

BASIN MANAGEMENT ACTION PLAN

**for the Implementation of Total Maximum Daily Loads for Fecal
Coliform Adopted by the Florida Department of Environmental
Protection**

in

Bayou Chico (Pensacola Basin)

*Developed in consultation with
Bayou Chico BMAP Technical and Local Stakeholders*

*and the
Florida Department of Environmental Protection
Division of Environmental Assessment and Restoration
Bureau of Watershed Restoration
Tallahassee, FL 32399*

August 2011

ACKNOWLEDGMENTS: The *Bayou Chico Watershed Basin Management Action Plan* (BMAP) was prepared as part of a statewide watershed management approach to restore and protect Florida’s water quality. It was developed by local stakeholders, with participation from affected local, regional, state, and federal governmental and private interests, and in cooperation with the Florida Department of Environmental Protection. FDEP especially recognizes and appreciates the efforts of all of our participants and local stakeholder groups, and **particularly wish to recognize the following contributors to the Bayou Chico BMAP:**

ENTITY/STAKEHOLDER	PARTICIPANT(S)
Bay Area Resource Council, in conjunction with the West Florida Regional Planning Council	Mary Gutierrez
Bayou Chico Association	John Naybor
City of Pensacola	Al Garza and L. Derrik Owens
Emerald Coast Utility Authority	Tim Haag, John M. Seymour, Stephen P. Holcomb, and Wade Wilson
Escambia County	Taylor Kirschenfeld, Brent Wipf, Sava Varazo, Joy Blackmon, T. Lloyd Kerr, Robert Turpin, Jeri Folse, and Erin Percifull
Escambia County Health Department – Florida Department of Health	Robert Merritt, Philip Davies, and Louviminda Donado
Florida Department of Environmental Protection – Northwest District	Shawn Hamilton (Director), Dick Fancher, Bradley Hartshorn, Mike King, Cheryl Bunch, Jennifer Claypool, Jonathon Colmer, and Dan Stripling
Florida Department of Environmental Protection – Tallahassee	John Abendroth, Bonita Gorham, Linda Lord, Kimberly Jackson, and Yesenia Escribano
Florida Department of Transportation, District 3	James “Jim” Kapinos, Joy Giddens, and Lonnie “DJ” Barber
Facilitators and Technical Support: Science Application International Corporation (SAIC) Wildwood Consulting, Inc.	Kathleen Harrigan and Robert Kelly Marcy Policastro
Other key local interest groups and private citizens and consultants	Larry Buxton, Alexander Maestre, Barbara Albrecht, Eleanor Godwin, Ken Davis, William DeBusk, Chris Knight (Florida Department of Agriculture and Consumer Services), Janet Hearn, Ann Shortell, Steve Freeman, Amy Tracy, Erin Cox, and Rick Higdon
Northwest Florida Water Management District	Ron Bartel
Pensacola Yacht Club	Sam Foreman, Alan McMillan, and Vicki Fletcher
University of West Florida, Center for Environmental Diagnostics and Bioremediation	Dr. Richard Snyder and Dr. Carl Mohrherr
U.S. Environmental Protection Agency	Michael Lewis and Franklin Baker
U.S. Navy (Naval Air Station)	Mark Gibson

For additional information on the Basin Management Action Plan in the Bayou Chico watershed, contact:

Bonita Gorham, Basin Coordinator
Florida Department of Environmental Protection
Bureau of Watershed Restoration, Watershed Planning and Coordination Section
2600 Blair Stone Road, Mail Station 3565
Tallahassee, FL 32399-2400
Email: Bonita.Gorham@dep.state.fl.us
Phone: (850) 245-8513

TABLE OF CONTENTS

LIST OF ACRONYMS AND ABBREVIATIONS.....	VII
EXECUTIVE SUMMARY	X
SECTION 1: CONTEXT, PURPOSE, AND SCOPE OF THE PLAN	1
1.1 <i>Water Quality Standards and Total Maximum Daily Loads</i>	1
1.2 <i>TMDL Implementation</i>	4
1.3 <i>The Bayou Chico BMAP</i>	5
1.3.1 <i>Stakeholder Involvement</i>	5
1.3.2 <i>Plan Purpose and Approach</i>	6
1.3.3 <i>Plan Scope</i>	7
1.3.4 <i>Sufficiency-of-Effort Determinations</i>	9
1.3.5 <i>Pollutant Reduction and Discharge Allocations</i>	12
1.3.5.1 <i>Categories for Rule Allocations</i>	12
1.3.5.2 <i>Initial and Detailed Allocations</i>	12
1.3.5.3 <i>Bayou Chico Watershed Fecal Coliform TMDL</i>	13
1.3.5.4 <i>Background and Pollutant Considerations in Bayou Chico</i>	13
1.4 <i>Assumptions and Considerations Regarding TMDL Implementation</i>	15
1.4.1 <i>Assumptions</i>	15
1.4.2 <i>Considerations</i>	16
1.5 <i>Future Growth in the Watershed</i>	17
SECTION 2: POLLUTANT SOURCES AND ANTICIPATED OUTCOMES.....	18
2.1 <i>Fecal Coliform Pollutant Sources</i>	18
2.1.1 <i>Sanitary Sewer Systems</i>	18
2.1.2 <i>OSTDS</i>	19
2.1.3 <i>Stormwater</i>	19
2.1.4 <i>Marina Activities</i>	20
2.1.5 <i>Wildlife</i>	21
2.2 <i>Water Quality Trends in the Watershed</i>	21
2.3 <i>Anticipated Outcomes</i>	22
SECTION 3: SANITARY SEWER SYSTEMS.....	24
3.1 <i>Potential Sources</i>	24
3.2 <i>Projects To Reduce Fecal Coliform Loading</i>	24
SECTION 4: ONSITE SEWAGE TREATMENT AND DISPOSAL SYSTEMS	32
4.1 <i>Potential Sources</i>	32
4.2 <i>Projects To Reduce Fecal Coliform Loading</i>	34
SECTION 5: STORMWATER	40
5.1 <i>Potential Sources</i>	40
5.2 <i>Projects To Reduce Fecal Coliform Loading</i>	40

SECTION 6: MARINAS, BOATYARDS, AND MOORINGS	49
6.1 <i>Potential Sources</i>	49
6.2 <i>Projects To Reduce Fecal Coliform Loading</i>	49
SECTION 7: SUMMARY OF RESTORATION ACTIVITIES AND SUFFICIENCY OF EFFORT	53
SECTION 8: ASSESSING PROGRESS AND MAKING CHANGES	57
8.1 <i>Tracking Implementation</i>	57
8.2 <i>Water Quality Monitoring.....</i>	58
8.2.1 <i>Water Quality Monitoring Objectives</i>	58
8.2.2 <i>Water Quality Indicators</i>	58
8.2.3 <i>Monitoring Network</i>	59
8.2.4 <i>Quality Assurance/Quality Control.....</i>	60
8.2.5 <i>Data Management and Assessment.....</i>	60
8.3 <i>Adaptive Management Measures</i>	61
APPENDICES	62
<i>Appendix A: TMDL Basin Rotation Schedule.....</i>	63
<i>Appendix B: Summary of Statutory Provisions Guiding BMAP Development and Implementation.....</i>	64
<i>Appendix C: Summary of EPA-Recommended Elements of a Comprehensive Watershed Plan.....</i>	67
<i>Appendix D: Programs To Achieve the TMDL</i>	71
<i>Appendix E: BMAP Annual Reporting Form.....</i>	81
<i>Appendix F: Minutes from Technical Meetings with Stakeholders</i>	83
<i>Appendix G: Glossary of Terms.....</i>	84
<i>Appendix H: Bibliography of Key References and Websites</i>	89

LIST OF FIGURES

<i>Figure 1-1: Bayou Chico Watershed Location Map.....</i>	<i>3</i>
<i>Figure 2-1: Long-Term Monitoring Stations in the Bayou Chico Watershed.....</i>	<i>23</i>
<i>Figure 3-1: Sewer Infrastructure in the Eastern Bayou Chico Watershed.....</i>	<i>25</i>
<i>Figure 3-2: Sewer Infrastructure in the Western Bayou Chico Watershed.....</i>	<i>26</i>
<i>Figure 4-1: Septic Tank Repairs in the Bayou Chico Watershed</i>	<i>33</i>
<i>Figure 7-1: Stakeholder Restoration Efforts in the Eastern Bayou Chico Watershed.....</i>	<i>55</i>
<i>Figure 7-2: Stakeholder Restoration Efforts in the Western Bayou Chico Watershed.....</i>	<i>56</i>

LIST OF TABLES

<i>Table 1-1: Designated Use Attainment Categories for Florida Surface Waters.....</i>	<i>1</i>
<i>Table 1-2: Phases of the Watershed Management Cycle.....</i>	<i>4</i>
<i>Table 1-3: Bayou Chico Fecal Coliform TMDL</i>	<i>13</i>
<i>Table 3-1: Sewer Expansion Program Projects in the Bayou Chico Watershed.....</i>	<i>28</i>
<i>Table 3-2: Stakeholder Projects and Activities To Reduce Fecal Coliform Loadings from Sanitary Sewer Sources.....</i>	<i>31</i>
<i>Table 4-1: Stakeholder Projects and Activities To Reduce Fecal Coliform Loading from OSTDS Sources.....</i>	<i>38</i>
<i>Table 5-1: Stakeholder Projects and Activities To Reduce Fecal Coliform Loading from Stormwater Sources.....</i>	<i>46</i>
<i>Table 6-1: Stakeholder Projects and Activities To Reduce Fecal Coliform Loading from Marinas, Boatyards, and Moorings</i>	<i>52</i>
<i>Table 7-1: Potential Source Control Categories in the Bayou Chico Watershed for Addressing Load Reductions for Fecal Coliform and Other Bacteria</i>	<i>54</i>
<i>Table 8-1a: Water Quality Indicators</i>	<i>59</i>
<i>Table 8-1b: Field Parameters.....</i>	<i>59</i>

LIST OF TABLES: APPENDICES

<i>Table A-1: Major Hydrologic Basins by Group and FDEP District Office.....</i>	<i>63</i>
<i>Table E-1: Proposed BMAP Annual Reporting Form.....</i>	<i>81</i>
<i>Table G-1: Stormwater and Water Quality Protection Websites.....</i>	<i>91</i>

LIST OF ACRONYMS AND ABBREVIATIONS

ACRONYM/ ABBREVIATION	EXPLANATION
umhos/cm	Micromhos per Centimeter
ARV	Air Release Valve
ATAC	Allocation Technical Advisory Committee
AWT	Advanced Wastewater Treatment
BARC	Bay Area Resource Council
BAT	Best Available Technology
BCA	Bayou Chico Association
BMAP	Basin Management Action Plan
BMP	Best Management Practice
BOD	Biochemical Oxygen Demand
CAFOs	Concentrated Animal Feeding Operations
CDBG	Community Development Business Grant
CDS	Continuous Deflective Separation
CEDB	Center for Environmental Diagnostics and Bioremediation
CFU	Colony-Forming Units
CIP	Capital Improvement Program
CIPP	Cured in Place Pipe
CMOM	Capacity, Management, Operations, and Maintenance
COP	City of Pensacola
Counts/100mL	Counts per 100 Milliliters
CVA	Clean Vessel Act
CWA	Clean Water Act
CWRF	Central Water Reclamation Facility
DSR	Drainage System Repair
EAP	Environmental Analysis Program
ECHD	Escambia County Health Department
ECMR	Escambia County Marine Resources
ECUA	Emerald Coast Utility Authority
ECWQD	Escambia County Water Quality Division
EPA	U.S. Environmental Protection Agency
F.A.C.	Florida Administrative Code
FCT	Florida Communities Trust
FDACS	Florida Department of Agriculture and Consumer Services
FDEP	Florida Department of Environmental Protection
FDOH	Florida Department of Health
FDOT	Florida Department of Transportation
FOG	Fats, Oils, and Grease (Program)
F.S.	Florida Statutes
FWC	Florida Fish and Wildlife Conservation Commission
FWRA	Florida Watershed Restoration Act
FY	Fiscal Year
GIS	Geographic Information System
HUD	U.S. Department of Housing and Urban Development

ACRONYM/ ABBREVIATION	EXPLANATION
I/E	Information and Education
I&I	Inflow and Infiltration
IWR	Impaired Surface Waters Rule
LA	Load Allocations
LF	Linear Feet
MF	Membrane Filter
MGD	Million Gallons per Day
mg/L	Milligrams per Liter
Mi ²	Square Miles
mL	Milliliter
MOS	Margin of Safety
MPN	Most Probable Number
MRP	Maintenance Rating Program
MS4	Municipal Separate Storm Sewer System
MSGP	Multi-Sector General Permit
MST	Microbial Source Tracking
MSWTP	Main Street Wastewater Treatment Plant
NMWF	National Marine Waste Foundation
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source Pollution
NRCS	Natural Resources Conservation Service
NTUs	Nephelometric Turbidity Units
NWFWMD	Northwest Florida Water Management District
OSTDS	Onsite Sewage Treatment and Disposal System
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PCPs	Pentachlorophenols
PIC	Potential Illicit Connection
PLRGs	Pollutant Load Reduction Goals
ppt	Parts per Thousand
PSA	Public Service Announcement
PVC	Polyvinyl Chloride (pipe)
QA/QC	Quality Assurance/Quality Control
ROW	Right-of-Way
SCADA	Supervisory Control And Data Acquisition
SEP	Sewer Expansion Program
SIC	Standard Industrial Classification
SOP	Standard Operating Procedure
SSO	Sanitary Sewer Overflow
STORET	Storage and Retrieval (database)
SU	Standard Units
SWIM	Surface Water Improvement Program
SWPPP	Stormwater Pollution Prevention Plan
SWR	Sewer

ACRONYM/ ABBREVIATION	EXPLANATION
TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
USACOE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
UV	Ultraviolet (light)
UWF	University of West Florida
WBID	Waterbody Identification (number)
WLAs	Wasteload Allocations
WQSS	Water Quality Standards
WWTF	Wastewater Treatment Facility
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

BAYOU CHICO WATERSHED

The Bayou Chico watershed, located in the southern end of Escambia County, just east of Blue Angel Parkway and north of Bayou Grande, has a 10.36-square-mile (mi²) drainage area and a water surface area of approximately 0.39 mi².

The waterbodies addressed by this Basin Management Action Plan (BMAP) consist of Bayou Chico, which discharges directly to Pensacola Bay, and the following six waterbody segments, all of which flow into Bayou Chico and the bay: Jones Creek, Jackson Creek, Bayou Chico Drain, Bayou Chico Beach (at Lakewood Park), Bayou Chico proper, and Sanders Beach.

The Bayou Chico watershed consists of two Class III fresh waterbodies (Jones Creek and Jackson Creek) and four Class III marine waterbodies (Bayou Chico, Bayou Chico Drain, Bayou Chico Beach, and Sanders Beach). Class III waterbodies have a designated use of recreation, propagation, and the maintenance of a healthy, well-balanced population of fish and wildlife. The water quality criterion applicable to the impairment addressed by the Bayou Chico Total Maximum Daily Load (TMDL) is the Class III criterion for fecal coliform.

BAYOU CHICO TMDLS

TMDLs are water quality targets for specific pollutants (such as fecal coliform) that are established for impaired waterbodies that do not meet their designated uses based on Florida's water quality standards. During Cycle 1 of the watershed management cycle in the Pensacola Basin, as required by federal law, the Florida Department of Environmental Protection (FDEP) verified fecal coliform impairments in five of the six waterbodies in the Bayou Chico watershed.

In 2008, FDEP adopted TMDLs for the following waterbodies, which are included in the BMAP:

- *Bayou Chico (Waterbody Identification [WBID] Number 846);*
- *Jones Creek (WBID 846A);*
- *Jackson Creek (WBID 846B);*
- *Bayou Chico Beach (WBID 846CB); and*
- *Sanders Beach (WBID 848DA).*

In addition, a sixth segment, Bayou Chico Drain (WBID 846C), was verified impaired for fecal coliform in Cycle 2 of the listing process. Also in Cycle 2, Bayou Chico (WBID 846) and Bayou Chico Drain (WBID 846C) were verified impaired for nutrients (with total phosphorus [TP] as the limiting nutrient), and this impairment will be further evaluated in subsequent BMAP planning efforts for the Pensacola Basin.

The Bayou Chico fecal coliform TMDL was calculated as the median of the percent reductions needed over the data range where exceedances occurred, which in this case was over the entire range of flow conditions. The source loadings (levels) for fecal coliform described in **Section 2** would need to be reduced by **61%** to achieve the required TMDL load reduction.

THE BAYOU CHICO BMAP

Stakeholder involvement is critical to the success of the TMDL Program, and varies with each phase of implementation to achieve the same purpose—the attainment of water quality standards for Bayou Chico. The BMAP development process is structured to achieve cooperation and consensus among a broad range of interested parties.

Stakeholder involvement and meaningful public involvement are essential to develop, gain support for, and secure commitments to implement a BMAP. They were a key component in the development of the Bayou Chico BMAP. Beginning in February 2009, FDEP initiated the BMAP development process for Bayou Chico and held a total of nine technical meetings. The purpose of the meetings, all of which were open to the general public, was to consult with key stakeholders to gather information on the impaired waterbody and its tributaries; identify potential sources; conduct field reconnaissance; define programs, projects, and actions currently under way; and develop the BMAP contents and actions that would result in improved water quality, with the goal of achieving the TMDL target reductions.

This BMAP addresses the waterbodies in the Bayou Chico watershed that were verified impaired for fecal coliform. Six segments that make up the entire watershed were impaired for fecal coliform (as described earlier, five were identified in Cycle 1 of the watershed assessment process and in the TMDL, and a sixth segment was listed for fecal coliform in Cycle 2).

The types of projects that stakeholders have been implementing over the last five years (2006–11) that help to address these impairments include sanitary sewer expansion projects, stormwater improvements, pet waste ordinance adoption, septic tank inspections and testing (prior to property sales), neighborhood clean-sweep programs, barge and derelict vessel removals, Clean Marina and Boatyard Program implementation, and Bayou Chico channel dredging (improved flushing). This BMAP highlights these and other projects that will address the known and suspected sources of fecal coliform and other pathogens, and demonstrate that local stakeholders have taken a proactive stance in addressing future water quality concerns.

The projects and activities outlined in this BMAP have been determined to be “sufficient” to address all of the identified sources and, with the full implementation of the BMAP, water quality in the Bayou Chico watershed is expected to meet the TMDL requirements. Through ongoing projects, studies, and monitoring efforts, the five-year BMAP milestone evaluation and annual BMAP reviews should help stakeholders identify and address any additional sources and any necessary actions that should be taken.

BMAP STAKEHOLDERS

FDEP worked with the following groups and organizations to prepare this BMAP:

- ***Bay Area Resource Council (BARC)**, in conjunction with the **West Florida Regional Planning Council**, comprises a cross-section of elected officials from local governments representing the Pensacola Basin that have signed an interlocal agreement. Through various activities, BARC works to share information gathered for local planning purposes and to develop a restoration program for Pensacola Bay;*
- ***Bayou Chico Association (BCA)** represents over 800 residents and commercial and industrial interests in the Bayou Chico watershed. It facilitates efforts to help the water quality, living, and working conditions on and around Bayou Chico;*
- *City of Pensacola;*
- *Emerald Coast Utility Authority (ECUA);*
- *Escambia County;*
- *Escambia County Health Department (ECHD), Florida Department of Health (FDOH);*
- *Florida Department of Environmental Protection (FDEP), Northwest District Office;*
- *Florida Department of Transportation (FDOT);*
- *Pensacola Yacht Club;*
- *University of West Florida (UWF), Center for Environmental Diagnostics and Bioremediation (CEDB) and Wetland Research Laboratory;*
- *U.S. Environmental Protection Agency (EPA), Gulf Islands Marine Research Laboratory; and,*
- *U.S. Naval Air Station*

BMAP APPROACH

The 1999 Florida Watershed Restoration Act (FWRA) contains provisions that guide the development of BMAPs and other TMDL implementation approaches. The Bayou Chico BMAP provides for phased implementation under Paragraph 403.067(7)(a)1, Florida Statutes (F.S.). A five-year milestone evaluation will be carried out to assess and verify that adequate progress is being made towards achieving water quality standards and the load reductions identified in the Bayou Chico TMDL. An adaptive management approach for TMDL implementation, as described in the BMAP, will address reductions to fecal coliform bacteria, and the iterative evaluation process will continue until reductions are attained.

This first five-year phase of the BMAP is designed to address the TMDL and work towards achieving water quality standards in the watershed. It includes gathering additional

information or studies that can be used in the development of the subsequent phase(s) to further support TMDL implementation, as well as more intensive monthly sampling to determine the locations of particular hot spots that should be addressed. In addition, the phased BMAP approach allows for the continued implementation of projects designed to achieve reductions, while simultaneously implementing source assessment, carrying out monitoring, and conducting studies to better understand fecal coliform variability and water quality dynamics in each impaired waterbody.

SUFFICIENCY-OF-EFFORT EVALUATION

The Bayou Chico fecal coliform TMDL is expressed as a percent reduction based on in-stream fecal coliform concentrations. This method of TMDL allocation precludes detailed allocations, as it would be complicated, if not impossible, to equitably allocate to stakeholders based on a percent reduction of in-stream concentrations. Fecal coliform are highly variable and easily transported, making it difficult in most cases to identify the source of the bacteria. Additionally, very few data are available that show the efficiency of stormwater best management practices (BMPs) and management actions in removing or reducing fecal coliform.

FDEP evaluated fecal coliform reduction activities using a *basinwide* sufficiency-of-effort approach by assessing identified potential sources and the specific activities over the entire Bayou Chico watershed that will reduce or eliminate sources of fecal coliform loading. Thus, this sufficiency-of-effort evaluation is not an evaluation of each entity's individual activities; rather, it focuses on whether these activities correspond to the potential sources identified in the watershed and whether the total efforts are adequate to eliminate or reduce the known sources, assess unknown sources, and prevent the development of new sources.

Based on source assessments and information gathered for this BMAP, a summary of restoration activities (**Section 7**) was produced to identify the appropriate programs and activities being implemented for the most likely sources in the Bayou Chico watershed. These programs and activities are expected to either reduce or eliminate the known sources, or they may be needed to further assess fecal coliform loadings. Both FDEP and key stakeholders have deemed the full implementation of the management actions/projects identified in this BMAP as sufficient to address the fecal coliform bacteria reductions needed to meet the target load reductions defined in the TMDL for Bayou Chico.

KEY ELEMENTS OF THE BMAP

This BMAP addresses the key elements required by the FWRA, Chapter 403.067, F.S., including the following:

- *Document how the public and other stakeholders were encouraged to participate or participated in developing the BMAP (**Section 1.3.1**);*
- *Equitably allocate pollutant reductions in the watershed (**Sections 1.3.4 and 1.3.5**);*

- *Identify the mechanisms by which potential future increases in pollutant loading will be addressed (Section 1.5);*
- *Document management actions/projects to achieve the TMDL (Sections 3 through 7);*
- *Document the implementation schedule, funding, responsibilities, and milestones (Sections 3 through 6); and*
- *Identify monitoring, evaluation, and a reporting strategy to evaluate reasonable progress over time (Section 8).*

ANTICIPATED OUTCOMES OF BMAP IMPLEMENTATION

Through the implementation of projects, activities, and additional source assessments as documented in this BMAP, stakeholders expect the following outcomes:

- *Improved water quality trends in the Bayou Chico watershed that will also help improve water quality in other receiving waterbodies (e.g., Pensacola Bay);*
- *Decreased loading of the target pollutants (fecal coliform and other pathogens, i.e., *Enterococcus* sp.);*
- *Enhanced public awareness of fecal coliform sources and impacts on water quality;*
- *Enhanced effectiveness of corresponding corrective actions by stakeholders;*
- *Better understanding of the watershed's hydrology, water quality, and pollutant sources; and*
- *Improved ability to evaluate management actions, assess their benefits, and identify additional pollutant sources.*

BMAP Cost

Costs were provided for 57% of the activities identified in the BMAP, with an estimated total cost of more than \$18,551,946 for capital projects and an estimated \$1,000,000 to \$1,500,000 (needed, or being funded) for ongoing programs, operation and maintenance, and restoration proposals. In addition, some of the activities identified in the BMAP have no defined real or actual costs (e.g., the Clean Marina and Boatyard Programs in Bayou Chico and state-funded, e.g., ECHD programs). The funding sources for the ongoing improvements have typically come from local contributions and homeowner associations, stormwater utility fees, and grants from state and federal programs (such as Section 319 programs, National Oceanic and Atmospheric Administration [NOAA] grants, and other programs). Technical stakeholders and local citizens will continue to explore new opportunities for funding assistance to ensure that the activities listed in this BMAP can be maintained at the necessary level of effort.

BMAP FOLLOW-UP

As a part of BMAP follow-up, FDEP and stakeholders will track implementation efforts and monitor water quality to determine additional sources and water quality trends. The sampling locations in the monitoring plan were selected to identify potential sources of contamination through source assessment monitoring at key locations throughout the watershed, and to track trends in fecal coliform (and *Enterococci*) using existing monitoring stations with historical data. In addition, more extensive monthly sampling is proposed at specific sampling locations where fecal coliform counts have been historically high.

The source assessment monitoring will follow the established sampling protocol, in which any observed fecal coliform counts of 5,000 colony-forming units per 100 milliliters (CFU/100mL) or greater will be followed up with targeted sampling efforts (*Tier 2*) to determine and address the source. FDEP, Escambia County, the city of Pensacola, BCA, and ECUA, in concert with FDEP's strategic monitoring network, will be responsible for the trend and source assessment sampling (*Tier 1*) in the overall monitoring plan. These stakeholders have committed to assist or provide services and/or monetary aid for a 3-year monitoring plan through the help of UWF and FDEP.

FDEP will add the analysis for *Enterococcus* as well as fecal coliform to its quarterly sampling. Escambia County will provide assistance in monthly field sampling. Samples for *Enterococcus* and fecal coliform will be processed by the Wetland Research Laboratory at UWF, while UWF's CEDB will help to compile and analyze the data, and will provide a three-year interim report on water quality status and trends. In addition, ECHD will continue (biweekly) beach sampling for fecal coliform and (weekly) *Enterococcus* bacteria counts at Bayou Chico (Lakewood Park) and Sanders Beach, in conjunction with its Healthy Beaches Program. Furthermore, all data collected for these follow-up BMAP efforts will be uploaded into FDEP's STORage and RETrieval (STORET) database, where water quality data can be stored and readily retrieved by WBID number(s) for watershed-wide assessments.

The *Tier 2* analysis will specifically target the following areas: (1) probable or suspected loading points previously identified, and (2) newly suspected spots, especially in the tributaries and creeks that were not previously sampled. Samples will be taken both during dry and rainy periods to isolate chronic and stormwater influences. Higher resolution sampling will be used to resample identified loading areas for further confirmation and to assist in pinpointing sources. Areas using septic tanks that were previously identified as hot spots and converted to sanitary sewer service will be revisited to document any remediation of fecal loadings from that activity.

The results of these efforts will be used to evaluate the effectiveness of the BMAP activities in reducing fecal coliform loading in the Bayou Chico watershed. In addition, technical stakeholders and local citizens will meet with FDEP at least every 12 months to discuss implementation issues, consider new information, and determine what other management strategies are needed, if monitoring indicates that additional measures are necessary to reduce fecal coliform.

BENEFITS OF THE BMAP PROCESS

With the implementation of the activities outlined in this BMAP, in addition to the anticipated outcomes noted above, the following benefits are expected:

- *Increased coordination between state and local governments and within divisions of local governments in problem solving for surface water quality restoration;*
- *Added security in obtaining additional state and local funding for water quality restoration;*
- *Improved communication and cooperation among state and local agencies responding to restoration needs; and*
- *The determination of effective projects through the stakeholder decision-making and priority-setting processes.*

COMMITMENT TO BMAP IMPLEMENTATION

Local technical stakeholders support the BMAP on behalf of the entities they represent and are committed to ensuring that the plan to reduce fecal coliform in the Bayou Chico watershed is implemented. In addition to this support, the BMAP was presented to BARC on April 27, 2011. The BARC representatives comprise many of the watershed's various stakeholders and include many of the entities involved in developing this BMAP. These entities share their support of the BMAP and activities in the watershed, and can ensure that as their staff and board members change over time, BARC has a way to continue support for the BMAP and the efforts it describes.

SECTION 1: CONTEXT, PURPOSE, AND SCOPE OF THE PLAN

1.1 WATER QUALITY STANDARDS AND TOTAL MAXIMUM DAILY LOADS

Florida's water quality standards are designed to ensure that surface waters can be used for their designated purposes, such as drinking water, recreation, and agriculture. Currently, most surface waters in Florida, including those in the Bayou Chico watershed, are categorized as Class III waters, which mean they must be suitable for recreation and must support the propagation and maintenance of a healthy, well-balanced population of fish and wildlife. **Table 1-1** shows all designated use categories.

Under Section 303(d) of the federal Clean Water Act, every two years each state must identify its impaired waters, including estuaries, lakes, rivers, and streams that do not meet their designated uses and that are not expected to improve within the subsequent two years. The Florida Department of Environmental Protection (FDEP) is responsible for developing this “303(d) list” of impaired waters.

TABLE 1-1: DESIGNATED USE ATTAINMENT CATEGORIES FOR FLORIDA SURFACE WATERS

* Class I and II waters include the uses of the classifications listed below them.

CATEGORY	DESCRIPTION
Class I*	Potable water supplies
Class II*	Shellfish propagation or harvesting
Class III	Recreation, propagation and maintenance of a healthy, well-balanced population of fish and wildlife
Class IV	Agricultural water supplies
Class V	Navigation, utility, and industrial use (no current Class V designations)

Florida's 303(d) list identifies hundreds of waterbody segments that fall short of water quality standards. The three most common water quality concerns are fecal coliform, excess nutrients, and oxygen-demanding substances from anthropogenic sources, resulting in impaired waters that do not meet state standards. The listed waterbody segments are candidates for more detailed assessments of water quality to determine whether they are impaired according to state statutory and rule criteria. FDEP develops and adopts Total Maximum Daily Loads (TMDLs) for waterbody segments identified as impaired. A TMDL is the maximum amount of a specific pollutant that a waterbody can assimilate while maintaining its designated uses.

The water quality evaluation and decision-making processes for listing impaired waters and establishing TMDLs are authorized by Section 403.067, Florida Statutes (F.S.), also known as the Florida Watershed Restoration Act (FWRA), and contained in Florida's Identification of Impaired Surface Waters Rule (IWR), Rule 62-303, Florida Administrative Code (F.A.C.). The impaired waters in the Bayou Chico watershed addressed in this Basin Management Action Plan (BMAP) are all Class III waters. The TMDLs established for the Bayou Chico watershed in June 2008 identify the amount of fecal coliform and other pollutants that the watershed's waterbodies can receive and still maintain Class III designated uses.

The Bayou Chico watershed consists of two Class III fresh waterbodies (Jones Creek and Jackson Creek) and four Class III marine waterbodies (Bayou Chico, Bayou Chico Drain, Bayou Chico Beach, and Sanders Beach). Class III waterbodies have a designated use of recreation, propagation, and the maintenance of a healthy, well-balanced population of fish and wildlife. The water quality criterion applicable to the impairment addressed by the TMDL is the Class III criterion for fecal coliform.

For assessment purposes, FDEP divided the Pensacola Basin into water assessment polygons with a unique waterbody identification (WBID) number for each watershed or stream reach. The Bayou Chico watershed was divided into six waterbody segments, and the TMDL addressed potential sources of bacteria in five of these six segments: **Bayou Chico (WBID 846)**, **Jones Creek (WBID 846A)**, **Jackson Creek (WBID 846B)**, **Bayou Chico Beach (WBID 846CB)**, and **Sanders Beach (WBID 848DA)**. The sixth segment, **Bayou Chico Drain (WBID 846C)**, was not listed as impaired prior to TMDL development. However, it was verified impaired for fecal coliform in Cycle 2 of the watershed management cycle, and thus this BMAP includes site-specific projects that may reduce or eliminate potential fecal coliform sources in WBID 846C. **Figure 1-1** shows the verified impaired waterbodies discussed in this BMAP.

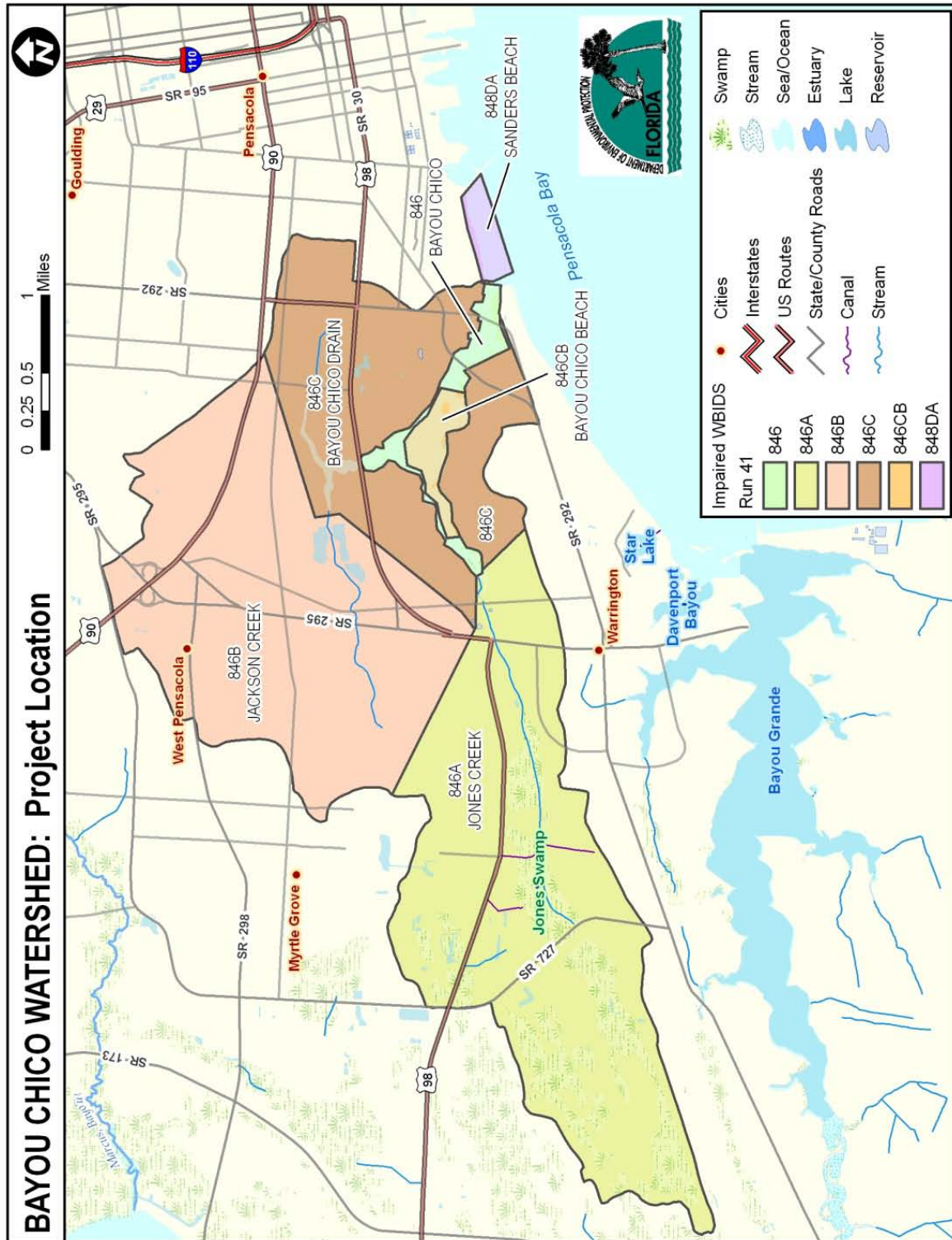
There are 25 sampling stations in the Bayou Chico watershed with historical coliform observations. The primary data collector of historical data is the Bureau of Water within the Florida Department of Health (FDOH), Florida Division of Environmental Health, which maintains routine sampling sites at Bayou Chico and Sanders Beach (STORET IDs: 21FLDOH ESCAMBIA96 and 21FLDOH ESCAMBIA91) (STORET refers to FDEP's STORage and RETrieval database). These sites were sampled between 2 and 6 times per month from August 14, 2000, through June 27, 2005. Additional sampling was conducted by FDEP up to 5 times per month, and by the Bream Fisherman's Association on a quarterly basis. Sample data also collected by the Florida Division of Environmental Health were also used in the TMDL.

The verified period for the TMDL was **January 1, 1998, through June 30, 2005**. Of the 965 fecal coliform samples collected within the verified period, 920 *qualified* samples could be used to establish the Bayou Chico TMDL (since 45 sampling events occurred on days without corresponding U.S. Geological Survey [USGS] flow measurements). The samples used in the TMDL calculation ranged from 0 to 25,000 counts per 100 milliliters (counts/100mL).

Samples were collected in all months of the year, and exceedances occurred in each of the months. At least 64 samples were collected during a given month, with the greatest number of samples (105) collected in March and December. The number of exceedances ranges from a low of 4 in January to a high of 35 in September. More than 50% of exceedances during the verified period occurred in all months except January, February, and March.

Numeric criteria for bacterial quality are expressed in terms of fecal coliform bacteria concentrations. The water quality criterion for the protection of Class III waters, as established by Rule 62-302, F.A.C., states the following:

FIGURE 1-1: BAYOU CHICO WATERSHED LOCATION MAP



Fecal Coliform Bacteria:

The most probable number (MPN) or membrane filter (MF) counts per 100 mL of fecal coliform bacteria shall not exceed a monthly average of 200, nor exceed 400 in 10% of the samples, nor exceed 800 on any one day.

The criterion states that monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30-day period. However, during the development of load curves for the impaired streams, there were insufficient data (fewer than 10 samples in a given month) available to evaluate the geometric mean criterion for fecal coliform bacteria. Therefore, the criterion selected for the TMDL was “not to exceed 400 in 10% of the samples.”

TMDLs are developed and implemented as part of a watershed management cycle that rotates through Florida’s 52 river basins every 5 years (see **Appendix A**) to evaluate waters, determine impairments, and develop and implement management strategies to restore impaired waters to their designated uses. **Table 1-2** summarizes the five phases of the watershed management cycle.

TABLE 1-2: PHASES OF THE WATERSHED MANAGEMENT CYCLE

PHASE	ACTIVITIES
Phase 1	Preliminary evaluation of water quality
Phase 2	Strategic monitoring and assessment to verify water quality impairments
Phase 3	Development and adoption of TMDLs for waters verified as impaired
Phase 4	Development of management strategies to achieve the TMDL(s)
Phase 5	Implementation of TMDL(s), including monitoring and assessment

1.2 TMDL IMPLEMENTATION

Rule-adopted TMDLs may be implemented through BMAPs, which contain strategies to reduce and prevent pollutant discharges through various cost-effective means. During Phase 4 of the TMDL process, FDEP and the affected stakeholders in the various basins jointly develop BMAPs or other implementation approaches. The FWRA contains provisions that guide the development of BMAPs and other TMDL implementation approaches. **Appendix B** summarizes the statutory provisions related to BMAP development and implementation.

Stakeholder involvement is critical to the success of the watershed assessment (Phase 2), TMDL development and adoption (Phase 3), and BMAP development (Phase 4), and varies with each phase of implementation to achieve different purposes. The BMAP development process is structured to achieve cooperation and consensus among a broad range of interested parties. Under statute, FDEP invites stakeholders to participate in the BMAP development process and encourages public participation to the greatest practicable extent. FDEP holds at least one noticed public meeting in each basin to discuss and receive comments during the planning process.

1.3 THE BAYOU CHICO BMAP

1.3.1 STAKEHOLDER INVOLVEMENT

Meaningful public involvement was a key component in the development of the Bayou Chico BMAP. The BMAP process promotes the engagement of local stakeholders in a coordinated and collaborative manner to address the reductions in fecal coliform bacteria needed to achieve the Bayou Chico TMDL. It also builds on existing water quality improvement programs and local participation to address water quality problems.

The following organizations and entities are key stakeholders in the Bayou Chico watershed:

- ***Bay Area Resource Council (BARC)**, in conjunction with the **West Florida Regional Planning Council**, consists of a cross-section of elected officials from local governments representing the Pensacola Basin (Escambia and Santa Rosa Counties and the municipalities of Pensacola, Gulf Breeze, and Milton) and other organizations that have signed an interlocal agreement. Its mission is “to develop annual goals and identify projects for implementation by engaging in agreements or contracts with public and private entities for assistance in planning, financing, and managing the physical, chemical, biological, economic, and aesthetic aspects of the Pensacola Bay System, to share information gathered for local planning purposes, and to develop a restoration program for the Pensacola Bay System” (EPA 2011);*
- ***Bayou Chico Association (BCA)** is a voluntary organization representing over 800 residents and commercial and industrial interests in the Bayou Chico watershed. Organized for charity, education, and science, it facilitates efforts to help the water quality, living, and working conditions on and around Bayou Chico;*
- *City of Pensacola;*
- *Emerald Coast Utility Authority (ECUA);*
- *Escambia County;*
- *Escambia County Health Department (ECHD), Florida Department of Health (FDOH);*
- *Florida Department of Environmental Protection (FDEP), Northwest District Office;*
- *Florida Department of Transportation (FDOT);*
- *Pensacola Yacht Club;*

- *University of West Florida (UWF), Center for Environmental Diagnostics and Bioremediation (CEDB) and Wetland Research Laboratory;*
- *U.S. Environmental Protection Agency (EPA), Gulf Islands Marine Research Laboratory; and,*
- *U.S. Naval Air Station*

In February 2009, FDEP initiated the BMAP development process and held a series of technical meetings involving key stakeholders and the general public. The purpose of these meetings was to consult with key stakeholders to gather information on the impaired waterbody and its tributaries, in order to aid in the development of the BMAP and identify specific management actions that would improve water quality. Beginning in 2009, a total of nine technical meetings, all open to the public, were held for the purposes of gathering information; identifying potential sources; conducting field reconnaissance; defining programs, projects, and actions currently under way; and developing the BMAP contents and actions that will result in improved water quality with the goal of achieving the TMDL target reductions. Stakeholder involvement is essential to develop, gain support for, and secure commitments to implement the BMAP.

In addition to stakeholder input on the technical issues of BMAP development, FDEP solicited further input from key stakeholder groups at the management level through a presentation to BARC on April 27, 2011. BARC's technical representatives constitute many of the same stakeholders as in the Bayou Chico watershed and include many of the entities directly involved in developing this BMAP. These entities share their support of the BMAP and activities in the watershed, and can ensure that as their staff and board members change over time, BARC has a way to continue support for the BMAP and the efforts it describes.

This BMAP document reflects the input of the technical stakeholders, along with public input from workshops and meetings held to discuss important aspects of the TMDL and BMAP development. **Appendix C** provides further details about the stakeholder and public involvement process in BMAP development.

1.3.2 PLAN PURPOSE AND APPROACH

The purpose of this BMAP is to implement the load reductions established in the fecal coliform TMDL for the Bayou Chico watershed. The plan outlines specific actions to achieve load reductions and a schedule for implementation. In addition, it details a monitoring approach to identify additional sources of fecal coliform (and *Enterococcus*) and to track trends in water quality. Following BMAP adoption, basin stakeholders will meet at least annually to review the progress made toward achieving target load reductions in the Bayou Chico watershed.

This BMAP addresses six impairments for fecal coliform in the watershed, all centered on tributaries of the larger bayou. Specifically, it focuses on actions that reduce fecal

coliform levels, with a goal of meeting water quality standards and load reductions as defined in the TMDL. Some water quality concerns in the bayou may benefit from these BMAP actions, such as issues with excess nutrients and turbidity (as verified in Cycle 2 of the watershed management cycle), while other concerns, such as a history of elevated levels of contaminants in sediments (polychlorinated biphenyls [PCBs] and dioxins/furans), must be addressed through programs other than the TMDL and BMAP process.

Therefore, it should be emphasized that this BMAP does not address all of the water quality issues in the watershed; rather, it is specifically developed to address anthropogenic sources and elevated levels of fecal coliform, *Enterococcus*, and other human-borne bacteria. The Bayou Chico BMAP contains a comprehensive set of strategies focused on the primary sources of bacteria, such as wastewater treatment plants (WWTPs), sewage pumping stations, onsite sewage treatment and disposal systems (OSTDS), marina activities (e.g., septic pump outs), and urban sources, including stormwater, pet waste, and other potential bacterial sources in the bayou.

Though considerable effort has been taken to understand the dynamics of the TMDL waterbodies, the relationship of fecal coliform water quality exceedances to pollutant sources is not well understood. Where specific fecal coliform sources have been identified, the stakeholders have proposed projects and activities to eliminate those sources. There are also other nonhuman sources that can contribute to fecal coliform impairments, such as wildlife, that are not addressed in this BMAP.

For the projects and programs in the BMAP, quantitative values for pollutant load reduction activities cannot be calculated due to the lack of scientific information on bacteria removal rates for best management practices (BMPs) or activities that reduce fecal coliform levels. While certain BMPs are expected to prevent or eliminate fecal coliform sources, it is not known exactly how much of a reduction will occur in the waterbody. As a result, the expected date on which target load reductions of fecal coliform addressed in the TMDL will be achieved is difficult to predict; however, the stakeholders do expect that significant water quality improvements can be achieved by the end of the first five-year BMAP cycle through ongoing and future activities, planned projects, and county and citywide programs to eliminate sources, as outlined in this BMAP. Coordinated efforts to monitor fecal coliform concentrations, in conjunction with the implementation of projects basinwide, will also enhance the capability to quantify positive effects in the future.

Furthermore, key stakeholders are committed to continue future assessments of potential sources and source controls through the implementation of projects, programs, and public education campaigns to eliminate potential sources, as well as to monitor the water quality impairment(s) to achieve the reductions established in the fecal coliform TMDL for Bayou Chico.

1.3.3 PLAN SCOPE

In an effort to address the known impairments, FDEP consulted with key stakeholders to describe potential sources and available water quality, spatial, and geographic data

that would be useful in the BMAP. The available data and local knowledge in the watershed pointed to the most probable sources of fecal coliform. These fall into five main categories (not in order of magnitude), as follows: (1) OSTDS; (2) sewer infrastructure; (3) urban stormwater and nonpoint pollution sources; (4) marinas located in the bayou, as well as other recreational boaters who enter (and sometimes moor in) the bayou; and (5) natural background such as wildlife (including wildlife parks, sanctuaries, and rookeries).

FDEP used existing reports and the local knowledge of technical stakeholders to establish a baseline to assist in identifying projects and activities that would address potential sources and specific monitoring needs and plans, all of which are included in this BMAP.

A “weight-of-evidence” approach was used to help identify likely sources of fecal coliform and guide follow-up reconnaissance and investigations into corrective action. This approach uses the best information available at the time to summarize impairments and identify potential sources, and then focuses on watershed management efforts and classifies priority areas or hot spots to support decisions related to fecal coliform reduction efforts. This weight-of-evidence method, in conjunction with best professional judgment and local knowledge of the bayou and of likely sources, was used to aid in source identification to the maximum extent possible. In addition, the identification of specific projects in the Bayou Chico watershed, their proximity to potential hot spots, and the expected positive outcome in achieving fecal coliform reductions were taken into consideration in evaluating a weight-of-evidence approach.

At this time, water quality modeling has not been used to assess the temporal relationship between the source of fecal coliform and the associated impact on the impaired waterbodies. Due to the intrinsic variability of fecal coliform and the diffuse nature of nonpoint sources, modeling is not a viable consideration; therefore, the weight-of-evidence approach seems the best way to assess information on the most likely sources and a particular project’s associated benefit(s).

BMAPs do provide for phased implementation approaches under Paragraph 403.067(7)(a)1, F.S. The adaptive management approach for TMDL implementation described in this BMAP will address fecal coliform bacteria reductions, and the iterative evaluation process will continue until the target load reductions defined in the TMDL are met. A phased BMAP approach also allows for the implementation of projects designed to achieve reductions while simultaneously executing source assessments, monitoring, and studies to better understand fecal coliform variability and water quality dynamics in each impaired waterbody.

This first five-year phase of the BMAP is designed to address the TMDL and the achievement of water quality standards in the watershed. This phase may include gathering additional information or carrying out studies that can be used in the development of the subsequent phase(s), which further support TMDL implementation. The adaptive management process will continue until the TMDL pollutant load reduction requirements are met.

A five-year milestone evaluation in this BMAP will be carried out to verify that adequate progress is being made toward achieving the TMDL. During the fifth year following BMAP adoption (anticipated to be 2015), water quality data will again be evaluated for in-stream reductions of fecal coliform levels within each WBID, or identified hot spots. If significant reductions are not achieved by the end of this five-year implementation phase, additional efforts may be necessary and will be reassessed. In addition, this five-year milestone provides opportunities to further improve source assessment and management measures going forward. Future projects that may be identified can open opportunities for continued reductions and move into the next phase of implementation, with the objective being to improve water quality trends, with the goal of reaching the target TMDL reduction over the entire watershed.

In addition to stakeholder management actions, BMAP monitoring efforts will continue in the watershed on a long-term basis. With many management actions already in place, water quality data collected after 2008 began showing some reductions in fecal coliform levels. The majority of the planned management actions will be implemented by the end of 2012. In addition, a number of well-established long-term monitoring stations in the watershed will continue to be monitored weekly or biweekly for both fecal coliform counts and for *Enterococcus* bacteria by ECHD (Sanders and Bayou Chico Beach). Other monitoring stations in the watershed are regularly monitored by Escambia County and the Bream Fisherman's Association. UWF also established a number of monitoring points for its 2001–03 study of urban watersheds that included Bayou Chico (Snyder 2003). That study provided additional baseline data and information relating to particular hot spots where fecal coliform and *Enterococcus* bacteria counts were measured.

This BMAP details a monitoring approach to identify additional sources of fecal coliform and to track trends in water quality. FDEP will meet with stakeholders at least annually to review progress made towards achieving the TMDLs.

In summary, the implementation of key projects and actions identified in the Bayou Chico BMAP, along with the implementation of the strategic monitoring plans described in the BMAP, should achieve water quality improvements, and management actions may be adjusted as needed to show continued progress.

1.3.4 SUFFICIENCY-OF-EFFORT DETERMINATIONS

Fecal coliform can be highly variable and easily transported, making it difficult in many cases to identify the source of the bacteria. Based on the potential sources in each WBID, the stakeholders were asked to identify completed activities carried out to reduce or remove bacteria sources since 1995 (the start of the TMDL verified period), as well as additional efforts that are currently under way or planned in the next five years. Escambia County, ECUA, city of Pensacola, ECHD, FDOT District 3, West Florida Regional Planning Council (in association with BARC), U.S. Naval Air Station, and BCA all submitted project sheets and program descriptions for the prevention, reduction, and source removal activities they conduct in the BMAP planning area and/or on a countywide or citywide basis. FDEP then used a sufficiency-of-effort approach to

conduct a basinwide assessment of potential sources and cumulative projects and activities that address or eliminate fecal coliform loading.

This sufficiency-of-effort evaluation was not an assessment of each agency's individual activities; rather, it focused on whether the activities submitted by all entities corresponded to potential sources or hot spots previously identified and whether the total efforts were adequate to eliminate the known sources, assess unknown sources, and/or prevent the development of new sources.

During a sufficiency-of-effort evaluation, FDEP reviews the following information about each WBID:

- *Documentation of the most likely sources;*
- *A geographic information system (GIS) database to determine the spatial and temporal distribution of the sources based on existing land use and activities;*
- *Permit and water quality information;*
- *Relevant field information and published data; and*
- *The completed corrective actions.*

As the evaluation was conducted, the agencies' programs and activities for each type of source were recorded in a table summarizing restoration activities (**Table 7-1**). Because the controllable sources (sewer infrastructure, septic tanks, and stormwater conveyances) vary considerably among the individual WBIDs, the actions and responsibilities of the stakeholders also vary considerably in the Bayou Chico watershed.

The criteria for sufficiency for OSTDS-related efforts included the following: designation as a septic tank failure or nuisance area in accordance with ECHD requirements (as described in **Section 4**) that prioritizes these areas for transition to sewer service; the status of phase outs to sewer in critical OSTDS failure areas; the number of complaint investigations and any resulting enforcement actions; the number of septic tank repair permits; and the proximity of repair sites to surface waters or stormwater inlets. In addition, program implementation was evaluated for efforts such as inspections, training programs, plan reviews, and site visits, as well as the regulation of annual operating permits. Local ordinances were also evaluated for their ability to proactively address potential OSTDS failures.

The criteria for sufficiency for sewer infrastructure included the assessment of recent sewer line upgrades within the watershed, as well as evaluation of sanitary sewer overflow (SSO) history to determine if previous problems were addressed through repairs and upgrades. Rehabilitated manholes can prevent overflows from occurring at the manhole and potentially reaching surface waters or the stormwater system; therefore, manhole rehabilitation and targeted monitoring efforts were also evaluated. Sanitary sewer programs that are carried out system wide or countywide, such as sewer

line inspections and rehabilitation, SSO investigations, and infiltration and inflow (I&I) programs were also evaluated as measures to prevent and control sewer infrastructure as a potential fecal coliform source.

The stormwater sufficiency evaluations included a review of flood control projects (which reduce fecal coliform loading by preventing water from inundating septic systems) and stormwater BMPs, such as wet/dry retention and baffle boxes (which reduce sediment buildup that can provide a breeding ground for fecal coliform). Consideration was also given to the maintenance of stormwater ditches, ponds, and closed conveyances to prevent debris, vegetation, dense tree canopy, and sediment from potentially providing conditions that would allow the growth of new sources of fecal coliform bacteria.

Another important activity that was evaluated was the detection and removal of potential illicit connections (PICs) to stormwater conveyances to eliminate illegal discharges that can contribute fecal coliform and other pollutants into surface waters. Stormwater-related program implementation also included public education campaigns, the Adopt-A-Highway Program, street sweeping, drainage connection permits, and countywide and citywide inspection programs, all of which may reduce the contaminants entering stormwater conveyance systems.

Additionally, stakeholders (through BARC and BCA) are developing and implementing pet waste programs, Clean Marina and Clean Vessel Programs, and other public education campaigns using public service announcements, website content, conferences, and printed handouts to raise awareness through public outreach and education. ECHD also shares brochures and information related to leaking septic tanks, permit requirements, and other important handouts on OSTDS with the public and through its website. In addition, Escambia County ordinances are in place for OSTDS inspections prior to property sales, and for pet waste management.

In efforts specific to each source, the entities also participate in special source assessment activities. These include the strategic sampling of several public access points to Bayou Chico (Lakewood Park and Sanders Beach) and follow-up sampling at locations where high counts occur, in an effort to identify potential sources or suspected hot spots.

Based on source assessments and information gathered for this BMAP, a summary of restoration activities (**Section 7**) was produced to ensure that appropriate programs and activities were being implemented that would either decrease or eliminate the known sources, or that might be needed to further assess fecal coliform loadings. The full implementation of the management actions/projects identified in this BMAP was deemed sufficient to address the fecal coliform bacteria reductions needed to achieve the fecal coliform reductions described in the TMDL.

1.3.5 POLLUTANT REDUCTION AND DISCHARGE ALLOCATIONS

1.3.5.1 CATEGORIES FOR RULE ALLOCATIONS

The rules adopting TMDLs must establish reasonable and equitable allocations that will alone, or in conjunction with other management and restoration activities, attain the target reductions defined in the TMDL. Allocations may be to individual sources, source categories, or drainage areas that discharge to the impaired waterbody. The allocations identify either in terms of how much pollutant discharge (which for fecal coliform is expressed in CFUs per day) that each source designation may continue to contribute (discharge allocation), or in terms of the percentage loading that the source designation must reduce (percent reduction allocation). Currently, the TMDL allocation categories are as follows:

- **Wasteload Allocation** – *The allocation to point sources permitted under the National Pollutant Discharge Elimination System (NPDES) Program includes the following:*
 - o **Wastewater Allocation** is the allocation to industrial and domestic wastewater facilities; and
 - o **NPDES Stormwater Allocation** is the allocation to NPDES stormwater permittees that operate municipal separate storm sewer systems (MS4s). These permittees are treated as point sources under the TMDL Program.
- **Load Allocation** – *The allocation to nonpoint sources, including agricultural runoff and stormwater from areas that are not covered by an MS4.*

This approach is consistent with federal regulations (40 CFR § 130.2[I]), which state that TMDLs can be expressed in terms of mass per time (e.g., pounds per day), toxicity, or other appropriate measure. The TMDL for the Bayou Chico watershed was expressed in terms of percent reduction, and represents the maximum annual fecal coliform load the watershed can assimilate and maintain the fecal coliform criterion.

1.3.5.2 INITIAL AND DETAILED ALLOCATIONS

Under the FWRA, the TMDL allocation may be an “initial” allocation among point and nonpoint sources. In such cases, the “detailed” allocation to specific point sources and specific categories of nonpoint sources must be established in the BMAP. The FWRA further states that the BMAP may make detailed allocations to individual “basins” (i.e., sub-basins) or to all basins as a whole, as appropriate. Both initial and detailed allocations must be determined based on a number of factors listed in the FWRA, including cost-benefit, technical and environmental feasibility, implementation time frames, and others (see **Appendix B**).

Due to the nature of fecal coliform impairments, this BMAP does not specify detailed allocations. It is difficult to attribute the fecal coliform loads to specific sources because bacteria are highly variable and can be easily transported. In addition, research and

information are not available to quantify the expected fecal coliform reduction from project implementation. Instead of assigning detailed allocations, a sufficiency-of-effort evaluation (as described above) was conducted to assess whether the management actions carried out by the entities in the watershed were sufficient to address potential sources of fecal coliform, or to address known or suspected areas of high exceedances of the water quality criterion.

1.3.5.3 BAYOU CHICO WATERSHED FECAL COLIFORM TMDL

The water quality criterion for fecal coliform bacteria is detailed in Subsection 62-302.530(6), F.A.C. The requirements for exceeding maximum fecal coliform concentrations in a Class III waterbody are stated as follows:

The most probable number (MPN) or membrane filter (MF) counts per 100 milliliters (mL) of fecal coliform bacteria shall not exceed a monthly average of 200, nor exceed 400 in 10% of samples, nor exceed 800 on any one day.

FDEP has verified six WBIDs in the Bayou Chico watershed as impaired for fecal coliform bacteria and adopted a TMDL to address these impairments in June 2008. **Table 1-3** lists the TMDL and pollutant load allocations adopted by rule for the watershed.

TABLE 1-3: BAYOU CHICO FECAL COLIFORM TMDL

* The percent reduction is based on the 10th to 90th percentile of recurrence intervals minus the wasteload allocation.

WBID	TMDL (% REDUCTION)	WASTELOAD ALLOCATION FOR WASTEWATER (CFUS/100ML)	WASTELOAD ALLOCATION FOR NPDES STORMWATER (%)	LOAD ALLOCATION* (%)
Bayou Chico watershed (WBIDS 846, 846A, 846B, 846C, 846CB, and 848DA)	61%	Point sources must meet permit limits	61%	61%

1.3.5.4 BACKGROUND AND POLLUTANT CONSIDERATIONS IN BAYOU CHICO

Pensacola Bay is a saline bay with about a one-half mile channel to the Gulf of Mexico. The bay is the receiving body of water for Escambia and East Bays and Bayous Texar, Chico, and Grande. The flushing of the bay is adequate, though it has water quality problems due to nonpoint and point sources and urbanization. Bayou Chico has had a long history of human activities and associated problems, including polluted stormwater runoff, wastewater inputs, nutrient enrichment, and contaminated sediments from urban runoff and industrial pollution. Prior to 1971, at least eight industrial and domestic wastewater facilities discharged into Bayou Chico.

Both the Northwest Florida Water Management District (NFWFMD) and the University of West Florida (UWF) have published studies that indicated the presence of polycyclic aromatic hydrocarbons (PAHs), pentachlorophenols (PCPs), and trace metals in both the sediments and water in Bayou Chico (Debusk *et al.* 2002; Liebens *et al.* 2007). The bayou

is adjacent to the abandoned American Creosote Works site, a National Priority List hazardous waste site that may still be affecting the bayou.

A review of the scientific literature shows that the quality of the water and sediments in Bayou Chico has been, and is still, affected by a variety of pollutants. Liebens *et al.* (2006) state, “In the 1970s, organic pollutants were found to be many times higher than typical values for coastal sediments.” Studies have shown elevated levels of polychlorinated biphenyls (PCBs) and dioxins/furans in seafood from the bayou (Snyder and Karouna-Renier 2009). Trace metals are also elevated in the main part of the bayou and between two topographic constrictions in the northern half of the bayou. Organisms affected by the pollution of Bayou Chico have diminished in density and diversity. Two other nearby industrial sites also have documented environmental problems, though their impact on the bayou is not well known.

The lower portion of Bayou Chico was dredged between March and August 2008. The NFWFMD partnered with the U.S. Army Corps of Engineers (USACOE) on the project. Dredged spoil was placed in the northwest pond of the Clark Sand Pit. The NFWFMD carried out monitoring during and following the deposition to determine the quality of water discharging into Jackson Branch Creek and to track saltwater movement into the lower water zone and into nearby wells. A potential issue whose impacts are still unknown is the behavior of the contaminants in the spoil after disposal. Even though these pollutants may not pose a direct threat to humans, who have limited direct contact with the sediments of Bayou Chico, they do have the potential to indirectly affect human health.

While these and other water quality issues in the bayou are very well documented, the impacts and solutions are beyond the scope of this BMAP. These water quality issues should, however, be addressed by programs other than the TMDL Program. They are valid concerns of stakeholders and residents in the bayou, in terms of both water quality and future restoration efforts, and thus deserve mention in this BMAP.

Chronic fecal coliform contamination in a number of waterways in Pensacola Bay has also been well documented (Snyder 2006; Maestre 2009). Snyder conducted a multiyear study (2001–03) to identify the sources of loadings of fecal coliform and *Enterococci* within the urban bayous in Pensacola Bay, including Bayou Chico. Sampling stations were selected to coincide with stormwater drains, perennial streams, and areas of likely ground water discharges. Spatially explicit loading in the bayou was evident. Snyder found that concentrations of fecal bacteria decreased along the salinity gradient of the system as a general trend, indicating that the freshwater tributaries and residential areas of the bayou were primary sources to the system, and that older residential areas using septic tanks in low-lying areas were also likely sources. In other nearby urban bayous, residential areas served by older sewer lines and/or affected by rainfall were evident as the likely sources.

Other available literature, including a report prepared for the city of Pensacola, *Bayou Chico Stormwater Needs Assessment* (Baskerville-Donovan 2004), also suggests that structural and nonstructural alternatives should be considered to address potential sources of runoff pollution in all the watersheds evaluated. These alternatives include

eliminating septic tanks in areas where sanitary sewer is available and educating residents and businesses in the area on proper septic tank maintenance and cleaning, as well as on proper disposal methods for animal waste. This information, as well as key stakeholders' local knowledge of the potential problem zones where high fecal coliform counts have been documented, provides a basis for the projects and activities identified in the Bayou Chico BMAP.

1.4 ASSUMPTIONS AND CONSIDERATIONS REGARDING TMDL IMPLEMENTATION

The water quality benefits of TMDL implementation are based on several fundamental assumptions about the targeted pollutants, modeling approaches, waterbody response, and natural processes. In addition, there are a number of important assumptions and considerations to keep in mind about the nature of the BMAP and its long-term implementation.

1.4.1 ASSUMPTIONS

The following assumptions were made during the BMAP process:

- *Load reductions for stormwater discharges are typically expressed as a percent reduction because it is difficult to quantify the loads from MS4s (given the numerous discharge points) and to distinguish MS4 loads from other nonpoint sources (given the diffuse nature of stormwater transport).*
- *Bacteria loads from specific sources cannot be quantified because they are highly variable and not well understood. Thus it is not possible to calculate a specific bacterial load for a specific source. Rather, a percent reduction in load, calculated from stream load, not source to stream, is the best way to quantify the necessary reduction.*
- *The technical stakeholders evaluated the known sources of bacteria contributing to the impairment in each waterbody and whether there was strong evidence of responsibility. Affected stakeholders then determined which projects would help to address these problems and included these projects in the BMAP.*
- *In cases where the sources were unknown, stakeholder groups determined appropriate assessment programs to investigate the sources of bacteria loadings.*
- *Due to a lack of literature values and high variability, it is difficult to determine the quantitative load reductions expected from management actions to decrease fecal coliform; therefore, the benefits of these actions were evaluated on a qualitative basis by matching elimination, reduction, and prevention activities to known or potential sources.*
- *Flood control projects are included as BMAP activities because these projects help to reduce flooding after a storm event, decreasing the amount of fecal coliform*

loading to nearby waterbodies through stormwater runoff. Programs such as Adopt-A-Highway, drainage connection permits, and street sweeping and inspection programs are also important because they remove trash, sediment, debris, and pollutants from roadways and conveyance systems that would otherwise be transported to stormwater systems and surface waters. Fecal coliform can be transported in sediments and debris, and these materials can also create a breeding ground for bacteria. Therefore, flood control projects and roadway clean-up programs were given credit in this BMAP as actions that may reduce fecal coliform.

- *The penetration of ultraviolet (UV) light into waters and sediments may aid fecal coliform die-off and prevent bacteria regrowth. Therefore, attention was paid to any restoration efforts that included the maintenance of stormwater ditches, ponds, and closed conveyance systems. Activities such as preventing the accumulation of debris, removing vegetation or dense tree canopy, and controlling sediment erosion help to eliminate conditions that would encourage the growth of potential new sources of fecal coliform bacteria.*

1.4.2 CONSIDERATIONS

This BMAP requires all stakeholders to implement projects and programs to achieve fecal coliform load reductions as soon as practicable. However, the full implementation of the BMAP is recognized to be a long-term process. While some of the projects and activities contained in the BMAP were recently completed, or are currently ongoing, there are still several projects that will require more time to design, secure funding, and construct. While project funding can be an issue, such limitations do not affect TMDL implementation requirements; thus, all stakeholders or entities must make *every* reasonable effort to secure funding and implement the activities listed in the BMAP.

Since BMAP implementation is a long-term process, the TMDL targets established for the Bayou Chico watershed may not be achieved in the next five years. It is understood that all waterbodies can respond differently to the implementation of reduced loadings in order to meet applicable water quality standards. Regular follow-up and continued coordination and communication by stakeholders will be essential to ensure the implementation of management strategies and assessment of their incremental effects. Any additional management actions required to meet the target load fecal coliform reductions in the TMDL will, if necessary, be developed as part of BMAP follow-up.

As part of this BMAP, stakeholders have committed to a wide variety of management actions/projects. Generally, the projects or activities fall into the following categories:

- *Public education and outreach;*
- *Wastewater infrastructure management, including sanitary sewer expansion programs;*

- *Stormwater management and the installation of new or retrofitted stormwater treatment;*
- *Regulations, ordinances, and guidelines (including local, state, and federal);*
- *Restoration, land acquisition, and water quality improvements; and*
- *Special studies, planning, monitoring, and assessment.*

1.5 FUTURE GROWTH IN THE WATERSHED

The FWRA, Paragraph 403.067(7)(a)(2), F.S., requires that BMAPs “identify the mechanisms by which potential future increases in pollutant loading will be addressed.”

As mandated by the FWRA, fecal coliform loadings associated with future growth were considered as part of the BMAP. Most lands surrounding Bayou Chico are already urbanized and consist of older, well-established residential subdivisions and industrial and commercial uses. Since these areas are mostly developed, future growth is not expected to substantially increase fecal coliform loadings to the tributaries and creeks.

Any new development or redevelopment would be connected to the existing or future sanitary sewer system infrastructure, where the wastewater will be treated to high levels, as opposed to septic tanks. The vast majority of anticipated residential and/or redevelopment areas (such as the Warrington drainage area) in the watershed has or will have centralized sewer available. Recent upgrades included in the newly relocated Main Street WWTP will also provide advanced and improved secondary or tertiary treatment with high-level disinfection. In addition, the availability of sanitary sewer where it did not previously exist in the Bayou Chico watershed, along with BMPs implemented for any structural works associated with new development or redeveloped areas (e.g., stormwater treatment facilities), should diminish any direct (and indirect) discharges into Bayou Chico and its associated tributaries and creeks. Where sewer service is not available, ECHD will review septic tank plans and evaluate sites before issuing new permits, so that the new systems are correctly designed, placed, and operated to prevent further fecal coliform loading. To address potential new sources, all new development will also have to meet all local, state, and federal requirements for stormwater management.

SECTION 2: POLLUTANT SOURCES AND ANTICIPATED OUTCOMES

2.1 FECAL COLIFORM POLLUTANT SOURCES

This section summarizes the general types of sources associated with fecal coliform impairments. Additional details on these sources in the watershed can be found in **Sections 3 through 6** of this document.

2.1.1 SANITARY SEWER SYSTEMS

A sanitary sewer system (i.e., public and privately owned sewer infrastructure) may contribute fecal coliform pollution to the environment through the slow and continuous leakage of sanitary sewer infrastructure, treatment failure in WWTPs, and SSOs. Common causes of SSOs may include the following:

1. *Heavy rainfall resulting in the inflow of stormwater or infiltration of ground water into sewer lines;*
2. *Breaks or blockages in sewer lines due to aging infrastructure or the accumulation of grease; and*
3. *Malfunctioning equipment and pumps (possibly due to power failures).*

It is not clear how much leaking sewer infrastructure below ground may contribute to surface water contamination. Although there is evidence that in some soils, bacteria may not be readily transported to nearby surface waters, there are no known local data related to bacterial transport in the soil types and ground water conditions in the Bayou Chico watershed.

Underground sanitary sewer pipes can leak. When ground water levels are low or the pressure in the sanitary sewer pipes is greater than the surrounding pressure of ground water, it is possible that wastewater in the sanitary sewer pipes can exfiltrate out through the leaks in the pipes and into the surrounding ground water, and potentially migrate to adjacent surface waters. When ground water levels are high, ground water surrounding the pipes can infiltrate into the leaks in the sanitary sewer pipes. Surface water associated with flooding also can inflow into the sanitary sewer pipes when stormwater pipes are connected illegally to the sanitary sewer pipes. In addition, surface water and/or ground water can inflow into the sanitary sewer pipes when the caps are off sanitary sewer laterals or when there are holes or breakages in sanitary sewer pipes.

A California study (Brown and Caldwell 2005) suggested that high water tables do not usually result in the exfiltration of sewage from pipes or couplings into ground water. Rather, as indicated above, ground water is more likely to infiltrate into the collection system. Some studies also suggest that the transport of sewage and fecal coliform bacteria into ground water depends on many factors, with one of the largest being the difference in hydraulic head between the sewage and the ground water table.

According to a recent U.S. Environmental Protection Agency (EPA) study, “The occurrence of exfiltration is limited to those areas where sewer elevations lie above the ground water table. Since ground water elevations near surface water bodies are typically near the ground surface, sewers near surface water bodies are generally below the ground water table, and infiltration (rather than exfiltration) will dominate as the mode of sewer leakage in these areas” (Amick and Burgess 2003). It is important to note that some areas in the Bayou Chico watershed have a relatively high water table, and therefore infiltration may be the primary form of sewer leakage in those areas.

ECUA owns and maintains the sanitary sewer system that serves the majority of the watershed. It is possible that the sewer system and the associated infrastructure (particularly aging infrastructure) could contribute to the impairments in these areas, especially where this infrastructure crosses or is located near Bayou Chico. A number of watersheds in the surrounding area have had SSOs with the potential to impact surface waters. Response times, however, can be minimized and the problems addressed by taking proactive steps.

2.1.2 OSTDS

OSTDS consist of a septic tank and a subsurface wastewater infiltration system, or drainfield, where most of the treatment occurs in the soil above the water table. The drainfield and underlying soils are the most critical components of septic systems for the treatment of wastewater. Under Subsection 64E-6.002(23), F.A.C., a failing septic system is one that is not functioning in a sanitary manner and that may result in the transport of untreated or partially treated wastewater to surface waters.

OSTDS failure can be due to a number of causes, including unsuitable soil conditions, flooding, improper design and installation, or inadequate maintenance practices. Improperly functioning septic systems are often recognized as a significant contributor of pollutants, including microbiological pathogens (Nicosia *et al.* 2001; McDowell *et al.* 2005). These failing systems may result in obvious sanitary hazards, such as ponding on the ground and runoff into surface waters or stormwater collection systems, and less conspicuous nuisances, including the leaching of untreated wastewater into ground water. As noted in **Section 1.3.5.4**, certain areas of the watershed have relatively high water tables, which could potentially transport fecal coliform from septic tanks through shallow ground water into Jackson and Jones Creeks, and into Bayou Chico.

2.1.3 STORMWATER

The term “nonpoint sources” is used to describe intermittent, rainfall-driven, diffuse sources of pollution (e.g., stormwater runoff) associated with everyday human activities, including runoff from urban land uses, agriculture, silviculture, and mining activities; discharges or overflow from failing septic systems; and atmospheric deposition. Additional nonpoint sources may include areas with concentrated wildlife (e.g., bird sanctuaries) or domestic animals (e.g., dog parks or improper pet waste disposal).

While there are no known dog parks in the watershed, a number of county and city parks close to Bayou Chico could be used by residents who walk their dogs and who

may improperly dispose of pet waste. Other land uses likely to contribute fecal coliform loading through runoff to surface waters include agricultural activities. Runoff from agricultural areas containing animals (e.g., livestock grazing, dairies, cattle farms, or concentrated animal feeding operations [CAFOs]) can contribute a significant amount of fecal contamination to surface waters. Bayou Chico, however, is a very urbanized watershed, with no agricultural land uses.

Sediments in streambeds also can allow stormwater conveyance systems, especially those underground, to act as reservoirs for contamination as bacteria persist and possibly regrow in the sediments. These sediment bacteria sources can periodically result in the influx of high levels of bacteria to receiving waters (Anderson *et al.* 2005; Brownell *et al.* 2007). Bacteria from sediments could potentially be an issue in certain areas of Jones Creek and Jackson Branch, where the majority of the watershed (more than 50%) is highly urbanized and stormwater runoff is managed through stormwater treatment systems or conveyances.

Illicit connections to stormwater conveyance systems can also contribute to fecal coliform loading. Escambia County and FDOT have ongoing programs to identify PICs to MS4 conveyances and to waterbodies. As part of this program, Escambia County, the city of Pensacola, and FDOT can verify PICs and remove illicit connections through their existing regulatory programs. The number of open PIC cases for Escambia County and FDOT is unknown, but the results of any investigations into PICs are typically reported in the MS4 annual monitoring information and will also be reported in the first annual BMAP progress report

2.1.4 MARINA ACTIVITIES

Marinas with onsite waste disposal areas (pump-out stations) that can leak or overflow can dump raw sewage directly into a waterbody. However, marinas that do not provide onsite waste disposal areas can be much larger sources of contamination if boaters discharge their waste directly into waterbodies. Eight commercial marinas in the Bayou Chico watershed represent potential sources for fecal contamination to surface waters.

Another potential source is seasonal or transient live-aboard boaters who may enter the bayou to moor temporarily. These boaters may contribute to the fecal coliform source problem if they are not properly disposing of their sewage or using existing pump-out facilities available in Bayou Chico.

Florida's Clean Marina Program is designed to make marine facilities and boaters aware of environmentally friendly practices intended to protect and preserve waterways. Marinas, boatyards, and marine retailers receive clean designations by demonstrating a commitment to implement and maintain a host of BMPs. These measures address critical environmental issues such as sensitive habitat, waste management, stormwater control, spill prevention, and emergency preparedness. Designated facilities and those facilities seeking the designation receive ongoing technical support from the Florida Clean Marina Program and the Clean Boating Partnership.

Another effective program that specifically addresses potential contaminant sources from marina activities is the Clean Vessel Act (CVA). CVA is a federally funded grant program administered by the Florida Clean Marina Program for the construction of pump-out facilities and pump-out vessels at marina and boatyard sites. The CVA Program also supports educational and public awareness programs on the importance and practice of keeping raw sewage out of Florida's waterways.

2.1.5 WILDLIFE

In some segments of the Bayou Chico watershed, wildlife can be a significant source of fecal coliform, especially in areas such as the Jones Creek swamp, where there is considerable undeveloped acreage, including wetlands, upland forest, or wooded corridors. A noted bird sanctuary (with a concentrated population of geese) was also noted in the northeast branch of Jackson Creek. While wildlife is a contributing source of fecal coliform loading to the tributaries, this is considered a background concentration and an uncontrollable source in the BMAP. Stakeholders are not asked to remove or discourage wildlife near the bayou. However, where stakeholders have noted instances or indicators of wildlife, additional sampling may help correlate potential sources with fecal coliform concentrations.

2.2 WATER QUALITY TRENDS IN THE WATERSHED

Rule 62-303, F.A.C., establishes a methodology by which surface waters of the state are verified as impaired. FDEP used the IWR database to assess water quality impairments in the Bayou Chico watershed based on fecal coliform data within the verified period, which was January 1, 1998, through June 30, 2005. Five of the six waterbody segments in the watershed have been verified impaired for fecal coliform: Bayou Chico (WBID 846), Jones Creek (WBID 846A), Jackson Creek (WBID 846B), Bayou Chico Beach (WBID 846CB), and Sanders Beach (WBID 848DA). In addition, a sixth segment, Bayou Chico Drain (WBID 846C) was verified impaired for fecal coliform in Cycle 2 of the listing process. These waterbody segments comprise the Bayou Chico watershed, for which this BMAP has been developed.

Samples were collected in all months of the year, and exceedances occurred in each month. At least 64 samples were collected during each month, with the greatest number of samples (105) collected in March and December. The number of exceedances ranged from 4 in January to 35 in September. Greater than 50% exceedances occurred in all months except January, February, and March (FDEP 2008).

For all of the long-term monitoring stations (**Figure 2-1**) with (nearly) 10-year records—Jackson Creek (Station 21FLBFA 33020146), Bayou Chico Drain (Station 21FLBFA 33020JF1), Upper Bayou Chico (Station 21FLBFA 3302JE20), Jones Creek (Station 21FLBFA 33020118), Bayou Chico Beach (21FLDOH ESCAMBIA96), and Bayou Chico proper (21FLPNS 33020JD4)—there has been a general trend of declining fecal coliform concentrations and a declining number of exceedances of both the 800 single-sample criterion and 400 CFUs in no more than 10% of samples. The trends, however, are not statistically significant, and all stations (except Upper Bayou Chico) have had exceedances of both criteria in one of the most recent 3 years of record.

So, while the trends are promising, there is still work to be done in reducing fecal coliform inputs.

2.3 ANTICIPATED OUTCOMES

Although the relationship between fecal coliform loading and sources is not fully understood, the implementation of the projects and programs in this BMAP should improve water quality in the impaired tributaries. The following outcomes are expected from BMAP implementation:

- *Improved water quality trends in the Bayou Chico watershed that will also help improve water quality in the surrounding bays (Escambia/Pensacola Bay);*
- *Attainment of the load reductions described in the adopted TMDL;*
- *Decreased loading of the target pollutant (fecal coliform bacteria);*
- *Increased coordination between state and local governments and within divisions of local governments in problem solving for surface water quality restoration;*
- *Ability to secure additional state and local funding for water quality restoration;*
- *Improved communication and cooperation among state and local agencies, allowing a more effective response to restoration needs;*
- *Determination of effective projects through the stakeholder decision-making and priority-setting processes;*
- *Enhanced public awareness of pollutant sources, pollutant impacts on water quality, and corresponding corrective actions; and*
- *Enhanced understanding of basin hydrology, water quality, and pollutant sources.*

SECTION 3: SANITARY SEWER SYSTEMS

3.1 POTENTIAL SOURCES

Sanitary sewer systems (i.e., public and privately owned sewer infrastructure) may contribute fecal coliform pollution to the environment through the slow and continuous leakage of sanitary sewer infrastructure, treatment failure in WWTPs, and SSOs.

ECUA owns and maintains the sanitary sewer system that serves the majority of the watershed. It is possible that the sewer system and the associated infrastructure (particularly aging infrastructure) could contribute to the impairments in these areas, especially where this infrastructure crosses or is located near Bayou Chico. A number of watersheds in the surrounding area have had SSOs with the potential to impact surface waters, but response times have been minimized and the problems addressed through proactive action.

Figures 3-1 and 3-2 depict the current ECUA sanitary sewer infrastructure (as of March 2011) in the eastern and western portions, respectively, of the Bayou Chico watershed. The map also highlights the new expansion projects currently under way in the Edgewater and Lakewood subdivisions north and south of Bayou Chico proper, respectively, and discussed further in **Section 3.2**. This map also illustrates sites where previously permitted OSTDS (i.e., septic tanks) failed and were repaired, and where sewer expansions were or are currently under design in those residential communities.

3.2 PROJECTS TO REDUCE FECAL COLIFORM LOADING

ECUA and ECHD provided FDEP with information on a number of projects that are expected to significantly reduce and eliminate potential sources of fecal coliform loading in the watershed. These projects either have been completed or are in design. A few more consist of planned or ongoing programs and activities that these two stakeholders are undertaking to address fecal coliform loading in this BMAP.

The following descriptions highlight a few of these projects:

- ***Main Street Wastewater Treatment Plant (MSWWTP) Replacement Project*** – ECUA owns and operates the MSWWTP, which is located in downtown Pensacola, approximately 1 ½ miles east of Bayou Chico. The plant is permitted at 20 million gallons per day (MGD) and discharges its effluent directly to Pensacola Bay. While the discharge does not have a direct impact on Bayou Chico, much of the watershed is served through the collection system that is connected to the MSWWTP.

FIGURE 3-1: SEWER INFRASTRUCTURE IN THE EASTERN BAYOU CHICO WATERSHED

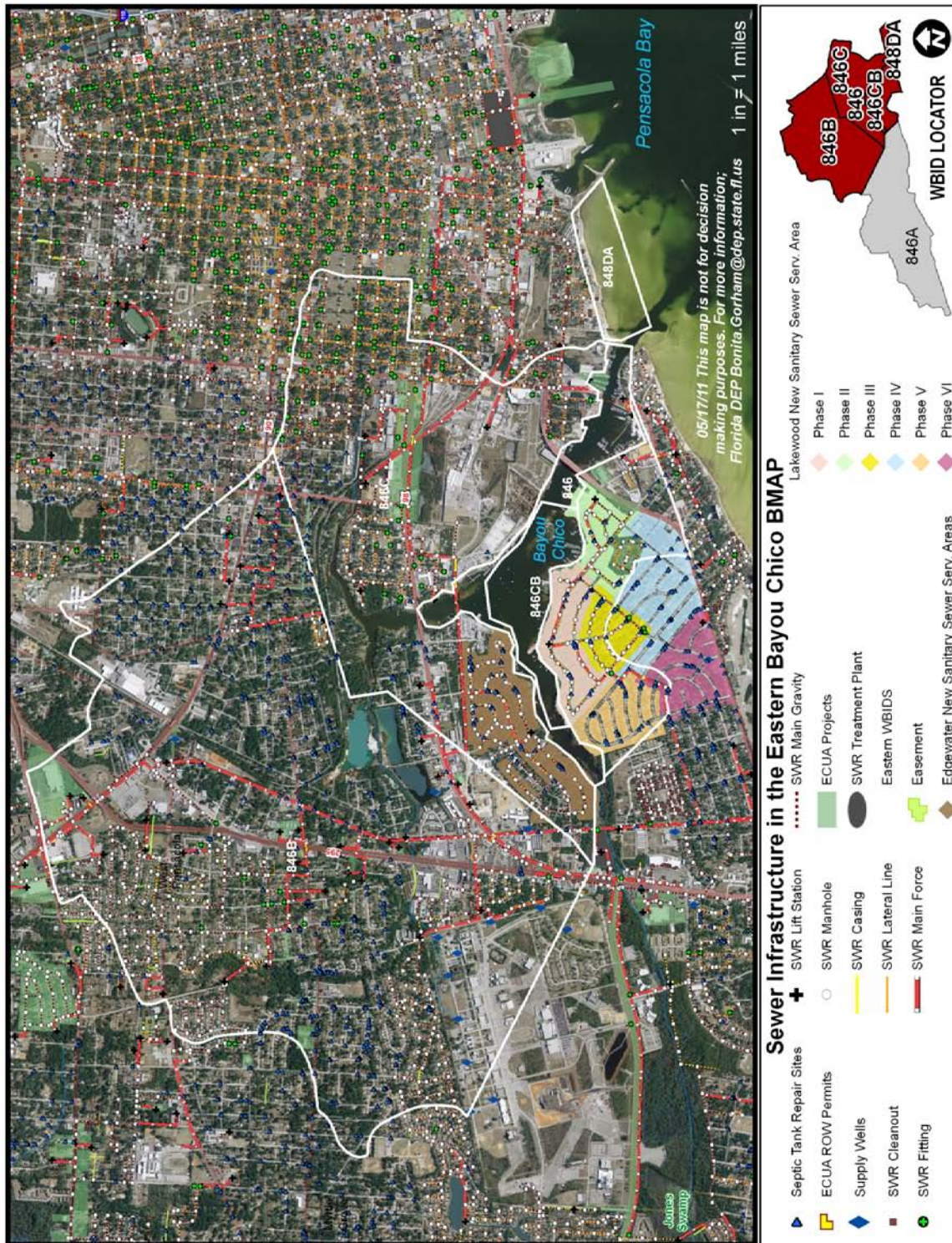
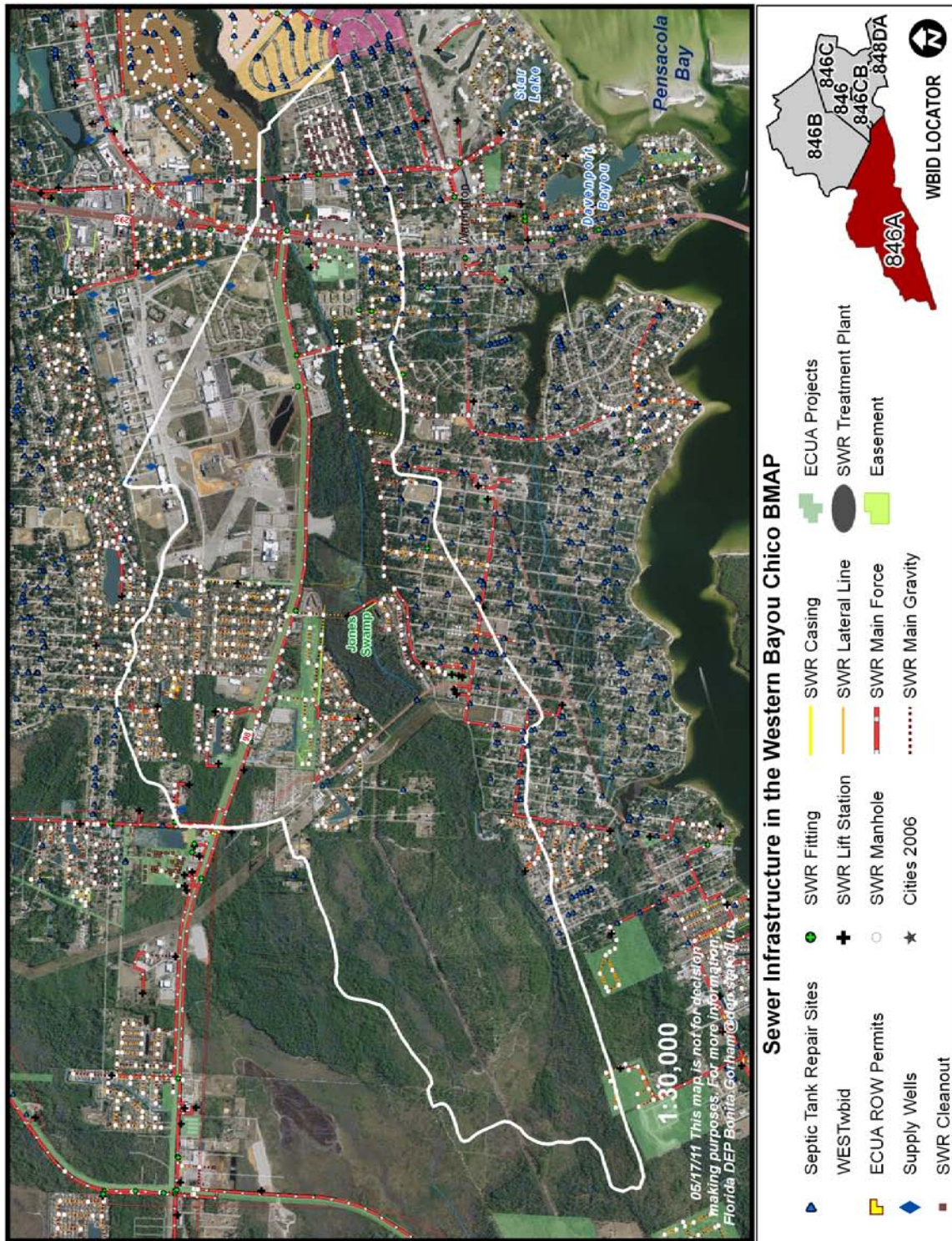


FIGURE 3-2: SEWER INFRASTRUCTURE IN THE WESTERN BAYOU CHICO WATERSHED



ECUA completed this major capital improvement project during the summer of 2010: the construction of a replacement water reclamation facility that will allow the closure of the MSWWTP. The new plant, the Central Water Reclamation Facility (CWRF), is located near Cantonment, approximately 15 miles north of the MSWWTP site. The CWRF is an advanced wastewater treatment (AWT) facility that is permitted at 22.5 MGD and features 100% industrial reuse of its reclaimed water, resulting in the total elimination of the surface water discharge in what was formerly the Main St. drainage area.

ECUA began diverting flows from the MSWWTP to the CWRF in August 2010. In early April 2011, the CWRF was treating approximately two-thirds of the flows in the Main St. drainage area, and the MSWWTP was officially taken offline on April 28, 2011. The flows from the Bayou Chico watershed that were previously treated at the MSWWTP are now transmitted to the CWRF for treatment, and the reclaimed water will be available for industrial reuse.

- **Sewer Expansion Program (SEP)** – ECUA has an ongoing capital improvement program (CIP) focusing on the phaseout and elimination of poorly operating or failed septic tanks through the expansion of the ECUA wastewater collection system. The priority areas targeted for this program are typically located close to surface water or public drinking water wells, or where the operation of septic tanks has caused health concerns. The program includes financial incentives to encourage connection to the sewer system. ECUA waives the wastewater capacity impact fee for all connections in the project areas that are completed within 365 days of notice of availability of the system.

SEP has benefitted the Bayou Chico area specifically through the completion of a number of projects within the Bayou Chico watershed and proposed/planned projects for the phaseout of existing septic tanks. **Table 3-1** lists the SEP projects that have benefitted the watershed and those that are planned for implementation in the near future. As of September 2010, of the 1,051 properties that had service available through the completed projects, 917 of those properties had connected to the sewer system. In other words, approximately 87% of the properties in the project areas have eliminated their septic tanks.

Funding for SEP originates with ECUA's annual CIP budget as well as through agreements with Escambia County for the use of disaster recovery grants.

- **Sanitary Sewer Overflow (SSO) Response Plan** – ECUA occasionally must deal with an emergency or unexpected discharge from its wastewater collection system. Typically, these discharges, or SSOs, result from extraordinary rainfall events, damaged or broken sewer mains, or pump malfunction/failure at a lift station due to electrical outage or mechanical failure. ECUA's response typically includes the repair or resolution of the cause, clean-up of any affected area(s)

TABLE 3-1: SEWER EXPANSION PROGRAM PROJECTS IN THE BAYOU CHICO WATERSHED

*Projected start date (Source: ECUA April 2011)

N/A = Not applicable

PROJECT	START DATE (MONTH/YEAR)	PROPERTIES SERVED	PROPERTIES CONNECTED	% CONNECTED
Jamaica Street	3/01	34	24	71%
Corry Heights	7/01	128	119	93%
Carver Heights	4/08	140	117	84%
Lakewood I	12/05	183	172	91%
Lakewood II	6/05	85	77	94%
Lakewood III	12/08	112	82	73%
Edgewater I	3/06	74	62	84%
Edgewater II	8/06	295	264	90%
Lakewood IV	6/11*	168	N/A	N/A
Lakewood V	5/11*	469	N/A	N/A

with a vacuum truck and application of a biocide, and notification to the State Warning Point (the office that coordinates the state's response to a wide variety of both natural and man-made emergencies). ECUA is dedicated to reducing the number of SSOs within its collection system through the implementation of a number of the policies detailed in this report, such as the Fats, Oils, and Grease (FOG) Program and the reduction of inflow and infiltration (I&I) (both of which are described below).

ECUA has installed emergency power generators at key lift stations throughout the collection system to provide electrical power if line power is lost. It also maintains a pool of portable generators that can be easily transported to smaller lift station sites if a loss of electrical power occurs. Most of the lift stations in the system have been equipped with quick-connect fixtures to facilitate the hook-up of these portable generators. This flexibility allows ECUA to react quickly in the event of a loss of power and reduces the incidence of SSOs.

- **Inflow and Infiltration (I&I) Reduction** – The ECUA wastewater collection system conveys sewage to either of the two ECUA water reclamation facilities on the mainland. The operation and maintenance of the collection system entails typical activities to keep the system in normal condition, as well as an attempt to reduce or eliminate the unintended flow of ground water and stormwater into the collection system. This extraneous flow into the system is commonly known as I&I.

ECUA staff perform routine maintenance practices such as using GIS-based system mapping on laptop computers for mobile access to collection system data, cleaning the collection system with vacuum trucks, inspecting pipes with a video camera, and remotely monitoring the operation of over 360 pumping stations through the use of a Supervisory Control And Data Acquisition (SCADA) system. ECUA also funds additional collection system maintenance activities through its CIP budget. These activities include a manhole rehabilitation

program to repair structural deficiencies in manholes and sewer line repair and replacement using a variety of proven repair approaches such as in-place liners, pipe-bursting, and pressure grouting.

- ***Fats, Oils, and Grease (FOG) Program*** – ECUA has implemented a program to reduce sewer overflows by controlling the discharge of fats, oils, and grease into the collection system. The aim of this program is to help sewer customers capture and dispose of cooking grease in an environmentally safe way, in order to reduce the occurrence of grease-related sewer clogs, which often result in SSOs. ECUA provides containers to customers who wish to participate in the program and offers a safe disposal option at a number of sites throughout the ECUA utility service area, thus avoiding the discharge of these materials to the ECUA collection system and related grease clogs. A contractor processes the materials collected through this program to produce biodiesel.

The implementation of the FOG Program also includes the monitoring and assessment of grease traps at restaurants and other food service establishments in ECUA's utility service area, which includes the Bayou Chico watershed. ECUA maintains a database of FOG customers and conducts routine inspections and follow-ups on these facilities. In 2010, ECUA established the Protector of the Environment Award Program to recognize organizations that implement BMPs for the removal of FOG prior to its discharge into the ECUA collection system. ECUA presents this award quarterly. FOG staff participates in community activities and train staff at local restaurants, cafeterias, and food service establishments.

- ***Lift Station Upgrades and Emergency Power Generation Program*** – In addition to the activities listed above, and as part of the MSWWTP, ECUA has upgraded a number of lift stations throughout its service area and has installed emergency power generators at the new WWTP (and existing MSWWTP) to address the release of untreated sewage caused by power failures – another potential source problem that can be posed during heavy storm events, including hurricanes.

The importance of replacing the MSWWTP was emphasized when Hurricane Ivan struck Pensacola in September 2004, rendering the plant inoperable for 3 days and causing the release of raw sewage into the streets of Pensacola. It was estimated that the hurricane, with its wind-driven salt water, aged the already outdated plant by approximately 10 years. The new facility, located near Cantonment, has increased capacity (20 to 22.5 MGD) and is located above the Category 5 storm surge level. It also addresses ECUA's primary goal, which is to provide long-range solutions to the sewage treatment needs of the community.

- ***ECHD Septic to Sewer Enforcement Program*** – This ongoing noticing and tracking program, carried out in conjunction with ECUA's sanitary sewer expansion projects, is designed to track residential communities that are phasing out septic systems and connecting to available sanitary sewer lines. At last report (2010), ECHD had sent out 751 notices informing residents of the requirement to

connect where sanitary sewer was available (e.g., the Edgewater and Lakewood subdivisions in the Bayou Chico watershed) and stated that 113 residents were still within the required connection time frame (within 1 year from the notice), while about 40 residents were noncompliant. ECHD continues to monitor progress and enforcement through a series of notices and mailers. The program also aids in promoting ECUA's waiver of the wastewater capacity impact fee for all connections in the project areas that are completed within 365 days of notice of availability of the system.

Table 3-2 summarizes all sanitary sewer system projects and activities that address potential fecal coliform loading in the Bayou Chico watershed, including their costs (if known) and status.

TABLE 3-2: STAKEHOLDER PROJECTS AND ACTIVITIES TO REDUCE FECAL COLIFORM LOADINGS FROM SANITARY SEWER SOURCES

PROJECT NUMBER	PROJECT NAME	PROJECT DESCRIPTION	LEVEL OF EFFORT	ESTIMATED COST	FUNDING SOURCE	PROJECT STATUS
ECUA – 1	Lakewood Phase I	Construct sewage collection system – 183 connections established	Sewer extensions in area previously served by septic tanks	\$1,431,866	ECUA	Completed
ECUA – 2	Lakewood Phase II	Construct sewage collection system – 85 connections established	Sewer extensions in area previously served by septic tanks	\$747,263	ECUA	Completed
ECUA – 3	Lakewood Phase III	Construct sewage collection system – 112 connections established	Sewer extensions in area previously served by septic tanks	\$723,964	ECUA	Completed
ECUA and Escambia County – 4	Lakewood Phase IV	Sewer extension project	Sewer extensions in area previously served by septic tanks	\$128,845	Community Development Business Grant (CDBG) (through U.S. Department of Housing and Urban Development [HUD]) and ECUA	In design
ECUA and Escambia County – 5	Lakewood Phase V	Sewer expansion project	Sewer extensions in area previously served by septic tanks (construction funded through Escambia County HUD/CDBG funds for Phases IV, V, and portions of VI)	\$3,390,897	CDBG (HUD)	In design
ECUA and Escambia County – 6	Lakewood Phase VI	Sewer expansion project	Sewer extensions in area previously served by septic tanks	Included in costs of Lakewood: Phase IV	Partly funded through CDBG (HUD)	Portions in design
ECUA – 7	Edgewater Phase I	Construct sewage collection system – 74 connections established	Sewer extensions in area previously served by septic tanks	\$1,467,661	ECUA	Completed
ECUA – 8	Edgewater Phase II	Construct sewage collection system – 295 connections established	Sewer extensions in area previously served by septic tanks	Included in costs of Edgewater: Phase I	ECUA	Completed
ECUA – 9	FOG Program	Reduce sewer overflows by controlling the discharge of fats, oils, and grease into the collection system.	Throughout entire ECUA service area	Unknown	ECUA	Ongoing
ECUA – 10	I&I Program	Reduce or eliminate the unintended flow of ground water and stormwater into the collection system	Throughout entire ECUA service area	Unknown	ECUA	Ongoing
ECUA – 11	SSO Response Plan	Respond and clean up SSOs	Throughout entire ECUA service area	Unknown	ECUA	Ongoing
ECUA – 12	Emergency Power Generator Program	Install generators at WWTP	Sewer upgrades/repairs	Unknown	ECUA	Completed
ECUA – 13	Lift Station Upgrades	Upgrade lift stations in the watershed	Throughout entire ECUA service areas	Unknown	ECUA	Ongoing
ECHD – 14	Septic to Sewer Enforcement Program	Carry out enforcement by notifying residents and tracking conversion compliance: 751 notices were sent out; 113 are still within the connect time frame; 40± are in noncompliance	Enforcement programs	Unknown	FDOH	Ongoing

SECTION 4: ONSITE SEWAGE TREATMENT AND DISPOSAL SYSTEMS

4.1 POTENTIAL SOURCES

A watershed tour was conducted with stakeholders in February 2009 to gain a better understanding of potential sources in the Bayou Chico watershed and insight into the best monitoring strategies that may help track water quality improvements over time. In addition to evaluating areas of the watershed that were not currently sewered, the group discussed potential areas where septic tank failures or poor siting of those facilities may be a contributing source.

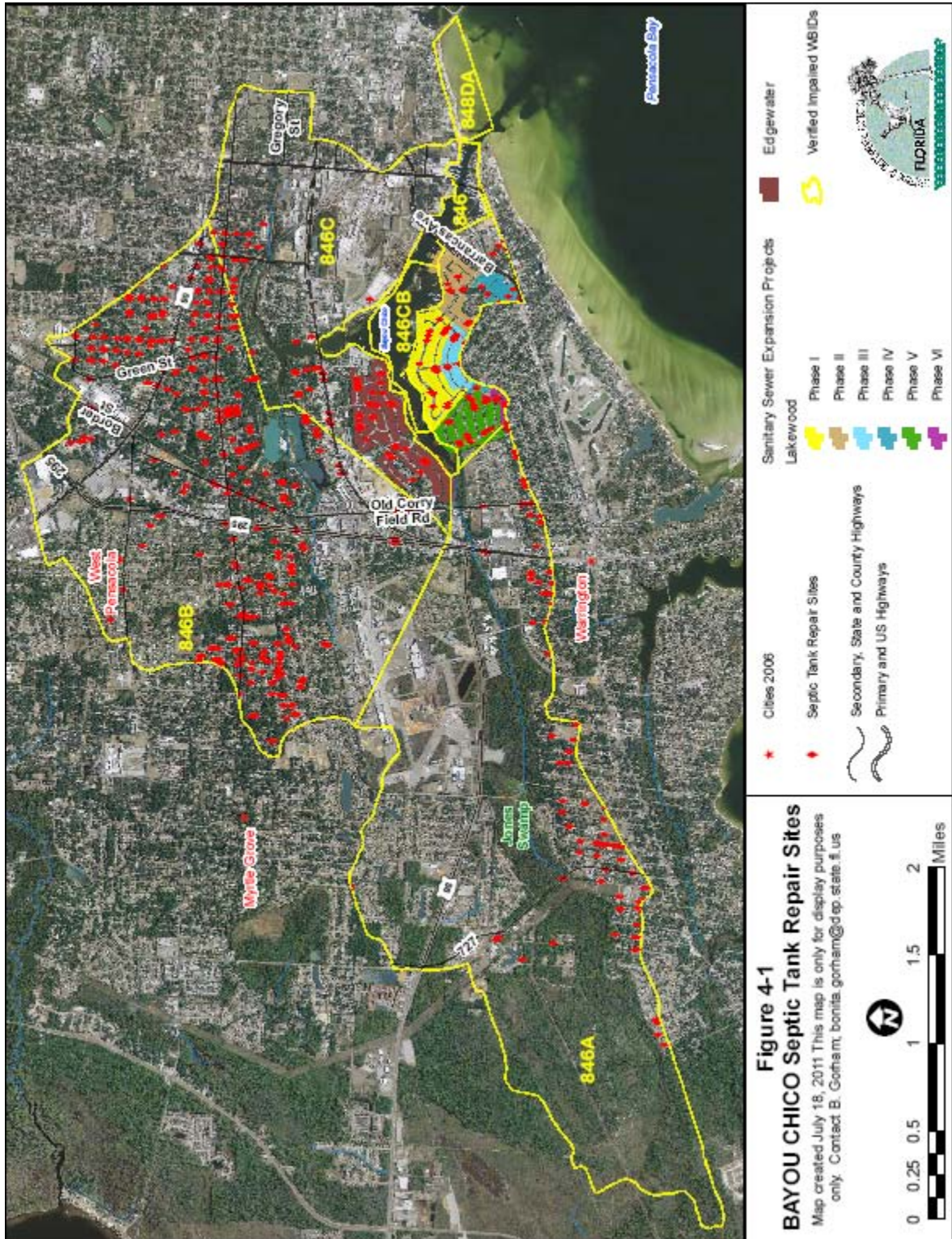
Historically, most of the residential and commercial development in several older neighborhoods used OSTDS prior to the implementation of ECUA's recent sewer expansion program. These subdivisions are planned for septic tank phaseout by the end of 2011. There are approximately 771 homes with OSTDS in the Bayou Chico watershed, principally in the Lakewood subdivision, located just south of Bayou Chico Beach (WBID 846CB), and in the Edgewater subdivision, situated just north of Bayou Chico (near WBID 846CB). Local stakeholders have pointed out that these older septic systems are a likely contributor to the elevated fecal coliform concentrations and impairments in the Bayou Chico watershed.

The majority of households (686 out of 1,017 homes) in the Lakewood subdivision are currently on septic, but ECUA's sewer expansion program is implementing 6 planned phases for conversion from septic to sewer. Of the 6 phases, 3 are now complete (2005 and 2008). Phases IV, V, and portions of Phase VI are now in design or under way, while some of Phase VI is without the necessary funding for the complete phaseout (see **Figures 3-1** and **3-2**).

Sewer expansion is now complete in the Edgewater subdivision. At this time, only 43 of 369 homes are still not connected where sewer service is available. In addition, an estimated 10 OSTDS on Jamaica Street, 9 in Corry Heights, and another 23 in Carver Heights have not yet connected where sanitary sewer is available (see Table 3-2).

ECHD is tracking and evaluating septic tank failure areas and has issued repair permits for septic tanks in all the surrounding WBIDs of Bayou Chico. The locations of the repair permits closely correspond with the failure areas in older subdivisions such as Lakewood and Edgewater, particularly in the areas adjacent to the freshwater tributaries of Bayou Chico (e.g., Jones Creek and Jackson Branch). **Figure 4-1** shows the septic tank repairs that have been reported in the Bayou Chico watershed.

FIGURE 4-1: SEPTIC TANK REPAIRS IN THE BAYOU CHICO WATERSHED



4.2 PROJECTS TO REDUCE FECAL COLIFORM LOADING

As identified in **Section 3**, ECUA has an ongoing CIP that is focused on phasing out and eliminating poorly operating or failed septic tanks through the expansion of the ECUA wastewater collection system. The priority areas targeted for this program are typically situated close to surface water or public drinking water wells, or where the operation of septic tanks has caused health concerns.

ECHD has determined that many areas of the Bayou Chico watershed are susceptible to ground water contamination by failing septic tank systems. Water quality monitoring has identified several hot spots of bacteria. The greatest concentrations are found in the small creeks and streams feeding into the area's waterbodies. Many septic tanks in sensitive areas have been abandoned, hopefully preventing further impacts to surface waters.

As ECHD continues to identify failing septic tanks and available sewer connections in sensitive areas, it plans to move closer to the goal of cleaning up susceptible areas near waterways and protecting drinking water resources. Further water quality improvements and the protection of drinking water resources will be realized as additional failing septic tanks are identified, taken offline, and connected to available sewer lines.

ECHD programs and activities being conducted in the Bayou Chico watershed to address fecal coliform loading from OSTDS include the following:

- ***ECHD OSTDS Program*** – *The objective of the OSTDS Program is to provide safe and sanitary treatment and disposal of domestic and commercial sewage waste in the areas not served by public sewage systems. Generally, OSTDS present no public health problems when they are properly designed, installed, and maintained on sites having satisfactory soil and drainage features. However, where an installation site is unsuitable, and where no modification of the property is possible or practical, the use of an OSTDS may contaminate ground or surface waters. The primary goals of ECHD are to protect public health by eliminating the potential for the spread of infectious disease caused by improperly built or maintained OSTDS, and to protect ground and surface water from OSTDS discharge.*

ECHD is responsible for all operational aspects of the OSTDS Program, as described in Rule 64E-6, F.A.C. To accomplish its program goals and objectives, ECHD uses the expertise of FDOH-certified supervisors, FDOH-certified field inspectors, and administrative support staff. In addition, ECHD has a field inspector to investigate complaints and address legal cases.

During the permitting process, OSTDS staff provides many services, including, but not limited to, the following:

- o Application/plan review;
- o Site evaluation;
- o System construction permitting; and
- o Installation inspection.

ECHD must review all applications for construction permits relating to the installation, modification, replacement, or repair of OSTDS and determine within the time limitations prescribed by the Florida Administrative Procedures Act, Section 120.60, F.S., whether to issue or deny a permit. The goal for the average number of days to issue a new construction permit is eight days and two days for a repair permit.

The review process involves a determination as to whether the site location and installation comply with standards set forth in Chapter 381, F.S., and Rule 64E-6, F.A.C. ECHD also inspects and evaluates all new installations, repairs, abandonments, or modifications of OSTDS; the inspections are made to ensure compliance with regulatory requirements for a number of system components, including adequate tank construction and capacity, fill material if needed, drain field size, elevation, cover, dosing system construction, and distance from surface water and potable wells. ECHD also inspects existing OSTDS for compliance when there is a change of use or occupancy. When Escambia County's Building and Zoning Department receives an application for a building permit, when a zoning change is requested, or when the county receives an application for an occupational license, the applicant is referred to ECHD for OSTDS review.

When a building served by an OSTDS is located in an area zoned or used for industrial/manufacturing purposes, or where a business generates commercial sewage waste, ECHD issues an annual operating permit and requires at least one compliance inspection per year. ECHD staff identify the updated listings of these properties.

In addition to the actual permitting process for OSTDS systems, ECHD also regulates the OSTDS maintenance industries. Service permits are issued to the following facilities annually, and ECHD performs one to two compliance inspections each year, depending on the type of facility:

- o Septic disposal services;*
- o Lime stabilization facilities;*
- o Land application facilities;*
- o Portable or temporary toilet services; and*
- o Septic tank manufacturers.*

When an inspection determines that an ECHD-issued OSTDS permit is out of compliance, the inspector notifies the appropriate parties in writing with the appropriate violations noted, as referenced in the Florida Statutes and Florida Administrative Code.

Most cases in Escambia County are corrected without further enforcement. For those cases that require enforcement, ECHD has its own attorney to take cases to court. FDEP law enforcement becomes involved in cases of willful pollution. The ECHD database includes a record of all complaints and investigations. This

database is updated daily and may include approximately 10 to 15 complaints per week.

- **ECHD Research Program** – In September 2006, Dr. Richard Snyder at UWF's CEDB published a report for ECHD, entitled Analysis of Fecal Loadings into Bayous Grande, Chico, and Texar: Pensacola Bay System, FL (Snyder 2006). ECHD funded a portion of the research and manpower for this project. The report summarizes the findings of a multiyear study to identify sources of fecal loading contamination within the Pensacola Bay system's urban bayous. UWF is working in partnership with ECHD to develop a method to distinguish human from nonhuman sources of pollution. Several avenues have been and are currently being explored. The goal is to determine if failing septic tank systems are contributing to pollution in the area's waterways. If problem areas can be identified, the information will be shared with ECUA and will help in prioritizing its sewer expansion projects.
- **ECHD Environmental Analysis Program (EAP)** – EAP began operating in August 1999. One of its tasks is to evaluate the effects of improperly installed and poorly maintained septic tank systems on ground water and surface water quality in Escambia County. Many areas of the county have soil conditions that are unsuitable for a septic tank system. For a septic system to work properly, the drain field should be at least 24 inches from the seasonal high water table. This allows bacteria, nutrients, and solids to be filtered and/or treated within the soil before reaching the sensitive ground water. Low-lying areas, especially along the coast, may have a water table very close to the ground surface that could be contaminated by improperly installed septic tank systems. Other potential problems include undersized septic tanks, illegal laundry discharges, improper setbacks to water wells, and drain fields crossing drinking water lines—all of which could allow contaminants to reach ground water, surface water, or drinking water.
- **Escambia County Ordinance, Chapter 98, Article III, Relating to OSTDS** – This ordinance, adopted in 1999, requires an inspection by ECHD prior to the sale or transfer of property with an existing septic tank system. The requirement pertains to all areas of Escambia County south of Well Line Road. The inspection is designed to identify septic tanks that may be having a detrimental effect on water resources and provide information to the buyer on the functionality of the septic system. Inspectors evaluate the drain field and determine the outside dimensions of the septic tank compartment, what material the tank is made from, and if the tank has any obvious structural defects. If a sanitary nuisance exists, the homeowner is required to correct the problem immediately. All required setbacks regarding system placement are also checked for compliance with Rule 64E-6, F.A.C., and Chapter 381, F.S. The results of the inspection must be made available to the seller as well as the buyer before or at the time of closing.

- ***ECHD Healthy Beaches Program*** – *It is anticipated that ECHD will continue its biweekly beach sampling for fecal coliform and weekly for Enterococcus bacteria counts in Bayou Chico, at Lakewood Park and Sanders Beach, in conjunction with its Healthy Beaches Program.*

As a part of BMAP follow-up, FDEP and stakeholders will track implementation efforts and monitor water quality to determine additional sources and water quality trends. Technical stakeholders and local citizens will continue to explore new opportunities for funding assistance. Their goal will be to ensure that the activities listed in this BMAP can be maintained at the necessary level of effort to address problem areas where OSTDS may contribute to fecal contamination in Bayou Chico.

Table 4-1 lists stakeholder activities that may reduce or eliminate fecal coliform from OSTDS sources.

TABLE 4-1: STAKEHOLDER PROJECTS AND ACTIVITIES TO REDUCE FECAL COLIFORM LOADING FROM OSTDS SOURCES
(page 1 of 2)

PROJECT NUMBER	PROJECT NAME	PROJECT DESCRIPTION	LEVEL OF EFFORT	ESTIMATED COST	FUNDING SOURCE	PROJECT STATUS
ECHD – 15	Environmental Analysis Program	Inspects septic tanks prior to property sales	When an inspection determines that an ECHD-issued OSTDS permit is out of compliance, the inspector notifies the appropriate parties in writing with the appropriate violations noted	Unknown	FDOH	For those cases that require enforcement, ECHD has its own attorney to take cases to court. FDEP law enforcement becomes involved in cases of willful pollution. The ECHD database contains a record of all complaints and investigations. It is updated daily and may include approximately 10 to 15 complaints per week.
ECHD – 16	OSTDS Permitting	Carries out all operational aspects of the OSTDS Program, as described in Rule 64E-6, F.A.C.	The goal for the average number of days to issue a new construction permit is eight days and two days for a repair permit	Unknown	FDOH	Ongoing
ECHD – 17	Industrial/Business Annual Operating Permits and Compliance Inspections	Issues a permit when a building served by an OSTDS is located in an area zoned or used for industrial/manufacturing purposes, or where a business generates commercial sewage waste	ECHD issues an annual operating permit and requires at least one compliance inspection per year	Unknown	FDOH	Ongoing
ECHD – 18	Septic to Sewer Enforcement Program	Through notification and tracking, enforces conversion compliance for the septic tank phase-out program done in concert with ECUA	Currently monitoring the progress of conversions in adjacent residential communities in the Bayou Chico watershed, including Edgewater, Lakewood, and Corry and Carver Heights.	Unknown	FDOH	Ongoing

Draft Bayou Chico Basin Management Action Plan – October 2011

PROJECT NUMBER	PROJECT NAME	PROJECT DESCRIPTION	LEVEL OF EFFORT	ESTIMATED COST	FUNDING SOURCE	PROJECT STATUS
ECHD – 19	ECHD Research Program	Funded a portion of the research and manpower for a study with UWF to develop a method to distinguish human from nonhuman sources of pollution. Several avenues have been and are currently being explored.	The goal is to determine if failing septic tank systems are contributing to pollution in area waterways. If problem areas can be identified, the information will be shared with ECUA and will help in prioritizing sewer expansion projects.	Unknown	ECHD	Complete; 2006 report provides important baseline data on fecal contamination in the Bayou Chico watershed
ECHD and Escambia County – 20	Escambia County Ordinance 99-36, referenced in Escambia County Ordinance, Chapter 98, Article III	Requires an inspection by ECHD prior to the sale or transfer of property with an existing septic tank system. All required setbacks regarding system placement are also checked for compliance with Rule 64E-6, F.A.C., and Chapter 381, F.S. The results of the inspection must be made available to the seller as well as the buyer before or at the time of closing.	The inspection is designed to identify septic tanks that may be having a detrimental effect on water sources and provide information to the buyer regarding the functionality of the septic tank system. Inspectors evaluate the drain field and determine the outside dimensions of the septic tank compartment, what material the tank is made from, and if the tank has any obvious structural defects.	Unknown	ECHD, through FDOH	To date, ECHD has found many areas that are susceptible to ground water contamination by failing septic tank systems; water monitoring has identified several hot spots of bacteria
ECHD – 21	Healthy Beaches Program	Samples for fecal coliform and <i>Enterococcus</i> at specific sites in Bayou Chico, at Lakewood Park and Sanders Beach	Weekly for <i>Enterococcus</i> and biweekly for fecal coliform	Unknown	ECHD, through FDOH and UWF	Ongoing (but funding to be reduced in 2012)

SECTION 5: STORMWATER

5.1 POTENTIAL SOURCES

Sources of stormwater runoff and other nonpoint sources may include the highly urbanized and medium- to high-density residential and commercial lands adjoining the Bayou Chico watershed, as well as areas with concentrated wildlife (e.g., bird sanctuaries) or domestic animals (e.g., dog parks or improper pet waste disposal). While there are no known dog parks in the watershed, a number of county and city parks close to the bayou could be used by residents who walk their dogs and may improperly dispose of any pet waste. Bacteria from sediments could also be a potential concern in certain areas of Jones Creek and Jackson Branch, where more than half of the watershed is urbanized and where stormwater runoff is managed through stormwater treatment systems or conveyances that outfall into Bayou Chico. While monitored by city and county programs, illicit connections to stormwater conveyance systems can also contribute to fecal coliform loading.

5.2 PROJECTS TO REDUCE FECAL COLIFORM LOADING

The city of Pensacola (representing approximately 18% of the watershed), Escambia County, the town of Century, and FDOT District 3 are all co-permittees on an MS4 permit and are required to carry out specific actions to reduce fecal coliform loading such as BMPs, operation and maintenance, and illicit discharge detections, as well as annual inspections and monitoring programs for stormwater conveyance systems that they own and operate.

These stakeholders provided the following information related to projects, programs, and activities they are conducting or planning to implement to reduce or eliminate fecal coliform loading in the Bayou Chico watershed:

- *Escambia County and the City of Pensacola*

Funding Source

In 2003, the city of Pensacola implemented a stormwater utility fee that generates approximately \$2 million annually for stormwater improvement projects. Escambia County uses a portion of the local option sales tax for capital improvement stormwater projects. The county designates approximately \$5 million annually for these efforts and projects the need for between \$1 million and \$1.5 million of additional funding to complete other planned stormwater improvements and restoration activities in the watershed.

MS4 Capital and Drainage System Repair (DSR) Projects

Between 1999 to present, Escambia County and the city of Pensacola completed numerous new MS4 capital improvement projects in the Bayou Chico watershed at a cost of over \$10 million. The county and city's current 5-year capital improvement plans list a number of MS4 projects in the watershed, with a total

estimated cost of over \$3 million. This does not include the estimated \$3,390,900 of HUD/CDBG funds that Escambia County secured in 2010 to complete ECUA's Lakewood Park sewer expansion projects (Phases IV and V, and part of Phase VI).

*In addition to constructing new capital improvement drainage projects in the Bayou Chico watershed, between 1999 and 2010 the county and city completed numerous DSR projects in the watershed (see **Table 5-1**). It is anticipated that continuing expenditures for DSR projects will average \$1 million annually.*

As summarized above, the county and city will continue to construct new MS4 projects, as well as DSR projects, in the Bayou Chico watershed in order to reduce and treat stormwater runoff and to address potential fecal coliform loading in surface waters.

Stormwater Management Plan

Both Escambia County and the city of Pensacola have Stormwater Management Plans that include new proposed stormwater capital improvement projects, needed DSR projects, water quality monitoring and modeling results, and proposed stormwater budgets.

MS4 NPDES Program

Escambia County and the city of Pensacola are MS4 NPDES co-permittees, along with FDOT and the town of Century. Managing stormwater, maintaining the MS4 infrastructure, reducing pollutant loading, monitoring progress, and carrying out education and outreach are important components of the NPDES Program.

MS4 Maintenance Activities

The Escambia County and city of Pensacola Public Works Departments manage MS4 maintenance activities, including street sweeping, stormwater pond and BMP maintenance, ditch cleaning, and infrastructure repair. Citizen concerns are logged in through telephone and internet systems to enable timely and responsive tracking and repair. Monthly schedules for regular maintenance activities are followed. Stormwater BMPs are regularly maintained, and miles of streets are swept regularly. The county and city budget between \$500,000 and \$1 million annually for MS4 maintenance activities.

Inspection and Sampling Activities

Escambia County and the city of Pensacola, through an interlocal agreement, inspect all major stormwater outfalls and monitor pollutant loading as required by the NPDES permit. Over 1,500 outfalls are inspected and over 150 major outfalls are sampled on a schedule specified by the NPDES permit. Escambia County has constructed and staffed a Water Quality Laboratory to analyze sediment and water samples for the NPDES Monitoring Plan. Stormwater outfalls in the Bayou Chico watershed are regularly inspected and sampled.

Bacteria monitoring data illustrate trends and areas of concern so that potential sources of contamination can be traced.

Illicit Connection Program and Enforcement

Escambia County and the city of Pensacola conduct routine inspections to locate potential illicit discharges and connections. Escambia County purchased a truck-operated camera that is deployed in the storm drain system to locate illicit connections. Dry weather monitoring is conducted to determine if dry weather flows are from illicit connections or discharges. High-risk industries and small-quantity generators are routinely inspected.

- FDOT

MS4 Maintenance Activities

In the event of an illicit discharge, FDOT takes immediate action to terminate the discharge if possible; however, FDOT has no formal enforcement authority under Rule 14-86, F.A.C., but monitors and reports illicit discharges to its co-permittee, who has enforcement authority.

The FDOT storm sewer system is inspected for operation and condition under a Maintenance Rating Program (MRP). Maintenance activities are graded and reported on based on this program. MRP is the method that FDOT uses to conduct a visual and mechanical evaluation of routine highway maintenance conditions. The purpose of the evaluation is to provide information that is used to schedule and prioritize routine maintenance activities and provide uniform maintenance conditions that meet established FDOT objectives. It is broken into five different elements: roadway, roadside, traffic services, drainage, vegetation/aesthetics.

MRP is just one tool that FDOT uses to ensure that roadways are maintained consistently and systematically. Other tools include Quality Assurance Reviews performed on each FDOT District by subject matter experts who compare the District's planned work activities with work actually accomplished using the FDOT's Maintenance Management System (MMS). Also, work needs supervisors regularly inspect the highways for issues that may require additional maintenance. In addition, the maintenance units are aware of problem areas and adjust routine schedules as needed to properly maintain the system. MRP is a proven system with demonstrated effectiveness for maintaining the FDOT infrastructure.

FDOT District 3 Projects

State Road 292 Bridge at Barrancas Avenue and U.S. Highway 98 Navy Boulevard Replacement Bridge: *These two newly constructed bridges over Bayou Chico were replaced by FDOT and now have stormwater treatment. Neither bridge had associated water quality treatment when originally constructed. The new construction meets current permitting water quality standards; it includes new stormwater ponds located on Barrancas Avenue under the high-rise bridge on the south side of the highway, and roadside treatment*

swales on U.S. Highway 98 Navy Boulevard, adjacent to the bridge within the right-of-way.

- **Other Projects and Activities**

Other projects and activities that have been (or will be) implemented in the Bayou Chico watershed over the last (or next) five years by the various stakeholder groups include the following:

Escambia County Stream and Floodplain Restoration Projects and Educational Boardwalks:

- **West Jones Creek Restoration Projects:** *Escambia County has completed and is continuing to monitor the Jones Creek Restoration Projects, which include natural stream channel restoration, associated sediment and erosion controls, and floodplain and wetland restoration/preservation*
- **Jackson Lakes and Glynn Key Stormwater Projects:** *These include the installation of new stormwater BMPs along with an educational amphitheater, boardwalk, and signage.*

Escambia County Pet Waste Ordinance: Part I: Article I, Section 10-11 (F)

This ordinance requires the removal of canine waste and requirement for possession of device for removal in the county.

Derelict Vessel Removal: *Escambia County's Marine Resources Division coordinated the removal of 40 vessels from the bayou during the years following Hurricane Ivan in 2004.*

City of Pensacola

Sanders Beach (at Pensacola Yacht Club) Ditch Improvement Project: *Currently in design, the project will reroute flow and add stormwater treatment from a known contaminated area (the former American Creosote Works site) of Bayou Chico.*

L St. and Zarragossa Drainage Improvements Project: *The project includes the installation of new (and replacement) stormwater treatment.*

Magnet School, Pace and Gregory Street Project: *This includes the installation of new baffle boxes at the new Charter School.*

Other Bayou Activities

Bayou Chico Channel Dredging: *This USACOE and NFWFMD project, which included the entrance channel dredging of Bayou Chico, was completed in 2008. Sediment/spoil was deposited in Clark's Sandpit (within Jackson Branch), and the NFWFMD is monitoring ground water and sediment transport as part of the permit conditions. The project opened up the turn basin and entrance*

channel, provided increased flushing between Bayou Chico and Pensacola Bay, and positively benefits water quality by reducing fecal coliform.

Neighborhood Clean Sweep Programs: *Escambia County, in partnership with BARC, hosts an annual neighborhood clean sweep event. The program is a one- or two-day event to clear debris and litter in the Bayou Chico watershed. The last event was held in April 2011.*

Oyster Reef Project near Harbor View Marina: *The project includes the establishment of an oyster reef and was funded by BCA and an FDEP grant.*

Planned Projects

Bayou Chico Channel Widening: *On the north end of Bayou Chico just south of the new Navy Boulevard Bridge lies the remains of an old railroad trestle bridge that chokes the north end of the bayou down to about a 20- to 26-foot opening. Two major tributaries feed the bayou through the opening. The debris restricts the flow of water and reduces the ability of the bayou to properly flush. Stakeholders generally agreed that by opening this restriction, the water would be able to flow more freely and allow greater flushing, helping to improve water quality in the bayou.*

The removal of this obstruction has been permitted by one of the commercial property owners on the north end of Bayou Chico, located between the obstruction and the U.S. Highway 98 Navy Boulevard Bridge. The permit authorizes the construction of a new 63-slip marina, placement of 234 cubic yards of riprap, and dredging of approximately 1,478 cubic yard of spoil material from within the mooring area. It also authorizes the removal of 908 cubic yards of material from within the former railroad trestle, located south of the project site. In addition, the permit authorizes the removal of 20 creosote pilings from the trestle area by cutting them off at the bayou bottom (at the mud line). The spoil from both sites will be placed in a lined spoil cell, with no return flow into Bayou Chico, and will be hauled off by truck to a landfill.

The property owner has discussed the project with BCA, and the owner has agreed to allow the use of this permit by other agencies/stakeholders to dredge the area (since marina construction is currently postponed). The current 20- to 26-foot opening may be expanded to approximately 60 feet and the depth increased from 2 to 4 to 6 to 8 feet. Unfortunately, because of the nature of the obstruction, its removal will not be easy. It consists of very large creosote pilings spaced 8 feet apart and armored by large rocks and sand. Estimates for the removal of the obstruction came in at about \$68,000. However, the detailed specifications have not yet been established and the price may rise. The permit to remove the obstruction has a limited life (5 years from 2009) and may expire before the project is funded or completed.

Projects or Proposals under Consideration

BCA has suggested to stakeholders and local agencies several activities that may aid in the restoration of the bayou and its water quality. Though the purpose of

this BMAP is to address very specific and limited pollutants (fecal coliform), the BCA has other water quality concerns for Bayou Chico. New technologies being proposed by BCA are expected not only to help in reducing the amount of fecal coliform, but may also help in reducing other contaminants such as nitrates, ammonia, phosphates, copper, and zinc. These methods have been proven in other situations and environments that BCA has researched, and so it wishes to evaluate and study their potential use; these additional proposals may benefit the bayou. Funding sources for the proposals have not yet been identified.

Two such project proposals are as follows:

- o **DO2E® aeration system** – This system, like many others, is used in sewage treatment plants as a major step in the breakdown of waste, including fecal coliform. BCA has proposed using these systems in the freshwater tributaries of Bayou Chico (Jackson Branch and Jones Creek). These are believed to be the principal hot spots where fecal coliform sources may enter the bayou. The DO2E® aeration system adds oxygen by injecting air in through its cylinder, facilitating the digestion process of raw sewage before it enters the main body of the bayou. Biological digestion is further enhanced by reducing biochemical oxygen demand (BOD), while the enhancement of the aerobic environment might also stimulate, or enhance the activity of microbes or beneficial organisms and propagate the growth of good bacteria that may account for 10% to 15% of the digestive process.
- o **BioHaven® Floating Islands** – BCA has proposed the installation of BioHaven® Floating Islands technology that is designed around the same principles as a wetland: using the natural processes of plants and microbes to improve water quality. BioHavens are man-made floating islands. Like wetlands, they create habitat for plant and aquatic species. Additionally, man-made floating islands can be produced, deployed, and maintained at a fraction of the cost compared to other water quality treatments.

Table 5-1 describes in more detail stakeholder activities that may reduce or eliminate fecal coliform loadings from stormwater runoff and nonpoint sources.

Table 5-1: STAKEHOLDER PROJECTS and ACTIVITIES TO REDUCE FECAL COLIFORM LOADING FROM Stormwater Sources

PROJECT NUMBER	PROJECT NAME	PROJECT DESCRIPTION	LEVEL OF EFFORT	ESTIMATED COST	FUNDING SOURCE	PROJECT STATUS
Escambia County – 22	Glynn Key Stormwater, Wetland Education Park	Construct new stormwater BMPs, educational boardwalk, and signage to show how such a stormwater wetland can be an asset to the individual development and community	Project is being expanded to include an educational component and connect Glynn Key with the existing Jones Creek project.	\$500,000	FDEP grant, partnered with Escambia County, U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), FDOT, Southgate Shopping Center, and BCA to convert a commercial development holding pond into a county stormwater wetland education park	Completed
Escambia County – 23	Bayou Chico Restoration Projects: W St. Weir	Replace a dilapidated weir at W St. that feeds into Bayou Chico	Stormwater upgrades and repair	Unknown	Escambia County and city of Pensacola	Completed
Escambia County – 24	Jackson Lakes Stormwater	Construct new stormwater BMPs, educational amphitheater, and signage	Stormwater treatment for drainage areas north of Navy Blvd.	\$500,000	Escambia County, through FDEP grant	Completed
Escambia County – 25	Derelict Vessel Removal	Remove derelict vessels from the bayou	Stakeholders pitched in to remove 40 vessels from the bayou that could be potential sources of contamination	\$50,000	Florida Fish and Wildlife Conservation Commission (FWC) grant	Completed
Escambia County – 26	Stormwater Treatment – construction of 11 new stormwater BMPs associated with new development	Install and maintain stormwater treatment BMPs	County is constructing stormwater BMPs for areas under redevelopment that are close to the bayou	\$1,100,000	Escambia County	Under construction
Escambia County and FDOT – 27	Illicit Discharge Detection	Carry out inspections associated with NPDES permit	Sampling to assess conditions and identify sources. Enforcement action taken if PICs detected.	\$50,000	Escambia County	Ongoing
Escambia County – 28	Stormwater Pond Inspection and Maintenance Program	County maintains and inspects > 300 ponds countywide	Stormwater inspections and maintenance continually ongoing	\$300,000	Escambia County	Ongoing
City of Pensacola and ECUA – 29	West Avery St. Drainage Improvements	Construct two stormwater treatment facilities	Stormwater upgrades/retrofit project between Pace and J St. in the watershed	\$1,400,000	Escambia County	In design
Escambia County – 30	Jones Swamp Wetland Preservation	Acquire four parcels of riparian wetlands along Jones Creek for preservation	Located near Fairfield Dr. and Albany Ave.	\$300,000	Funded (Florida Communities Trust [FCT] grant)	Completed

PROJECT NUMBER	PROJECT NAME	PROJECT DESCRIPTION	LEVEL OF EFFORT	ESTIMATED COST	FUNDING SOURCE	PROJECT STATUS
Escambia County – 31	West Jones Creek Stream Restoration	Construct natural stream channel, restoration activities in floodplain (wetland restoration)	Wetland restoration and maintenance carried out west of Navy Blvd., east of Fairfield Dr.	\$250,000	Funded (EPA grant)	Completed
Escambia County, BARC, and BCA – 32	Public Education and Outreach	Carry out miscellaneous public education activities	Stormwater and pollution prevention brochures and information distributed to public in Bayou Chico watershed	\$10,000	Escambia County	Ongoing
NFWFMD and USACOE – 33	Bayou Chico dredging	Dredge entrance to Bayou Chico channel	Entrance to the bayou at the main channel was dredged to improved flushing and channel depth	Unknown	USACOE/NFWFMD	Completed
Escambia County – 34	Stormwater Outfall Monitoring	Sample as part of ongoing monitoring efforts for stormwater facilities located in the bayou	Ongoing	Unknown	Escambia County	Ongoing
Escambia County and U.S. Navy – 35	Retrofit Projects (Planned) Corry Field	Remove runway and install stormwater BMPs for treatment adjacent to bayou on Naval Air Station property	Seeking funding	Unknown	U.S. Navy and Escambia County	Pending
Escambia County / US Navy - 36	Corry Station Runway Surface Restoration	Involves the complete logistics to move 5-acres of impervious concrete and asphalt surface to promote environmental restoration projects surrounding the NAS Pensacola Complex, including providing new treatment for stormwater runoff, where currently there is no treatment. The concrete material will be available for use as base substrate material for community offshore fishery habitat improvements, oyster reefs, and other shoreline stabilization and restoration projects	Stormwater treatment for 100 acres (drainage area) north of US Hwy 98 vicinity of Pensacola State College and Corry Station US Navy.	\$80,000	Funded (FCT Grant)	In Planning

PROJECT NUMBER	PROJECT NAME	PROJECT DESCRIPTION	LEVEL OF EFFORT	ESTIMATED COST	FUNDING SOURCE	PROJECT STATUS
Escambia County – US Navy – Gulf Coastal Plain Ecosystem Partnership - 37	Jackson's Branch Headwater Restoration	This project with Naval Air Station (NAS) Pensacola at Corry Station will involve stream restoration for the headwaters of Jackson's Branch from the northeast corner of Corry Station eastward to New Warrington Road. Stream debris and sedimentation will be removed, invasive species removed, and wetlands restoration at the Corry Station headwater area.	Stormwater treatment for 20 acres (drainage area) in Jackson's Branch from Corry Station US Navy eastward to New Warrington Road.	\$125,000	Seeking Funding	In Planning
Escambia County / US Navy - 38	Bayou Chico / Jones Creek Stormwater Retrofit Project West Side of Corry Station US Navy	Stormwater treatment drainage areas north of US Hwy 98 vicinity of Pensacola State College and Corry Station US Navy.	Stormwater Retrofit Project	Unknown at this time	Unknown	In Planning
Escambia County – 39	Pet Waste Ordinance, Part 1, Article 1, Section 10-11(f)	Pass an ordinance to define the handling and removal of domestic pet waste countywide	County-wide, ongoing	Unknown	Escambia County	Completed
FDOT – 40	State Road 292 Barrancas Ave. Bridge	Add stormwater improvements with bridge construction	Roadway project with stormwater treatment	Unknown	FDOT, District 3	Completed
FDOT – 41	U.S. Highway 98 Navy Blvd. Bridge Replacement	Add stormwater improvements with bridge construction	Roadway project with stormwater treatment	Unknown	FDOT, District 3	Completed
BCA-42	Oyster Reef Project	Construct oyster reef near Harbor View Marina	Establishment of oyster reef – habitat	Unknown	BCA/Escambia County and FDEP	Completed
BCA – 43	Bayou Chico Channel Dredging	Remove restrictive pilings to open up channel and increase flushing in the tributaries of the bayou	Seeking approvals and funding	Estimated at \$68,000	BCA/permittee, owner	Pending
BCA – 44	Aeration Systems in Tributary (Jones Creek)	Install aeration systems to break down waste and allow aerobic activity and bacterial digestion	Seeking approvals and funding	Unknown	BCA	Planning stages
BCA – 45	Floating Islands	Promote the use of BioHaven® Floating Islands to enhance wetland functions and improve water quality	Seeking approvals and funding	Unknown	BCA	Planning stages

SECTION 6: MARINAS, BOATYARDS, AND MOORINGS

6.1 POTENTIAL SOURCES

Marinas, boatyards, and moorings are all potential sources of fecal coliform. Escambia County, the city of Pensacola and local marina owners within the Bayou Chico watershed are active supporters of the state's Clean Marina Program. Waste management and reduction, hazardous material storage, and sewage pump-out facilities are key elements of this program. Most of the marinas and boatyards in the watershed have been awarded Clean Marina recognition.

6.2 PROJECTS TO REDUCE FECAL COLIFORM LOADING

There are currently eight commercial marinas in the Bayou Chico watershed. Five of these eight have been awarded *Clean Marina* status: *Island Cove Marina* (806 Lakewood Rd.), *Palm Harbor Marina* (1206 Mahogany Mill Rd.), *Bahia Mar Marina* (1901 Cypress St.), *Pensacola Ship Yard and Marine Complex* (Clean Marina and Clean Boatyard, 700 Myrick St.), and the newest Clean Marina, *Harbor View Marina* (Clean Boatyard and Clean Retailer, 1220 Mahogany Mill Rd.).

Individual marina owners in the BMAP area are carrying out a number of ongoing efforts, as follows, to address pathogen sources from the marinas to the bayou:

- ***Pump Outs in Florida*** – *The National Marine Waste Foundation, Inc. (NMWF) is a new organization whose goals are to make waste removal services free to boaters through funding from local business sponsors and state grants. NMWF's mission is to provide free marine disposal to the general public in order to enhance and benefit water resources. The organization has 501(c)(3) nonprofit status and can secure funding from the Boating Improvement Trust Fund and Florida Boating Improvement Program grants.*

Currently three pump-out stations are available in local marinas in the Bayou Chico watershed, including one mobile unit that can be transported to any boater who requests the service. Recent upgrades and capacity to handle more sewage were added to this mobile unit.

- ***Barge and Derelict Vessel Removals*** – *Two abandoned barges and many derelict vessels left from the aftermath of recent hurricanes were removed from Bayou Chico and may have been potential sources of contaminants. These programs were funded through an FWC grant, BCA, and the Escambia County Marine Resources Division.*
- ***Florida's NPDES Stormwater Program***: *regulates point source discharges of stormwater into surface waters of the state from certain municipal, industrial, and construction activities. Industrial activities that discharge to surface waters of the state or into an MS4 and that fall under any one of the 11 categories of industrial activities identified in 40 CFR 122.26(b)(14) are required to obtain NPDES*

stormwater permit coverage. (The 11 categories are defined using both narrative descriptions and the facilities' Standard Industrial Classification [SIC] codes.)

Most regulated facilities obtain permit coverage by submitting a **Notice of Intent (NOI) To Use Multi-Sector Generic Permit for Stormwater Discharge Associated with Industrial Activity (MSGP)**. However, some facilities are required to obtain an individual permit. Industrial activities that can certify "no exposure" at the facility may be excluded from the requirement to obtain an NPDES stormwater permit. Regulated facilities that apply for coverage under the MSGP must also prepare a Stormwater Pollution Prevention Plan (SWPPP).

Marine industry operations that fall under the definition of industrial activity include the following:

- o Ship and boat building and repair facilities under SIC Codes 3731 and 3732 ; and
- o Water transportation facilities under SIC Code 44 that have vessel maintenance shops (mechanical repairs, painting, fueling, and lubrication) and/or equipment-cleaning operations. This group includes marinas identified under SIC Code 4493. Note that equipment-cleaning operations include areas where vessel and vehicle exterior wash downs take place.

Marinas and boatyards that meet the criteria above must obtain coverage under the NPDES Stormwater Program with either an MSGP or individual permit. An SWPPP is an essential component of a MSGP.

As part of a marina's SWPPP, measures must be identified that address good housekeeping, spill prevention, and response procedures, as well as plans to address non-stormwater and sediment and erosion controls. Such measures and the implementation of specific SWPPP plans by all marinas should provide some source controls in these particular areas of the watershed. It is not known how many marine industry operations fall under this MSGP permit requirement in the Bayou Chico watershed at this time. Additional information will be obtained for future BMAP annual reporting.

- **Mooring and Live-aboard Vessels: FWC Inspection and Compliance Sweeps** – Another potential source includes seasonal or transient live-aboard boats that may enter the bayou to moor temporarily. Some stakeholders have reported that many seasonal or transient boats frequent the Bayou Chico watershed and are not marina slip holders, but rather moor or stay in the bayou for extended periods. These boaters may contribute to the fecal coliform source problem if they are not properly disposing of their sewage or using existing pump-out facilities that are available in Bayou Chico.

The FWC has the authority to issue warnings to moored and live-aboard vessels for noncompliance with state rules on the disposal of waste, or improper safety

equipment aboard boats. It issued warnings to nearly a dozen vessels on a compliance and inspection sweep in the bayou early in 2011.

Table 6-1 describes in more detail the stakeholder activities that may reduce or eliminate fecal coliform loadings from marina, boatyards, or moorings.

TABLE 6-1: STAKEHOLDER PROJECTS AND ACTIVITIES TO REDUCE FECAL COLIFORM LOADING FROM MARINAS, BOATYARDS, AND MOORINGS

PROJECT NUMBER	PROJECT NAME	PROJECT DESCRIPTION	LEVEL OF EFFORT	ESTIMATED COST	FUNDING SOURCE	PROJECT STATUS
BCA – 46	Clean Marina – Clean Boatyard	Pensacola Shipyard	Awarded Clean Marina and Clean Boatyard status	Unknown	Marina owners	Completed
BCA – 47	Pump Out	Bahia Mar	Pump out Facility Available	Unknown	Marina owners	Completed
BCA – 48	Clean Marina	Palm Harbor	Awarded Clean Marina status	Unknown	Marina owners	Completed
BCA – 49	Clean Marina	Island Cove Marina	Awarded Clean Marina status	Unknown	Marina owners	Completed
BCA – 50	Clean Marina	Harbor View Marina	Awarded Clean Marina and Clean Boatyard status	Unknown	Marina owners	Completed
BCA-51	Planned	Pensacola Yacht Club (private marina)	Currently working on obtaining Clean Marina status	Unknown	Private Marina	Ongoing
BCA – 52	Pump-out Facilities	Three pump-out facilities, including a mobile unit, are available at marinas to access for sewage treatment disposal	Make waste removal services free to boaters; available at a number of locations in Bayou Chico marinas	Unknown	Funding from local business sponsors and grants through the state	Completed
BCA – 53	Marine Industry Operations	Requirement to obtain an NPDES stormwater permit (MSGP) to address good housekeeping, spill prevention, and response procedures, as well as plans to address non-stormwater and sediment and erosion controls	Ship and boat building and repair facilities and all water transportation facilities and /or equipment-cleaning operations	Unknown	Permittees consist of marine industry operations and ship or commercial boat operators	Ongoing
FWC – 54	Compliance and Inspection Sweeps	FWC has the authority to issue warnings to moored and live-aboard vessels for noncompliance with state rules relating to the disposal of waste, or improper safety equipment aboard boats	Annually, or on occasion; one sweep conducted in early 2011	Unknown	FWC	Ongoing

SECTION 7: SUMMARY OF RESTORATION ACTIVITIES AND SUFFICIENCY OF EFFORT

Successful BMAP implementation requires proactive action, commitment, and follow-up. Key stakeholders have expressed their intention to carry out the plan, monitor its effects, and continue to coordinate within and across jurisdictions to achieve water quality targets. The FWRA requires that an assessment be conducted every five years to determine whether there is reasonable progress in implementing the BMAP and achieving pollutant load reductions.

Table 7-1 summarizes the key stakeholders' level of effort related to controlling, reducing, or eliminating potential fecal coliform (bacterial) sources in the Bayou Chico watershed. **Figures 7-1 and 7-2** illustrate the many restoration and stakeholder activities and projects currently under way, completed, or planned to prevent fecal coliform (bacterial) sources from entering the eastern and western portions, respectively, of the Bayou Chico watershed.

The number of activities carried out to restore Bayou Chico and its associated tributaries over the last 5 to 10 years is very impressive, and demonstrates stakeholders' commitment to address the fecal coliform impairments in the watershed. FDEP has determined that the projects and activities outlined in this BMAP are sufficient to address all of the identified sources and, with the full implementation of the BMAP, the Bayou Chico watershed is expected to meet the TMDL requirements.

Through ongoing projects, studies, and monitoring efforts, stakeholders should be able to use the 5-year BMAP milestone evaluation and annual BMAP reviews to identify and take the necessary actions to address any additional sources that occur. **Appendix D** summarizes all stakeholder programs and local ordinances involving activities to implement the required TMDL reductions.

TABLE 7-1: POTENTIAL SOURCE CONTROL CATEGORIES IN THE BAYOU CHICO WATERSHED FOR ADDRESSING LOAD REDUCTIONS FOR FECAL COLIFORM AND OTHER BACTERIA

N/A = Not applicable

WATERBODY (WBID)	BAYOU CHICO BMAP MANAGEMENT ACTIONS CATEGORY	PROJECTS
Bayou Chico (WBID 846)	Stormwater Management Programs	√
Bayou Chico (WBID 846)	Education and Outreach Efforts	√
Bayou Chico (WBID 846)	Regulations, Ordinances, and Guidelines	√
Bayou Chico (WBID 846)	Special Studies, Planning, Monitoring, and Assessment	√
Bayou Chico (WBID 846)	Restoration and Water Quality Improvement	√
Bayou Chico (WBID 846)	Wastewater Infrastructure Management	N/A
Bayou Chico (WBID 846)	Marinas, Boatyards, and Mooring Activity	√
Jones Creek (WBID 846A)	Stormwater Management Programs	√
Jones Creek (WBID 846A)	Education and Outreach Efforts	√
Jones Creek (WBID 846A)	Regulations, Ordinances, and Guidelines	√
Jones Creek (WBID 846A)	Special Studies, Planning, Monitoring, and Assessment	√
Jones Creek (WBID 846A)	Wastewater Infrastructure Management	√
Jones Creek (WBID 846A)	Marinas, Boatyards, and Mooring Activity	√
Jackson Creek (WBID 846B)	Stormwater Management Programs	√
Jackson Creek (WBID 846B)	Education and Outreach Efforts	√
Jackson Creek (WBID 846B)	Regulations, Ordinances, and Guidelines	√
Jackson Creek (WBID 846B)	Special Studies, Planning, Monitoring, and Assessment	√
Jackson Creek (WBID 846B)	Wastewater Infrastructure Management	√
Jackson Creek (WBID 846B)	Marinas, Boatyards, and Mooring Activity	√
Bayou Chico Drain (WBID 846C)	Stormwater Management Programs	√
Bayou Chico Drain (WBID 846C)	Education and Outreach Efforts	√
Bayou Chico Drain (WBID 846C)	Regulations, Ordinances, and Guidelines	√
Bayou Chico Drain (WBID 846C)	Special Studies, Planning, Monitoring, and Assessment	√
Bayou Chico Drain (WBID 846C)	Restoration and Water Quality Improvement	√
Bayou Chico Drain (WBID 846C)	Wastewater Infrastructure Management	√
Bayou Chico Drain (WBID 846C)	Marinas, Boatyards, and Mooring Activity	√
Bayou Chico Beach (WBID 846CB)	Stormwater Management Programs	√
Bayou Chico Beach (WBID 846CB)	Education and Outreach Efforts	√
Bayou Chico Beach (WBID 846CB)	Regulations, Ordinances, and Guidelines	√
Bayou Chico Beach (WBID 846CB)	Special Studies, Planning, Monitoring, and Assessment	√
Bayou Chico Beach (WBID 846CB)	Restoration and Water Quality Improvement	
Bayou Chico Beach (WBID 846CB)	Wastewater Infrastructure Management	√
Bayou Chico Beach (WBID 846CB)	Marinas, Boatyards, and Mooring Activity	√
Sanders Beach (WBID 848DA)	Stormwater Management Programs	√
Sanders Beach (WBID 848DA)	Education and Outreach Efforts	√
Sanders Beach (WBID 848DA)	Regulations, Ordinances, and Guidelines	√
Sanders Beach (WBID 848DA)	Special Studies, Planning, Monitoring, and Assessment	√
Sanders Beach (WBID 848DA)	Restoration and Water Quality Improvement	√
Sanders Beach (WBID 848DA)	Wastewater Infrastructure Management	√
Sanders Beach (WBID 848DA)	Marinas, Boatyards, and Mooring Activity	√





SECTION 8: ASSESSING PROGRESS AND MAKING CHANGES

This section describes the water quality monitoring component sufficient to assess progress and make adjustments as necessary to determine the success of programs and activities identified in the Bayou Chico BMAP.

8.1 TRACKING IMPLEMENTATION

FDEP is working with stakeholders to organize the monitoring data and track project implementation. This information will be presented in an annual report. Stakeholders have agreed to meet at least every 12 months after the adoption of the BMAP to follow up on plan implementation, share new information, and continue to coordinate on TMDL-related issues. The following types of activities may occur at annual meetings:

- *Implementation Data and Reporting*
 - o Collect project implementation information from stakeholders and MS4 permit reporting, and compare with the BMAP schedule. **Table E-1 in Appendix E** provides a sample annual reporting form for BMAP project implementation (to be completed by the entities).
 - o Discuss the data collection process, including any concerns and possible improvements to the process.
 - o Review the monitoring plan implementation, as detailed in **Section 8.2**.
- *Sharing New Information*
 - o Report on results from water quality monitoring and trend information.
 - o Provide updates on new projects and programs in the watershed that will help reduce fecal coliform loading.
 - o Identify and review new scientific developments in addressing fecal coliform contamination and incorporate any new information into annual progress reports.
 - o Discuss new sampling technologies that will improve source identification.
- *Coordinating TMDL-Related Issues*
 - o Obtain updates from FDEP on the basin cycle and activities related to any impairments, TMDLs, and BMAP.
 - o Obtain reports from other basins where tools or other information may be applicable to the Bayou Chico TMDL.

Covering all of these topics is not required for the annual meetings, but this list provides examples of the types of information that should be considered for the agenda, in order to assist with BMAP implementation and improve coordination among the agencies and stakeholders.

8.2 WATER QUALITY MONITORING

8.2.1 WATER QUALITY MONITORING OBJECTIVES

Focused objectives are critical for a monitoring strategy to provide the information needed to evaluate implementation success. The primary and secondary objectives of the monitoring strategy for the Bayou Chico watershed will help stakeholders evaluate the success of the BMAP, interpret the data collected, and provide information for potential future refinements of the BMAP. These objectives are as follows:

- **Primary Objective** – *To track implementation efforts and monitor water quality, in order to determine additional sources and water quality trends using existing monitoring stations in the watershed. There are six STORET stations with long term historical data which also coincide with key problem areas, or hot spots, observed in the watershed. This Tier 1 monitoring effort will provide critical information to meet this primary objective.*
- **Secondary Objective** – *To conduct more extensive monthly sampling at specific locations where fecal coliform counts are historically high and where additional sampling has been proposed. This Tier 2 analysis will target the following areas: (1) probable or suspected loading points previously identified, and (2) newly suspected spots, especially in the tributaries and creeks, that were not previously sampled. Samples will be taken both during dry and rainy periods to isolate chronic and stormwater influences.*

8.2.2 WATER QUALITY INDICATORS

The water quality indicators that are commonly collected during sampling events (see **Tables 8-1a** and **8-1b**) will be sampled to achieve the monitoring plan objectives. These parameters will be analyzed to determine if there is a correlation with the observed fecal coliform concentrations. In addition, descriptions of the field conditions are important because factors other than water quality could affect the observed bacterial colony counts.

TABLE 8-1A: WATER QUALITY INDICATORS

*Nutrients sampled as part of FDEP's Strategic Monitoring Plans and for Escambia County's MS4 permitting requirements.

WATER QUALITY INDICATORS
Fecal coliform (colony-forming units per 100 milliliters [CFU/100mL])
Enterococcus (CFU/100mL)
Nutrients (total Kjeldahl nitrogen [TKN], total phosphorus [TP], total nitrogen [TN]) (for verifying nutrient impairments)*
Turbidity (nephelometric turbidity units [NTU])

TABLE 8-1B: FIELD PARAMETERS

FIELD CONDITIONS
Air Temperature (°C)
Cloud Cover
Rainfall
Tide Stage
Canopy Cover
Water Flow Condition
Wind
YSI-Measured Parameters:
Conductivity (micromhos per centimeter [umhos/cm])
Dissolved Oxygen (milligrams per liter [mg/L])
Dissolved Oxygen Saturation (%)
pH (standard units [SU])
Salinity (parts per thousand [ppt])
Temperature (°C)

8.2.3 MONITORING NETWORK

As a part of BMAP follow-up, FDEP and stakeholders will track implementation efforts and monitor water quality to determine additional sources and water quality trends. The sampling locations in the monitoring plan were selected to identify potential sources of contamination through source assessment monitoring at key locations throughout the watershed, and to track trends in fecal coliform (and *Enterococci*) using existing monitoring stations (see **Figure 2-1**) with historical data. In addition, more extensive monthly sampling is proposed at specific sampling locations where fecal coliform counts were historically high.

The source assessment monitoring will follow the established sampling protocol, in which any observed fecal coliform counts greater than 5,000 CFU/100mL will be followed up with targeted sampling efforts (*Tier 2*) to determine and address the source. FDEP, Escambia County, the city of Pensacola, BCA, and ECUA, in concert with FDEP's strategic monitoring network, will be responsible for the trend and source assessment sampling (*Tier 1*) in the overall monitoring plan. These stakeholders have committed to

assist or provide services and/or monetary aid for a three-year monitoring plan with the help of UWF and FDEP. FDEP will add the analyses for *Enterococcus* as well as fecal coliform to its quarterly sampling. Escambia County will provide assistance in monthly field sampling. Samples for *Enterococcus* and fecal coliform will be processed by the Wetland Research Laboratory at UWF, while UWF's CEDB will contribute to the compilation and analyses of the data and provide a three-year interim report on water quality status and trends. In addition, ECHD will continue its weekly beach sampling of *Enterococcus* bacteria counts at Bayou Chico (Lakewood Park) and Sanders Beach, in conjunction with its Healthy Beaches Program. Furthermore, all data collected for these follow-up BMAP efforts will be uploaded into FDEP's STORET database, where water quality data can be stored and readily retrieved by WBID number(s) for basinwide watershed assessments.

The *Tier 2* analysis will specifically target the following areas: (1) probable or suspected loading points previously identified, and (2) newly suspected spots, especially in the tributaries and creeks, that were not previously sampled. Samples will be taken during both dry and rainy periods to isolate chronic and stormwater influences. Higher resolution sampling will be used to resample identified loading areas for further confirmation and to assist in pinpointing sources. Areas using septic tanks that were previously identified as hot spots and connected to sanitary sewer service will be revisited to document any remediation of fecal loadings from that effort.

8.2.4 QUALITY ASSURANCE/QUALITY CONTROL

Through cooperation on TMDL-related data collection, FDEP and stakeholders have consistently used similar standard operating procedures (SOPs) for field sampling and lab analyses. This consistency will continue into the future to ensure that data can be used not only for tracking BMAP progress but also for future TMDL evaluations and other purposes. Water quality data will be collected in a manner consistent with FDEP's SOPs for quality assurance/quality control (QA/QC). The most current version of these procedures can be downloaded from <http://www.dep.state.fl.us/water/sas/sop/sops.htm>. All stakeholders contributing data in support of the BMAP agree to follow these SOPs.

8.2.5 DATA MANAGEMENT AND ASSESSMENT

To be useful in support of the BMAP, data collected as part of this monitoring plan will need to be tracked, compiled, and analyzed. The Florida STORET database will serve as the primary resource for storing ambient data and providing access for all stakeholders, in accordance with Section 62-40.540, F.S. Stakeholders have agreed to upload data to STORET in a timely manner, after the appropriate QA/QC checks have been completed. All applicable data collected by the entities responsible for monitoring will be uploaded to STORET regularly, but at least quarterly. FDEP will be responsible for data storage and retrieval from the STORET database.

STORET uploads are only appropriate for data that represent ambient conditions. Data that are collected to follow up on fecal coliform water quality exceedances should not be uploaded to STORET.

8.3 ADAPTIVE MANAGEMENT MEASURES

Adaptive management involves setting up a mechanism for making adjustments in the BMAP when circumstances change or feedback indicates the need for a more effective strategy. Adaptive management measures include the following:

- *Procedures to determine whether additional cooperative strategies are needed;*
- *Criteria/processes for determining whether and when plan components need revision due to changes in costs, environmental impacts, social effects, watershed conditions, or other factors;*
- *Descriptions of the stakeholders' roles after BMAP completion; and*
- *The use of key components of adaptive management to share information and expertise, such as tracking plan implementation, monitoring water quality and pollutant loads, and holding periodic meetings.*

BMAP implementation is expected to be a long-term process. Some projects may extend beyond the first five years of the BMAP cycle. The stakeholders will track implementation efforts and monitor water quality to measure effectiveness and ensure BMAP compliance. Stakeholders will meet at least every 12 months to discuss implementation issues, new information will be considered, and, if the watershed is not projected to meet the TMDL, additional corrective actions will be defined. Project implementation as well as program and activity status will be collected annually from the participating entities. The stakeholders will review these reports to assess progress towards meeting the BMAP's goals.

APPENDICES

APPENDIX A: TMDL BASIN ROTATION SCHEDULE

TMDLs are developed, allocated, and implemented through a watershed management approach (managing water resources within their natural boundaries) that addresses the state's 52 major hydrologic basins in 5 groups, on a rotating schedule. **Table A-1** shows the hydrologic basins within each of the 5 groups, with the FDEP District office of jurisdiction.

TABLE A-1: MAJOR HYDROLOGIC BASINS BY GROUP AND FDEP DISTRICT OFFICE

N/A = Not applicable

FDEP DISTRICT	GROUP 1 BASINS	GROUP 2 BASINS	GROUP 3 BASINS	GROUP 4 BASINS	GROUP 5 BASINS
Northwest	Ochlockonee–St. Marks	Apalachicola–Chipola	Choctawhatchee–St. Andrews Bay	Pensacola Bay	Perdido Bay
Northeast	Suwannee	Lower St. Johns	N/A	Nassau–St. Marys	Upper East Coast
Central	Ocklawaha	Middle St. Johns	Upper St. Johns	Kissimmee	Indian River Lagoon
Southwest	Tampa Bay	Tampa Bay Tributaries	Sarasota Bay–Peace–Myakka	Withlacoochee	Springs Coast
South	Everglades West Coast	Charlotte Harbor	Caloosahatchee	Fisheating Creek	Florida Keys
Southeast	Lake Okeechobee	St. Lucie–Loxahatchee	Lake Worth Lagoon–Palm Beach Coast	Southeast Coast–Biscayne Bay	Everglades

Each group will undergo a cycle of five phases on a rotating schedule:

Phase 1: Preliminary evaluation of water quality

Phase 2: Strategic monitoring and assessment to verify water quality impairments

Phase 3: Development and adoption of the TMDL for waters verified as impaired

Phase 4: Development of the BMAP to achieve the TMDL

Phase 5: Implementation of the BMAP and monitoring of results

The Bayou Chico watershed is part of the Pensacola Bay Basin, which is a Group 4 basin. As such, the Cycle 1 list of verified impaired waters was developed in 2006. Subsequent TMDL and BMAP development is occurring on a schedule driven by the 1998 303(d) list (see <http://www.dep.state.fl.us/water/tmdl/> for more information) and FDEP staff resource availability. FDEP will re-evaluate impaired waters every five years to determine whether improvements are being achieved, and to refine loading estimates and TMDL allocations using new data. If any changes in a TMDL are required, the applicable TMDL rule may be revised. Changes to a TMDL would prompt revisions to the applicable BMAP, which will be revisited at least every five years and modified as necessary, regardless of whether the TMDL is modified.

APPENDIX B: SUMMARY OF STATUTORY PROVISIONS GUIDING BMAP DEVELOPMENT AND IMPLEMENTATION

SECTIONS 403.067(6) AND (7), F.S. – *Summary of Excerpts*

ALLOCATIONS

- The TMDL shall include reasonable and equitable allocations of the TMDL between or among point and nonpoint sources that will alone, or in conjunction with other management and restoration activities, provide for the attainment of pollutant reductions established pursuant to paragraph (a) to achieve applicable water quality standards.
- The allocations may establish the maximum amount of the pollutant that may be discharged or released in combination with other discharges or releases.
- Allocations may also be made to individual basins and sources or as a whole to all basins and sources or categories of sources of inflow to the water body or water body segments.
- An initial allocation of allowable pollutant loads may be developed as part of the TMDL; in such cases detailed allocations to specific point sources and categories of nonpoint sources shall be established in the basin management action plan.
- The initial and detailed allocations shall be designed to attain pollutant reductions established pursuant to paragraph (a) and shall be based on consideration of:
 1. Existing treatment levels and management practices;
 2. Best management practices established and implemented pursuant to paragraph (7)(c);
 3. Enforceable treatment levels established pursuant to state or local law or permit;
 4. Differing impacts pollutant sources may have on water quality;
 5. The availability of treatment technologies, management practices, or other pollutant reduction measures;
 6. Environmental, economic, and technological feasibility of achieving the allocation;
 7. The cost benefit associated with achieving the allocation;
 8. Reasonable timeframes for implementation;
 9. Potential applicability of any moderating provisions such as variances, exemptions, and mixing zones; and
 10. The extent to which non-attainment of water quality standards is caused by pollution sources outside of Florida, discharges that have ceased, or alterations to water bodies prior to the date of this act.

GENERAL IMPLEMENTATION

- **DEP is the lead agency** in coordinating TMDL implementation, through existing water quality protection programs.
- **Application of a TMDL by a water management** district does not require WMD adoption of the TMDL.
- **TMDL implementation may include**, but is not limited to:
 - o Permitting and other existing regulatory programs
 - o Non-regulatory and incentive-based programs
 - o Other water quality management and restoration activities, such as Surface Water Improvement and Management (SWIM) plans or **basin management action plans**
 - o Pollutant trading or other equitable economically based agreements
 - o Public works
 - o Land acquisition

BASIN MANAGEMENT ACTION PLAN DEVELOPMENT

- DEP may develop a basin management action plan that addresses some or all of the watersheds and basins tributary to a TMDL waterbody.

- A basin management action plan **shall**:
 - Integrate appropriate management strategies available to the state through existing water quality protection programs.
 - Equitably allocate pollutant reductions to individual basins, all basins, each identified point source, or category of nonpoint sources, as appropriate.
 - Identify the mechanisms by which potential future increases in pollutant loading will be addressed.
 - Specify that for nonpoint sources for which BMPs have been adopted, the initial requirement shall be BMPs developed pursuant to paragraph (c).
 - Establish an implementation schedule.
 - Establish a basis for evaluating plan effectiveness.
 - Identify feasible funding strategies.
 - Identify milestones for implementation and water quality improvement, and an associated water quality monitoring component to evaluate reasonable progress over time.
 - Be adopted in whole or in part by DEP Secretarial Order, subject to chapter 120.
- A basin management action plan **may**:
 - Give load reduction credits to dischargers that have implemented load reduction strategies (including BMPs) prior to the development of the BMAP. (*Note: this assumes the related reductions were not factored into the applicable TMDL.*)
 - Include regional treatment systems or other public works as management strategies.
 - Provide for phased implementation to promote timely, cost-effective actions.
- An assessment of progress in achieving milestones shall be conducted every 5 years and the basin management action plan revised, as appropriate, in cooperation with basin stakeholders, and adopted by secretarial order.
- DEP shall assure that key stakeholders are invited to participate in the basin management action plan development process, holding at least one noticed public meeting in the basin to receive comments, and otherwise encouraging public participation to the greatest practicable extent.
- A basin management action plan shall not supplant or alter any water quality assessment, TMDL calculation, or initial allocation.

BASIN MANAGEMENT ACTION PLAN IMPLEMENTATION

- NPDES Permits
 - Management strategies related to a discharger subject to NPDES permitting shall be included in subsequent applicable NPDES permits or permit modifications when the permit expires (is renewed), the discharge is modified (revised), or the permit is reopened pursuant to an adopted BMAP.
 - Absent a detailed allocation, TMDLs shall be implemented through NPDES permit conditions that include a compliance schedule. The permit shall allow for issuance of an order adopting the BMAP within five years. (*Note: Intended to apply to individual wastewater permits – not MS4s*)
 - Once the BMAP is adopted, the permit shall be reopened, as necessary, and permit conditions consistent with the BMAP shall be established.
 - Upon request by a NPDES permittee, DEP may establish individual allocations prior to the adoption of a BMAP, as part of a permit issuance, renewal, or modification (revision).
 - To the maximum extent practicable, MS4s shall implement a TMDL or BMAP through the use of BMPs or other management measures.
 - A BMAP does not take the place of NPDES permits or permit requirements.
 - Management strategies to be implemented by a DEP permittee shall be completed according to the BMAP schedule, which may extend beyond the 5-year term of an NPDES permit.
 - Management strategies are not subject to challenge under chapter 120 when they are incorporated in identical form into a NPDES permit or permit modification (revision).

- Management strategies assigned to nonagricultural, non-NPDES permittees (state, regional, or local) shall be implemented as part of the applicable permitting programs.
- Nonpoint source dischargers (e.g., agriculture) included in a BMAP shall demonstrate compliance with the applicable TMDLs by either implementing appropriate BMPs established under paragraph 7(c), or conducting water quality monitoring prescribed by **DEP or a WMD**. (*Note: this is not applicable to MS4s, as they are considered point sources under the federal Clean Water Act and TMDL Program.*)
 - o Failure to implement BMPs or prescribed water quality monitoring may be subject to **DEP or WMD** enforcement action.
- Responsible parties who are implementing applicable BMAP strategies shall not be required to implement additional pollutant load reduction strategies, and shall be deemed in compliance with this section. However, this does not limit DEP's authority to amend a BMAP.

BEST MANAGEMENT PRACTICES

- DEP, in cooperation with WMDs and other interested parties, may develop interim measures, BMPs, or other measures for non-agricultural nonpoint sources to achieve their load reduction allocations.
 - o These measures may be adopted by **DEP or WMD** rule. If adopted, they shall be implemented by those responsible for non-agricultural nonpoint source pollution.
- DACS may develop and adopt by rule interim measure, BMPs, or other measures necessary for agricultural pollutant sources to achieve their load reduction allocations.
 - o These measures may be implemented by those responsible for agricultural pollutant sources. **DEP, the WMDs, and DACS** shall assist with implementation.
 - o In developing and adopting these measures, DACS shall consult with DEP, DOH, the WMDs, representatives of affected farming groups, and environmental group representatives.
 - o The rules shall provide for a notice of intent to implement the practices and a system to ensure implementation, including recordkeeping.
- Verification of Effectiveness and Presumption of Compliance -
 - o DEP shall, at representative sites, verify the effectiveness of BMPs and other measures adopted by rule in achieving load reduction allocations.
 - o DEP shall use best professional judgment in making the initial verification of effectiveness, and shall notify **DACS and the appropriate WMD** of the initial verification prior to the adoption of a rule proposed pursuant to this paragraph.
 - o Implementation of rule-adopted BMPs or other measures initially verified by DEP to be effective, or verified to be effective by monitoring at representative sites, provides a presumption of compliance with state water quality standards for those pollutants addressed by the practices.
- Reevaluation –
 - o Where water quality problems are demonstrated despite implementation, operation, and maintenance of rule-adopted BMPs and other measures, **DEP, a WMD, or DACS**, in consultation with DEP, shall reevaluate the measures. If the practices require modification, the revised rule shall specify a reasonable time period for implementation.

APPENDIX C: SUMMARY OF EPA-RECOMMENDED ELEMENTS OF A COMPREHENSIVE WATERSHED PLAN

The following is an excerpt on the nine elements of a watershed plan from the EPA's *Draft Handbook for Developing Watershed Plans to Restore and Protect Our Waters*. Additional information regarding these elements can be found in the full version of the handbook, available at: http://www.epa.gov/owow/nps/watershed_handbook/.

NINE MINIMUM ELEMENTS TO BE INCLUDED IN A WATERSHED PLAN FOR IMPAIRED WATERS FUNDED USING INCREMENTAL SECTION 319 FUNDS

Although many different components may be included in a watershed plan, EPA has identified a minimum of nine elements that are critical for achieving improvements in water quality. EPA requires that these nine elements be addressed for watershed plans funded using incremental Section 319 funds and strongly recommends that they be included in all other watershed plans that are intended to remediate water quality impairments.

The nine elements are provided below, listed in the order in which they appear in the guidelines. Although they are listed as *a* through *i*, they do not necessarily take place sequentially. For example, element *d* asks for a description of the technical and financial assistance that will be needed to implement the watershed plan, but this can be done only after you have addressed elements *e* and *i*.

Explanations are provided with each element to show you what to include in your watershed plan.

NINE ELEMENTS

a. Identification of causes of impairment and pollutant sources or groups of similar sources that need to be controlled to achieve needed load reductions, and any other goals identified in the watershed plan. Sources that need to be controlled should be identified at the significant subcategory level along with estimates of the extent to which they are present in the watershed (e.g., *X* number of dairy cattle feedlots needing upgrading, including a rough estimate of the number of cattle per facility; *Y* acres of row crops needing improved nutrient management or sediment control; or *Z* linear miles of eroded streambank needing remediation).

What does this mean?

Your watershed plan should include a map of the watershed that locates the major sources and causes of impairment. Based on these impairments, you will set goals that will include (at a minimum) meeting the appropriate water quality standards for pollutants that threaten or impair the physical, chemical, or biological integrity of the watershed covered in the plan.

b. An estimate of the load reductions expected from management measures.

What does this mean?

You will first quantify the pollutant loads for the watershed. Based on these pollutant loads, you will determine the reductions needed to meet the water quality standards.

You will then identify various management measures (see element *c* below) that will help to reduce the pollutant loads and estimate the load reductions expected as a result of these management measures to be implemented, recognizing the difficulty in precisely predicting the performance of management measures over time.

Estimates should be provided at the same level as that required in the scale and scope component in paragraph *a* (e.g., the total load reduction expected for dairy cattle feedlots, row crops, or eroded streambanks). For waters for which EPA has approved or established TMDLs, the plan should identify and incorporate the TMDLs.

Applicable loads for downstream waters should be included so that water delivered to a downstream or adjacent segment does not exceed the water quality standards for the pollutant of concern at the water segment boundary. The estimate should account for reductions in pollutant loads from point and nonpoint sources identified in the TMDL as necessary to attain the applicable water quality standards.

c. A description of the management measures that will need to be implemented to achieve load reductions in paragraph 2, and a description of the critical areas in which those measures will be needed to implement this plan.

What does this mean?

The plan should describe the management measures that need to be implemented to achieve the load reductions estimated under element *b*, as well as to achieve any additional pollution prevention goals called out in the watershed plan. It should also identify the critical areas in which those measures will be needed to implement the plan. This can be done by using a map or a description.

d. Estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement this plan.

What does this mean?

You should estimate the financial and technical assistance needed to implement the entire plan. This includes implementation and long-term operation and maintenance of management measures, information and education (I/E) activities, monitoring, and evaluation activities. You should also document which relevant authorities might play a role in implementing the plan. Plan sponsors should consider the use of federal, state, local, and private funds or resources that might be available to assist in implementing the plan. Shortfalls between needs and available resources should be identified and addressed in the plan.

e. An information and education (I/E) component used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the nonpoint source management measures that will be implemented.

What does this mean?

The plan should include an I/E component that identifies the education and outreach activities or actions that will be used to implement the plan. These I/E activities may support the adoption and long-term operation and maintenance of management practices and support stakeholder involvement efforts.

f. Schedule for implementing the management measures identified in this plan that is reasonably expeditious.

What does this mean?

You need to include a schedule for implementing the management measures outlined in your watershed plan. The schedule should reflect the milestones you develop in g.

g. A description of interim measurable milestones for determining whether management measures or other control actions are being implemented.

What does this mean?

You'll develop interim, measurable milestones to measure progress in implementing the management measures for your watershed plan. These milestones will measure the implementation of the management measures, such as whether they are being implemented on schedule, whereas element *h* (see below) will measure the effectiveness of the management measures, for example, by documenting improvements in water quality.

h. A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made toward attaining water quality standards.

What does this mean?

Using the milestones you developed above, you'll develop a set of criteria (or indicators) with interim target values to be used to determine whether progress is being made toward reducing pollutant loads. These interim targets can be direct measurements (e.g., fecal coliform concentrations) or indirect indicators of load reduction (e.g., number of beach closings). You must also indicate how you'll determine whether the watershed plan needs to be revised if interim targets are not met and what process will be used to revise the existing management approach. Where a nonpoint source TMDL has been established, interim targets are also needed to determine whether the TMDL needs to be revised.

*i. A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under item *h* immediately above.*

What does this mean?

The watershed plan must include a monitoring component to determine whether progress is being made toward attainment or maintenance of the applicable water quality standards. The

monitoring program must be fully integrated with the established schedule and interim milestone criteria identified above. The monitoring component should be designed to determine whether loading reductions are being achieved over time and substantial progress in meeting water quality standards is being made. Watershed-scale monitoring can be used to measure the effects of multiple programs, projects, and trends over time. In stream monitoring does not have to be conducted for individual BMPs unless that type of monitoring is particularly relevant to the project.

APPENDIX D: PROGRAMS TO ACHIEVE THE TMDL

PROGRAMS TO ADDRESS THE SANITARY SEWER SYSTEM AS A SOURCE OF FECAL COLIFORM CONTAMINATION

SPECIFIC COUNTYWIDE IMPROVEMENT PROGRAMS BY ECUA

- ***Main Street Wastewater Treatment Plant Relocation:** ECUA completed a major capital improvement project during the summer of 2010: the construction of a replacement water reclamation facility that will allow the closure of the MSWWTP. The new plant, the CWRF, is located near the Cantonment community, approximately 15 miles north of the MSWWTP site. The CWRF, an AWT facility that is permitted at 22.5 MGD, features 100% industrial reuse of its reclaimed water, resulting in the total elimination of the surface water discharge in what was formerly the Main St. drainage area. ECUA began diverting flows from the MSWWTP to the CWRF in August 2010. In early April 2011, the CWRF was treating approximately two-thirds of the flows in the Main St. drainage area, and the MSWWTP was officially taken offline on April 28, 2011. The flows from the Bayou Chico watershed that had previously been treated at the MSWWTP are now transmitted to the CWRF for treatment, and the reclaimed water will be available for industrial reuse.*
- *Sewer Expansion Program*
- *Sanitary Sewer Overflow Response Plan*
- *Lift Station Upgrades and Repairs*
- *Emergency Generator Program*
- *Infiltration and Inflow Program*
- *Fats, Oils, and Grease Program: The program includes the following requirements for participants:*
 - o Satisfactorily pump out grease traps/interceptors;
 - o Attend waste hauler education meeting;
 - o Accept limited regulatory responsibility for the generator; and
 - o Submit a manifest document for the disposal of all trap contents generated in ECUA's service area on a quarterly basis.

Documentation, measurement, and reporting in this standardized fashion will lead to more informed decisions based on hard data, allowing ECUA to identify and address system priorities, detect trends, and proactively address problems both internally and cooperatively with local partners.

PROGRAMS TO ADDRESS STORMWATER AS A SOURCE OF FECAL COLIFORM CONTAMINATION

- *MS4 Capital Improvement and DSR Projects*
- *MS4 Maintenance Activities*
- *Inspection, Sampling, and Enforcement Activities*
- *Stormwater Management Plan*
- *MS4 NPDES Program*
- *Outreach and Education:*
 - o Public service announcements on septic tank maintenance and pet waste management;
 - o Educational materials and newsletters to provide a better understanding of ordinances; and
 - o Presentations to groups such as homeowners' associations and local citizens on the effects of fecal coliform generated by pet waste entering waterways.
- *PIC Program*

PET WASTE MANAGEMENT

Escambia County, Florida, Code of Ordinances: Part I: Article I, Section 10-11 (F)

Sec. 10-11. – Animal control.

- (f) Removal of canine waste and requirement for possession of device for removal in the county.
- (1) It shall be the duty of each person who is in the company of or responsible for a dog on areas other than the property of such person to remove any feces left by his dog on any yard, sidewalk, gutter, street, right-of-way, or other public or private place.
 - (2) It shall further be the duty of any person while in direct control of a dog to have in his possession a plastic bag or "pooper scooper" or other such device sufficient for his use in the removal of canine waste.
 - (3) Violators of this section shall be guilty of a civil infraction and punishable pursuant to section 10-23
 - (4) This section may be enforced by the county sheriff or county animal control officers. The provisions of Rule 3.125, Florida Rules of Criminal Procedure, providing that violators of county ordinances may be served with a notice to appear, shall be applicable to violations of this section. Failure of a person receiving a notice to appear to comply with the requirements on the notice shall

be deemed a separate violation of this chapter for which a warrant for the violator's arrest may be issued.

SPECIAL PROJECTS AND INVESTIGATIONS

ECHD Research Programs

Escambia County Special Studies and Demonstration Projects (examples include Jackson Lakes and Glynn Key stormwater projects and educational boardwalks)

FDOT DRAINAGE CONNECTION PROGRAM

14-86.001 Purpose. The purpose of this rule chapter is to regulate and prescribe conditions for the transfer of stormwater to the Department of Transportation's right of way as a result of manmade changes to adjacent property(ies), through a permitting process designed to ensure the safety and integrity of the Department of Transportation's facilities and to prevent an unreasonable burden on lower properties. This rule chapter does not regulate dewatering activities.

Specific Authority 334.044(2), (15) FS. Law Implemented 334.044(15) FS. History - New 11-12-86, Amended 1-20-09.

14-86.002 Definitions. As used in this rule chapter the following terms shall have the following meanings:

- (1) "Adjacent Property" means any real property or easement with a shared boundary to the Department's right of way.
- (2) "Applicant" means the owner of adjacent property or the owner's authorized representative.
- (3) "Applicable Water Quality Standards" means rules and regulations of state or federal governmental entity(ies) pertaining to stormwater discharges from the Department's facilities to which the drainage connection is made.
- (4) "Approved Stormwater Management Plan" or "Master Drainage Plan" means a plan adopted or approved by a city, county, water management district, or other agency with specific drainage or stormwater management authority provided that:
 - (a) Such plan is actively being implemented;
 - (b) Any required construction is substantially complete;
 - (c) Downstream mitigation measures have been provided for in the plan; and
 - (d) The use of any Department facilities either existing or planned, which are part of such plan, have been approved by the Department.
- (5) "Closed Basin" means a basin without any positive outlet, for the design storms applicable to this rule.
- (6) "Critical Duration" means the length of time of a specific storm frequency which creates the largest volume or highest rate of net stormwater runoff (post-improvement runoff less pre-improvement runoff) for typical durations up through and including the 10-day duration for closed basins and up through the 3-day duration for basins with positive outlets. The critical duration for a given storm frequency is determined by calculating the peak rate and volume of stormwater runoff for various storm durations and then comparing the pre-improvement and post-improvement conditions for each of the storm durations. The duration resulting in the

highest peak rate or largest net total stormwater volume is the “critical duration” storm (volume is not applicable for basins with positive outlets).

(7) “Department” means the Florida Department of Transportation.

(8) “Discharge” means the event or result of stormwater draining or otherwise transferring from one property to another or into surface waters.

(9) “Drainage Connection” means any structure, pipe, culvert, device, paved or unpaved area, swale, ditch, canal, or other appurtenance or feature, whether naturally occurring or created, which is used or functions as a link to convey stormwater.

(10) “Facility” or “Facilities” means anything built, installed, or maintained by the Department within the Department’s right of way.

(11) “Impervious Area” means surfaces which do not allow, or minimally allow, the penetration of water. Examples of impervious areas are building roofs, all concrete and asphalt pavements, compacted traffic-bearing areas such as limerock roadways, lakes, wet ponds, pond liners, and other standing water areas, including some retention/detention areas.

(12) “Improvement” means any man-made change(s) to adjacent property.

(13) “Licensed Professional” means an individual licensed by a Florida professional licensing board, authorized by law to design and certify the stormwater management system under review.

(14) “Man-made Change” means any intentional physical change to or upon adjacent property resultant from an intentional physical change, which establishes or alters the rate, volume, or quality of stormwater.

(15) “Permit” or “Drainage Connection Permit” means an authorization to establish or alter a drainage connection to the Department’s right of way issued pursuant to this rule chapter.

(16) “Permittee” means the individual or entity to which a Drainage Connection Permit is issued.

(17) “Positive Outlet” means a point of stormwater runoff into surface waters which under normal conditions would drain by gravity through surface waters ultimately to the Gulf of Mexico, or the Atlantic Ocean, or into sinks, closed lakes, or recharge wells provided the receiving waterbody has been identified by the appropriate Water Management District as functioning as if it recovered from runoff by means other than transpiration, evaporation, percolation, or infiltration.

(18) “Post-improvement” means the condition of property after improvement.

(19) “Pre-improvement” means the condition of property:

(a) Before November 12, 1986; or

(b) On or after November 12, 1986, with connections which have been permitted under this rule chapter or permitted by another governmental entity based on stormwater management requirements equal to or more stringent than those in this rule chapter.

(20) “Right of Way” means land in which the Department owns the fee or less than the fee, or for which the Department has an easement, devoted to or required for use as a transportation or stormwater management facility.

(21) “Stormwater” or “Stormwater Runoff” means the flow of water which results from and occurs immediately following a rainfall event.

(22) “Stormwater Management System” means a system which is designed and constructed or implemented to control stormwater, incorporating methods to collect, convey, store, infiltrate, treat, use, or reuse stormwater to prevent or reduce flooding, overdrainage, pollution, and otherwise affect the quantity or quality of stormwater in the system.

(23) “Surface Water” means water upon the surface of the earth whether contained in bounds created naturally or artificially or diffused. Water from natural springs shall be classified as surface water when it exits onto the earth’s surface.

(24) “Watershed” means the region draining or contributing water to a common outlet, such as a stream, lake, or other receiving area.

Specific Authority 334.044(2), (15) FS. Law Implemented 334.044(15) FS. History - New 11-12-86, Amended 1-20-09.

14-86.003 Permit, Assurance Requirements, and Exceptions.

(1) Permit.

(a) No permits are required for properties without improvements on or after November 12, 1986.

(b) All improvements on or after November 12, 1986, require a Drainage Connection Permit, Form 850-040-06 (10/08), whether or not the work is done in conjunction with a driveway connection, and whether or not the improvement retains stormwater runoff on the adjacent property up to and including the 100 year event of critical duration.

(2) Assurance Requirements.

(a) The applicant for a drainage connection permit shall provide reasonable assurances that:

1. The peak discharge rates and total volumes of stormwater discharging from the adjacent property to the Department’s right of way are those provided for in an approved stormwater management plan or master drainage plan; otherwise the post-improvement stormwater runoff discharging from the adjacent property to the Department’s right of way shall not exceed the more stringent of the following:

a. The peak discharge rates and total volumes allowed by applicable local regulation; or

b. The improvement shall not increase stormwater discharge rate above the pre-improvement discharge rate, and in watersheds which do not have a positive outlet, the post-improvement total volume of stormwater runoff shall not be increased beyond the pre-improvement volume considering worst case storms for up to the frequencies and durations contained in paragraph 14-86.003(2)(c), F.A.C.

2. Any discharge pipe establishing or constituting a drainage connection to the Department’s right of way is limited in size based on the pre-improvement discharge rate, downstream conveyance limitations, downstream tailwater influences, and design capacity restrictions imposed by other governmental entities.

3. If the improvement changes the inflow pattern of stormwater or method of drainage connection to the Department’s right of way, post-improvement discharge will not exceed the pre-improvement discharge to the Department’s right of way, any new drainage connection will not threaten the safety or integrity of the Department’s right of way, and will not increase maintenance costs to the Department. At a minimum pavement hydraulics, ditch hydraulics, storm drain hydraulics, cross drain hydraulics, and stormwater management facilities shall be analyzed. The analysis must follow the methodology used in the design of the Department’s facilities receiving the discharge and meet the criteria in chapters 2, 3, 4, and 6 of the Department’s *Drainage Manual*, Topic Number 625-040-002-c, May 2008, incorporated herein by reference. The *Drainage Manual* is available from the Department at: <http://www.dot.state.fl.us/rddesign/dr/Manualsandhandbooks.shtm>.

4. The quality of water conveyed by the connection meets all applicable water quality standards, and such assurance shall be certified in writing. In the event the discharge is identified causing or contributing to a violation of applicable water quality standards, the

permittee will be required to incorporate such abatement as necessary to bring the permittee's discharge into compliance with applicable standards.

(b) If the requirements set forth in paragraph 14-86.003(2)(a), F.A.C., cannot be fully complied with, the applicant may submit alternative drainage connection designs. The analysis supporting the proposed alternative connection must follow the methodology used in the design of the Department's facilities receiving the proposed alternative drainage connection and meet the criteria in chapters 2, 3, 4, and 6 of the Department's *Drainage Manual*. Deviation from a standard in the *Drainage Manual* must be approved by the District Drainage Engineer. Acceptance of any alternative design must serve the purpose of this rule chapter and shall be based upon consideration of the following:

1. The type of stormwater management practice proposed;
2. The efficacy and costs of alternative controls;
3. The impact upon the operation and maintenance of the Department's facilities; and
4. The public interest served by the drainage connection.

(c) In providing reasonable assurances, the applicant shall:

1. Use a methodology which is compatible with the methodology employed in the design of the Department's facilities receiving the stormwater;
2. Determine the peak discharge rates considering various rainfall event frequencies up to and including a 100 year event of critical duration of up to three days; and
3. In watersheds without a positive outlet, determine the stormwater runoff total volumes considering various rainfall amounts up to a 100 year rainfall frequency of critical durations of up to ten days. The pond retention volume must recover at a rate such that one-half of the volume is available in seven days with the total volume available in 30 days, with a sufficient amount recovered within the time necessary to satisfy applicable water treatment requirements.

(3) Exceptions. The following exceptions do not require a Drainage Connection Permit:

(a) Improvements to adjacent properties not draining to the Department's right of way in the pre-improvement and post-improvement condition.

(b) Single-family residential improvements which are not part of a larger common plan of improvement or larger common plan of sale.

(c) Agricultural and silvicultural improvements that:

1. Are subject to regulation by the Department of Environmental Protection or regional Water Management Districts;
2. Are exempt under the provisions of Section 373.406, F.S.; or
3. Are implementing applicable best management practices adopted by the Florida Department of Agriculture and Consumer Services in Rule Chapter 5M, F.A.C., or Rule Chapter 5I-6, F.A.C.

(d) Any other improvement provided that all of the following apply:

1. The total impervious area, after improvement, is less than 5,000 square feet of cumulative impervious area and is less than 40% of that portion of the property that naturally drained to the Department's right of way;
 2. The improvement does not create or alter a drainage connection;
 3. The improvement does not change flow patterns of stormwater to the Department's right of way, and does not increase the surface area draining to the Department's right of way;
 4. The property is located in a watershed which has a positive outlet; and
 5. The site or improvement is not part of a larger common plan of improvement or larger common plan of sale.
- (4) An exception provided in subsection 14-86.003(3), F.A.C., shall not apply if any drainage connection from the adjacent property threatens the safety and integrity

of the Department's facilities or creates an unreasonable burden on lower properties, including violations of applicable water quality standards.

Specific Authority 334.044(2), (15) FS. Law Implemented 334.044(15) FS. History - New 11-12-86, Amended 1-20-09.

14-86.004 Permit Application Procedure.

(1) An applicant shall submit a Drainage Connection Permit, Form 850-040-06 (10/08), incorporated herein by reference. This form may be obtained from any of the Department's local area Maintenance Offices, District Offices, or on the internet at the Department's website: <http://www.dot.state.fl.us/onestoppermitting/>.

(2) The applicant shall submit four completed Drainage Connection Permits packages. Each completed Drainage Connection Permit package shall include all applicable attachments. All applicable plans and supporting documentation shall be submitted on no larger than 11" X 17" multipurpose paper and included in PDF format on a compact disk.

(3) The Drainage Connection Permit shall be accompanied by:

(a) A location map, included in the construction plans, sufficient to show the location of the improvement and any drainage connection to the Department's right of way, and shall include the state highway number, county, city, and section, range, and township.

(b) A grading plan drawn to scale showing pre-improvement and post-improvement site conditions including all pervious and impervious surfaces, land contours, spot elevations, and all drainage facilities of the Department and of the adjacent property. The bench mark datum for the plans (whether NGVD 29 or NAVD 88) shall be noted on the plans. Contour information shall extend 50 feet beyond the property boundaries or be sufficient to clearly define the portion of the watershed which drains through the property to the Department's right of way.

(c) Photographs which accurately depict pre-improvement and present conditions.

(d) Soil borings and water table data and, where percolation or infiltration is utilized in the design, appropriate percolation test methodology and results.

(e) Computations as required by subsection 14-86.003(2), F.A.C.

(f) The Drainage Connection Certification, Part 2 of the permit must be certified by a Licensed Professional that the complete set of plans and computations comply with either paragraph 14-86.003(2)(a) or 14-86.003(2)(b), F.A.C.

(4) Improvements which otherwise meet the criteria of subparagraphs 14-86.003(3)(d)1. and 14-86.003(3)(d)4., F.A.C., but which create or alter a drainage connection to the Department's right of way, will not require submittal of the information required by paragraphs 14-86.004(3)(d) through (f), F.A.C., but will otherwise require the submittal of all other required information.

(5) The Department recognizes that regulatory and permitting programs exist or may be developed in the future by local units of government, and state or federal agencies which may overlap with some or all of the requirements of this rule chapter. In order to avoid duplication the Department will:

(a) In lieu of the requirements in Rule 14-86.003 and subsection 14-86.004(3), F.A.C., accept a permit that accomplishes the purposes of this rule chapter so long as the permit is issued by a governmental entity with specific stormwater management authority and is based on requirements equal to or more stringent than those in Rule 14-86.003, F.A.C.; or

(b) Accept any form, plans, specifications, drawings, calculations, or other data developed to support an application for a permit required by a governmental entity, pursuant to any rule which establishes requirements equal to or more stringent than Rule 14-86.003, F.A.C.

(6) The Drainage Connection Permit serves as the application. Once approved by the Department, the form and supporting documents become the Drainage Connection Permit. Specific Authority 334.044(2), (15) FS. Law Implemented 334.044(15) FS. History - New 11-12-86, Amended 1-20-09.

14-86.005 General Conditions for a Drainage Permit.

(1) A Drainage Connection Permit does not exempt the permittee from meeting all other applicable regulations and ordinances governing stormwater management.

(2) All work done in conjunction with the drainage connection permit shall meet and adhere to all general and specific conditions and requirements contained on the Permit.

(3) Within 15 working days after completion of the work authorized by an approved Drainage Connection Permit, the permittee shall notify the Department in writing of the completion; and for all design work that originally required certification by a Licensed Professional, this notification shall contain the As Built Certification, Part 8 of the Permit. The certification shall state that work has been completed in substantial compliance with the Drainage Connection Permit.

(4) The permittee or property owner, will be required to reimburse the Department for any fines, penalties and costs, e.g., abatement costs, mitigation costs, remediation costs, etc. incurred by the Department in the event the permittee's discharge fails to meet the applicable water quality standards or minimum design and performance standards contrary to the permittee's assurances provided in subsection 14-86.003(2), F.A.C.

Specific Authority 334.044(2), (15) FS. Law Implemented 334.044(15) FS. History - New 11-12-86, Amended 1-20-09.

14-86.006 Permit Suspension or Revocation. A permit will be suspended or revoked if:

(1) The permitted drainage connection is not constructed, operated, or maintained in accordance with the permit;

(2) Emergency conditions or hazards exist;

(3) False or misleading information is submitted to the Department in the Drainage Connection Permit package;

(4) Another governmental entity revokes or suspends a permit which was the basis upon which a Department Drainage Connection Permit was obtained;

(5) The As-built Certificate required for the Drainage Connection Permit is not submitted in accordance with subsection 14-86.005(3), F.A.C.

(6) Any discharge above the permitted design discharge.

Specific Authority 334.044(2), (15) FS. Law Implemented 334.044(15) FS. History - New 11-12-86, Amended 1-20-09.

14-86.007 Forms.

Specific Authority 334.044(2) FS. Law Implemented 120.53(1)(b), 120.60, 334.03(17), (22), 334.035, 334.044(1), (12), (13), (27), 335.04(2), 335.10(2), 339.155(2)(a), (f) FS. History - New 11-12-86, Repealed 1-20-09.

PROGRAMS TO ADDRESS OSTDS SOURCES AS A SOURCE OF FECAL COLIFORM CONTAMINATION

- *ECHD*
- *OSTDS Program*
- *ECHD Research Program*
- *ECHD Environmental Analysis Program*
- *Escambia County Ordinance, Chapter 98, Article III, Relating to OSTDS*
- *ECHD Healthy Beaches Program*

PROGRAMS TO ADDRESS MARINAS, BOATYARDS, AND MOORING SOURCES AS A SOURCE OF FECAL COLIFORM CONTAMINATION

- ***Clean Marina and Clean Boatyards Program:*** Most of the marinas in the Bayou Chico watershed have been designated as Clean Marinas and/or Clean Boatyards. A list of designated marinas and information related to this program is available at: <http://www.dep.state.fl.us/cleanmarina/>.
- ***Pump Outs in Florida:*** The National Marine Waste Foundation, Inc. (NMWF) is a new organization whose goals are to make waste removal services free to boaters through funding from local business sponsors and grants through the state of Florida.
- *Barge and Derelict Vessel Removals*
- ***Florida's NPDES Stormwater Program:*** This program regulates point source discharges of stormwater into surface waters of the state from certain municipal, industrial, and construction activities. Most regulated facilities obtain permit coverage by submitting a **Notice of Intent (NOI) To Use Multi-Sector Generic Permit for Stormwater Discharge Associated with Industrial Activity (MSGP)**; however, some facilities are required to obtain an individual permit. Industrial activities that can certify "no exposure" at the facility may be excluded from the requirement to obtain an NPDES stormwater permit. Regulated facilities that apply for coverage under the MSGP must also prepare a Stormwater Pollution Prevention Plan (SWPPP).
- ***Marine industry operations that fall under the definition of industrial activity include the following:***
 - o Ship and boat building and repair facilities under SIC Codes 3731 and 3732; and

- o Water transportation facilities under SIC Code 44 that have vessel maintenance shops (**mechanical repairs, painting, fueling, and lubrication**) and/or equipment-cleaning operations. This group includes marinas identified under SIC Code 4493. Note that equipment-cleaning operations include areas where vessel and vehicle exterior wash down takes place.

Marinas and boatyards that meet the criteria above must obtain coverage under the NPDES Stormwater Program with either an MSGP or individual permit. An SWPPP is an essential component of a MSGP.

As part of the marinas' SWPPPs, measures must be identified that address good housekeeping, spill prevention, and response procedures, as well as plans to address nonstormwater and sediment and erosion controls. Such measures and the implementation of specific SWPPP plans by all marinas should provide some source controls in these particular areas of the watershed. It is not known how many marine industry operations fall under the MSGP permit in the Bayou Chico watershed at this time.

- **Mooring and Live-aboard Vessels:** *The Florida Fish and Wildlife Conservation Commission (FWC) has the authority to issue warnings to moored and live-aboard vessels for noncompliance with state rules relating to the disposal of waste or improper safety equipment aboard boats. The FWC issued warnings to nearly a dozen vessels on a compliance and inspection sweep in Bayou Chico earlier this year (2011).*

APPENDIX E: BMAP ANNUAL REPORTING FORM

TABLE E-1: PROPOSED BMAP ANNUAL REPORTING FORM

2011 Bayou Chico Watershed BMAP

___YEAR___ ANNUAL IMPLEMENTATION REPORT

REPORTING ENTITY: _____ DATE: _____

Note: Relevant MS4 activities, whether contained in the BMAP or not, may be included in this report.

IMPLEMENTATION STATUS – BMAP MANAGEMENT STRATEGIES

BMAP PROJECT # ¹	AFFECTED AREA (WBID)	BRIEF DESCRIPTION ²	PROJECTED START/ END ³	PROJECT/ ACTIVITY STATUS ⁴	PROJECT MONITORING RESULTS ⁵	COMMENTS ⁶
Shade if also an MS4 activity						

NEW MANAGEMENT STRATEGIES

BMAP PROJECT # ¹	AFFECTED AREA (WBID)	BRIEF DESCRIPTION ²	PROJECTED START/ END ³	PROJECT/ ACTIVITY STATUS ⁴	PROJECT MONITORING RESULTS ⁵	COMMENTS ⁶
Shade if also an MS4 activity						

Directions for BMAP Annual Reporting Format:

¹ **BMAP Projects:** This includes projects and other management strategies. Use the project number assigned in the BMAP Activities Tables (e.g., A.1). Please include all management strategies for which you have lead responsibility in the BMAP, regardless of their status. **New Management Strategies:** Include new projects/activities that are not included in the BMAP in the New Management Strategies table. Create a project number for new management strategies by using the prefix, then -N# (e.g., A-N1). **If a management action listed in either table is part of your MS4, please shade the project number box in grey.**

² Include a brief description of the management action being reported (e.g., street sweeping removing gross debris on all streets with "L curbs" – 5 miles performed each month).

³ If applicable, include the start and end dates for the management action. If not applicable, put "N/A" or, if it is a continuous activity, put "Continuous" and indicate how often the activity takes place (e.g., for street sweeping).

⁴ Clearly summarize the status of the management action, in a way that makes sense for the item listed. For instance, for educational activities, list pertinent publications, events, etc., including name and/or topic for each. Include specific or general time frames (e.g., two public workshops on pet waste disposal in July 2011). Also, describe any significant changes to the management action that have taken place.

⁵ As applicable: If monitoring is required as part of a management action (e.g., in a cost-share situation), or is conducted voluntarily (e.g., as part of an effort to collect information on BMAP effectiveness), include the monitoring results to date, as practicable.

⁶ Include comments on any implementation obstacles, including weather, funding, and technical difficulties. Include any other comments you consider important.

APPENDIX F: MINUTES FROM TECHNICAL MEETINGS WITH STAKEHOLDERS

APPENDIX G: GLOSSARY OF TERMS

303(d) List: The list of Florida's waterbodies that do not meet or are not expected to meet applicable water quality standards with technology-based controls alone.

305(b) Report: Section 305(b) of the federal Clean Water Act requires states to report biennially to the EPA on the quality of the waters in the state.

Allocation Technical Advisory Committee (ATAC): The Florida Watershed Restoration Act of 1999 required FDEP to form a Technical Advisory Committee to address issues relating to the allocation of load reductions among point source and nonpoint source contributors. The ATAC was therefore formed in order to develop recommendations for a report to the legislature on the process for allocating TMDLs.

Background: The condition of waters in the absence of human-induced alterations.

Baffle box: An underground stormwater management device that uses barriers (or baffles) to slow the flow of untreated stormwater, allowing particulates to settle out in the box before the stormwater is released into the environment.

Baseline period: A period of time used as a basis for later comparison.

Baseline loading: The quantity of pollutants in a waterbody, used as a basis for later comparison.

Basin Management Action Plan (BMAP): The document that describes how a specific TMDL will be implemented; the plan describes the specific load and wasteload allocations as well as the stakeholder efforts that will be undertaken to achieve an adopted TMDL.

Basin Status Report: For the Pensacola Basin, this document was published in 2004 by FDEP. The report documents the water quality issues, list of water segments under consideration for a TMDL, and data needs in the basin.

Best Available Technology (BAT) Economically Achievable: As defined by 40 CFR, §125.3, outlines technology-based treatment requirements in permits.

Best Management Practices (BMPs): Methods that have been determined to be the most effective, practical means of preventing or reducing pollution from nonpoint sources.

Coliforms: Bacteria that live in the intestines (including the colon) of humans and other animals, used as a measure of the presence of feces in water or soil.

Clean Water Act (CWA): The Clean Water Act is a 1977 amendment to the Federal Water Pollution Control Act of 1972, which set the basic structure for regulating discharges of pollutants to waters of the United States.

Continuous deflective separation (CDS) Unit: A patented stormwater management device that uses the available energy of the storm flow to create a vortex to cause a separation of solids from fluids. Pollutants are captured inside the separation chamber, while the water passes out through the separation screen.

Designated use: Uses specified in water quality standards for each waterbody or segment (such as drinking water, swimmable, fishable).

Detention Pond: A stormwater system that delays the downstream progress of stormwater runoff in a controlled manner, typically by using temporary storage areas and a metered outlet device.

Domestic Wastewater: Wastewater derived principally from dwellings, business buildings, institutions and the like; sanitary wastewater; sewage.

Dry Season: The dry part of the year when rainfall is low; in Florida, the dry season is defined as November through May.

Effluent: Wastewater that flows into a receiving stream by way of a domestic or industrial discharge point.

Event mean concentration: The flow-weighted mean concentration of an urban runoff pollutant measured during a storm event.

Exfiltration: Loss of water from a drainage system as the result of percolation or absorption into the surrounding soil.

External loading: Pollutants originating from outside a waterbody that contribute to the pollutant load of the waterbody.

Flocculent: A liquid that contains loosely aggregated, suspended particles.

Florida Department of Environmental Protection (FDEP): FDEP is Florida's principal environmental and natural resources agency. The Florida Department of Natural Resources and the Florida Department of Environmental Regulation were merged to create FDEP effective July 1, 1993.

Geomean: A log-transformation of data to enable meaningful statistical evaluations.

Ground Water or Groundwater: Water below the land surface in the zone of saturation where water is at or above atmospheric pressure.

Impairment: The condition of a waterbody that does not achieve water quality standards (designated use) due to pollutants or an unknown cause.

Load Allocations (LA): The portions of a receiving water's loading capacity that are allocated to one of its existing or future nonpoint sources of pollution.

Load Capacity: The greatest amount of loading that a waterbody can receive without violating water quality standards.

Loading: The total quantity of pollutants in stormwater runoff that contributes to the water quality impairment.

Margin of safety (MOS): An explicit or implicit assumption used in the calculation of a TMDL that takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality. An explicit MOS is typically a percentage of the assimilative capacity or some other specific amount of pollutant loading (e.g., the loading from an out-of-state source). Most FDEP-adopted TMDLs include an implicit MOS based on the fact that the predictive model runs incorporate a variety of conservative assumptions (they examine worst-case ambient flow conditions and worst-case temperature, and assume that all permitted point sources discharge at their maximum permissible amount).

National Pollutant Discharge Elimination System (NPDES): The permitting process by which technology-based and water quality-based controls are implemented.

Nonpoint Source (NPS): Diffuse runoff without a single point of origin that flows over the surface of the ground by stormwater and is then introduced to surface or ground water. NPS includes atmospheric deposition and runoff or leaching from agricultural lands, urban areas, unvegetated lands, OSTDS, and construction sites.

Nonpoint Source Pollution: Nonpoint source pollution is created by the flushing of pollutants from the landscape by rainfall and the resulting stormwater runoff, or by the leaching of pollutants through the soils into ground water.

Organic Matter: Carbonaceous waste contained in plant or animal matter and originating from domestic or industrial sources.

Outfall: The place where a sewer, drain, or stream discharges.

Particulate: A minute separate particle, as of a granular substance or powder.

Pollutant Load Reduction Goals (PLRGs): PLRGs are defined as the estimated numeric reductions in pollutant loadings needed to preserve or restore the designated uses of receiving waterbodies and maintain water quality consistent with applicable state water quality standards. PLRGs are developed by the water management districts as part of a Surface Water Improvement and Management (SWIM) plan.

Point Source: An identifiable and confined discharge point for one or more water pollutants, such as a pipe, channel, vessel, or ditch.

Pollutant: Generally any substance, such as a chemical or waste product, introduced into the environment that adversely affects the usefulness of a resource.

Pollution: An undesirable change in the physical, chemical, or biological characteristics of air, water, soil, or food that can adversely affect the health, survival, or activities of humans or other living organisms.

Removal efficiency: The amount of a given substance (metals, sediment, etc.) that has been extracted from another substance.

Retention Pond: A stormwater management structure whose primary purpose is to permanently store a given volume of stormwater runoff, releasing it by infiltration and/or evaporation.

Reuse: The deliberate application of reclaimed water for a beneficial purpose. Criteria used to classify projects as “reuse” or “effluent disposal” are contained in Subsection 62-610.810, F.A.C.

Runoff curve: A calculated number representing the percentage of rainfall that becomes runoff for a given area.

Quality Assurance (QA): An integrated system of management activities involving planning, implementation, documentation, assessment, reporting, and quality improvement to ensure that a process, product, or service meets defined standards of quality.

Quality Control (QC): The overall system of technical activities that measures the attributes and performance of a process, product, or service against defined standards to verify that they meet the established data quality objectives.

Septic Tank: A watertight receptacle constructed to promote the separation of solid and liquid components of wastewater, to provide the limited digestion of organic matter, to store solids, and to allow clarified liquid to discharge for further treatment and disposal in a soil absorption system.

STORET: The STORage and RETrieval database, used nationally for water quality data storage.

Stormwater: Water that results from a rainfall event.

Stormwater runoff: The portion of rainfall that hits the ground and is not evaporated, percolated, or transpired into vegetation. Rather, it flows over the ground surface seeking a receiving waterbody.

Submersed: Growing or remaining under water.

Surface Water: Water on the surface of the earth, whether contained within boundaries created naturally or artificially, or diffused. Water from natural springs is classified as surface water when it exits the spring onto the earth’s surface.

Total Maximum Daily Load (TMDL): The sum of the individual wasteload allocations for point sources and the load allocations for nonpoint sources and natural background. Prior to determining individual wasteload allocations and load allocations, the maximum amount of a

pollutant that a waterbody or waterbody segment can assimilate from all sources while still maintaining its designated use must first be calculated. TMDLs are based on the relationship between pollutants and instream water quality conditions.

U.S. Environmental Protection Agency (EPA): This federal agency was created in December 1970 to address the nation's urgent environmental problems and to protect the public health. The majority of FDEP's regulatory programs have counterparts at the EPA or are delegated from the EPA.

Wasteload Allocations (WLAs): Pollutant loads allotted to existing and future point sources, such as discharges from industry and sewage facilities.

Wastewater: The combination of liquid and pollutants from residences, commercial buildings, industrial plants, and institutions, together with any ground water, surface runoff, or leachate that may be present.

Waterbody Identification (WBID) Numbers: WBIDs are numbers assigned to hydrologically based drainage areas in a river basin.

Water column: The water within a waterbody between the surface and sediments.

Water Quality Index: Determines the quality of Florida's streams, blackwaters, and springs. Categories include water clarity, dissolved oxygen, oxygen-demanding substances, nutrients, bacteria, and macroinvertebrate diversity.

Water Quality Standards (WQSs): (1) Standards that comprise the designated most beneficial uses (classification of water), the numeric and narrative criteria applied to the specific water use or classification, the Florida Anti-degradation Policy, and the moderating provisions contained in Rules 62-302 and 62-4, F.A.C. (2) State-adopted and EPA-approved ambient standards for waterbodies. The standards prescribe the use of the waterbody (such as drinking, fishing and swimming, and shellfish harvesting) and establish the water quality criteria that must be met to protect designated uses.

Watershed: The topographic area that contributes or may contribute runoff to specific surface waters or an area of recharge.

Watershed management approach: The process of addressing water quality concerns within their natural boundaries, rather than political or regulatory boundaries. The process draws together all the participants and stakeholders in each basin to decide what problems affect water quality in the basin, which are most important, and how they will be addressed.

Wet Season: The rainy part of the year; in Florida, the wet season is defined as June through October.

APPENDIX H: BIBLIOGRAPHY OF KEY REFERENCES AND WEBSITES

KEY REFERENCES

- Amick, R., and E. Burgess. March 2003. *Exfiltration in sewer systems*. Cincinnati, OH: U.S. Environmental Protection Agency, National Risk Management Research Laboratory. EPA J600/SR-01/934. Available: <http://www.epa.gov/nrmrl/pubs/600r01034/600sr01034.pdf>.
- Anderson, K.L., J.E. Whitlock, and V. J. Harwood. 2005. Persistence and differential survival of fecal indicator bacteria in subtropical waters and sediments. *Applied and Environmental Microbiology* 71:3041-3048.
- Baskerville-Donovan Inc. August 2004. *Bayou Chico stormwater needs assessment*. Prepared for the city of Pensacola, FL.
- Brown and Caldwell. September 2005. *Status report on the development of a reporting methodology for surface discharges of sewage*. Irvine, CA. Prepared for the Orange County Sanitation District.
- Brownell, M.J., V.J. Harwood, R.C. Kurz, S.M. McQuaig, J. Lukaisik, and T. M. Scott. 2007. Confirmation of putative stormwater impact on water quality at a Florida beach by microbial source tracking methods and structure of indicator organism populations. *Water Research* 41:3747-3757.
- Davies, C.M., J.A. Long, M. Donald, and N.J. Ashbolt. 1995. Survival of fecal microorganisms in marine and freshwater sediments. *Applied and Environmental Microbiology* 61:1888-1896.
- Debusk, W.F., I. Poyer, and I. Herzfeld. 2002. *Sediment quality in the Pensacola Bay system, final report*. Northwest Florida Water Management District.
- Florida Department of Environmental Protection (FDEP). July 1998. *The Pensacola Bay watershed management guide: An integrated ecosystem action plan*. Available: <http://www.uwf.edu/rsnyder/reports/PBWMG.pdf>. (Note: pp. 12-14 and 320 of the guide address Bayou Chico, Jones Creek, and Jackson Creek.)
- — —. 2004. *Water quality status report: Pensacola*. Tallahassee, FL: Bureau of Watershed Management.
- — —. 2008. *Fecal coliform TMDL for the Bayou Chico watershed, WBIDs 846, 846A, 846B, 846CB, and 848DA*. Tallahassee, FL: Bureau of Watershed Management.
- Liebens, J., C.J. Mohrherr, and K.R. Rao. 2007. Sediment pollution pathways of trace metals and petroleum hydrocarbons in a small industrialized estuary: Bayou Chico, Pensacola, FL. *Marine Pollution Bulletin* 54: 1529-1539.
- Liebens, J., C.J. Mohrherr, K.R. Rao, and C.A. Houser. 2006. Pollution in an urban bayou: Magnitude, spatial distribution, and origin. *Water, Air, and Soil Pollution* 174: 235-263.

- Maestre, A. 2009. *Advisory and warning analyses in Alabama and northwest Florida beaches*. Presentation to the February 17, 2009, Bayou Chico Basin Management Action Plan Technical Meeting. Pensacola, FL.
- Mallin, M.A. L.B. Cahoon, B.R. Toothman, D. C. Parsons, M.R. McIver, M.L. Ortwine, and R.N. Harrington. 2007. Impacts of a raw sewage spill on water and sediment quality in an urbanized estuary. *Marine Pollution Bulletin* 54:81-88.
- McDowell, W., C. Brick, M. Clifford, M. Frode-Hutchins, J. Harvela, and K. Knudsen. 2005. *Septic system impact on surface water: A review for the inland northwest*. Tri-State Water Quality Council.
- Metz, A. April 26, 2010. "Pumped up for pumping out: Free marine waste removal service 'just about a reality.' " *The Destin Log*. Available: <http://www.thedestinlog.com/articles/boaters-13568-service-free.html>.
- Nicosia, L., J.B. Rose, L. Stark, and M. Stewart. 2001. Ground water quality. *Journal Environmental Quality* 30, 1933-1939.
- Snyder, R.A. 2006. *Analysis of fecal loadings into Bayous Grande, Chico, and Texar: Pensacola Bay system, FL*. Prepared for the Florida Department of Health, Escambia County Health Department. Pensacola, FL: University of West Florida, Center for Environmental Diagnostics and Bioremediation. Available: http://uwf.edu/cedb/Analysis_of_Fecal_Loadings_Bayou_Report.pdf.
- Snyder, R.A., and N. Karouna-Renier. 2009. *Accumulation of pollutants in fish and shellfish from the northwest Florida region, final report*. Pensacola, FL: University of West Florida, Center for Environmental Diagnostics and Bioremediation.
- U.S. Environmental Protection Agency (EPA). June 2007. *Report of the experts scientific workshop on critical research needs for the development of new or revised recreational water criteria*. EPA 823-R-07-006. Washington, D.C.: Office of Water, Office of Research and Development. Available: http://water.epa.gov/scitech/swguidance/standards/criteria/health/recreation/experts_index.cfm.
- — —. March 2008. *Handbook for developing watershed plans to restore and protect our waters*. EPA 841-B-08-002. Washington, D.C.: Office of Water, Nonpoint Source Control Branch. Available: http://www.epa.gov/owow/nps/watershed_handbook/.
- — —. 2011. *West Florida Regional Planning Council/Bay Area Resource Council. Surf Your Watershed website*. Available: <http://yosemite.epa.gov/water/surfnote.nsf/95ac962f1308404885256392006ee6ba/88fedfc9eb4ae352852564fa00693444!OpenDocument>.

STORMWATER AND WATER QUALITY PROTECTION WEBSITES

TABLE H-1: STORMWATER AND WATER QUALITY PROTECTION WEBSITES

- = Empty cell/no data

ENTITY/PROGRAM	URL
Local and Regional Sites	-
University of West Florida Center for Environmental Diagnostics and Bioremediation (CEDB)	http://uwf.edu/cedb/
Escambia County	http://www.myescambia.com/index.html
City of Pensacola	http://www.ci.pensacola.fl.us/
Emerald Coast Utility Authority (ECUA)	http://www.ecua.fl.gov/
West Florida Regional Planning Council	http://www.wfrpc.org/
Bay Area Resource Council (BARC)	http://www.wfrpc.dst.fl.us/barcstructure
Escambia County Health Department (ECHD)	http://www.escambiahealth.com/
Northwest Florida Water Management District (NFWMD)	http://www.nfwmd.state.fl.us/
State Sites	-
General Portal for Florida	http://www.myflorida.com
FDEP	http://www.dep.state.fl.us/
Watershed Management	http://www.dep.state.fl.us/water/watersheds/index.htm
TMDL Program	http://www.dep.state.fl.us/water/tmdl/index.htm
BMAP Program	http://www.dep.state.fl.us/water/watersheds/bmap.htm
BMPs, Public Information	http://www.dep.state.fl.us/water/nonpoint/pubs.htm
NPDES Stormwater Program	http://www.dep.state.fl.us/water/stormwater/npdes/index.htm
Nonpoint Source Funding Assistance	http://www.dep.state.fl.us/water/nonpoint/319h.htm
Surface Water Quality Standards	http://www.dep.state.fl.us/legal/Rules/shared/62-302/62-302.pdf
Pensacola Bay Water Quality Assessment Report	http://www.dep.state.fl.us/water/basin411/pensacola/assessment.htm
Clean Marina Program	http://www.dep.state.fl.us/cleanmarina/
FDOH	http://www.doh.state.fl.us
Standards for OSTDS	http://www.doh.state.fl.us/environment/ostds/pdfiles/forms/64e620070924.pdf
National Sites	-
Center for Watershed Protection	http://www.cwp.org/
EPA Office of Water	http://www.epa.gov/water
EPA Region 4 (Southeast United States)	http://www.epa.gov/region4
EPA SSO Fact Sheet	http://www.epa.gov/npdes/ssso/control/
National Marine Waste Foundation, Inc. (NMWF)	http://nationalmarinewastefoundation.org/