SECTION 3: Charlotte County's Future Water Story

--Monitoring, Modeling, and Watershed Improvement Planning--

ONE WATER VISION: Create a comprehensive system for monitoring water quality and quantity trends in Charlotte County, creating meaningful stories to inform those activities that affect our waters now and into the future.

PATHWAYS TO THE VISION

	Establish a comprehensive water flow and pollutant load-based monitoring network, tracking and identifying regions with high rates of loading compared to background conditions and water quality criteria exceedances.
	Develop interactive flow, flood, and pollutant modeling products to inform water management and permitting decisions.
	Develop and implement water quality restoration plans throughout impaired areas of the county.
	Develop Watershed Management Plans to protect non-impaired waters.

CURRENT VISION TASKS

Categories	Task	Anticipated Regional Benefits
	Install comprehensive water flow and elevation monitoring system to track pollutant loading rates, identify areas of flood and tidal surge risk, and calibrate/validate predictive flow and pollutant loading models.	
	Build initial iteration of the *Spatially Integrated Model for Pollutant Loading Estimates* (SIMPLE) pollutant loading model to identify possible sources and drivers of pollutant discharges in the county.	
	Coordinate with regional partners to initiate Charlotte Harbor and Lemon Bay water circulation study to determine hydrologic dynamics in areas experiencing chronic annual macroalgae and cyanobacteria blooms.	
	Begin developing restoration plans based on prioritization described in this plan. For those impaired waterbodies recommended for TMDL	

Categories	Task	Anticipated Regional Benefits
	development, confer with relevant partners to request FDEP's prioritization of these areas for modeling and restoration strategy development.	
	Create Charlotte Harbor nutrient loading reduction and management strategy, to be integrated with regional agencies' management strategies for restoring the health of Charlotte Harbor. Work with partner agencies to develop an annual "state of the estuary" one-pager to describe current water chemistry and ecological health of Charlotte Harbor, in order to maintain focus on addressing management gaps. Participate in and support implementing recommendations emerging from the regional Charlotte Harbor/Lemon Bay harmful algal bloom working group.	
	For waterbodies indicating potential water quality impacts but for which no impairment designation has been established, determine data needs as applicable and implement enhanced monitoring in the area to support assessment by FDEP. In addition, expand current monitoring program to account for impacts from National Pollutant Discharge Elimination System (NPDES) wastewater discharge facilities and other point-sources.	
	Implement central data management, review, and storage warehouse for all water quality and quantity monitoring efforts collected or funded by the county.	
	Partner with regional monitoring agencies as needed to support complimentary, cooperative monitoring programs. Assist partner agencies in streamlining data review and management processes to maximize the efficiency and accuracy of monitoring activities in our estuary.	

Associated Plans, Ordinances, and Mandates

- Charlotte County Ambient Monitoring Project Plan

Background

Water quality/quantity monitoring, modeling, and source tracking are foundational activities to most recommendations in this Plan; such efforts are essential to understanding the drivers behind current and future impacts to our aquatic resources. Water quality monitoring in Charlotte Harbor and Lemon Bay has been ongoing for decades, allowing us to identify general water quality trends for nutrients and other parameters that have been sampled over the life of these programs. In contrast, water quality and quantity information in Charlotte County is sporadic at best, with project-specific efforts occurring in various locations, but before 2022 no long-term accounting of water quality and quantity characteristics was available for the county. This creates both a lack of clarity on potential pollution contributions to Charlotte Harbor and Lemon Bay from county waters, as well as an inability to determine the water quality status of county watersheds; only a handful of waterbodies in Charlotte County are considered impaired, but this may be because of insufficient data available to assess those waters rather than a lack of impairment.

This began to change with the implementation of the county's ambient monitoring program, where approximately 60 locations across the county were selected with the following goals in mind:

- Identify long-term trends and ambient water quality conditions within:
  - Waters discharging to Charlotte Harbor, Lemon Bay, and the Caloosahatchee River.
  - Waters within Water Body Identification Numbers (WBIDs) within Charlotte County's boundaries.
  - Waters entering Charlotte County (where warranted/possible).
- Inform potential needs for source tracking and opportunities for water quality improvement.
- Conduct investigatory work as warranted to identify or clarify the origin and/or impact of in-stream conditions identified through the ambient monitoring activities of this project.
- Submit data to FDEP WIN for assessing Charlotte County WBIDs in accordance with 62-302, 62-303, and 62-304, Florida Administrative Code (FAC).
- Develop models that will allow loading characteristics and trends in Charlotte County to be identified and predicted.
- Present sample results to the public in a manner that clearly describes water quality trends in relation to applicable water quality criteria.

As of this writing, three years' worth of monitoring has been completed. Although this is not a sufficient dataset to draw definitive conclusions about water quality trends in the county, some general observations can be gleaned from the data:

- The Charlotte County ambient surface water monitoring program, though early on, has already led to informed decisions. Using the data collected to date, staff have identified segments of the county with higher concentrations of nutrients than others, prompting more focused investigations into potential sources of those nutrients. Bacteria hot spots have also been identified, and staff have been collecting DNA tracing samples to determine if those levels are due to anthropogenic inputs. From a state assessment standpoint, the County has identified a number of watersheds mis-classified as tidal systems by FDEP, and has been working with them to ensure the proper waterbody classifications (and thus the correct water quality criteria) are being used to assess the county's waters. This is important as different criteria are used to assess different waterbody types. These changes will be instituted as part of FDEP's next biennial assessment.

- DEP will also begin using the data gathered by the County with its next Biennial Assessment, which will assess ambient surface water quality data through July 2024. Unfortunately, three years' worth of data are needed to assess a waterbody for nutrient impairment determinations, a primary parameter of concern for most waterbodies. It takes a minimum of 5 years of monthly data to determine statistically significant trends in water quality. Long-term trends provide an indication whether a waterbody is degrading or improving. As such, it is recommended that the County continue its current monitoring effort for the time being to get the most of its investment to date.

Other recommendations regarding water quality monitoring include:

- Developing a consistent QA/QC program across all county sampling programs to ensure a timely accurate assessment of the data collected.

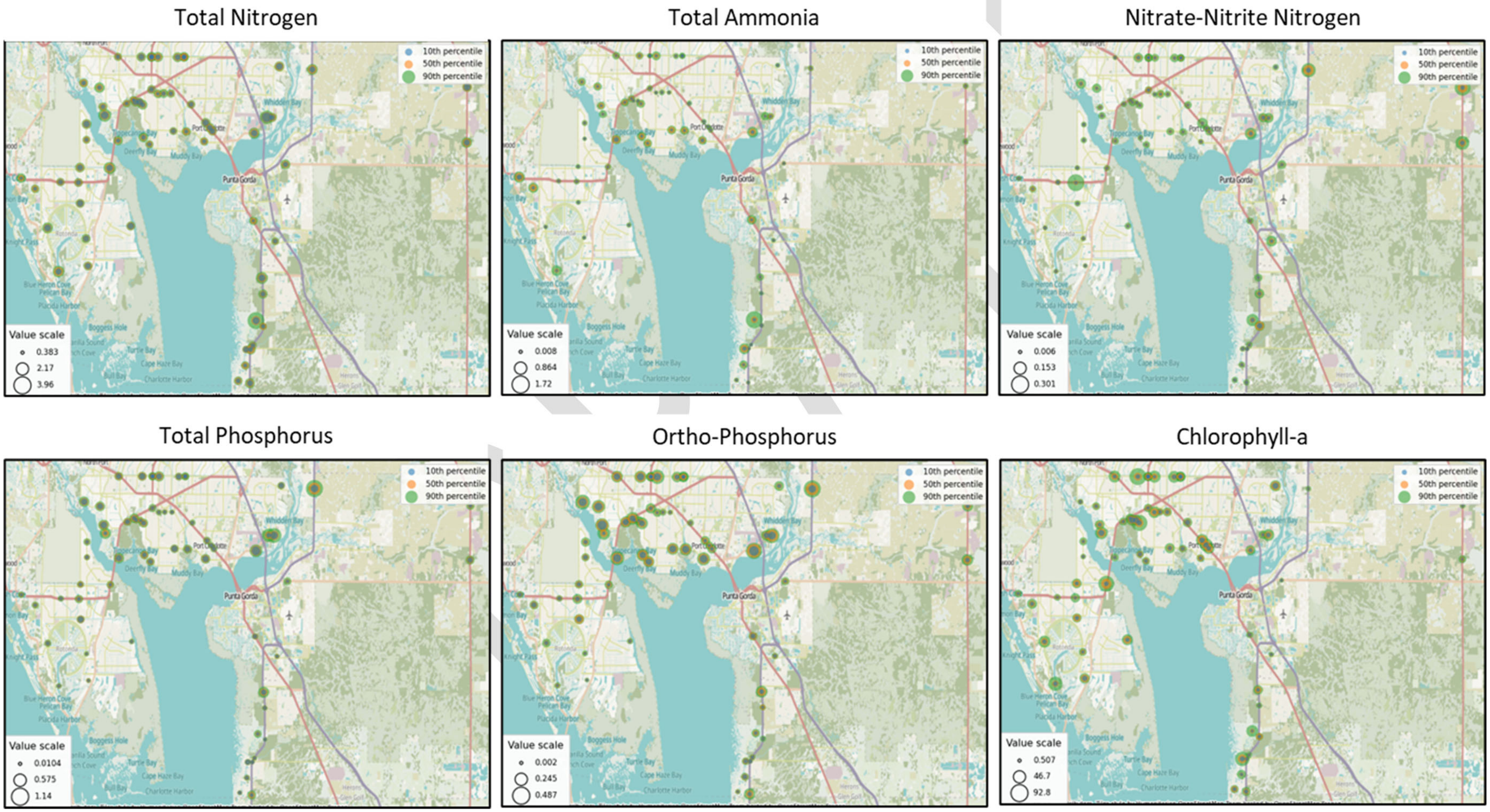
- Continue to participate in the Southwest Florida Regional Ambient Monitoring Program (RAMP) working group. The group strives to assist member organizations to achieve quality water quality data consistently along the southwest Florida coast. The County should encourage other organizations collecting data within its waters to participate in RAMP.

- Conducting pre- and post-monitoring of water quality improvement projects to evaluate the efficacy of those measures.
- Looking towards utilizing the DEP's Fecal Indicator Bacteria Toolkit to track down the source of excessive bacteria or determine if it is naturally occurring. The DEP verified impairment list and the County's data indicate areas where fecal indicator bacteria exceed the appropriate criteria.
- The County should continue collecting the appropriate fecal indicator bacteria parameter for the waterbody Class rather than based on the conductivity at the time of collection as that is how DEP will assess the data.

Many of the County's receiving waters have been deemed impaired for nutrients, including Charlotte Harbor, Lemon Bay and the tidal Peace/Myakka Rivers. These impairments usually are the result of pollutant loading throughout the drainage basin contributing runoff to the impaired waterbody, the sources of which often include a combination of non-point and point source discharges from varying types of land uses. To best prioritize watersheds based on their relative pollutant contribution to our estuaries, it is as important to understand the quantity of water discharging from these systems as it is the quality of the water. To do so requires the use of models and/or flow monitoring equipment. Therefore, it is recommended that the County begin a water **quantity** monitoring program to compliment current water quality efforts. The installation of flow meters at key locations where water quality is collected will assist in targeting areas with high loading rates for possible BMP implementation. This will also be important for calibrating/verifying any pollutant loading model the County may be considering deploying.

Figure 13. Nutrient Concentration Trends at Charlotte County Monitoring Locations, June 2022-June 2025

For each location, three dots are displayed corresponding to the 10th, 50th, and 90th percentile of data collected at that site; larger dots indicate higher concentrations. Sites at which the three dots are very different in size from one another indicate potentially flashy conditions, meaning stormwater or intermittent point-source discharges might be contributing to the nutrient concentrations. For Chlorophyll-a, high concentrations indicate a greater chance of algal blooms in the area, and thus a more persistent source of excessive nutrients may be present.



Impaired Waters Restoration Pathways

Generally, the regulatory path to assessing the health of waters is described in **Figure 14** below. In short, water quality data collected by the county and other regional partners are submitted to the state Department of Environmental Protection (FDEP). If said data meets their data sufficiency and quality requirements, they will utilize it to evaluate the health of the waterbody by comparing that information to established water quality criteria. Failure to meet that criteria will result in the waterbody being placed on the Impaired Waters list. If data indicates the waterbody might be trending towards impairment but insufficient information is available to make a final determination, FDEP may place the waterbody on their Planning or Study lists, earmarking that location for additional data collection in the near future.

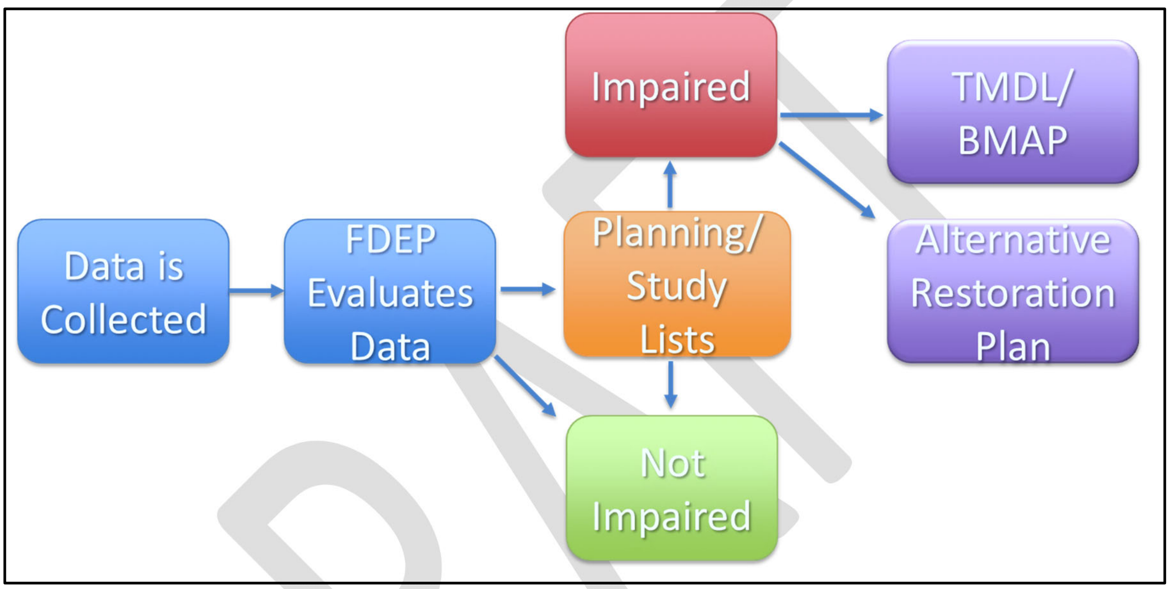


Figure 14. General regulatory pathway for assessing surface waters in Florida.

Historically, once a waterbody has been placed on the Impaired Waters list FDEP would then initiate development of a Total Maximum Daily Load (TMDL), followed by a Basin Management Action Plan (BMAP). The TMDL process utilizes empirical data, modeling, and land use analysis to identify the sources of impairment to the waterbody, and the extent to which each of those sources must reduce their pollutant discharges in order to bring the waterbody back into compliance with water quality criteria. The BMAP then outlines the specific actions each source will take to reduce their pollutant discharges. Note this effort is initiated and funded by FDEP. The county does not have the authority to initiate this process.

Similarly, the Alternative Restoration Plan (ARP) is designed to accomplish the same goals as the TMDL/BMAP process; that is, it identifies sources of pollution and describes strategies and mechanisms to reduce pollutant discharges from those sources. The key difference is this can be enacted by local governments, allowing them to take control of the restoration process rather than wait for FDEP to take action in a given waterbody. Alternative Restoration Plans must be submitted to FDEP for approval, after which it carries a similar level of enforcement as TMDL/BMAP pollution reduction requirements. The obstacles to creating an ARP are twofold: the cost of developing the plan is borne by the local government(s), and participation in developing an ARP is voluntary, thus relying on all entities responsible for the health of a watershed willingly agreeing to work together to address said pollution issues.

The following three (3) tables list FDEP verified impaired waters as of July 11, 2022. The tables are grouped by parameter type: Nutrients, Fecal Indicator Bacteria and General. Due to the different complexities of these groups, each WBID group should be addressed by different means.

The water segments in **Table 3** are categorized by Readiness ratings; that is, the potential for fast-tracking ARP development based on the availability of regional partners also aligned with, and committed towards, developing ARPs for these segments, as well as monitoring and modeling data that can be used to support selection of appropriate water quality improvement activities. Segments are also categorized by Priority, which ranks the need for restoration plans for each area based on known impairments. Restoration planning for waterbodies will commence immediately for those segments with high Readiness or high Priority designations.

With respect to nutrients (**Table 4**), it is recommended to address impairments by developing Alternative Restoration Plans as they lead to "cleaner water faster" than the traditional DEP TMDL/BMAP approach. As it is a priority to bring the waters into compliance with State water quality criteria, these waterbodies are assigned a "readiness" rating, based on how fast a reasonable assurance plan can be initiated and completed. It makes the most sense to utilize a regional approach when addressing nutrient impairments in estuarine receiving waters, which would include assistance from additional partners to restore waterways back to compliance. For example, Sarasota County has conducted extensive monitoring and pollutant loading analyses in northern Lemon Bay, in part to inform their Lemon Bay Watershed Management Plan. As such, of the nutrient impaired waters described in **Table 5 below,** an ARP for Lemon Bay can be developed more expediently than for other watersheds, generating water quality protection/improvement mechanisms while also providing "lessons learned" for ARP development in other county waters.

That said, the Charlotte Harbor estuary system should be considered highest priority to begin restoration planning and implementation activities, given water quality and ecological degradation observed in that system. Ultimately, both Lemon Bay and Charlotte Harbor efforts could occur simultaneously, doing the work needed on Lemon Bay while gathering financial, regional partnership, and data/modeling support for Charlotte Harbor. Details on the strategy for positioning Charlotte Harbor for RAP development are detailed in Task G.

Table 3. Charlotte County waterbodies impaired for nutrients

<table>
<tr><th>Water Segment Name</th><th>WBID</th><th>Waterbody Type</th><th>Waterbody Class[1]</th><th>Parameters Assessed Using the Impaired Waters Rule (IWR)</th><th>Recommendation</th><th>Readiness</th><th>Priority</th></tr>
<tr><td>Charlotte Harbor (Middle Segment1)</td><td>2065B</td><td>Estuary</td><td>2</td><td>Nutrients (Chlorophyll-a)</td><td rowspan="8">Charlotte Harbor RAP</td><td rowspan="8">Low</td><td rowspan="8">High</td></tr>
<tr><td>Charlotte Harbor (Middle Segment1)</td><td>2065B</td><td>Estuary</td><td>2</td><td>Nutrients (Total Nitrogen)</td></tr>
<tr><td>Charlotte Harbor (Middle Segment2)</td><td>2065C</td><td>Estuary</td><td>2</td><td>Nutrients (Total Nitrogen)</td></tr>
<tr><td>Charlotte Harbor (Upper Segment)</td><td>2065A</td><td>Estuary</td><td>2</td><td>Nutrients (Chlorophyll-a)</td></tr>
<tr><td>Charlotte Harbor (Upper Segment)</td><td>2065A</td><td>Estuary</td><td>2</td><td>Nutrients (Total Nitrogen)</td></tr>
<tr><td>Charlotte Harbor (Upper Segment)</td><td>2065A</td><td>Estuary</td><td>2</td><td>Nutrients (Total Phosphorus)</td></tr>
<tr><td>Whidden Creek</td><td>2079</td><td>Estuary</td><td>2</td><td>Nutrients (Chlorophyll-a)</td></tr>
<tr><td>Whidden Creek</td><td>2079</td><td>Estuary</td><td>2</td><td>Nutrients (Total Nitrogen)</td></tr>
<tr><td>Coral Creek (West Branch)</td><td>2078A</td><td>Estuary</td><td>2</td><td>Nutrients (Chlorophyll-a)</td><td rowspan="4">Lemon Bay RAP</td><td rowspan="4">High</td><td rowspan="4">Medium</td></tr>
<tr><td>Coral Creek (West Branch)</td><td>2078A</td><td>Estuary</td><td>2</td><td>Dissolved Oxygen (Percent Saturation)</td></tr>
<tr><td>Upper Lemon Bay</td><td>1983A</td><td>Estuary</td><td>2</td><td>Nutrients (Chlorophyll-a)</td></tr>
<tr><td>Upper Lemon Bay</td><td>1983A</td><td>Estuary</td><td>2</td><td>Nutrients (Total Nitrogen)</td></tr>
<tr><td>Myakka River</td><td>1991A</td><td>Estuary</td><td>2</td><td>Nutrients (Total Nitrogen)</td><td rowspan="4">Lower Myakka RAP</td><td rowspan="4">Medium</td><td rowspan="4">High</td></tr>
<tr><td>Myakka River</td><td>1991B</td><td>Estuary</td><td>2</td><td>Nutrients (Total Nitrogen)</td></tr>
<tr><td>Myakka River</td><td>1991B</td><td>Estuary</td><td>2</td><td>Nutrients (Total Phosphorus)</td></tr>
<tr><td>Tippecanoe Bay</td><td>2055</td><td>Estuary</td><td>3M</td><td>Nutrients (Chlorophyll-a)</td></tr>
<tr><td>Direct Runoff to Stream</td><td>2061</td><td>Estuary</td><td>3M</td><td>Nutrients (Chlorophyll-a)</td><td></td><td>Medium</td><td>Medium</td></tr>
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Water Segment Name	WBID	Waterbody Type	Waterbody Class[1]	Parameters Assessed Using the Impaired Waters Rule (IWR)	Recommendation	Readiness	Priority
Flopbuck Creek	2048C	Estuary	3M	Nutrients (Chlorophyll-a)	Either TMDL or grouped into Lower Peace River TMDL		
Huckaby Creek	2048B	Estuary	3M	Nutrients (Chlorophyll-a)			
Manchester Way	2047	Estuary	3M	Nutrients (Chlorophyll-a)			
Shell Creek below Hendrickson Dam	2041A	Estuary	3M	Nutrients (Total Nitrogen)			
Shell Creek below Hendrickson Dam	2041A	Estuary	3M	Nutrients (Total Phosphorus)			
Middle Peace River Estuary (Middle Segment)	2056B	Estuary	3M	Nutrients (Chlorophyll-a)	Lower Peace River RAP	Low	High
Middle Peace River Estuary (Middle Segment)	2056B	Estuary	3M	Nutrients (Total Nitrogen)			
Middle Peace River Estuary (Middle Segment)	2056B	Estuary	3M	Nutrients (Total Phosphorus)			
Peace River Estuary(Upper Segment South)	2056C2	Estuary	3M	Nutrients (Total Nitrogen)			
Gator Slough Canal	2082C	Stream	3F	Nutrients (Macrophytes)	Exotic Vegetation Removal	As needed	Medium
Cow Slough	1964	Stream	1	Nutrients (Macrophytes)			
Myrtle Slough	2040	Stream	1	Nutrients (Macrophytes)			Medium

[1]Waterbody Classes are defined in 62-302.400, F.A.C.

Table 4 describes waterbodies with fecal indicator bacteria impairments. DEP has recently adopted a regional approach to adopting bacteria TMDLs at a basin scale. The first example of this was the draft Everglades West Coast TMDL (DEP, 2024). It is thus recommended that the County allow DEP to determine TMDLs for these waters; however, source tracking activities should be implemented in the interim, in order to determine if the cause of any of these impairments stem from anthropogenic activities. Prioritization should be given to Class 1 (potable water supplies) and Class 2 (shellfish harvesting areas) waters. For the Class 2 waters determined to be impaired for failing the fecal coliform criteria for shellfish harvesting areas, it should first be determined that the waterbody classification is appropriate for the waterbody.

Table 4. Charlotte County waterbodies impaired for fecal indicator bacteria.

<table>
<tr><th>Water Segment Name</th><th>WBID</th><th>County (-ies)</th><th>Waterbody Type</th><th>Waterbody Class</th><th>Parameters Assessed Using the Impaired Waters Rule (IWR)</th><th>Recommendation</th><th>Priority</th></tr>
<tr><td>Alligator Creek</td><td>2074</td><td>Charlotte</td><td>Stream</td><td>1</td><td>Fecal Coliform</td><td>Regional TMDL</td><td>Medium</td></tr>
<tr><td>Coral Creek (West Branch)</td><td>2078A</td><td>Charlotte</td><td>Estuary</td><td>2</td><td>Fecal Coliform</td><td rowspan="4">Regional TMDL</td><td rowspan="4">High</td></tr>
<tr><td>Coral Creek (West Branch)</td><td>2078A</td><td>Charlotte</td><td>Estuary</td><td>2</td><td>Fecal Coliform (3)</td></tr>
<tr><td>Upper Lemon Bay</td><td>1983A</td><td>Charlotte, Sarasota</td><td>Estuary</td><td>2</td><td>Enterococci</td></tr>
<tr><td>Upper Lemon Bay</td><td>1983A</td><td>Charlotte, Sarasota</td><td>Estuary</td><td>2</td><td>Fecal Coliform (3)</td></tr>
<tr><td>Myakka River</td><td>1991B</td><td>Charlotte, Sarasota</td><td>Estuary</td><td>2</td><td>Fecal Coliform (3)</td><td rowspan="3">Regional TMDL</td><td rowspan="3">High</td></tr>
<tr><td>Tippecanoe Bay</td><td>2055</td><td>Charlotte</td><td>Estuary</td><td>2</td><td>Fecal Coliform</td></tr>
<tr><td>Trailer Park Canal</td><td>2053</td><td>Charlotte</td><td>Estuary</td><td>2</td><td>Fecal Coliform</td></tr>
<tr><td>Cleveland Cemetery Ditch</td><td>2059</td><td>Charlotte</td><td>Estuary</td><td>3M</td><td>Enterococci</td><td rowspan="3">Regional TMDL</td><td rowspan="3">High</td></tr>
<tr><td>Lee Branch</td><td>2035</td><td>Charlotte, DeSoto</td><td>Stream</td><td>3F</td><td>Fecal Coliform</td></tr>
<tr><td>Myrtle Slough</td><td>2054</td><td>Charlotte</td><td>Estuary</td><td>3M</td><td>Fecal Coliform</td></tr>
<tr><td>Telegraph Creek</td><td>3236A</td><td>Charlotte, Lee</td><td>Stream</td><td>3F</td><td>Escherichia coli</td><td>Regional TMDL</td><td>Low</td></tr>
<tr><td>Chapel Creek / Bayshore Creek</td><td>3240B1</td><td>Charlotte, Lee</td><td>Stream</td><td>3F</td><td>Escherichia coli</td><td rowspan="6">Regional TMDL</td><td rowspan="6">Low</td></tr>
<tr><td>Daughtrey Creek</td><td>3240F</td><td>Charlotte, Lee</td><td>Stream</td><td>3F</td><td>Escherichia coli</td></tr>
<tr><td>Owl Creek</td><td>3240N</td><td>Charlotte, Lee</td><td>Stream</td><td>3F</td><td>Escherichia coli</td></tr>
<tr><td>Popash Creek</td><td>3240Q</td><td>Charlotte, Lee</td><td>Stream</td><td>3F</td><td>Escherichia coli</td></tr>
<tr><td>Powell Creek</td><td>3240L</td><td>Charlotte, Lee</td><td>Stream</td><td>3F</td><td>Escherichia coli</td></tr>
<tr><td>Stroud Creek</td><td>3240M</td><td>Charlotte, Lee</td><td>Stream</td><td>3F</td><td>Escherichia coli</td></tr>
</table>

Water Segment Name	WBID	County (-ies)	Waterbody Type	Waterbody Class	Parameters Assessed Using the Impaired Waters Rule (IWR)	Recommendation	Priority
Trout Creek	3240G	Charlotte, Lee	Stream	3F	Escherichia coli		
Cypress Creek	3235C	Charlotte, Lee	Stream	3F	Escherichia coli	Regional TMDL	Low
Jacks Branch	3235D	Charlotte, Glades, Hendry	Stream	3F	Fecal Coliform		

The remaining impairments include waterbodies exceeding iron, copper, or dissolved oxygen criteria, or are related to shellfish harvesting classifications (**Table 5**). Priority is given to how quickly an impairment can be verified, starting with bacteria-related impairments, followed by iron and dissolved oxygen, and finally copper. Once these impairments are verified, TMDLs (which are recommended for these parameters) may be developed. The number of iron impairments indicate a natural source of iron may be present and should be identified. The source of the singular dissolved oxygen and copper impairments should be identified prior to determining a TMDL. Finally, those waters impaired due to the shellfish harvesting classifications should be verified as shellfish harvesting areas and reviewed to determine the rationale provided by state agencies for the impairment designation is sufficient to proceed with restoration activities.

Table 5. Charlotte County waterbodies impaired for general parameters.

Water Segment Name	WBID	County (-ies)	Waterbody Type	Waterbody Class	Parameters Assessed Using the Impaired Waters Rule (IWR)	Recommendations	Priority
Charlotte Harbor Upper	2065A	Charlotte	Estuary	2	Iron	Determine if source is Natural Background	Medium
Rock Creek	2045	Charlotte, Sarasota	Estuary	3M	Iron		
Trailer Park Canal	2053	Charlotte	Estuary	2	Iron		
Prairie Creek	1962	Charlotte, DeSoto	Stream	1	Iron		
Flopbuck Creek	2048C	Charlotte	Estuary	3M	Iron		
Myrtle Slough	2054	Charlotte	Estuary	3M	Iron		
Peace River Estuary (Lower Segment)	2056A	Charlotte	Estuary	3M	Iron		
Middle Peace River Estuary (Middle Segment)	2056B	Charlotte	Estuary	3M	Iron		
Peace River Estuary (Upper Segment North)	2056C1	Charlotte, DeSoto	Estuary	3M	Iron		
Peace River Estuary(Upper Segment South)	2056C2	Charlotte	Estuary	3M	Iron		
Cleveland Cemetery Ditch	2059	Charlotte	Estuary	3M	Iron		
Direct Runoff to Stream	2061	Charlotte	Estuary	3M	Iron		
Sam Knight Creek	2048A	Charlotte	Estuary	3M	Dissolved Oxygen	Identify possible sources.	Medium
Trailer Park Canal	2053	Charlotte	Estuary	2	Copper	Identify possible sources.	Low
Lemon Bay	1983B	Charlotte	Estuary	2	Bacteria (in Shellfish)	Verify waterbody classification	High
Charlotte Harbor Mid	2065C	Charlotte	Estuary	2	Bacteria (in Shellfish)		
Lemon Bay	1983A	Charlotte, Sarasota	Estuary	3M	Bacteria (in Shellfish)		

Water Segment Name	WBID	County (-ies)	Waterbody Type	Waterbody Class	Parameters Assessed Using the Impaired Waters Rule (IWR)	Recommendations	Priority
Myakka River	1991A	Charlotte, Sarasota	Estuary	2	Bacteria (in Shellfish)		
Myakka River	1991B	Charlotte, Sarasota	Estuary	2	Bacteria (in Shellfish)		

Summary of Opportunities and Obstacles

As directed by the Strategic Plan, Charlotte County established a surface water monitoring program in 2022 to help identify water quality trends in our canal systems. Through this effort, FDEP will be able to assess many watersheds in our county previously lacking sufficient data to conduct assessments.

Most impaired waterways in Charlotte County do not have TMDLs associated with them, nor are they currently considered priorities for development of TMDLs by FDEP. Because of this, the county will need to pursue Alternative Restoration Plans to accelerate the process for improving impaired waterways.

The county lacks a comprehensive flow and water elevation monitoring program, which would help identify areas at higher risk of flooding, track tidal surge rates and risk to our coastal communities, and create a load-based assessment tool to better narrow focus on addressing waterways with the highest loading rates in the county.

Vision Task Details

Task A: *Install comprehensive water flow and elevation monitoring system to track pollutant loading rates, identify areas of flood and tidal surge risk, and calibrate/validate predictive flow and pollutant loading models.*

Estimated Cost: MEDIUM ($100,000-$1,000,000): Tidal and inland networks will cost an estimated $200,000 for the first year of installation and calibration, and $80,000-$100,000 per year for annual maintenance.

Details and Justification: Recent regional storm events have underscored the county's need for enhanced water elevation and flow monitoring systems to allow the county to better predict and prepare areas susceptible to flooding. In the immediate aftermath of Hurricane Ian, historic rainfall throughout the region caused near unprecedented levels of flooding in the Peace River, Myakka River, and Big Slough basins draining into Charlotte Harbor and breached some water control structures in North Port (Due to multiple factors involved in the history of residential lot design/development in southwest Florida, North Port's stormwater management system is hydrologically connected to Port Charlotte's system at multiple locations). This created concern among Charlotte County staff that Port Charlotte was at risk of receiving uncontrolled discharges from North Port, potentially threatening life and property if the stormwater canals responsible for managing runoff in the area were already at or near maximum capacity due to localized rain and flooding.

Nearly 1 year later, Hurricane Idalia brought moderate rainfall to the area (3–5 inches on average), which the county's stormwater system has sufficient capacity to manage. Unlike Ian, however, tidal surges helped push harbor and tidal river elevations into low-lying areas of the county, causing extensive flooding in our coastal communities. If we experience a storm that combines precipitation rates on par with Hurricane Ian in addition to tidal surges like Idalia, the flood impacts to our residents could be catastrophic.

These events highlight the need to establish mechanisms by which county Emergency Operations Center (EOC) staff can receive advance notice of potential flooding by installing telemetry-based water elevation/flow gages. No elevation gages are present in any canals in Charlotte County, preventing decision-makers at the county EOC from ascertaining the actual risk of flooding within residential areas. Only one telemetry-based water elevation station is present in the marine waters of Charlotte County, in the tidal Peace River near the Harbor Heights neighborhood. In addition, the county lacks a comprehensive stormwater flow model, and thus the EOC has relied on flow estimates from generalized models provided by the National Oceanic and Atmospheric Administration (NOAA). As these model runs predicted varying pictures of the actual flood risk to residents during Hurricane Ian, a stormwater model calibrated using data collected within Charlotte County waterways is clearly needed to accurately predict and act on future potential flood risks in our jurisdiction.

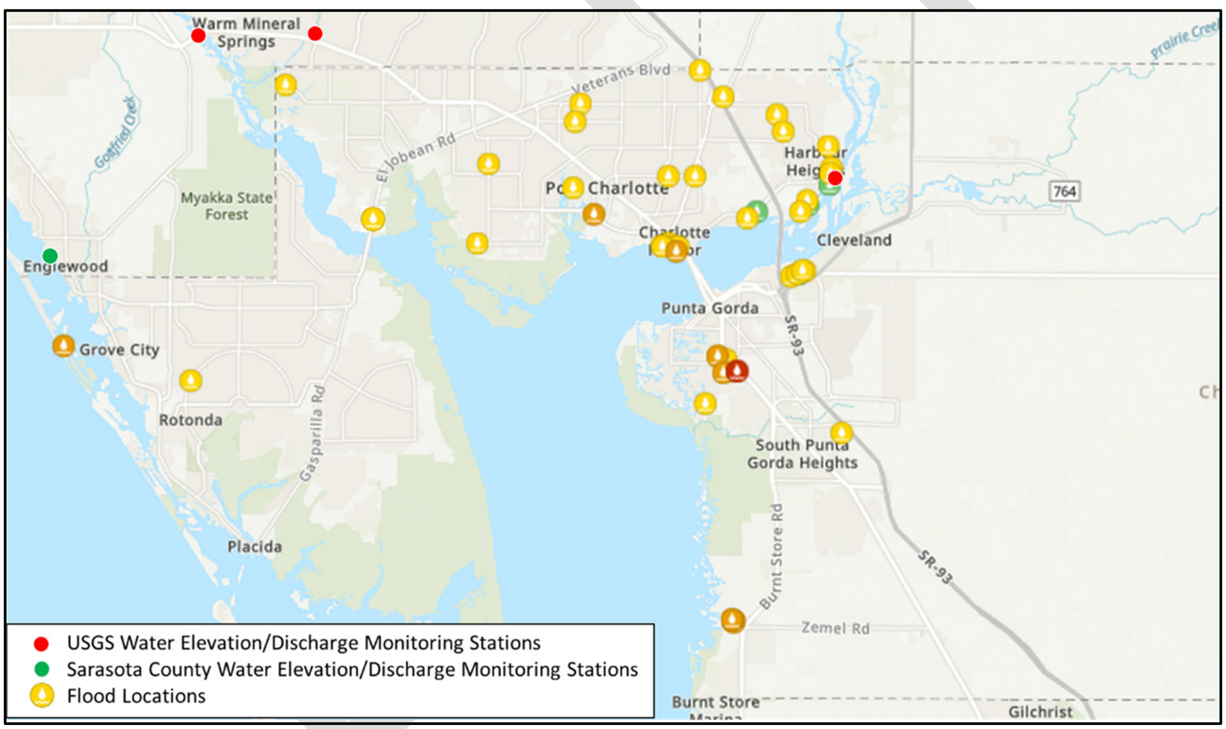

Figure 15. Reported tidal surge and stormwater flooding locations during the Hurricane Idalia weather event.

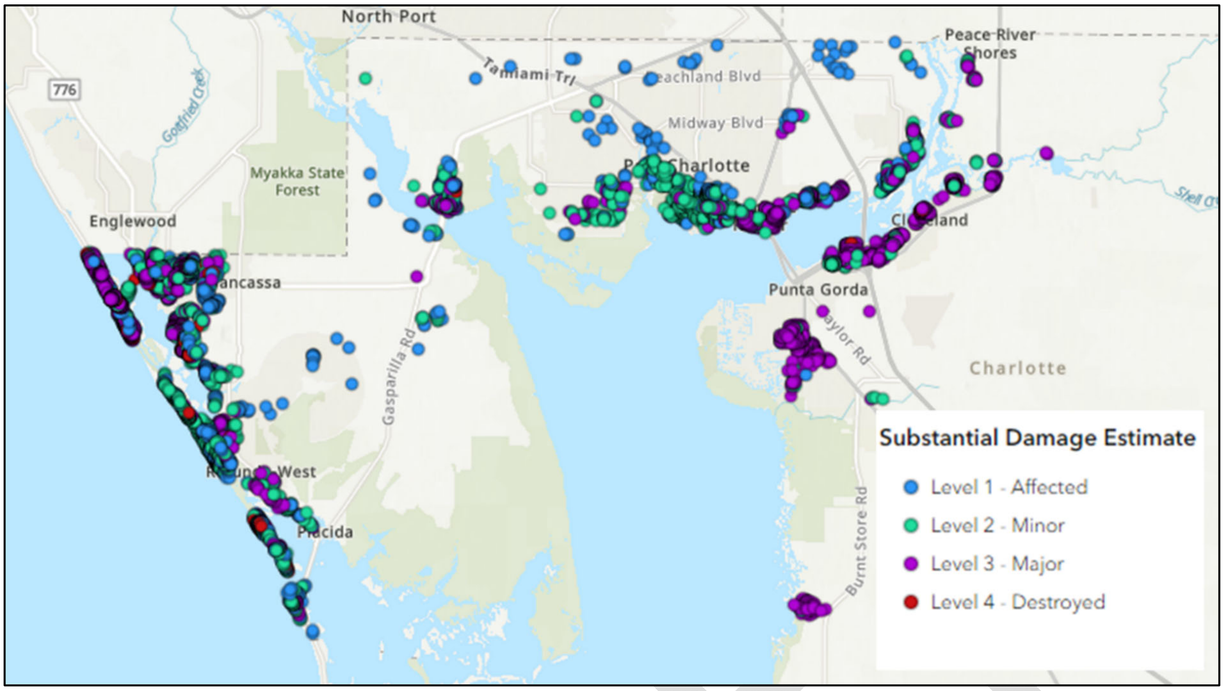

Figure 16. Residential properties damaged during the Hurricane Milton surge event.

To provide emergency response staff with the necessary tools to quickly assess and act on potential life-threatening flood events, the county is requesting funding for designing and installing a stormwater system elevation gage network and flood warning system. The County will partner with appropriate agencies and private firms to install telemetry-capable flow and/or elevation gages in tidal areas around the county such as in the Myakka River, Charlotte Harbor, and Lemon Bay. In addition, the county will work with experienced hydrologists to install telemetry-capable gages for real-time tracking of elevation and drainage capacity within our canal management system. Final locations will be determined based on review of past regional flood events in consultation with contractors experienced in designing stormwater tracking systems.

The data collected by this proposed elevation monitoring network will be used in the future development of a comprehensive stormwater model for the population centers in Charlotte County. The goal is to use this in concert with the Sarasota County and North Port existing stormwater models to complete a full Myakka River/Big Slough basin hydrodynamic stormwater model.

The data collected through this effort will also be used to develop pollutant loading models and monitoring programs to better target pollution “hot spots” that need to be addressed through the county’s One Charlotte, One Water initiative.

Task B: *Build initial iteration of the Spatially Integrated Model for Pollutant Loading Estimates (SIMPLE) pollutant loading model to identify possible sources and drivers of pollutant discharges in the county*

Estimated Development Cost: MEDIUM ($100,000-$1,000,000)

Details and Justification: To support the many goals under the One Charlotte One Water Plan, a pollutant loading model must be developed to project and track pollutant loads across the county. For mainly the same needs that Charlotte County currently has, Sarasota County (with SWFWMD) requested that Jones Edmunds develop the *Spatially Integrated*

Model for Pollutant Loading Estimates (SIMPLE). The model was originally formulated as a seasonal/annual loading model (SIMPLE-Seasonal) and later expanded to a monthly loading model (SIMPLE-Monthly). This pollutant-loading model, which has been accepted by FDEP on previous alternative restoration plans, is the clear choice to serve the County's needs and support water-quality planning. Model calibration should be conducted at least two locations where the watershed area is mostly urbanized and two where it is mostly unurbanized. To properly calibrate the model, at least a year of flow data is needed to complement the current water quality sampling.

The following describes the underlying data needed for developing the model. In some cases, additional sampling might be required to fulfill the data requirements described below; those expenses are not incorporated into the cost estimate for this task:

Rainfall Data - Rainfall is the primary driver of pollutant loads from direct runoff and is highly variable temporally and spatially. Because of its superior spatial coverage to gauge data, Next Generation Weather Radar (NEXRAD)-derived rainfall data should be used to generate direct runoff and baseflow via a hydrologic engine. NEXRAD-derived rainfall data are readily available at a relatively nominal cost.

Evapotranspiration (ET) Data - Although less important than rainfall, ET affects the amount of annual direct runoff and base flow. Daily ET data calculated using the Priestly-Taylor method on a 2-km-by-2-km pixel grid are available from the USGS Integrated Science Center.

Soils Data - Soils data are also important in calculating direct runoff and base flow. The US Department of Agriculture Natural Resources Conservation Service Soil Survey Geographic Database (SSURGO) is the most widely used and comprehensive geographic information system (GIS) layer of soils data and will be used for this project. Soils files will be used to parameterize the primary groundwater and vadose zone (infiltration) parameters.

Land Use Data - Land use affects direct runoff and base flow quantities and concentrations. SIMPLE-Monthly uses time-aware land use data so that a single land use dataset can be modeled over a long period (e.g., decades) without user intervention. Each polygon can have multiple land use attributes and corresponding start dates for when that polygon was converted to that land use. To create the time-aware land use layer, two land use layers are initially used – one from the beginning of the simulation period and one from the end. When these two layers are merged, a significant amount of cleanup is required due to inconsistencies in the layers and the number of slivers created. The final step to set up this layer is to determine when each polygon changed land use conditions.

Direct Runoff and Baseflow Time Series - Current hydrologic methods of creating time series of flow for direct runoff and baseflow will be used for the County's SIMPLE-Monthly model. Alternatively, ICPR4 models could be built with the groundwater component exercised at an increased project cost but with the benefit of greater accuracy. In addition, ICPR4 modeling can benefit flow and flood predictions to guide decision making within the stormwater, emergency management, and community development sectors of the county.

BMP Layer Data - BMPs reduce direct runoff pollutant loads and sometimes base flow pollutant loads. This layer is one of the most time-intensive to build, requiring compiling information from Environmental Resource Permitting files from SWFWMD, the South Florida Water Management District (SFWMD), and FDEP. Each BMP needs to have a polygon created showing the area it serves, the BMP type, its removal efficiencies, and the year built. Following that process, aerial photographs need to be reviewed to determine whether any significant BMPs were not captured in the initial process. Date-built data need to be estimated from available historical aerial photographs, and BMP types need to be estimated from available imagery. In addition, an analysis of pollutant attenuation in canals with control structures will need to be conducted.

Event-Mean and Baseflow Concentration Data - Event-mean concentrations (EMCs) are correlated with land use and multiplied by direct runoff volumes to predict direct runoff pollutant loads. Determining this will require sufficient baseflow concentration data for the county in addition to EMC data, derived from local flow-weighted mean data (which is not currently available) or estimates from the recently ratified stormwater rule update.

Point Source Data - Point source loads are ones that typically discharge to a single (point) location, although in some instances such as reclaimed wastewater for irrigation the 'point' source is spatially distributed. The model requires point source data for pollutants that are ultimately discharged to a surface waterbody in the County. Non-recurring point source data (e.g., spills) can also be included in this category, though analyses in other similar studies showed that spills were generally not significant enough to consider.

Irrigation Data - Irrigation is sometimes added to the model. Except for reuse, past modeling efforts have shown irrigation to be a relatively small contributor. The county will need to determine whether including non-reuse irrigation is worth the expenditure. For reuse data, this overlaps with point source data. Reuse polygons need to be created for where reuse is applied, and reuse data (flows and concentrations) from the DMRs have to be distributed to the polygons as time series.

Onsite Sewage Treatment and Disposal System (OSTDS) Data - OSTDSs contribute pollutant loads primarily through discharge to shallow groundwater tables that flow horizontally to a surface waterbody. The current septic module in SIMPLE-Monthly was developed well before the current methods that FDEP uses for BMAPs and TMDLs. FDEP's current standard guidance is that the ArcNLET model would need to be used to estimate these loads due to the large number of OSTDSs in the County.

Atmospheric Deposition Data - For watersheds with large waterbodies (e.g., Charlotte Harbor), the loading from atmospheric deposition can be significant and is important to account for. The data are generally readily available for this element, and some preprocessing is involved to pair that data with the rainfall data.

Out-of-County Loading Data – The Myakka River, Peace River, and Shell Creek have watersheds that extend well beyond the County border. If these waterbodies or Charlotte Harbor are part of future evaluations, these loads (presumably) outside the SIMPLE-Monthly model must be accounted for. That type of accounting is usually done using measure flow and concentration data.

Task C: *Coordinate with regional partners to initiate Charlotte Harbor and Lemon Bay water circulation study to determine hydrologic dynamics in areas experiencing chronic annual macroalgae and cyanobacteria blooms.*

Estimated Development Cost: MEDIUM ($100,000-$1,000,000)

Details and Justification: Over the last decade, researchers at various universities have attempted to model the hydrodynamics of Charlotte Harbor, in an effort to describe the various mechanisms impacting flow direction, water quality, and residence rates in our area. These models have identified the following:

General circulation patterns are such that water discharging from the Peace and Myakka rivers have more influence on the western portion of the Charlotte Harbor, while the eastern region of the harbor is influenced by tidal flows to/from the Gulf of Mexico.

Under certain conditions, discharges from the Caloosahatchee River might reach portions of the eastern wall of Charlotte Harbor. Two separate modeling efforts have identified this possibility, contingent on the volume of water entering the Caloosahatchee estuary and the time of year in which discharges are occurring.

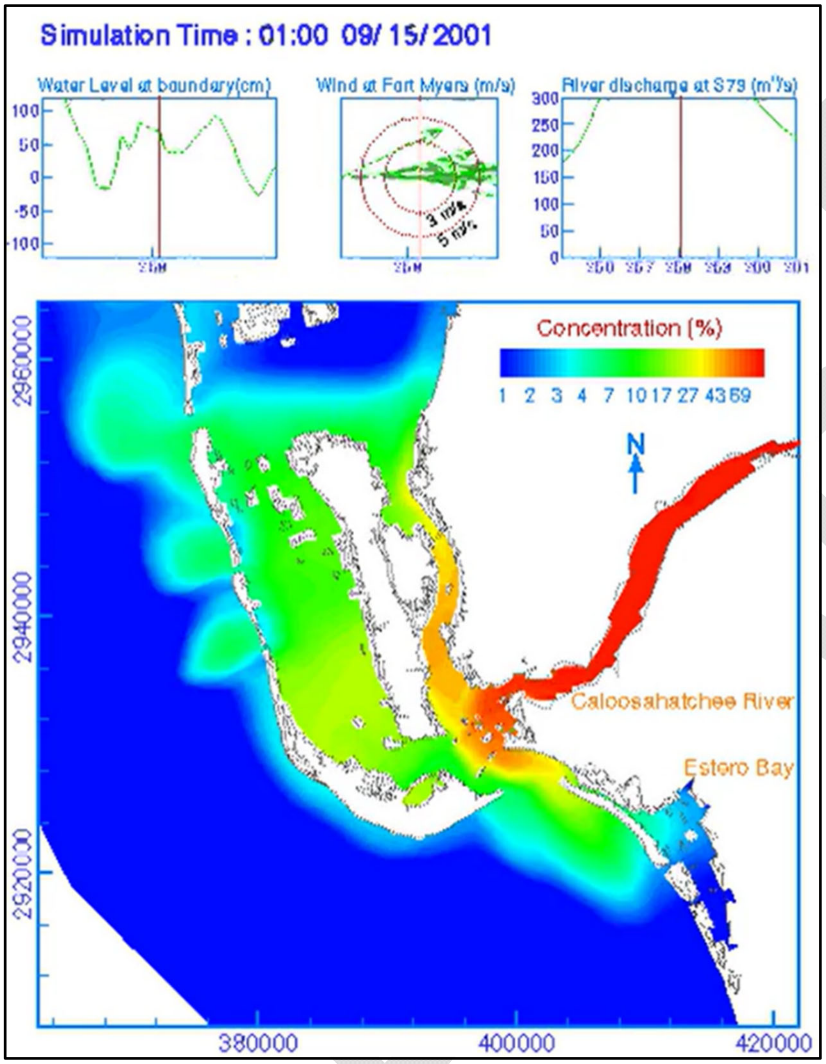

Figure 17. Predicted distribution and concentration of Caloosahatchee discharges, from Sheng et al 2010. Note the high volume of discharge from structure S-79 shown here, influencing the distribution of Caloosahatchee discharges northward into Charlotte Harbor.

In addition, recent doppler-based monitoring of tidal Peace River dynamics have revealed that:

- Tidal inflow to the Peace River is more pronounced around the Port Charlotte than Punta Gorda;
- Wind is not the only factor that can drive differences in water elevation near Port Charlotte vs Punta Gorda;
- Surge events can result in different recovery responses in different parts of the tidal Peace. During hurricane Idalia, post-surge drainage back into the harbor was detected in the mainstem of the Peace and the Port Charlotte side of the river within 24 hours of the surge event. On the Punta Gorda side of the river, however, water continued pushing northward for as long as 72 hours after the hurricane passed.

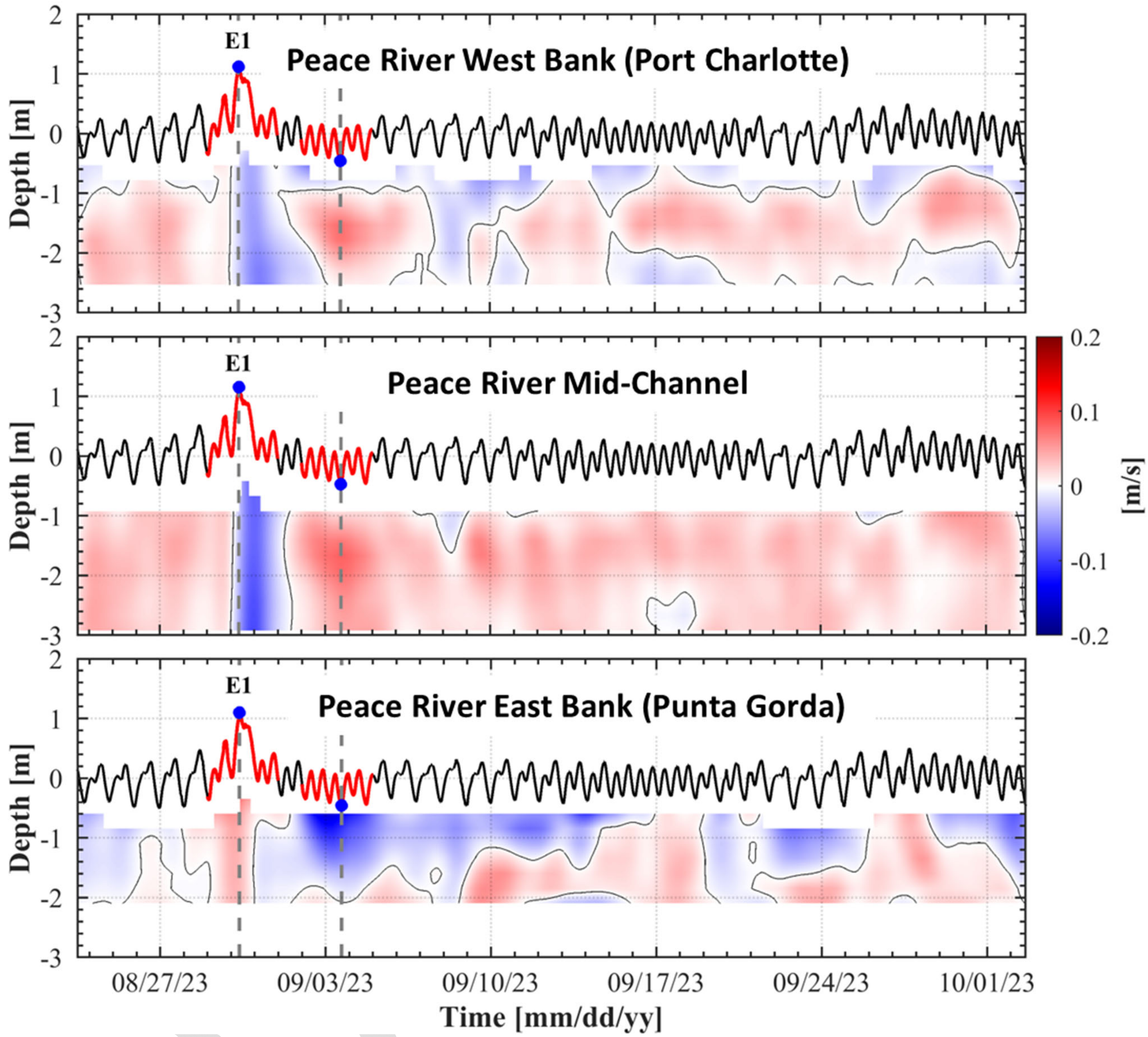

Figure 18. Measured flow velocities of a cross-section of the Peace River during Tropical Storm Idalia (labeled as "E1" on the graphs). Blue areas indicate water discharging towards Charlotte Harbor, while red areas show water flowing upstream towards DeSoto County. Note that waters along the Punta Gorda side of the river were measured flowing upstream after the Idalia surge event for as long as 72 hours post-storm, while the mid-channel and Port Charlotte portions of the river were discharging towards Charlotte Harbor.

Given the above, there is a pronounced need to refine existing predictive flow models for the Harbor and Lemon Bay, in order to better identify areas of heightened surge and flood risk, and to track potential sources of water quality impairment in regions disproportionately impacted by declining water quality (such as the east wall of Charlotte Harbor). This effort will also establish tide monitoring gauges for the Lemon Bay area, as the nearest NOAA or USGS maintained gauges are currently in the tidal Caloosahatchee and Tampa Bay.

Task D: *Begin developing restoration plans based on the prioritization described in this Plan. For impaired waterbodies recommended for TMDL development, confer with relevant partners to request FDEP's prioritization of these areas for modeling and restoration strategy development.*

Estimated Development Cost: MEDIUM ($100,000-$1,000,000)

Details and Justification:

Restoration Planning is a necessary step on the path to water quality improvement, as this process helps determine the extent, sources, and strategies needed to reduce pollutant inflow into a waterbody and sets reduction targets for each source. As the county lacks the authority to develop Total Maximum Daily Loads and Basin Management Action Plans, it is recommended to address impaired watersheds in our jurisdiction using the Reasonable Assurance Plan (RAP) approach.

The cost of a RAP is influenced by several factors. Some of the biggest factors are the magnitude of pollutant load reductions identified, and the effort required to develop a set of projects/programs that will achieve them, the number of stakeholders and number of needed stakeholder meetings, the complexity of the modeling/analysis required to determine targets and required reductions. These factors are assuming that a useable pollutant loading model already exists and that no additional monitoring/field data collection is required. A RAP for a small watershed (e.g., a few square miles) with a single key stakeholder may cost roughly $100,000-$200,000, not considering the cost of time needed from the stakeholder. A RAP for a medium-sized watershed (e.g. tens of square miles) with approximately five key stakeholders may cost roughly $500,000. A RAP for a large watershed with many key stakeholders could be in excess of $1,500,000. Current estimates to develop a RAP for the Lemon Bay watershed are approximately $400,000 for Charlotte County's portion of the Bay, while smaller waterbodies such as those in Mid-County may cost roughly $200,000-$250,000. In addition, FDEP requires annual reporting and five-year update reports for approved Plans, similar to what is conducted with BMAPs. Depending on the complexity and scale of the RAP, development of these reports may cost approximately $40,000-$80,000.

Task E: *In collaboration with regional entities responsible for monitoring and maintaining the health of Charlotte Harbor and Lemon Bay, Create Charlotte Harbor algae reduction and seagrass management strategy, to be integrated with agencies' own management strategies for restoring the health of Charlotte Harbor. Work with partner agencies to develop an annual "state of the estuary" one-pager to describe current water chemistry and ecological health of Charlotte Harbor, to maintain focus on addressing management gaps. Participate in and support implementing recommendations emerging from the regional Charlotte Harbor/Lemon Bay harmful algal bloom working group.*

Task F: *Participate in and support implementing recommendations emerging from the regional harmful algal bloom working group.*

Task G: *Partner with regional monitoring agencies as needed to create complementary, cooperative monitoring programs. Assist partner agencies in streamlining data review and management processes to maximize the efficiency and accuracy of monitoring activities in our estuary.*

Estimated Development Cost: LOW (<$100,000) NOTE: future iterations of the One Water Plan may be updated with specific project needs based on working group and partner recommendations, each with their own cost estimate that may exceed that which is described here.

Details and Justification: Many of the tasks described in this plan are centered around a key reality when protecting the quality of our waters: meaningful progress in restoring and managing the health of the Charlotte Harbor and Lemon Bay estuaries will require action by, and cooperation with, both Charlotte County and our regional partners. Since the establishment of the Water Quality Manager position, the county has been working extensively with its partners to aid, coordinate efforts, and collaborate on measures designed to improve our understanding of the drivers impacting water quality. These tasks aim to help advance those activities as a cornerstone requirement of the county's water quality management program.

This Plan also recognizes that formal regional coordination among multiple agencies and local governments can take significant time to coalesce, and action should be taken now to begin to address possible sources of nutrient loading into the Charlotte Harbor estuary. Additional work is needed within the harbor to determine drivers and management opportunities of the large-scale algae and cyanobacteria blooms impacting the estuary. The county recognizes that it has the responsibility to serve as a leader in driving forward the science and policy needed to address impairments in Charlotte Harbor.

As such, the county, in partnership with Florida Sea Grant, has organized a regional inter-agency harmful algal bloom working group such that representatives from various agencies can:

- Collaborate on identifying and addressing knowledge, management, and education/outreach gaps related to the ecological issues impacting the harbor;
- Codify agreed-upon mitigation activities into applicable management plans, allowing for additional avenues to fund said efforts;
- Inform county activities and investments into those efforts that would be most effective in reducing nutrient loading from county managed waters;
- Identify and recruit the partners necessary to build substantial, comprehensive restoration strategies for our estuaries, and;
- Through the above efforts, create the blueprint for what can serve as an impairment reduction/ecosystem restoration strategy for Charlotte Harbor, not unlike the elements of a Reasonable Assurance Plan.

It should be emphasized that this task is intended to complement the other nutrient loading reduction strategies proposed in this Plan; in effect, many of the other tasks described in this document focus on improving the water quality in county-maintained waters which discharge into Charlotte Harbor and Lemon Bay, while this task is focused on strategies to be enacted within the estuary itself and other waters not within the county's jurisdiction.

This partnership is an appropriate forum to serve as an advisory group for the creation of estuary condition reports. The Coastal and Heartland Estuary Partnership has been developing water quality and seagrass trend information dashboards, as well as summary handouts with this information. Using input from the public and One Water advisory panel (see the "Programmatic and Policy" section for more details), the county will work with agencies to refine these resources into an annual "one-pager" similar to a report card, that can be used to quickly inform citizens of the current status and trends related to the health of the harbor.

Task H: *For waterbodies indicating potential water quality impacts but for which no impairment designation has been established, determine data needs as applicable and implement enhanced monitoring in the area to support assessment by FDEP.*

Estimated Development Cost: MEDIUM ($100,000-$1,000,000); current sample collection costs to the county are approximately $7,200 per site, per year. As such, total costs of this task will vary based on the level of effort needed in each watershed of concern.

Details and Justification: As previously discussed, Charlotte County's ambient water quality monitoring program is still in in its infancy, having begun in full in July 2022. For most waterbodies in the county, the current design and budget allows samples to be collected at one location per watershed, which is used to determine the concentration of constituents entering receiving estuaries just downstream. In the event that measured concentrations at a location are nearing or exceeding its designated water quality criteria, additional sampling should be conducted to narrow down potential sources and determine

Task I: *Implement central data management, review, and storage warehouse for all water quality and quantity monitoring efforts collected or funded by the county.*

Estimated Development Cost: LOW (<$100,000)

Details and Justification: As the county's water quality data collection has increased, so too has the need for establishing mechanisms for streamlining and standardizing the process of recording, processing, and presenting this information. This task seeks to create a central repository designed to allow for ease of access to data collected by the county, facilitate the ability to compare data across multiple projects, and streamline the process for generating reports and responding to data requests. In addition, data quality review functions will be built into the system, allowing for automatic checks of both the data and supporting metadata. This will serve to standardize QC processes in the county while also expediting those efforts, so more time is spent on interpreting, rather than reviewing data collected.