Memorandum

Date: June 28, 2023

To: Honorable Chairman Oliver G. Gilbert III
and Members, Board of County Commissioners

From: Daniella Levine Cava
Mayor

Subject: Report on the County's Comprehensive Flood Mitigation Measures and Future Stormwater Planning - Directive No. 221494

Executive Summary

On July 7, 2022, the Board of County Commissioners (Board) adopted Resolution R-664-22 sponsored by Commissioner Cohen Higgins directing the County Mayor or County Mayor's designee to prepare a report explaining the comprehensive flood mitigation measures the County is currently undertaking, the measures the County has employed in the past, and the measures the County Mayor or County Mayor's designee is planning for future implementation. The report shall also include any available information on flood mitigation measures being taken by state and municipal governments and other owners and operators of stormwater management systems for stormwater-related needs under their purview. The report shall further address the flood maps and any other information or systems the County uses to identify areas at risk of flooding.

Past, Present and Future Flood Mitigation Planning and Accompanying Capital Investments

The County has invested $1 billion in its stormwater infrastructure over the 30 years since the adoption of our Stormwater Utility (SWU) Fee in the early 1990s. Another billion is planned for investment over the coming 30-year planning horizon. This robust and consistent investment has been documented through the County's past and present Stormwater Master Plans. The most recent Plan was updated in 2021 and incorporates a number of new initiatives that are already underway to address the flood mitigation needs of our residents. Additionally, sea level rise is already having an impact on our ability to operate a system largely designed on gravity. Our future investments are intended to mitigate for the growing set of obstacles that higher sea levels and extreme storm events can create.

Importantly, our water management strategy is cognizant of water quality and the impact that stormwater can have on the natural environment. Managing flooding and surface water quality is a critical environmental strategy and key to smart floodplain management. Surface water has an impact on groundwater and salt intrusion, and therefore on our water supply and wellfields. The flow of surface water also influences how we experience tidal effects on low-lying coastal areas, and how we design and engineer physical controls to help us manage the effects of rainfall in developed areas.

Because the County has such a robust capital investment plan for future stormwater improvements in our 780 square mile regional jurisdictional area, the master plan exceeds 4,000 pages and identifies 241 mitigation project areas scheduled for specific capital improvements to address projected flood risks over the next 30 years. It can be found online at https://www.miamidade.gov/environment/library/maps/2021-stormwater-management-program-master-plan.pdf. All together, it reflects nearly half a billion dollars of future investment funded by the Stormwater Utility Fees and an additional half billion dollars in drainage reconstruction and improvements associated with road reconstruction countywide funded by road impact fees and maintained and operated by the Stormwater Utility. The projects range in scope and complexity, with some as basic as replacing or upgrading of specific drains to innovative green and experimental technology applications. The most significant sums are associated with the raising of canal banks serving the portions of our community that we know are low lying and subject to repetitive flood concerns. The highlights of these County SWU investments are summarized below and in Exhibit 1. The County presently has 20 projects in some phase of bid preparation or actual construction, with another 10 in assessment, survey and/or design stages. Approximately 25 percent of these projects are occurring in the southern basins of the County, another 25 percent are in the central areas, and the balance are in the north where the County's greatest flood risk and water quality concerns have emerged.

Investment Highlights:

- RER-DERM bid, awarded and is currently managing the construction of the Biscayne Bay Water Quality Characterization and Pollution Reduction contract to test the use of innovative technologies at three pilot locations to treat stormwater before discharging to the Little River Canal (C-7 Basin). The pilot locations will be used to test different stormwater screening and filtering products. These innovative applications and testing of new technologies is part of on-going activities being implemented leveraging a State DEP $3.3 million grant with a 15% local match. Contract completion is October 21, 2023. Up to five additional pilot locations are currently being assessed to implement other products available in the market, with estimated design and construction over the next year and funding from the same Florida Department of Environmental Protection (FDEP) grant. The objective of these pilots is to determine performance of these new technologies, and ease of maintenance with the goal of replicating their use, as appropriate, systemwide.

- RER-DERM is bidding the first contract of a new multi-year effort, Secondary Canal Maintenance Mechanical Harvesting of Drainage Canals. With this initiative, the County will be increasing up to 80% the maintenance of the network of secondary canals (160 of the 200 miles of secondary canals countywide) using mechanical harvesting. The balance of the canals will need to continue to be treated with approved chemicals due to physical constraints and access challenges that preclude mechanical harvesting. This is, however, a significant departure from the current maintenance procedures that rely on chemicals only

to supplement manual removal of aquatic weeds and is an important step to achieving improved water quality in Biscayne Bay.

- This same RER-DERM contract includes the installation and testing of booms to collect floating debris from secondary canals. The County has coordinated with the South Florida Water Management District to identify new products and select systemwide locations for boom installation. Maintenance cycles will also be optimized to decide on future boom deployments in the network of secondary canals.

- The design has been completed and permitting is underway for the improvements to the stormwater Biscayne Shores Pump Station No. 3, and design is underway for a new stormwater Lake Belmar Pump Station. These pump station projects totaling over $4.5 million are located in the C-8 and C-7 Basins, respectively. RER-DERM is funding construction of these stormwater pump station improvements by leveraging two State DEP Resilience grants totaling $2.25 million with a 50% local match. Construction awards are anticipated by the fall 2023. Design, permitting and construction are being implemented by DTPW in coordination with RER-DERM.

- The design has been completed and permitting is underway for the improvements to the stormwater Biscayne Shores Pump Stations No. 1 & 2. These pump station projects totaling over $2 million are located in the C-8 Basin. RER-DERM is funding construction of these stormwater pump station improvements with Stormwater Utility Fees. Construction awards are anticipated by the fall 2023. Design, permitting and construction are being implemented by DTPW in coordination with RER-DERM.

- RER-DERM will be bidding and awarding design-build contracts totaling $32 million to raise secondary canal banks to meet 2060 hydraulic and hydrologic requirements. These projects will increase the stormwater storage and conveyance capacity of the network of secondary canals in the C-7 and C-8 Basins, respectively. Basins C-7 and C-8 are high priority basins in terms of vulnerabilities to flooding and water quality risks, now and in the anticipated future with Sea Level Rise. These projects are being implemented by leveraging three State Resilience DEP grants of over $16 million with a 50% local match. Contract awards are anticipated by the fall of 2023.

- RER-DERM Stormwater Capital Improvement Program (CIP) includes a total of $132 million planned for implementation in improvements to the Local Drainage tertiary systems over the next 20 years, and a total of $338 million planned for implementation in improvements to the Secondary Canal system over the next 30 years. These improvements are based on improving infrastructure resilience to meet 2060 conditions with Sea Level Rise.

The highlights noted above do not include additional investments being made through roadway elevation improvements identified in the master plan but not included in its $470 million Stormwater Capital Improvement Program (CIP) estimate, since those improvements will be funded through other sources supporting the County's roadway reconstruction projects. With respect to these roadways in UMSA, there are approximately 20 miles of road segments with deficiency elevations (based on the 2060 modeling horizon adopted through the County Flood Criteria via Ordinance No. 22-141). Those miles represent roadway segments with deficiencies in elevation that average between 6-12 inches. Reconstruction to elevate these segments is valued at over $35 million in today's dollars. Within municipalities, there are an additional 50 miles of road segments with similar deficiency elevations ranging between 6 – 24 inches on average, requiring approximately $85 million in investment. Correction of elevation deficiencies for all these segments will generally occur as part of larger road reconstruction projects planned and executed by DTPW.

The County has been aggressively pursuing grants from federal and state opportunities and has been very successful in securing significant awards. These grants are used to leverage Stormwater Utility fees to accelerate resilience investments. Furthermore, the stormwater Utility has historically issued bonds to back its capital program. The latest bond series will be paid in 2029, providing an opportunity for issuance of a new investment series. Lastly, the County is assessing a fee increase proposal for FY 2025 to support an increased level of effort for the capital, maintenance, and operations of the County's stormwater management system.

Our Multi-Jurisdictional Stormwater Management Reality and the Need for Greater Regional Coordination and Planning

It is important to keep in mind that the effectiveness of the County's regional improvements is affected by the choices made by our partner state and federal water management jurisdictions, including the South Florida Water Management District and the Army Corps, who together manage and maintain the County's primary canal system. We also depend on these entities to invest in their infrastructure, as well as conduct critical regional watershed studies - such as the Central and Southern Florida Resiliency Study - which is now updating their assessment of regional flood risk for the Southeastern portion of the State. The study outcomes will determine these entities' future capital investments in our region.

But just as significant for storm and individual rain events are the actions of the 34 municipalities that manage their own municipal tertiary systems with their respective municipal Stormwater Utility Fee (SWU) revenue proceeds. The County cannot legally invest SWU funds collected from the unincorporated area in municipally controlled tertiary infrastructure funded by municipal Stormwater Utilities. However, we know that the flow of stormwater is unrestrained by these artificial jurisdictional boundaries, therefore we often assist when localized flooding conditions occur after a specific rain event. Such was the case with the Saga Bay flooding episode cited in

the resolution that requested this report, which occurred entirely in areas under the jurisdiction of Cutler Bay and on private systems within the town's jurisdiction.

This is the case with any number of drainage features throughout our community: in each jurisdiction, some drainage infrastructure is publicly managed and other drainage infrastructure is privately managed. Private management is necessary because the drainage features serving those sites occur within the geographic footprint of the private property. Such features are required by County code during the development approval process (all private development has stormwater retention requirements), both for that private property's own stormwater protection and to ensure that its runoff does not affect neighboring properties. Some retention requirements can be satisfied very simply (by maintaining, for example, the unpaved swale and grassy areas within a home's front or back yards). Other larger or more complex developments such as industrial parks and shopping centers are required to build and maintain their own drainage infrastructure or other features to ensure the proper management of stormwater within their private boundaries. Hence, stormwater management in our community can be a complicated sum of many public and private parts.

Despite the necessary existence of many stormwater management entities, the County has a rich history of coordination across jurisdictions in the planning, operation, and technical design of our multifaceted regional stormwater system. Multijurisdictional coordination will continue to be key in managing stormwater into our future. The County will continue its holistic approach to stormwater management to ensure that all parts of our multifaceted drainage network are working together to prevent and minimize flooding and water pollution countywide.

To that end, this summer, RER-DERM will be workshopping a suite of regional planning and legislative initiatives designed with this multijurisdictional reality in mind. Together with our municipal, private development partners, and building industry we can ensure that this County's historic and future multi-billion-dollar investment in stormwater infrastructure leaves no part of our community vulnerable to flooding. These planning and legislative initiatives have been designed to help bring higher standards and uniformity to the performance and management of our regional secondary, tertiary and private systems, which are inextricably linked to and affect the quality of our communities' overall flood protection and stormwater level of service (LOS) performance during storms and can directly impact the health of Biscayne Bay. The County is looking forward to receiving feedback as we workshop these initiatives and to greater future collaboration and planning with our Federal, State, municipal and private stormwater partners.

Flood Mapping and Identification of Risk Areas

The latest update to the County's Stormwater Master Plan was completed in 2021 by RER-DERM Water Management Division. It incorporated Sea Level Rise (SLR) and climate change projected impacts for current and future scenarios in 2040, 2060, 2080, and 2100; the determination of the latest system's operational and design criteria; the identification of water quality and flood

management needs; and provided the basis for prioritizing and budgeting of dedicated funding for the implementation of stormwater capital improvement projects countywide, including the projects highlighted above and the balance of the County's Stormwater Capital Improvement Plan.

The County's Stormwater Master Plan models provide the most up-to-date representation of the performance of the countywide stormwater management system for current and future hydrologic and hydraulic conditions. The watershed numerical models analyze the most current and best available forecasts for population growth, topography, SLR scenarios, land use, soils, groundwater levels, and rainfall volumes and intensity. It was modeled using Lidar images, which are used in the development of high-resolution maps used in surveying and other applications of geographic and topographic data. The County's modeling has a high level of sophistication, modeling parcel by parcel to a precision as small as a 5' by 5' data cell. The County is a Technical Cooperating Partner with FEMA, and the County models are used by FEMA to update the FEMA Flood Insurance Rate Maps (FIRMs) under a FEMA grant partnership.

The overall goal of the Stormwater Master Plan is to review and evaluate the regional and local facilities owned and operated by Miami-Dade County and to identify sustainable stormwater management solutions and improvements to mitigate future risks. Typical maps used include:

- Inundation maps countywide for each of the five scenarios (current, 2040, 2060, 2080, 2100), 10 maps for each scenario based on storm events with different recurring intervals
- Water Control Map (WCM)
- County Flood Criteria Map (CFC)
- Federal Emergency Management Agency (FEMA) Flood Insurance Study Report (FIS) and Flood Insurance Rate Maps (FIRMs)

As a part of the planning efforts, there is extensive coordination on flood mitigation measures by State, municipalities, agencies and other owners and operators of stormwater management systems, including for operations, sharing of technical and engineering design information, modeling and planning.

Future impacts and mitigation scenarios are modeled and analyzed to effectively address short- and long-term strategic infrastructure and stormwater management decisions countywide, and capital projects are developed to address areas requiring mitigation. This effort yields the Stormwater Capital Improvement Plan (CIP) which is funded solely through SWU fees. It is programmed to expend $187 million over the next 10 years and a total of $470 million over the 30-year capital planning horizon. As noted above, when combined with elevation and drainage investments realized through other roadway and neighborhood improvement projects, the future investment totals $1 billion to address identified risks.

Additional background for this report is provided in the attached document, including further detail on:

- the role of federal, state, county, municipal and private drainage infrastructure
- the modeling behind the Stormwater Master Plan
- how the modeling is used to understand and mitigate flood risks via design of capital improvements
- mitigation measures employed by other agencies in cooperation with the County including specific operational, planning, and technical and design efforts
- specific stormwater capital improvements.

This report will be placed on the next available Board meeting agenda. If you have any questions or require additional information, please contact Lourdes M. Gomez, RER Director.

Attachments

c: Geri Bonzon-Keenan, County Attorney
Gerald Sanchez, First Assistant County Attorney
Jess McCarty, Executive Assistant County Attorney
Office of the Mayor Senior Staff
Lourdes M. Gomez, Director, Department of Regulatory and Economic Resources
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Jennifer Moon, Chief, Office of Policy and Budgetary Affairs
Yinka Majekodunmi, Commission Auditor
Basia Pruna, Director, Clerk of the Board
Eugene Love, Agenda Coordinator

ATTACHMENT

Additional Background Information for Resolution No. R-664-22, Directive No. 221494

Our Drainage System is a Combination of Federal, State, County, Municipal and Private Infrastructure

The primary drainage system in Miami-Dade County consists of approximately 320 miles of canals and associated features that are managed and maintained by the South Florida Water Management District (SFWMD) in coordination with the US Army Corps of Engineers (USACE).

The secondary drainage system consists of 200 miles canals and associated features under the control of designated public or private entities. The secondary drainage system may discharge to receiving lakes, coastal waterbodies, or the primary drainage system.

Tertiary systems consist of local drainage infrastructure generally located on public right-of-way (ROW) or on public/private facilities and properties providing localized drainage benefit and infiltration of stormwater into the ground, discharge into retention/detention areas, or discharge into primary/secondary or other surface waters.

Miami-Dade County maintains and operates approximately 200 miles of secondary canals countywide (regional conveyance system). The County also controls tertiary drainage systems serving the public ROW within unincorporated Miami-Dade County and along County maintained roads within municipal boundaries. Miami-Dade County is responsible for the related capital improvements, operations and maintenance of the stormwater infrastructure under its purview.

Municipalities, other public agencies such as FDOT, private entities, special taxing districts, and homeowner/commercial associations are typically responsible for tertiary stormwater management systems (local drainage systems) including related capital improvements, operations and maintenance.

County Flood Mitigation Strategy is based on Modeling and the Stormwater Master Plan

For over 25 years, the County has had a Stormwater Management Program (SWMP) and a countywide Stormwater Master Plan. The County's Stormwater Master Plan is regularly revised and updated. Over the years, the County's Stormwater Master Plan has guided the development of future County regulations with respect to stormwater management; has been used as the basis to establish and implement the stormwater CIP and the prioritization of County resources; has been used to manage, operate and maintain stormwater infrastructure and surface water levels; and has been used as the basis for determining the infrastructure Level of Service (LOS) and design criteria to engineer public and private stormwater systems countywide.

The watershed models cover approximately 780 square miles of inland and coastal land surface area within and adjacent to Miami-Dade County and incorporate countywide hydrologic and hydraulic data. The watershed numerical models analyze the most current and best available forecasts for population growth, topography, SLR scenarios, land use, soils, groundwater levels, and rainfall volumes and intensity.

The most current update of the County's Stormwater Master Plan was completed in 2021. The Stormwater Master Plan Report was signed and sealed on September 24, 2021 and is available online at https://www.miamidade.gov/environment/library/maps/2021-stormwater-management-program-master-plan.pdf.

Miami-Dade County has developed and provided continuous updates of the County's Stormwater Master Plan using numerical hydraulic and hydrologic surface water models since 1993. Over the years, the County's Stormwater Master Plan has undergone several modeling upgrades. However, the recent availability of Lidar technology has made the latest 2021 update the most comprehensive effort yet since modeling has been used. The latest County's Stormwater Master Plan update also included, for the first time, several current and future scenarios for 2040, 2060, 2080, and 2100 using SLR projections based on NOAA's Intermediate High curve (Unified SLR Projections from the Southeast Florida Regional Climate Change Compact from 2015 and subsequent revision in 2019). These scenarios were not previously available for prior modeling efforts.

For each of the five scenarios modeled (current, 2040, 2060, 2080, 2100), ten simulations were used to develop flood maps for 24-HR storms with recurrence intervals of 5-, 10- and 25-years and for 72-hour storms with recurrence intervals of 5-, 10-, 25-, 50-, 100-, 500- and 1000- years.

Continued updates to the County's Stormwater Master Plan are conducted within a five-year cycle, and more frequently (partially or countywide) based on the availability of updated data, implementation of key infrastructure projects (public and/or private), and/or updated regulatory requirements.

All updates to the County's Stormwater Master Plan are consistent with Florida Statute 403.0891, the requirements set forth in Chapters 62-40 and 62-43 of the Florida Administrative Code (FAC); U.S. Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) requirements; South Florida Water Management District (SFWMD) rules; Chapter 24 of the Miami-Dade County code; and the Miami-Dade County Comprehensive Development Master Plan (CDMP) prepared pursuant to the requirements of Chapter 163 Florida Statutes. Objectives of the Stormwater Master Plan also include mitigating impacts of discharges (both in quantity and quality) to the Biscayne Bay, which is designated as a State Aquatic Preserve and regulated according to the Florida Statute 258.397 and Chapter 24 of the Miami-Dade County Code.

Flood Maps and Other Information or Systems Used by the County to Identify Flood Risk Areas

The Miami-Dade County's Stormwater Master Plan is used to update maps and better understand flood risks. The Stormwater Master Plan is used to review and evaluate the regional and local facilities owned and operated by Miami-Dade County and to identify sustainable stormwater management solutions and improvements to mitigate future risks such as:

- Protect infrastructure from flooding
- Protect and improve water quality

- Evaluate performance and LOS of existing infrastructure and update future standards
- Provide aquifer recharge where practicable to protect and enhance existing and potential future water supply
- Implement Inspection, Operations and Maintenance Plan (IOM)
- Provide new engineering recommendations for improvements
- Add recommended capital improvements to the CIP (short- and long-term), including prioritization
- Update the anticipated impact of SLR on the infrastructure capacity and performance.

Available Information on Flood Mitigation Measures by State, Municipalities and Other Owners and Operators of Stormwater Management Systems

Operational Cooperation

The South Florida Water Management Division (SFWMD), Miami-Dade County, local municipalities, other agencies and private operators of stormwater systems voluntarily coordinate for pre-, during, and post-event system management activities to maximize flood protection.

The SFWMD implements pre-storm drawdowns to lower the primary canal levels in preparation for storm events. Pre-, during, and post-storm coordination occurs regularly between the SFWMD, Miami-Dade County, local governments, districts and others to ensure that system needs are communicated, and assistance is available to avoid storm related losses and widespread flood damage.

It is often a challenge, especially at the beginning of the rainy season, to lower canal stages while groundwater levels may be seasonally low, as this may accelerate saltwater intrusion into the Biscayne Aquifer and pose a risk to the wellfields that provide our drinking water supply. It is typically best to maintain the balance between lowering canal levels while still protecting the wellfields for water supply and other areas from salt intrusion. This dynamic process occurs because the stage in canals largely determines the water table elevation of the local groundwater. In order to balance the need to protect the drinking water supply with the need for flood protection, the stages of some canals near the ocean may be maintained at levels high enough to prevent salt intrusion into the groundwater. In other areas, surface water elevations are maintained to keep water table elevations low enough to prevent flooding problems.

All primary canals in the County have gated control structures that provide salinity control and allow the discharge of excess water into Biscayne Bay (Bay). The gates remain closed during dry periods and high tides to maintain the high freshwater levels needed to recharge the groundwater table and retard inland saltwater intrusion in the canal system. Ground and surface water in South Florida strongly interact due to the highly transmissive nature of the Biscayne Aquifer which is additionally the major source of drinking water for residents of Miami-Dade County. When the primary canal gates are opened to discharge excess water, canal stages generally become lower than the surrounding water table, inducing ground-water flow to the canals and discharging to tide by gravity or with forward pumping as per installed infrastructure.

During the dry season, the gated control structures in the primary canals are operated so water stages at the control structures are generally higher than the surrounding groundwater levels, and the canals recharge the aquifer. The secondary canal system, under County control, is tributary to the primary canal system and is typically characterized by uncontrolled gravity flow. There are, however, five control structures in the secondary canal system under the control of Miami-Dade County which are operated to provide stormwater management on a seasonal basis and under storm events. Draining the secondary canals into the primary canals is ultimately dependent on water levels in the primary canal system. Secondary canal stages are lowered when the primary canal levels are lowered as the tidal structures open to discharge water to the Bay. This system network configuration promotes distribution of water volumes within the network and provides the most operational flexibility as it allows canal segments, both in the primary and the secondary systems, to convey as well as detain flow as needed.

This is an efficient strategy to allow redirecting flows when needed to canal segments with lower canal stages to relieve impacted areas during rain events. This flexibility, paired with the availability of storage and retention features throughout the system, provides enhanced Protection Levels of Service for extreme storm events. Flooding may occur during extreme storm events that exceed the design system capacity. The goal during extreme storm events is to keep water from entering buildings and living spaces; to maintain evacuation routes open to vehicular traffic; and to provide for other roads and property grounds to be flood-free in the shortest time possible.

In addition to implementing system improvements, below are the critical success factors and responsible parties cooperating to optimize flood protection in Miami-Dade County in response to rain events:

1. Responsive operations of the primary canal system, to include storm preparation activities such as lowering canal levels as safely as possible prior to storm events, adjustment of pumping and gate operation triggers as needed to maximize discharges and drain floodwaters from inland areas – SFWMD and USACE
2. Active maintenance of the secondary canal system to minimize obstructions and to maintain the design conveyance of flows into the primary canals, thus allowing the timely drainage of inland areas during storm events – Miami-Dade County; and
3. Active maintenance of the tertiary systems. These localized drainage systems are the first local "line of defense" during rain events. It is critical that public and private entities in control of these tertiary systems actively manage them and be prepared to use temporary pumping and other strategies to reduce the impacts of localized flooding during and after rain events - Miami-Dade County, municipalities, FDOT, other private and public entities.

Technical & Design Cooperation

Stormwater management systems are engineered using the required design storm event as determined by the applicable regulatory agency. Design storms are defined by the statistical frequency for the storm event to occur; for example, once every five, 10, 25, or 100 years.

Principal arterial roads including major evacuation routes are typically designed to be passable during a 100-year design event. Minor arterials (four-lane roads) are designed to be passable during a 10-year design event. Collector and local residential streets are designed to be passable during a five-year design event.

Minimum finished grade elevation of developed properties needs to meet a 10-year design event for a 2060 SLR scenario per the County Flood Criteria map just adopted by the Board.

The minimum elevation of the lowest building floor for new construction and substantial improvements is required to use the 100-year flood event and apply corresponding freeboard allowances depending on the building category per the current Florida Building Code and FEMA Flood Insurance Rate Maps (FIRMs) in effect.

The County's Stormwater Master Plan design criteria and information is shared with municipalities, other agencies and private entities to ensure the technical information is available for project implementation countywide. Results from the County models are also shared with the South Florida Water Management District, the USACE and FEMA. The County is also actively participating with the SFWMD in their on-going Level of Service Studies for all the watershed basins in Miami-Dade County.

Planning Cooperation

Since 1988, Miami-Dade County has an active Local Mitigation Strategy (LMS) which is a community initiative designed to reduce or eliminate the long-term risk to human life and property from hazards. The LMS Plan is a multi-volume Plan that documents the planning process and addresses mitigation measures in relation to the hazard risk and vulnerability assessment of Miami-Dade County. This is a living document which is revised in order to integrate and reflect current and projected issues, and to track mitigation measures and actions that have occurred, are presently occurring, are planned for and/or are desired. The Miami-Dade Office of Emergency Management (OEM), serves as the LMS Coordinator for the County.

This Plan is a compendium of efforts of the whole community, integrating governmental and non-governmental agencies such as non-profits, private sector, educational and faith-based organizations, healthcare organizations, as well as communities, families and individuals. The LMS includes initiatives that integrate climate change, SLR, and additional measures to address floodplain management through the Community Rating System (CRS). The Plan is open for public review and the comments received are integrated prior to submission to the Florida Division of Emergency Management (FDEM). The latest Miami-Dade County LMS (updated every 5 years) was adopted by the Board on October 6, 2020 by Resolution R-945-20. It was approved by FDEM on September 15, 2020

Participation in the LMS includes representatives from eight main groups:

- Municipalities
- County Departments
- Colleges and Universities
- Hospitals and Health Care

- Private Non-Profit
- Private Sector/Businesses
- Regional, State and Federal Partners
- Other Stakeholders, including private citizens.

The purpose of the LMS is to develop a comprehensive approach to effectively reduce the impact of current and future hazards and risks faced by local communities within Miami-Dade County. The LMS accomplishes this through the following measures:

- A planning process that encourages whole community participation and input
- Review and incorporation of community plans, local, state and federal regulations and guidance, studies, reports and technical information
- Overview of past and present occurrences and projected future hazard events
- Linkage of mitigation measures and actions to the Threat and Hazard Identification and Risk Assessment (THIRA)
- Identification of measures and actions as LMS Projects are implemented, planned, or identified as potential or future initiatives
- Identification of potential or actual funding sources
- Integration of GIS to provide maps to illustrate hazard and risk areas, consequence analysis and mitigation measures
- Reviews and updates of all strategy components
- Regular meetings, informational bulletins, training and workshops to engage the mitigation participants; and
- An identified process for monitoring the overall progress of mitigation strategies and documentation of completed initiatives, including a strategy to continuously evolve to address current and future risk and vulnerability.

Any proposed changes are reviewed and compared against LMS and Comprehensive Emergency Management Plan (CEMP) crosswalks provided by FDEM, the Emergency Management Accreditation Program (EMAP) Standards, the Community Rating System (CRS) Coordinator's Manual, and the Threat Hazard Identification and Risk Assessment (THIRA). An annual update to the LMS is provided to the State by January 31st.

The LMS is updated and prepared for the third quarterly meeting of the fourth year for public review and comments on the Plan. Once all comments are reviewed and incorporated, the updated LMS is submitted to FDEM. Updating the LMS includes the LMS working group members and partner agencies. Multiple efforts are made to involve a diverse groups of partners in its update.

Stormwater Capital Improvement Plan Expenditures

The Miami-Dade County RER Water Management Division administers the County's CIP through continuous implementation of this Stormwater Master Plan. Stormwater infrastructure projects are identified and prioritized based on the stormwater model results, including flood complaints, repetitive loss analysis, and strategic short- and long-term planning. Future impacts and mitigation scenarios are continually modeled and analyzed to effectively address infrastructure planning and stormwater management decisions.

Stormwater infrastructure projects are maintained in a GIS database and categorized as completed, active or planned. Once a project is completed and as-builts become available the infrastructure changes are incorporated into the stormwater model. The County CIP (short- and long-term projects) includes stormwater projects for all the watershed basins as follows:

A total estimated expenditure of over $470 million has been identified by the County for future investments in stormwater infrastructure improvements over the next 30 years. Exhibit 1 (2023 Stormwater Strategic Plan) provides the project mitigation areas identified countywide, for all the basins. Three implementation horizons have been planned:

- 0 to 10 Years: Local drainage improvements of over $60 million and secondary canal improvements of over $127 million
- 10 to 20 Years: Local drainage improvements of over $70 million and secondary canal improvements of over $97 million
- 20 to 30 Years: Secondary canal improvements of over $113 million

Additional local drainage projects are assumed to be identified through future updates to the stormwater master plan as a reflection of newer data and anticipated environmental conditions moving forward. The canal improvements are mostly resilience mitigation actions being significantly accelerated in terms of needed implementation. These resilience mitigation canal projects are based on increasing the canal LOS to 25 Year/72 Hour for a 2060 scenario from a 10 Year/72 Hour LOS under current scenario.

The summary detail of the County CIP by basin and planned implementation horizon is shown in the table below:

		Planning Implementation Horizon		
Basin	**BCC**	**0 to 10 YR**	**10 to 20 YR**	**20 to 30 YR**
C1	8,9,11	$1,551,000	$219,000	$0
C2	7, 8, 10, 11	$4,629,000	$43,528,000	$25,159,000
C4	5, 6, 7, 10, 12	$2,298,000	$57,496,000	$64,366,000
C6	2, 3, 5, 6, 12, 13	$40,780,000	$407,000	$0
C7	2, 3, 6, 12, 13	$42,110,000	$289,000	$0
C8	1, 2, 3, 4, 13	$36,615,000	$1,487,000	$0
C9	1, 2, 3, 4, 12, 13	$54,601,000	$11,288,000	$0
C100	7, 8, 9	$1,674,000	$25,896,000	$0
C102	8, 9	$1,350,000	$16,403,000	$2,100,000
C103	8, 9	$2,335,000	$6,476,000	$14,946,000
C111	8, 9	$0	$5,355,000	$6,723,000
	Total	**$187,943,000**	**$168,844,000**	**$113,294,000**

These planned projects are characterized as follows:

Elevation of canal banks –The analysis identified areas that may be improved by elevating the banks of selected secondary canals above the design stage in the 25- YR /72-HR 2060 future model with SLR scenario, thus improving the storage LOS of the network of secondary canals. The improvements that have been identified to elevate canal banks will increase stormwater storage and detention capability. These improvements enhance flood management and water quality treatment.

Interconnectivity Improvements – The analysis determined areas subjected to flooding which can be mitigated by providing interconnectivity of drainage areas, secondary canal segments and stormwater storage. This alternative shows the benefits of additional infrastructure used to mitigate flooded areas that are currently disconnected. Improvements have been identified for new canal segments and canal cross section improvements to increase interconnectivity with other existing stormwater infrastructure, stormwater storage and detention capability. These improvements enhance flood management and water quality treatment.

Backflow for high canal stages. – The analysis determined the effects of installing backflow preventers at selected outfalls to eliminate flooding caused by backflow from canals during high stage periods. Backflow prevention is to be installed in existing outfalls (as needed) in the secondary canals identified for improvements to the elevation of canal banks. These improvements enhance flood management capability.

Exfiltration trenches and drainage wells – The analysis identified locations for addition of stormwater exfiltration and other related drainage infrastructure. This alternative provides the benefits of improved drainage rates particularly during the initial period of storms. These improvements enhance flood management and water quality treatment.

Upgrades in capacity – Alternative simulations were developed to determine conceptual designs to upgrade system capacity and provide increased flood mitigation by improving canal cross sections and improve pumping capacity as needed. This analysis was used to identify the stormwater infrastructure improvements which will result in system capacity enhancements to provide protection for 2060 needs.

Short- and long-term implementation of CIP projects is funded by the County's Stormwater Utility Fees and budgeted annually as approved by the Board. Planned projects are evaluated against target Flood Protection Level of Service (FPLOS) and priority areas are identified through the stormwater modeling results countywide. The highest priority projects are selected annually for design, permitting, and construction. The RER-DERM has been aggressively pursuing external funding such as Federal and State grants to help accelerate some of the longer-term projects that prepare the County service area for future forecasted conditions in 2060 and beyond.

https://worldlandscapearchitect.com/beyond-management-stormwater-as-asset-on-the-urban-campus/?v=7516fd43adaa

WATER…

PROTECTING OUR PRECIOUS RESOURCE

Vision and Mission

Strategic Assessment

Current Situation

We built what was planned:

- 32 years history
- Dedicated funding
- Regional operations
- Local drainage operations

Desired State

We are planning for the future:

- Be the leader in resilience
- Contribute to the health of the bay
- Protect drinking water supply
- Mitigate flooding

Our Focus Areas

Tactics & Initiatives

Analyze Challenges & Identify Solutions

- SW Master Plan Implementation
- New Technology Applications
- SWU Restructuring
- Asset Management System Interface

Collaborate with Other Agencies & the Public

- Collaboration with USACE & SFWMD in Regional Planning
- Partnering with Cities
- New Service Offer to Cities (Mapping, Planning, Budgeting)
- Educational Outreach

Establish Consistent Processes & Procedures

- Operating Records for Public ROW Systems (*)
- Certification for Public ROW Systems (*)
- Operating Permits for Private Systems
- MDC Public Works Manual Update
- Maintenance Optimization of Secondary & Tertiary Systems

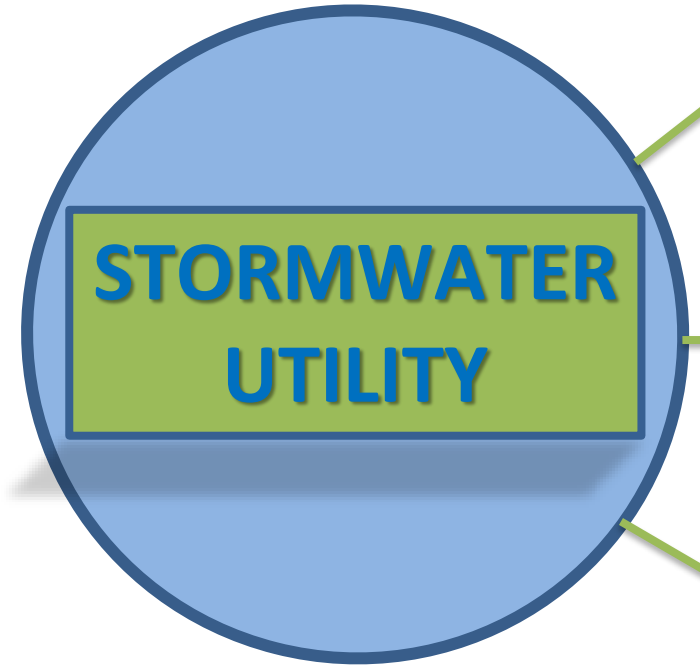
Deliver Higher Protection Standards

- County Flood Criteria (Adopted 10/2022)
- Water Control Map (Adopted 10/2022)
- Chapter 11C Updates (Adopted 10/2022)
- (*) Impervious Ordinance

Completed On-Going Coming Soon

SW = Stormwater SWU = Stormwater Utility MDC = Miami-Dade County ROW = Right-of-Way USACE = US Army Corps of Engineers SFWMD = South Florida Water Management District

About Us



#1 in Florida
Physical Area Served

#1 in Florida
Population Served

#1 in Florida
SWU Accounts Served

18 times larger land area

served compared to the average size of SWUs in the state (~70,000 Acres)

12 times larger population

served compared to the average SWU in the state (~85,000)

8 times more accounts

served compared to the average SWU in the state (~34,000)

SWU = Stormwater Utility

About Us

$1 BILLION in stormwater infrastructure

Funding sources:

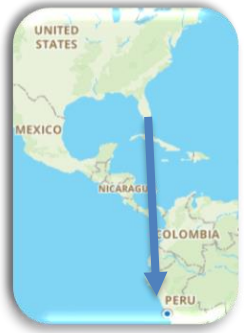
- SWU fees
- Federal & State grants (FEMA, NRCS, FDEP, FDOT)
- Bonds (QNIP, GOB, PTP, and Stormwater Utility Bonds)
- Roadway and Neighborhood Improvements (Road Impact fees)

200+ miles secondary canals

(Example: Miami, FL - Orlando, FL

2,600+ miles grass treatment swales

(Example: Miami, FL – Lima, Peru)



600 MGD installed capacity

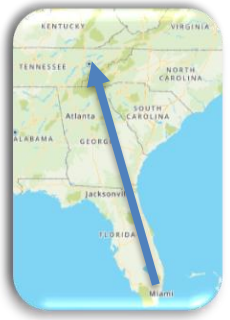
at 18 pump stations (total pump discharge equivalent to the installed SFWMD forward pumping capacity for the C-4 and C-6 primary canals)

1.4 Billion gallons of storage/detention capacity in secondary canals,

equivalent to filling 325 football fields 10 feet high

800+ miles piping

(Example: Miami, FL – Knoxville, TN)

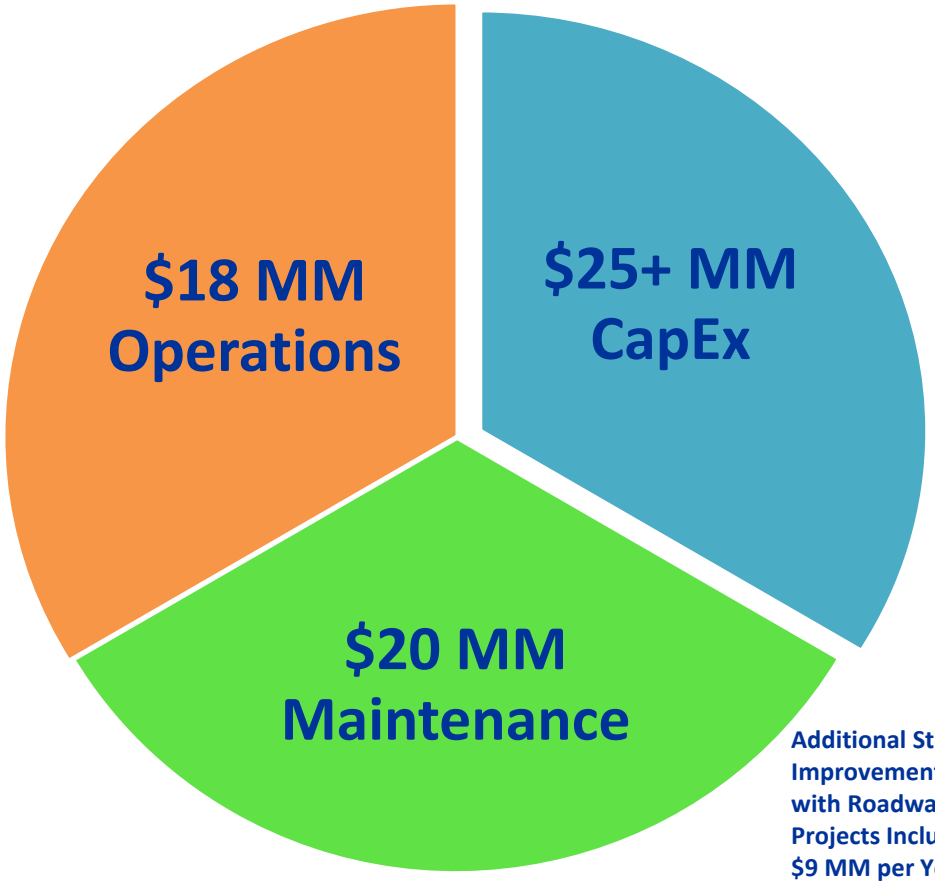


50,000+ structures

WWTP = Wastewater Treatment Plant MGD = Million Gallons per Day PTP = People's Transportation Plan Bond SFWMD = South Florida Water Management District

Stormwater Program Funding

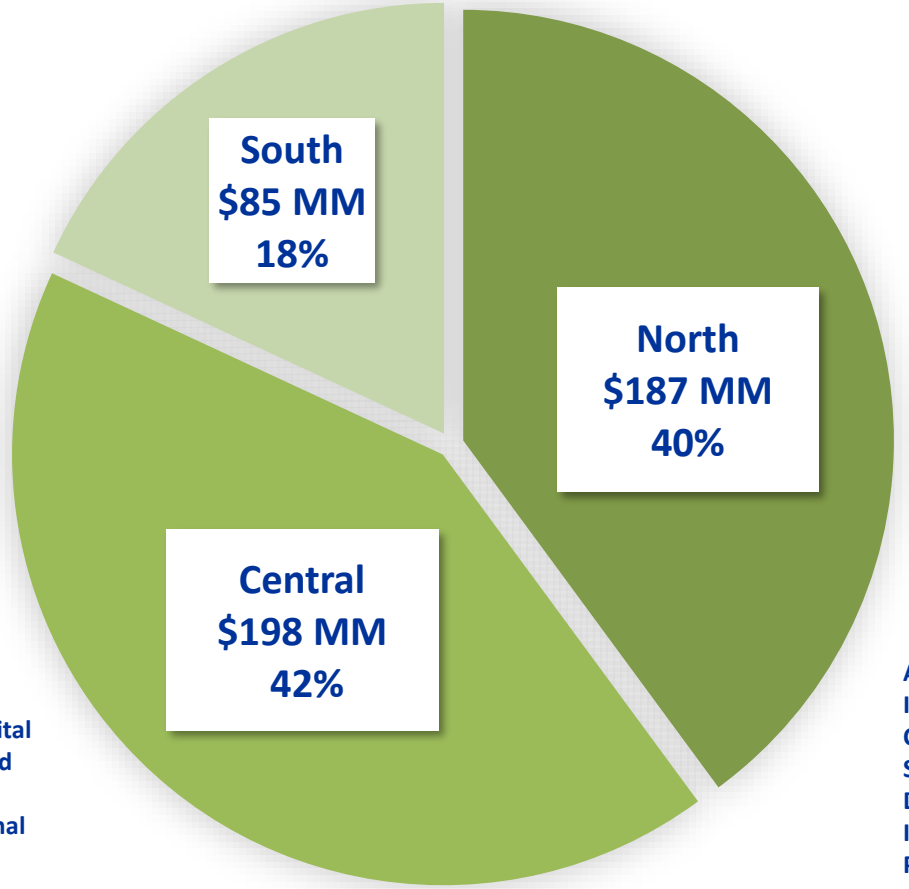
$63 MM Annual Budget *



Additional Stormwater Capital Improvements Implemented with Roadway Planned Projects Include an Additional $9 MM per Year

$470 MM CapEx

Over 30 Yrs by Basins Served, Based on Need & Priority from Master Plan



- North (Basins C-6, 7, 8, 9) (BCC 1,2,3, 4, 5, 6, 12, 13)
- Central (Basins C- 2, 4) (BCC 5, 6, 7, 10, 11, 12)
- South (Basins C-1, 100, 102, 103, 111) (BCC 7, 8,9, 11)

Additional Stormwater Capital Improvements Beyond the CapEx Include Elevating Road Segments as Needed and Drainage/Road Reconstruction Implemented with Roadway Planned Projects

MM = Millions CapEx = Capital Expenditures Funded by SWU Yrs = Years * SWU Fiscal Year 2023-2024 SWU = Stormwater Utility

On-Going Mitigation Improvements

Installation of new technologies and upgrades to improve water quality and flood control

- Implement new technologies
- Include data collection to optimize maintenance cycles
- Enhance community engagement

~$30 MM in Multi-Year Grants Awarded

Raising secondary canal banks to increase the Level of Service to 2060 requirements

- Increase storage in network of secondary canals, a very effective strategy to detain flows, and provide treatment
- Benefits are countywide

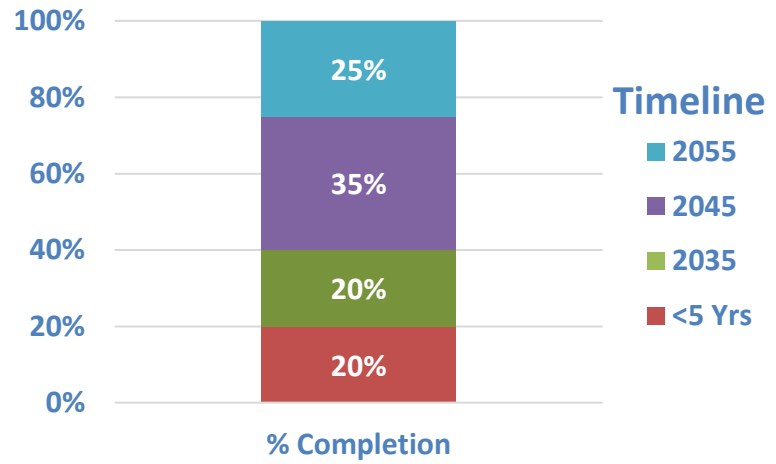
MM = Million

Planned Mitigation Improvements to Meet 2060 Scenario with SLR

Secondary System (Regional)

Planned Projects to Increase Storage & Detention

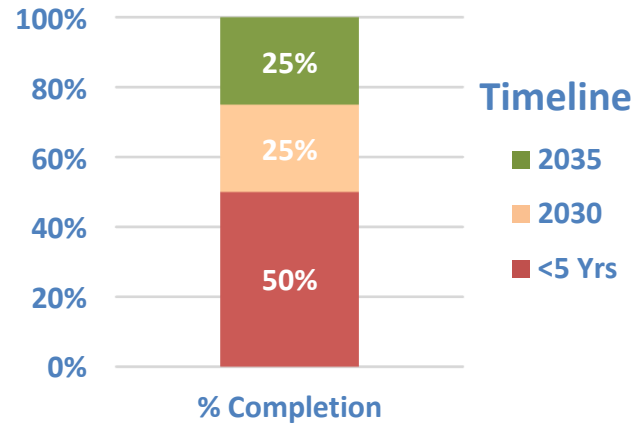
- Elevation of canal embankments
- Additional pump stations
- Treatment technologies in canals
- Green infrastructure & regional stormwater management areas



Tertiary System (Local)

Planned Projects to Increase Ground Infiltration, Retention & Treatment

- Additional drainage & system improvements
- Treatment technologies in local drainage
- Green infrastructure & localized stormwater management areas
- Additional pump stations



CapEx

Total $470 MM Planned

Average project takes up to 3 years from design to completion, and has a cost range of $1 to $3 MM

CapEx = Capital Expenditures Funded by SWU SLR = Sea Level Rise MM = Million

After Planned Upgrades

Expenditures

Timeline	CapEx (MM)	Total Stormwater Infrastructure
2023		$1 Billion
< 5 Yrs	$99	$1.1 Billion
2030	$68	$ 1.2 Billion
2035	$100	$1.4 Billion
2045	$118	$1.7 Billion
2055	$85	~$2 Billion

Funding sources:

- SWU fees
- Federal & State grants (FEMA, NRCS, FDEP, FDOT)
- Bonds (QNIP, GOB, PTP, and Stormwater Utility Bonds)
- Roadway and Neighborhood Improvements (Road Impact fees)

1.5 Billion gallons of storage/detention capacity in secondary canals, which is a 48% increase in storage capacity after upgrades

93 miles of secondary canals completed (100% of those requiring mitigation, which equals to 45% of all secondary canal miles)

750 MGD pump station capacity installed after upgrades, equal to a 25% increase in pump station installed capacity

10+ new stormwater management areas completed (wet retention, detention, green infrastructure)

50 square miles of mitigation areas completed (100% of those requiring mitigation, which is ~10% of the total square miles in the County service area)

MM = Million WWTP = Wastewater Treatment Plant MGD = Million Gallons per Day