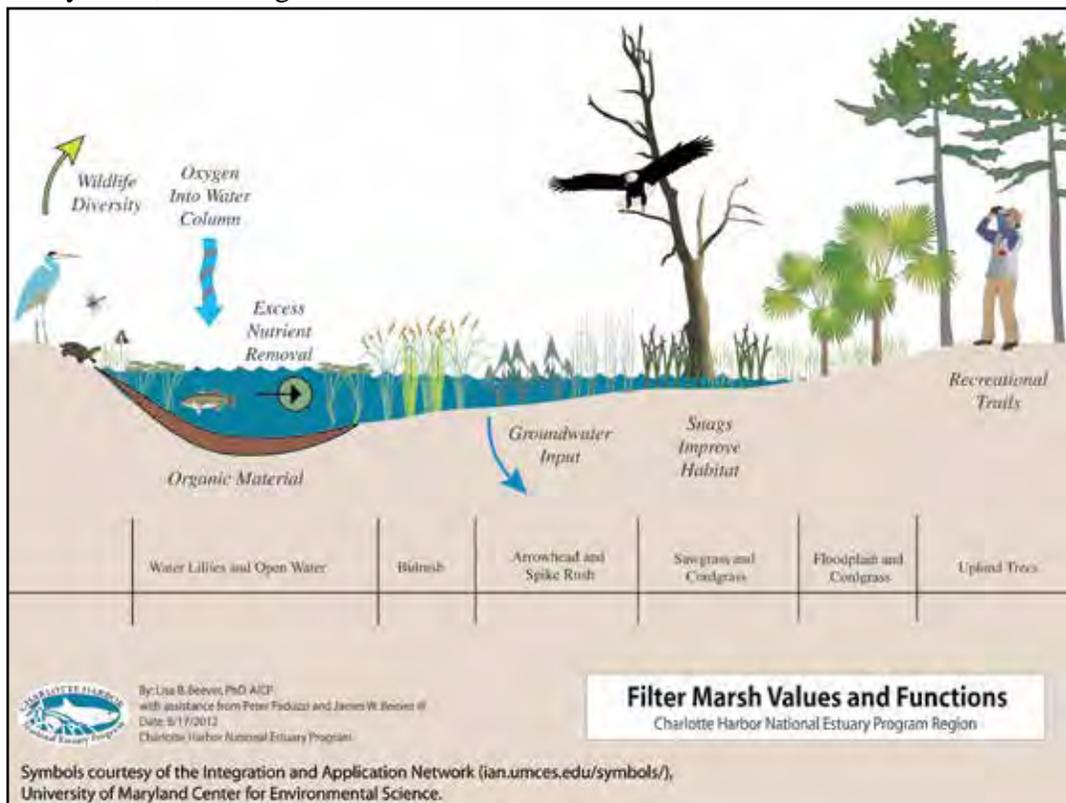


Figure 10: Conceptual Diagram of Artificial Water Body Improvements

Background

Southwest Florida is comprised of a variety of plant and animal communities. The extent of impact on these communities has been variable depending on their level of regulation, the value placed upon them and their general ability to be developed. For example, a higher percentage of pine flatwoods have been impacted than freshwater wetlands. Seagrass beds receive more protection than unvegetated bottoms. Communities of note include submerged aquatic vegetation (SAV), mangroves, saltwater marsh habitats, freshwater wetlands systems, oyster bars, native upland communities and the water column.

This priority action helps fulfill FW-1.

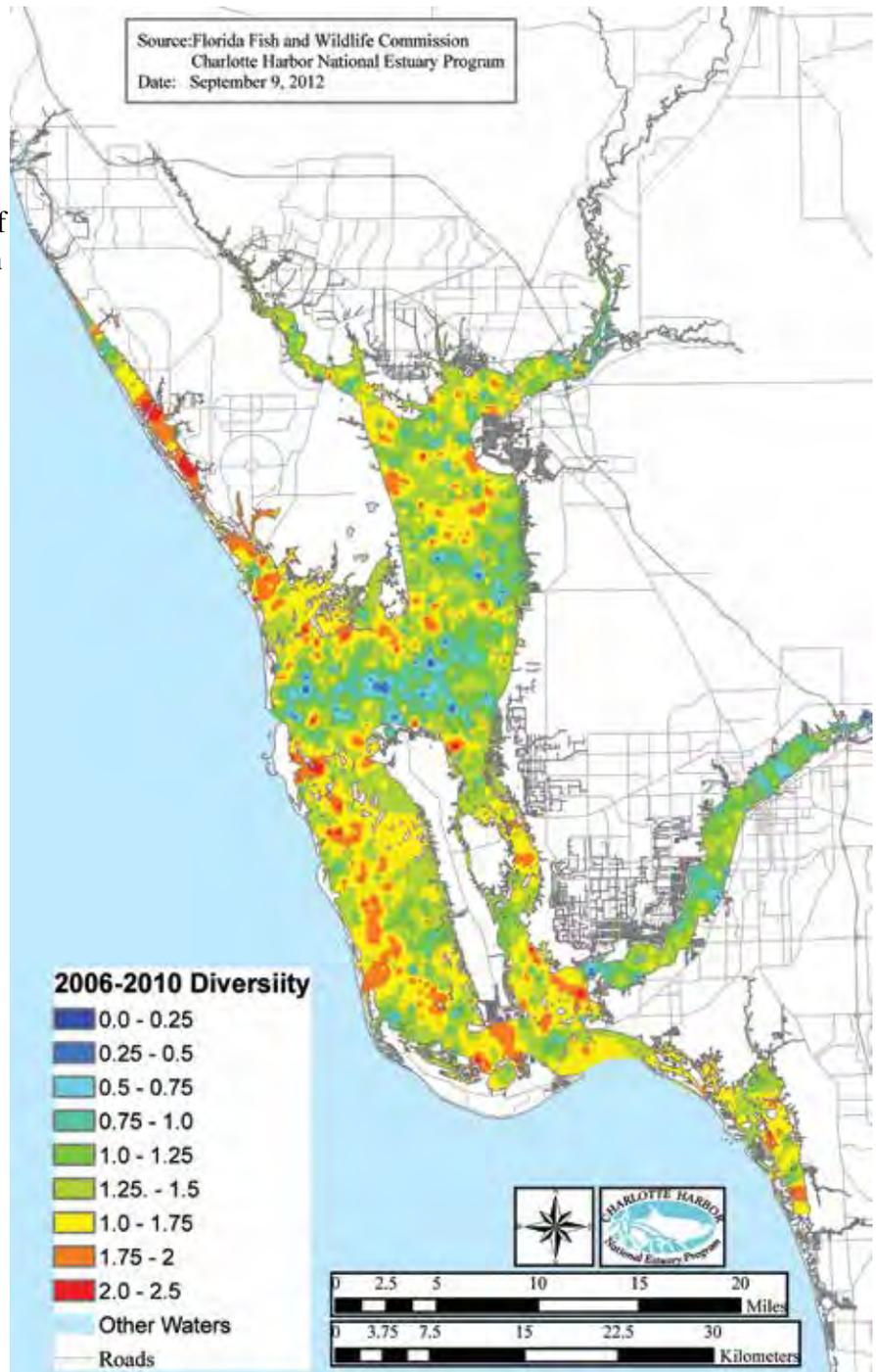
Strategy

- 1) Advocate water quality and habitat restoration projects that will improve the habitat value of native plant and animal communities.
- 2) Consider balance of rare habitats and habitats that have received a high percentage of impacts in restoration plans, consistent with restoring the balance approaches.
- 3) Continue and expand independent fisheries' monitoring programs.

Environmental indicator and target

FW-f: Fish community composition by bay segment.

No decline in native fish species diversity by bay segment.



Map 33: 2006-2010 Fish Diversity

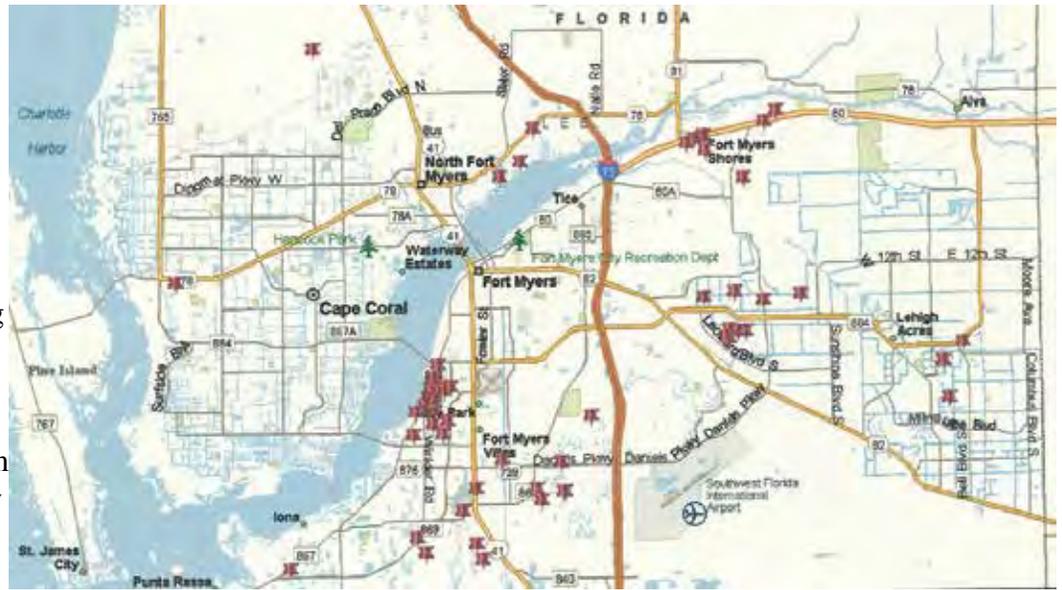
Data from the Fish and Wildlife Research Institute's Fisheries Independent Monitoring were analyzed and mapped by CHNEP staff to display areas of highest fish species diversity (in red).

FW-G

Provide additional support for environmental compliance and enforcement on land and water. Ensure uniform compliance and enforcement of environmental regulations and permitting criteria.

Background

Existing laws provide a sound basis for habitat and wildlife protection. However, the environmental law enforcement agencies need increased funding to perform their duties under the existing statutes and regulations. Enforcement of permitting and other environmental regulations should be uniform throughout the CHNEP study area.



Map 34: Lee County Fertilizer Ordinance

Lee County enforces its fertilizer ordinance with investigating complaints and issuing warnings and fines. The map above illustrates the distribution of fines for unincorporated Lee County in 2011. (Source: www.lee-county.com/gov/dept/NaturalResources/WaterQuality/Pages/FertilizeSmart.aspx)

This priority action helps fulfill FW-1.

Strategy

- 1) Advocate adequate funding for environmental law enforcement agencies, including an increase in the number of law enforcement officers.
- 2) Cooperate with regulatory agencies to develop protocol that tracks the effectiveness of permit compliance within the CHNEP study area.
- 3) Continue conducting workshops to train law enforcement and environmental permitting personnel regarding environmental regulations.

Environmental indicator and target

FW-g: Compliance with environmental laws.

At least one in-kind project or pollution prevention project implemented in the study area by 2017.



Photo by Maran Hilgendorf, 2/14/2011

In 2011, the CHNEP co-hosted environmental law enforcement workshops.

FW-H

Bring environmentally sensitive land under protection through ownership and/or management and expand conservation areas, reserves and preserves, including undeveloped platted lots.

Background

Important areas of existing natural habitat are currently threatened with substantial alteration due to rapid rates of development. The CHNEP process encourages, promotes and supports efforts by government and private organizations, as well as private landowners, to increase the protection of these habitats through expanded conservation, reservation, preservation and stewardship programs. These efforts include large, mostly vacant, platted areas.

This priority action helps fulfill FW-2.

Strategy

- 1) Gather priorities from existing land acquisition agencies and the CHNEP restoration vision.
- 2) Create list of priority acquisitions by watershed.
- 3) Identify key habitats in existing natural areas within each watershed for protection.
- 4) Promote private stewardship of vital habitats through incentives and technical assistance to landowners, local governments and other parties.
- 5) Develop and implement public land acquisition programs for critical habitat adjacent to public lands.
- 6) Develop an acquisition plan and funding strategy for the Peace River watershed through collaboration of local, state and regional conservation land acquisition entities to assure a coordinated and equitable approach, as identified through the *Peace River Resource Management Plan*.
- 7) Continue to pursue “less-than-fee” simple acquisition programs to acquire critical lands for fish and wildlife, as well as water management, water supply and the conservation and protection of water resources.
- 8) Work with mining companies to develop permanent

- reserves and preserves from post-mined land.
- 9) Develop a funding resource and management plan for acquired lands before purchase or acquisition.
- 10) Support existing and proposed land trusts for the acquisition of wildlife habitat.
- 11) Conduct a periodic convocation to review the restoration plan and acquisition plan.
- 12) Track habitats in conservation.
- 13) Support incentive programs such as the Wildlife Habitat Incentive Program.
- 14) Support land acquisition agencies’ efforts to contact targeted property owners requesting:
 - a. Land donation in exchange for income tax write-off.
 - b. Exchange for equivalent land in nontargeted areas.
 - c. Permanent wildlife easement.
 - d. Sale of land to the trust.

Environmental indicator and target

FW-h: Acreage in conservation status within study area and by basin.

By 2025, increase of coverage for lands in conservation status by 100 percent over 1998 levels to 488,000 acres.

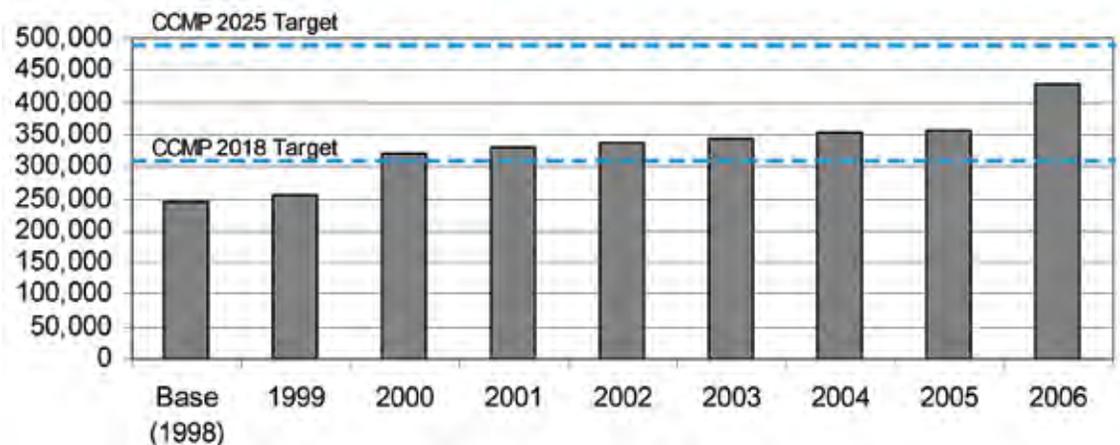


Figure 11: Land Conservation

Land has been placed under stewardship every year within the CHNEP study area after adoption of the CCMP in 1999. An objective of 25 percent more than in 1998 by 2018 was set at the time. By 2000, that objective had been achieved. This update increases the objective to 100 percent more than in 1998 by 2025.



Background

The southwest coast of Florida was once a reticulate necklace of beautiful emerald, blue and amber gems composed of an interlocked complex of bays, lagoons, inlets, sounds and harbors. Decorated with wetlands, submerged aquatic vegetation and coastal rivers, these features supported one of the most biologically diverse plant, fish and wildlife populations in the continental United States. This entire system has been fragmented, losing much of its natural productivity due to coastal habitat loss, water quality degradation and hydrologic alterations, attributable to the area's rapid growth. State and federal agencies, local governments, conservation organizations, as well as the general public, overwhelmingly support programs and efforts that focus on the protection of the remaining coastal ecosystems. Such programs achieve these protections through fee simple acquisition and conservation easements.

A conservation easement is a legal agreement voluntarily entered into between a property owner and a qualified conservation organization, such as a land trust or government agency. The easement contains permanent restrictions on the use or development of land in order to protect its conservation values. These easement restrictions vary greatly for each agency or organization, as do landowner motivations to offer conservation easements. There are many advantages to conservation easements: property remains in private ownership and contributes to the tax base, flexibility, permanency, property tax reductions, charitable tax deductions and estate tax reductions.

This priority action helps fulfill FW-2.

Strategy

1) Support existing federal, state, water management district and local conservation land acquisition programs, such as Florida Forever, Florida Communities Trust, Save our Rivers and private land acquisition organization projects. Support activities may include letter writing and contact with legislators and other decision-makers to authorize and increase funding, approve specific project allocations and management funds, contact

prospective sellers and make introductions. Such efforts may include coordination of Coastal Conservation Corridor Plan activities, facilitating regional land acquisition forums, assistance with the formation and maintenance of local land trusts and providing information and education on behalf of local conservation efforts, including funding initiatives.

- 2) Inventory government land acquisition programs and private land trusts. Include information such as program requirements, processes and area limitations.
- 3) Evaluate and prioritize restoration projects and refer to likely funding programs.
- 4) Assist land trusts and funding agencies to send letters of inquiry and appropriate materials to targeted property owners.
- 5) Revise, update and secure funding for the Integrated Habitat Network and accelerate floodplain mapping modernization.

Environmental indicator and target

Advocating land acquisition and conservation easements is part of an overall approach to place lands in conservation management. Effects may be seen under Priority Action FW-H.

FW-J

Provide information on the economic, social and environmental benefits of protected land and environmental restoration, including ecosystem services.

Background

The protection of land for conservation purposes provides significant economic, social and environmental benefits to the local and regional area. Those local areas in Florida containing the most expansive areas of conservation lands tend to have both increased quality of life and enhanced tax base of the remaining adjacent private lands. The presence of conservation lands can reduce infrastructure needs, including transportation, health care, public safety and utility services, saving local governments and taxpayers millions of dollars in capital improvements and operating costs. Conservation and agricultural lands generate more revenue than services required through associated taxes, fees and tourism support. Hunting, fishing and nonconsumptive outdoor recreational activities are a major contributor to the southwest Florida tourist industry.

This priority action helps fulfill FW-2.

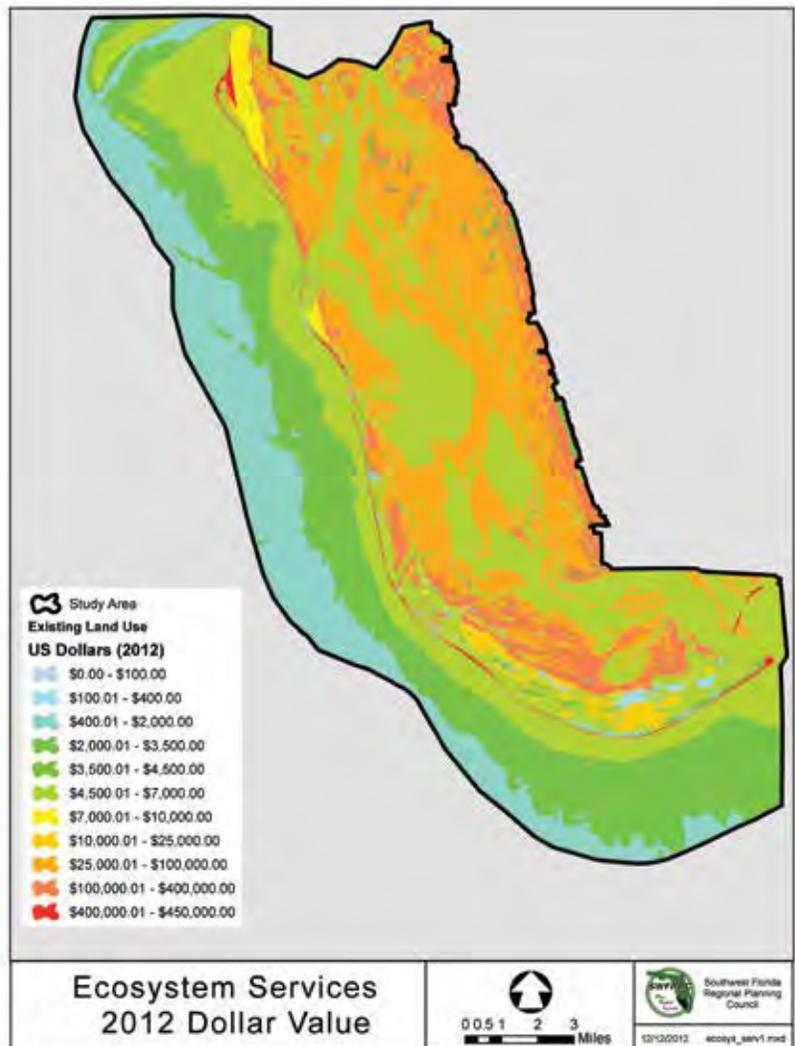
Strategy

- 1) Document existing studies that have defined benefits of protected land in Florida with emphasis in the CHNEP study area.
- 2) Gather data on recreational use of protected lands and compile the results for a summary report to the public and decision-makers.
- 3) Estimate the economic benefits of identified land acquisition projects and how infrastructure and operating costs will be reduced, user fees and tourist revenue will be increased and how quality of life will be improved. Consider such issues as traffic congestion and mortality, air pollution, school crowding, crime and taxes.
- 4) Use models to assess future pollutant loading as a result of preserved land not being developed.
- 5) Utilize appropriate metropolitan planning organization and regional planning council build-out models for urban service area and platted lands throughout the CHNEP watershed to assess alternatives that reduce infrastructure costs.

- 6) Encourage economic research to bolster the fundamentals of ecosystem services valuations and suggest innovative funding mechanisms for CCMP actions.

Environmental indicator and target

Providing information on the economic, social and environmental benefits of protected land is part of an overall approach to place lands in conservation management. Effects may be seen under Priority Action FW-H.



Map 35: Ecosystem Services Values

In 2013, Southwest Florida Regional Planning Council and Sanibel-Captiva Conservation Foundation assessed ecosystem services values for an area associated with Pine Island Sound by land use.



Background

Babcock Ranch lies immediately east of the Babcock-Webb Wildlife Management Area and is situated in Charlotte and Lee counties, within the Telegraph Swamp watershed. The property has been managed for nearly 100 years as a working ranch and timber operation. However, mining, sod farming, truck farming and hunting currently take place also.

Babcock Ranch is recognized as a critical link in the regional wildlife habitat landscape of southwest Florida. It adjoins the Babcock-Webb Wildlife Management Area to the Fisheating Creek core conservation and conservation easement lands and the Caloosahatchee State Recreation Area. It is on the current Florida Department of Environmental Protection Florida Forever acquisition list and the Florida Fish and Wildlife Conservation Commission Additions and Inholdings acquisition list.

The Babcock Ranch is the largest freshwater landscape that drains into the CHNEP estuarine system.

The state has been pursuing acquisition of the Babcock Ranch since 2002. In 2005, the FDEP in partnership with Lee County reached an agreement to purchase approximately 80 percent (73,476 acres) of the Babcock Ranch out of the total 91,682 acres. The state will develop a management plan that provides for the conservation and stewardship of the property that will include continued operation of certain activities of the ranch.

This priority action helps fulfill FW-2.

Strategy

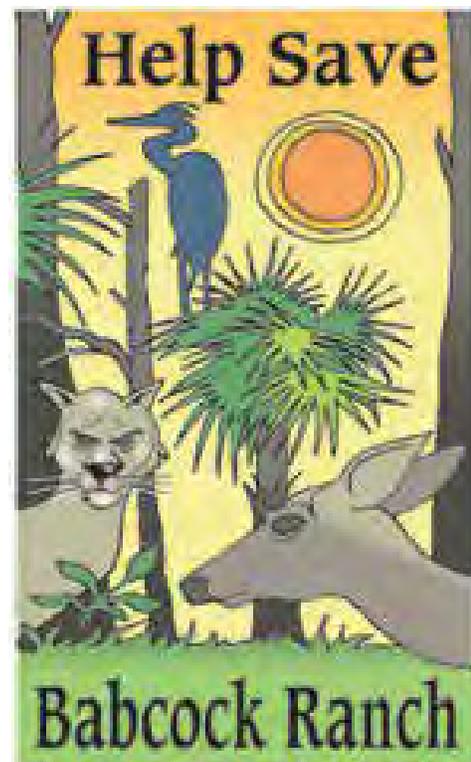
- 1) Continue to advocate the acquisition of Babcock Ranch for public stewardship through the state, federal, local and nonprofit entity processes. Identify viable alternative acquisition scenarios and advocate the most protective methods.
- 2) Participate in the designation of additional conservation areas within the development area of the Babcock Ranch community including fee-simple and less-than-fee-simple acquisition preservation of the Curry Lake wildlife corridor,

the Trout Creek riparian ecosystem, the Florida scrub jay habitats and the Telegraph Creek Canal buffer. Promote conservation practices on all Babcock Ranch property.

- 3) Support acquisition within the development area footprint of lands using Florida Forever, Florida Communities Trust, Conservation 20/20 or other public or private land acquisition programs.
- 4) Assist the management entities, including the FWC, FDEP and the nonprofit corporation, in development of the State Management Plan and in environmental interpretation and education on the Babcock Ranch.
- 5) Seek CHNEP representation on the Babcock Ranch Management Partnership.

Environmental indicator and target

Acquiring additional components of the Babcock Ranch is part of an overall approach to place lands in conservation management. Effects may be seen under Priority Action FW-H.



Background

Significant wildlife habitat in the CHNEP study area has been extensively invaded and altered by invasive exotic vegetation and exotic nuisance animals. Existing programs and incentives need to be continued and enhanced to reduce and control both the extent and spread of such invasive exotic species.

This priority action helps fulfill FW-3.

Strategy

- 1) Identify areas of heavy invasive exotic vegetation and exotic nuisance animals.
- 2) Conduct a biogeographic analysis of aquatic and terrestrial exotics and assess the threats.
- 3) Examine existing exotic pest plan and nuisance exotic animal lists and recommend additions as necessary.
- 4) Develop a ranking matrix for public lands and waters.
- 5) Develop and encourage county and community-based programs for the removal of exotics and the maintenance of native vegetation on private lands.
- 6) Develop plans to reduce occurrence of exotics in areas containing or linking significant habitats identified in the regional restoration coordination plans.
- 7) Work with regulatory agencies to require exotic removal and maintenance as a condition of all new permits (dock, surface water, land clearing, etc.) for development.
- 8) Develop and implement incentive (rebate) programs to encourage removal of exotics and the maintenance of native vegetation on private lands.

- 9) Work with regulatory agencies to alter permitting regulations to encourage landowners to remove exotic vegetation prior to land development and to plant native vegetation.
- 10) Work with regulatory agencies to institute ordinances for the removal of nuisance vegetation and exotic nuisance animals.
- 11) Work with regulatory and planning agencies to modify comprehensive plans to include exotic nuisance animal and exotic pest plant mapping and management strategies.
- 12) Advocate legislation that restricts ownership of exotic nuisance animals and continued funding at the federal and state level to identify, research and release additional biocontrol agents for existing invasive plant species.

Environmental indicator and target

The most complete and consistently derived information on exotic vegetation is from the CHNEP shoreline conditions monitoring. Effects may be seen under Priority Action FW-D.



Photo by Catherine Corbett, 7/29/05

The invasion of West Indian marsh grass (Hymenachne amplexicaulis) in the CHNEP study area, especially in Myakka State Park, is threatening biodiversity. A CHNEP grant to the University of Florida resulted in a recommendation to control this invasive with a mix of glyphosate and imazapir, targeted in the early growing season, in combination with winter burning, herbicide application and hydroperiod control.

Background

Since European colonization, hundreds of animal species have been introduced to Florida. In recent times, many of these avian, aquatic and terrestrial wildlife species and insects have become a threat to the survival of native plant and animal species and/or their habitats.

This priority action helps fulfill FW-3.

Strategy

- 1) Research the extent of invasive animal imports/introductions.
- 2) Using the Internet, USFWS, USDA, FDACS, pet trade associations, hobby groups, pet shops, shows and pet supply stores, ascertain the extent of importation of dangerous and potentially invasive wildlife species, including birds, reptiles, fish, invertebrates, mammals and amphibians.
- 3) Where appropriate, develop education programs to disseminate information about harmful invasive species, advocate control programs and introduction, possession and/or release of harmful exotic animal species.

- 4) Develop professional presentations for legislators and commissioners.
- 5) With input from pet trade, hobby groups, wildlife biologists and the public, develop educational materials and programs to emphasize the problem of wildlife introductions and releases, as well as the related laws. Present these materials/programs at exotic pet shows, trade shows and other venues.
- 6) Encourage federal and state regulations and statute changes to restrict or prohibit introduction and release of nonnative wildlife species.
- 7) Encourage the development of “humane” rescue groups to take unwanted pets (rather than have them “dumped”).

Environmental indicator and target

Local programs to eliminate invasive exotic plants and exotic nuisance animals is part of an overall approach to reduce the impacts of exotic plants and animals. Effects may be seen under Priority Action FW-L.



Photo by Todd Campbell, 2003

*In 2003, the CCMP was amended to include exotic nuisance animals. The threat of the emerging Nile monitor lizard (*Varanus niloticus*) in Cape Coral was considered a serious threat to environmental health. Dr. Todd Campbell, University of Florida, was awarded a grant from the CHNEP to research to learn about the population and assess the feasibility of eradicating it from Cape Coral. Information made available through the CHNEP led the City of Sanibel to budget funds to eradicate the Nile monitor lizard if it should appear on the island. In 2005, one was sighted and it was eliminated from Sanibel.*

Background

The problem of invasive exotic pest plants and invasive, exotic and nuisance animals is not well understood by the public in general. The unprecedented growth and development rates within the greater Charlotte Harbor area are expected to continue. While many new residents have been coming to Florida for years as seasonal residents and may be familiar with state, regional and local environmental issues and problems, many more lack an understanding of Florida ecology and resource management. Effective exotic control, exotic removal and eradication programs require that our Charlotte Harbor communities understand the severity of the

problems resulting from invasive, exotic plants and animals, share a vision of healthy environmental future and join together in providing public support for that vision.

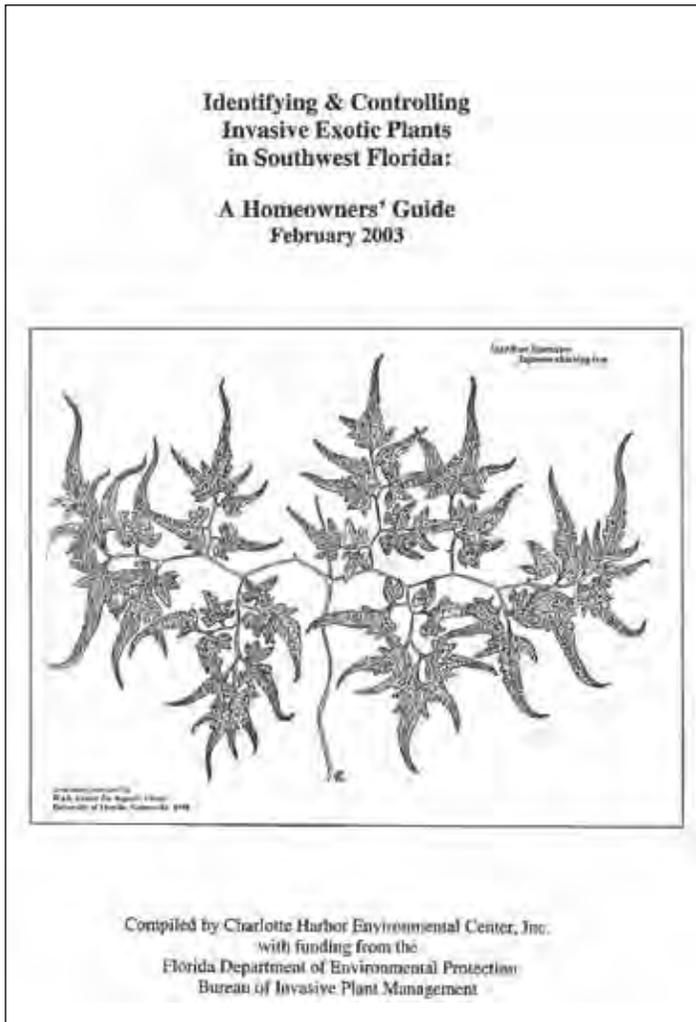
This priority action helps fulfill FW-3 and SG-1.

Strategy

- 1) Offer programs to the general public that match the community with the exotic problems, including “hands-on” control measures and directives with respect to follow-up maintenance and prevention.
- 2) Develop up-to-date materials concerning the problems and resource management of invasive exotic plants and animals.

Environmental indicator and target

Public knowledge of regarding the impacts of invasive exotic plants and exotic nuisance animals is part of an overall approach to reduce the impacts of exotic plants and animals. Effects may be seen under Priority Action FW-L.



Charlotte Harbor Environmental Center (CHEC) produced a homeowners' guide to identifying and controlling invasive exotic plants.

FW-O

Provide multifaceted environmentally responsible boater education programs.

Background

Boating activity frequently has negative consequences on the environment. Prop scar severity and extent, water quality degradation and marine mammal injuries have increased in the CHNEP study area during the last decade. Because of the nature of our estuaries, most of the estuarine extent is shallow. Shallow-water boating requires special knowledge. There are many organizations that help educate the increasing number of boaters on these special concerns.

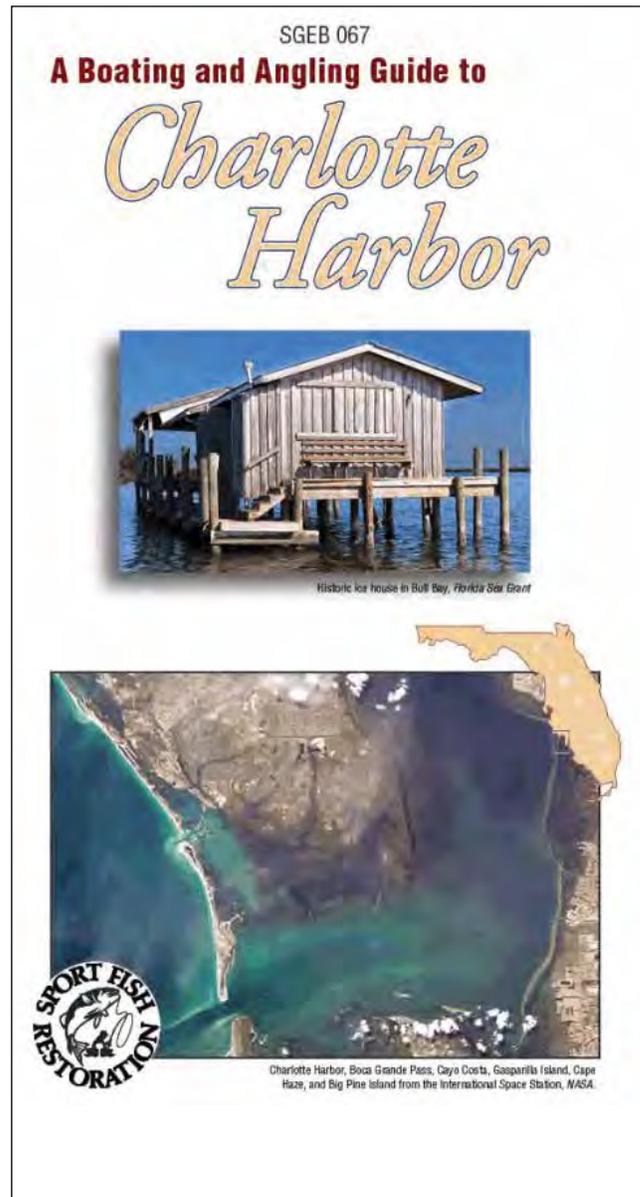
This priority action helps fulfill FW-1 and SG-1.

Strategy

- 1) Develop programs for each of the major estuarine areas that show the habitat losses associated with prop damage and how boaters can avoid damage to grass beds.
- 2) Produce and distribute materials on environmentally responsible boating practices, including the continuing development of boater guides. Possible means of providing watercraft users with this information can include Coast Guard auxiliaries, marine dealers, watercraft rental businesses, marinas, tackle shops, sporting goods stores; local civic and business groups, local schools and boating and fishing associations as well as in boat registration packages.
- 3) Consider extending enforcement of marine sanctuaries to aquatic preserves, or at least around all existing state parks, taking into account the cost of maintenance and upkeep for regulatory markers, which must be within 500 feet of one another.
- 4) Involve boater groups, including guide associations, marine trade associations and West Coast Inland Navigation District, to help generate solutions to seagrass scarring and other environmental problems.
- 5) Work with boat motor dealers to recommend lower horsepower and to provide information that jet boats can cause “blowouts.”
- 6) Evaluate areas that could use additional navigational signage, such as Matlacha Pass.

Environmental indicator and target

Responsible boater education programs are part of an overall approach to improve benthic resources. Effects may be seen under Priority Actions FW-A and FW-B.



The Boating and Angling Guide to Charlotte Harbor is a user-friendly printed guide of Charlotte Harbor. Graphics and text provide boaters with a variety of useful information. This guide includes Charlotte Harbor from Lemon Bay in the north to Pine Island Sound in the south, the Peace River to Fort Ogden (Route 761) and the Myakka River to North Port (US 41). Other guides cover waters in Lee and Sarasota counties.



Background

Habitat protection is the cornerstone of water quality and quantity restoration. People are most passionate about habitat protection and wildlife issues in and around their own neighborhoods. This can be used as a springboard into broader estuarine and watershed protection activities. Without public involvement, solutions to the protection of fish and wildlife habitat cannot be successful.

This priority action helps fulfill FW-1, FW-2 and SG-1.

Strategy

- 1) Promote programs and opportunities for citizens to participate with nonprofit conservation organizations, environmental agencies and policy-making bodies.
- 2) Promote and support programs and opportunities for citizens to be involved with habitat and wildlife issues.
- 3) Promote and support demonstration areas that instruct people on habitat and wildlife issues.
- 4) Provide habitat and wildlife information through local media and other outlets.

Environmental indicator and target

Public knowledge of habitat and wildlife issues is part of an overall approach to improve conservation of fish and wildlife habitat. Effects may be seen under Priority Actions FW-A through FW-H.



Photo by Catherine Corbett, 5/12/03

Volunteers are placing bagged oyster shell where oysters once thrived. The oyster shell provides excellent substrate for oyster spat to settle and grow. These kinds of activities, where the public can help restore ecosystems, are valuable.

Stewardship Gaps

Quantifiable objectives

SG-1: By 2025, a minimum of 75 percent of all residents will have recalled attending a watershed event, reading watershed material or hearing watershed/estuary information on radio or TV. A minimum of 50 percent of all residents in the CHNEP study area can recognize estuaries and watersheds. A minimum of 10 percent of all residents will be able to claim personal actions that protect the estuaries and watersheds.

SG-2: By 2020, the CHNEP will expand its role as a recognized resource to elected officials or their agents from local, state and federal government for policy advice.

SG-3: Through 2020, the CHNEP long-term monitoring strategy and data management strategy will continue and be enhanced. The resulting Internet-based Water Atlas will be maintained systematically.

SG-4: Through 2020, key geographic and scientific information will be presented in ways that are meaningful to the majority of people.

Priority actions

SG-A: Gauge public involvement.

SG-B: Provide people with opportunities to be involved in research, monitoring and restoration activities.

SG-C: Identify underrepresented populations and develop methods to include them in estuary and watershed protection.

SG-D: Produce watershed and estuary communication tools.

SG-E: Offer grants to broaden participation of individuals and groups in implementing the CCMP.

SG-F: Provide events that involve people in the stewardship of their local natural resources and opportunities to connect them to their watershed.

SG-G: Implement target audience programs.

SG-H: Incorporate estuary and watershed protection in educational curricula.

SG-I: Conduct new resident programs to inform and encourage environmental stewardship.

SG-J: Identify and showcase accomplishments and excellent examples of research findings, restoration, legislative changes and outreach successes using a variety of methods.

SG-K: Present scientific information in a form readily understood by the majority of people.

SG-L: Implement *The Advocacy and Review Procedures*.

SG-M: Vigorously pursue the *Long Range Funding Strategy* and funding mechanisms to implement watershed and estuary protection.

SG-N: Update comprehensive inventories of research, restoration, legislative and outreach needs.

SG-O: Create incentives to protect desired ecosystem resources.

SG-P: Incorporate into federal, state and local permits, and public works improved standard practices that better protect estuaries and watersheds.

SG-Q: Build capacity for communities and their local leadership to mitigate and adapt to the effects of climate change through joint efforts.

SG-R: Track and present monitoring data according to CHNEP-adopted environmental indicator targets.

SG-S: Post raw data, geographic information system (GIS) and technical analysis on the Internet under the data management strategy.

Other priority actions

WQ-K: Implement conservation landscaping plant programs, including the Florida Yards & Neighborhoods program, throughout the CHNEP study area.

WQ-L: Increase the use of personal and home best management practices by residents and visitors throughout the watershed to reduce nonpoint-source pollution.

WQ-M: Support public involvement programs addressing water quality issues.

HA-P: Support public involvement programs addressing watershed management issues of hydrology, water resources, water conservation and water use.

FW-H: Bring environmentally sensitive land under protection through ownership and/or management and expand conservation areas, reserves and preserves, including undeveloped platted lots.

FW-I: Advocate land acquisition and conservation easement programs.

FW-J: Provide information on the economic, social and environmental benefits of protected land and environmental restoration, including ecosystem services.

FW-K: Acquire as much of Babcock Ranch as possible for public stewardship and promote conservation management of the entire ranch.

FW-N: Provide education programs on the impacts of invasive exotic plants and exotic nuisance animals.

FW-O: Provide multifaceted environmentally responsible boater education programs.

FW-P: Support public involvement programs in habitat and wildlife issues.

Background

Public outreach effectiveness is difficult to ascertain without the use of surveys and other methods. The CHNEP is a science-based organization and similar standards should be used with social research. It is in the best interest of the program to measure the present conditions regarding the level of public awareness, understanding, attitude and actions toward environmental conditions in the CHNEP study area.

The CHNEP and its partners have been successful in establishing monitoring, restoration, research and outreach programs in the CHNEP study area. However, social indicators that link the sound science performed by these programs and the effect on the population, or vice versa, have not been routinely evaluated. These environmental-social indicators should be conducted regularly to determine the effectiveness of the activities conducted or sponsored by the program.

We are committed to establishing a base line and to tracking changes in citizen awareness, knowledge, behaviors and advocacy through time. We are committed to measuring the effectiveness of our priority actions related to education and outreach. An active outreach program must have measurable results. A study/survey tool will identify educational gaps encountered through a scientific evaluation of our community. The study will provide a framework to guide our efforts in closing gaps in stewardship.

So how do we achieve our vision of stewardship together? First, we use survey tools to establish an environmental awareness base line. The base line tells us where we are. We already have a vision of where we want to be. Then we devise a plan to get there—a plan that closes the gap between where we are and where we want to go. How will we know when we have succeeded as good stewards of our watershed? Set up quantifiable and achievable objectives that we can measure over time.

This priority action helps fulfill SG-1.

Strategy

1) Establish base line information on familiarity and

actions regarding estuaries and watersheds by conducting random sample surveys. Determine the awareness of the program, understand the differences between an estuary and watershed and identify behavior programs associated with protecting our estuaries and watersheds.

- 2) Verify results using a variety of methods, such as interviews and focus groups.
- 3) Analyze the results of the surveys and compare with other partners' surveys.
- 4) Continue to assess delivered CHNEP programs for future improvements.
- 5) Develop mechanisms to assess changes in awareness, understanding and behavior.

Performance target

75 percent of all residents recall watershed or estuary information. 50 percent of all residents recognize estuaries and watersheds. 10 percent of all residents will be able to claim personal actions that protect the estuaries and watersheds.

SG-B

Provide people with opportunities to be involved in research, monitoring and restoration activities.

Background

The CHNEP has identified a need for an increase in public awareness and public responsibility of natural resources. Participation in research, monitoring and restoration activities provides opportunities for hands-on stewardship, educational outreach and promotion of the CHNEP and its partners' continued efforts in the community. Examples of public volunteer opportunities include citizen removal of invasive exotic plants, conservation landscaping demonstration garden planting, oyster reef building, water quality monitoring and amphibian monitoring.

This priority action helps fulfill SG-1.

Strategy

- 1) Encourage use of volunteers in research, monitoring and restoration such as invasive exotic removal, marsh plantings, upland plantings and maintenance and volunteer water quality monitoring.

- 2) Network and build partnerships with schools and environmental and volunteer organizations to create, coordinate and promote opportunities.
- 3) Promote general public events such as coastal cleanups and estuary cleanups.
- 4) Offer grants and letters of support for citizen-driven research, monitoring and restoration activities.

Performance target

Five citizen restoration activities per year. Two major citizen monitoring networks per year.



Photo by Charlotte Harbor Aquatic Preserves

Volunteers collect water quality samples for the Florida Department of Environmental Protection and the CHNEP. The data are incredibly valuable because they are taken monthly at the same time throughout the estuaries.

SG-C

Identify underrepresented populations and develop methods to include them in estuary and watershed protection.

Background

Underrepresented segments of the population are difficult to access. Many of these segments are constrained by low income, language barriers and cultural differences. Major health problems from industrial pollution and disproportionate hardship from infrastructure development among these groups resulted in environmental justice concerns. Everyone should receive their share of benefits from the National Estuary Program and partner programs.

This priority action helps fulfill SG-1.

Strategy

- 1) Identify segments of the population that are not currently benefiting from the CHNEP.
- 2) Maximize reach to underrepresented groups by using existing networks such as rural and minority area parks, churches, community centers and recreational clubs.
- 3) Develop multilanguage materials and programs.

- 4) Support community environmental projects.
- 5) Actively work to involve leaders of underrepresented populations with the CHNEP.

Performance target

Three projects targeted at underrepresented populations per year.



Photo by Dennis Guenther, 5/6/02

Working with city parks and recreation departments, such as the city of Fort Meade, is an excellent way to reach underrepresented communities.



Background

Communication tools, such as websites and magazines, can be effective in increasing knowledge and awareness of CHNEP issues throughout the CHNEP study area. In addition, these tools can be used to further the average person's understanding of terms such as *estuary* and *watershed* and the effect human activities have on them. They can also be used to provide scientific information on water quality degradation, hydrologic alterations, habitat loss and stewardship gaps, which are often not meaningful to the average person.

This priority action helps fulfill SG-1 and SG-4.

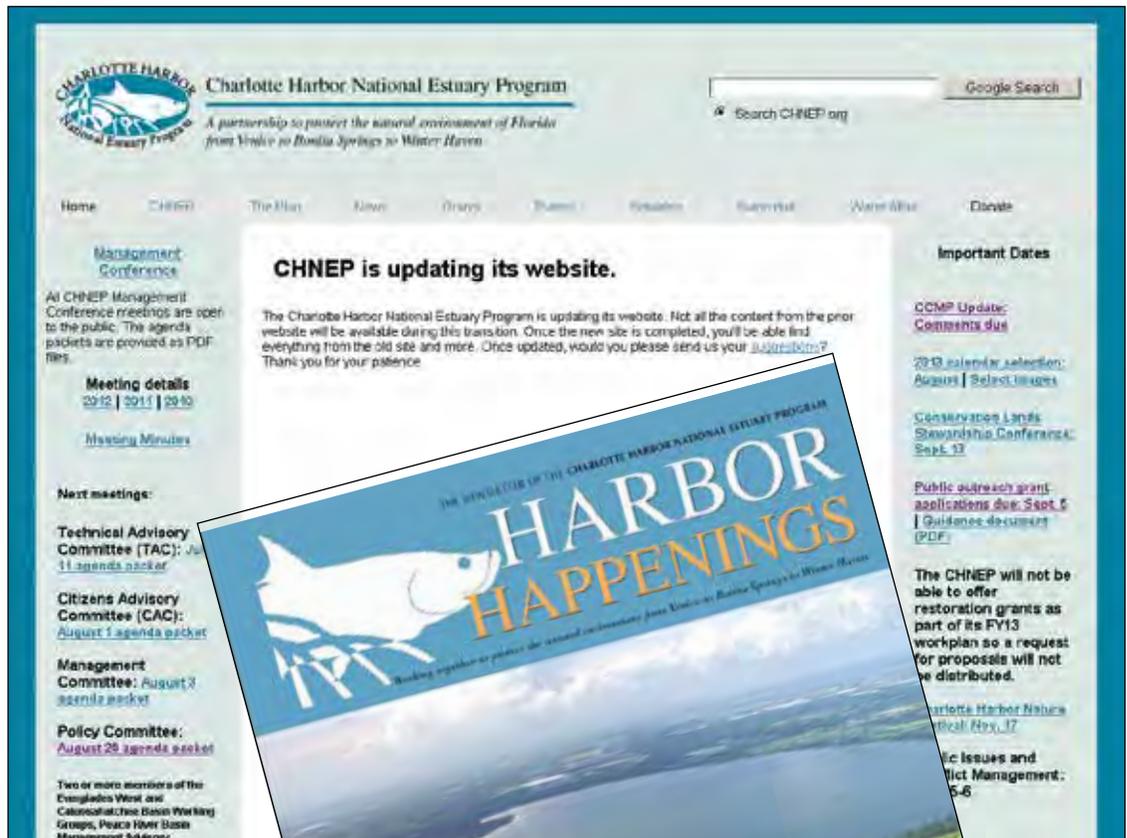
Strategy

- 1) Maintain a user-friendly website, with links to partners' websites, that is meaningful and relevant to the average person.
- 2) Publish *Harbor Happenings* magazine and increase its accessibility.
- 3) Measure the success of the communication tools used, including the website and magazine, through surveys.

Performance target

Quarterly publication of *Harbor Happenings* magazine, supplemented by annual calendar.

Complete website update by 2013.



Tools such as the www.CHNEP.org website and *Harbor Happenings* magazine are critical to communicating to the Management Conference and to the public.

SG-E

Offer grants to broaden participation of individuals and groups in implementing the CCMP.

Background

There are many talented and imaginative individuals and groups who are capable of developing projects that implement the CCMP.

Additional funding may make the difference whether these groups are able to make their ideas reality. Grants also help increase understanding of the CCMP.

This priority action helps fulfill SG-1.

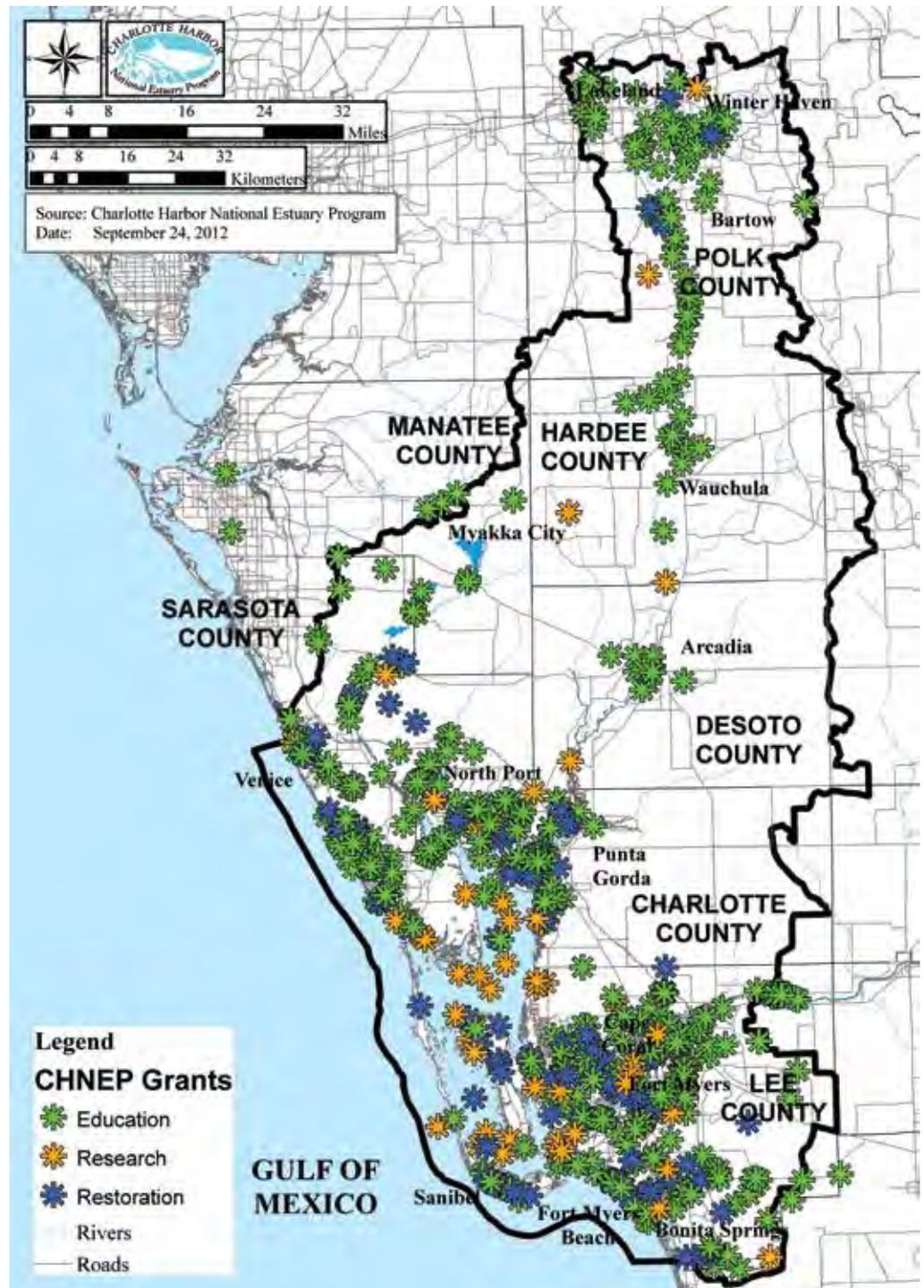
Strategy

- 1) Develop grant programs through the CHNEP budgeting process.
- 2) Increase awareness of available grants offered by the CHNEP and partners to those who could help implement the CCMP.
- 3) Provide assistance to those who request grant-writing guidance and letters of support.

Performance target

Grants that implement the plan completed annually.

Implement 50 grants annually.



Map 36: Grant Awards

Distribution of CHNEP grants geared to public information and education, research and restoration from 1996–2012.

SG-F

Provide events that involve people in the stewardship of their local natural resources and opportunities to connect them to their watershed.

Background

Events provide specialized family-friendly, fun and hands-on learning experiences. They connect the public to a concentration of resources and groups. A well-publicized event is effective at providing information and at showcasing partners' programs. Conferences help communities solve local problems and scientists communicate their recent findings. Professional development workshops sponsored by the CHNEP help its partners in their efforts to protect the natural environment and fulfill the program management plan. Opportunities for people to experience the natural environment are critical to connect them to their watershed and highlight the importance of these resources.

This priority action helps fulfill SG-1.

Strategy

- 1) Partner with select festivals and events.
- 2) Participate in continuing education outlets such as the Charlotte County Cultural Center.

- 3) Host professional development and public workshops, seminars, summits and conferences.
- 4) Financially support hands-on education.
- 5) Offer multiple opportunities throughout the year to celebrate National Estuaries Days and other designated days.
- 6) Determine effectiveness of events using tools such as exit surveys, interviews and other means.
- 7) Offer multiple and varied opportunities for people to experience the study area's ecosystems.

Performance target

Number of events hosted by CHNEP and its partners annually.

Complete 30 events annually.



Photo by Lisa Beever,

CAC Chair Deb Highsmith working the crowd at the 2004 Charlotte Harbor Nature Festival.

SG-G

Implement target audience programs.

Background

Not everyone can be reached using a one-message-fits-all approach, requiring specific efforts to reach targeted audiences with a message delivered in a way that is appropriate for that audience. The CHNEP Education Strategy, developed in 1999, listed the following as targets for individualized treatment:

- Business and Industry: Mining, Agriculture, Developers and Real Estate Professionals, Hotel and Tourism, Marine Trades/Fisheries, Recreation and Transportation
- Government Agencies and Elected Officials
- Education
- Clubs, Organizations and Associations
- Media

In 2011, the CHNEP adopted a Strategic Communication Plan.

This priority action helps fulfill SG-1.

Strategy

- 1) Survey Management Conference on strategic target audiences.
- 2) Determine strategic target audiences that will provide the greatest value in implementing our CCMP.
- 3) Identify leaders within or affecting the strategic target audiences.
- 4) Define the purpose of reaching that target audience, such as change behavior, increase understanding or provide information to others.
- 5) Develop, implement and evaluate plans to reach strategic target audiences.
- 6) Develop mechanisms to reach strategic target audiences in a cost-effective way.

Performance target

Number of target audiences identified and addressed annually.

Reach at least five new audiences annually.



Photo by Maran Hilgendorf, 12/10/04

Hotel industry representatives saw different ecotour sites over the course of several months to engage their industry in environmental protection.



Background

The region is rich in programs that provide informal and formal education. Informal education is provided by many, including:

- Site-based nonprofit organizations found throughout the region, such as Explorations V.
- Citizens organizations, such as Estero Bay Buddies.
- Government agencies, including parks such as Paynes Creek State Historic Site, Lemon Bay Park and Cape Coral Rotary Park.

Formal education is just as diverse. For students in K–12, each county and a Virtual School have their own school district that implements academic plans based on Next Generation Sunshine State Standards and grade level expectations, with guidance provided by the Florida Department of Education. As of the 2004–5 school year, there were approximately 170,000 students in 170 K–12 public schools, and 31,000 students in 200 private schools in the CHNEP study area. Statewide, more than 50,000 students are homeschooled. State-assisted colleges based in the region include New College of Florida, Florida Gulf Coast University, Edison College, Manatee College, Polk State College and South Florida State College. Many private colleges are also based in the region.

This priority action helps fulfill SG-1.

Strategy

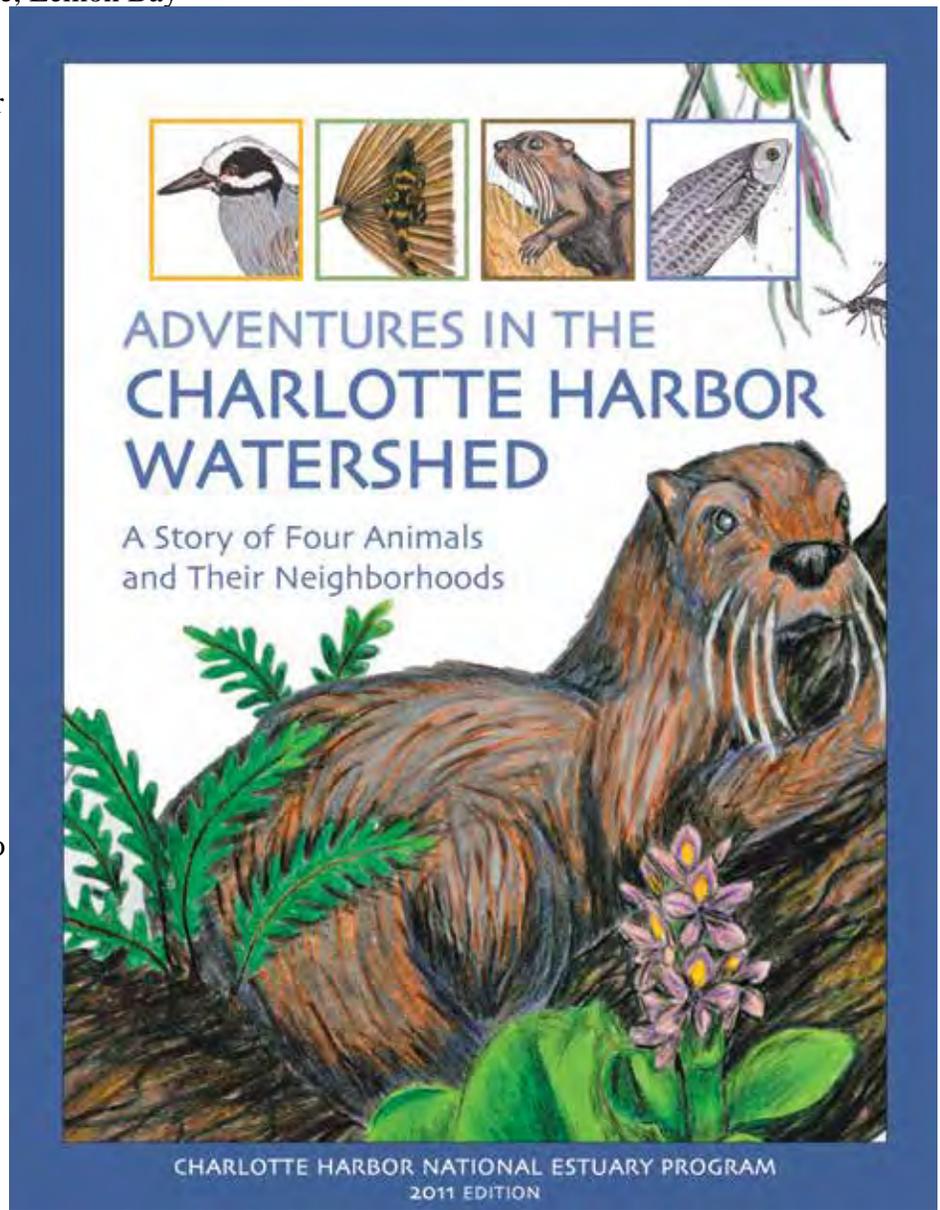
- 1) Inventory and evaluate estuary and watershed protection educational curricula offered.
- 2) Identify problems in existing curricula and recommend improvements, including filling gaps.
- 3) Enhance programs by supplying materials (posters, videos, curricula) and offering grants.

- 4) Promote educational programs to increase participation.

Performance target

Number of curricula where estuary and watershed topics are included.

Complete two new curricula enhancements annually.



CHNEP produces Adventures in the Charlotte Harbor Watershed: A Story of Four Animals and Their Neighborhoods, which is tailored to the study area. This book is distributed to every child in one age group in the public school system, homeschool associations and private schools.

SG-I

Conduct new resident programs to inform and encourage environmental stewardship.

Background

As the population of the CHNEP study area continues to grow, it is increasingly important to educate residents about the fragility of their new natural environment and promote a sense of stewardship. By focusing on new residents, materials presented will be meaningful to all residents.

New resident packages have been developed by those partners that include printed material available from those concerned with the health of the natural environment. The CHNEP provided support of these packets and developed a new resident guide that summarizes information in many publications by numerous sources.

This priority action helps fulfill SG-1.

Strategy

- 1) Review existing new resident packets and citizens guides for continued relevance.
- 2) Make new resident materials and programs available in a variety of ways. Distribution locations may include utilities, libraries, parks, chambers of commerce, county extension, government administrative offices, car and boat registration departments and local civic and business organizations.
- 3) Increase public awareness regarding environmental laws, violations and impacts to resources.



Photo by Maran Hilgendorf, 4/26/04

Demonstration gardens in high-growth areas, such as the Cape Coral Historical Museum garden, reach new residents.

Performance target

Number of new resident programs offered annually.

Complete new resident programs in each county annually.



SG-J

Identify and showcase accomplishments and excellent examples of research findings, restoration, legislative changes and outreach successes using a variety of methods.

Background

The vision of the CCMP is rooted in sound science and measured results. Implementation of the CCMP is only successful if results are clearly communicated and put to use by public officials, educators and private citizens. Scientific findings lead to sound decision making by legislators and other public officials. Sharing effective public outreach methods increases environmental knowledge and awareness exponentially across partner networks. Showcasing the CHNEP project results is essential for continued legislative and public support of the CHNEP and highlights excellent examples for partner consideration.

This priority action helps fulfill SG-1 and SG-2.

Strategy

- 1) Network with other National Estuary Programs and partners for effective ways to represent accomplishments.
- 2) Design current and fluid “accomplishment brochures” or “talking points” for legislators and elected officials.
- 3) Interview legislative staffers for the most effective way to communicate with them.
- 4) Produce videos, posters, publications, displays and other appropriate tools.
- 5) Showcase research, restoration and outreach results to the media with press releases and special publications.
- 6) Maintain databases of successes.

Performance target

Number of accomplishments showcased.

Showcase eight examples annually.



Photo by Maran Hilgendorf, 6/10/04

The Hardee County Outdoor Classroom EcoCamp is an outstanding example of environmental education and is showcased in a video designed for teachers.

SG-K

Present scientific information in a form readily understood by the majority of people.

Background

Scientific information is often hard to access and difficult to understand. It is imperative that scientific information be presented in ways meaningful to the majority of people, including decision-makers.

This priority action helps fulfill SG-4.

Strategy

- 1) Continue using CAC members to review scopes of work and findings of research projects to ensure clarity and applicability to the majority of people.
- 2) Assist scientists on methods to present their findings in a meaningful way to the public, such as

providing published guides and hosting workshops and presentations.

- 3) Use a variety of communication tools such as conceptual diagrams and models.
- 4) Through surveys, measure the success of this effort to provide meaningful scientific information to the public.

Performance target

The majority of people who receive CHNEP information understand scientific information presented by the CHNEP.

Additional communication tools are developed as needed so all CHNEP scientific information is understood.

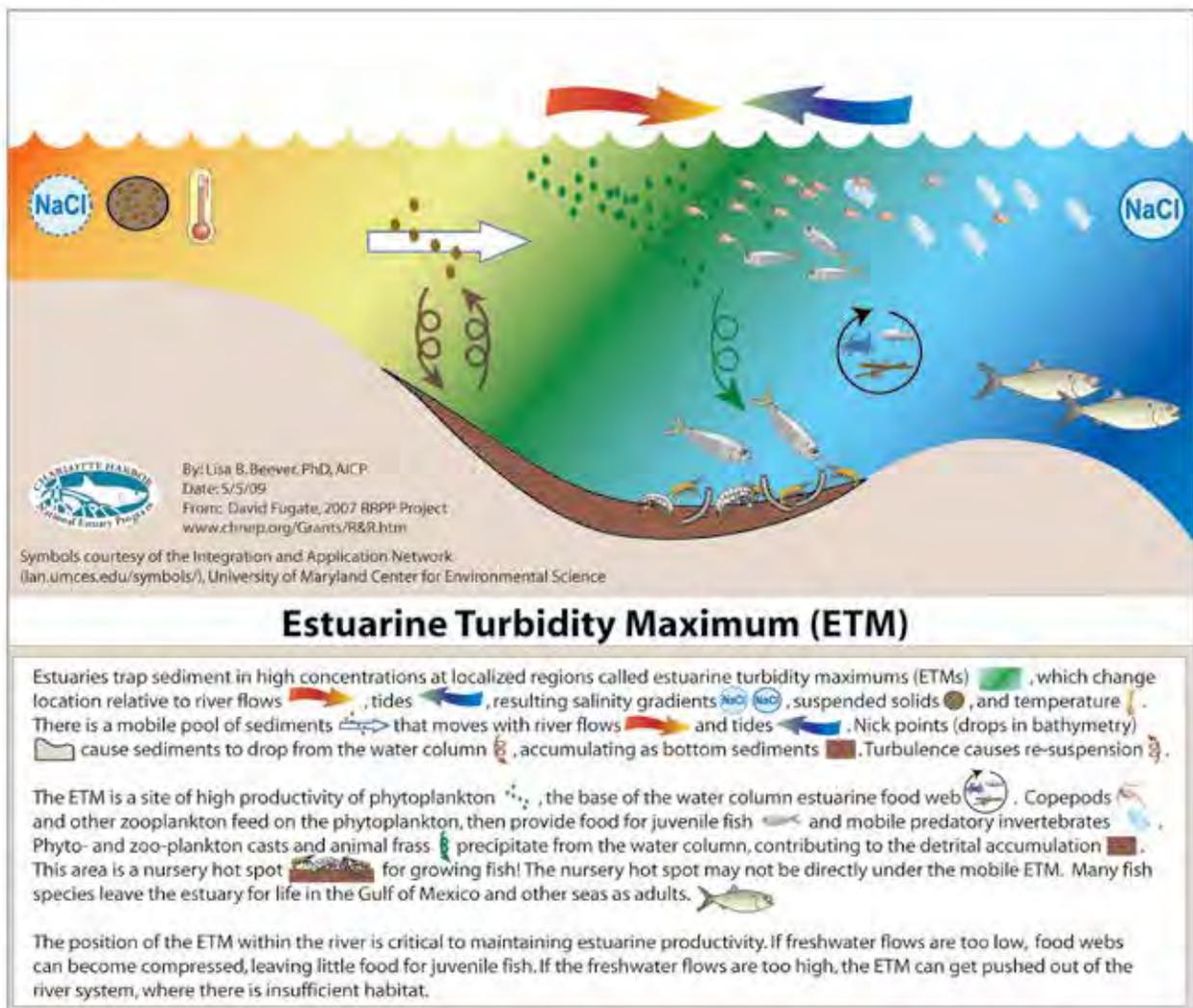


Figure 12: Estuarine Turbidity Maximum (ETM)

The conceptual diagram was prepared to describe the Estuarine Turbidity Maximum (ETM) to augment presentation of research conducted under CHNEP's Research and Restoration Partners Program.



Background

On December 7, 2001, the CHNEP Policy Committee unanimously adopted the motion to “become a spokesman for the Harbor and the water bodies in the natural system in the forums where decisions are being made and implementations are being undertaken.” Although special reference was made to minimum flows and levels (MFLs), total maximum daily loads (TMDLs) and the Comprehensive Everglades Restoration Plan (CERP) and its implications for the Caloosahatchee River, the overall goal was for “the CHNEP to assume the lead role in being the advocate for the Charlotte Harbor Ecosystem Complex and its watersheds.” The position further suggested that the Florida Department of Environmental Protection, the South Florida Water Management District and the Southwest Florida Water Management District “look to the CHNEP for guidance in setting goals for the CHNEP study area for their various programs currently under way.” With this guidance, the CHNEP adopted its *Advocacy and Review Procedures* on February 21, 2003. The aims of the CHNEP advocacy stance are:

- To implement the quantitative objectives and priority actions of the adopted *Comprehensive Conservation and Management Plan* (CCMP).
- To provide policymakers with a source of review and comment from an organization that represents the considered opinions of diverse interests.
- To provide a voice for natural systems within the CHNEP study area watersheds based on the best scientific information available.
- To facilitate citizen entry into the CHNEP Management Conference process.

It is important that the CHNEP be recognized as a resource to elected officials. Without insightful ordinances and sound legislation, no environmental initiative can succeed. A key component of effective communication must be advocacy. We must bring issues of relevance backed by sound science to the political fore. With informed leadership, our communities can be clean, safe and compatible for humans and the wildlife that make Florida the home sought by so many.

We are succeeding in closing stewardship gaps if we are building strong citizen advocates. We are succeeding if our elected officials look to the CHNEP as a resource.

This priority action helps fulfill SG-2.

Strategy

- 1) Utilize all CHNEP committees and subcommittees as a vehicle to identify issues requiring the attention of the Management Conference.
- 2) Provide opportunities to reveal all aspects of an issue in the context of the best available science.
- 3) Craft correspondence and presentations pursuant to the procedures.
- 4) Amend the procedures as needed to serve the Management Conference.
- 5) Review pending 404 permit applications, policies and rule making regarding development of headwater tributaries.
- 6) Recognize water reservations as a tool to protect fish and wildlife; promote this tool to decision-makers, their staff and public.
- 7) Advocate the continued ability to set water reservations under state statutes.
- 8) Establish water reservations for the Caloosahatchee estuary and Estero Bay. Include the Caloosahatchee estuary and Estero Bay as a legal source user for environmental purposes.

Performance target

Changes in public policy based on communications from the CHNEP.

Eighty percent success rate, annually.

SG-M

Vigorously pursue the *Long Range Funding Strategy* and funding mechanisms to implement watershed and estuary protection.

Background

Six themes were identified in the 2000 CCMP to direct funding toward its implementation:

- Maintain existing levels of expenditures for programs making cost-effective contributions to restoration goals.
- Evaluate programs that fall short of these aims and investigate opportunities to redirect resources to accomplish more with public dollars.
- Aggressively pursue state and federal funding assistance for watershed management.
- Promote public-private partnerships with the potential for real economic and natural resource benefits.
- Support local option taxes, when deemed essential for the implementation of action plans.
- Pursue new funding sources beyond those described above only if strategies fail to achieve adequate progress toward management and implementation.

The *Long Range Funding Strategy*, adopted in 2004, outlines the status of the six themes and identifies core services provided through the CHNEP, partner commitments, funding and resource needs, as well as funding strategies.

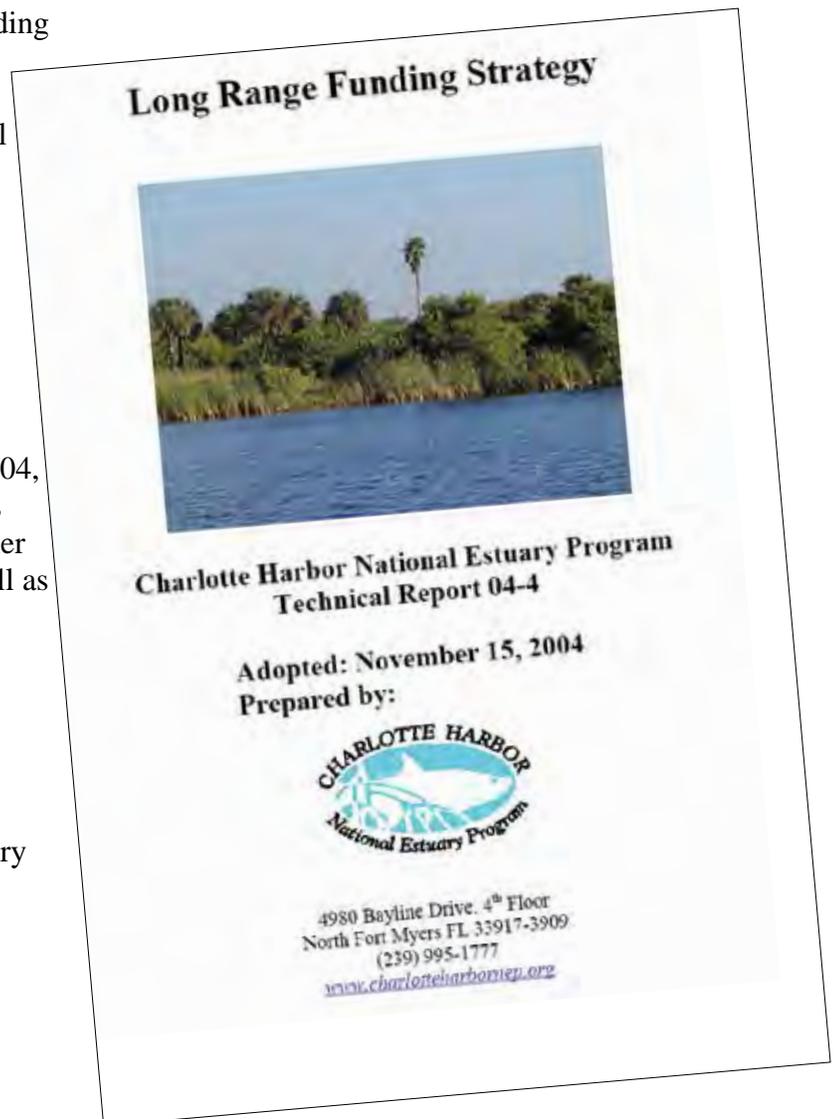
This priority action helps fulfill SG-2.

Strategy

- 1) Implement the *Long Range Funding Strategy*.
- 2) Enter into an agreement with CHNEP signatory partners that outlines general implementation commitments, funding goals and funding commitments. Consider equitable allocations among partners.
- 3) Identify top-priority needs to pursue for each CHNEP study area watershed.
- 4) Investigate new funding sources to fund environmental projects.
- 5) Facilitate discussions of funding mechanisms to implement CCMP actions.
- 6) Advocate the creation of competitive grant programs for CCMP action.

Performance target

Continued annual funding of the CHNEP, sufficient to make progress toward implementing the CCMP.



The *Long Range Funding Strategy* was adopted by the CHNEP on November 15, 2004. It outlines concepts and recommendations regarding resources to implement the CCMP.



SG-N

Update comprehensive inventories of research, restoration, legislative and outreach needs.

Background

In order to implement the *Comprehensive Conservation and Management Plan* adopted in 2000, the CHNEP developed a database to track research, restoration, legislative and outreach needs and implemented projects. By highlighting and prioritizing these needs, Management Conference-wide attention resulted in cost-effective implementation of many of the most critical watershed and estuary needs. This mechanism has become a core implementation action to achieve all quantifiable objectives.

This priority action helps fulfill SG-2.

Strategy

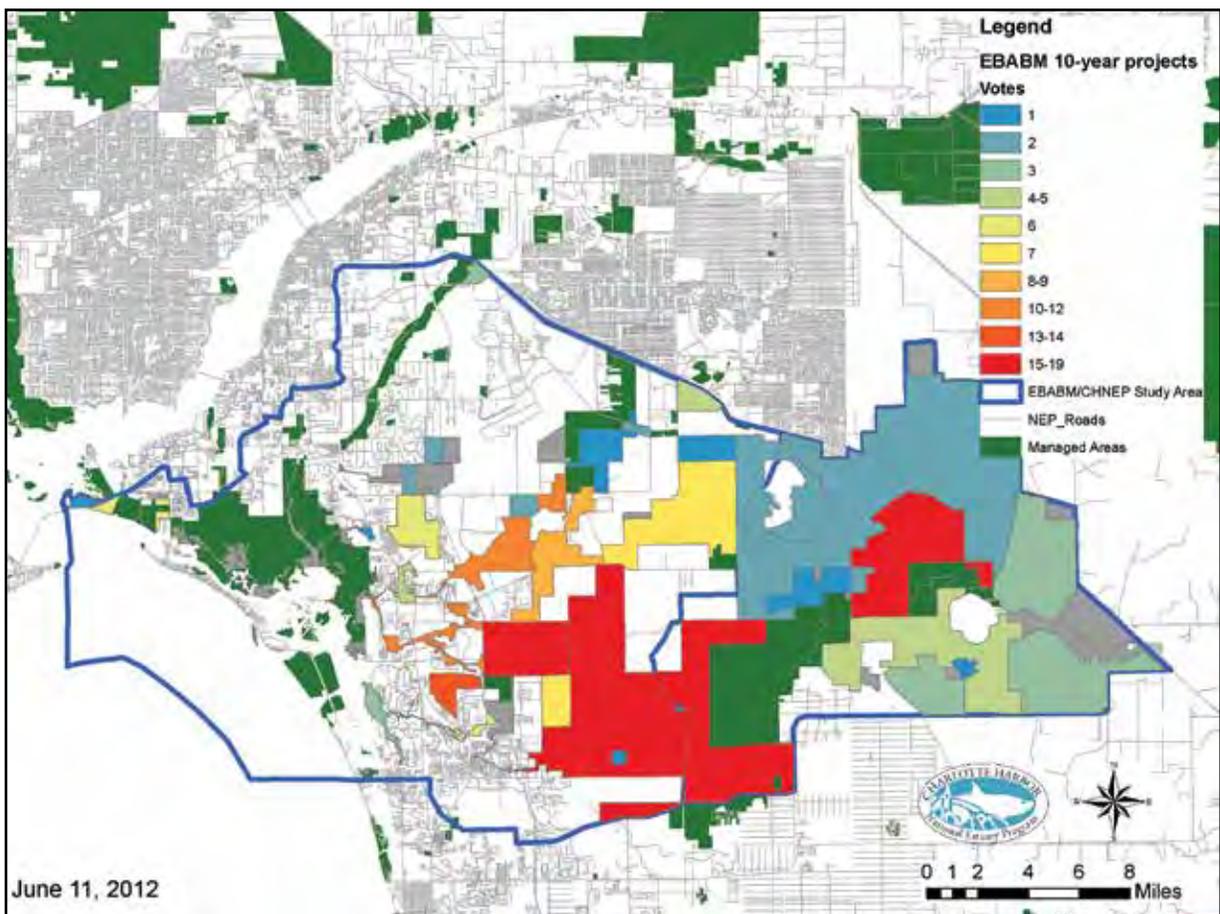
- 1) Participate in the development of watershed plan development such as the Southwest Florida Regional Restoration Plan, Estero Bay 10-year

Restoration Plan and the Peace Creek Basin Area Management Plan. These efforts will serve to use local stakeholders to identify and prioritize restoration needs.

- 2) Publish restoration needs and other geographic information to the Internet.
- 3) Publish database information to the Internet.
- 4) Publish needs in the form of technical reports for the purposes of disseminating the information.

Performance target

Update of restoration and research needs inventories by 2018.



Map 37: Estero Bay Watershed Restoration Projects

CHNEP assisted the Estero Bay Agency on Bay Management to update and prioritize projects within its 10-year restoration plan. The highest priority projects are in red.

SG-O

Create incentives to protect desired ecosystem resources.

Background

It has been argued that the traditional regulatory approaches have failed to protect desired ecosystem resources. In response, there has been a call for the use of incentives to complement this regulatory approach. Conservation policy for private lands could be improved by relying on a combination of incentives, including financial incentives and assurances, rather than exclusively on regulation. Trade-offs may include incentives for increased densities and the addition of other uses that may require zoning changes to protect ecosystems of higher value.

This priority action helps fulfill SG-2.

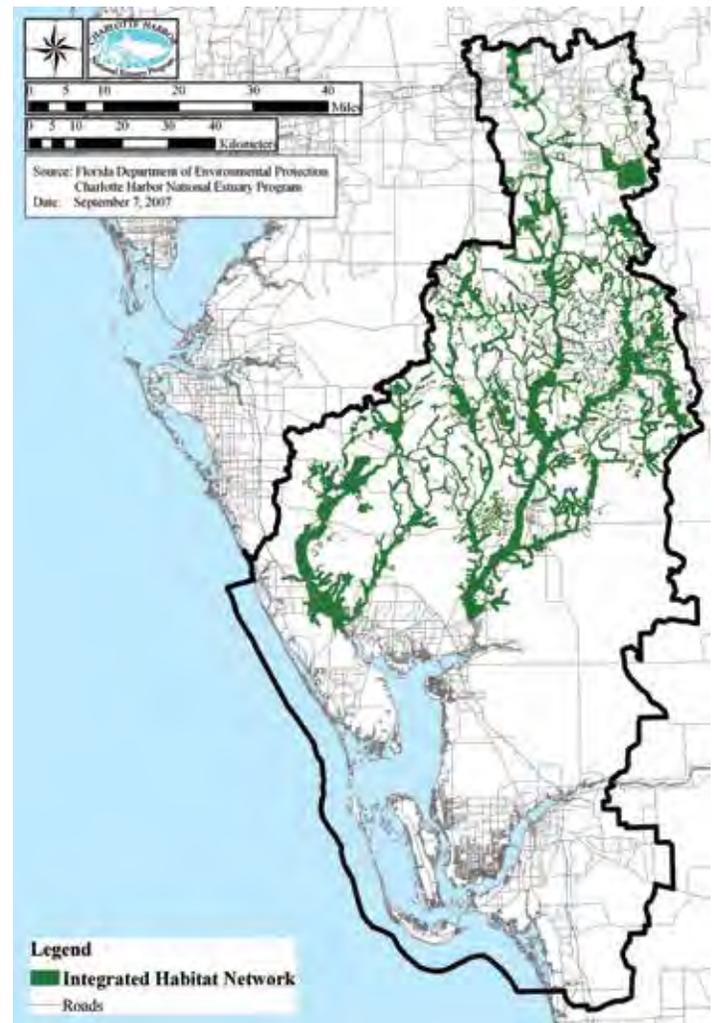
Strategy

- 1) Prepare a business-oriented presentation and pamphlet to offer to chambers of commerce that catalog ways in which protection of natural resources can make them money. Use www.envirovaluation.org/ and the *Ecological Economics* journal as resources.
- 2) Inventory alternative incentives that have been used by governments to protect desired ecosystem resources and post at www.CHNEP.org.
- 3) Provide incentives to direct development away from the 100-year floodplain, review Florida's Uniform Mitigation Assessment Methodology (wetlands) to determine whether preservation of the floodplain would serve as appropriate mitigation offset for development activities, as identified in the *Peace River Resource Management Plan*.
- 4) Identify situations where sensitive habitats are not protected by the existing zoning and subdivision laws and consider implementing incentives for activities that protect these areas. For example, maintenance of allowable density on a parcel where a developer agrees to preserve a vegetated shoreline buffer that exceeds the legal requirement. The process may begin by reviewing the criteria and checklist accounting system developed by the American Planning Association.

Performance target

List incentives that have been implemented annually.

Data Source: 1992



Map 38: Integrated Habitat Network

The Florida Department of Environmental Protection's *A Regional Conceptual Plan for Florida's Southern Phosphate Region* features an Integrated Habitat Network (IHN). The Peace River 100-year floodplain is a part of the IHN.



SG-P

Incorporate into federal, state and local permits, and public works improved standard practices that better protect estuaries and watersheds.

Background

State and local permitting activities, such as the Environmental Resource Permitting Program and the federal Section 404 of the Clean Water Act, require permits for specific activities occurring in wetlands and other waters. In many areas there are also local permitting requirements for development and other activities. There are many standard practices that are incorporated into land development and infrastructure designs that have negative effects on the estuaries and their watersheds. A review of these practices is needed and could improve the effects of these activities.

This priority action helps fulfill SG-2.

Strategy

- 1) Identify types of activities and regional trends with permitted actions.
- 2) Determine effectiveness of permitting process (e.g., how well are the actions following 404(b)(1) guidelines of avoidance, minimization, etc.).
- 3) Determine areas for improvement based on current legislation and site-specific locations/needs.
- 4) Evaluate environmental resource permitting to determine whether enhanced permitting criteria, special watershed (basin) rules or other regulatory strategies should be implemented to minimize cumulative impacts more effectively, as identified in the *Peace River Resource Management Plan*.
- 5) Evaluate combining Environmental Resource Permit and Conceptual Reclamation Plan approval into single phosphate mining authorization, as identified through the *Peace River Resource Management Plan*.
- 6) Identify local and regional activities (i.e., ordinances, best management practices, etc.) that could support federal and state programs.
- 7) Identify specific practices for each general type of permit activity that could protect the estuaries and watershed.
- 8) Develop standard practices that could be incorporated into land development and infrastructure design, leading to better local environmental results.

9) Pursuant to EPA's *Protecting Water Resources With Smart Growth*:

- Encourage development in strategic areas to ensure that preservation areas and development areas sustain the estuary. Redevelopment is a priority over development in new areas. Tie analyses to cumulative and secondary assessments.
- Modify regulations from process-driven to outcome-driven, link water (including water for the environment) to growth and tie performance approvals to needs at build-out.
- Regarding site planning, emphasize water storage over water discharge, green infrastructure over constructs, off-site mitigation for redevelopment and on-site mitigation for new development, and encourage mitigation projects to also be remediation projects.
- Maximize the use of existing impervious surface and encourage 15 percent or less impervious surface for new development.
- Encourage adoption of local ordinances for stormwater management and quality, water conservation, conservation landscaping and waterway protection.
- Coordinate funding strategies among state, regional and local levels to promote concentrated urban areas, recognize full environmental mitigation as a public works cost, and update funding sources as the need for complexity of infrastructure increases.
- Incorporate watershed and green models into professional certification and provide examples/ models of good development, codes, financing strategies, etc.

Performance target

Adoption of new standards in permits and standard practices.

One adopted improvement annually.

SG-Q

Build capacity for communities and their local leadership to mitigate and adapt to the effects of climate change through joint efforts.

Background

The climate is changing. It has been changing since the formation of the atmosphere and the presence of water as vapor, liquid and ice on the surface of the Earth. In the past 100 years, average air temperatures have increased, the number of days in the year over 90°F have increased, rainfall delivered in the rainy season has increased, rainfall delivered in the dry season has decreased and sea level has risen about 8 inches. Since 1965, sea level has risen at the Fort Myers gage by one inch per decade. In addition, salt marshes and seagrass beds have migrated landward by approximately 100 yards since 1950.

Charlotte Harbor was one of six original programs under EPA's Climate Ready Estuary (CRE) program. Working with its host agency, the Southwest Florida Regional Planning Council, the CHNEP has pioneered development of citywide climate change adaptation plans based on public participation and developed other climate change planning tools pursuant to the 2008 CCMP.

This priority action helps fulfill SG-2.

Strategy

- 1) Continue providing assistance to communities to develop coastal ecosystem resiliency and adaptation plans.
 - 2) Continue to assess ecosystem changes as a result of climate change and develop methods to assist natural systems respond to the changes.
 - 3) Seek assistance from EPA's Office of Atmospheric Programs (OAP), Climate Change Division (CCD), to assess vulnerabilities to climate changes and integrating information on climate science, impacts and adaptation. CCD is looking to support application of those tools, particularly in coastal communities.
 - 4) Continue enhancements to the CHNEP Climate Ready Estuary program to educate, communicate and mitigate climate change and air pollution.
 - 5) Work with partners to implement the following methods to improve coastal ecosystem resilience:
 - a. Maintain the existing habitat migration corridors that have been established on Cape Haze, Eastern Charlotte Harbor shoreline, and Estero Bay Buffer.
 - b. Identify the highest priority habitat migration corridors so they can protect these areas from future development, followed by acquisition of inland buffer zones to provide an opportunity for habitats and wildlife to migrate inland.
 - c. Support restoration of existing coastal habitats by removal of exotic vegetation, removal of barriers to tidal connection and degradation of exotic dominated adjacent uplands .
 - d. Discourage or stop shoreline hardening, including seawalls, bulkheads, riprap, and "living shorelines" backed by riprap.
 - e. Reengineer existing vertical shoreline infrastructure to a sloped soil-based shoreline with GeoWeb or other permeable stabilization.
 - f. Restore impaired water flows to enhance sediment supply for coastal wetland deposition.
 - g. Elevate roadway berms by bridging and culverting or abandon coastal road corridors with associated beamed roadbeds.
 - h. Backfill mosquito control ditches to reduce depth and sediment loss.
 - i. Backfill borrow pits, agricultural pits and spreader waterways to allow coastal wetland establishment and migration corridors.
 - j. Sediment-slurry addition to assist in marsh building processes.
- 6) Follow the suggestions from www.epa.gov/oppt/greenmeetings/, including increasing conference calls, video conferencing and other remote participation methods when available.
 - 7) Work with hotel industry to gain green lodging certification (www.dep.state.fl.us/greenlodging/) by the state of Florida.

Environmental indicator and target

FW-c: Mangrove, salt marsh and freshwater wetland acreage.

60,000 acres of mangrove, 12,000 acres of salt marsh and 325,000 acres of freshwater wetland.



Source: Southwest Florida Regional Planning Council
Charlotte Harbor National Estuary Program
Date: September 3, 2008

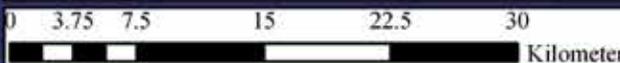
Potential sea level rise to the year 2200 based on 95 percent cumulative probability (Titus and Narayanan 1995)

Legend

Potential Sea Level Rise

Underlying Land Uses

-  Tidal Wetlands
-  Nontidal Wetlands
-  Upland Conservation
-  Urban
-  Land Above 10'
-  Roads



Map 39: Potential Sea Level Rise and Underlying Land Uses



SG-R

Track and present monitoring data according to CHNEP-adopted environmental indicator targets.

Background

Subsequent to the 1993 U.S. Government Performance and Results Act (GPRA), government agencies are required to develop performance reports that measure management success using indicators and goals.

According to U.S. Environmental Protection Agency 2000 Evaluation Guidelines for Ecological Indicators, 15 evaluation guidelines for developing environmental indicators include the following:

- Relevance to the assessment.
- Temporal variability across years.
- Discriminatory ability.
- Linkage to management action.

Examples of indicators of ecological condition include direct measurements (e.g., total nitrogen concentration), indices (e.g., macroinvertebrate condition index) and multimetrics (e.g., fish assemblage).

The CHNEP developed a series of environmental indicators and targets that was approved by the Management Conference in 2005. Knowledge, monitoring and reporting gaps regarding the approved indicators were identified and will need to be addressed so that the CHNEP can track environmental changes and success and failures regarding management practices and land-use changes. These indicators and targets will also need refinement as the state of science advances and knowledge gaps are filled.

This priority action helps fulfill SG-3.

Strategy

- 1) Update the *Charlotte Harbor 7-County Watershed Report* by 2015.
- 2) Maintain and enhance the CHNEP Water Atlas at www.chnep.wateratlas.usf.edu.
- 3) Work with both water management districts to conduct uniform biennial seagrass mapping.
- 4) Improve the Sarasota County predevelopment vegetation map to conform with improved methods applied in the Peace River basin and by CHNEP.

- 5) Develop improved mapping of mangrove systems by type, similar to salt marsh mapping conducted in 2012.
- 6) Update prop scar maps every 10 years.

Performance target

Monitoring programs including water quality testing, flow gaging and mapping.

Maintain existing routine programs and enhance public accessibility of analysis.



Citizen volunteers Frost, Davis, Holtz and Park test water quality samples early in the morning.

Photo by Judy Ott, FDEP



SG-S

Post raw data, geographic information system (GIS) and technical analysis on the Internet under the data management strategy.

Background

A data management strategy is a required element of each National Estuary Program. The purpose of these activities is to provide technical information that is available, facilitate the exchange of information among different organizations and support efforts for the analysis of scientific information. The interested public, engineers, managers and scientists desire relevant resource information in a timely and easy-to-use manner. Government agencies may be capable of reducing overlapping data acquisition efforts and filling in data gaps without significantly increasing budgets and personnel if they are aware of efforts outside their individual organizations. Providing timely information by maximizing the existing systems is the goal of a coordinated information management, analysis and exchange process.

This priority action helps fulfill SG-3.

Strategy

- 1) Maintain and enhance data, analysis, mapping and other information capabilities on the CHNEP Water Atlas.

- 2) Develop automated water quality status and trends analysis capabilities. Post a triennial assessment of water quality status and trends so that partners may have citation abilities.
- 3) Create pages for each volunteer monitoring program, similar to the Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network (CHEVWQMN) and Cape Coral Canalwatch.
- 4) Post all CHNEP-created geographic information system (GIS) files on the Water Atlas for citizen mapping and technician download.
- 5) Work with partners to ensure that all suitable water quality data are posted to the state's water quality database, named STORET, in a timely fashion.

Performance target

Data on the Water Atlas are as current as available.

Partners data uploaded to STORET at least annually. Additional volunteer data uploaded to the water atlas at least quarterly.

Water Resource	Recent Sample	Historical Comparison
Sarasota Bay near Saprito Pier	Temperature, water 86.50 °F 1 hour ago	Temperature, water 80.76 °F Average for September
	Chlorophyll a, corrected	Chlorophyll a, corrected

Maps, data, analysis and information are served at www.chnep.wateratlas.usf.edu.



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Glossary

algae—a group of small aquatic plants; occur as one-celled, filaments or colonial; having no true root, stem or leaf; the base of the aquatic food chain.

algae bloom—a heavy growth of algae in a body of water; blooms commonly caused by high concentrations of nutrients in the water column.

anoxic—a condition of no oxygen in a water body or in soil.

anthropogenic—resulting from human activities.

aquifer—a water-storing underground geologic formation.

atmospheric deposition—the transfer of pollutants and nutrients suspended in the air to the ground or open water; deposition commonly metals and compounds of nitrogen and sulfur.

beach renourishment—the process of pumping sand onto eroded beaches; material for this process commonly taken from channels and offshore resources.

beneficiation—an industrial process to transform phosphate pebble (rock) into commercially marketable phosphate; the process is an energy-intensive activity.

benthic—referring to the bottom of a body of water.

best management practices (BMPs)—a practice or combination of practices that provide the most effective and practicable means of controlling point and nonpoint pollutants at levels compatible with environmental quality goals.

biochemical oxygen demand (BOD)—the quantity of oxygen demand present in a sample as measured by a specific test; a major objective of conventional wastewater treatment is to reduce the BOD so the oxygen content of the water body will not be significantly reduced; although BOD is not a specific compound, it is defined as a conventional pollutant under the federal Clean Water Act.

biodiversity—a network of composition, structure and function of a given system that encompasses the natural biological wealth of organisms.

brackish—water with salinity common to estuaries; this condition has a salinity concentration between fresh and marine.

carnivore—flesh-eating organism.

coliform bacteria—a type of bacterium that in high concentrations indicates a polluted water body; this type occurs in animal feces.

deep-well injection—a process whereby a liquid, usually treated water or wastewater, is pumped underground.

detritus—small particles of rock, sand and/or dead organic and disintegrating vegetation.

development—residential, commercial, industrial and agricultural land uses.

dredge spoil—sand and/or mud removed from the bottom of a water body after dredging.

ecosystem—a system formed by the interaction of a community of organisms with their environment.

effluent—water released into the environment; commonly from wastewater treatment processes or industrial processing.

epiphytes—a plant growing on, but not parasitic on, another organism; epiphytes are a general classification of algae commonly attached to seagrasses.

estuary—a tidally influenced ecological system where rivers meet the sea and fresh water mixes with salt water.

eutrophic—a water quality condition typified by high productivity and nutrient inputs, with periods of oxygen deficiency from algae decomposition; this condition can be accelerated by pollution.

exotic species—a plant or animal species not native to an ecosystem.

fauna—animals of a region.

flora—plants of a region.

ground water—water stored in underground geologic formations; replenished from surface infiltration.

habitat—the specific place or environment where a particular plant or animal lives; an organism habitat must provide all the basic requirements for life and should be free of harmful contaminants.

hypoxia—a condition of low dissolved oxygen in the water; hypoxia typically indicates less than or equal to two milligrams of oxygen per liter.



inlet—a short, narrow waterway connecting a bay or lagoon with the sea.

intertidal—the area of bay bottom and adjacent wetlands that is alternately covered with water and then exposed due to the rise and fall of tide waters.

littoral drift—the parallel movement of suspended sand along the beach that is caused by longshore currents.

mangrove—a salt-tolerant, subtropical tree found in estuarine and marine environments; mangrove leaves are an integral part of the food web.

nonpoint-source pollution—pollution from no specific source; this type of pollution is generally from surface water, ground water or rainwater coming in contact with contaminants on the land or air such as pesticides, herbicides, fertilizers, animal waste, gasoline, vehicle exhaust, power plant emissions and liquid waste from failing household septic systems; this source of pollution is difficult to measure.

nutrients—any substance required by organisms for normal growth and maintenance; mineral nutrients usually refer to inorganic substances derived from soil and water; excessive amounts of nutrients, including nitrogen and phosphorus, may result in excessive growth of algae, leading to oxygen depletion and water quality degradation.

photosynthesis—the synthesis of organic matter from inorganic substrates using light as a source of energy.

plankton—passively floating or weakly motile microscopic plant and animal life; refers to various species of plants and animals at or near the base of the aquatic food chain.

plat—a map, drawn to scale, showing the divisions of a piece of land. The act of platting divides land areas under a single ownership in order to sell it to different owners.

point-source pollution—pollution from a specific source such as a stormwater pipe, wastewater plant discharge or industrial discharge; easier to quantify this source.

red tide—characterized by an above-average concentration of the toxic phytoplankton *Karenia brevis*; red tide causes fish and manatee mortality and shellfish contamination; process thought to be linked to high freshwater flows and nutrients in marine waters.

rookery—the breeding or nursery ground of birds or mammals.

runoff—the portion of precipitation on the land that reaches a water body.

salinity—a measure of the dissolved salts in a water body, especially of sodium, magnesium and potassium.

salt flat—a tidal area where seawater evaporates and salt concentrates.

salt marsh—coastal ecosystems with communities of salt-tolerant plants occupying intertidal zones that are at least occasionally inundated with salt water; refers to a type of marsh that exists at interface of land and marine waters.

saltwater intrusion—a process of high salinity ground water moving inland and mixing with low salinity ground water; intrusion commonly results from overpumping groundwater resources.

SAV—abbreviation for “submerged aquatic vegetation,” including seagrasses and other submerged aquatic vegetation.

seagrass—extremely productive flowering vascular marine plants found in estuaries and shallow open shelves off the coast; seagrass provides habitat for numerous fishes and invertebrates; turtle grass, manatee grass and shoal grass are three common species existing in Florida.

seawall—a wall or embankment constructed along a shore to reduce erosion from wave action; the structure greatly reduces tidal habitat.

septic system—a system of tanks and porous pipes in which wastewater is treated by aerobic and anaerobic bacterial decomposition in the surrounding soil; septic systems are a common source of pollution to surface and ground water if not functioning properly.

stormwater runoff—water from rain, often carrying oils, nutrients, sediments, trash, dissolved metals and other pollutants; storm water is a major source of pollution to rivers, lakes and estuarine waters.

tide—periodic rising and falling of the oceans resulting from lunar and solar forces acting upon the rotating earth; tide action strongly influences marine and estuarine plants, animals and bottom configuration.

tributary—a body of water that empties into a larger body of water.

trophic state—the nutritional status of a particular

body of water; nitrogen and phosphorus, the principal waterborne nutrients, commonly influence the trophic state.

turbidity—a measurement of water clarity; caused by a suspension of fine solids and microscopic organisms, particularly algae.

uplands—terrestrial areas above the influence of tide waters.

urban—residential, commercial and industrial land uses that can be characterized as classically urban and suburban densities.

urbanization—the conversion of low-density open spaces to high-density human development such

as houses or shopping malls; process decreases the volume of groundwater infiltration and increases stormwater runoff.

watershed—a drainage area or basin in which all surface waters resulting from precipitation or ground water drains toward a central collector such as a stream, river or lake at a lower elevation.

wetland—an ecosystem defined by specific plant, soil and hydrologic characteristics; plants in wetlands are adapted to tolerate wet conditions.

zooplankton—microscopic animals that float freely in water, graze on detritus particles, bacteria and algae, and may be consumed by fish.

List of Abbreviations

ACOE	U.S. Army Corps of Engineers	FLUCCS	Florida Land Use Code and Classification System
BMAP	Basin Management Action Plan		
CAC	Citizens Advisory Committee	FWC	Florida Fish and Wildlife Conservation Commission
CCHMN	Coastal Charlotte Harbor Monitoring Network	HAS	Hydrologic Alterations Subcommittee
CCMP	<i>Comprehensive Conservation and Management Plan</i>	HCS	Habitat Conservation Subcommittee
CH RAMP	Charlotte Harbor Regional Ambient Monitoring Program	HUD	Housing and Urban Development
CHEVWQMN	Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network	NEP	National Estuary Program
CHNEP	Charlotte Harbor National Estuary Program	NMFS	National Marine Fisheries Service
DOT	Department of Transportation, Florida or United States	NOAA	National Oceanic and Atmospheric Administration
EPA	U.S. Environmental Protection Agency	TAC	Technical Advisory Committee
FDEP	Florida Department of Environmental Protection	TMDL	Total Maximum Daily Loads
FEMA	Federal Emergency Management Administration	TSI	Trophic State Index
		USFWS	United States Fish and Wildlife Service
		USGS	U.S. Geological Survey
		WQQOS	Water Quality Quantifiable Objectives Subcommittee



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Notes



<p>WQ-1: Maintain or improve water quality from year 2000 levels. By 2018, bring all impaired water bodies into a watershed management program such as reasonable assurance or basin management action plan. By 2015, remove at least two water bodies from the impaired list by improving water quality.</p>	<p>WQ-2: By 2020, develop and meet water quality criteria that are protective of living resources for dissolved oxygen, nutrients, chlorophyll <i>a</i>, turbidity, salinity and other constituents.</p>	<p>WQ-3: By 2025, reduce severity, extent, duration and frequency of harmful algal blooms (HABs), including macroalgae, phytoplankton and periphyton, through the identification and reduction of anthropogenic influences.</p>	<p>WQ-4: By 2025, meet shellfish harvesting standards year round for the Myakka River conditionally restricted area and the conditionally approved areas of Lemon Bay, Gasparilla Sound, Myakka River, Pine Island Sound.</p>
<p>A: Participate in the development and implementation of coordinated watershed management programs that accommodate the variable missions and funding priorities of program participants. Encourage the application of flexible, goal-oriented approaches in reasonable assurance plans, basin management action plans (BMAPs), <i>Implementation Guidance for the Fecal Coliform Total Daily Maximum Loads</i> and nutrient reduction plans.</p> <p>B: Continue collecting consistent water quality data from throughout the study area used to assess impairments, determine TMDL limits and develop BMAPs. Support key programs such as the CCHMIN, partners' long-term fixed stations and volunteer monitoring programs.</p> <p>C: Use tools such as geographic information systems, integrated ground and surface water quality models and pollutant loading models to identify water quality problems and select less polluting alternatives.</p> <p>D: Reduce nonpoint-source pollutants associated with stormwater runoff. Install or retrofit BMPs to maintain or improve water quality and flows.</p> <p>E: Implement projects to improve or protect water quality to offset anthropogenic impacts.</p> <p>F: Promote water conservation, stormwater treatment and intergovernmental coordination within local plans and codes to prevent the impacts of increasing levels of impervious surface and fill to achieve improvements to water quality and groundwater and surface water storage.</p> <p>K: Implement conservation landscaping plant programs, including the Florida Yards & Neighborhoods program, throughout the CHNEP study area.</p> <p>L: Increase the use of personal and home best management practices by residents and visitors throughout the watershed to reduce nonpoint-source pollution.</p> <p>M: Support public involvement programs addressing water quality issues.</p>	<p>G: Develop and implement water quality criteria that are protective of living resources for dissolved oxygen, nutrients, chlorophyll <i>a</i>, turbidity, salinity and other constituents as applicable.</p> <p>H: Assess the bacteria, nutrient load and base flow impacts of septic systems, wastewater treatment plants and reuse water. Recommend effective corrective action.</p> <p>M: Support public involvement programs addressing water quality issues.</p>	<p>I: Determine the relationship between macro- and micronutrients and phytoplankton/algal blooms. Support measures to reduce phytoplankton/algal blooms where relationships have been determined.</p> <p>M: Support public involvement programs addressing water quality issues.</p>	<p>H: Assess the bacteria, nutrient load and base flow impacts of septic systems, wastewater treatment plants and reuse water. Recommend effective corrective action.</p> <p>J: Provide central sanitary sewers to developed areas within 900 feet of waters such as estuarine shorelines, rivers, creeks, canals and lakes.</p> <p>M: Support public involvement programs addressing water quality issues.)</p>
<h1>Objectives and Actions Summary</h1>			



<p>FW-1: Protect, enhance and restore native habitats where physically feasible and within natural variability, including submerged aquatic vegetation (SAV), submerged and intertidal unvegetated bottoms, oyster, mangrove, salt marsh, freshwater wetland, native upland and water column.</p>	<p>FW-2: By 2020, achieve a 100 percent increase in conservation, preservation and stewardship lands within the boundaries of the CHNEP study area. The increase will be based upon 1998 acreage.</p>	<p>FW-3: By 2020, achieve controllable levels of invasive exotic plants, as defined by the Florida Exotic Pest Plant Council, and exotic nuisance animals, as defined by the Florida Fish and Wildlife Conservation Commission, on publicly managed lands. Encourage and support the removal and management of invasive exotic plants and exotic nuisance animals on private lands.</p>
<p>A: Restore submerged and intertidal habitats (seagrass, oyster and unvegetated bottoms) from the effects of anthropogenic stresses.</p> <p>B: Ensure navigation programs protect CHNEP study area habitat resources.</p> <p>C: Restore freshwater and estuarine wetland areas, especially those adversely impacted by ditching, using methods such as the backfilling of ditches, the removal of spoil piles and the elimination of exotic vegetation.</p> <p>D: Enhance fish and wildlife habitat along shorelines, including canals, lakes, riverine systems and artificial waterways.</p> <p>E: Improve canal, pond, lake and river management activities to benefit fish and wildlife.</p> <p>F: Restore and protect a balance of native plant and animal communities.</p> <p>G: Provide additional support for environmental compliance and enforcement on land and water. Ensure uniform compliance and enforcement of environmental regulations and permitting criteria.</p> <p>O: Provide multifaceted environmentally responsible boater education programs.</p> <p>P: Support public involvement programs in habitat and wildlife issues.</p>	<p>H: Bring environmentally sensitive land under protection through ownership and/or management and expand conservation areas, reserves and preserves, including undeveloped platted lots.</p> <p>I: Advocate land acquisition and conservation easement programs.</p> <p>J: Provide information on the economic, social and environmental benefits of protected land and environmental restoration, including ecosystem services.</p> <p>K: Acquire as much of Babcock Ranch as possible for public stewardship and promote conservation management of the entire ranch.</p> <p>P: Support public involvement programs in habitat and wildlife issues.</p>	<p>L: Where practical, identify and remove areas of heavy invasive exotic vegetation and exotic nuisance animals.</p> <p>M: Promote local programs to research and eliminate nuisance exotic animal species.</p> <p>N: Provide education programs on the impacts of invasive exotic plants and exotic nuisance animals.</p>



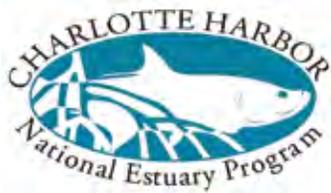
<p>HA-1: By 2020, identify, establish and maintain a more natural seasonal variation (annual hydrograph) in freshwater flows for:</p> <ul style="list-style-type: none"> • Caloosahatchee River. • Peace River and its tributaries. • Myakka River, with special attention to Flatford Swamp and Tatum Sawgrass. • Estero Bay and its tributaries. 	<p>HA-2: By 2020, restore, enhance and improve where practical historic watershed boundaries and natural hydrology for watersheds within the CHNEP study area, with special attention to Outstanding Florida Waters and Class I water bodies.</p>	<p>HA-3: By 2020, enhance and improve to more natural hydrologic conditions water bodies affected by artificially created structures throughout the CHNEP study area. Reduce negative hydrologic effects of artificially created structures such as weirs, causeways, dams, clay settling areas and new reservoirs.</p>	<p>HA-4: By 2020, for each watershed, identify and recommend additional reforms to improve linkages between local, water management district, state and federal government development permitting and capital programs affecting water storage, flood control and water quality. By 2025, implement the additional reforms.</p>
<p>A: Utilize historic, current and future scenario estuarine mixing models, focusing on salinity and indicator species for better evaluation of proposed capital and operations projects.</p> <p>B: Utilize integrated ground and surface water models to improve decision making, addressing ecosystem needs in the context of population growth, development, agriculture and mining water demands.</p> <p>C: Protect headwater tributaries from elimination and restore these tributary courses and their floodplains where opportunities exist.</p> <p>D: Set and achieve minimum aquifer levels. Reduce the rate of saltwater intrusion in the Floridan aquifer.</p> <p>E: Meet established minimum flows and levels (MFLs). Establish and meet Estero Bay and major tributary MFLs.</p> <p>F: Participate in Everglades restoration and related planning and restoration efforts.</p> <p>P: Support public involvement programs addressing watershed management issues of hydrology, water resources, water conservation and water use.</p>	<p>F: Participate in Everglades restoration and related planning and restoration efforts.</p> <p>G: Reestablish hydrologic watersheds to contribute flows to their historic receiving water bodies.</p> <p>H: Identify natural, existing and target water budgets for each watershed. Use water budgets as tools to improve decision making.</p> <p>P: Support public involvement programs addressing watershed management issues of hydrology, water resources, water conservation and water use.</p>	<p>F: Participate in Everglades restoration and related planning and restoration efforts.</p> <p>I: Evaluate the impacts of man-made barriers to historic flows and modify them to establish more natural hydrologic conditions.</p> <p>J: Build and restore water conveyances to have shallow, broad, vegetated and serpentine components that also restore floodplains.</p> <p>K: Identify the hydrologic and environmental interactions on surface water reservoirs on estuaries within the watershed. Mimic natural systems in the choice site selection, design and operation of reservoirs.</p> <p>P: Support public involvement programs addressing watershed management issues of hydrology, water resources, water conservation and water use.</p>	<p>L: Encourage the use of low-impact development (LID) and green infrastructure techniques in new and old developments.</p> <p>M: Limit big-pulsed release events.</p> <p>N: Implement watershed (basin) initiative projects to address hydrologic alterations, loss of water storage and changed hydroperiod, and improve water quality.</p> <p>O: Encourage, expand and develop incentives for the reuse of waters that are protective of water quality and natural hydrology.</p> <p>P: Support public involvement programs addressing watershed management issues of hydrology, water resources, water conservation and water use.</p>



<p>SG-1: By 2025, a minimum of 75 percent of all residents will have recalled attending a watershed event, reading watershed material or hearing watershed/estuary information on radio or TV. A minimum of 50 percent of all residents in the CHNEP study area can recognize estuaries and watersheds. A minimum of 10 percent of all residents will be able to claim personal actions that protect the estuaries and watersheds.</p> <p>A: Gauge public involvement.</p> <p>B: Provide people with opportunities to be involved in research, monitoring and restoration activities.</p> <p>C: Identify underrepresented populations and develop methods to include them in estuary and watershed protection.</p> <p>D: Produce watershed and estuary communication tools.</p> <p>E: Offer grants to broaden participation of individuals and groups in implementing the CCMP.</p> <p>F: Provide events that involve people in the stewardship of their local natural resources and opportunities to connect them to their watershed.</p> <p>G: Implement target audience programs.</p> <p>H: Incorporate estuary and watershed protection in educational curricula.</p> <p>I: Conduct new resident programs to inform and encourage environmental stewardship.</p> <p>J: Identify and showcase accomplishments and excellent examples of research findings, restoration, legislative changes and outreach successes using a variety of methods.</p>	<p>SG-2: By 2020, the CHNEP will expand its role as a recognized resource to elected officials or their agents from local, state and federal government for policy advice.</p> <p>J: Identify and showcase accomplishments and excellent examples of research findings, restoration, legislative changes and outreach successes using a variety of methods.</p> <p>L: Implement <i>The Advocacy and Review Procedures</i>.</p> <p>M: Vigorously pursue the <i>Long Range Funding Strategy</i> and funding mechanisms to implement watershed and estuary protection.</p> <p>N: Update comprehensive inventories of research, restoration, legislative and outreach needs.</p> <p>O: Create incentives to protect desired ecosystem resources.</p> <p>P: Incorporate into federal, state and local permits, and public works improved standard practices that better protect estuaries and watersheds.</p> <p>Q: Build capacity for communities and their local leadership to mitigate and adapt to the effects of climate change through joint efforts.</p>	<p>SG-3: Through 2020, the CHNEP long-term monitoring strategy and data management strategy will continue and be enhanced. The resulting Internet-based Water Atlas will be maintained systematically</p> <p>R: Track and present monitoring data according to CHNEP-adopted environmental indicator targets.</p> <p>S: Post raw data, geographic information system (GIS) and technical analysis on the Internet under the data management strategy.</p>	<p>SG-4: Though 2020, key geographic and scientific information will be presented in ways that are meaningful to the majority of people.</p> <p>D: Produce watershed and estuary communication tools.</p> <p>K: Present scientific information in a form readily understood by the majority of people.</p>
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**Charlotte Harbor
National Estuary Program**

1926 Victoria Avenue

Fort Myers, FL

33901-3414

239/338-2556

Toll-free 866/835-5785

www.CHNEP.org

LEGEND

Watershed Basins

-  Dona & Roberts
-  Myakka River
-  Lemon Bay
-  Peace River
-  Charlotte Harbor
-  Pine Island Sound
-  Caloosahatchee
-  Estero Bay
-  Creeks and Rivers
-  Roads

