

2015 Research Needs Inventory



Photo by Lisa B. Beever, PhD

Data collection conducted as part of the Wetland Program Development Grant Project “Mangrove Heart Attack.” Components of the project ranked high in the 2007 Research Needs Inventory which prompted the successful grant request.

Charlotte Harbor National Estuary Program Technical Report 15-2 Adopted August 13, 2015



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The Charlotte Harbor National Estuary Program is a partnership of citizens, elected officials, resource managers and commercial and recreational resource users working to improve the water quality and ecological integrity of the greater Charlotte Harbor watershed. A cooperative decision-making process is used within the program to address diverse resource management concerns in the 4,700-square-mile study area. Many of these partners also financially support the Program, which, in turn, affords the Program opportunities to fund projects. The entities that have financially supported the program include the following:

U.S. Environmental Protection Agency
Southwest Florida Water Management District
South Florida Water Management District
Florida Department of Environmental Protection
Peace River/Manasota Regional Water Supply Authority
Polk, Sarasota, Manatee, Lee, Charlotte, and Hardee Counties
Cities and Towns of Sanibel, Cape Coral, Fort Myers, Punta Gorda, North Port, Venice,
Fort Myers Beach, Winter Haven, and Bonita Springs

Table of Contents

- Introduction and Purpose5
 - Purpose..... 5
 - History..... 5

- Past CHNEP Research Funding.....7
 - CHNEP Research Investments 9
 - Implementation of the 2007 Research Priorities..... 12

- 2015 Research and Monitoring Priorities15
 - Hydrologic Alteration (HA) Research and Monitoring Priorities 17
 - Water Quality Degradation (WQ) Research and Monitoring Priorities 19
 - Fish and Wildlife Habitat Loss (FW) Research and Monitoring Priorities 21
 - Stewardship Gaps (SG) Research and Monitoring Priorities 23

- Conclusions24

- Appendix25

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Introduction and Purpose

Purpose

The purpose of the Research Needs Inventory is to identify gaps in science that are obstacles to sound decision-making. This product of the Charlotte Harbor National Estuary Program (CHNEP) may be used in a multitude of arenas.

First of all, the development of a Research Needs Inventory will assist CHNEP in implementing the *Comprehensive Conservation and Management Plan* (CCMP). The CCMP includes priority actions that prompt the CHNEP to identify data gaps, suggests research projects, and requires decisions for which there may not be a good scientific base available.

Second, CHNEP's research priorities may be implemented by other agencies where common needs are identified. A written research plan will assist the CHNEP in communicating with potential funding agencies and universities. Many of the projects are suitable for graduate student work.

Third, a comprehensive summary of needs will assist the CHNEP in ranking projects for funding through the budgeting and workplan process. Most projects will not be funded through this process. The CHNEP uses its Technical Advisory Committee (TAC) to develop an initial ranking of projects. The top ranked projects are considered for program funding based on likelihood of no other partner funding being forthcoming and importance to implementing the CCMP.

Finally, a Research Needs Inventory will assist CHNEP staff with identifying grant sources which will implement the CCMP. Several funding sources are available to implement research project which include Wetlands Program, EPA Discretionary Funds, Gulf of Mexico Program, and Everglades Restoration.

History

The first Research Needs Inventory was adopted on March 15, 2004. This first inventory simply listed the various research concepts which implemented the CCMP. In 2007, the research needs inventory was updated with the development of a major CCMP amendment process and the adoption and update of CHNEP's Environmental Indicators. Both research and monitoring needs were considered. A survey was conducted to identify research priorities. There were 25 respondents representing all the Management Conference Committees, most of who serve on the Technical Advisory Committee of scientists (Table 1).

The result was an excel table which served the Management Conference as they selected projects to fund. In addition, CHNEP staff and partners worked together to identify high priority projects to seek grant funding.

Name	Affiliation	Committee
Al Cheatham	CHEC	Management
Celia Stearns	FDEP	TAC
Daphne MacFarlan	NOAA	TAC
David Dale	NOAA	Management
Debra Highsmith	Citizen	CAC
Ellen Hawkinson	Citizen	CAC
Ernie Estevez	Mote Marine Lab	TAC
Ford Walton	FDEP	TAC
Frank Baker	EPA	EPA
Greg Blanchard	Manatee County	TAC
James Evans	City of Sanibel	TAC
Jennifer Nelson	FDEP	TAC
Jim Beever	SWFRPC	TAC
Joan Bush	Citizen	CAC
John Ryan	Sarasota County	TAC
Jon Thaxton	Sarasota County	Policy
Kathleen Rohrer	Citizen	CAC
Kris Kaufman	SWFWMD	TAC
Lizanne Garcia	SWFWMD	Management
Mike Jones	Sarasota County	TAC
Rhonda Evans	EPA	TAC
Stuart Stauss	Citizen	CAC
Tony Janicki	Janicki Environmental	Other
Warren Bush	Citizen	CAC
Wayne Daltry	Lee County	Policy

Table 1: 2007 Research Needs Inventory Respondents

Past CHNEP Research Funding

Through its grant programs and consulting contracts, the CHNEP has funded research efforts since Fiscal Year 1996/97, the fiscal year after the CHNEP Management Conference was organized. In the 19 years of funding research, the CHNEP has committed over \$3,500,000 in research, valued over \$5,000,000 with partner leverage. This represents 97 separate projects. The most research investment has been made to address the Priority Problems of Water Quality Degradation and Fish and Wildlife Habitat Loss (Table 2.)

Priority Problem	NEP Cost	Leverage	Project Cost	Count
FW: Fish and Wildlife Habitat Loss	\$1,169,834	\$597,900	\$1,767,734	38
HA: Hydrologic Alterations	\$186,961	\$0	\$186,961	4
SG: Stewardship Gaps	\$556,793	\$0	\$556,793	19
WQ: Water Quality Degradation	\$1,636,102	\$924,029	\$2,560,131	36
Total	\$3,549,690	\$1,521,929	\$5,071,619	97

Table 2: Research Expenditures and Leverage by Problem Area

Partner Leverage was more common when CHNEP funded its Research and Restoration Partner Program (RRPP). Mote Marine Laboratory, Fish and Wildlife Research Institute, Charlotte Harbor Environmental Center and Florida Gulf Coast University have been CHNEP’s most consistent partners (Table 3.) A total of 60 projects included partner leverage, funding 51% of these projects. The remaining 37 projects were funding entirely through CHNEP, with contributions from water management districts, grants and sources other than the research organization doing the work.

Who	NEP Cost	Leverage	% Leverage	Project Cost	Count
Mote Marine Laboratory	\$427,184	\$466,056	109%	\$893,240	16
City of Cape Coral	\$30,000	\$280,000	933%	\$310,000	1
Fish and Wildlife Research Institute	\$370,975	\$176,130	47%	\$547,105	8
Charlotte Harbor Environmental Center	\$159,881	\$151,233	95%	\$311,114	11
Florida Gulf Coast University	\$189,809	\$119,140	63%	\$308,949	8
Conservancy of SWF	\$44,641	\$72,212	162%	\$116,853	2
Florida Department of Environmental Protection	\$75,642	\$61,712	82%	\$137,354	3
Sanibel Captiva/ Conservation Foundation	\$37,782	\$47,171	125%	\$84,953	2
Polk County	\$10,000	\$41,600	416%	\$51,600	1
University of Massachusetts	\$18,585	\$34,473	185%	\$53,058	1
Southwest Florida Regional Planning Council	\$35,000	\$30,000	86%	\$65,000	2
Center for Systematics and Taxonomy	\$43,200	\$24,984	58%	\$68,184	2
University of Florida	\$10,775	\$11,173	104%	\$21,948	1
Cape Coral Friends of Wildlife	\$3,575	\$3,975	111%	\$7,550	1
SWF Watershed Council	\$2,960	\$2,070	70%	\$5,030	1
Total	\$1,460,009	\$1,521,929	51%	\$2,981,938	60

Table 3: Partner Leverage in Research

CHNEP Research Investments

Broad areas of monitoring, analysis and research investments include Geographic Information Systems (GIS), Water Quality Monitoring, Water Quality Targets and Standards, Data Management, Benthic Invertebrate Research and Fisheries Monitoring.

Geographic Information Systems

CHNEP's largest research investment has been into Geographic Information Systems (GIS) products, at \$424,000 within the following four projects:

- Historic Subbasin Boundary Map
- Pre-Development Vegetation Map- Charlotte and Manatee
- Historic Coastal Benthic Habitat
- Tidal Charlotte Harbor Shoreline Condition Map.

These products provide baseline data for CHNEP's adopted environmental indicators, CCMP vision and restoration approaches. The one-time investment in such baseline data provides information that can be used into the future. For example, the 1950s-era geo-rectified aerial photographs prepared under the Historic Coastal Benthic Habitat has been used on many other research projects, especially long-term climate change analysis and habitat migration issues. The Southwest Florida Water Management District (SWFWMD) has been a funding partner for all GIS investments within their jurisdiction.

Water Quality Monitoring

Water Quality Monitoring projects include the Coastal Charlotte Harbor Monitoring Network (CCHMN) and the Charlotte Harbor Estuaries Water Quality Monitoring Network (CHEVWQMN). The CCHMN represents is a broad partnership with SWFWMD, Florida Fish and Wildlife Commission Fish and Wildlife Research Institute (FWRI), Florida Department of Environmental Protection (FDEP), Sarasota County, Charlotte County, Lee County and the City of Cape Coral. Through these partnerships, water quality is monitored monthly using a stratified random sample design. These data are used to provide an overall ambient water quality picture of the estuaries and help to determine water quality health. The CHEVWQMN is a partnership with FDEP Charlotte Harbor and Estero Bay Aquatic Preserves Program and volunteer citizen scientists. THE CHEVWQMN is a fixed station design. The power of this program is that individual citizens take the data at the same time of day (sunrise on the first Monday of the month). The CCHMN sites are throughout the estuaries and CHEVWQMN sites are nearshore. Both datasets have different uses because of different controls that are in place. FDEP uses both datasets to determine water quality impairments under the Federal Clean Water Act and Florida's Impaired Waters Rule (Chapter 62-303 FAC).

To date, CHNEP has invested \$347,375 in CCHMN, beginning in FY 2001/02 and \$75,642 in CHEVWQMN beginning in FY 1996/97. Both programs represent significant partner leverage that exceeds CHNEP funding values.

In addition, the CHNEP funded a wet atmospheric deposition monitoring station for Lee County through an EPA grant. The equipment cost was \$100,000 and was initiated in FY 1998/99. Lee County collects the data for their use and use by CHNEP and other partners.

Water Quality Targets and Standards

In FY 2008/09 and in response to the CCMP update, CHNEP funded a large project to refine seagrass targets, link them to water clarity targets and provide an updated assessment of pollution load rates. In FY 2009/10, the project was expanded to develop estuarine Numeric Nutrient Criteria (NNC), in cooperation with Tampa Bay Estuary Program (TBEP) and Sarasota Bay Estuary Program (SBEP.) The initial work on targets and pollutant load assessment was critical to be able to recommend NNC to FDEP and EPA. The CHNEP recommendations have been adopted into law and are being implemented. Water quality monitoring discussed above in the previous section was critical to provide necessary data for targets and standards. The project's total cost to CHNEP was \$267,800 and included funding assistance from SWFWMD and South Florida Water Management District (SFWMD.)

Water Atlas

Beginning in FY 2010/11, CHNEP contracted with the University of South Florida (USF) to offer water quality data, assessment tools, GIS, documents, maps, and other features through its online water atlas at www.chnep.wateratlas.usf.edu through www.wateratlas.org. The total cost to date has been \$245,131 and supersedes earlier data management investments of \$237,539. These earlier investments began in FY 1998/99, before the USF water atlas was fully operational for CHNEP's needs. SWFWMD helped to fund the initial creation of the water atlas and Mosaic Foundation has funded enhancements. A cost-effective feature of the water atlas is when one partner funds an enhancement, the enhancement is shared for free among its partners. The atlas also provides a source of local information for presentation to community groups.

One of the latest enhancements funded through Mosaic Foundation is a water quality trends tool which takes CHNEP's investment in a triennial status and trends analysis of \$195,254 and allows trends analyses for updated time periods.

Benthic Invertebrate Research

CHNEP and its partners have funded various benthic invertebrate research efforts. Featured species include oysters and scallops. In FY 2003/04, CHNEP funded Mote Marine Laboratory to assess overall benthic invertebrate species richness within different habitats. CHNEP staff tied species abundance and diversity by habitat and watershed to GIS maps to better understand these patterns. Most other specific research was funded through CHNEP grants and leveraged with partner match. CHNEP has directly invested \$230,180 (\$381,493 including partner leverage) to gain a better understanding of oysters, scallops and other benthic invertebrates.

Fisheries Monitoring

CHNEP has funded FWRI to expand fisheries monitoring for various purposes including environmental indicator assessment and restoration monitoring. Most Federal restoration grant funding requires functional and structural restoration monitoring. Fisheries monitoring provides the functional monitoring that is required. By expanding the base of pre-restoration monitoring, more changes may be detected. Currently, SWFWMD, Bonefish and Tarpon Trust, and Mote Marine Laboratory are CHNEP's funding partners and CHNEP has invested \$143,500 in this work

Implementation of the 2007 Research Priorities

In 2007, the CHNEP Management Conference ranked 162 research and monitoring projects. Since 2007, 22 of the top 30 priorities had some level of CHNEP or partner progress made (Table 4.) The 13 projects highlighted in green were funded or advocated by CHNEP because they were considered a high priority. In addition, minimum flows and levels (MFLs) analyses by both water management districts provided needed analysis for several of the listed high-priority projects.

Rank	Problem	Project	Status
1	FW	Coordinating the Biennial Seagrass Mapping for total study area consistency	2008 and 2014 coordinated, 2010, 2012 SFWMD did not map.
2	FW	Assess the economic, social, and environmental benefits of protected land in the CHNEP study area.	CHNEP funded ecosystem services in Pine Island Sound in FY12. CHNEP voted for entire study area.
3	WQ	Identify gaps in water quality data needed to assess impairments	Completed by FDEP through impaired waters assessments.
4	FW	Map shoreline treatments including hedged mangrove, windowed mangrove, uplifted mangrove, vertical seawall, riprap revetment, lawn, herbaceous wetlands, etc.	Completed in 2007, Volunteer component expanded, updated and assessed in 2010 and 2013
5	WQ	Conduct a Triennial Water Quality Analysis to establish status and trends	Funded in 2010 but delayed to 2011 so Numeric Nutrient Criteria could be funded. In process of being added to the Water Atlas as a tool.
6	HA	Determine the natural variation of flow in the Caloosahatchee, Peace, Myakka, and Estero Rivers and analyze the amount of time the flows are outside the range	SFWMD conducted MFL analyses for Peace and Myakka; SFWMD working on Caloosahatchee
7	HA	Identify areas with limited flow data, install gauges and monitor flow in relation to natural variation, e.g. storms & droughts	Additional gauges were installed for the Charlotte Harbor Flatwoods Initiative. EPA is working with USGS to identify additional sites using RESTORE Act funding.
8	HA	Adopt indicators for river oligohaline, mesohaline, and polyhaline zone health	Analysis of typical minimums, maximums and averages conducted in 2012; MFL models
9	HA	Study the effects of freshwater releases on key estuarine components (e.g. SAV, oysters, fish)	MFL analyses and Caloosahatchee River Watershed Protection Plan
10	WQ	Develop exceedance criteria for numeric CHNEP water quality targets using the plane of constant attenuation. Determine if subbasins in Lemon Bay, Charlotte Harbor and Estero Bay are meeting exceedance criteria	Funded in 2008 and completed 2011, resulting in adopted numeric nutrient criteria.
11	FW	Develop a local loading model that compares preserved land to developed land	2009 Loading model compares different land use types

12	HA	Estuarine Flows and Mixing-Circulation Models	A 2007 list of water quality and hydrodynamic models is at: www.dep.state.fl.us/coastal/downloads/Present_Hydrodynamic_Models_in_Florida.pdf .
13	WQ	Identify more accurate nutrient loading rates from various land uses in the Charlotte Harbor Watershed	2009 Loading model was calibrated with gauge data.
14	WQ	If subbasins are not meeting exceedance criteria, develop load reduction goals and management strategies to address exceedances	Being developed through TMDL adoption.
15	FW	Compile existing information on the natural re-vegetation and restoration of propeller scars.	
16	FW	Prepare map of conservation easements within the Study Area.	EPA Wetland Program Development Grant funded Southwest Florida Regional Planning Council to complete statewide map.
17	HA	Evaluate the Impacts of Man-made Barriers to Historic Flows	Addressed in Lower Myakka MFL
18	FW	Determine the natural variation in seagrass bed characteristic.	Addressed in Seagrass Target development
19	HA	Workable watershed models for land and water management, with water quality and hydrology goals	Address in MFL and NNC development
20	FW	Develop methods to enhance seagrass recovery from prop scarring.	
21	FW	Develop oyster bar monitoring program for spat recruitment, percent living/dead and disease.	FDEP Cooperative Funding Initiative (CPI) funded CHNEP to create volunteer program.
22	WQ	Identify sources of bacteria, nutrients, and other indicators in water bodies	
23	WQ	Determine the source of nutrients linked to macro-algal blooms.	
24	WQ	Modify numeric water quality targets to incorporate quality of light considerations and seagrass light requirements	Funded in 2009 and implemented by state rule.
25	FW	Examine pre- and post-dredging impacts on the environment.	
26	FW	Expand mangrove species composition monitoring throughout entire CHNEP area, monitor transects every 5-10 years to evaluate mangrove species changes.	CHNEP funded by WPDG grant in 2015.
27	HA	Quantify the effects of large canals (e.g. Gator slough, Cape Coral spreader canals) on flow/water quality.	
28	HA	Research effects of existing reservoirs on downstream waters	

29	WQ	Refine optical models to help establish local standards or numeric water quality targets for chlorophyll a, turbidity, and total suspended solids that incorporate dissolved matter.	Contracted with Mote in 2012
30	FW	Compile data and study the cumulative impacts of boat docks and hardened shorelines on SAV, oyster bar, intertidal, unvegetated and other habitats.	

Table 4: 2007 Research and Monitoring Priorities

2015 Research and Monitoring Priorities

In 2015, the projects listed in the 2007 survey were updated with the addition of projects in the 2013 CCMP update. This update added environmental indicators and targets for each priority action. As a result, environmental indicators and targets or performance measures were added for the section entitled “Stewardship Gaps” (SG.) For consistency, research or monitoring related to the SG priority actions were added. Public outreach/engagement, governance and data management issues are included in the 2015 survey.

The 2015 survey was offered online at <https://www.surveymonkey.com/s/CHNEPresearch> on March 16, 2014 with a due date of April 6, 2015. The survey listed 279 potential projects and allowed respondents to select 10 of the highest ranked projects for each of the four problem areas, totaling 40 choices. There were 78 hydrologic alteration (HA), 74 water quality degradation (WQ), 90 fish and wildlife habitat loss (FW), 37 stewardship gap (SG) research and monitoring projects from which to choose.

There were 41 respondents to the survey, compared to 25 in 2007. Policy Committee member participation increased from one to six. Management Committee participation increased from three to seven. CAC participation increased slightly from six to seven. TAC participation was level with 12 respondents. There were seven other partners that participated. CHNEP Director also took the survey to represent policies of the CHNEP as applicable. The committees from which there were the most participation was the same between the surveys. TAC followed by CAC, Management and Policy. The 2015 saw greater participation from Policy and Management Committees for a more balanced distribution from the committees.

There were 6 people that participated in both surveys: Greg Blanchard, Jim Beever, John Ryan, Lizanne Garcia and Tony Janicki.

The 2007 survey combined all projects into a single ranking. The 2015 ranks research needs by priority problem. An advantage is to have 4 top priorities, 4 second high priorities etc.

Name	Affiliation	Committee
Charles Hines	Sarasota County	Policy
Cheryl Clark	FDEP Aquatic Preserves	Other
Cheryl Cook	City of North Port	Policy
Cynthia Ovdenk	ACOE	TAC
David Blewett	FWC	TAC
David Craun	Citizen	CAC
David Moe	Citizen	CAC
David W Ceilley	Citizen	TAC
Debi Osborne	Conservation Foundation	CAC
Elizabeth Wong	City of North Port	Management
Emilio Carlesimo	City of Venice	Policy
Greg Blanchard	SWFWMD	TAC
Hans Zarbock	Polk County	TAC
Jackson G. Mosley	FDEP State Parks	CAC
James Douglass	FGCU	TAC
James Locascio	Mote Marine Laboratory	Other
Jeffrey Spence	Polk County	Policy
Jim Beever	SWFRPC	Management
Jim Cooper	Lemon Bay Conservancy	CAC
Jim Culter	Mote Marine Laboratory	TAC
Jim Knoy	Citizen	CAC
Joanne Vernon	Charlotte County	Other
John Ryan	Sarasota County	Management
Julie Neurohr and Kirby Wolfe	FDEP, South District	TAC
Kathleen Weeden	City of Venice	Management
Kathy Meaux	Sarasota County	Other
Keith Laakkonen	Town of Fort Myers Beach	Management
Keith N Waltz Jr	Citizen	Other
Lisa Beever	CHNEP	Other
Lizanne Garcia	SWFWMD	TAC
Louis Kovach	Citizen	CAC
Matthew Miller	Dewberry Consultants	TAC
Melynda Brown	FDEP	TAC
Mike Britt	City of Winter Haven	Management
Nancy Prafke	City of Punta Gorda	Policy
Nora Demers	FGCU	Other
Paul Tritaik	USFWS	Management
Philip Stevens	FWC	Policy
Richard Bartleson	SCCF	TAC
Tony Janicki	Janicki Environmental	Other
William Hammond	Citizen	Other

Table 5: 2015 Survey Respondents

Hydrologic Alteration (HA) Research and Monitoring Priorities

Project	Score
HA-A: Study the effects of freshwater releases on key estuarine components (e.g. SAV, oysters, fish)	19
HA-A: Determine the natural variation of flow in the Caloosahatchee, Peace, Myakka, and Estero Rivers and analyze the amount of time the flows are outside the range	15
HA-I: Evaluate the Impacts of Man-made Barriers to Historic Flows	14
HA-N: Assess the overall effect of multiple stormwater treatment ponds in a watershed on the hydrologic cycle and freshwater delivery to the streams and estuarine system	12
HA-B: Identify areas with limited flow data, install gauges and monitor flow in relation to natural variation, e.g. storms & droughts	11
HA-O: Study the effectiveness, benefits, and impacts of existing reuse water services in relation to varying land uses. Examine water quality of reuse water to determine if runoff is contributing to impairments of adjacent wetlands and waterbodies.	11
HA-B: Evaluate the interaction between groundwater and surface water and how they contribute to overall flows	10
HA-G: Feasibility Assessment for the Environmental Restoration of Selected “Old Mine Lands” in the Upper Peace River basin	10
HA-N: Create a GIS map of stormwater systems and facilities	10
HA-B: Quantify the effects of large canals (e.g. Gator slough, Cape Coral spreader canals) on flow/water quality.	9
HA-B: Workable watershed models for land and water management, with water quality and hydrology goals	9
HA-E: Assess compliance with adopted MFLs	9
HA-G: Prepare a map of springs in the CHNEP estuaries	9
HA-N: Collect information and analyze effects that stormwater runoff has on flow characteristics of tributaries	9
HA-N: Wildlife and Flow-way Crossing Study	9
HA-A: Adopt targets for river oligohaline, mesohaline, and polyhaline zone health	8
HA-A: Develop an overarching three-dimensional model for the entire tidal Charlotte Harbor system and more detailed watershed models for each estuary watershed.	8
HA-D: Inventory and evaluate long-term average withdrawals from the Floridian aquifer, pursuant to SWUCA.	8
HA-D: Investigate the use of water from reclaimed mine lakes to recharge aquifer systems.	8
HA-K: Complete a study to evaluate the natural water storage capacity of the watershed.	8
HA-A: Use current and historic distribution of shellfish (i.e. oysters and bay scallops) as an indicator of salinity regime.	7
HA-A: Wading Birds as Environmental Indicators	7
HA-G: Map historic and current hydrologic subbasins and analyze changes	7
HA-G: Prepare a map of historic springs locations	7

HA-O: Track percent of wastewater effluent captured as reuse water.	7
HA-P: Support public involvement programs addressing watershed management issues of hydrology, water resource issues, water conservation and water use	7
HA-B: Inventory uses of new SWFWMD integrated models and SFWMD models for improvements in decisions	6
HA-I: Prepare map of barriers to flow on natural waterways.	6
HA-K: Increase consideration of cost-benefit analysis and economic costs when planning, siting, assessment and permitting of new reservoirs and other hydrologic alterations, including emphasis on the economic value of natural water storage and conservation.	6

Water Quality Degradation (WQ) Research and Monitoring Priorities

Project	Score
WQ-B: Assess accuracy and sufficiency of water quality data in Lee, Charlotte, Sarasota, Manatee, DeSoto, Hardee and Polk Counties	15
WQ-B: Continued monthly water quality monitoring through the CCHMN	15
WQ-A: Review 303(d) list for at least two water bodies delisted because improving water quality by 2015.	13
WQ-C: Identify more accurate nutrient loading rates from various land uses in the Charlotte Harbor Watershed	13
WQ-E: Identify sources of bacteria, nutrients, and other indicators in water bodies	13
WQ-M: Increase the use of personal and home best management practices by consumers through the watershed to reduce nonpoint source pollution.	13
WQ-B: Establish monitoring program for emerging contaminants including pharmaceuticals and Personal Care Products (PPCPs)	12
WQ-B: Invest in real-time water quality data collection, analysis, and delivery	11
WQ-H: Assess bacteria, nutrient load, and base flow impacts of septic tank systems, WWTP, and reuse water (Conduct appropriate groundwater and surface water studies necessary to determine the cumulative impacts of high densities of septic tanks.)	11
WQ-I: Determine the source of nutrients linked to macro-algal blooms.	11
WQ-B: Assess the Magnitude & Extent of Chem. Contamination & Toxicity of Sediments	10
WQ-B: Charlotte Harbor Water Quality Monitoring	10
WQ-B: Determine the causes of turbidity (natural vs. anthropogenic) by hydrologic basin	10
WQ-B: Expand Volunteer Water Quality Monitoring Program	10
WQ-B: Identify gaps in water quality data needed to assess impairments	10
WQ-B: Surface Water Monitoring	10
WQ-C: Confirm five sources of pollution and eliminate them by 2018.	10
WQ-H: Identify appropriate indicators to identify septic system discharges.	10
WQ-B: Create a more extensive groundwater quality monitoring program	9
WQ-G: Assess the ecological impact of pesticides and nutrients in freshwater habitats	9
WQ-C: Determine the cumulative effect of pollutant loading, including emerging contaminants, nutrients, non-algal suspended matter and other pollutants	8
WQ-C: Quantify and assess the impacts of sediment loads from Lake Okeechobee into the Tidal Caloosahatchee	8
WQ-D: Determine feasibility of recycling/reuse of phosphate in agricultural practices	8
WQ-E: Conduct a Triennial Water Quality Analysis to establish status and trends	8
WQ-G: Develop Stream Condition Index for Charlotte and Lee Counties	8
WQ-M: Support public involvement programs addressing water quality issues.	8
WQ-F: Develop BMP Manual for SWF With Cost/Benefit Assessments	7
WQ-F: Study county by county water quality regulations-what is working and what is not (would add to base of knowledge from Spring '05 Tampa Bay report-Best Practices)	7
WQ-G: Effects of Hypoxic and Anoxic Condition on Benthic Organisms in Charlotte Harbor	7
WQ-G: Establish or expand sediment monitoring programs for pesticides.	7

WQ-G: Map areas that have regular septic system maintenance programs implemented.	7
WQ-I: Determine the relationship between macro- and micro-nutrients and phytoplankton/algae blooms.	7
WQ-M: Stormwater Best Management Practices Map	7

Fish and Wildlife Habitat Loss (FW) Research and Monitoring Priorities

Project	Score
FW-J: Cost benefit analysis comparing land acquisition and easements keeping lands in low impact agriculture versus creation of new infrastructure for developments in rural areas, include single-family ranchettes.	13
FW-A: Coordinating the Biennial Seagrass Mapping for total study area consistency	10
FW-A: 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.	10
FW-J: Assess the economic, social, and environmental benefits of protected land in the CHNEP study area.	10
FW-A: Analyze muck depth and changes of much depth within estuaries, especially associated with tidal creek and rivers.	9
FW-A: Compile existing research and study results of SAV restoration projects, including successes and lessons learned.	9
FW-A: Create an area-wide benthic fauna monitoring program	9
FW-A: Prepare a map of the Hard Bottom Community	9
FW-F: Best Management Practices (BMP's) for Fish and Wildlife Habitat Conservation on Agricultural Lands	9
FW-F: Studies Targeting Sea level rise and its effects	9
FW-M: Exotics research (fish, amphibians, reptiles, vegetation)	9
FW-A: Map existing oyster habitats by type within the CHNEP estuaries by 2020.	8
FW-A: Monitor success of pilot oyster restoration projects implemented in a variety of habitats in 50% of CHNEP estuary strata by 2010.	8
FW-E: Fill Gaps in understanding of biological responses to water levels and pollution	8
FW-H: Continue tracking acreage in conservation management.	8
FW-H: Prepare map of conservation easements within the Study Area.	8
FW-A: Determine the historic spatial extent of freshwater submerged aquatic vegetation in the Caloosahatchee, Peace and Myakka Rivers	7
FW-A: Develop and implement coordinated mapping and monitoring program for SAV habitats within Caloosahatchee River and tributaries.	7
FW-A: Digitize the Harris et. al. (1983) maps of mangrove, tidal flat Oyster reef, saltmarsh and seagrass for 1945 and 1982. Maps are in the possession of FWC. Compare 1950s era mapping associated with the Historic Benthic Habitats map.	7
FW-A: Document the functions of non-vegetated intertidal and subtidal systems	7
FW-A: Transect monitoring of freshwater SAV in the Peace, Myakka, and Caloosahatchee Rivers and in the Estero Bay, and Lemon Bay tributaries	7
FW-B: Conduct a Decennial Prop Scar Mapping and Analysis Project for Study Area	7
FW-C: Assess the functional ecology of ephemeral wetlands and impacts of the Federal ruling regarding isolated wetlands	7
FW-C: Expand mangrove species composition monitoring throughout entire CHNEP area, monitor transects every 5-10 years to evaluate mangrove species changes.	7

FW-E: Impacts of Canal/Lake Management Activities on Fish and Wildlife in Southwest Florida	7
FW-F: Determine the natural area and extent of upland habitat	7
FW-F: Effects of cattle ranching on plant communities	7
FW-F: Expand FWRI Fisheries Independent Monitoring Program to Lemon Bay and continued support of other areas	7
FW-F: Fish sampling in creeks downstream of Flatwoods Restoration ~40K/yr	7

Stewardship Gaps (SG) Research and Monitoring Priorities

Project	Score
SG-K: Present scientific information so that is easily understood by people.	19
SG-C: Inventory and evaluate outreach efforts in underserved (rural, poor, minority) communities.	17
SG-B: Citizen Science- Foster the Charlotte Harbor Volunteer Water Quality Monitoring Program (CHEVWQMN).	16
SG-D: Enhance effective social media tools, such as the website, YouTube videos, Tumblr, etc.	15
SG-S: Maintain the online Water Atlas	15
SG-B: Citizen Science- Foster citizen water quality monitoring programs such as Pond-, Lake- and Canal-watch programs, and ensure upload to STORET.	14
SG-B: Inventory citizen restoration and monitoring efforts, and identify gaps.	12
SG-M: Update restoration and research needs inventories	12
SG-B: Citizen Science- Foster Volunteer Oyster Habitat Monitoring.	11
SG-I: Inventory and evaluate new residents programs.	11
SG-Q: Track habitat migration of seagrass, mangrove and salt marsh.	11
SG-F: Inventory and evaluate public outreach events offered by CHNEP and by partners.	10
SG-G: Inventory and evaluate audiences reached in special target audience efforts.	10
SG-M: Inventory and evaluate funding sources to support CCMP	9
SG-Q: Track changes in coastal erosion rates	9
SG-Q: Track changes in water temperature, normalized for time of day and season	9
SG-Q: Track Sea-levels, especially at the Fort Myers gauge.	9
SG-R: Maintain and expand monitoring programs	9
SG-D: Develop and adapt social media initiatives such as the Citizens Academy.	8
SG-E: Inventory and evaluate Public Outreach and micro-grant accomplishments.	8
SG-B: Citizen Science-Take action as opportunities are identified.	7
SG-J: Continue showcase accomplishments through mechanisms such as Harbor Happenings and YouTube.	7
SG-Q: Monitoring and Modeling Global Climate Change Impacts	7
SG-Q: Track changes to precipitation trends and patterns, including extreme precipitation	7
SG-D: Enhance effective print communication tools, such as Harbor Happenings magazine and the calendar.	6
SG-J: Initiate an awards program coupled with an annual event (with perhaps different venues and themes.) Require photographs and summary so accomplishments can be showcased.	6
SG-O: Inventory and evaluate incentives that have been implemented	6
SG-B: Citizen Science- Inventory and foster Volunteer Stream Monitoring following EPA Blue Book.	5
SG-L: Inventory and evaluate CHNEP policy-based communications	5
SG-P: Inventory and evaluate improvements to permits or standards	5

Conclusions

Since its creation in 1995, the CHNEP has committed over \$3,500,000 in research, valued over \$5,000,000 with partner leverage. These projects have served to fill gaps in our understanding of water quality, hydrology and habitat which were barriers to effective decision-making. Through the process of deciding investments to make, the CHNEP management conference of elective officials, top agency heads, resource managers, scientists and citizens has helped to guide our choices.

With the update of the CHNEP's *Comprehensive Conservation and Management Plan* in 2013, a re-evaluation of our future priorities was warranted. Our last consideration of research and monitoring priorities was conducted in 2007, with 25 survey respondents and 159 project choices. The 2015 survey had 43 respondents and 276 project choices.

The top choices for consideration include:

- HA-A: Study the effects of freshwater releases on key estuarine components (e.g. SAV, oysters, fish).
- SG-K: Present scientific information so that is easily understood by people.
- WQ-B: WQ-B: Assess accuracy and sufficiency of water quality data in Lee, Charlotte, Sarasota, Manatee, DeSoto, Hardee and Polk Counties.
- FW-J: Cost benefit analysis comparing land acquisition and easements keeping lands in low impact agriculture versus creation of new infrastructure for developments in rural areas, include single-family ranchettes.
- SG-C: Inventory and evaluate outreach efforts in underserved (rural, poor, minority) communities.
- WQ-B: Continued monthly water quality monitoring through the CCHMN.
- HA-A: Determine the natural variation of flow in the Caloosahatchee, Peace, Myakka, and Estero Rivers and analyze the amount of time the flows are outside the range.
- FW-A: Coordinating the Biennial Seagrass Mapping for total study area consistency.

The selections represent a variety of concerns within the CHNEP study area and a commitment to continued monitoring and analysis.

Appendix

Blended Research Needs Rankings

Project	Score
HA-A: Study the effects of freshwater releases on key estuarine components (e.g. SAV, oysters, fish)	19
SG-K: Present scientific information so that is easily understood by people.	19
SG-C: Inventory and evaluate outreach efforts in underserved (rural, poor, minority) communities.	17
SG-B: Citizen Science- Foster the Charlotte Harbor Volunteer Water Quality Monitoring Program (CHEVWQMN).	16
HA-A: Determine the natural variation of flow in the Caloosahatchee, Peace, Myakka, and Estero Rivers and analyze the amount of time the flows are outside the range	15
SG-D: Enhance effective social media tools, such as the website, YouTube videos, Tumblr, etc.	15
SG-S: Maintain the online Water Atlas	15
WQ-B: WQ-B: Assess accuracy and sufficiency of water quality data in Lee, Charlotte, Sarasota, Manatee, DeSoto, Hardee and Polk Counties	15
WQ-B: Continued monthly water quality monitoring through the CCHMN.	15
HA-I: Evaluate the Impacts of Man-made Barriers to Historic Flows	14
SG-B: Citizen Science- Foster citizen water quality monitoring programs such as Pond-, Lake- and Canal-watch programs, and ensure upload to STORET.	14
FW-J: Cost benefit analysis comparing land acquisition and easements keeping lands in low impact agriculture versus creation of new infrastructure for developments in rural areas, include single-family ranchettes.	13
WQ-A: Review 303(d) list for at least two water bodies delisted because improving water quality by 2015.	13
WQ-C: Identify more accurate nutrient loading rates from various land uses in the Charlotte Harbor Watershed	13
WQ-E: Identify sources of bacteria, nutrients, and other indicators in water bodies	13
WQ-M: Increase the use of personal and home best management practices by consumers through the watershed to reduce nonpoint source pollution.	13
HA-N: Assess the overall effect of multiple stormwater treatment ponds in a watershed on the hydrologic cycle and freshwater delivery to the streams and estuarine system	12
SG-B: Inventory citizen restoration and monitoring efforts, and identify gaps.	12
SG-M: Update restoration and research needs inventories	12
WQ-B: Establish monitoring program for emerging contaminants including pharmaceuticals and Personal Care Products (PPCPs)	12
HA-B: Identify areas with limited flow data, install gauges and monitor flow in relation to natural variation, e.g. storms & droughts	11
HA-O: Study the effectiveness, benefits, and impacts of existing reuse water services in relation to varying land uses. Examine water quality of reuse water to determine if runoff is contributing to impairments of adjacent wetlands and waterbodies.	11
SG-B: Citizen Science- Foster Volunteer Oyster Habitat Monitoring.	11
SG-I: Inventory and evaluate new residents programs.	11

SG-Q: Track habitat migration of seagrass, mangrove and salt marsh.	11
WQ-B: Invest in real-time water quality data collection, analysis, and delivery	11
WQ-H: Assess bacteria, nutrient load, and base flow impacts of septic tank systems, WWTP, and reuse water (Conduct appropriate groundwater and surface water studies necessary to determine the cumulative impacts of high densities of septic tanks.)	11
WQ-I: Determine the source of nutrients linked to macro-algal blooms.	11
FW-A: Coordinating the Biennial Seagrass Mapping for total study area consistency	10
FW-A: 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.	10
FW-J: Assess the economic, social, and environmental benefits of protected land in the CHNEP study area.	10
HA-B: Evaluate the interaction between groundwater and surface water and how they contribute to overall flows	10
HA-G: Feasibility Assessment for the Environmental Restoration of Selected "Old Mine Lands" in the Upper Peace River basin	10
HA-N: Create a GIS map of stormwater systems and facilities	10
SG-F: Inventory and evaluate public outreach events offered by CHNEP and by partners.	10
SG-G: Inventory and evaluate audiences reached in special target audience efforts.	10
WQ-B: Assess the Magnitude & Extent of Chem. Contamination & Toxicity of Sediments	10
WQ-B: Charlotte Harbor Water Quality Monitoring	10
WQ-B: Determine the causes of turbidity (natural vs. anthropogenic) by hydrologic basin	10
WQ-B: Expand Volunteer Water Quality Monitoring Program	10
WQ-B: Identify gaps in water quality data needed to assess impairments	10
WQ-B: Surface Water Monitoring	10
WQ-C: Confirm five sources of pollution and eliminate them by 2018.	10
WQ-H: Identify appropriate indicators to identify septic system discharges.	10
FW-A: Analyze muck depth and changes of much depth within estuaries, especially associated with tidal creek and rivers.	9
FW-A: Compile existing research and study results of SAV restoration projects, including successes and lessons learned.	9
FW-A: Create an area-wide benthic fauna monitoring program	9
FW-A: Prepare a map of the Hard Bottom Community	9
FW-F: Best Management Practices (BMP's) for Fish and Wildlife Habitat Conservation on Agricultural Lands	9
FW-F: Studies Targeting Sea level rise and its effects	9
FW-M: Exotics research (fish, amphibians, reptiles, vegetation)	9
HA-B: Quantify the effects of large canals (e.g. Gator slough, Cape Coral spreader canals) on flow/water quality.	9
HA-B: Workable watershed models for land and water management, with water quality and hydrology goals	9
HA-E: Assess compliance with adopted MFLs	9
HA-G: Prepare a map of springs in the CHNEP estuaries	9

HA-N: Collect information and analyze effects that stormwater runoff has on flow characteristics of tributaries	9
HA-N: Wildlife and Flow-way Crossing Study	9
SG-M: Inventory and evaluate funding sources to support CCMP	9
SG-Q: Track changes in coastal erosion rates	9
SG-Q: Track changes in water temperature, normalized for time of day and season	9
SG-Q: Track Sea-levels, especially at the Fort Myers gauge.	9
SG-R: Maintain and expand monitoring programs	9
WQ-B: Create a more extensive groundwater quality monitoring program	9
WQ-G: Assess the ecological impact of pesticides and nutrients in freshwater habitats	9
FW-A: Map existing oyster habitats by type within the CHNEP estuaries by 2020.	8
FW-A: Monitor success of pilot oyster restoration projects implemented in a variety of habitats in 50% of CHNEP estuary strata by 2010.	8
FW-E: Fill Gaps in understanding of biological responses to water levels and pollution	8
FW-H: Continue tracking acreage in conservation management.	8
FW-H: Prepare map of conservation easements within the Study Area.	8
HA-A: Adopt targets for river oligohaline, mesohaline, and polyhaline zone health	8
HA-A: Develop an overarching three-dimensional model for the entire tidal Charlotte Harbor system and more detailed watershed models for each estuary watershed.	8
HA-D: Inventory and evaluate long-term average withdrawals from the Floridian aquifer, pursuant to SWUCA.	8
HA-D: Investigate the use of water from reclaimed mine lakes to recharge aquifer systems.	8
HA-K: Complete a study to evaluate the natural water storage capacity of the watershed.	8
SG-D: Develop and adapt social media initiatives such as the Citizens Academy.	8
SG-E: Inventory and evaluate Public Outreach and micro-grant accomplishments.	8
WQ-C: Determine the cumulative effect of pollutant loading, including emerging contaminants, nutrients, non-algal suspended matter and other pollutants	8
WQ-C: Quantify and assess the impacts of sediment loads from Lake Okeechobee into the Tidal Caloosahatchee	8
WQ-D: Determine feasibility of recycling/reuse of phosphate in agricultural practices	8
WQ-E: Conduct a Triennial Water Quality Analysis to establish status and trends	8
WQ-G: Develop Stream Condition Index for Charlotte and Lee Counties	8
WQ-M: Support public involvement programs addressing water quality issues.	8
FW-A: Determine the historic spatial extent of freshwater submerged aquatic vegetation in the Caloosahatchee, Peace and Myakka Rivers	7
FW-A: Develop and implement coordinated mapping and monitoring program for SAV habitats within Caloosahatchee River and tributaries.	7
FW-A: Digitize the Harris et. al. (1983) maps of mangrove, tidal flat Oyster reef, saltmarsh and seagrass for 1945 and 1982. Maps are in the possession of FWC. Compare 1950s era mapping associated with the Historic Benthic Habitats map.	7
FW-A: Document the functions of non-vegetated intertidal and subtidal systems	7
FW-A: Transect monitoring of freshwater SAV in the Peace, Myakka, and Caloosahatchee Rivers and in the Estero Bay, and Lemon Bay tributaries	7

FW-B: Conduct a Decennial Prop Scar Mapping and Analysis Project for Study Area	7
FW-C: Assess the functional ecology of ephemeral wetlands and impacts of the Federal ruling regarding isolated wetlands	7
FW-C: Expand mangrove species composition monitoring throughout entire CHNEP area, monitor transects every 5-10 years to evaluate mangrove species changes.	7
FW-E: Impacts of Canal/Lake Management Activities on Fish and Wildlife in Southwest Florida	7
FW-F: Determine the natural area and extent of upland habitat	7
FW-F: Effects of cattle ranching on plant communities	7
FW-F: Expand FWRI Fisheries Independent Monitoring Program to Lemon Bay and continued support of other areas	7
FW-F: Fish sampling in creeks downstream of Flatwoods Restoration ~40K/yr	7
HA-A: Use current and historic distribution of shellfish (i.e. oysters and bay scallops) as an indicator of salinity regime.	7
HA-A: Wading Birds as Environmental Indicators	7
HA-G: Map historic and current hydrologic subbasins and analyze changes	7
HA-G: Prepare a map of historic springs locations	7
HA-O: Track percent of wastewater effluent captured as reuse water.	7
HA-P: Support public involvement programs addressing watershed management issues of hydrology, water resource issues, water conservation and water use	7
SG-B: Citizen Science-Take action as opportunities are identified.	7
SG-J: Continue showcase accomplishments through mechanisms such as Harbor Happenings and YouTube.	7
SG-Q: Monitoring and Modeling Global Climate Change Impacts	7
SG-Q: Track changes to precipitation trends and patterns, including extreme precipitation	7
WQ-F: Develop BMP Manual for SWF With Cost/Benefit Assessments	7
WQ-F: Study county by county water quality regulations-what is working and what is not (would add to base of knowledge from Spring '05 Tampa Bay report-Best Practices)	7
WQ-G: Effects of Hypoxic and Anoxic Condition on Benthic Organisms in Charlotte Harbor	7
WQ-G: Establish or expand sediment monitoring programs for pesticides.	7
WQ-G: Map areas that have regular septic system maintenance programs implemented.	7
WQ-I: Determine the relationship between macro- and micro-nutrients and phytoplankton/algal blooms.	7
WQ-M: Stormwater Best Management Practices Map	7
FW-A: Compare SAV mapping results of digital photography to film photography: are macro-algae signals more recognizable?	6
FW-A: Determine suitability of planting Vallisneria in stormwater treatment areas in southwest Florida.	6
FW-B: Develop methods to enhance seagrass recovery from prop scarring.	6
FW-D: Map shoreline treatments including hedged mangrove, windowed mangrove, uplifted mangrove, vertical seawall, riprap revetment, lawn, herbaceous wetlands, etc.	6
FW-F: Pre-Development Map of Sarasota County, using GLOS note method.	6
HA-B: Inventory uses of new SWFWMD integrated models and SFWMD models for improvements in decisions	6

HA-I: Prepare map of barriers to flow on natural waterways.	6
HA-K: Increase consideration of cost-benefit analysis and economic costs when planning, siting, assessment and permitting of new reservoirs and other hydrologic alterations, including emphasis on the economic value of natural water storage and conservation.	6
SG-D: Enhance effective print communication tools, such as Harbor Happenings magazine and the calendar.	6
SG-J: Initiate an awards program coupled with an annual event (with perhaps different venues and themes.) Require photographs and summary so accomplishments can be showcased.	6
SG-O: Inventory and evaluate incentives that have been implemented	6
WQ-B: Origins of Organic Matter within the Sediments of the CHNEP Study Area	6
WQ-G: Impacts of light attenuation on seagrass community structure	6
WQ-G: Modify numeric water quality targets to incorporate quality of light considerations and seagrass light requirements	6
WQ-H: Establish a Shellfish/WQ-monitoring network to ensure sampling of 100% of Class II waters in the study area	6
WQ-K: Implement conservation landscaping plant programs through the CHNEP study area, including the Florida Yards & Neighborhood Program	6
FW-A: Develop a method for determining freshwater SAV acreage	5
FW-A: Develop accurate method to map oysters.	5
FW-A: Evaluate economic services associated with loss and restoration of Caloosahatchee River SAV.	5
FW-A: Map sediment type over the estuary bottoms	5
FW-A: Monitor benthic algae complementary to those for seagrasses	5
FW-B: Compare aerial photography used for prop scar analysis with lower elevation photography for accuracy assessment	5
FW-B: Compile data and study the cumulative impacts of boat docks and hardened shorelines on SAV, oyster bar, intertidal, unvegetated and other habitats.	5
FW-B: Determine cumulative impacts of single family docks and marinas.	5
FW-B: Examine pre- and post-dredging impacts on the environment.	5
FW-C: Develop GIS data layer of mosquito ditches and other ditches for use in priority restoration plans	5
FW-C: Investigate the change in white mangroves distribution to determine causes	5
FW-C: Map mangrove systems by predominate species within existing programs	5
FW-C: Wetland productivity rates	5
FW-F: Extension of fish sampling in Coral Creek ~40K/yr (so that sampling overlaps temporarily with Alligator Creek fish sampling)	5
FW-F: Myakka/Peace large fish-floodplain connections 50-100K/yr (collaboration with FWC Lakeland office)	5
FW-F: Pre-Development Map of SFWMD portion of CHNEP, using GLOS note method.	5
FW-F: Reestablish FIM Caloosahatchee River Estuary ~150K/yr	5
FW-G: Inventory and evaluate environmental compliance efforts	5
FW-M: Conduct a biogeographic analysis of aquatic and terrestrial exotics and assess the threats.	5
HA-B: Expand digital Bathymetry Mapping to Entire Study Area	5
HA-C: Map of 1st and 2nd order streams and changes	5

HA-K: Assess changes in abundance and diversity in estuarine segments	5
HA-K: Engage staff from different levels of agencies in discussions furthering sustainable water management within the CHNEP as it ties multiple water related considerations together, including Minimum Flows and Levels (MFLs), water user permits, wildlife management considerations, etc.	5
HA-K: Further explore the “eco-reservoirs” concept.	5
HA-K: Identify and develop scientific support for sensitive indicators of ecosystem change at several spatial and temporal scales and use them to monitor and assess downstream effects of structural and operational changes to the hydrologic system.	5
HA-L: Inventory and evaluate adoption of LID rules	5
HA-N: Inventory and evaluate hydrologic restoration project acreage	5
HA-O: 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.	5
SG-B: Citizen Science- Inventory and foster Volunteer Stream Monitoring following EPA Blue Book.	5
SG-L: Inventory and evaluate CHNEP policy-based communications	5
SG-P: Inventory and evaluate improvements to permits or standards	5
WQ-C: Investigate sources and effects of atmospheric deposition and develop action plans to address findings.	5
WQ-G: Conductivity Change Implications for Freshwater Wetland Biota	5
WQ-G: Impacts of pharmaceuticals/endocrine disruptors	5
WQ-I: Analyze nutrient content and stable isotope ratios in seagrasses and algae to assess trophic state and nutrient sources	5
WQ-I: Determine if and to what extent the practice of removing drift algae affects natural systems.	5
WQ-I: Establish consistent freshwater HAB sampling in the Caloosahatchee, Peace, and Myakka	5
WQ-I: Establish consistent sampling for macro-algae and periphyton density, composition, and spatial extent within the study area	5
WQ-I: Establish consistent sampling for red tide and HAB in the study area, for taxonomic composition, severity and duration.	5
WQ-J: Map urban areas that are served by central sewer v not in 900' buffer	5
WQ-K: Evaluate water quality impacts of Conservation Landscaping principles	5
WQ-M: Case study of “better-than-BMP” development in region (e.g. roof gardens, solar energy use, pervious pavements, conservation landscaping, etc.)	5
FW-A: Create map of Caloosahatchee River SAV overlaid 2.5 foot bathymetry contour from 1993 data and compare to current conditions.	4
FW-A: Develop an accurate method for using aerial photography to map the extent of oyster bars.	4
FW-C: Determine natural variation in salt water marsh habitat extent	4
FW-C: Map isolated versus connected wetlands	4
FW-C: Use 2011 saltmarsh mapping for post restoration monitoring, to compare gains. Update salt marsh maps using the same protocols in 2021.	4
FW-E: Evaluate lake management strategies in upper Peace River Basin & Winter Haven Chain of Lakes	4
FW-H: Assess the effect of mitigation bank restoration on fauna	4
FW-J: Develop a local loading model that compares preserved land to developed land	4

HA-A: Salt flats as Water Level Stage Performance Measures	4
HA-B: Relate area hydrologic models to its natural systems models	4
HA-D: Determine the pre-development seasonal aquifer elevations for the Peace, Myakka, and Caloosahatchee River	4
HA-H: Regional / Subregional Water Budget	4
HA-I: Hydrologic monitoring of hydrologic restoration projects to determine changes of flow and upstream acres improved.	4
HA-K: Assure unbiased technical reviews of findings regarding reservoirs, possibly using a National Research Council Panel approach.	4
HA-K: Complete an inventory of the numbers, types and locations of current, proposed and possible reservoirs and related water storage facilities.	4
HA-K: Coordinate agency efforts to consider reservoirs from a watershed perspective (rather than a location-by-location approach), when planning, siting, assessment and permitting of new reservoirs and other hydrologic alterations.	4
HA-K: Initiate aggressive water conservation programs and include water conservation in water budget analyses and when planning, siting, assessment and permitting of new reservoirs and other hydrologic alterations.	4
HA-K: Research effects of existing reservoirs on downstream waters	4
HA-O: 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.	4
SG-A: Collect and evaluate existing and relevant survey information related to the CCMP.	4
SG-A: Conduct scientifically valid survey of residents' knowledge and behavioral changes.	4
SG-H: Inventory and evaluate curricula that implements the CCMP.	4
SG-Q: Citizen Science- Blue Carbon Sequestration in Coastal Mangrove Plots	4
WQ-E: If subbasins are not meeting exceedance criteria, develop load reduction goals and management strategies to address exceedances	4
WQ-G: Refine optical models to help establish local standards or numeric water quality targets for chlorophyll a, turbidity, and total suspended solids that incorporate dissolved matter.	4
WQ-H: Continue to assess the water quality impacts of biosolid landspreading	4
WQ-H: Identify areas with septic tank maintenance program enforced	4
WQ-I: Changes in phytoplankton community dynamics in Charlotte Harbor and implications for hypoxia and red tide	4
WQ-I: Determine nutrient influence on phytoplankton community dynamics	4
WQ-I: Prepare annual and mean monthly maps of red tide severity and extent within the study area	4
FW-A: Assess why SAV recovering well in the meso- and oligohaline Caloosahatchee	3
FW-A: Compile Caloosahatchee River SAV monitoring data and identify gaps in distribution, frequency and methods.	3
FW-A: Develop benthic index for mud and salt flats and subtidal unvegetated bottoms of Charlotte Harbor to be used as an indicator	3
FW-A: Develop oyster bar monitoring program for spat recruitment, percent living/dead and disease	3
FW-A: Map salt flats and mud flats separately to determine natural variation in habitat extents	3
FW-B: Cumulative Impacts of Intra-Coastal Waterway Dredging and other dredging	3

FW-C: Seasonal Distribution of Freshwater Fish in Ephemeral Wetlands	3
FW-F: Determine how SAV loss in the Caloosahatchee affects manatee movements and mortality	3
FW-F: WMD or FWC to map hydric pine flatwoods within existing programs	3
FW-J: Expand the SWFRPC ECOSERVE technique that was applied to the Pine Island Sound and associated lands to the entire CHNEP study area.	3
FW-M: Create a monitoring program to determine the percent of exotic plants in freshwater marshes throughout the CHNEP area	3
HA-A: Evaluate Life History of Reptile/Amphibian Populations as an indicator of Ecosystem Shift	3
HA-A: Identify the location and extent of the historic oligohaline zones within the Charlotte Harbor NEP study area.	3
HA-E: Monitor flow in the Estero River	3
HA-G: Mapping/GIS program to track changes in subbasin hydrology	3
HA-I: Monitor hydrologic conditions near artificially created structures (e.g. weirs, bridges)	3
HA-J: Map ditches and canals that have been modified to slow flow.	3
HA-J: Update Delineation of the Regional Flowways	3
HA-K: Examine groundwater chemistry at proposed reservoir sites.	3
HA-K: Give greater consideration to climate change and its effects when siting and designing reservoirs.	3
HA-K: Identify primary water users to engage them in watershed-wide conservation discussions.	3
HA-K: Increase consideration of cumulative impacts on demographic, economic, political, legal, public safety when planning and permitting water storage activities and hydrologic alterations.	3
HA-L: Inventory and evaluate impervious contributions, BMPs, etc. through land monitoring	3
SG-B: Citizen Science- Use i-Tree to characterize urban forests by subbasin.	3
SG-K: Place informative signage in public transit buses and at bus terminals.	3
SG-Q: Track changes in floral organ differentiation using model data.	3
WQ-B: Survey sediments to assess heavy metals every several years	3
WQ-E: Investigate the presence of organophosphate pesticides in run-off effect on water mammals in the Gulf.	3
WQ-F: Assess all water quality reformed adopted by state and local governments.	3
WQ-G: Assess impacts of arsenic from boat docks and marinas	3
WQ-G: Develop exceedance criteria for numeric Charlotte Harbor NEP water quality targets using the plane of constant attenuation. Determine if subbasins in Lemon Bay, Charlotte Harbor and Estero Bay are meeting exceedance criteria	3
WQ-G: Freshwater Invertebrates as Indicators of Cultural Eutrophication	3
WQ-G: Whether hypoxia is ancient or recent	3
WQ-I: 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.	3
WQ-I: Install continuous nutrient monitoring devices in critical locations (e.g., areas commonly experiencing phytoplankton blooms).	3
FW-A: Bottom Sediments at the Widening of the Caloosahatchee and Peace Rivers	2
FW-A: Create map of Caloosahatchee River estimated SAV and Vallisneria distribution during the 1960s.	2

FW-A: Determine deep edge of Vallisneria growth in Caloosahatchee River using herbivore exclusion cages.	2
FW-A: Determine the natural variation in seagrass bed characteristic	2
FW-A: Investigate methods for controlling herbivory on Caloosahatchee River SAV.	2
FW-C: Analyze Wetland Monitoring Reports Submitted to the WMD from Wells	2
FW-C: Determine natural variation in freshwater wetland habitat extent	2
FW-C: Develop a community profile of salt marsh systems	2
FW-C: Use WMD FLUCCS maps to track changes in freshwater wetland extent	2
FW-F: Assess the impacts of firelines (fire plow lines) on wildlife	2
FW-F: Map of historic and modern Tropical Hardwood Hammocks	2
FW-L: Develop a protocol with Florida Natural Areas Inventory to develop complete surveys for invasive exotic plants within study area public conservation lands and implement	2
HA-A: Black Mangrove Marsh as Water Level Stage Performance Measures	2
HA-B: Determine maximum cumulative withdrawals	2
HA-B: Improved Topographic Resolution	2
HA-F: Track Everglades and Comprehensive Southwest Florida Restoration Plan implementation	2
HA-K: Clarify definitions of reservoirs and other related water storage practices.	2
HA-K: Enhance interagency coordination of reservoir management using new technologies, improved models and more monitoring data, and in some cases conducting special studies to assess performance.	2
HA-K: Increase consideration of environmental factors, particularly the effects of reservoirs on the freshwater flow regime and water budget of the receiving streams and estuaries when planning, siting, assessment and permitting of new reservoirs and other hydrologic alterations.	2
WQ-G: Assessment of Adverse Ecological Impact of Agricultural Chemicals in fish and wildlife habitat	2
WQ-G: Develop partial attenuation coefficients for the CHNEP water quality optical model reflecting spatiotemporal variability of absorbance and scattering components in the water column	2
WQ-H: Identify Sludge Application Sites and Amounts	2
WQ-I: Monitor zooplankton concentrations that may exhibit top-down, grazing influence on phytoplankton and therefore mask the effect of increased nutrients.	2
FW-D: Citizen Science- Replicate shoreline survey of urban lots.	1
FW-F: Monitor and assess invertebrate grazers that may control algal abundance	1
FW-L: Create a monitoring program to determine the percent of exotic plants in saltwater marshes throughout the CHNEP area	1
HA-B: Expand SWFFS or CFRPC Hydrologic Model to Charlotte Harbor Study Area	1
HA-B: Subsurface Hydrology in Natural Communities at Myakka River State Park and Beker B Property	1
HA-F: Southwest Florida Feasibility Study	1
HA-K: Compare Water Use to Water Conservation Programmatic Variables	1
HA-K: Examine soil chemistry at proposed reservoir sites.	1
HA-K: Map oysters in Caloosahatchee 15 years after construction of C-43 reservoir	1
HA-K: Include National Environmental Policy Act requirements when planning, siting, assessment and permitting of new reservoirs and other hydrologic alterations.	1

HA-M: Identify maximum flows for restoration targets	1
HA-M: Track greater than 2800 cfs over S-78, Franklin Locks.	1
WQ-D: Replicated pollutant load modeling accomplished in 2007.	1
WQ-D: Use i-Tree Hydro to assess Orange River basin and impact of more trees.	1
WQ-G: Develop site specific alternative criteria for DO, Chl a, Turbidity, Salinity, Pesticides	1
WQ-I: Assess Phytoplankton Species Composition and Abundance in Myakka Lakes	1
FW-B: Impacts of Boat Propeller Scars on Organisms that Rely on SAV and/or Open Bottom Habitats	0
FW-C: Assess impacts of vehicle tread marks on wetland habitat	0
FW-L: Compile nuisance exotic animals for the study area from the FWC and USGS databases	0
HA-N: Land Monitoring System	0
WQ-I: 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.	0