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MFLs and Recovery and Prevention Strategies

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Section 373.709, Florida Statutes (F.S.), requires each South Florida Water Management District (SFWMD or District) regional water supply plan to be based on at least a 20-year planning period and include, among other items, the Minimum Flow and Minimum Water Level (MFL) criteria and associated recovery or prevention strategies adopted within the planning area. This appendix provides additional and updated information on MFLs and recovery and prevention strategies adopted for the Caloosahatchee River and Lower West Coast (LWC) Aquifers. Additional information specific to the MFLs and recovery strategies for Lake Okeechobee and the freshwater portions of ENP can be found in the *2013 Lower East Coast Water Supply Plan Update* (SFWMD 2013), which is being revised for publication in 2018.

LEGAL BASIS

Minimum Flows and Minimum Water Levels

The overall goal of Chapter 373, F.S., is to ensure the sustainability of water resources in Florida [Section 373.016, F.S.]. Chapter 373, F.S., provides the SFWMD with several tools to carry out this responsibility, including authority to establish MFLs. MFL criteria are flows or levels at which water resources or the ecology of the area would experience significant harm from further withdrawals. Significant harm is defined in Subsection 40E-8.021(31), Florida Administrative Code (F.A.C.), as the temporary loss of water resource functions, which results from a change in surface water or groundwater hydrology, that takes more than 2 years to recover, but which is considered less severe than serious harm (**Figure C-1**). Significant harm is considered more severe than the no-harm standard imposed in the water use permitting process, associated with a 1-in-10 year drought level of certainty. Therefore, MFLs in a recovered natural system would not be exceeded until rainfall conditions exceeded the 1-in-10 year drought level of certainty permitting criteria. Per Subsection 40E-8.021(17), F.A.C., an MFL exceedance means “to fall below a minimum flow or level, which is established in Parts II and III of Chapter 40E-8, F.A.C., for a duration greater than specified for the MFL water body”.

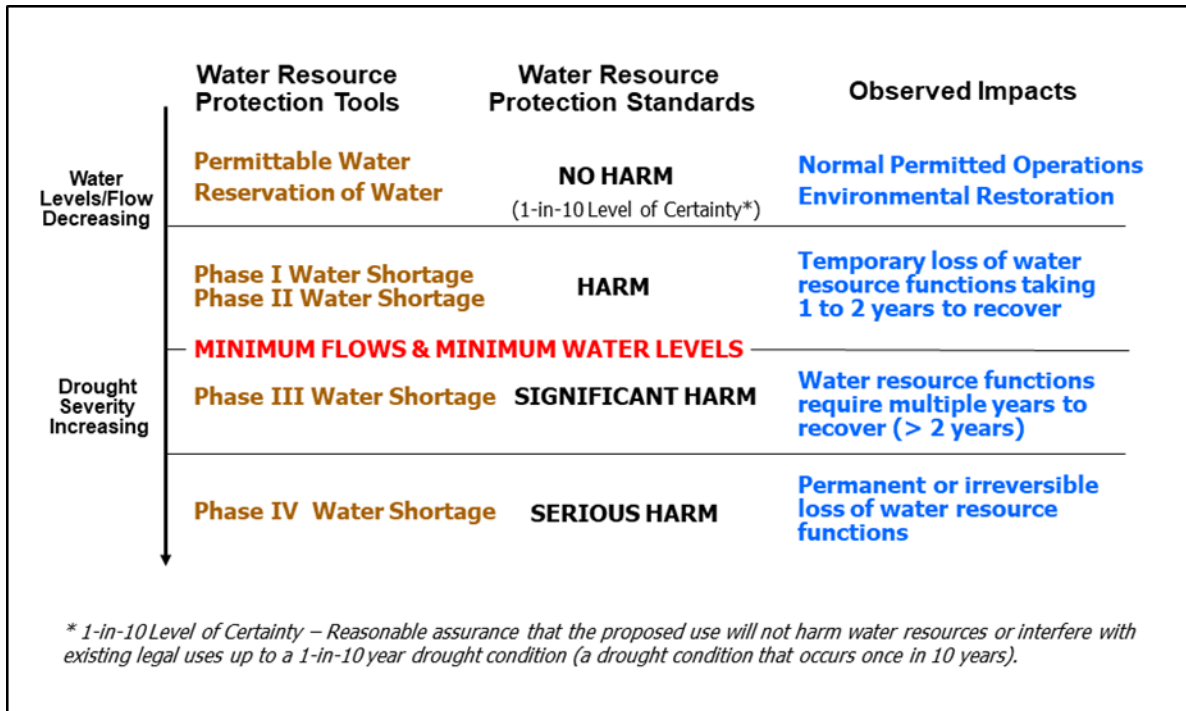


Figure C-1. Conceptual relationship among water resource protection standards at various levels of water resource harm.

Serious harm, the ultimate harm to water resources contemplated under Chapter 373, F.S., is defined as long-term, irreversible, or permanent loss to water resource functions. MFL water bodies approaching their MFL threshold criteria are factors the District Governing Board considers when contemplating water shortage restrictions. However, MFL criteria are not utilized to trigger water shortage restrictions during climatic conditions less severe than a 1-in-10-year drought. The District Governing Board may impose water shortage restrictions if an MFL exceedance occurs, or is projected to occur, during climatic conditions more severe than a 1-in-10-year drought, to the extent consumptive uses contribute to such exceedance.

MFL criteria are applied individually to affected water bodies and define the minimum flow or minimum water level for surface water bodies, or minimum water level for groundwater in aquifers. When establishing MFLs, the District Governing Board considers changes and structural alterations to watersheds, surface waters, and aquifers as well as the effects such changes or alterations have had, and the constraints such changes or alterations have placed on the hydrology of an affected watershed, surface water body, or aquifer [Section 373.0421, F.S.].

The SFWMD developed water resource protection standards, consistent with legislative direction, that are implemented in phases to prevent various levels of harm (Figure C-1). Each standard plays a role in achieving a sustainable water resource. Figure C-1 represents the conceptual relationship among the water resource protection standards, associated conditions, and water shortage severity.

The water use permitting program protects water resources from harm by ensuring water use is reasonable-beneficial, does not interfere with existing legal water uses, and is consistent with the public interest. In 2001, MFLs were adopted for four water bodies in the

LWC Planning Area: Caloosahatchee River, LWC Aquifers, Lake Okeechobee, and the freshwater portions of Everglades National Park (ENP) (Figure C-2).

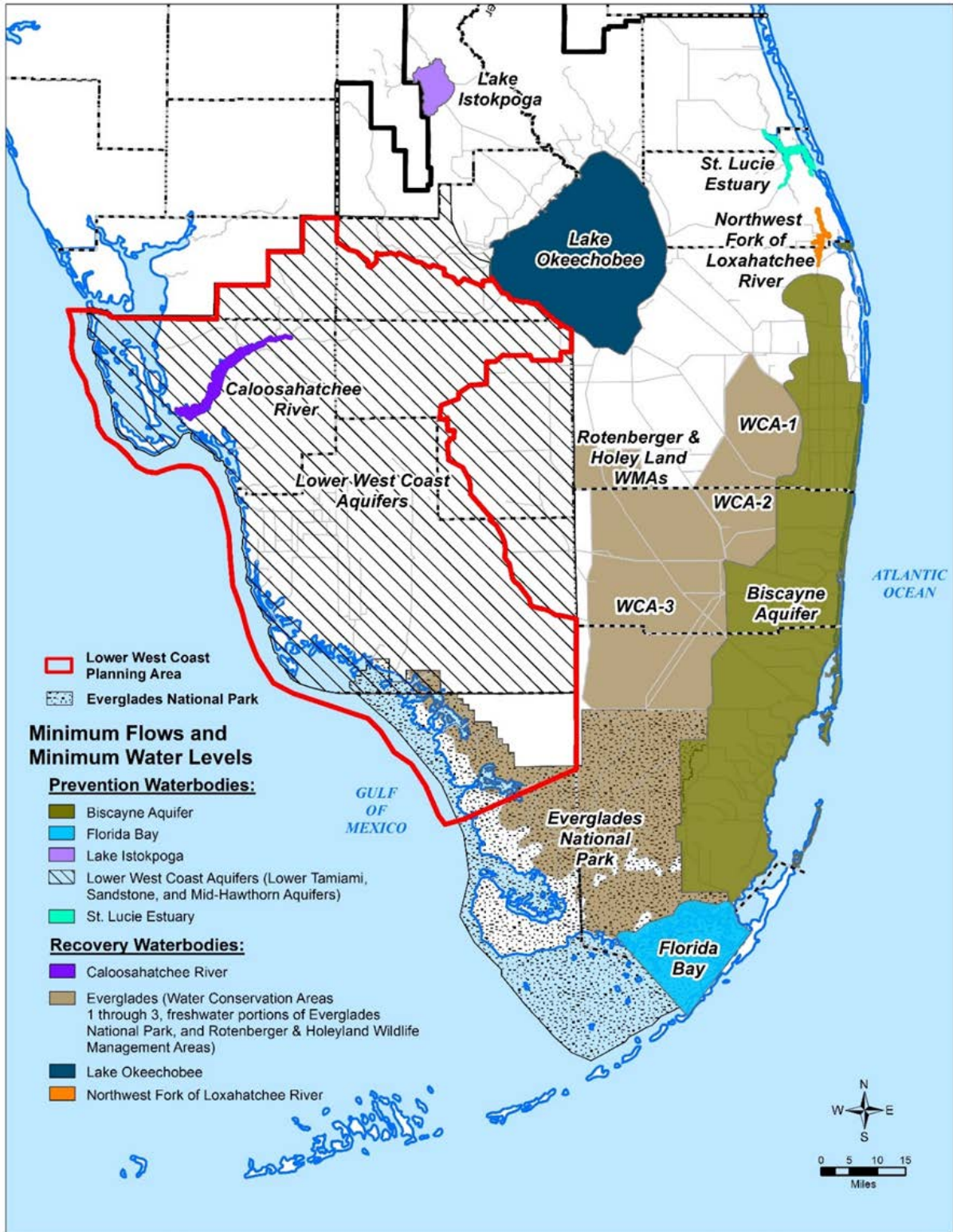


Figure C-2. Adopted Minimum Flows and Minimum Water Levels in the South Florida Water Management District.

Recovery and Prevention Strategies

Section 373.0421, F.S., requires the water management districts to develop and implement a recovery or prevention strategy for water bodies with flows or levels that are below, or are projected to fall within 20 years below, the adopted MFL criteria. Analyses of current and future conditions are conducted for each water body for which MFL criteria are defined. MFL recovery strategies are developed when MFL criteria are violated [Subsection 40E-8.021(25), F.A.C.]. MFL prevention strategies are developed when MFL criteria currently are not violated, but are projected to be violated within 20 years of the establishment of the MFL [Subsection 40E-8.021(24), F.A.C.]. The recovery or prevention strategy must include a list of projects that develop additional water supplies and other actions. The phasing or timetable for each project must be included in the strategy. Section 373.0421(2), F.S., in part, provides the following:

The recovery or prevention strategy shall include phasing or a timetable which will allow for the provision of sufficient water supplies for all existing and projected reasonable-beneficial uses, including development of additional water supplies and implementation of conservation and other efficiency measures concurrent with, to the extent practical, and to offset, reductions in permitted withdrawals, consistent with the provisions of this chapter.

Section 373.709, F.S., requires regional water supply plans to contain recovery and prevention strategies needed to achieve compliance with MFLs during the planning period. These strategies may include development of additional water supplies and implementation of conservation and other efficiency measures. The implementation of projects will allow for the orderly replacement or enhancement of existing water sources with alternative supplies to provide sufficient water for all existing and projected reasonable-beneficial uses, consistent with Section 373.0421, F.S.

In the LWC Planning Area, a prevention strategy was developed and adopted for the LWC Aquifers [Subsection 40E-8.421(4), F.A.C.], and recovery strategies were developed and adopted for the Caloosahatchee River, Lake Okeechobee, and the freshwater portions of ENP [Subsection 40E-8.421(2), F.A.C.]. MFLs for Lake Okeechobee and the freshwater portions of ENP affect portions of the LWC Planning Area but are included in the *2013 Lower East Coast Water Supply Plan Update* (SFWMD 2013), which is being revised in 2018. Recovery and prevention strategies can consist of multiple components within the following categories: capital projects, regulatory measures and requirements, water shortage measures, and environmental projects.

LOWER WEST COAST MFL WATER BODIES

Caloosahatchee River

MFL Background

In 2001, the SFWMD adopted an MFL for the Caloosahatchee River [Subsection 40E-8.221(2), F.A.C.]. The Caloosahatchee River MFL water body is defined in Subsection 40E-8.021(2), F.A.C. as the surface waters that flow through the S-79 water control structure, combined with tributary contributions below the structure that collectively flow southwest to San Carlos Bay (**Figures C-2 and C-3**). The portion of this waterway located upstream of the S-79 structure is considered the C-43 Canal.

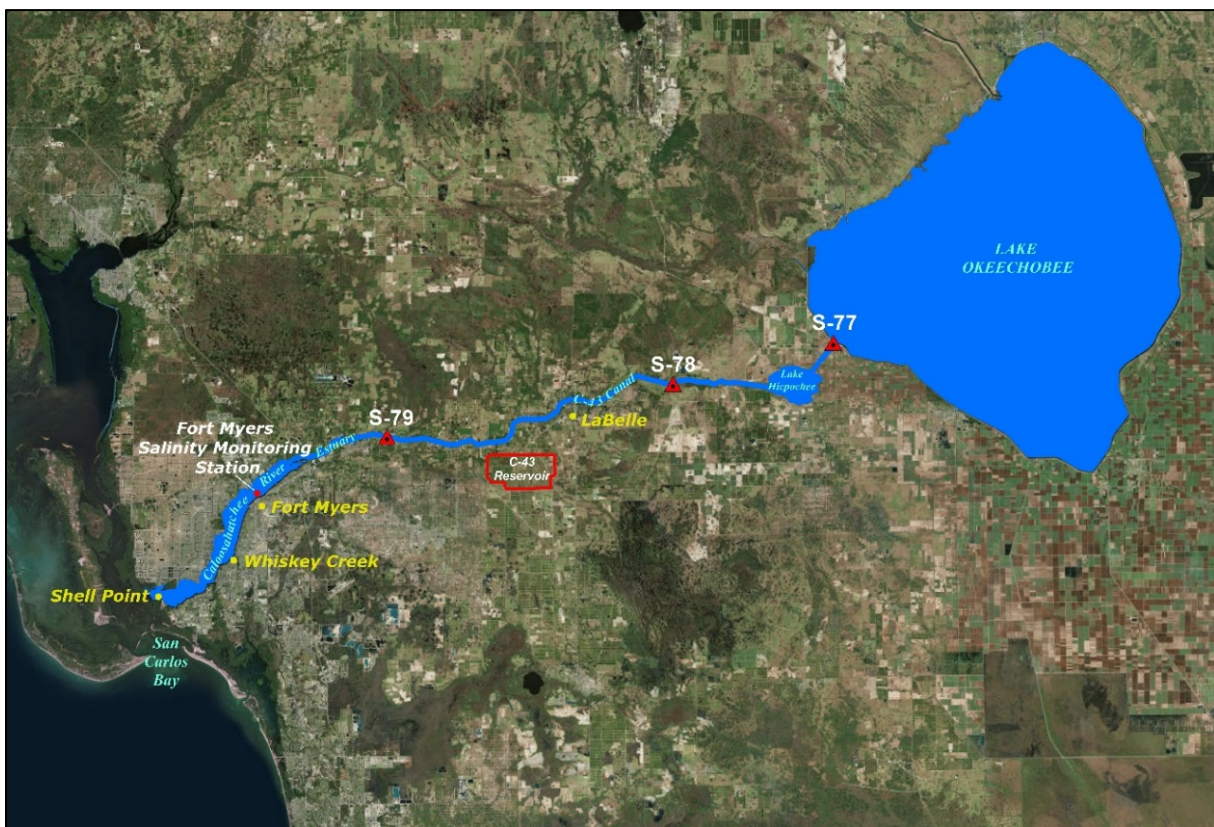


Figure C-3. Caloosahatchee River Minimum Flow and Minimum Water Level water body (downstream of S-79), showing the hydrologic connection to Lake Okechobee.

Analyses completed for the *2000 Lower East Coast Water Supply Plan* (SFWMD 2000) showed that long-term regional storage was necessary to achieve proposed MFL criteria, and that MFL violations would continue until a recovery strategy was implemented. As a result, the SFWMD projected that a recovery strategy based on construction of regional storage would be necessary to achieve the MFL. Historical information on the MFL water body and the basis of the current MFL criteria can be found in technical documentation reports available on the SFWMD website (www.sfwmd.gov; Search: Minimum Flows and Levels).

MFL Re-evaluation

A re-evaluation of the Caloosahatchee River MFL began in 2013. The re-evaluation included application of new and updated models as well as a resource-based approach to evaluate multiple indicators using historical and new data and information regarding the Caloosahatchee River. The re-evaluation sought to:

- ◆ Evaluate alterations in the Caloosahatchee River watershed and the effects on flows;
- ◆ Better understand water sources and the tidal contributions to the Caloosahatchee River;
- ◆ Assess responses of multiple ecological indicators to various flow scenarios;
- ◆ Evaluate the performance of the MFL recovery strategy; and
- ◆ Re-evaluate current MFL criteria to protect the Caloosahatchee River in light of new analyses.

SFWMD staff researched effects of flow scenarios on a suite of environmental indicators in the Caloosahatchee River, including oysters (*Crassostrea virginica*), blue crabs (*Callinectes sapidus*), ichthyoplankton, zooplankton, phytoplankton, smalltooth sawfish (*Pristis pectinata*), benthic macrofauna, and tape grass (*Vallisneria americana*). SFWMD staff also assessed the effect of low flows on the aforementioned environmental indicators and summarized the associated science (SFWMD 2018). This information was presented to the public at the Caloosahatchee Science Symposium (September 15-16, 2016) to gain public input on the completed low-flow assessment. SFWMD staff then completed additional data collection and analyses as well as model development updates, and an application to predict environmental responses to flow and salinity conditions in the Caloosahatchee River was developed. The sum of this information was included in the technical document supporting the re-evaluation (SFWMD 2018). An independent, scientific peer-review of the technical document, re-evaluation approach, and MFL criteria was conducted after the draft MFL technical document was developed. The public participated in the public peer-review session. The final peer-review report was received in October 2017.

In December 2017, the District Governing Board authorized rulemaking to revise the MFL rule [Subsection 40E-8.221(2), F.A.C.]. The public participated in the rulemaking effort during two rule development workshops. In September 2018, the District Governing Board adopted a minimum flow criterion of 400 cubic feet per second (cfs) at the S-79 structure and revisions to the duration and return frequency components. A rule challenge was filed, and an administrative hearing occurred in October 2018. In March 2019, the Administrative Law Judge issued a final order and determined the rule was a valid exercise of delegated legislative authority.

In April 2019, the District Governing Board directed staff to further engage with stakeholders and consider different mathematical and statistical approaches, within the framework of the existing science, to increase the minimum flow above 400 cfs. SFWMD staff held three additional public workshops (May, June, and September 2019) and presented the additional statistical approach and revised rule language to the District Governing Board at its October 2019 meeting. The revised rule language proposes the development of a research and monitoring plan, and the Caloosahatchee River MFL recovery strategy must be modified to include the monitoring plan. Additionally, initial modeling of C-43 Reservoir performance with a modified minimum flow of 457 cfs indicates additional storage may be necessary. The SFWMD proposed further amendment of the recovery strategy to include development of a

water control plan for the C-43 Reservoir and evaluations to 1) determine if additional storage is needed, and 2) identify potential projects to provide such additional storage.

The revised MFL rule is expected to go before the District Governing Board for adoption on October 10, 2019. Further information about the MFL and re-evaluation can be found on the SFWMD website (www.sfwmd.gov; Search: Minimum Flows and Levels).

Recovery Strategy

The recovery strategy for the Caloosahatchee River MFL includes the following components:

- ◆ The Caloosahatchee River MFL Research and Monitoring Plan (SFWMD 2019) will evaluate indicator responses to freshwater inflows and will be implemented before and after operation of the C-43 Reservoir during the wet and dry seasons;
- ◆ Regulatory constraints on the consumptive use of water from the C-43 Reservoir with the adoption of a Water Reservation [Subsection 40E-10.041(3), F.A.C.] to protect the water for environmental purposes;
- ◆ Capital projects such as the C-43 Reservoir that are designed to capture excess water during the wet season and make environmental deliveries during the dry season to provide a stable salinity regime; and
- ◆ Development of a water control plan governing operation of the C-43 Reservoir.

The timeline for completion of the modified recovery strategy components is provided in **Table C-1**.

Table C-1. Timeline of the Caloosahatchee River MFL modified recovery strategy components.

Completed	Near Term (2020-2024)	Long Term (2022-2027)
Obtain project funding and initiate construction of the C-43 Reservoir	Implement baseline MFL Research and Monitoring Plan (2020-2024)	If needed, evaluate project(s) to meet potential unmet requirements – storage, volume, and type (2022-2023)
Establish water reservation rule for the C-43 Reservoir	Complete construction of the C-43 Reservoir (2020-2023)	Select additional project(s) and obtain federal and/or state funding for selected project(s), if needed (2024)
	Develop C-43 Reservoir Water Control Plan (2021)	Complete C-43 Reservoir testing (2024)
	Re-assess C-43 Reservoir performance (2022)	Implement post-operation MFL research and monitoring plan (2025-2027)
		Design and construct selected project(s) (2024-2027)

MFL = Minimum Flow and Minimum Water Level.

Completed

Project Funding and Initiation of Construction

Project funding for the C-43 Reservoir was obtained in 2014 and construction of the reservoir began in 2015. Construction is expected to be complete by 2023.

Water Reservation

A Water Reservation for the C-43 Reservoir was adopted in 2014. The rule reserves all water within and released from the reservoir for the benefit fish and wildlife in the Caloosahatchee River downstream of the S-79 structure. Consumptive uses are prohibited from using the reserved water.

Near Term (2020-2024)

Implement Baseline Component of the Caloosahatchee River MFL Research and Monitoring Plan (2020-2024)

In 2020, the SFWMD will begin implementing the baseline component of the Caloosahatchee River Research and Monitoring Plan. This component will provide additional information about the ecological indicators in the mesohaline and oligohaline zones of the upper estuary before additional freshwater flows are released from operation of the C-43 Reservoir. The Research and Monitoring Plan incorporates the peer-review recommendations provided in the 2017 Final Peer Review Report (Buskey et al. 2017) for monitoring future ecological indicators. SFWMD staff will revise and update the Caloosahatchee River Research and Monitoring Plan as needed to reflect results of the initial studies, current scientific evaluations, and a review of any remaining knowledge gaps and uncertainties.

C-43 Reservoir Construction Completion (2020-2023)

In 2001, when the MFL for the Caloosahatchee River was adopted, the MFL criteria were projected to be exceeded until storage could be constructed and operated in the watershed to capture excess surface water flows for release to the river during times of need. Therefore, a recovery strategy was adopted for the river simultaneously with MFL adoption. The storage project identified at that time was the Comprehensive Everglades Restoration Plan (CERP) Caloosahatchee River (C-43) West Basin Storage Reservoir. CERP identifies restoration of the Caloosahatchee River as an integral step in achieving system-wide benefits in the South Florida ecosystem. Promoting a balanced and healthy salinity regime in the Caloosahatchee River is essential for maintaining the ecological integrity and associated economic benefits of this unique habitat on Florida's southwest coast. Construction of the Caloosahatchee River (C-43) West Basin Storage Reservoir serves to address these CERP objectives as well as SFWMD objectives to improve flows to the Caloosahatchee River to meet MFL criteria. The SFWMD is the state-designated local sponsor of the reservoir project with the United States Army Corp of Engineers (USACE).

The reservoir site is located on a 10,700-acre parcel, formerly known as Berry Groves, in Hendry County, southwest of the S-78 structure and the City of LaBelle, as shown in **Figure C-4** and described in Appendix 1-12 of Chapter 40E-10, F.A.C.

Flows to the Caloosahatchee River will be moderated through capture of surface water flows and a portion of Lake Okeechobee releases in the reservoir during wet periods, and release of water from the reservoir to the Caloosahatchee River during dry periods. This will provide a more natural, consistent flow of fresh water to the Caloosahatchee River and a more balanced salinity regime by improving the timing, quality, and quantity of water inflows.

Key features of the reservoir include the following:

- ◆ 170,000 acre-feet of water storage (>55 billion gallons) stored in two cells (**Figure C-5**)
- ◆ Normal pool depth when full: 15 to 25 feet
- ◆ External and internal embankments and canals
- ◆ Two pump stations (S-470 and S-476)
- ◆ Sixteen internal control and outflow water control structures
- ◆ Environmental features to provide fish and wildlife habitat and recreational opportunities for the public

As stated earlier, C-43 Reservoir construction started in 2015. Finalizing construction of the C-43 Reservoir is a high a priority for the SFWMD. The reservoir is scheduled to be completed in 2023. The State provided funding to expedite completion of the project in advance of receipt of federal costs share monies. The total construction cost associated the C-43 Reservoir is approximately \$725 million.

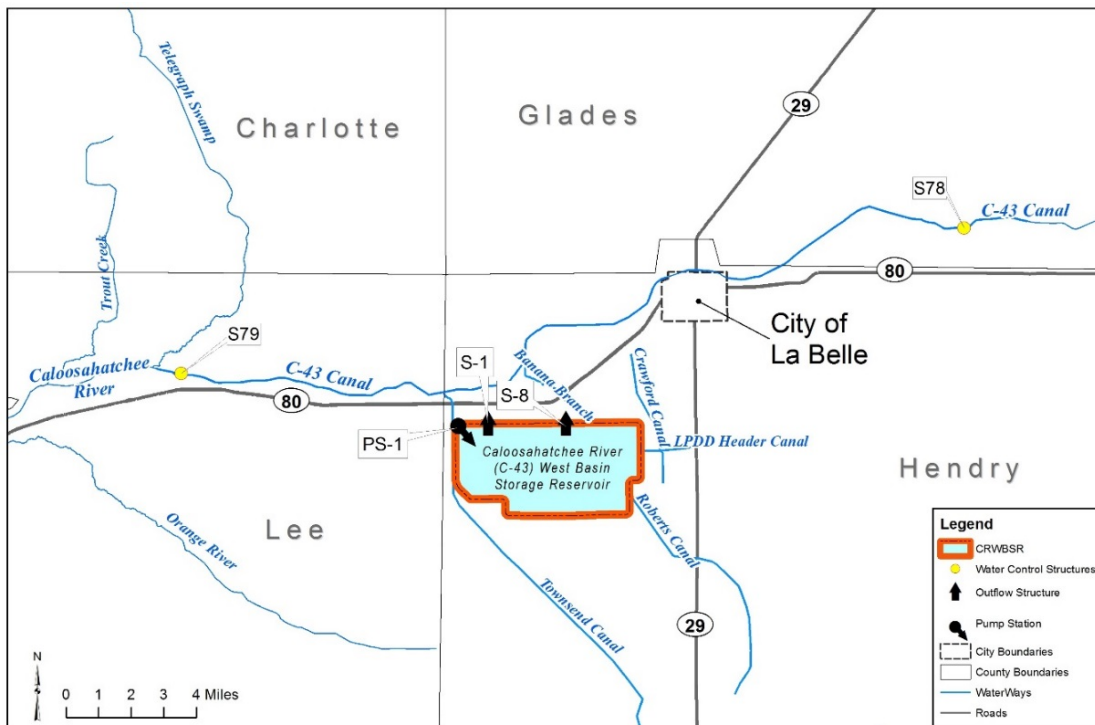


Figure C-4. Location of the Comprehensive Everglades Restoration Plan Caloosahatchee River (C-43) West Basin Storage Reservoir.

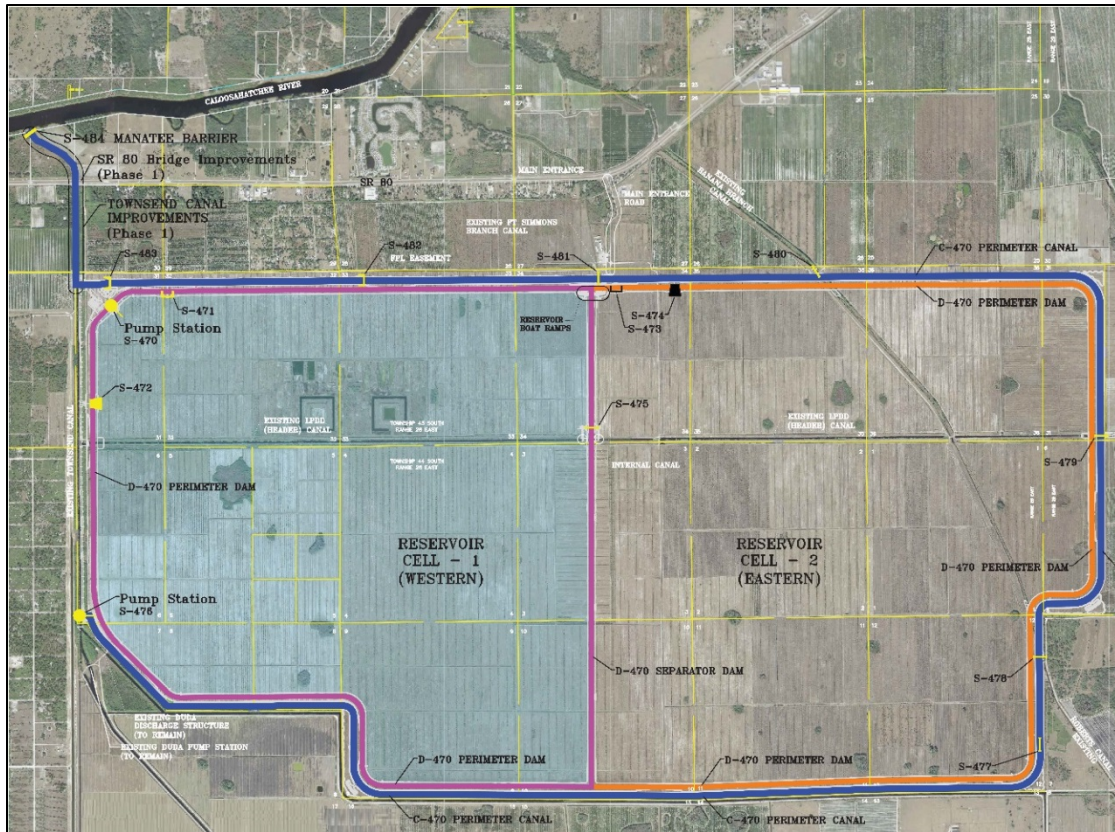


Figure C-5. Caloosahatchee River (C-43) West Basin Storage Reservoir site plan.

Development of a Water Control Plan (2021)

A critical component of the C-43 Reservoir is the development of the Water Control Plan (also known as the Project Operation Manual). Significant work will be required to develop this plan in partnership with the USACE. The operation plan will incorporate the 2008 Lake Okeechobee Regulation Schedule or the Lake Okeechobee System Operating Manual update, if completed (targeted for 2022), and the Water Reservation requirements. Once the Water Control Plan has been completed, it will be submitted to the Florida Department of Environmental Protection with a future Operations Permit application for operation of the C-43 Reservoir.

Re-assess C-43 Reservoir Performance (2022)

This component of the recovery strategy will be implemented following completion of the Water Control Plan to re-assess the C-43 Reservoir's performance in meeting the MFL. Additional storage may be required as the C-43 Reservoir originally was designed to deliver 450 cfs. This assessment is expected to require a modeling evaluation to determine the additional storage needed to meet the MFL (i.e., to ensure that the MFL is not violated). The appropriate modeling tool(s) will be used and evaluated to understand additional storage requirements to meet the MFL.

Long Term (2022-2027)

Evaluate Project to Meet Potential Unmet Requirements – Storage Volume and Type (2022-2023)

This component of the recovery strategy involves evaluation of potential water resource development projects within the C-43 watershed (upstream of the S-79 structure) to provide additional storage, if needed, to meet the MFL. Project location(s) will be within the Caloosahatchee Watershed (**Figure C-6**). This component includes evaluating of the potential storage capacities and types associated with each project using a preliminary design. The types of storage that will be evaluated to meet any storage deficit include shallow and deep storage along with the storage benefits associated with aquifer storage and recovery.

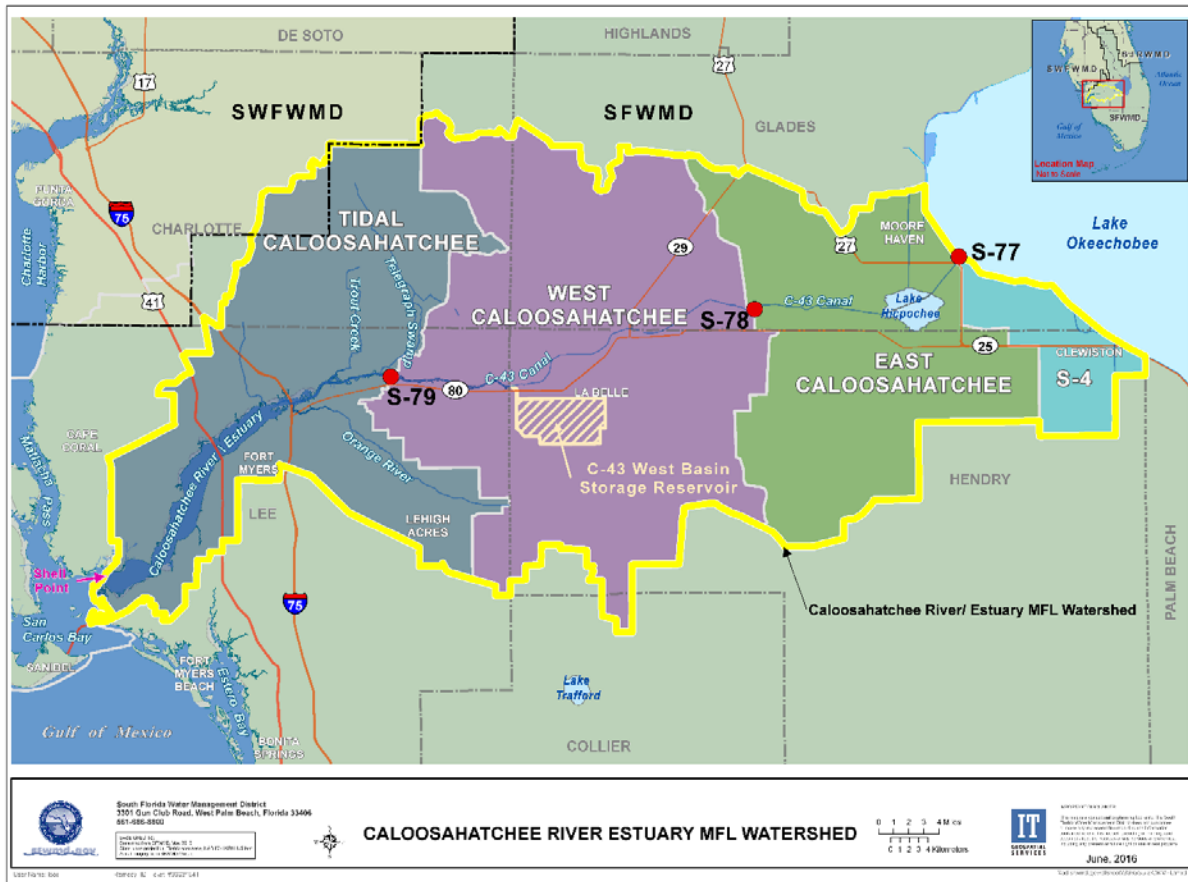


Figure C-6. Caloosahatchee River MFL Watershed.

Select Additional Project(s) and Obtain Federal and/or State Funding for Selected Projects, If Needed (2024)

This component of the recovery strategy involves the selection of appropriate projects to fulfill the potential unmet storage needs to meet the MFL, as needed. The specific projects will be determined based on the amount of storage each project is capable of providing based on preliminary design information. This component also involves obtaining federal and/or state funding to complete the project(s).

Complete Operational Testing of the C-43 Reservoir (2024)

Once construction of the C-43 Reservoir is complete, a testing period is necessary to ensure the reservoir can be operated as envisioned and to determine if additional efficiencies are possible. Final testing of all infrastructure to ensure it will operate as designed and constructed is expected to take at least 1 year.

Implement Post-Operation Caloosahatchee River MFL Research and Monitoring Plan (2025-2027)

This phase of the Research and Monitoring Plan (SFWMD 2019) will be implemented after construction of the C-43 Reservoir has been completed and the reservoir is operational. The purpose of this phase is to understand the responses of ecological indicators to increased freshwater flows from the reservoir within the mesohaline and oligohaline zones of the upper estuary.

Design and Construction of Selected Projects (2024-2027)

This component of the recovery strategy is the last step in the Long Term portion of the MFL recovery strategy. Once funding is secured, project design and construction will be initiated. The design and permitting of large-scale projects can take 1 to 2 years to complete. Once all appropriate state and federal permits have been issued, the construction process begins. Construction of large-scale projects can take 2 to 3 years. Once construction is complete, the project will enter a testing phase (as described below for the C-43 Reservoir) to ensure the infrastructure is meeting design specifications.

Further information about the MFL recovery strategy for the Caloosahatchee River, including the Research and Monitoring Plan, can be found on the SFWMD website (www.sfwmd.gov; Search: Minimum Flows and Levels) and in Subsection 40E-8.421(2), F.A.C. More information on the Water Reservation rule can be obtained in Subsection 40E-10.041(3), F.A.C., and on the SFWMD website (www.sfwmd.gov; Search: Water Reservations). Information specific to the Caloosahatchee River CERP (C-43) West Basin Storage Reservoir project is available at www.evergladesrestoration.gov and in USACE (2016).

Lower West Coast Aquifers

MFL Criteria

The LWC Aquifers (**Figure C-2**) comprise the Lower Tamiami, Sandstone, and Mid-Hawthorn aquifers. In 2001, the SFWMD adopted an MFL specifying that the minimum water levels for

the LWC Aquifers must equal the structural top of the aquifers [Subsection 40E-8.331, F.A.C.]. In 2015, the SFWMD published a set of regional maps (**Figures C-7 to C-9**) indicating the elevation of the structural top of the Lower Tamiami, Sandstone, and Mid-Hawthorn aquifers (Geddes et al. 2015). The maps were developed based on the best hydrogeologic information available at the time; however, local and isolated variations in aquifer elevations may not be depicted on the maps as they are regional in nature and new data may be available.

A violation of the MFL criteria occurs when water levels in the aquifers drop below the top of the uppermost geologic strata that composes the aquifer at any point in time. Water level measurements used to determine the conditions of the aquifers for the purpose of this rule are collected no closer than 50 feet from any existing pumping well, as required pursuant to Rule 40E-8.331, F.A.C. Further information about the MFL for the LWC Aquifers can be found on the SFWMD website (www.sfwmd.gov; Search: Minimum Flows and Levels).

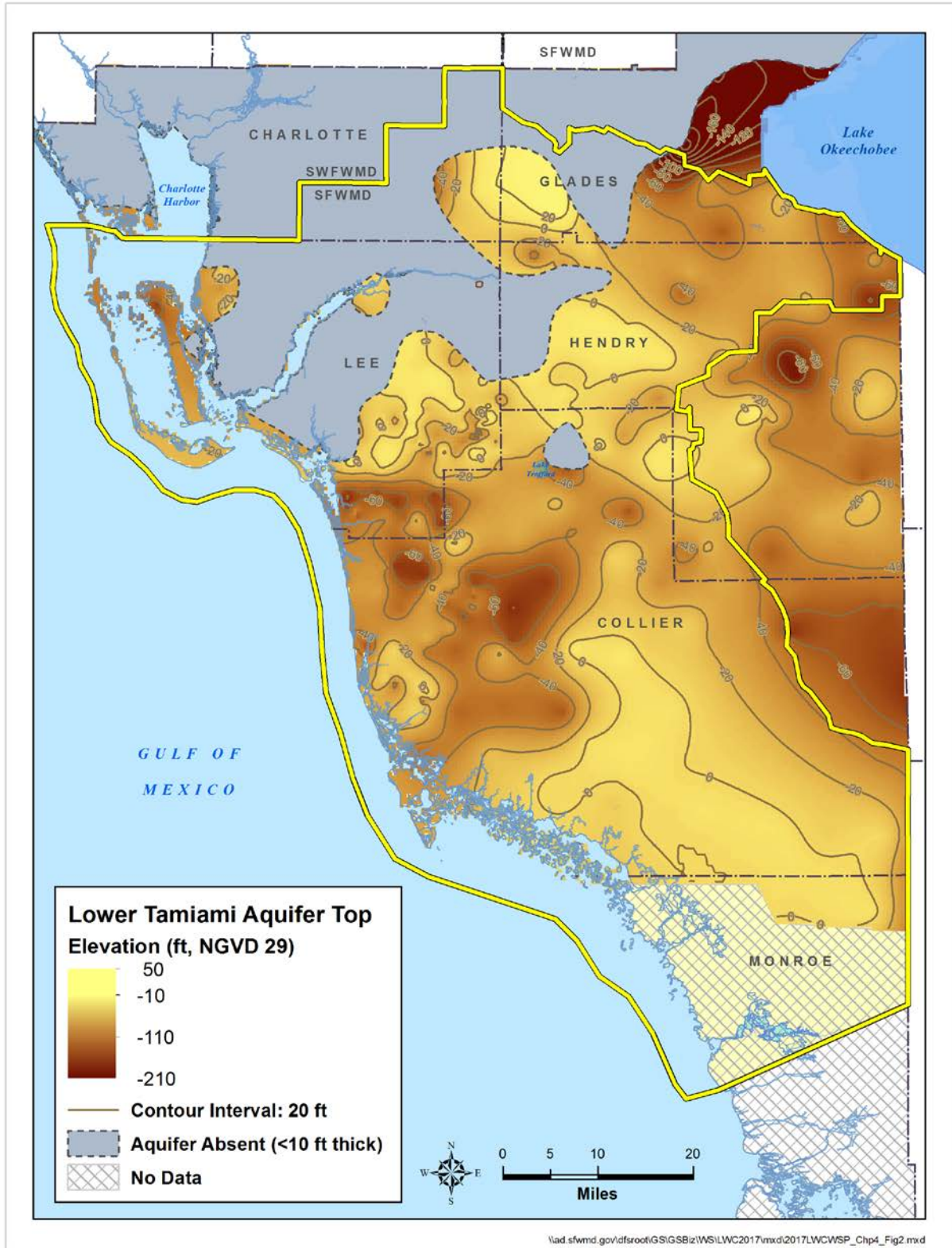


Figure C-7. Structural top of the Lower Tamiami aquifer in the Lower West Coast Planning Area.

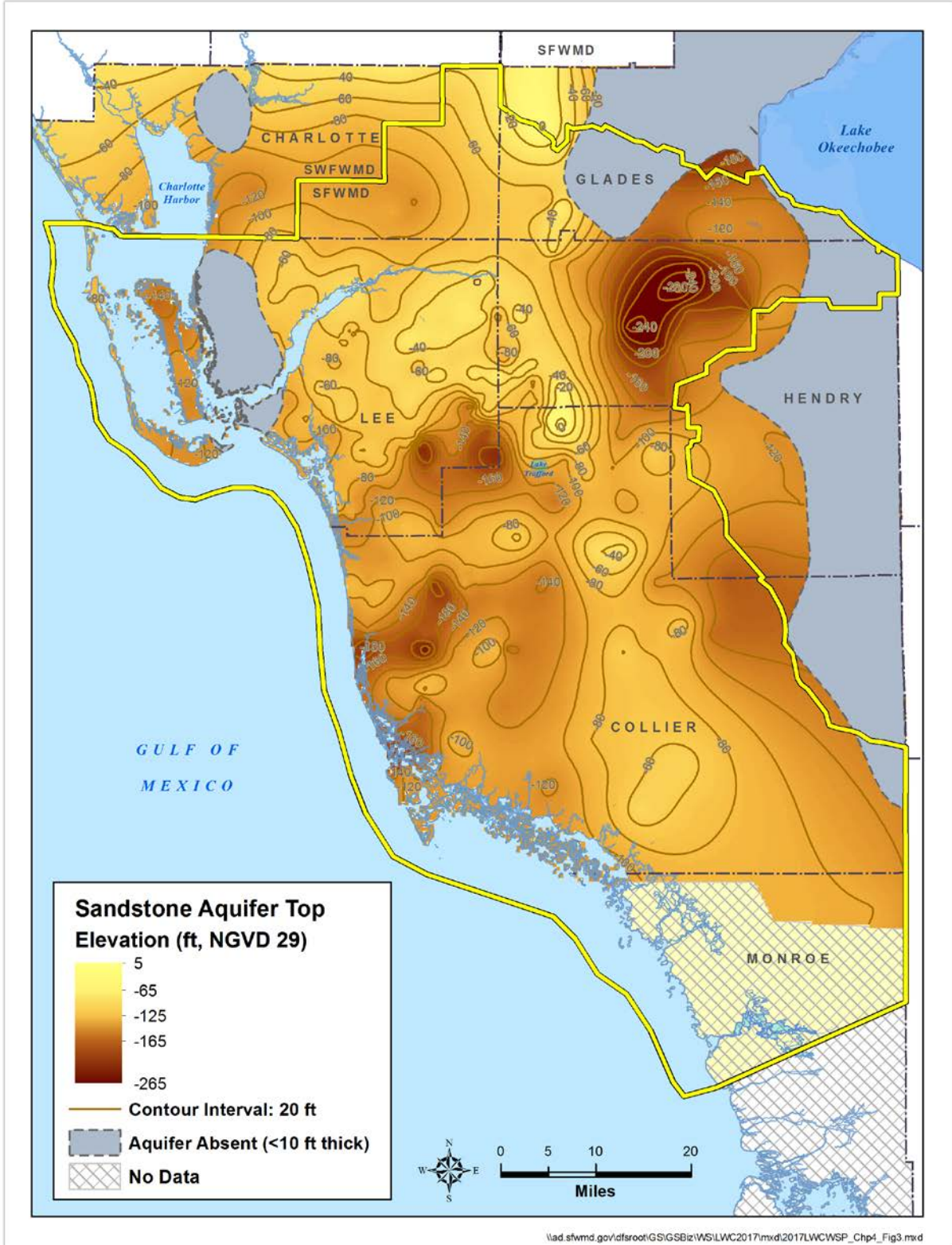


Figure C-8. Structural top of the Sandstone aquifer in the Lower West Coast Planning Area.

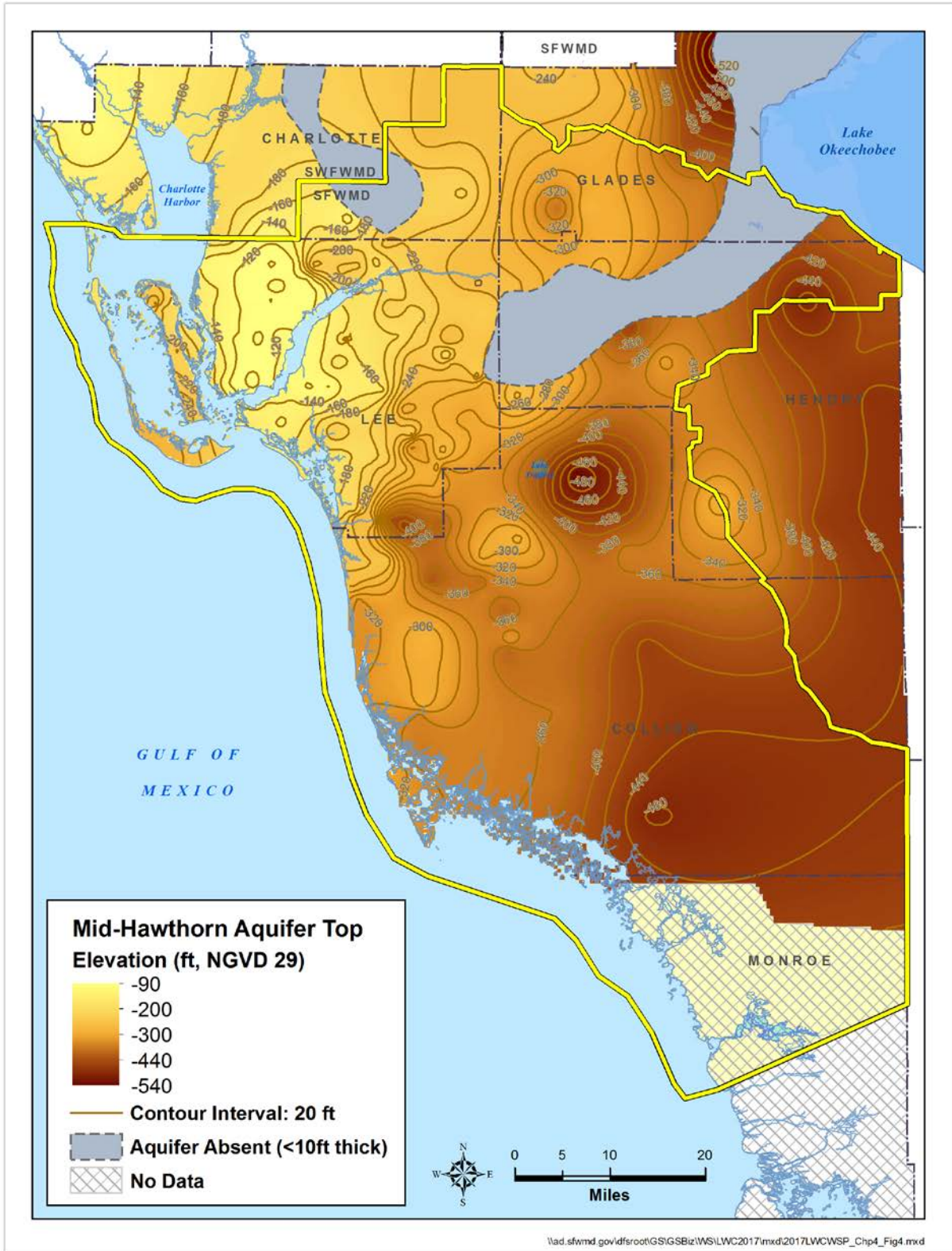


Figure C-9. Structural top of the Mid-Hawthorn aquifer in the Lower West Coast Planning Area.

Prevention Strategy

In 2001, when the MFL for the LWC Aquifers was adopted, the water level criteria of the MFL were not violated, and current water levels in the aquifers are well above the MFL criteria (Chapter 6 of the plan update). However, to minimize the likelihood of a violation and to prevent water levels within the aquifers from declining below the MFL criteria in the future, a prevention strategy was adopted for the aquifers simultaneously with the MFL [Subsection 40E-8.421(4), F.A.C.]. The prevention strategy for the aquifers consists of the following components:

- ◆ Establish “no harm” maximum permittable levels for each aquifer (regulatory levels) for a 1-in-10 year drought level of certainty
- ◆ Implement rule criteria to prevent harm through the water use permitting process, including conditions for permit issuance in Rule 40E-2.301, F.A.C.
- ◆ Construct and operate water resource and supply development projects
- ◆ Implement the water shortage plan in Chapter 40E-21, F.A.C., as needed to prevent serious harm during drought conditions in excess of a 1-in-10 year drought level of certainty

In order to prevent the LWC Aquifers from falling below the minimum water level, the SFWMD adopted Maximum Developable Limits (MDLs) in 2003. The MDLs, contained in the *Applicant’s Handbook for Water Use Permit Applications within the South Florida Water Management District* (Applicant’s Handbook; SFWMD 2015), prohibit water withdrawals that lower the potentiometric head (water level) within the Lower Tamiami, Sandstone, and Mid-Hawthorn aquifers to less than 20 feet above the top of the uppermost geologic strata of the aquifer at any point during a 1-in-10 year drought condition. MDLs are permitting constraints that prevent the region’s aquifers from experiencing harm due to withdrawals. Further details about the prevention strategy for the LWC Aquifers can be found on the SFWMD website (www.sfwmd.gov; Search: Minimum Flows and Levels) and in Subsection 40E-8.421(4), F.A.C.

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