Draft

Fecal Indicator Bacteria TMDLs for the Everglades West Coast Basin

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Executive Summary

This report documents fecal indicator bacteria (FIB) Total Maximum Daily Loads (TMDLs) for surface waterbodies that do not meet bacteriological quality criteria designed to protect human health, as defined in the State's Surface Water Quality Standards (Chapter 62-302, F.A.C.). Fresh and marine waters that do not meet applicable FIB criteria are included on the state's comprehensive verified list of impaired waters. The focus of the current TMDL development effort are waters located in the Everglades West Coast Basin in southwest Florida. This report will be expanded into a consolidated report documenting FIB TMDL development for fresh and marine waters throughout the state that do not meet the applicable criteria.

The TMDLs presented in this report are for individual waterbody segments that are impaired for not meeting the applicable water quality criteria for *Escherichia coli* (*E. coli*), enterococci, or fecal coliform bacteria. The TMDLs are set at the existing FIB criteria in Chapter 62-302, F.A.C., applicable to the impaired waters. The TMDLs are expressed as concentration-based restoration targets (**Table EX-1**) that are consistent with the expression of the bacteriological criteria used to perform the surface water assessment resulting in the impairment listing. Additionally, TMDL reduction targets (percent reductions) in bacteria counts are identified for individual impaired waterbodies that are necessary to meet the applicable FIB criteria.

The report also provides general information on common bacteria sources and provides a web link to a Story Map showing the locations of waterbodies addressed by the FIB TMDLs and provides geographic information about potential sources of bacteria contributions to surface waters. This information serves as an aid for developing TMDL implementation strategies to control pollution.

Table EX-1. TMDL components for FIB impairments

[1] The TMDL applies to impaired waterbodies where the data exceed the applicable TPTV criterion in Subsection 62-302.530(6), F.A.C.
[2] The TMDL applies to impaired waterbodies where the median value of the data exceed the applicable criterion in Subsection 62-302.530(6), F.A.C.

Parameter	TMDL Target (counts/100mL)	WLA for Wastewater (counts/100mL)	WLA for NPDES Stormwater (counts/100mL)	LA (counts/100mL)	MOS
***E. coli* Bacteria**	410 (for MPN or MF counts)[1]	Must meet permit limits when applicable	410 for areas covered by MS4 permit	410	Implicit
Enterococci Bacteria	130 (for MPN or MF counts)[1]	Must meet permit limits when applicable	130 for areas covered by MS4 permit	130	Implicit
Fecal Coliform Bacteria	31 (for MF counts)[1]	Must meet permit limits when applicable	31 for areas covered by MS4 permit	31	Implicit

Parameter	TMDL Target (counts/100mL)	WLA for Wastewater (counts/100mL)	WLA for NPDES Stormwater (counts/100mL)	LA (counts/100mL)	MOS
Fecal Coliform Bacteria	43 (for MPN counts)[1]	Must meet permit limits when applicable	43 for areas covered by MS4 permit	43	Implicit
Fecal Coliform Bacteria	14 (for MPN or MF counts)[2]	Must meet permit limits when applicable	14 for areas covered by MS4 permit	14	Implicit

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List of Abbreviations and Acronyms

µmhos/cm	Micromhos Per Centimeter
BPCP	Bacteria Pollution Control Plan
BMAP	Basin Management Action Plan
BMP	Best Management Practice
CAFO	Concentrated Animal-Feeding Operation
CFR	Code of Federal Regulations
Counts/100mL	Counts Per 100 Milliliters
CWA	Clean Water Act
DEP	Florida Department of Environmental Protection
E. coli	*Escherichia coli*
EPA	U.S. Environmental Protection Agency
F.A.C.	Florida Administrative Code
FDACS	Florida Department of Agriculture and Consumer Services
FIB	Fecal Indicator Bacteria
F.S.	Florida Statutes
FWRA	Florida Watershed Restoration Act
GIS	Geographic Information System
HUC	Hydrologic Unit Code
IWR	Impaired Surface Waters Rule
LA	Load Allocation
MF	Membrane Filter
mg/L	Milligrams Per Liter
MPN	Most Probable Number
MOS	Margin of Safety
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
OSTDS	Onsite Sewage Treatment and Disposal System
PLRG	Pollutant Load Reduction Goal
SSAC	Site Specific Alternative Criteria
SSO	Sanitary Sewer Overflow
SWIM	Surface Water Improvement and Management (Program)
TPTV	Ten Percent Threshold Value
TMDL	Total Maximum Daily Load
USGS	U.S. Geological Survey
WBID	Waterbody Identification (Number)
WLA	Wasteload Allocation
WWTF	Wastewater Treatment Facility

Chapter 1: Introduction

1.1 Purpose of Report

This report presents the total maximum daily loads (TMDLs) for individual waterbody segments, identified by waterbody identification numbers, or WBIDs, that are impaired for fecal indicator bacteria (FIB). These WBIDs do not meet the applicable water quality criteria for *Escherichia coli* (*E. coli*), enterococci, or fecal coliform bacteria. The state uses *E. coli* bacteria in fresh waters, enterococci bacteria in estuarine or marine waters, and fecal coliform bacteria in Class II shellfishing waters as indicator organisms for the presence of potentially harmful pathogens.

Each FIB TMDL analysis provides an overall percent reduction in bacteria counts for the impaired WBID needed to achieve the applicable criteria (the TMDL restoration target), found in the state's Surface Water Quality Standards (paragraphs 62-302.530[11][a–d], Florida Administrative Code [F.A.C]). These concentration (count) based TMDLs are established for waterbodies verified impaired for *E. coli*, enterococci, or fecal coliform bacteria where sufficient data are available to calculate the percent reductions necessary to meet the criteria. The needed percent reduction to achieve the target concentration is calculated for each impaired waterbody to show the difference between the existing FIB concentrations and the applicable target concentrations for verified impaired waters. This report includes information to help identify potential sources contributing to the impairments.

In some cases, DEP will collect additional data for individual impaired waterbodies to obtain a dataset representative of existing conditions before calculating the percent reductions. This additional monitoring will be implemented through DEP's strategic monitoring program. In the future, percent reductions will be calculated for waterbodies added to the Verified List of Impaired Waters and for those waters where additional monitoring was performed.

When new waterbodies are verified for *E. coli*, enterococci, or fecal coliform bacteria impairment, DEP anticipates establishing FIB TMDLs using the methodology described in this report, and will update this document to include information about the new waters. The rule language in Chapter 62-304, F.A.C., will be updated. DEP will include analyses documenting that the facts and circumstances assumed during the development of the comprehensive approach apply to the new WBIDs under consideration. If circumstances for a particular waterbody warrant, DEP may develop an individual FIB TMDL and TMDL report, instead of including the new WBID impairment listing in this comprehensive document.

DEP intends to revise the FIB TMDL reporting process in the future following the biennial assessment of surface waters. Under the biennial approach, the agency will complete the assessment analysis for all state waters and publish an updated impaired waters list every two years. It then intends to revise the TMDL report to include information on new impaired waterbodies in the year following the biennial assessment, subsequently update the rule language in Chapter 62-304, F.A.C., and submit any new TMDLs to EPA for approval.

Appendix A contains specific information on the state's FIB-impaired WBIDs that are the subject of this report. The Everglades West Coast Basin is the first basin where TMDLs are developed in what will eventually become a consolidated report to document FIB TMDL development for fresh and marine waters throughout the state. It identifies the basis for the listing of each FIB-impaired WBID, summarizes existing data for the impaired segments, and lists the needed percent reduction to achieve the TMDL targets.

1.2 Statutory Requirements and Rulemaking History

Section 303(d) of the federal Clean Water Act (CWA) requires states to submit to the EPA lists of surface waters that do not meet applicable water quality standards (impaired waters) and establish a TMDL for each pollutant causing the impairment of listed waters on a schedule. DEP has developed such lists, commonly referred to as 303(d) lists, since 1992.

The Florida Watershed Restoration Act (FWRA) (Section 403.067, Florida Statutes [F.S.]) directed DEP to develop, and adopt by rule, a science-based methodology to identify impaired waters. The Environmental Regulation Commission adopted the methodology as Chapter 62-303, F.A.C. (the Impaired Surface Waters Rule [IWR]), in 2001. The rule was last amended in 2016.

The list of impaired waters in each basin, referred to as the Verified List, is also required by the FWRA (Subsection 403.067[4], F.S.). The state's 303(d) list is amended biennially to include basin updates.

Chapter 2: Description of Applicable Water Quality Standards

2.1 Classification of the Waterbodies and Criteria Applicable to the TMDL

Florida's surface waters are protected for seven designated use classifications, as follows:

Class	Designated Use
Class I	Potable Water Supplies
Class I-Treated	Treated Potable Water Supplies
Class II	Shellfish Propagation or Harvesting
Class III	Fish Consumption; Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife
Class III-Limited	Fish Consumption; Recreation or Limited Recreation; and/or Propagation and Maintenance of a Limited Population of Fish and Wildlife
Class IV	Agricultural Water Supplies
Class V	Navigation, Utility, and Industrial Use

Water quality classifications are arranged in order of the degree of protection required, with Class I waters having generally the most stringent water quality criteria and Class V the least. Class I, I-Treated, II, and III surface waters share water quality criteria established to protect fish consumption, recreation, and the propagation and maintenance of a healthy, well-balanced population of fish and wildlife (i.e., aquatic life use). Class III-Limited waterbodies may share full recreational or aquatic life uses on a site-specific basis. Site-specific alternative criteria (SSAC) may be developed for any or all of the following parameters: nutrients (including nutrient response variables), bacteria, dissolved oxygen, alkalinity, specific conductance, transparency, turbidity, biological integrity, or pH. However, there are currently no waters in Florida with SSAC for FIB.

Class III and III-Limited waters may be additionally classified as either marine or freshwater based on the waterbody's chloride concentration or specific conductance. "Predominately marine waters" are defined in subsection 62-302.200(30), F.A.C., as surface waters in which the chloride concentration is greater than or equal to 1,500 milligrams per liter (mg/L), or specific conductance is greater than or equal to 4,580 micromhos per centimeter (µmhos/cm). "Predominately fresh waters" are waters with chloride or specific conductance less than 1,500 mg/L or 4,580 µmhos/cm, respectively.

2.2 Applicable Water Quality Standards

Florida has adopted numeric bacterial criteria to protect recreational (swimming) uses in Class I, I-Treated, II, III, and III-Limited waters. These criteria are based on the use of two bacterial indicators of fecal contamination, *E. coli* and enterococci. The criteria are designed to protect primary contact recreation, including swimming, bathing, surfing, water skiing, tubing, water play by children, and similar water contact activities where a high degree of bodily contact with the water and immersion and ingestion are likely. The FIB used depends on whether the waterbody is predominately marine (i.e., Class II or Class III Marine) or predominately fresh (i.e., Class I or Class III-Fresh). *E. coli* bacteriological criteria are applicable to fresh waters and enterococci criteria are applicable to marine waters.

In addition to enterococci criteria to protect recreational uses, Class II waters also have a criterion for fecal coliform bacteria to protect shellfishing uses that is consistent with the indicator used by the Florida Department of Agriculture and Consumer Services (FDACS) to open and close designated shellfishing areas.

Subsection 62-302.530(6), F.A.C., provides the bacteriological criteria applicable to Florida waters, and **Table 2.1** lists these criteria by surface water classification.

Table 2.1. Summary of FIB criteria applicable to Florida waters by surface water classification and associated sampling requirements

Bacteriological Parameter	Surface Water Classification	Criterion	Sample Requirements
Enterococci	Class II and Class III Marine	Most probable number (MPN) or membrane filter (MF) counts (number/100 milliliters [ml]) shall not exceed a monthly geometric mean of 35 nor exceed the Ten Percent Threshold Value (TPTV) of 130 in 10 % or more of the samples during any 30-day period.	Monthly geometric means shall be based on a minimum of 10 samples taken on 10 different days over a 30-day period. If there are fewer than 10 samples in a month for a given location, the TPTV is assessed as a single-sample maximum.
E. coli	Class III Fresh	MPN or MF counts (number/100 ml) shall not exceed a monthly geometric mean of 126 nor exceed the TPTV of 410 in 10 % or more of the samples during any 30-day period.	Monthly geometric means shall be based on a minimum of 10 samples taken on 10 different days over a 30-day period. If there are fewer than 10 samples in a month for a given location, the TPTV is assessed as a single-sample maximum.
E. coli	Class I	MPN or MF counts (number/100 ml) shall not exceed a monthly geometric mean of 126 nor exceed the TPTV of 410 in 10 % or more of the samples during any 30-day period.	Monthly geometric means shall be based on a minimum of 5 samples taken on 10 different days over a 30-day period. If there are fewer than 5 samples in a month for a given location, the TPTV is assessed as a single-sample maximum.

Bacteriological Parameter	Surface Water Classification	Criterion	Sample Requirements
Fecal Coliform	Class II	MPN or MF counts shall not exceed a median value of 14 with not more than 10 % of the samples exceeding 43 (for MPN) or 31 (for MF).	To determine the percentage of samples exceeding the criteria when there are both MPN and MF samples for a waterbody, the percent shall be calculated as 100*(nmpn+nmf)/N, where nmpn is the number of MPN samples greater than 43, nmf is the number of MF samples greater than 31, and N is the total number of MPN and MF samples.

Chapter 3: Water Quality Assessment and Identification of Pollutants of Concern

3.1 Information on the Verified Impaired Waterbodies

DEP followed the methodology in the IWR (Chapter 62-303, F.A.C.) to assess water quality and verified a number of waterbody segments as impaired for fecal coliform, enterococci, or *E. coli* bacteria. These impairments are based on the applicable designated uses and waterbody type. **Chapter 2** provides more details on the applicable water quality standards.

Waterbodies were placed on the Verified List because the data sufficiency and listing requirements were met as provided in subsection 62-303.460(3), F.A.C., for primary contact and recreation use support, subsection 62-303.470(3), F.A.C., for shellfish consumption use support, or subsection 62-303.480(3), F.A.C., for drinking water use support (see **Table 2.1** for additional details).

Before FIB TMDLs were established for individual WBIDs on the Comprehensive Verified List, the available results were reviewed to determine if the data were representative of existing conditions. A dataset sufficient to represent current conditions is considered a minimum of 20 samples collected in at least 3 of the last 10 years, with at least 5 of the samples collected between June and September. Impaired water segments that lacked sufficient data will be considered for inclusion in DEP's Strategic Monitoring Plan for additional sampling in order to meet the data sufficiency requirements for establishing TMDLs.

DEP has established FIB TMDLs for the waterbody segments listed in **Table 3.1**. These waterbodies have adequate bacteria results to represent existing conditions and calculate the percent reductions necessary to meet the applicable criteria, following the data sufficiency methodology described in **Sub-section 5.2.3**. All the listed waterbodies are either Class II, Class III-Marine, or Class III-Fresh.

Table 3.1. Classification and applicable bacteriological quality criteria (fecal indicator bacteria) for waterbodies addressed in this TMDL development document. Table sorted by waterbody name.

[1] F = Fresh; M = Marine

[2] Verifed impaired for exceeding the TPTV criterion and the Class II median count criterion

Basin	Waterbody Name	WBID	Classification[1]	Applicable Bacteriological Quality Criteria
Everglades West Coast	Cocohatchee River	3259A	II	Enterococci
Everglades West Coast	Cow Slough	3278E	III-F	*Escherichia coli*
Everglades West Coast	Estero River (Marine Segment)	3258D1	III-M	Enterococci
Everglades West Coast	Gordon River (Marine Segment)	3278R5	III-M	Enterococci

Basin	Waterbody Name	WBID	Classification[1]	Applicable Bacteriological Quality Criteria
Everglades West Coast	Gordon River Extension	3278K	III-F	*Escherichia coli*
Everglades West Coast	Haldeman Creek (Lower)	3278R1	III-M	Enterococci
Everglades West Coast	Haldeman Creek (Upper)	3278R2	III-F	*Escherichia coli*
Everglades West Coast	Imperial River (Marine Segment)	3258EB	III-M	Enterococci
Everglades West Coast	Mullock Creek	3258C2	III-F	*Escherichia coli*
Everglades West Coast	Mullock Creek (Marine Segment)	3258C4	III-M	Enterococci
Everglades West Coast	Naples Bay (Coastal Segment)	3278R4	II	Enterococci
Everglades West Coast	Naples Bay (Coastal Segment)	3278R4	II	Fecal Coliform[2]
Everglades West Coast	Rock Creek	3278R3	III-M	Enterococci
Everglades West Coast	Spring Creek (Marine Segment)	3258H2	III-M	Enterococci

Chapter 4: Assessment of Sources

4.1 Types of Sources

An important part of the TMDL analysis is the identification of pollutant source categories, source subcategories, or individual sources of pollutants in the impaired waterbody and the amount of pollutant loadings contributed by each of these sources. Sources are broadly classified as either "point sources" or "nonpoint sources." Historically, the term "point sources" has meant discharges to surface waters that typically have a continuous flow via a discernable, confined and discrete conveyance, such as a pipe. Domestic and industrial wastewater treatment facilities (WWTFs) are examples of traditional point sources. Point sources also include certain urban stormwater discharges, such as those from local government master drain systems, construction sites over five acres, and a wide variety of industries. In contrast, the term "nonpoint sources" was used to describe intermittent, rainfall-driven, diffuse sources of pollution associated with everyday human activities, including runoff from urban land uses, agriculture, silviculture, and mining; discharges from septic systems; and atmospheric deposition.

To be consistent with Clean Water Act definitions, the term "point source" will be used to describe traditional point sources (such as domestic and industrial wastewater discharges) and stormwater systems requiring a National Pollutant Discharge Elimination System (NPDES) stormwater permit when allocating pollutant load reductions required by a TMDL (see **Section 6.1**). However, the methodologies used to estimate nonpoint source loads do not distinguish between NPDES stormwater discharges and non-NPDES stormwater discharges, and as such, this source assessment section does not make any distinction between the two types of stormwater.

FIB impairments are commonly caused by fecal contamination originating from humans, livestock, pets, and wildlife. The bacteria are found in the intestinal systems of warm-blooded animals. Animal wastes, if not managed properly, can enter surface waters. In some cases, inputs of fecal bacteria can survive and grow in waterbody sediments under the right conditions.

The following are general descriptions of potential point and nonpoint sources that can contribute to elevated levels of FIB in surface waters throughout the state. **Appendix A** lists the waterbody-specific percent reductions in existing bacteria concentrations needed to achieve the TMDL targets for the FIB-impaired WBIDs. A Bacteria TMDL Story Map that provides information to aid in identifying potential sources of bacteria contamination in surface waters is available at: Bacteria TMDL Story Map. The potential sources of bacteria to individual waterbodies are thoroughly investigated when developing implementation plans to address bacteria impairments, as described in **Chapter 7**.

4.2 Potential Sources of FIB

4.2.1 Point Sources

WASTEWATER POINT SOURCES

Point sources include domestic and industrial WWTFs where effluent is discharged through outfall pipes to surface waters. Elevated bacteria counts, at levels above permit limits, may be found in discharges to surface waters because of malfunctioning or poorly maintained treatment systems.

Another source of bacteria contamination is sanitary sewer overflows (SSOs), when failures occur in wastewater collection/transmission systems and raw sewage enters the environment. SSOs can occur for a number of reasons, including pipe obstructions, leaking sewer lines, pump station failures, and the infiltration of groundwater or inflow of stormwater into defective piping systems.

In agricultural areas, point source discharges from concentrated animal-feeding operations (CAFOs) can potentially contribute to elevated bacteria counts if animal wastes are not managed properly. CAFOs are generally defined as farms with 700 or more head of livestock confined for more than 45 days. These facilities generally congregate and feed animals, manage their manure, and operate on a small land area.

Direct illicit or accidental connections from homes or businesses are another potential point source that can enter surface waters. These sources can include the infiltration of contaminated groundwater into stormwater collection systems caused by damaged stormwater and sewer collection pipes and failing laterals from homes. This waste stream commonly enters local stormwater systems and is routed and discharged to receiving waterbodies. **Appendix B** lists the permitted wastewater facility outfalls, by FIB-impaired WBIDs. See **Appendix C** for background information on the federal and state stormwater programs.

MUNICIPAL SEPARATE STORM SEWER SYSTEMS (MS4S)

Stormwater runoff is water that does not soak into the ground during a rainstorm, but instead flows over the surface of the ground until it reaches a waterbody. As the runoff moves, it picks up and carries away pollutants such as soil and manure from human activities and natural areas, eventually depositing them into surface water and groundwater. Stormwater runoff is one of the leading sources of impairment of the nation’s waters and often contains high concentrations of bacteria. **Appendix B** lists the MS4 and MS4 jurisdictions, by basin.

4.2.2 Land Uses and Nonpoint Sources

Obtaining an accurate accounting of bacteria contributions from nonpoint sources requires identifying nonpoint source categories, locating the sources, determining the intensity and frequency with which these sources create high bacteria loadings, and specifying the relative contributions from each source. Nonpoint sources include onsite sewage treatment and disposal systems (OSTDS), pets, livestock, the land application of sewage sludge and manure, wildlife, marina pumpout facilties, boat anchorages, and waterbody sediments. These sources are associated with particular land use activities. While detailed source information is not always available for accurately quantifying the bacteria loadings from different sources, land use information can provide some hints on the potential sources of observed FIB impairments.

LAND USES

The spatial distribution and acreage of different land use categories can be obtained from land use/land cover layers available in geographic information system (GIS) libraries. The spatial distribution of principal land uses in the areas of verified impaired WBIDs, obtained from data layers in DEP's GIS library, is available to view in the interactive Story Map available at: Bacteria TMDL Story Map. Data layers representing potential bacteria sources are also available on the Story Map web page. The land use information and other data layers provided with this report are intended to serve as general information, which can be refined using other data obtained during the development of implementation plans. The nonpoint source categories where FIB exceedances are common within the principal land use/land cover categories are as follows:

> **Urban Areas** – In urban areas, the most common sources of bacteria originate from failing OSTDS (septic tanks and drain fields), pet feces, and wildlife feces. When properly installed, most of the bacteria from septic systems should be removed within 50 meters of the drainage field (Minnesota Pollution Control Agency 1999). However, the physical properties of an aquifer, such as thickness, sediment type (sand, silt, and clay), and location play a large part in determining whether contaminants from the land surface will reach groundwater (U.S. Geological Survey [USGS] 2010). The risk of contamination is greater for unconfined (water table) aquifers than for confined aquifers because they usually are nearer to the land surface and lack an overlying confining layer to impede the movement of contaminants (USGS 2010).
>
> Sediment type (sand, silt, and clay) also determines the risk of contamination in a particular watershed. According to USGS (2010), "Porosity, which is the proportion of a volume of rock or soil that consists of open spaces, tells us how much water rock or soil can retain. Permeability is a measure of how easily water can travel through porous soil or bedrock. Soil and loose sediments, such as sand and gravel, are porous and permeable. These sediments can hold a lot of water, and water flows easily through them. Although clay and shale are porous and can hold a lot of water, the pores in these fine-grained materials are so small that water flows very slowly through them. Clay has a low permeability."
>
> The risk of contamination is greater for areas with a relatively high groundwater table. The drain field can be flooded during the rainy season, resulting in ponding,

and bacteria can pollute surface waters through stormwater runoff. Additionally, in these circumstances, a high water table can result in bacteria pollution reaching the receiving waters through baseflow, which is the portion of flow not directly generated from rainfall during storm events.

Septic systems may also cause pollution when they are built too close to irrigation wells. Any well that is installed in the surficial aquifer system will cause a drawdown. If the septic system is built too close to the well (e.g., less than 75 feet), the septic system discharge will be situated within the cone of influence of the well. As a result, septic system effluent may enter the well, and once the polluted water is used to irrigate lawns, fecal bacteria may reach the land surface and wash into surface waters through stormwater runoff.

Pet (especially dog) waste can be a significant source of bacteria pollution through surface runoff to waterbodies. Studies report that up to 95 % of the fecal coliform bacteria found in urban stormwater can have nonhuman origins (Alderiso et al. 1996; Trial et al. 1993).

The most important nonhuman contributors of fecal coliform bacteria are dogs and cats. In a highly urbanized Baltimore catchment, Lim and Olivieri (1982) found that dog feces were the single greatest source of fecal coliform and fecal strep bacteria. Trial et al. (1993) also reported that cats and dogs were the primary source of fecal coliform bacteria in urban subwatersheds.

In urban areas, wildlife can typically be found in city parks and corridors along waterways and thus can potentially be a source of bacteria. A bacterial source tracking study of the Stevenson Creek urban watershed in Clearwater, Florida, found that when bacteria levels were high, wild animal feces were the dominant source (Whitlock et al. 2002).

Agricultural Areas – In areas where agricultural activities occur, contamination may be associated with the application of sewage sludge (also referred to as biosolids and wastewater residuals) and animal manure on the land surface.

Livestock and other agricultural animals are a potentially important source of bacteria in agricultural areas. Runoff from pastureland and agricultural animals with access to surface waters can affect water quality. Agricultural animal waste is associated with various pathogens in streams, including *E. coli, Salmonella, Giardia, Campylobacter, Shigella,* and *Cryptosporidium parvum* (Landry and Wolfe 1999). Research conducted by EPA indicates that fecal waste originating from cattle may pose human health risks comparable to the risks from human sources (EPA 2010; 2012).

Properly treated sewage sludge and manure are applied on land as a fertilizer supplement and a soil conditioner. Sewage sludge is the solid byproduct generated when domestic wastewater is treated. The sludge, which is removed routinely from treatment plants, has a high organic content and contains moderate amounts of nutrients. Regulatory requirements are in place to protect public health and the environment, including treatment to destroy harmful microorganisms and management practices for land application sites. However, these areas may be a bacteria source if the regulations are not followed. Biosolids may be applied in farming and ranching operations, to forest lands, and in public areas such as parks, or in land reclamation projects such as the restoration of mined properties. As with biosolids, animal manure can be a source of bacteria to surface waters. The likelihood of contamination is increased if manure or biosolids are applied to fields in excess of agronomic rates or under wet weather conditions (FDACS 2015).

Surface Waters – Sources of bacteria contamination within and adjacent to waterbodies include boat anchorages, marina pumpout facilities, and underlying sediments.

Boats have the potential to discharge bacteria in sewage from installed toilets and graywater from sinks, baths, and showers. Waterbodies and marinas that are heavily used for recreational boating have been shown to have elevated levels of FIB (EPA 2001). The discharge of untreated sewage from boats into waters of the state is prohibited by both state law (Florida Litter Law, Section 403.413, F.S.) and federal law (Clean Water Act). Graywater is not considered sewage in the law; therefore, the discharge of graywater from boats into waters around Florida is currently not prohibited. The law defines graywater from boats as "galley (kitchen), bath, and shower water."

Studies have shown that fecal coliform bacteria can survive and reproduce in streambed sediments and can be resuspended in surface water when conditions are right (Jamieson et al. 2005; Desmarais et al. 2002). Extended survival times have especially been noted for bacteria that have attached to sediment particles and settled to the bottom of streams and lakes (Burton et al. 1987). The survival of fecal bacteria in sediments is primarily attributed to the availability of soluble organics (Davies et al. 1995) and to increased protection from predatory protozoans (Enzinger and Coope 1976). Several studies have shown that concentrations of indicator organisms are typically higher in sediment as opposed to the overlying water column in both marine and freshwater systems (Burton et al. 1987; Sherer et al. 1992).

Additionally aquatic wildlife, including waterfowl, otters, manatees, and alligators will deposit their feces directly into surface waters.

Forests and Wetlands – Pristine forested lands might appear to be unlikely candidates for pathogen sources; however, wildlife can contribute fecal bacteria in these areas. Many wildlife species are reservoirs of microorganisms that are potentially pathogenic to themselves, other wildlife, and humans (EPA 2001). Streams draining largely undeveloped watersheds with extensive riparian wetlands can be important natural sources of bacteria. Animal bacteria from saturated wetland surfaces is a known mechanism for bacterial transport to the streams draining them, as was observed in a wetland-dominated watershed free of bacteria sources related to development (Weiskel et al. 1996).

Wildlife such as deer, bear, and feral hogs deposit bacteria with their feces onto land surfaces, where they can be transported during storm events to nearby waterbodies. In addition, waterfowl such as geese, ducks, and herons can act as direct nonpoint sources of bacteria and contaminate surface water with microbial pathogens (EPA 2001), especially in wetlands, lakes, ponds, and rivers.

Chapter 5: Determination of Assimilative Capacity

5.1 Determination of Loading Capacity

The bacteria TMDLs for individual waterbody segments (WBIDs) are based on the applicable FIB criteria in Chapter 62-302, F.A.C., used to verify impairment in each waterbody segment. In the majority of cases, these segments have bacteria concentrations that exceed the TPTV criteria for *E. coli*, enterococci, or fecal coliform bacteria. In addition, Class II waters can be listed as verified impaired for having median concentration values exceeding the applicable criterion of 14 counts per 100 milliliters (counts/100 mL) of colony-forming units.

A needed percent reduction to achieve the target concentration is calculated for each impaired waterbody and is included in this TMDL analysis to show the difference between the existing FIB concentrations and the applicable target concentrations in verified impaired waters. The needed percent reductions only represent the relative difference between the existing and target bacteria concentrations. The percent reductions should not be interpreted as the needed reduction in bacteria loads entering the impaired waters. **Appendix A** lists the percent reductions needed to achieve the concentration-based TMDLs in each FIB-impaired WBID.

5.2 Determination of Percent Reductions

To show the difference between the existing *E. coli*, enterococci, and fecal coliform bacteria concentrations and the applicable target concentrations in verified impaired waters, a needed percent reduction to achieve the applicable target concentration was calculated for each impaired waterbody. As previously noted, the needed percent reduction only represents the relative difference between the existing and target bacteria concentrations.

5.2.1 Percent Reductions for Waters Exceeding the TPTV Criterion

Because bacteriological counts in water are not normally distributed, a nonparametric method is more appropriate for the analysis of fecal coliform bacteria data (Hunter 2002). For waters verified impaired for exceeding the FIB TPTV, the Hazen method, which uses a nonparametric formula, was used to determine the 90th percentile. The 90th percentile value is used to represent the existing condition. The percent reduction needed to reduce the existing bacteria concentration was calculated by comparing the existing concentrations and target concentrations using **Formula 1**:

$$Needed\ \%\ Reduction = \frac{Existing\ 90th\ Percentile\ Concentration - Allowable\ Concentration}{Existing\ 90th\ Percentile\ Concentration} \qquad (1)$$

Using the Hazen method for estimating percentiles, as described in Hunter (2002), the existing condition concentration was defined as the 90th percentile of all the data collected during the last

10 years, defined as the 2011-2020 period. The 90th percentile is also called the 10 % exceedance event. This will result in a target condition that is consistent with the state bacteriological water quality criteria TPTV and assessment thresholds for verified impairment listings. Additionally, because microbiological results are log-normally distributed, the following calculations were done on the log-transformed concentration values.

To calculate 90th percentile values, all of the available data are ranked (ordered) from the lowest to the highest, and **Formula 2** is used to determine the percentile value of each data point:

$$Percentile = \frac{Rank - 0.5}{Total\ number\ of\ samples\ collected} \qquad (2)$$

If none of the ranked values is shown to be the 90th percentile value, then the 90th percentile number (used to represent the existing condition concentration) is calculated by interpolating between the two data points adjacent (above and below) to the desired 90th percentile rank using **Formula 3**:

$$90th\ Percentile\ Concentration = C_{lower} + (P_{90th} * R) \qquad (3)$$

Where:

- C_{lower} is the concentration corresponding to the percentile lower than the 90th percentile.
- P_{90th} is the percentile difference between the 90th percentile and the percentile number immediately lower than the 90th percentile.
- R is a ratio defined as R = (concentration$_{upper}$ – concentration$_{lower}$ / (percentile$_{upper}$ – percentile$_{lower}$).

5.2.2 Percent Reductions for Waters Exceeding the Class II Median Count Criterion

For Class II marine waters listed as verified impaired for median concentration values exceeding the applicable criterion of 14 counts/100 mL, the existing condition is expressed as the median value of the waterbody results collected in the last 10 years defined as the 2011-2020 period.

The percent reduction needed to reduce the existing median bacteria concentration was calculated by comparing the existing concentration and target concentration using **Formula 4**:

$$Needed\ \%\ Reduction = \frac{Existing\ Median\ Concentration - Allowable\ Median\ Concentration}{Existing\ Median\ Concentration} \qquad (4)$$

If Class II marine waters are verified impaired for exceeding the applicable TPTV criterion and the median concentration value exceeds the applicable criterion of 14 counts/100 mL colony-forming units, the highest percent reduction will be assigned to the impaired segment.

5.2.3 Data Sufficiency Evaluation

Prior to calculating the 90th percentile values and median values, as applicable, data collected prior to 2011 were removed from analysis. Percent reductions were only calculated for waterbodies with at least 3 years of data and 20 samples taken in the last 10 years, with at least 5 samples collected between June and September. The daily median was used for stations with multiple samples collected on the same day.

In cases where waters did not meet the data sufficiency requirements, DEP will collect additional data for the waterbodies to obtain a dataset representative of existing conditions, before calculating the percent reductions. In the future, percent reductions will be calculated for those waters where additional monitoring was performed and for waterbodies newly added to the verified impaired list with sufficient data to represent existing conditions.

Chapter 6: Determination of Loading Allocations

6.1 Expression and Allocation of the TMDL

The objective of a TMDL is to provide a basis for allocating loads to all the known pollutant sources in a watershed so that appropriate control measures can be implemented and water quality standards achieved. A TMDL is expressed as the sum of all point source loads (wasteload allocations, or WLAs), nonpoint source loads (load allocations, or LAs), and an appropriate margin of safety (MOS), which accounts for uncertainty in the relationship between effluent limitations and water quality:

$$\mathbf{TMDL = \sum WLAs + \sum LAs + MOS}$$

As discussed earlier, the WLA is broken out into separate subcategories for wastewater discharges and stormwater discharges regulated under the NPDES Program:

$$\mathbf{TMDL \cong \sum WLAs_{wastewater} + \sum WLAs_{NPDES\ Stormwater} + \sum LAs + MOS}$$

The various components of the revised TMDL equation may not sum up to the value of the TMDL because (1) the WLA for NPDES stormwater is typically based on the percent reduction needed for nonpoint sources and is also accounted for within the LA, and (2) TMDL components can be expressed in different terms (for example, the WLA for stormwater is typically expressed as a percent reduction, and the WLA for wastewater is typically expressed as mass per day). Stormwater reductions are included in both the MS4 WLA and LA, as applicable. However, in determining the overall stormwater reductions needed, DEP does not differentiate between the MS4 WLA and the LA, and instead applies the same overall reductions to both as if the two categories were a single category source, unless otherwise specified.

WLAs for stormwater discharges are typically expressed as "percent reduction" because it is very difficult to quantify the loads from MS4s (given the numerous discharge points) and to distinguish loads from MS4s from other nonpoint sources (given the nature of stormwater transport). The permitting of stormwater discharges also differs from the permitting of most wastewater point sources because (1) stormwater discharges cannot be centrally collected, monitored, and treated, (2) they are not subject to the same types of effluent limitations as wastewater facilities, and (3) they are required to meet a performance standard of providing treatment to the "maximum extent practical" through the implementation of best management practices (BMPs).

This approach is consistent with federal regulations, which state that TMDLs can be expressed in terms of mass per time (e.g., pounds per day), toxicity, or other appropriate measure—see 40 Code of Federal Regulations (CFR) § 130.2(i). The TMDLs for waters verified impaired for FIB are expressed as concentration-based restoration targets (**Table 6.1**) that are consistent with the expression of the bacteriological criteria used to perform the surface water assessment resulting in the impairment listing.

No local data were available that allowed DEP to explicitly quantify the bacteria loads from all the sources in the watershed of each impaired waterbody segment and link the source loads with the surface water bacteria concentrations. Therefore, the WLA for stormwater discharge under the NPDES MS4 permits and the load allocation (LA) were implicitly considered as the appropriate restoration activities to bring the bacteria concentrations in the impaired waters below the applicable target level. DEP created an implementation guidance document for bacteria TMDLs (see DEP's website for the Restoring Bacteria-Impaired Waters Toolkit). The guidance document outlines the typical activities used for controlling urban sources of bacteria (e.g., sewer infrastructure, OSTDS, and stormwater).

Additionally, FDACS has adopted BMPs contained in manuals for most commodities in the state describing practical measures that agricultural producers can follow to reduce the amount of animal wastes, fertilizers, and other pollutants entering surface waters. The BMP manuals are available through the FDACS website.

Appendix A lists WBID-specific percent reductions in existing bacteria concentrations needed to achieve the FIB TMDL targets..

6.2 Load Allocation

Table 6.1 identifies the FIB LAs for all nonpoint sources, including stormwater runoff and septic system contributions, using the concentration-based approach. The LA applies equally to all anthropogenic sources of bacteria contributing to waterbody impairments. In determining the overall stormwater reductions in bacteria concentrations needed to achieve the applicable TMDL targets in **Table 6.1**, the TMDLs do not differentiate between the MS4 WLA and the LA, and instead apply the same overall percent reductions to both as if the two categories were a single category source. Aggregated allocations for a category of sources are not intended to be applied uniformly to individual sources in that category. The LA includes loading from stormwater discharges regulated by DEP and the water management districts that are not part of the NPDES stormwater program (see **Appendix C**).

Although the TMDLs are based on the percent reductions from all sources to the waterbodies, it is not DEP's intent to abate natural conditions. The needed reduction from anthropogenic inputs may be calculated based on more detailed source information conducted as part of a restoration plan (such as a bacteria pollution control plan [BPCP]).

Table 6.1. TMDL components for FIB impairments

[1] The TMDL applies to impaired waterbodies where the data exceed the applicable TPTV criterion in Subsection 62-302.530(6), F.A.C.
[2] The TMDL applies to impaired waterbodies where the median value of the data exceed the applicable criterion in Subsection 62-302.530(6), F.A.C.

Parameter	TMDL (counts/100mL)	WLA for Wastewater (counts/100mL)	WLA for NPDES Stormwater (counts/100mL)	LA (counts/100mL)	MOS
***E. coli* Bacteria**	410 (for MPN or MF counts)[1]	Must meet permit limits	410 for areas covered by MS4 permit	410	Implicit
Enterococci Bacteria	130 (for MPN or MF counts)[1]	Must meet permit limits	130 for areas covered by MS4 permit	130	Implicit
Fecal Coliform Bacteria	31 (for MF counts)[1]	Must meet permit limits	31 for areas covered by MS4 permit	31	Implicit
Fecal Coliform Bacteria	43 (for MPN counts)[1]	Must meet permit limits	43 for areas covered by MS4 permit	43	Implicit
Fecal Coliform Bacteria	14 (for MPN or MF counts)[2]	Must meet permit limits	14 for areas covered by MS4 permit	14	Implicit

6.3 Wasteload Allocation

6.3.1 NPDES Wastewater Discharges

NPDES-permitted wastewater facility outfalls are available for viewing on DEP's Story Map web page. **Appendix B** lists the wastewater facility outfalls associated with the impaired WBIDs. The state requires all NPDES-permitted wastewater point source dischargers to meet bacteria criteria at the end of the pipe (i.e., at the point of discharge into the receiving waterbody). Permit effluent limitations for bacteria serve as the WLA for wastewater discharges. It is DEP's current practice not to allow mixing zones for bacteria. Any future point sources that may discharge to impaired waterbody segments will also be required to meet end-of-pipe standards for bacteria. Violations of permit effluent limitations or SSOs will be addressed through compliance enforcement.

6.3.2 NPDES Stormwater Discharges

MS4 permittees with jurisdiction within the boundaries of the impaired WBIDs (listed in **Appendix B**) are available to view at DEP's Story Map website. Absence from this list does not necessarily shield an MS4 permit holder from addressing bacteria pollution to waters that its effluent reaches. Any MS4 permittee is only responsible for reducing the anthropogenic loads associated with stormwater outfalls that it owns or otherwise has responsible control over, and it is not responsible for reducing other nonpoint source loads in its jurisdiction.

In determining the overall stormwater reductions in bacteria concentrations needed to achieve the applicable TMDL targets (**Table 6.1**), the TMDLs do not differentiate between the MS4 WLA and the LA, and instead apply the same overall percent reductions to both as if the two categories were a single category source (**Appendix C**). Aggregated allocations for a category of sources are not intended to be applied uniformly to individual sources in that category. Pollutant reductions to attain a TMDL can come from many sources, and these percent reductions do not directly apply to any individual MS4 outfall.

6.4 Margin of Safety

The MOS is a required component of a TMDL and accounts for the uncertainty about the relationship between pollutant loads and the quality of the receiving waterbody (CWA, Section 303[d][1][c]). The MOS can either be implicitly accounted for by choosing conservative assumptions about loading or water quality response, or explicitly accounted for during the allocation of loadings. The explicit MOS usually takes the form of setting a TMDL target at a certain percentage below the protective target. An implicit MOS can be achieved by making conservative assumptions or using conservative approaches when developing a TMDL.

Consistent with the recommendations of the Allocation Technical Advisory Committee (DEP 2001), an implicit MOS was used in the development of these TMDLs because the applicable FIB TMDL concentration targets assume the waterbody bacteria counts are all from anthropogenic sources, while in reality a portion of the bacteria contributions originate from natural sources. This makes the allowable anthropogenic contribution lower than the TMDL targets, adding an MOS.

Chapter 7: Next Steps: Implementation Plan Development

7.1 Implementation Mechanisms

Following the adoption of a TMDL, implementation takes place through various measures. The implementation of TMDLs may occur through specific requirements in NPDES wastewater and MS4 permits, and, as appropriate, through local or regional water quality initiatives or basin management action plans (BMAPs).

Facilities with NPDES permits that discharge to the TMDL waterbody must respond to the permit conditions that reflect target concentrations, reductions, or WLAs identified in the TMDL. NPDES permits are required for Phase I and Phase II MS4s as well as domestic and industrial wastewater facilities. MS4 Phase I permits require a permit holder to prioritize and act to address a TMDL unless management actions to achieve that particular TMDL are already defined in a BMAP. MS4 Phase II permit holders must also implement the responsibilities defined in a BMAP.

7.2 Basin Management Action Plans

Information on the development and implementation of BMAPs is contained in Section 403.067, F.S. (the FWRA). DEP or a local entity may initiate and develop a BMAP that addresses some or all of the contributing areas to the TMDL waterbody. BMAPs are adopted by the DEP Secretary and are legally enforceable.

BMAPs describe the fair and equitable allocations of pollution reduction responsibilities to the sources in the watershed, as well as the management strategies that will be implemented to meet those responsibilities, funding strategies, mechanisms to track progress, and water quality monitoring. Local entities, such as wastewater facilities, industrial sources, agricultural producers, county and city stormwater systems, military bases, water control districts, state agencies, and individual property owners usually implement these strategies. BMAPs can also identify mechanisms to address potential pollutant loading from future growth and development.

7.3 Other Water Quality Initiatives

The Surface Water Improvement and Management (SWIM) Program is implemented by Florida's water management districts, by working cooperatively with DEP, other state and federal agencies, local governments, and private stakeholders. SWIM plans outline initiatives to accomplish watershed protection and restoration.

Phase I MS4 permittees that have prioritized FIB-impaired waterbodies are required to develop a BPCP. Efforts include the identification of potential sources using maps and field investigations, bacteria source tracking and monitoring techniques to support the identification of bacterial sources, the development of a pet waste management ordinance or program, the implementation of an educational program directed at reducing bacterial pollution, and the identification of structural or nonstructural BMPs or program activities needed to reduce bacterial loadings from the MS4 to the maximum extent practicable. Permittees are required to submit a BPCP and report annually on progress and updates.

Phase II MS4 permittees with prioritized FIB-impaired waterbodies are required to develop a schedule for implementing structural and/or nonstructural BMPs and other program activities in their Stormwater Management Program. As part of the Phase II MS4 permit process, permittees submit their schedule for review and approval by DEP.

Additionally, FDACS develops and adopts BMP manuals specific to different agricultural commodities, such as row crops or cow-calf operations. Each manual is the result of research, field testing, and expert review, and each contains effective and practical means for improving water quality in agricultural and urban discharges. Many BMP manuals explicitly address techniques and practices for reducing sources of bacterial pollution, such as using buffers, setbacks, and swales to reduce or prevent the transport of pollutants from production areas to waterbodies.

7.4 Implementation Considerations

FIB impairments result from the cumulative effects of a multitude of potential sources, both natural and anthropogenic. Restoration relies on holistic approaches to address point and nonpoint sources. Plans need to be adaptively managed and include actions. Local stakeholders should create and enforce municipal codes and ordinances, and they should conduct investigations to determine the impact of land uses and activities in each watershed. Entities are responsible for the management of nonpoint sources within their jurisdictional boundaries, to the extent of the law. The combined active participation of state, county, and city authorities will be necessary to identify, reduce, eliminate, and prevent anthropogenic sources of FIB from reaching stormwater and natural waterbodies.

For more information on identifying urban and agricultural sources of bacteria—and suggestions for involving stakeholders to address the sources—see DEP's website for the Restoring Bacteria Impaired Waters Toolkit. The toolkit assists local governments and interested stakeholders by providing a range of activities, from the simple (such as Walk the WBIDs and GIS mapping) to the complex (such as bacteria source tracking). DEP staff may provide technical assistance, guidance, and oversight of local efforts to identify and minimize bacteria sources of pollution.

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Appendices

Appendix A: Information on WBID-Specific Bacteria Data Summaries and Reductions, by Basin. Table sorted by waterbody name.

Everglades West Coast Basin

Notes: Mullock Creek (WBID 3258C2), Mullock Creek - Marine (WBID 3258C4), Estero River – Marine (WBID 3258D1), Imperial River (WBID 3258EA), Imperial River – Marine (WBID 3258EB), and Spring Creek – Marine (WBID 3258H2) were adopted as additions to the Verified List through a Secretarial Order signed on October 2, 2019. The impairment listings used water quality data available in the IWR Run 56 Database from the Group 1, Cycle 4 verified period (January 1, 2011—June 30, 2018). These waterbodies remained impaired based on data evaluated during the 2022 biennial assessment. The impairment for Hendry Creek – Marine (WBID 3258F) used water quality data available in the IWR Run 60 database from the 2022 biennial assessment verified period (January 1, 2013–June 30, 2020). Summaries of *E. coli*, enterococci, and fecal coliform bacteria monitoring results used for impairment determination of individual WBIDs for the applicable verified period can be found on Florida's Comprehensive Verified List.
HUC = Hydrologic unit code; F = Fresh; M = Marine

[1] Waterbody classifications are defined as follows:
I – Potable water supplies.
II – Shellfish propagation or harvesting.
III-F – Recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife in fresh water.
III-M – Recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife in marine water.
[2] The existing condition is represented by the data collected in the last 10 years, defined as the 2011-2020 period.
[3] The exceedance frequency is not applicable, as the long-term median value is compared with the criterion (target).

Basin Name	WBID	Waterbody Segment Name	Water-body Type	Water-body Class[1]	FIB	Existing Condition: Number of Exceedances/ Number of Samples[2]	Existing Condition Bacteria Count Mean (counts/100ml)[2]	Existing Condition Bacteria Count Median (counts/100ml)[2]	Existing Condition Bacteria Count 90th Percentile (counts/100ml)[2]	TMDL Target	% Reduction to Meet TMDL Target
Everglades West Coast	3259A	Cocohatchee River	Estuary	2	Enterococci	124/855	108	10	190	≤ 130 Counts / 100 mL	31
Everglades West Coast	3278E	Cow Slough	Stream	3F	*E. coli*	15/45	475	248	1300	≤ 410 Counts / 100 mL	68
Everglades West Coast	3258D1	Estero River (Marine Segment)	Estuary	3M	Enterococci	171/245	463	270	1160	≤ 130 Counts / 100 mL	88
Everglades West Coast	3278R5	Gordon River (Marine Segment)	Estuary	3M	Enterococci	44/171	139	73	296	≤ 130 Counts / 100 mL	56
Everglades West Coast	3278K	Gordon River Extension	Stream	3F	*E. coli*	21/115	406	119	842	≤ 410 Counts / 100 mL	51

Basin Name	WBID	Waterbody Segment Name	Water-body Type	Water-body Class[1]	FIB	Existing Condition: Number of Exceedances/ Number of Samples[2]	Existing Condition Bacteria Count Mean (counts/100ml)[2]	Existing Condition Bacteria Count Median (counts/100ml)[2]	Existing Condition Bacteria Count 90th Percentile (counts/100ml)[2]	TMDL Target	% Reduction to Meet TMDL Target
Everglades West Coast	3278R1	Haldeman Creek (Lower)	Estuary	3M	Enterococci	62/172	230	63	689	≤ 130 Counts / 100 mL	81
Everglades West Coast	3278R2	Haldeman Creek (Upper)	Stream	3F	*E. coli*	35/104	492	170	1414	≤ 410 Counts / 100 mL	71
Everglades West Coast	3258EB	Imperial River (Marine Segment)	Estuary	3M	Enterococci	165/295	517	194	1733	≤ 130 Counts / 100 mL	92
Everglades West Coast	3258C2	Mullock Creek	Stream	3F	*E. coli*	30/89	495	261	1482	≤ 410 Counts / 100 mL	72
Everglades West Coast	3258C4	Mullock Creek (Marine Segment)	Estuary	3M	Enterococci	35/193	188	42	335	≤ 130 Counts / 100 mL	61
Everglades West Coast	3278R4	Naples Bay (Coastal Segment)	Estuary	2	Enterococci	61/466	83	10	193	≤ 130 Counts / 100 mL	32
Everglades West Coast	3278R4	Naples Bay (Coastal Segment)	Estuary	2	Fecal Coliform	108/343	72	18	220	≤ 43 Counts / 100 mL	80
Everglades West Coast	3278R4	Naples Bay (Coastal Segment)	Estuary	2	Fecal Coliform	NA[3]	72	18	--	≤ 14 MPN / 100 mL	22
Everglades West Coast	3278R3	Rock Creek	Estuary	3M	Enterococci	68/164	342	85	800	≤ 130 Counts / 100 mL	83
Everglades West Coast	3258H2	Spring Creek (Marine Segment)	Estuary	3M	Enterococci	138/307	421	104	1414	≤ 130 Counts / 100 mL	90

Appendix B: Permitted Wastewater Facility Outfalls and MS4 Permittees for Bacteria-Impaired WBIDs, by Basin. Table sorted by waterbody name.

Everglades West Coast Basin

[1] M = Marine; F = Fresh
[2] (Permit number: Outfall designation)
[3] (Facility ID)

Waterbody Name	WBID	Classification[1]	FIB Impairment	NPDES Wastewater Facility Outfalls[2]	NPDES MS4 Permittees[3]
Cocohatchee River	3259A	II	Enterococci		Collier County (FLR04E037), FDOT District 1 (FLR04E161), Lee County and Co-permittees (FLS000035)
Cow Slough	3278E	III-F	*E. coli*		Collier County (FLR04E037), FDOT District 1 (FLR04E161)
Estero River (Marine Segment)	3258D1	III-M	Enterococci		Lee County and Co-permittees (FLS000035)
Gordon River (Marine Segment)	3278R5	III-M	Enterococci	City of Naples Water Reclamation Facility (FL0026271: D-002, D-003, D-005)	Collier County (FLR04E037), FDOT District 1 (FLR04E161), City of Naples (FLR04E080)
Gordon River Extension	3278K	III-F	*E. coli*	10th St N Area W Goodlette-Frank SS SW Improvements (FLG914741: D-001), City of Naples Water Reclamation Facility (FL0026271: D-004)	Collier County (FLR04E037), FDOT District 1 (FLR04E161), City of Naples (FLR04E080)
Haldeman Creek (Lower)	3278R1	III-M	Enterococci		Collier County (FLR04E037), FDOT District 1 (FLR04E161), City of Naples (FLR04E080)
Haldeman Creek (Upper)	3278R2	III-F	*E. coli*		Collier County (FLR04E037), FDOT District 1 (FLR04E161)
Imperial River (Marine Segment)	3258EB	III-M	Enterococci		Collier County (FLR04E037), Lee County and Co-permittees (FLS000035)

Waterbody Name	WBID	Classification[1]	FIB Impairment	NPDES Wastewater Facility Outfalls[2]	NPDES MS4 Permittees[3]
Mullock Creek	3258C2	III-F	*E. coli*		Lee County and Co-permittees (FLS000035)
Mullock Creek (Marine Segment)	3258C4	III-M	Enterococci		Lee County and Co-permittees (FLS000035)
Naples Bay (Coastal Segment)	3278R4	II	Enterococci, Fecal coliform		Collier County (FLR04E037), FDOT District 1 (FLR04E161), City of Naples (FLR04E080)
Rock Creek	3278R3	III-M	Enterococci	Collier County South County WRF (FL0141356: D-001, D-002)	Collier County (FLR04E037), FDOT District 1 (FLR04E161), City of Naples (FLR04E080)
Spring Creek (Marine Segment)	3258H2	III-M	Enterococci		Lee County and Co-permittees (FLS000035)

Appendix C: Background Information on Federal and State Stormwater Programs

In 1982, Florida became the first state in the country to implement statewide regulations to address the issue of nonpoint source pollution by requiring new development and redevelopment to treat stormwater before it is discharged. The Stormwater Rule, as authorized in Chapter 403, F.S., was established as a technology-based program that relies on the implementation of BMPs designed to achieve a specific level of treatment (i.e., performance standards) as set forth in Chapter 62-40, F.A.C. In 1994, DEP stormwater treatment requirements were integrated with the stormwater flood control requirements of the water management districts, along with wetland protection requirements, into the Environmental Resource Permit regulations, as authorized under Part IV of Chapter 373, F.S.

Chapter 62-40, F.A.C., also requires the state's water management districts to establish stormwater pollutant load reduction goals (PLRGs) and adopt them as part of a SWIM Program plan, other watershed plan, or rule. Stormwater PLRGs are a major component of the load allocation part of a TMDL. To date, they have been established for Tampa Bay, Lake Thonotosassa, the Winter Haven Chain of Lakes, the Everglades, Lake Okeechobee, and Lake Apopka.

In 1987, the U.S. Congress established Section 402(p) as part of the federal CWA Reauthorization. This section of the law amended the scope of the federal NPDES permitting program to designate certain stormwater discharges as "point sources" of pollution. EPA promulgated regulations and began implementing the Phase I NPDES stormwater program in 1990 to address stormwater discharges associated with industrial activity, including 11 categories of industrial activity, construction activities disturbing 5 or more acres of land, and large and medium MS4s located in incorporated places and counties with populations of 100,000 or more.

However, because the master drainage systems of most local governments in Florida are physically interconnected, the EPA implemented Phase I of the MS4 permitting program on a countywide basis, which brought in all cities (incorporated areas), Chapter 298 special districts; community development districts, water control districts, and Florida Department of Transportation throughout the 15 counties meeting the population criteria. DEP received authorization to implement the NPDES stormwater program in 2000. The authority to administer the program is set forth in Section 403.0885, F.S.

The Phase II NPDES stormwater program, promulgated in 1999, addresses additional sources, including small MS4s and small construction activities disturbing between 1 and 5 acres, and urbanized areas serving a minimum resident population of at least 1,000 individuals. While these urban stormwater discharges are technically referred to as "point sources" for the purpose of regulation, they are still diffuse sources of pollution that cannot be easily collected and treated by a central treatment facility, as are other point sources of pollution such as domestic and industrial wastewater discharges. Phase I MS4 permits issued in Florida include a reopener clause that allows permit revisions to implement TMDLs when the implementation plan is formally adopted.